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A sociophonetic analysis of Tyneside English in the DECTE corpus.

The case of FACE, GOAT, PRICE and MOUTH.

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Titre : Analyse sociophonétique de l'anglais de Tyneside dans le corpus DECTE : le cas des voyelles FACE, GOAT, PRICE et MOUTH.

Résumé : Cette thèse propose une analyse sociophonétique synchronique et diachronique de l'anglais de Tyneside à partir de deux sous-corpus du *Corpus Diachronique de l'Anglais de Tyneside* (DECTE) datant des années 1970 et de 1990 (Corrigan, Buchstaller, Mearns, & Moisl, 2012). Elle comporte deux grands volets : (**1**) une analyse de la variation inter et intra-locuteurs par le biais de transcriptions phonétiques des variantes linguistiques de FACE, GOAT, PRICE et MOUTH (Wells 1982) à l'aide d'une analyse factorielle multiple (AFM, Escofier 2008, Husson et al. 2011) (**2**) une étude acoustique des trajectoires formantiques de ces quatre ensembles lexicaux à l'aide de modèles mixtes additifs généralisés afin de vérifier la pertinence du codage (GAMMs, Wood 2015).
Pour ce **premier volet**, nous proposons un profilage sociolinguistique de 44 locuteurs de Gateshead et de Newcastle, à partir de données phonétiques transcrites dans les années 1970 lors de *l'Enquête Linguistique de Tyneside* (TLS, Strang 1968). Bien que notre analyse porte sur la totalité des transcriptions du système phonétique des locuteurs, l'accent est davantage porté sur FACE, GOAT, PRICE and MOUTH. Selon l'AFM suivi d'une classification, FACE est l'ensemble lexical le plus déterminant dans la catégorisation sociolinguistique des locuteurs. La symétrie entre FACE et GOAT (Watt 1999), PRICE et MOUTH est plus nette chez les femmes : celles de la classe moyenne privilégient une diphtongue fermantes dans entre FACE et GOAT et une attaque de diphthongue ouverte pour PRICE et MOUTH, tandis que les femmes issues de classes plus populaires optent pour la monophtongue pan-régionale pour FACE et GOAT, avec une attaque davantage fermée et antérieure chez PRICE et MOUTH. La monophtongue centrale de GOAT la variante privilégiée par des hommes à l'accent local moins marqué, ce qui entre en cohérence avec les résultats de Watt (1998) dans le sous-corpus des années 1990 du DECTE.
Le **second volet** analyse les trajectoires formantiques de FACE, GOAT et PRICE. Le but premier de cette analyse est de vérifier la correspondance des transcriptions avec le contour formantique. Les résultats confirment la pertinence du codage au niveau des liste de mots (TLS & PVC). Les différences entre les deux variantes principales de PRICE ([aɪ] vs. [eɪ]) se révèlent être foncièrement différentes tant sur le plan de l'attaque, de la trajectoire et de la cible.

Mots clefs : sociolinguistique, variation linguistique de l'anglais, dialectologie, dialectométrie, cohérence en variation, phonétique, diphthongues, analyse factorielle multiple, modèles additifs mixtes généralisés, trajectoires formantiques.

Title: A sociophonetic analysis of Newcastle English in the DECTE corpus: The case of FACE, GOAT, PRICE and MOUTH.

Abstract: The present thesis offers both apparent-time and real-time analyses of two sub-corpora of the Diachronic Electronic Corpus of Tyneside English (DECTE) : one from the 1970s and another one compiled in the 1990s (Corrigan et al., 2012). It comprises two main parts: (1) an analysis of inter and intra-speaker variation in the lexical sets FACE, GOAT, PRICE and MOUTH (Wells 1982) based on a multiple factor analysis (MFA, Escofier 2008, Husson et al. 2011) (**2**) a dynamic acoustic analysis of formant trajectories of these vowels using Generalised additive mixed models (GAMMs, Wood 2015) followed by a static analysis of onsets in PRICE.

The **first part** establishes the sociolinguistic profiles of 44 speakers from Gateshead and Newcastle based on the original phonetic transcriptions of the Tyneside Linguistic Survey (TLS, Strang 1968). Although the profiling analysis are based on the entire phonetic system transcribed by the original TLS team, the main focus is on FACE, GOAT, PRICE and MOUTH only. Results indicate that FACE the main determinant of TE speech. The symmetry between FACE et GOAT as found by Watt 1999, was also observed in PRICE et MOUTH among women. While middle-class women clearly favour a closing diphthong in FACE et GOAT and have a low onset in PRICE and MOUTH, working-class women tend to have higher frequency scores of pan-northern monophthongs in the first pair of lexical sets. They also exhibit more frequent raised onsets in in PRICE and MOUTH. In addition, the central monophthong GOAT is more often used by men with a less traditional accent in the 1970s corpus, which is in line with Watt's findings for the 1990s corpus (Watt 1998).

The **second part** analyses formant trajectories in FACE, GOAT and PRICE. The main aim was to compare the original phonetic transcriptions with the corresponding formant trajectories. Results confirm the pertinence of the transcriptions in the wordlist section of the corpora (TLS & PVC). Differences between the two main variants of PRICE ([aɪ] vs. [eɪ]) appeared to be strikingly different be in terms of both onsets / offset heights and trajectory shape.

Keywords: sociolinguistics, language variation in English, dialectology, dialectometry, coherence in variation, phonetics, diphthongs, multiple factor analysis, generalised additive mixed models, formant trajectories.

Je dédie cette thèse à ma famille et à tous mes ami.e.s. Je vous remercie et vous suis profondément reconnaissante d'avoir cru en moi et de m'avoir apporté votre soutien inconditionnel.

Cherry blossoms wane

Research swallows all seasons

Write a PhD

マエル・アマン

Table of contents

List of figures

List of tables

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Figure 0-0. Polyglot greeting card displaying *thank you* in 14 languages. Retrieved 14th September from: https://i.pinimg.com/736x/ea/cf/b3/eacfb38d01ab51c7df671594abfd735e--stationery-paper-travel-design.jpg

List of abbreviations

FA	Factor Analysis
k=n	Number of clusters created in a cluster analysis
MCA	Multiple Correspondence Analysis
MFA	Multiple Factor Analysis
ncp=n	Number of principal components
NL	Non-localised speech
OU	Overall unit
PCA	Principle Component Analysis
PDV	Putative Diasystemic Variant
PVC	Phonetic Variation of Contemporary English
TE	Tyneside English
TLS	Tyneside Linguistic Survey
VC	Variety cluster
VSp	Variety space

A glossary of selected terms

The definitions below have been adapted to applications in sociolinguistics.

Centroid (or, barycentre)	The arithmetic mean position of all the speakers of a given cluster on a factor map.
Cluster	A group of speakers having similar variation patterns across several linguistic features.
Cluster diagnostics	A list of social or linguistic features that characterize a cluster of speakers.
Correlation circle	Graphical representation of the co-occurrence of linguistic variants which are featured as arrows in a PCA/MFA analysis. The closer the arrows the more they tend to co-occur. If a pair of variants form a flat angle, the correlation is negative. A right angle indicates no apparent correlation. The correlation circle is generally paired up with a factor map.
Factor map of individuals	Graphical representation of the distances between speakers with respect to their variation patterns in a PCA/MFA analysis. The closer the individuals are from one another, the more similar their linguistic patterns.
Factor map of partial individuals	The variation patterns (PCA/MFA analysis) of one or more speakers are added to their position on the factor map using diverging lines.
Feature centric approach	A statistical approach, e.g. MFA, which takes into account the relationship between a linguistic feature and its variants. Each feature is given the same weight regardless of the number of variants they may have. The present thesis shows that it is recommended to adopt feature centric approaches in sociolinguistic analyses that include the study of more than one linguistic feature.
Group of variables	The variant scores of a lexical set, e.g. FACE, are considered as individual statistical variables in an MFA analysis. Together, they form the **group of variables** *FACE*. This helps assess the overall effect of FACE in the MFA and subsequently, the cluster analysis.

	Graph of the groups of variables: in MFA, scatterplot showing how well the linguistic features (groups of variables) contribute to the creation of the major trends in two dimensions (the two axes). The higher the score, the more the feature contribute to the creation of speaker groups. I shall call it the *feature plot*.
Multiple Factor Analysis (MFA)	Multivariate analysis approach similar to PCA that reduces the number of dimensions and takes into account the effect of groups of variables and not only the individual effect of each variables on the linguistic variation patterns.
Non-localised speech (NL)	Speakers whose speech does not reflect their geographical origins. Generally "middle-class, well-educated and in high income groups" (Jones-Sargent 1983, p. 32).
Number of principal components (ncp=n)	Written *ncp* on the figures in the present thesis. Number of dimensions (aka, principal components) used in an MFA model. More dimensions means that more complexity is taken into account when analysing the variation patterns.
Overall unit (OU)	The broad IPA transcription of a lexical set in Southern British English (TLS project. For the full list see Jones-Sargent 1983).
Paragon vs. extreme speakers	**Paragons**: in an MFA analysis, it is the speakers who are closest to the centroid of a cluster they belong to. **Extreme speaker**: a speaker which is the furthest away from the centroids of the clusters they do NOT belong to.
Putative diasystemic variant (PDV)	A family of variants within an overall unit that are "sociolinguistically discriminable" (Jones-Sargent 1983, p. 39A).
State	A more fine-grained IPA transcription of variants within a PDV (TLS project. For the full list see Jones-Sargent 1983).
Variant centric approach	A statistical approach, e.g. PCA, which does not take into account the relationship between a linguistic feature and its variants. Each variant is given the same weight regardless of the feature they belong to. As a result, some

	variants appear as more important than they actually are. The present thesis argues against adopting variant centric approaches in sociolinguistic analyses that include the study of more than one linguistic feature.
Variety space (SP)	"A multi-dimensional space comprising a mixture of . . . variables (linguistic criteria), which are assumed, initially to be orthogonal or independent" (Pellowe 1990, vol. 2 p. 13).

INTRODUCTION

> *The North of England is an area which looms large in the general consciousness of English and in that of both dialectologists and variationists concerned with forms of English in Britain (Hickey, 2015, p. vii)*

This thesis reports on a quantitative and qualitative study of speech patterns in Tyneside English, in North-East England. It provides a review of 4 lexical sets with the aim of tracking changes taking place in the area. The resulting patterns are then related to external factors pertaining to the speakers themselves (age, gender, class etc.) and to the speaking style (wordlist and interview data). Analyses were based on two sub-corpora from the *Diachronic Electronic Corpus of Tyneside English* (DECTE; Corrigan et al., 2012)[1], the *Tyneside Linguistic Survey* (TLS; Strang, 1968) and the *Phonological Variation and Change in Contemporary Spoken British English* project (PVC; J. Milroy, L. Milroy, & G. Docherty, 1997). These two corpora are separated by a span of about 25 years and came to form the *Newcastle Electronic Corpus of Tyneside English* (NECTE). It is supplemented by an ongoing monitor corpus which started in 2007 (NECTE2[2]). New recordings are regularly added to the corpus. They comprise sociolinguistic interviews (TLS), dyadic interviews (PVC, NECTE2), wordlist material (TLS & PVC) and judgements on certain language features and constructions (TLS). It is the combination of NECTE and NECTE2, which was set up between 2010-2012, that now

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[1] The DECTE was funded by the Arts and Humanities Research Council between October 2010 and January 2012 – grant number AH/H037691/1.

[2] https://research.ncl.ac.uk/decte/n2archive.htm

forms the DECTE. It was one of the first "large scaled, web-based" corpora of vernacular speech to include aligned part-of-speech tagging and to be "fully compliant with international standards for encoding text" (Beal, Corrigan, Mearns, & Moisl, 2014).

The aim of the present thesis

Ever since the late 1990s, the region has been heavily represented in sociolinguistic literature (Allen, Beal, Corrigan, Maguire, & Moisl, 2007; Corrigan, 2012; Corrigan, Mearns, & Moisl, 2014; G. J Docherty & Foulkes, 1999; Gerard J Docherty, Foulkes, Milroy, Milroy, & Walshaw, 1997; Foulkes & Docherty, 1999; A. Mearns, Corrigan, & Buchstaller, 2016; Watt, 1998, 1999; Watt & Allen, 2003). Yet there remains a major gap in TE studies. The TLS, albeit often cited, has remained largely untapped, especially regarding the original phonetic transcriptions by McNeany (Corrigan et al., 2014; Jones-Sargent, 1983; Hermann L Moisl & Maguire, 2008). As the NECTE was created, these transcriptions were first considered as "historical artefacts" (Allen, Beal, Corrigan, Maguire, & Moisl, 2004). Notes in this 2004 report indicate that dealing with these transcriptions would have made the scope the of NECTE much larger, while the scope of researchers interested in them was expected to be restricted to phoneticians:

> TLS transcriptions are offered as an **historical artefact**, but offer a great deal of detail that would have otherwise been beyond the scope of the NECTE project. . . The TLS transcriptions are offered as an **historical artefact**, and our rationale here is because of their intrinsic interest to researchers who want to study the phonetics of the TLS material: the phonetic analysis is extremely detailed, providing from one up to ten realizations of any given phonological segment. [emphasis mine] (Allen et al., 2004).

Still today, the most commonly cited phonetic works on Tyneside English relies on the PVC sub-corpora and not so much on these TLS transcriptions. The present thesis is therefore an attempt to revisit a largely untapped database on linguistic variation and turn these *historical artefacts* into perusable linguistic information, making the most of acoustic data and statistical analysis to revisit both sub-corpora. The rest of the section details my perspective.

The original aim of the TLS was maximum exhaustivity in both the social and linguistic features to filter out linguistic markers from mere indicators of speech using statistical tools and not intuitions of linguists (John Pellowe, Nixon, Strang, & McNeany, 1972). Thanks to the present statistical tools, vast amounts of data can be analysed simultaneously, which was not possible at the time of the TLS, when first terminals were installed and used at Newcastle University in the late 1970s. I endeavoured to respect the original aim of the TLS by providing a multivariate analysis of the social data and the phonetic features stemming from phonetic transcriptions of the first ten minutes of the recordings. However, in spite of the exhaustive amount of social characteristics used for the first analyses of the survey (Jones-Sargent, 1983; V. Jones, 1978), I preferred to focus on linguistic variables and narrow down the number of social categories to age, social class, education and gender to see whether more sophisticated ways in which gender, age and social class interact could be found. But to respect the survey's original aim for exhaustivity in the social material too, I inspected the transcriptions of the interviews for atypical and typical speakers to get more information from the informants themselves as they talk during the sociolinguistic interview. By *atypical* and *typical* speakers I mean the speakers that were deemed *extreme* and *median* speakers in the statistical analysis, i.e. speakers with variation patterns that greatly differ from the average pattern in the sample, and those who are very close to it. However, the exploration of the TLS data will not be confined to summary statistics of social distributions. It will extend to a direct view of the speakers themselves on the local dialect and on their own speech.

The selection of variables

I shall use Wells's convention of lexical sets (1982) to refer to the vowels of English. FACE, GOAT, PRICE and MOUTH are particularly sensitive to change according to the existing sociolinguistic literature on the local area (Watt & Milroy, 1999). Since FACE & GOAT are well-documented (Buchstaller, Krause, Auer, & Otte, 2017; Corrigan, 2012; Watt, 1998), the literature will help study relevance and comparability with the results in this thesis. For all of these, a highly localised variant exists. This creates an opportunity to explore the level of variant retention or levelling in based on external factors like gender, age & class or more subtle aspects provided in the metadata for each speaker. MOUTH "more raised nucleus in Sunderland English" (Beal 2000).

Apparent-time vs real-time

Since the present thesis analyses two datasets from two different time periods, an important choice to make was whether to provide 2 apparent-time analysis or provide a real-time approach combining the TLS and the PVC. Exploring the production trends of generationally-differentiated cohorts of speakers provide a tried and tested way of observing apparent-time change in Tyneside English. However, at the end of his Norwich revisited study, Trudgill concludes by comparing the apparent-time with real-time approaches: "the apparent-time methodology is an excellent sociolinguistic tool for investigating linguistic changes in progress". He then adds: "provided that one can find something else interesting to do in the meantime [than apparent-time methodology], the study of linguistic change in real time is in many ways an even more informative experience” (Trudgill 1988, p. 48). Apparent-time and real-time have become two major constructs in sociolinguistics, both having their own advantages and disadvantages. In the 1960s, Labov (1963, 1966b) demonstrated the viability of the apparent-time construct for accounting and inferring about ongoing linguistic change. These publications then ushered in a plethora of work investigating the topic using apparent-time approaches in the ensuing four decades. Another construct emerged around the 1980s: Trudgill’s real-time study of Norwich English (1988) served as a primary example of real-time analysis (among others, cf. Clermont & Cedegren 1979, Macaulay 1977), which led to questioning about which methodological framework to follow in future sociolinguistic studies (Turell, 2003). Tillery and Bailey (2003) put both methods to the test and conclude that they are both useful tools but “none of them can be used uncritically” (Tillery & Bailey, 2003, p. 352). They advise using them “in combination” to as to get closer to “resolving the time problem dialectology and sociolinguistics” (Tillery & Bailey, 2003, p. 364).

This thesis is in line with Tillery and Bailey (2003) as it uses both methods to compensate the disadvantages that either may have. The apparent-time analysis was better suited for an aggregate analysis. This meant that I could include more than 500 phonetic variants and visualise how the speakers pattern with regards to these variables *and* to their social profile. However, change in progress is more straightforwardly captured by a real-time analysis but you need to treat the variants of the features one by one and take into account that the speech of the speakers at the time of the recording have evolved and is still evolving across their life-span. Studies like that of Buchstaller and colleagues (2017) on the TLS are an important case in point.

Thesis outline

The thesis is organised around three main parts. **Part I (chapters 1-5)** includes a general overview of the dialect and the region itself before providing a literature review on earlier works and on their methodology, with a particular focus on multivariate approaches. This part also comprises a presentation of the data and the methodology used for the present thesis. **Part II (chapters 6-7)** encapsulates a pilot study on the PVC wordlist material and the 3 main studies on the TLS transcriptions, the TLS and the PVC wordlist materials. They include both the apparent-time and real-time studies. **Part III** (chapter 8) provides an acoustic analysis of the TLS and PVC wordlist materials. What follows is a more detailed account of the content of each chapter.

In **chapter 1**, a brief geographical & social history of Tyneside is proposed. Against this backdrop, the local dialect is presented with a specific focus on the phonetic features that have highly localised variants in the area. Demographic information helps make sense of language variation in the region. Despite being perceived as a remote and isolated area, the economic dynamism of the region of Newcastle has paved the way to a large influx of immigrants and thereby, various forms dialect contacts, which is bound to lead to the levelling of TE. Socio-economic changes and urban planning are what hurled the implementation of the Tyneside Linguistic Survey. During the high tide of regionalism in the UK in the second half of the 1960s, linguists at Newcastle University foresaw that the transfiguration of the city's urban landscape would completely and utterly dismantle the then sociolinguistic stratification patterns, thus precipitating further change in the dialect, despite claims to preserve the local communities and neighbourhood dynamics as much as possible (Miller Lane, 2006).

Chapter 2 is a review of the literature on traditional dialectology and geolinguistics and how the TLS project paved the way to a new Northern-led British dialectology diverging from the Labovian methodology without eschewing it altogether. To really grasp the original theoretical framework of the TLS, it was necessary to trace back the work of two major national studies, one in the 19th century and the other, in the 20th century (the Dialect Society and the *Survey of English Dialects*). Since they included works on the region, they were considered as two crucial references, upon which the original TLS team built and improved their own methodological approaches. As most studies in dialectology were carried out from the North – mostly Leeds from the 1950-1960s, Viereck 1964 –, it is possible that such a dynamic research may have created a positive and emulating environment amongst Northern universities, with Newcastle University trying to find ways of promoting their own identity in research via a corpus on Tyneside English.[3]

Chapter 3 presents the corpus in more detail with regards to its genesis & the development of the project into an online corpus available to the public and to researchers. The selection of speakers and fieldwork methodology, transcription verifications for the PVC is also included.

[33] See for example the work by Labianca et al. (2001) on emulation dynamics in academia: "[f]urther, interorganizational emulation decisions based on tactics of upward comparison (e.g., emulating universities with better reputations) are associated with greater strategic change" (Labianca et al., 2001, p. 253).

Since this thesis was originally intended to be interdisciplinary with a strong focus on statistics applied to phonetics, in **chapter 4**, I provide a literature review of a multivariate analysis tool called Principal Component Analysis (PCA) applied by linguists. I then explain why an improved version called Multiple Factor Analysis (MFA) is better suited for sociolinguistic data.

Chapter 5 is a breakdown of the methodology and descriptions of the TLS & PVC data used for this specific thesis, i.e. how the different datasets were compiled for this study, ranging from speech annotation in Praat (Boersma, 2001) to hand-corrected formant tracking using a script by Emmanuel Ferragne for both data sets. The TLS-coding data required a more tailored approach with several steps in between the extraction of the codes from the pre-processed XML files to the compilation of two datasets (long & wide formats) with each phonetic code being matched with the speaker's metadata and the range of IPA transcriptions from narrow to broad it is related to. I endeavoured to capture every single step I used to compile the TLS dataset.

Chapter 6 details the results of a pilot study made on the PVC wordlist. The aim was to test if data was clusterable (had relevant sociolinguistic patterns), if the chosen multivariate analyses (PCA & MFA) were well-adapted to the PVC wordlist material prior to move on to a much bigger corpus, namely the TLS-coding data & the wordlist material.

The results of the main study are to be found in chapters 7 and 8. **Chapter 7** is an analysis of the TLS and PVC auditory data. Both sub-corpora are analysed separately as apparent-time studies. Comparisons among dyads are also carried out for the PVC. Levelling from the 1970 to the 1990 is also measured as a real-time approach. **Chapter 8** brings to the fore the results from the acoustic analysis of the TLC and PVC wordlists. The reliability of the auditory analysis is checked using Generalised Additive Mixed Models (Fasiolo, Nedellec, Goude, & Wood, 2018; S. Wood, 2017).

PART I

Presentation of Tyneside English & literature review

Summary of PART I

After a brief introduction of the North East from a geographical, historical and social point of view which have all contributed to the shaping of modern Tyneside English, I detail a few segmental specificities regarding TE, with a particular focus on vowels. I then trace the evolution of quantitative approaches in traditional urban dialectology and dialectometry (Séguy, 1971) from the premises of the Tyneside Linguistic Survey (Pellowe, 1972) to the creation of the *Diachronic Electronic Corpus of Tyneside English* (henceforth TLS and DECTE). The last section involves a literature review of multivariate analysis applied to sociolinguistics and dialectology, mostly with regards to Principal Component Analysis and Multiple Correspondence analysis. These tools can help simplify the statistical analysis and the clustering of speakers, which was one of the main goals of the original research team of the TLS. A more recent technique (Multiple Factor Analysis), which stems from PCA is also explained. It was deemed the most appropriate tool for dealing with sociolinguistic variation studies that involve at least three linguistic features with a lexical set/variant hierarchical structure (Amand, Ballier, & Corrigan, 2019).

CHAPTER 1 Introduction to Newcastle English: history, culture and language

Summary of CHAPTER 1

In **section 1.1** of this chapter, I first briefly present the geographical specificities of the North East, often seen as a rough and isolated place (Pearson 1994), which may have contributed to the preservation of the dialect. **Section 1.2** covers industrialisation led to the birth a working-class culture with which the accent of Tyneside is deeply associated. Deindustrialisation is also dealt with as it led to more women working, which is bound to have had an impact on their speech. The social landscape of the first TE fieldwork (TLS) in the 1970s is also compared to that of 1994 (PVC). **Section 1.3** explains how the term *Geordie* became progressively linked to minors, and by analogy, their speech. *In fine*, **section 1.4** highlights a few phonetic characteristics of TE based on works ranging from the nineteenth to the twenty-first century. Spectrographic examples are provided at the end of each section accompanied with a link to the corresponding sounds.

Before describing Tyneside English, it is necessary to understand the geographical and social specificities of Tyne-and-Wear, where it is spoken. The Newcastle area is also nicknamed *Geordieland* and is described by Beal as both a “nation apart” and a “nation united” (1999, pp. 34-35). Geographically, it is a region isolated by natural boundaries such as moors, mountains and the coastline. Historically, isolation is what probably led to the peculiar evolution of this variety of English (Schreier, 2009). This can also be ascribed to a slower increase in cultural diversity in its pre-industrial era (Ashraf & Galor, 2011, p. 1). The industrial revolution, along with the massive influx of migration that resulted from it completely transformed the region and created new working-class cultures and identities: the *Geordie* identity was born and the local dialect, TE, also known as *Geordie*, became intrinsically linked to the culture of workmen and mines. Today the Geordie identity is more than alive and manifests itself through various forms. For instance, it is highly present in the football world (Beal, 1999) and in the local marketing industry through commodification (Beal, 2009). All of this contributes to a very high degree of dialect *enregisterment* (Agha, 2003). In this section, I start by presenting the geographical specificities of the region. Then, I explain how industrialisation in the North-East and its subsequent deindustrialisation led to significant restructuring of job market affecting both men and women and how this is reflected in the TLS and the PVC. Since I could find but very few detailed explanations of the origins of the term *Geordie*, I chose to add a few lines related to it and to touch on how the connotations to the word evolved over time until becoming an object of commodification with dialect words surrounding the urban landscape today. Since spectrograms have rarely been used in descriptions of TE vowels and of the Northumbrian burr, I also included some with their accompanying sounds for illustration purposes. Most of them are either from the TLS or the PVC. For each lexical set covered in this chapter, I provide several variants indexing various social identities.

1.1 Geographical presentation

> *In the North-East, England, or rather the notion of England, seems a long way off. The North-East is at the far corner of the country but it is separated by more than just miles. There is the wilderness of the Pennines to the west, the emptiness of the North Yorkshire moors to the south and to the north, the Scottish border. The nearest major city to Newcastle is Edinburgh, and that is another country.* (H. Pearson, 1994, pp. 136-137)

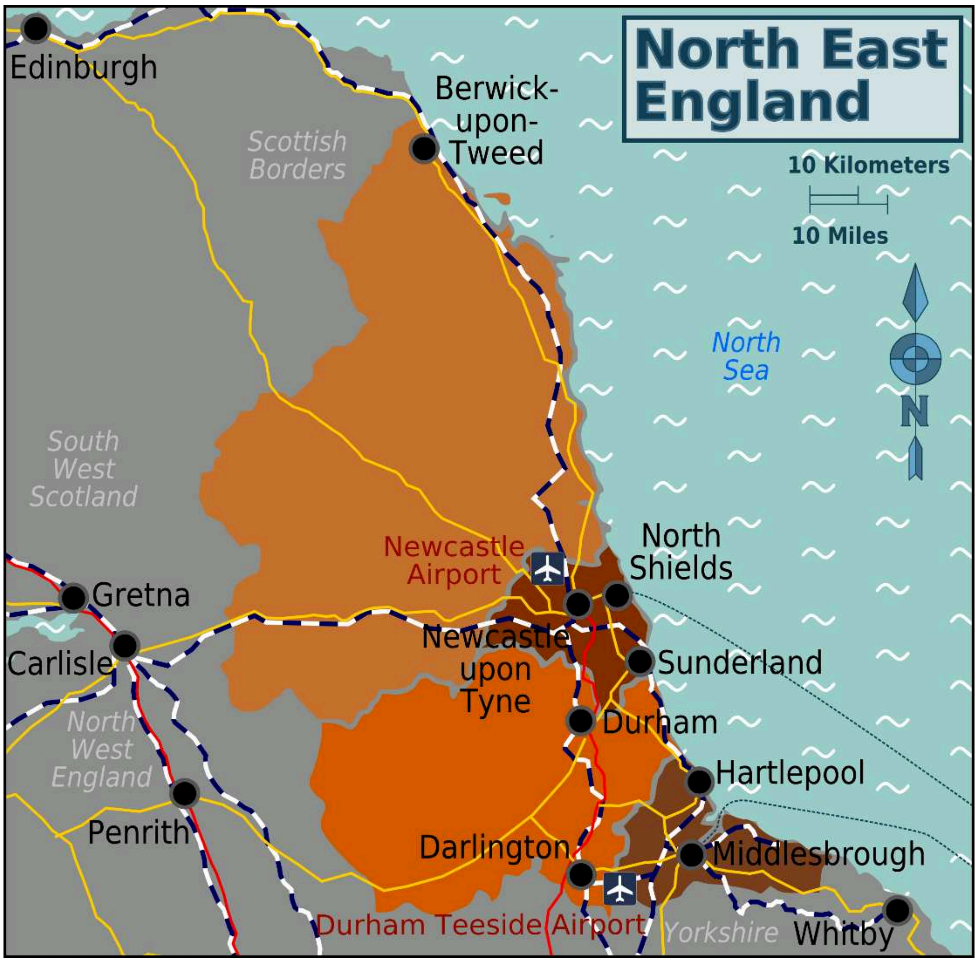


Figure 1-1 Map the North East
(from https://commons.wikimedia.org/wiki/File:North_East_England_map.png#metadata).

The dialect under scrutiny is located in the North East of England (Figure 1-1). Bordering Scotland in the North, the region is surrounded by hills on its western border (the

Pennines) and by the North Sea on its opposite side. It extends right up to the southern banks of the Tees and comprises other rivers such as the Tyne and the Wear. Its main urban centres are as follows: Newcastle/Gateshead, Sunderland and Durham along with Middlesbrough. Together with North Tyneside and South Tyneside, Newcastle and Gateshead form the urban core of the Tyneside Conurbation. Before a rearrangement of the counties in 1965 and 1974, Gateshead was in county Durham and Newcastle was in Northumberland. This means that at the time of the Tyneside Linguistic Survey in the early 1970s, the two fieldwork areas of Gateshead and Newcastle were separated by geographical and administrative boundaries. After 1974, they became part of the metropolitan county of Tyne and Wear.[4]

But as Beal reminds us, the linguistic and social boundaries are less clearly defined than the geographical ones. Not all people in the North East identify as Geordies, and an important boundary for Geordies is the city of *Sunderland*, the "territory of the rival tribe, the 'Mackens'" (Beal, 1999, p. 34). *Macken* is said to refer to shipbuilders in Sunderland and by extension, people in County Durham. Identity boundaries can be pushed as far up as Gateshead, which is also on the south bank of the Tyne and was part of Durham until 1972 before being part of the county Tyne-and-Wear. The rivalry between Newcastle and Gateshead is locally well-

4 For a recent mapping of metropolitan districts, see the interactive council map: https://www.gov.uk/guidance/local-government-structure-and-elections#council-map (Accessed 19/07/2019)

known (Miles, 2005, p. 917) and appears every now and then in the TLS interviews.[5] Newcastle is generally seen as *posher* and Gateshead more working-class even though there are also several areas that are traditionally working-class areas in Newcastle, such as Benwell or Fenham, all shaped by long lines of terraced houses. However, both Newcastle and Geordies claim to be *Geordies* as opposed to Sunderland. Miles (2005) explains that the recent notion of *NewcastleGateshead*, coined as part of the revitalisation of the area, is “in itself a construction of the destination-marketing agency Newcastle Gateshead Initiative, intent on cashing in on both the reputation of Newcastle upon Tyne as a regional capital and party city, and the cultural iconicity on the Gateshead side of the Tyne” (Miles, 2005, p. 917). Politically, various attempts have been made to create a more unified North East but they have remained partially vain (J. Walker, 2018). It is with these differences in mind that the TLS fieldwork

[5] Upon my first visit to Newcastle, when I was introduced to the TLS and the PVC thanks to Karen Corrigan, Adam Mearns and other researchers related to the project, I remember being told to bear in mind that Gateshead was *distinct* from Newcastle. I then went to the *Stand* in Newcastle, where comedy shows often take place, so as to listen to more recent versions of the accent. In this dramatic *genre*, accents are often used a tool for comic effects. A comedian from Gateshead who was on for a show that night also made us clear how Gateshead was distinct from Newcastle, with more *genuinely* working-class Geordies speaking with a *genuine* Geordie accent. An informant living in the area, later told me that in one of the Gateshead venues which welcomes comedians from across the world, signs had to be put up on the walls of the green room to reminds the comedians to great the audience with a “Hello Gateshead” since too many of them had slightly annoyed the audience by considering the place to be in Newcastle (PC, Diane Jones 2018).

areas were initially chosen, with a sample of participants being interviewed in Gateshead, and another, from Newcastle.

1.2 The rise and fall of the industrial development in Newcastle

The social aspects of the TLS and PVC surveys cannot be fully grasped without an overview of the social and economic specificities of the city. The latter's strong identity as a former factory of the world in coal, iron and shipbuilding gradually transformed Tyneside English into a linguistic relay and symbol of workmen's speech in the area. In this section, I first outline the development of Newcastle via its heavy industrialisation, which led to a significant increase of migration in the region. Then, I explain how deindustrialisation, concomitant with the opening of the marketplace for women led to a sampling of informants with different social profiles from one linguistic survey to the next. Eventually, the term *Geordie*, which also refers to Tyneside English, is defined since it the term is strongly linked to Tyneside's industrial workers.

1.2.1 Industrialisation

In the North-East, industrialisation is "by far the most important – and pervasive – legacy of the past" (Robinson, 2002, p. 317). During that period, the social demography of the region was transformed massively with the development of coal, iron, and shipbuilding industries. Railways were also developed in the region. Coal was so intensively produced that even an expression was coined: "it's like taking coal to Newcastle", which suggests the futility of an action such as bringing coal to a city that abounds in coal. This propelled the North-East in having "a major role in securing Britain's economic supremacy" (Robinson, 2002, p. 318). The painting by Bell Scott in 1861 provides a good visual illustration of the massive and diverse industrial development taking place in Newcastle (Figure 1-2). It comprises all of the above-mentioned industries thriving at the time and depicts strong men at work, probably shaping iron. Behind them is a miner, another typical occupation at the time. A strong sense of identity and pride to be a Northumbrian is also present in the title of the painting and potentially hints at the development of new working-class cultures and communities built around factory work and factory villages. As Robinson points out:

> Conurbations, comprising collections of occupational communities built around pits and shipyards, steel mills and engineering works, developed along the rivers Tyne, Wear and Tees. And cultures grew out of industrialization—cultures which have lasted longer than the industrial base. (Robinson 2006, p. 318)

By creating and reinforcing pockets of communities, the industrial revolution considerably influenced and shaped what the linguistic and dialectal landscape of the region is today. These industrially-rooted "cultures" came hand in hand with the urban dialect of Tyneside, also known as *Geordie English*. In addition, the name of the painting itself in Figure 1-2 also suggests pride in the region's recent economic growth thanks to the hard work of the Northumbrians, thereby reflecting the development of a positively connoted *Geordie* social and linguistic identity. Such cultures and identities have remained deeply rooted in the region, and if now mines have disappeared there, such "cultures", be they social and linguistic, are what remains after deindustrialisation (Robinson 2006, p. 318). And with them, also remained *Geordie English*. The next section is an overview of the impact of deindustrialisation on people living in Tyneside and how this is reflected in the TLS and the PVC.

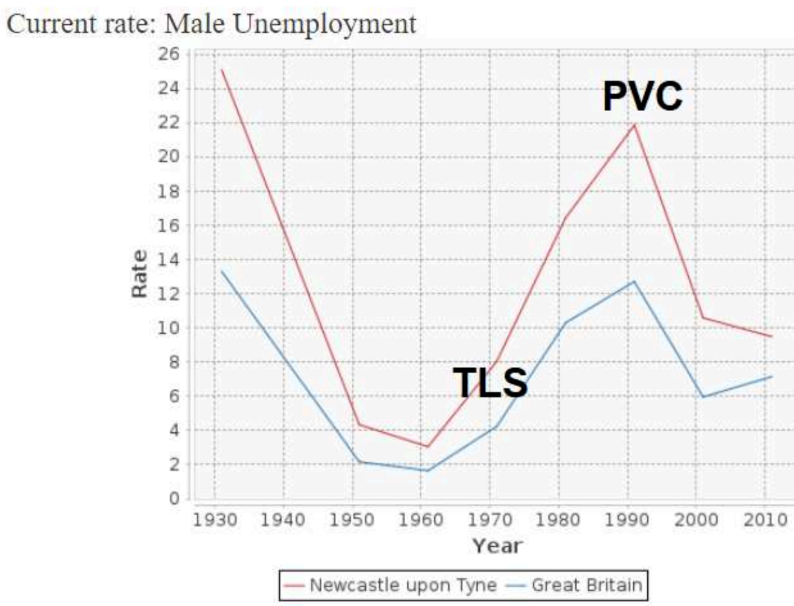
Figure 1-2 Northumbrian industry & local identity. Oil on canvas. *In the Nineteenth Century the Northumbrians show the World what can be done with Iron and Coal* by William Bell Scott, 1861. Wallington, The Trevelyan Collection (National Trust).

1.2.2 Deindustrialisation

Deindustrialisation had a severe impact on the North-East and the Midlands. As Stanley remarked about the latter, “[b]y shuttering factories, disrupting social networks, defamiliarizing the landscape, and relegating thousands to the unemployment lines, deindustrialization marooned the Midlands working class in a world they struggled to recognize” (Stanley, 2017, p. i). The working-class had to adapt to new forms of social structures. Communities had to find ways to rebuild the bonds within the community, which had been severed because of these redundancies and were restored through social events like football (Stanley, 2017). The decline of industries in the North, which started with the economic collapse of the 1930s (Armstrong & Beynon, 1977), was long and unsteady. As Figure 1-4 illustrates male unemployment rates reached a peak before plummeting until the 1960s.

In the 1950s re-armament and post-war reconstruction instilled a new lease of life to the economy in the North-East, with companies like Vickers-Armstrongs (Figure 1-3) for which TLS speaker G30M worked. However, this short economic recovery was followed by another long-lasting economic decline during the Thatcher years (1979-1990) with a severe recession and restructuring. Unemployment soared to reach a peak just below that of the 1930s (Figure 1-4). Today several of the Newcastle former industries have become heritage buildings or have been transformed into museums like the Baltic in Gateshead (Robinson 2006, p. 318). But these industries "have certainly left their mark and have left behind casualties—redundant people and forgotten places which have not recovered from deindustrialization" (Robinson 2002, p. 318). This was the socio-economic context in which the TLS (1970s) and PVC (1994) linguistic surveys were carried out although the economic context for either surveys differs significantly. While the TLS informants lived in a context of rising unemployment after a low of about 5% in the 1960s, those recorded for the PVC were at a tilting point where unemployment had reached a peak and was about to drop dramatically by 20%. These figures coincide with higher rates of emigration than of immigration, with the trend reversing since 1994 (Sturge, 2019, p. 3).

Figure 1-3 Advertisement for Vickers-Armstrongs in Newcastle (1938), for which TLS speaker G30M worked (Retrieved 29/07/2019 from: https://www.gracesguide.co.uk/File:ImIDH1938-VickersArmstrongs.jpg).



Source: http://www.visionofbritain.org.uk/unit/10142714/rate/CENSUS_MALE_UNEM

Figure 1-4 Male unemployment between 1930 and 2010: GB vs. Newcastle.

1.2.3 Population dynamics in Tyneside

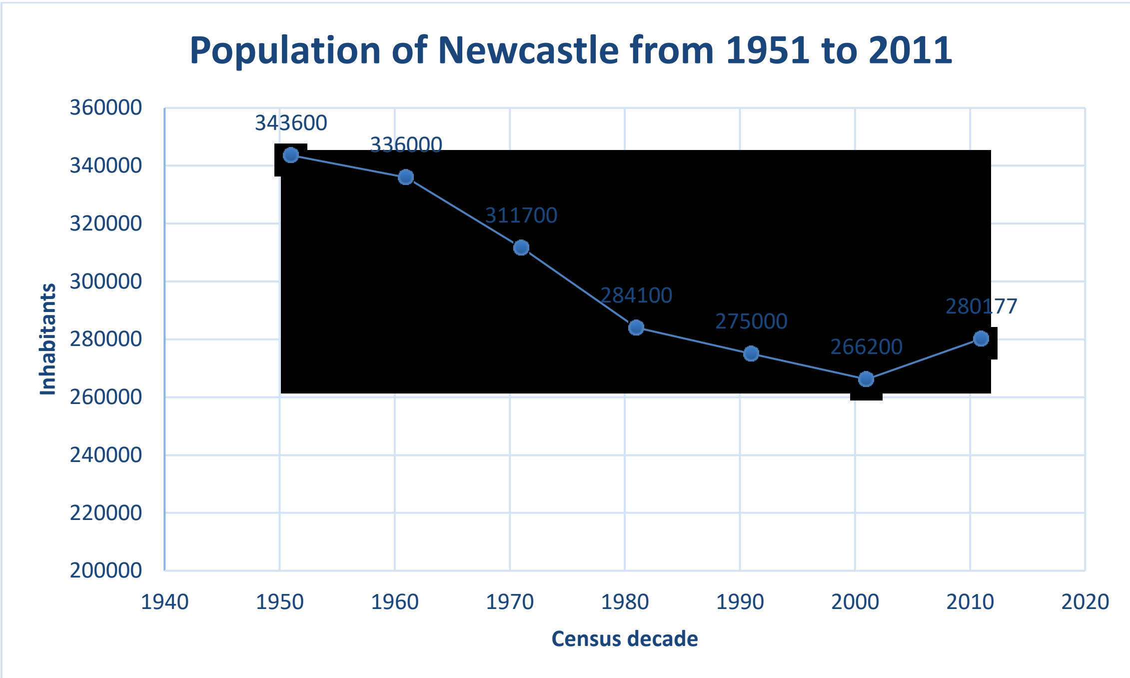


Figure 1-5 The decline of the Newcastle population in the post-War era. (Source: O.N.S., Mid-year estimates, 2011 Census[6]).

In the 1960s the population of Newcastle was estimated to have reached 336,000 and declined gradually to 311,700 in 1971 and continued to drop until reaching a low of 266,200 inhabitants in 2001. Ten years later, the 2011 census revealed that the population had risen again by more than 13,000. This decline coincides with a change in industrial activity (Figure 1-5). The heavy industry that had been highly dynamic and productive at the end of the nineteenth century and the first half of the twentieth became obsolete as lighter industries along with the service sector took over (Lewis & Townsend, 1989).

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[6] Retreived in March 06 2019 from: http://www.ukcensusdata.com/newcastle-upon-tyne-e08000021#sthash.vG4TeLza.dpbs

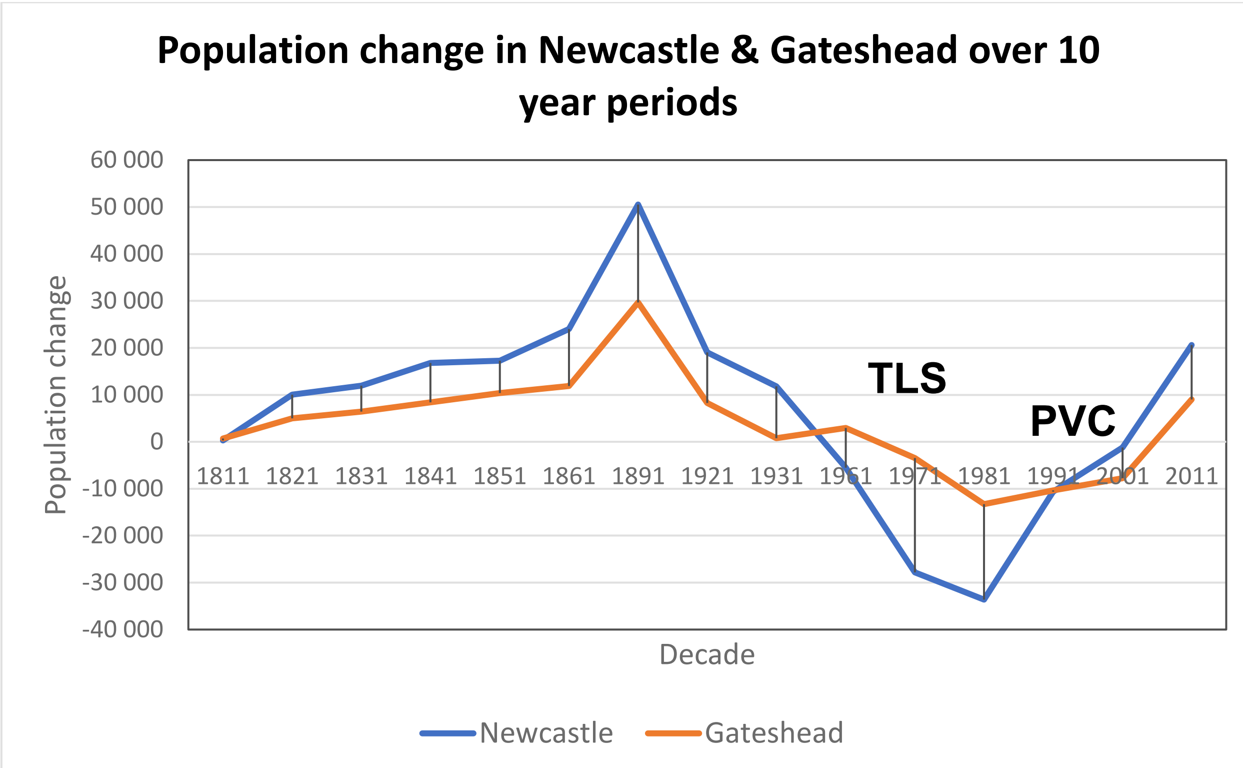

Figure 1-6 Population change in Newcastle and Gateshead over 10 year periods.[7]

Population dynamics in Gateshead and Newcastle pattern in a similar way except during the period of the TLS and PVC surveys. In the 1970s, the population of Newcastle plummeted to a much greater extent than Gateshead (-27,810 vs. -3,475 inhabitants). It is possible that the economic situation there made it become a less desirable place to live. In 1991, as unemployment was starting to decrease (a few years before the PVC), figures indicate that the population in Newcastle had risen faster than Gateshead. Living in

[7] **Source for Gateshead**: GB Historical GIS / University of Portsmouth, Gateshead District through time | Population Statistics | Population Change, *A Vision of Britain through Time*. http://www.visionofbritain.org.uk/unit/10092759/cube/POP_CHANGE (Accessed 02/08/2019). **Source for Newcastle**: GB Historical GIS / University of Portsmouth, Newcastle upon Tyne District through time | Population Statistics | Population Change, *A Vision of Britain through Time*. http://www.visionofbritain.org.uk/unit/10142714/cube/POP_CHANGE (Accessed 02/08/2019).

Newcastle and Gateshead had become more desirable than during the TLS. It is difficult to determine to what extent population dynamics impacted variation patterns in both surveys but it is probable that an increase in population and emigration from abroad which was accelerated in the 1990s may have sped up the levelling process towards pan-northern linguistic features.

1.2.4 Tyneside women enter the workplace: new jobs, new speech?

As deindustrialisation was severely hitting the region during both linguistic surveys, tertiarisation was under way. New patterns emerged in the workplace. While, in the past industries employed men more than women, at the turn of the twenty first century women made up about half of the employed workforce. At the time of the TLS, by the 1970s, "women had become the major element of growth in the local economy, falling in line with the national average" (Robinson, 2002, p. 319). Across the decade, the rate of female activity rose from 40% to 45% of women in both Newcastle/Gateshead and Britain.[8] This was a major shift from an unobtrusive, nearly "invisible" position – either confined within the home boundaries or within low-paid "feminised" jobs – with virtually no prospects for advancement (Knox, 1992) p. 99. Claudia Goldin coined this evolution change a "quiet revolution" that started in the late 1970s and is still an undergoing process today (Goldin, 2006).

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[8] From the 1990s up until the 1970s, there is a noticeable difference in female activity rates between Newcastle and Gateshead. The latter had lower rates than the former but from the 1980s onwards, the gap between the national average and Gateshead was smaller than Newcastle. Cf. Newcastle figures: http://www.visionofbritain.org.uk/unit/10142714/rate/CENSUS_FEM_ACTIVE Gateshead figure: http://www.visionofbritain.org.uk/unit/10092759/rate/CENSUS_FEM_ACTIVE. Retrieved in March 15th 2019.

Such a tremendous upturn is reflected in the social data pertaining to the TLS and PVC female informants. More than half of the women in the TLS declared themselves as housewives (enlarged sample of Gateshead speakers, women = 50), as opposed to one only in the PVC and another one who stayed at home to raise her child for two years (women =18). The dramatic difference should not be overestimated, though. In the TLS, there are only 4 female speakers around 17/18 years old and in the PVC, 11. In both decades, the younger speakers were probably a bit young to get married and thereby, less likely be potential housewives yet since the average marriage age was around 24 in the 1970 and rose to 30 in 1994 (Figure 1-7). Besides, all the PVC young women were still attending school, which rules them out from the housewife category. Moreover, the Gateshead sample is mostly drawn from people with a more working-class background, while in the PVC half of the speakers are considered more middle-class. Hence the sampling methodology may well differ from one survey to the next, but the social and economic evolution of women in the workplace remains visible through female occupations found in both surveys.

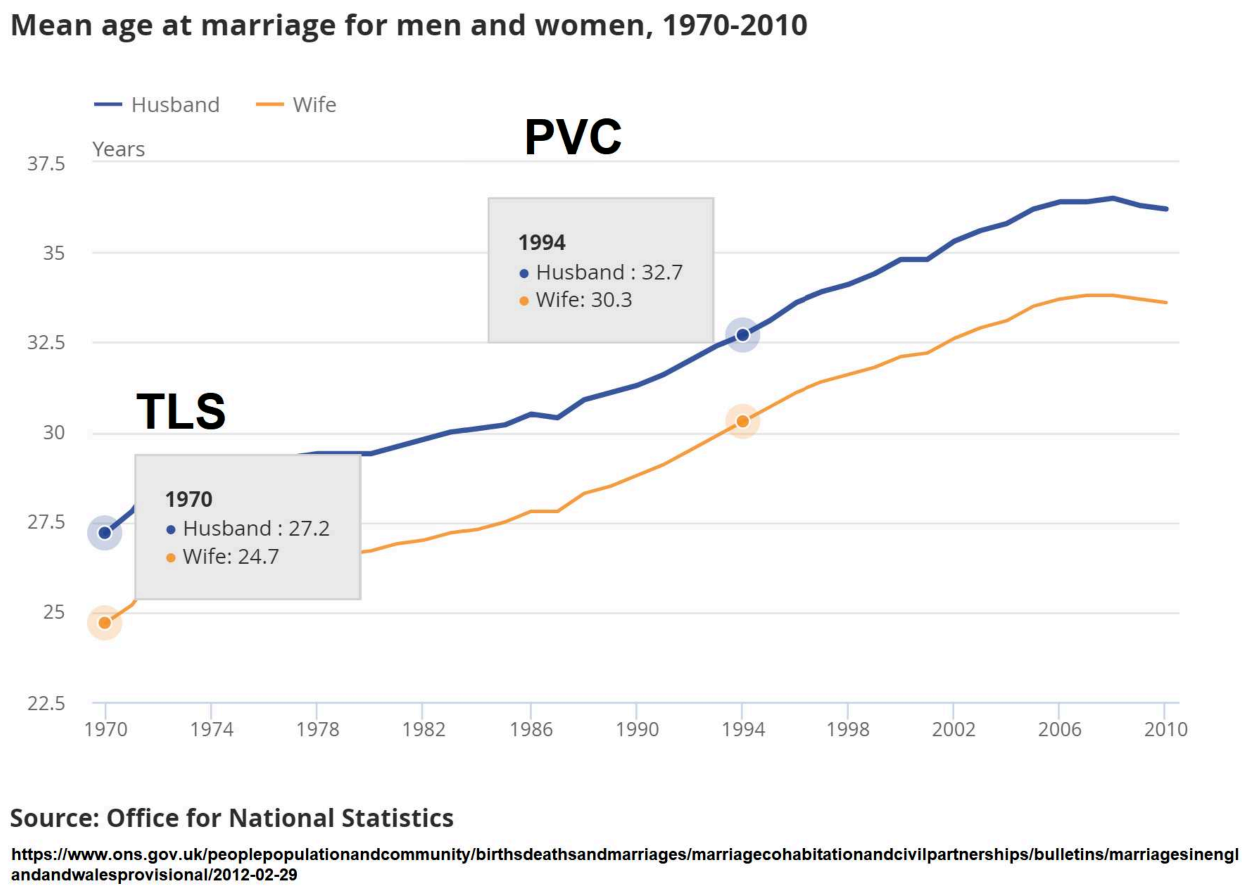

Figure 1-7 Mean age at marriage for men and women in the UK at the time of the TLS and of the PVC (Source: O.N.S).

We can therefore hypothesise that the speech patterns of women entering the tertiary sector will take on a new turn, which may be conducive to a faster levelling of the accent in the PVC than in the TLS because they are likely to adopt the social and linguistic values of the working sector associated with it. A study by Susan Gal (1978) carried out in Oberwart (Austria) among a Hungarian-German community showed that women had “more to gain” from the shift from an agricultural age to an industrial one and therefore adopted the more prestigious linguistic patterns – German only – that went hand in hand with that new era. Her conclusions are as follows:

> The women of Oberwart feel they have more to gain than men by embracing the new opportunities of industrial employment. Also, considering the male-dominated nature of East European peasant communities generally and the lives of Oberwart women in particular, women have less to lose in rejecting the traditional peasant roles and values.

Similarly, as more diverse and prestigious jobs for women were made available in the UK, it is possible that women had "less to lose in rejecting the traditional" values and gender roles that prevailed before deindustrialisation in Newcastle. Hence, as Gal explains: "women's speech choices must be explained within the context of their social position, their strategic life choices and the symbolic values of the available linguistic alternatives" (1978, p. 1). We expect to find similar linguistic evolutions in both the PVC and the TLS, although the shift for more prestigious alternatives probably started earlier than when the TLS was carried out.[9]

I have briefly outlined the geography, demographics and economy of Tyneside associated with both linguistic surveys. Deindustrialisation dismantled linguistic communities even though some of their own social and cultural codes remained. Therefore, lower scores of traditional variants typically associated with the speech Newcastle working-class men are expected to be found in the corpus. Moreover, between the TLS and the PVC, the number of housewives decreased as the number jobs available for women in various fields like the service sector increased. I expect a greater degree of levelling among women, whose private and professional image has to be maintained and preserved (Gal, 1991;

[9] It is precisely because women already adopted linguistic alternatives to the traditional, broad rural male features, that were not included in the Survey of English Dialects which was initiated in the 1950s. Men being considered as more "genuine" representatives (Orton, 1962; Orton & Dieth, 1952; Orton & Halliday, 1962). See also Gordon (1998) on speech and gender.

Gordon, 1997). I now proceed to a short description of TE with a particular focus on segmental specificities after a definition of the term *Geordie*.

1.3 From the b[or]th of Geordiness to its commodification as a way to measure enregisterment in TE

It is not easy to find the exact etymology of the name *Geordie*, restricted to its association with the area. But delving into dialect dictionaries and numismatics, I realised that the term referred to different realities from one century to the next. But what mattered to me was to find out how closely linked the term was to the industrial revolution and more specifically, to the miners themselves and their speech. Today, features in the speech of minors such as the *Northumbrian burr* have become nearly extinct (Beal, 2004) and certain vowels like FACE and GOAT are levelling (Buchstaller et al., 2017; Watt, 2002). Certain forms are fossilised or even iconised (Beal 1999, p. 45) and are the object of commodification thereby forming a "distinctive voice for the Geordie nation" despite being in the process levelling (Beal 1999, p. 45).

1.3.1 Origin of the term and definitions

The word *Geordie*, also found as *Geordy* in 18th century texts, is a diminutive of the name George in the Northern and Scottish dialects of England (Wales). The word George itself comes from Ancient Greek *geōrgós*, meaning farmer. According to the *English Living Oxford Dictionary*,[10] the term Geordie was conferred on the people of Newcastle who supported

[10] Retrieved in March 05 from: https://en.oxforddictionaries.com/explore/the-origin-of-geordie/

George I and his successor George II during the Jacobite risings of 1714 and 1745 (Hingley, 2012; Oates, 2003) p. 122. The term *Geordy* is also found in ballads and songs from the 18th and 19th century, often associated with Scotland or Northumberland,[11] such as the collection of songs entitled *The Northumberland garland: or, Newcastle nightingale: A matchless collection of famous songs* (1793) or *The tea-Table miscellany: a collection of choice songs, Scots and English* (1794).

In the 19th century the term was linked with workmen and miners. Wright gives a few entries in his *English Dialect Dictionary* (1892). The first definition is a guinea because the portrait of King George III was struck on these gold coins in the late 18th century (Figure 1-9).[12] The last guinea which was called "military guinea" also had a portrait of the King on it. It was struck in 1813 before the Great Recoinage of 1816 (Clancy, 1999). The second one is a nickname for George Sephenson's safety lamp for minors illustrated in Figure 1-8. A glossary of mining terms in Northumberland and Durham from the late 19th century (Greenwell, 1888) indicates that the term *Geordy* refers to the "safety-lamp invented by George Stephenson" (1888, p.44). The reader is also redirected to the term *Davy* (1888, p. 30) which is the name of another safety-lamp invented by Humphrey Davy. A second glossary published in the US (Fay, 1947), p. 302, provides two definitions, indicating that the term is more specific to Scotland: (1) "A coal worker". (2) "A miner's name for a safety lamp invented by

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[12] For an example of such guineas, you may visit the Royal Mint website: https://www.royalmint.com/our-coins/ranges/historic-coins/historic-guineas/george-III-spade-guinea/ or the following website for a picture of a military guinea: http://mjhughescoins.co.uk/eshop/1813-george-iii-gold-military-guinea (Accessed in March 05 2019).

George Stephenson (Webster)". In the *EDD* Wright also indicates that Geordie refers to a Tynesider or a miner (Figure 1-9). Artists also used the term in 19th century songs and in names of paintings to refer to local inhabitants, especially miners. A painting by Ralph Hedley (1892)[13] showing a man with a baby in his arms (Figure 1-10) was even named after a song by a prolific writer of the region (Joe Wilson)[14] "Geordie Haa'd the bairn" (Allan & Allan, 1891) p. 474. Above the man's head is a miner safety lamp, indicating his profession. The name of the painting reinforces the link with miners from Tyneside along with the miners' sub-culture of popular songs like "Geordie Haa'd the bairn" (Figure 1-11). The song was written using the local dialect of Tyneside, where Joe Wilson was from, hence, in collective memory, the term *Geordie* is not only associated with miners from the area but it is also deeply linked with the local dialect.

[13] The painting is exhibited at the Laing Art Gallery of Newcaslte-Upon-Tyne and can be viewed on the following website: https://www.artuk.org/discover/artworks/geordie-haad-the-bairn-36441# (Accessed in March 07 2019).

[14] According to Allan, "[b]eyond all comparison, Joe Wilson has been the most successful of Tyneside song-writers" (1891) p. 475.

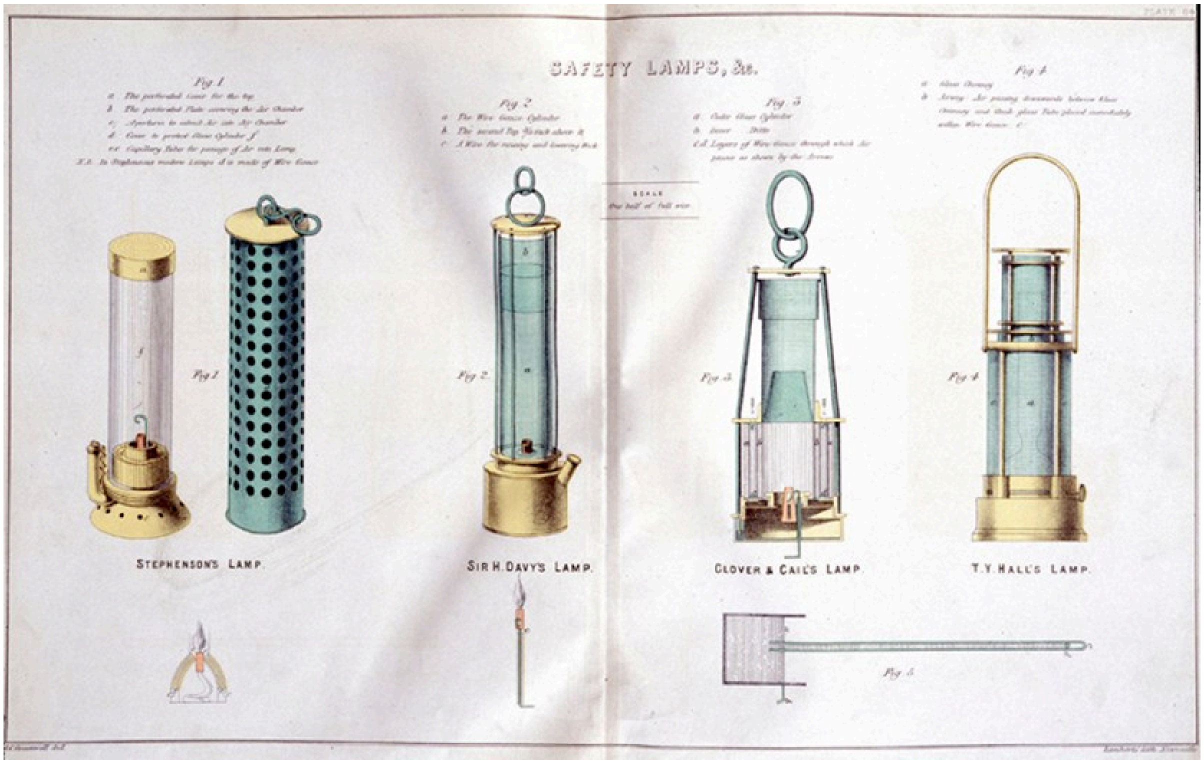


Figure 1-8 George Stephenson's safety lamp (left) compared with other miners' lamps. http://www.bbc.co.uk/schools/primaryhistory/famouspeople/george_stephenson/images/stephenson_lamp_small.jpg.

GEORDIE, *sb.* Sc. Nhb. Dur. Also Aus. 1. A guinea. See **George** (**2**).

Frf. They cost the Geordies red an' roun, Morison *Poems* (1790) 13. **Ayr.** The yellow letter'd Geordie keeks, Burns *Twa Dogs* (1786) st. 8; Fifteen yellow Geordies tied up in a rag, *Ballads and Sngs.* (1846) I. 118. **Edb.** If ye can make auld stockens burst Wi' yellow Geordies, Liddle *Poems* (1821) 172. **Wgt.** A handful of 'yellow Geordies,' Fraser *Wigtown* (1877) 36. **Nhb.** Wor Geordies now we thrimmel'd oot, Marshall *Sngs.* (1819) 5.

2. *Obs.* George Stevenson's safety-lamp. Also in *comb.* **Geordie-lamp**.

N.Cy.1, Nhb.1 Nhb., Dur. It consisted of an oil vessel, a glass chimney with a perforated copper cap, surrounded by an iron shield perforated with large holes. The air was admitted through large holes at the base and through small holes at the top of the oil vessel. It is now made with a wire gauze in lieu of the perforated iron shield, Nicholson *Coal Tr. Gl.* (1888).

3. phr. *by the Geordie*, by George, by St. George.

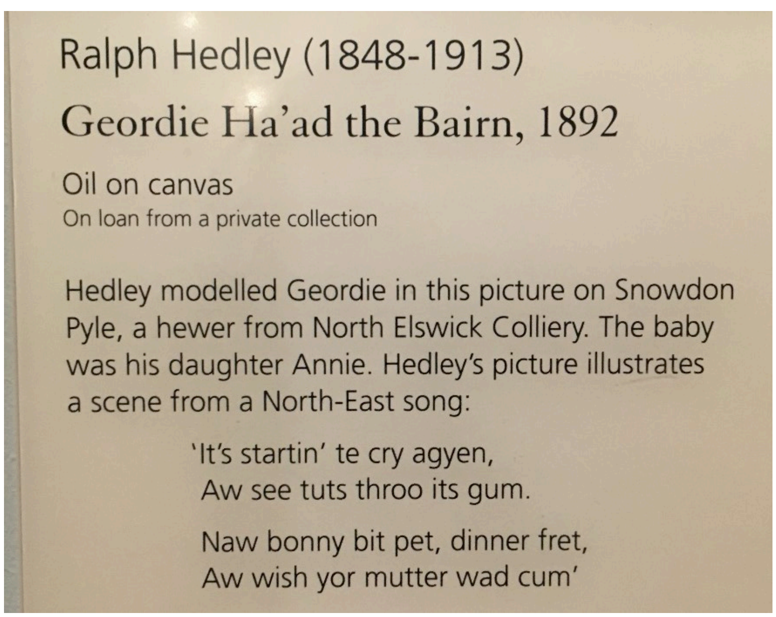
Ayr. Wife! By the Geordie, a lade o' meal wad ser' 'ou better Service *Dr. Duguid* (ed. 1887) 196.

4. A man from Tyneside; a miner; a north-country collier vessel.

Nhb. Set a' the Geordies in a roar, Allan *Tyneside Sngs.* (ed. 1891) 416; **Nhb.1** When a man from Tyneside came to work in a new place, outside his district, it was said 'a Geordy' had come among them. In South Tynedale, even, this name was applied to the Lower Tyneside men. **e.Dur.1 Aus.** Whose yer friend; a Geordie, most like? Boldrewood *Miner's Right* (1890) I. ix. ['What is that out there?' I asked. 'A Geordie,' he answered; 'a north-country collier,' Russell *Heart of Oak in Good Wds.* (1895) 121.]

Figure 1-9 Dictionary entry of the word *Geordie* in volume 2 of the EDD (Wright 1900, p. 597) . Retrieved in March 05 2019 from http://eddonline-proj.uibk.ac.at/edd.

Figure 1-10 *Geordie Haa'd the Bairn*, by R. Hedley, 1892 (Laing Art Gallery). Retrieved March 05 2019 from: https://www.artuk.org/discover/artworks/geordie-haad-the-bairn-36441.



Ralph Hedley (1848-1913)

Geordie Ha'ad the Bairn, 1892

Oil on canvas
On loan from a private collection

Hedley modelled Geordie in this picture on Snowdon Pyle, a hewer from North Elswick Colliery. The baby was his daughter Annie. Hedley's picture illustrates a scene from a North-East song:

'It's startin' te cry agyen,
Aw see tuts throo its gum.

Naw bonny bit pet, dinner fret,
Aw wish yor mutter wad cum'

Figure 1-11 Label giving details of the painting *Geordie Haa'd the Bairn* at the Newcastle Laing Art Gallery.

According to Frank Graham, a local writer and publisher, the word had also been used in many instances as a term of abuse or a derogatory term pointing at someone's idiocy. In popular novels with Northerners as protagonists, the word *Geordie* or *Geordy* is regularly resorted to. For example, in one Philip Robson's popular novels (1849, p. 128), the protagonist humiliates a "silly fellow" and "pitman" and cries out that he is a "*fair doon reet* feul[15] (…) a real Geordy!"[16] Such a term of abuse could also have originated in George III's madness and resulting incompetence (Graham, 1987). With negative connotations repeatedly associated with the term, and the disappearance of entire communities of miners after deindustrialisation, the future of the Geordie identity and dialect appeared rather gloomy. But the inhabitants managed to kindle their identity to reach a phase of linguistic and cultural renaissance (Colls, 2000) which is visible through the amounts of Geordie dialect souvenir shops that crop up all over the city.

1.3.2 Geordiness in the 21st century: a commodification of the dialect and reinforcement of pride in the dialect

Today, Geordie by-products have become ever more popular in Newcastle. The term has lost its derogatory connotations and is used more as a symbol and token of geographical identity (Beal 2009). Associated with *Geordiness*, the dialect is increasingly the object of

[15] Semi-phonetic local pronunciation for a "fair down right fool".

[16] However, I believe that from someone *within* the Geordie community this could be an affectionate insult (Diarra & Fougeyrollas, 1969) but from someone *without*, it may be considered as a mere term of abuse.

commodification promoting the Newcastle region. In every major shopping street you can find shops selling souvenirs from Newcastle illustrated with popular dialect words.[17] Fake birth certificates in Tyneside English can be bought on eBay or the Tyne & Wear archives and museum online shop (Figure 1-12 & Figure 1-13). T-shirts, mugs or posters also featuring dialect words and expression also abound. Such commodities exemplify the now positive overtones now associated with Geordiness and the Geordie dialect and further reinforces awareness of the existence of the dialect despite the prevalence of a pan-northern standard. Nyffenegger and Steffen (2010), both design analysts from the Lucerne School of Art and Design, insist on the importance of these products or souvenir gifts as they “they materialize both personal memories and social encounters”. Moreover, “in destination marketing, they may play an important role by word-to-mouth promotion."[18] (F. K. Nyffenegger & D. Steffen, 2010, p. 135).

Geordie by-products are not merely commercial traps targeting the tourist to Newcastle, they target the local inhabitants too. They can therefore be read as “constituents

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[17] By means of comparison, French Britany, which boast a very strong identity, uses a much more limited amount of Breton words in its by-products. Only *Breizh*, the Breton name for Britanny and “ker” (meaning town) abound in shop names and products. More recently however, small expressions like “digemer mat” (or welcome) have started to appear even in places where Breton was not originally spoken. The abusive use of Breton words to make a company or a product more desirable among the locals such as calling a detergent “Breizh-wash”, a bus company “Breizh-go” etc, is now called “Breizh-washing”. As opposed the *Geordie* scene, locals frown upon such commodification and call for a more bilingual public life that would be similar to the situation in Wales. On the perception of the commodification of Breton see: https://www.letelegramme.fr/bretagne/breizh-washing-a-vannes-ai-ta-mene-une-operation-sur-les-transports-regionaux-13-10-2018-12105453.php and https://www.breizh-info.com/2018/10/16/104122/aita-breizh-washing. Accessed on 27/08/2019.

[18] Destination marketing refers to the commercial strategies to incite people to visit a specific location and buy specific products there. Retrieved on 05/03/2019 from https://destinationthink.com/word-of-mouth-future-destination-marketing/

of an individual's identity", "biographical testimonies" (F. K. Nyffenegger & D. Steffen, 2010, p. 137), linked to more abstract concepts such as "narratives of self-identity" (Morgan & Pritchard, 2005, p. 31) or "museum[s] of the personal" (Tracey Benson, 2001) and thereby enhance one's pride in the dialect.[19] Indeed, the commercial description of the product on the right hand side of Figure 1-12 indicates that it is chiefly targeting Geordie people themselves who wish to display their affiliation to the Tyneside area without lack of taste: "Available in any colour to suit but we think this Black & White version is perfect for this, don't you?" The final sentence hints at the colours of the Newcastle football team. A tourist from outside Newcastle, who is not a football fan may not necessarily have understood this inside joke.

The term "Geordiness" even appears in blogs[20] and forums and encapsulates both the Geordie accent and way of life. In one forum, members comment on other people's exaggeration of their attachment to the North East through their behaviour: "every Newcastle fan, whether they are from Benwell or Hartlepool, claim to be Geordies, they even purposefully change their accents to add to the 'Geordiness'."[21] In sociology this phenomenon may be called self-stereotyping, or, as Turner defines it: "people come to see themselves more as the interchangeable exemplars of a social category than as unique personalities defined by their differences from others" (Turner, 1985). People wishing to belong to the Geordie community therefore redefine themselves in terms of group membership (Hornsey, 2008). As far as dialectology is concerned, this may be called *enregisterment*, i.e. "processes through

[20] A student blog has created a "Geordiness" section for some of her articles about her life, a "Geordie lass studying in Liverpool": https://geordiegiraffe.wordpress.com/category/geordiness/

[21] http://www.readytogo.net/smb/threads/durham-cleansed.775956/page-3

which a linguistic repertoire becomes differentiable within a language as a socially recognized register of forms" (Agha, 2003, p. 231) and is in line with Kerswill's interview of 16 Durham teenagers in 2002, who all claimed "that they did not mind being labelled 'Geordies'. The attitudes were almost all positive, with comments that the Newcastle accent was 'stronger', 'broader', and even, 'It's good, aye!'" (Kerswill, 2003, p. 236). In the PVC data, Watt also found a certain degree linguistic re-assertion of Geordiness among Newcastle teenage boys through their more frequent use of the local central monophthong [ɵː] in the GOAT lexical set (Watt, 1998). Being a Geordie and *speaking* Geordie has become a reaffirmation of one's proud association with Northern culture.

Figure 1-12 Geordie by-products and gifts that could be bought online in the 2010s.[22] Retrieved in May 30 2014 from http://www.creative-force.co.uk/calm-doon-geordie-gift.html.

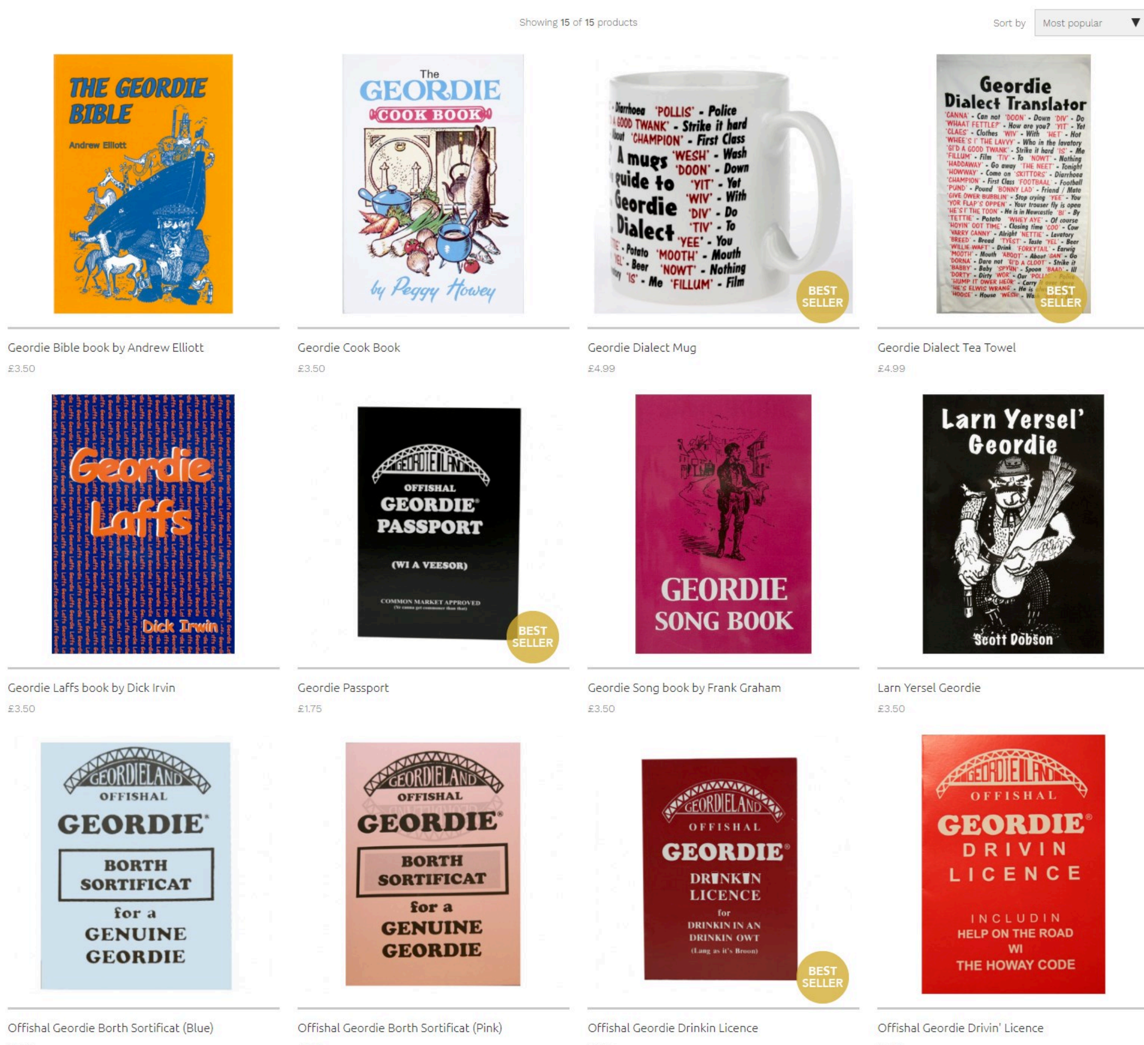

Figure 1-13 Geordie by-products from the Tyne and Wear archives & museums. Retrieved in March 04 2019 from https://www.shoptwmuseums.co.uk/geordie-519-c.asp.

1.4 Introduction to Tyneside English: segmental characteristics

This section aims at providing an overview of TE and hones in on segmental issues. Monophthongs as well as diphthongs that are idiosyncratic of TE are briefly described along with the production nearly extinct but iconic Northumbrian burr. This initial presentation of previous research on segmental features in TE is meant to contextualise and justify the focus of our analysis on four lexical sets: FACE, GOAT, PRICE and MOUTH. Our survey of the previous studies on vowels trying to characterise the main determinants of TE mostly rely on major studies by Jones-Sargent (1983), Watt (1998), Moisl & Maguire (2008). Jones-Sargent's (1983) separate analysis of monophthongs based on the original phonetic transcriptions of the TLS indicates that variability tends to be on a fine-grained level but that KIT, STRUT, FOOT stand out as main determinants of variation in TE (1983, pp. 220-221). The second analysis includes diphthongs, r-modified and reduced vowels. FACE, GOAT, PRICE, NURSE and lettER were considered as important determinants of speech too. MOUTH was also considered as important. In this description of TE segmental features, I have included these main determinants except NURSE.[23] The idiosyncratic lack of TRAP/BATH (Beal, 1985) distinction was also added. For each feature, spectrographic illustrations accompanied with links to the corresponding sounds were taken from both the TLS and PVC.

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[22] "Calm doon al mek yee a cuppa" stands for "calm down, I'll make you a cup (of tea)".

[23] For a more detailed analysis of the NURSE vowel in TE, see Maguire (2007).

1.4.1 Absence of a FOOT/STRUT split

The lack of distinction between the vowels FOOT and STRUT is probably one of the most distinctive segmental feature between the North and the South (2012, p. 20). Despite slight variation in the North, both lexical sets are generally pronounced /ʊ/, while in the South, a split occurred as early as the middle of the seventeenth century as shown in Figure 1-14 (J. C. Wells, 1982, p. 197). Figure 1-15 is the result of recent findings by the University of Manchester and shows that the split is gradually expanding North (MacKenzie, Bailey, & Turton, 2014; "Our dialects – FOOT-CUT," 2018). Newcastle English is also known to present a lack of distinction between FOOT and STRUT with exponents varying from "peripheral close back rounded [u]" (Watt, 1998, p. 217), a more open back rounded [o] (D. Jones, 1911), an approximation of the 'prestige' form /ʌ/ as [ə] (Watt, 1998, p. 218).

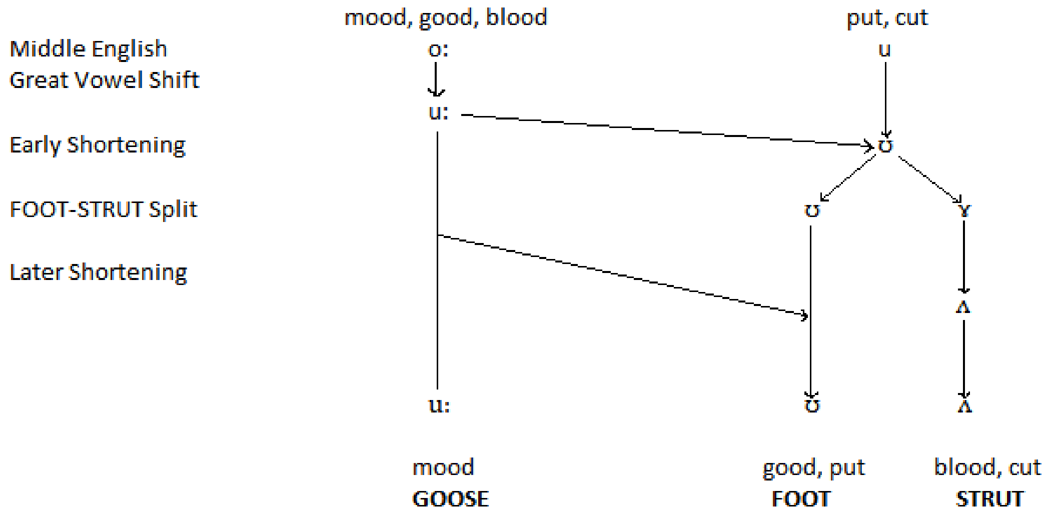
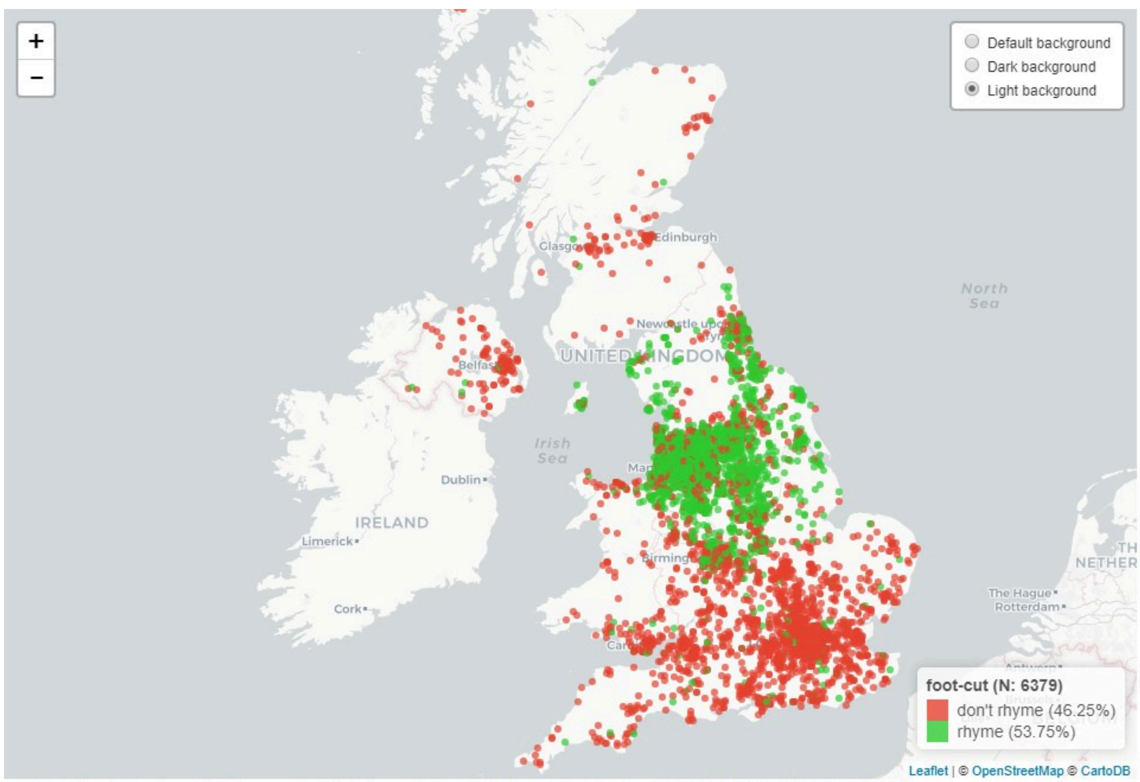


Figure 1-14 Wells's diagram of the historical development of Middle English /o:/ and /u/ towards the STRUT/FOOT split (1982, p. 198).



http://projects.alc.manchester.ac.uk/ukdialectmaps/phonological-variation/foot-cut/ (COPY RIGHT PERMISSION NEEDED

Figure 1-15 FOOT / STRUT dialect map of the UK (Manchester University 2014). Participants were asked whether *foot* rhymed with *cut*.

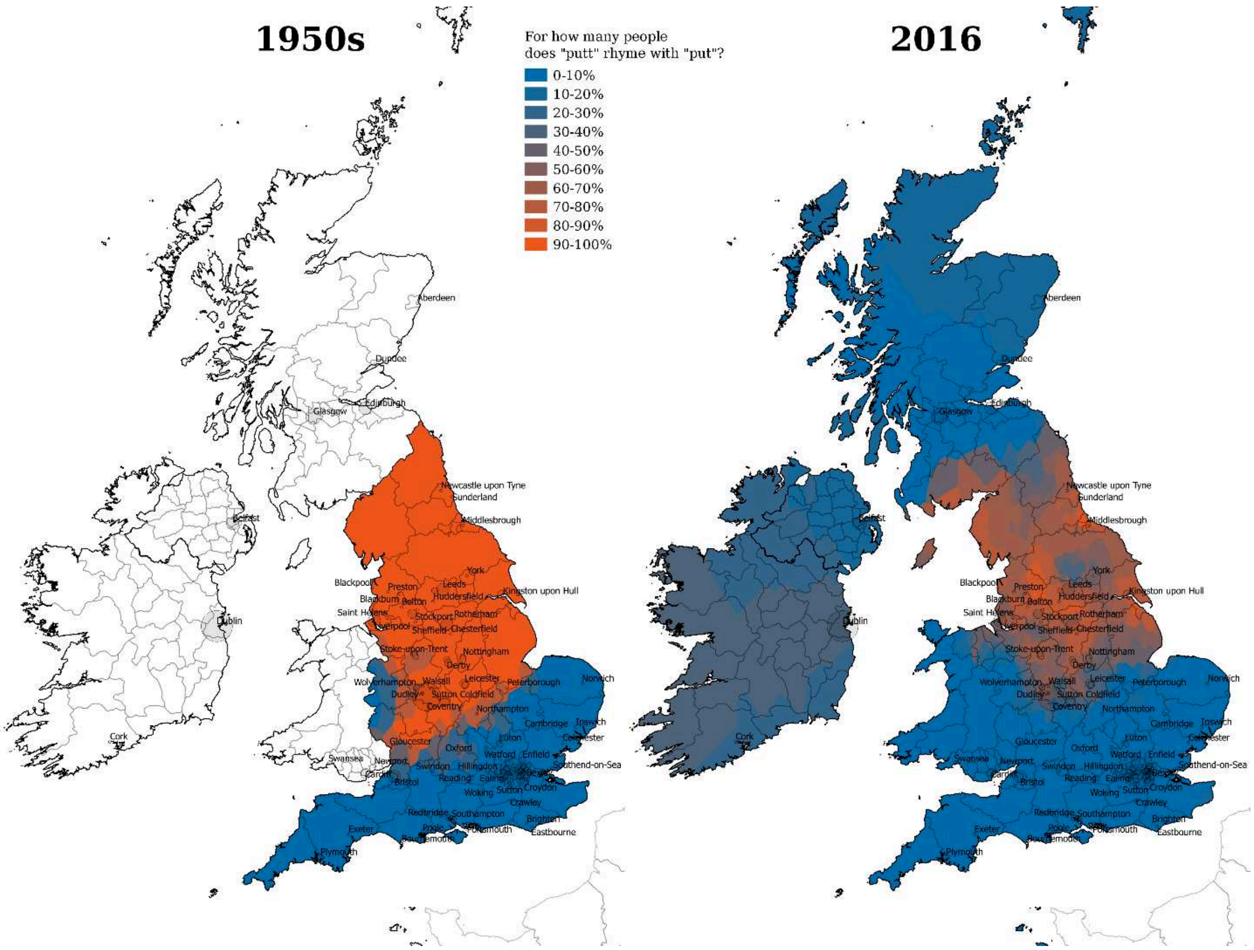


Figure 1-16 Dialect map of the STRUT/FOOT split. Left: 1950s (SED). Right: Data gathered from dialect app (Leemann, Kolly, & Britain, 2018).[24]

[24] The map was retrieved 29/07/2019 from https://www.cam.ac.uk/research/news/cambridge-app-maps-decline-in-regional-diversity-of-english-dialects. Other maps for press release including this one can be accessed here: https://drive.google.com/drive/u/0/folders/0BzJdYPQ73V5nb0ZYWVVlcEtsaW8 (29/07/2019).

1.4.2 No TRAP/BATH distinction

According to Wells, less variation is found among Northerners regarding the lack of distinction between TRAP and BATH**.** They are expected to produce a short [a] in both sets – with a few exceptions**.** The absence of a BATH retraction is deemed "more stable and salient" than the "unsplit FOOT–STRUT vowel" (Beal, 2004, p. 122). With a hint of humour, Wells remarks:

> There are many educated northerners who would not be caught dead doing something so vulgar as to pronounce STRUT words with [ʊ], but who would feel it to be a denial of their identity as northerners to say BATH words with anything other than short [a] (John C Wells, 1982, p. 354).

Beal provides more details regarding the BATH vowel realised in Newcastle and the Tyneside area (Beal, 1985) and shows that the lack of retraction is not categorical and that certain words are more generally lengthened such as *master* or *plaster*. They are usually pronounced either [ɑː] or [ɒː] and in words like *all*, *walk* and *ball*, are realised with a more fronted exponent [aː] (Beal, 1985, p. 32), which may be the cause of an internal development within the dialect rather than the influence of R.P. upon TE (Beal, 1985, pp. 42-43).

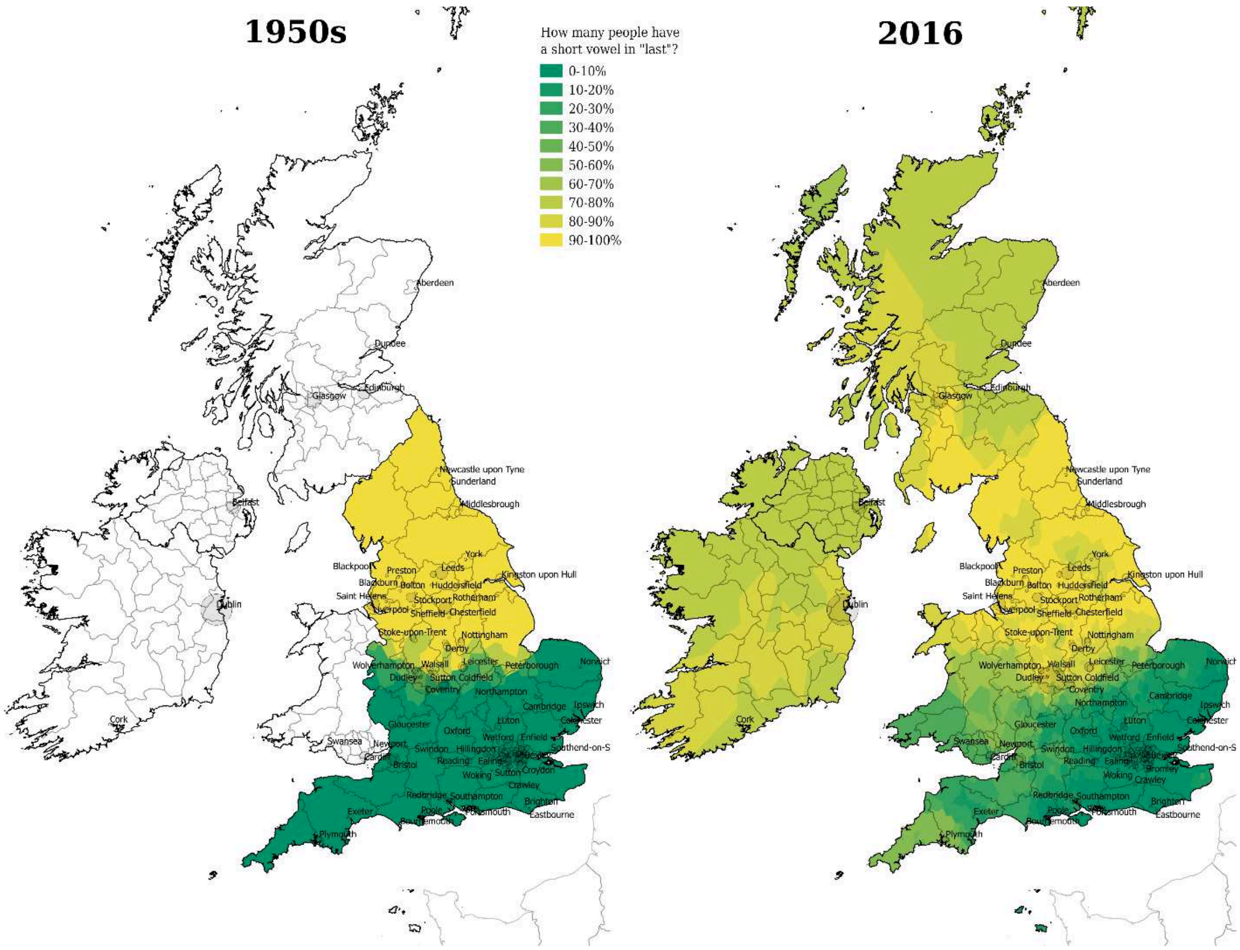


Figure 1-17 Map of length preference for the word *last*. English Dialect App (Leemann et al., 2018).[25]

More recent findings from the English Dialect App (Leemann et al., 2018) on the word *last* suggest that, in Newcastle, the lack of distinction between TRAP and BATH, which was prevalent at the time of the *Survey of English Dialects* (Orton, 1962) in rural areas, still prevails today, be it in rural and urban areas (Figure 1-17). This gives us a general indication of what we are likely to find in the TLS and PVC recordings.

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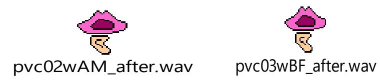
[25] The map was retrieved 29/07/2019 from https://www.cam.ac.uk/research/news/cambridge-app-maps-decline-in-regional-diversity-of-english-dialects. Other maps for press release including this one can be accessed here: https://drive.google.com/drive/u/0/folders/0BzJdYPQ73V5nb0ZYWVVlcEtsaW8 (29/07/2019).

Looking at spectrograms in the word *after* in the PVC wordlist, I noticed that most speakers had a rather centralised vowel, as shown in Figure 1-18. The word was the closest I could find to *last* (Figure 1-17). The BATH and the lettER vowels are very similar acoustically. F1s are different by less than 70Hz and F2s, by 100Hz. In Figure 1-19, speaker 03BF (woman middle class, aged 59) has a more focal vowel in BATH. She was one of the rare speakers to realise such a variant in BATH, and in chapter 7 she is considered as an above supralocal speaker in her realisations of FACE, GOAT, PRICE and MOUTH. Despite the lower quality of the recording, the difference with lettER is striking. F1 is much higher and F2, lower in BATH. While F2 remains at similar heights in both the female and male speaker, the difference in mean F1 is very clear.



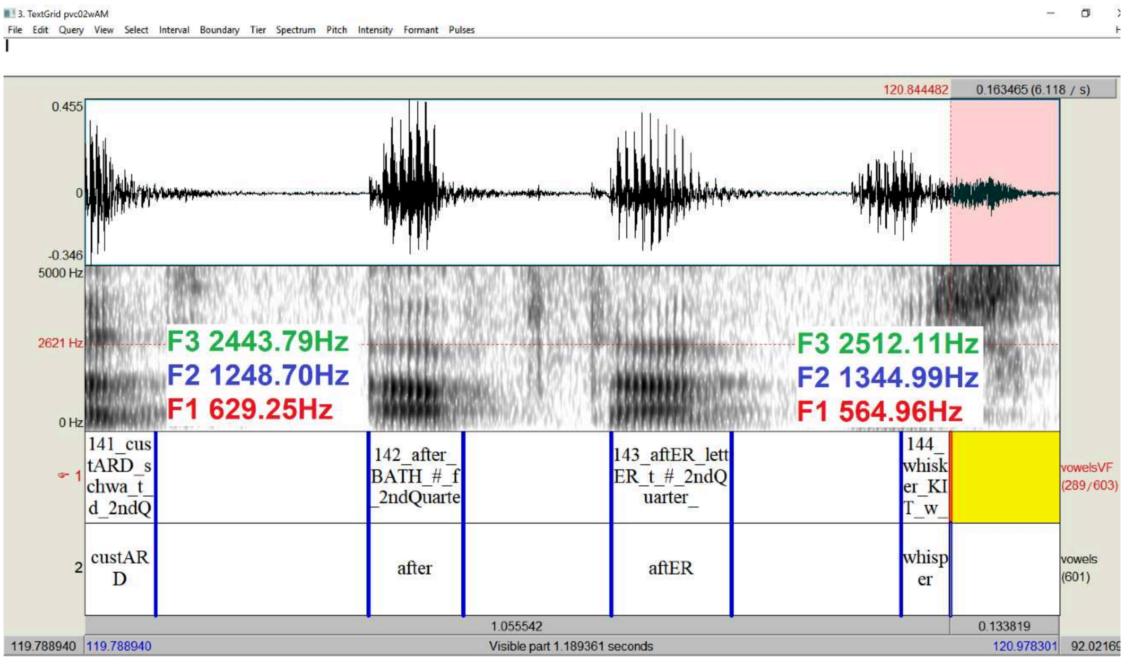


Figure 1-18 Spectrographic illustration of a fronted BATH vowel in the word *after* compared to the final schwa realisation in the final unstressed vowel (*aftER*). Estimated mean formant values (speaker 02AM, WC aged 62, PVC wordlist).

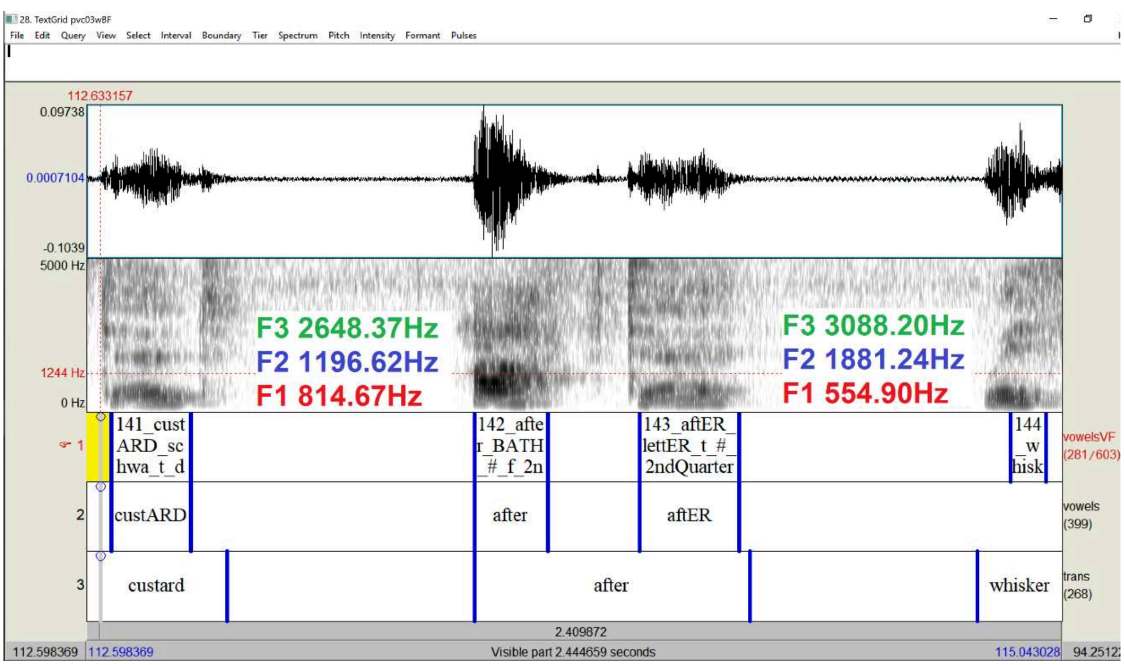


Figure 1-19 Spectrographic illustration of a low-back BATH vowel in the word *after* compared to the final schwa realisation in the final unstressed vowel (*aftER*). Estimated mean formant values (speaker 03BF, MC aged 59, PVC wordlist).

1.4.3 An open KIT vowel

The KIT vowel in Newcastle has hitherto received very little attention since it is not as dramatically open[26] as the one generally heard in Glasgow. Ferragne & Pellegrino (2010) compared the monophthongs and diphthongs of 13 urban dialects from the British Isles. Although little comment is made regarding this lexical set, its median F1 is among the four highest values of the 13 dialects under scrutiny (Figure 1-20). Amand (2014) demonstrated that the F1 values from Ferragne & Pellegrino (2010) were consistent with another sample of Newcastle speakers from the DECTE corpus. She showed that although, a majority of KIT vowels were transcribed as [ɪ] in the TLS, the open vowel [ɐ] was also a common realisation (Amand, 2014, p. 67). Spectrographic analyses of men from the PVC corpus (Figure 1-21) show that F1 is usually higher and F2, lower than RP men from similar age groups in Table 1-1 (Hawkins & Midgley, 2005).

[26] The vowel is low enough to trigger misunderstandings among speakers brought up in an essentially Southern Standard English environment. While on one of my regular trips to Newcastle University, a local academic dictated his email address to me. It included the number 6 but I was reluctant to write it down since I was repeatedly hearing the word “sex”. On seeing me eventually type the latter word, the academic cleared the misunderstanding by saying “the number ‘six’”. This raised my awareness of the importance to include the open KIT vowel as a segmental characteristic of TE.

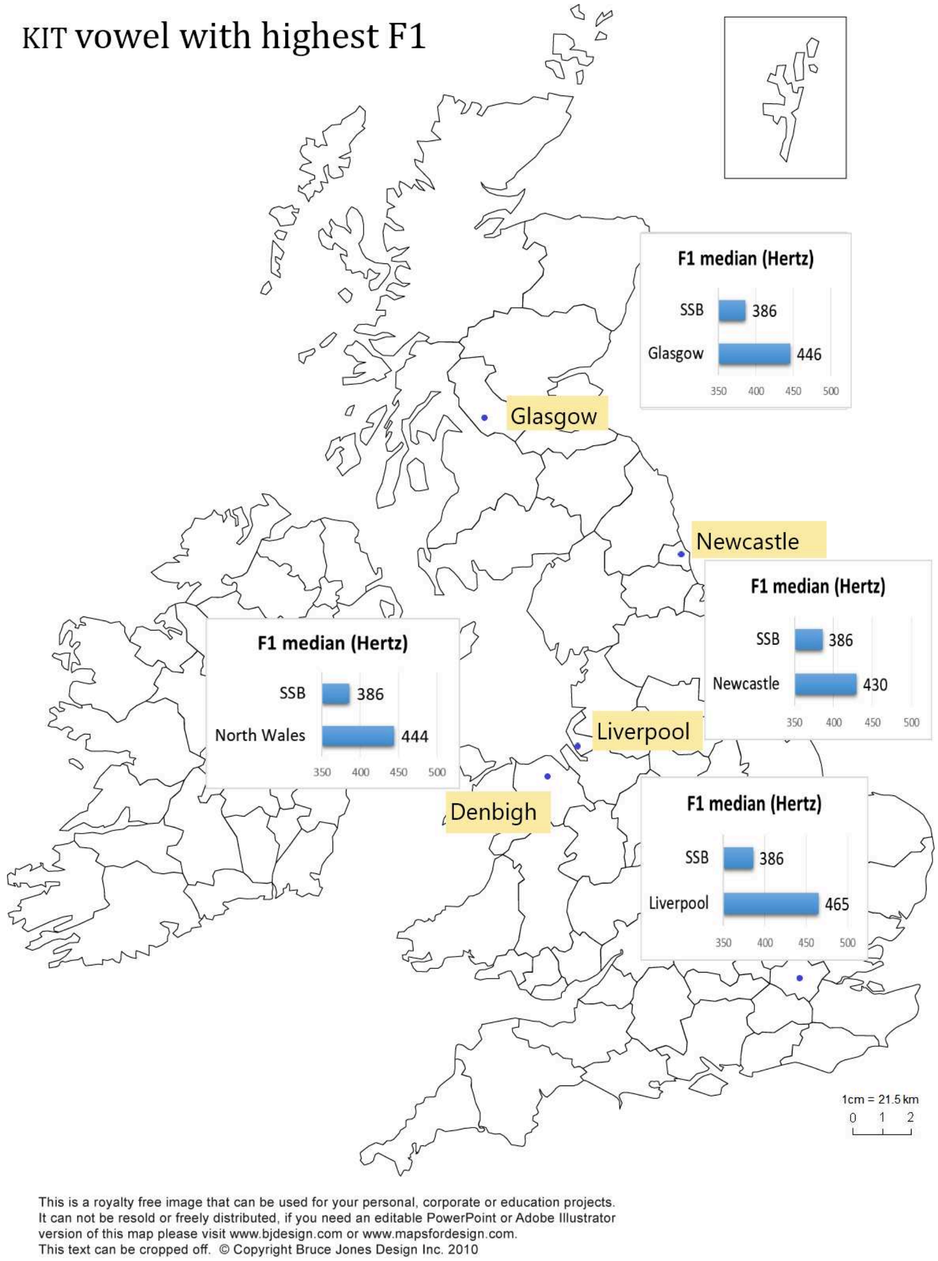


Figure 1-20 Top 4/13 dialects with the highest F1 in KIT compared to Standard Southern British English (SSB). Map including data from Ferragne & Pellegrino (2010, p. 28).

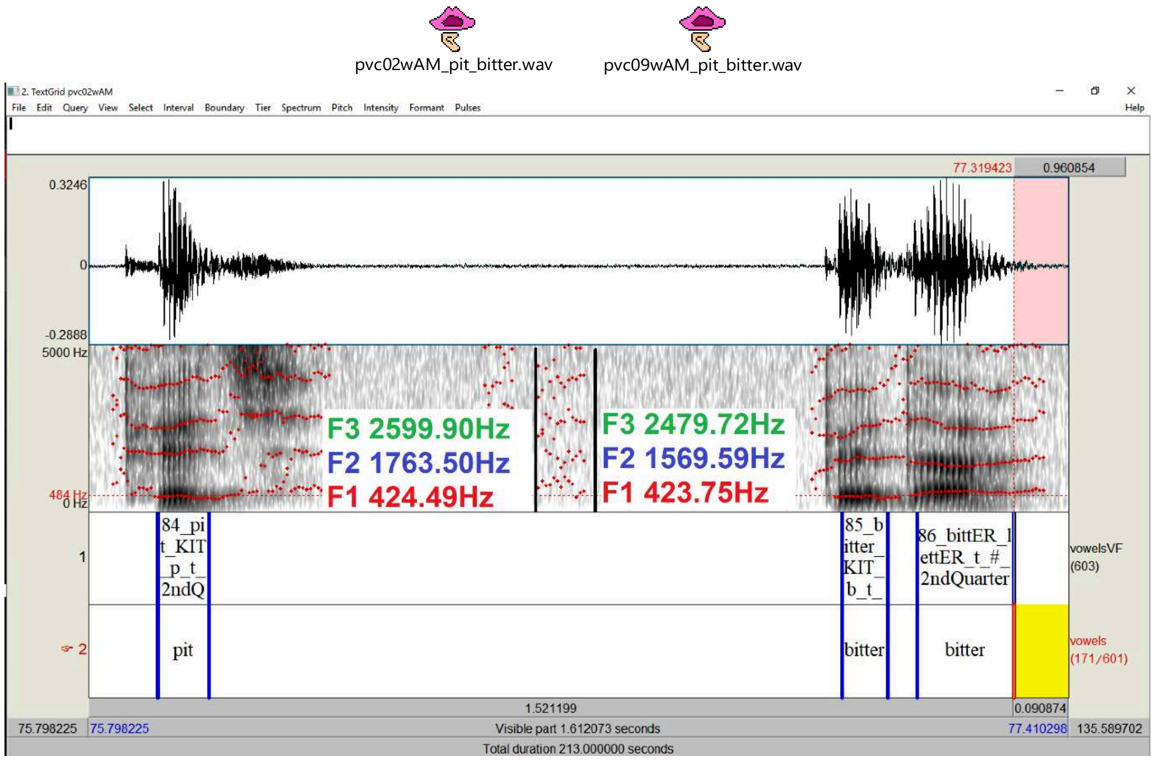


Figure 1-21 Spectrographic illustration of the KIT vowel in *pit* and *bitter* with estimated mean formant values (speaker 02AM, WC aged 62, PVC wordlist).

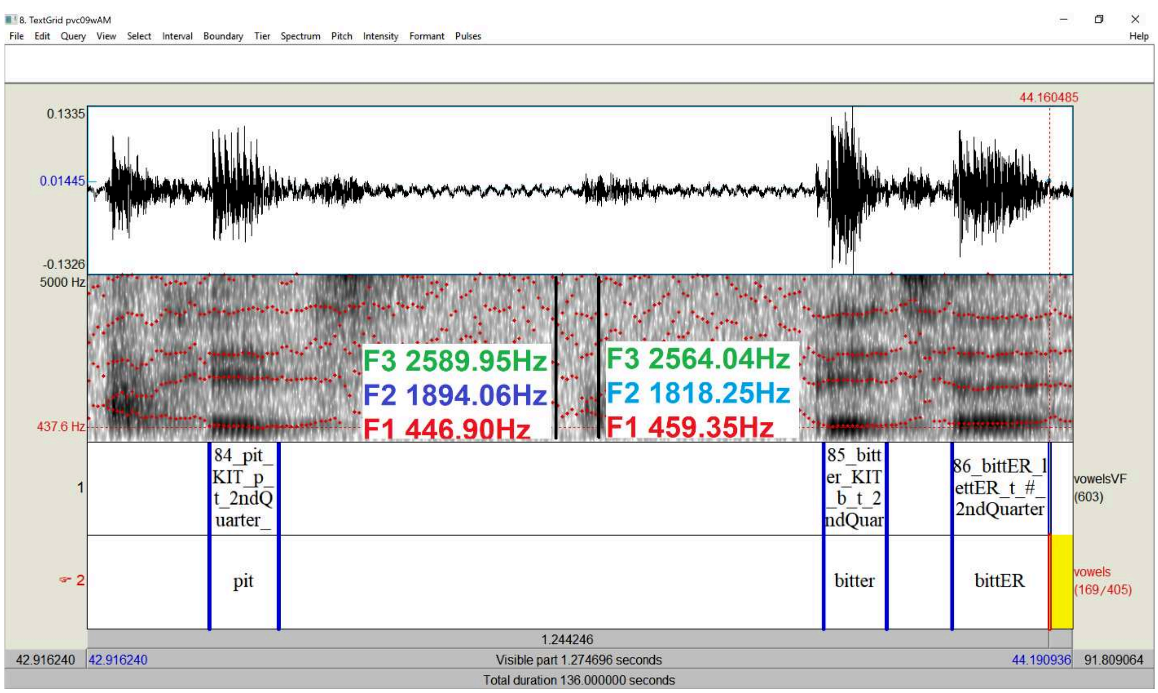


Figure 1-22 Spectrographic illustration of the KIT vowel in *pit* and *bitter* with estimated mean formant values (speaker 09AM, MC aged 17, PVC wordlist).

Table 1-1 Mean formant frequencies (Hz) of 5 men per age-group of vowels produced in a /hVd/ context (from Hawkins & Midgley 2005, p. 195).

Vowel	65+		50–55		35–40		20–25	
	F1	F2	F1	F2	F1	F2	F1	F2
iː	285	2283	269	2355	269	2312	276	2338
ɪ	382	2024	341	2074	374	2115	393	2174
ɛ	454	1962	489	1920	512	1888	600	1914
æ	644	1678	693	1579	696	1574	917	1473
ɑː	665	1085	639	1041	608	1062	604	1040
ɒ	518	875	522	865	496	833	484	865
ɔː	391	619	360	604	382	626	392	630
ʊ	376	990	371	975	381	984	413	1285
uː	301	994	283	1112	288	1336	289	1616
ʌ	630	1213	643	1215	629	1160	658	1208
ɜː	475	1321	511	1340	497	1419	494	1373

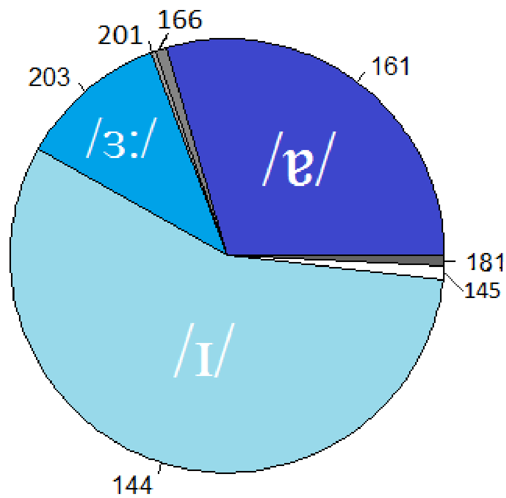


Figure 1-23 Distribution of KIT variants for all 44 speakers (numbers indicate the PDV coding, Jones-Sargent 1983, p. 295).

In the TLS, the original phonetic transcriptions indicate that [ɪ] is the most common reflex (PDV code: 0144) as Figure 1-23 illustrates. The second one is more open vowel [ɐ] followed by a central vowel [ɜː] (respective PDV codes: 0161 & 0203). In addition, Kolb's *Phonological Atlas of the Northern Region* which used data from the *Survey of English Dialects* (Orton, 1962), shows that the KIT set was realised as a rather central vowel around the region of Newcastle for all three words targeting the KIT vowel, i.e. *whip*, *brimming* and *squirrel* (Kolb, 1966, pp. 65-67). In these examples, however, the perception of a central vowel may also be due to labialised sounds on either side of the vowel, which lowers F2 and F1 (Vaissière, 2015), and not only due regional specificity.

1.4.4 FACE & GOAT

The FACE and GOAT vowels exhibit considerable variation both within and between communities since they are "particularly socially sensitive" (Beal et al., 2012, p. 26). While more and more speakers use the pan-northern monophthongs [eː] and [oː], the centring diphthongs [ɪə] and [ʊə] are "characteristic of the region" –Middlesbrough and Tyneside – especially among male speakers (Beal et al., 2012, p. 30). A central diphthong [ɵː] and open one [ɔː] is also heard among young men from Newcastle (Watt, 1998). Dominic Watt (Watt, 1998, 1999, 2000) demonstrated that in a 1990s corpus of Tyneside English, variation patterns of both sets worked in *lockstep*: "while both appear to be changing over time . . . they do so at exactly the same rate within each speaker group" (Watt, 1998, p. 261). I discuss this issue in more detail in chapter 7 (auditory analysis) and 8 (acoustic analysis).

In Old English, GOAT was written *gāt* and pronounced with a long low back vowel. By the ME period, it was fronted to [aː] in Northumbria and Scotland as opposed to [ɔː] in the South (Corrigan, 2012). In the late 19th century, Heslop (1892, pp. xvii-xix) reported at least three ways of pronouncing the GOAT vowel depending of its phonetic environment. (1) Either with an opening diphthong/gliding onset in *home* [ʻhjɛm] or *both* [ʻbjɛθ] (found under the PDV code 0124, Jones-Sargent 1983, p. 297), or (2) with an open fronted [aː] in *snow* [snaː] or *blow* [blaː] (PDV 0122, Jones-Sargent 1983, p. 297). This variant is often enregistered as *ye knaa*.[27] (3) When followed by an <l> and a consonant, it becomes a closing diphthong [aʊ] or [ɒʊ][28] in words like *bold* and *roll*.

Examination of Jones-Sargent's (1983) analysis on GOAT reveals that variation among working-class speakers from Gateshead & Newcastle (n=52) is strongly determined by gender. Men tend to adopt the local variant [ɑː] – and its various sub-realisations – 38% of the time, while the predominantly female group scored only 4%, having an overwhelming majority of supralocal [ɔː] (78%) (Jones-Sargent, 1983, p. 230 & 257). This is in line with Moisl & Maguire's study of the TLS at a less fine-grained level of the same transcriptions (Hermann L Moisl & Maguire, 2008, p. 63).[29] Middle-class female speakers from the smaller Newcastle sample generally use a closing diphthong [oʊ] (Jones-Sargent, 1983, p. 230 & 226). Similar results were found in the PVC corpus (Watt, 1998).

Old English words like *spade*, *bake*, *made* or *name*, were written with a short <a>. Other words like *gate* came from OE *geat* – *gatan* in Proto-Germanic. In ME they were generally pronounced with variants of [aː] but in Tyneside English, it developed into [jɛ]. This was also the case for the GOAT vowel in words like *home* [hjɛm] which later evolved into monophthongs for their supralocal forms (Viereck, 1968, p. 69). Ellis reports that words like

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[27] Ellis transcribes this form as *yi na'* with a raised vowel in *you* and what seems to correspond to [aː] or [a] in *know* (A. J. Ellis, 1890, p. 129).

[28] Heslop (1892) uses the spelling *bowld* to account for the pronunciation of bold. I initially assumed he meant [aʊ] since he makes those words rhyme with *now* (1892, p. xviii) – providing that he used a standard southern pronunciation as a point of reference. However, in the TLS, men tend to have a retracted onset in words like *now*, e.g. [ɒʊ], which brings the MOUTH set closer to GOAL words in this variety. It is therefore probable that TE itself was a point of reference not a standard southern pronunciation.

[29] While Jones-Sargent used the transcriptions at a state level, Moisl & Maguire used the PDV level to carry out cluster analyses of the TLS speakers based on the phonetic transcriptions of their speech.

name, *home* and *soon* have comparable realisations in Newcastle and Hexam, which is further west. However, for the former, the onset the vowel is longer than the offset while for the latter, the onset is more like glide [j] and the offset appears longer:

> Another difference between [Hexham] and [Newcastle] is that in words like 'name, home, soon,' [Hexham] has *nee·ŭm*, *hee·ŭm*, *see·ŭn*, with the stress on the first vowel, and the second vowel indistinct, whereas [Newcastle] has *nĭem, hĭem, sĭoen,* where the first element is short and nearly consonantal, so that it is generally written *y*, and the stress lies on the second element. (A. J. Ellis, 1890, p. 127)

Ellis's transcription of a schwa corresponds to *ŭ* and the glide [j] being *ĭ*. Hence, words like *name* and *home* belonged to the same set in 19th century TE. This might explain why GOAT and FACE have an "underlying structural symmetry" today (Watt, 2000, p. 96). Watt adds that what matters in the relationship between these two lexical sets is "the significance [that] these forms hold for the speakers who use them and the degree to which they are used in speech as a reflection of the social structure of the community in question" (Watt, 2000, p. 96). The closing diphthongs, monophthongs and centring diphthongs in both GOAT and FACE tend to pattern alike because they function as similar social markers.

The first and last spectrograms[30] represent examples of FACE and GOAT (&) from the TLS wordlist (Figure 1-24 & Figure 1-26). Formant movements are visible with the former revealing closing diphthongs and the second one, more centring ones. The former indexes above-supralocality and the latter, locality. In Figure 1-25, the speaker produces supralocal monophthongs with a few formant transitions in the words *cold* and *alone*, due to the

30 In the word *straight*, it is very difficult to find a clear boundary between the /r/ and the vowel. I preferred to keep the two sounds together in the segmentation below. The word was removed from the formant analysis.

presence of /l/ whose F2 generally reaches a value of 1 800 Hz (Vaissière, 2015) for men and higher for women.

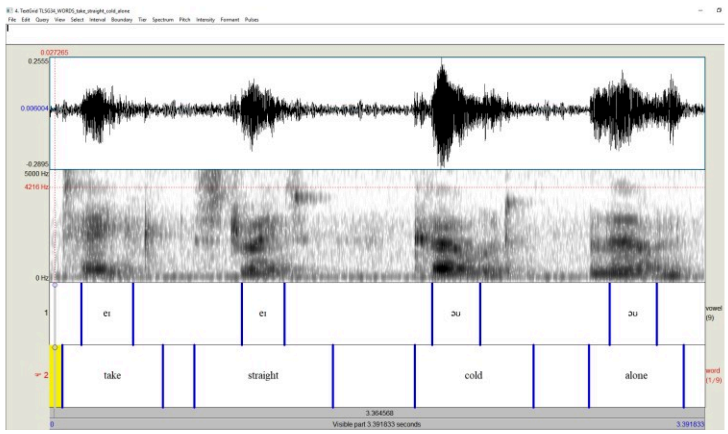


Figure 1-24 Spectrographic representation of FACE and GOAT by an above-supralocal speaker (G34F, LMC, aged 31-40, school secretary).

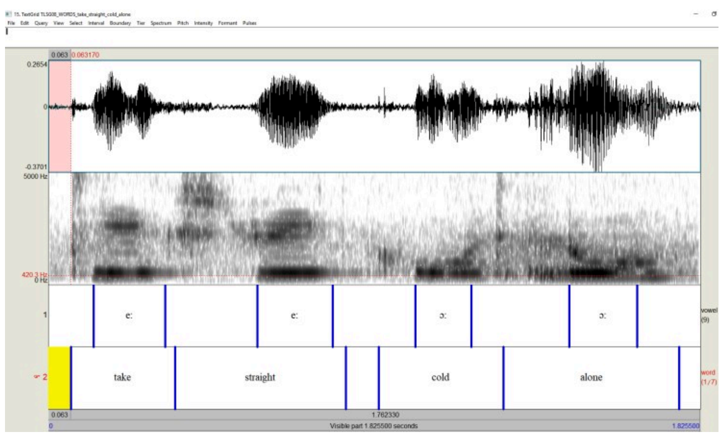


Figure 1-25 Spectrographic representation of FACE and GOAT by a supralocal speaker (G08F, WC, aged 17-20, sewing machinist).

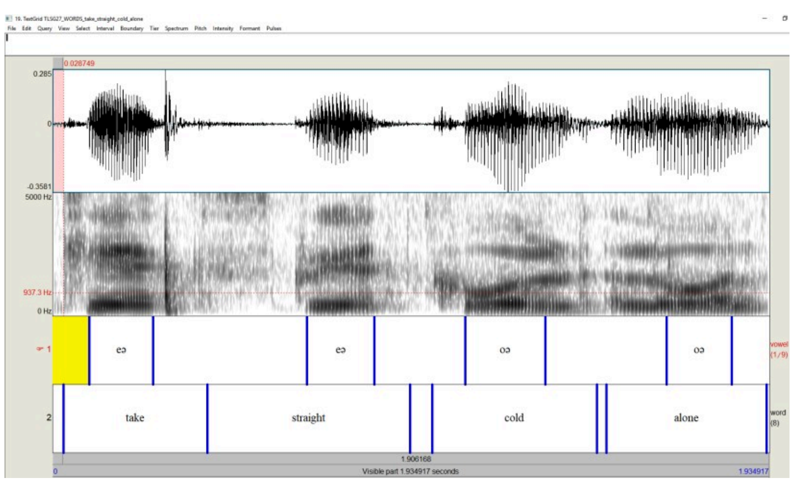
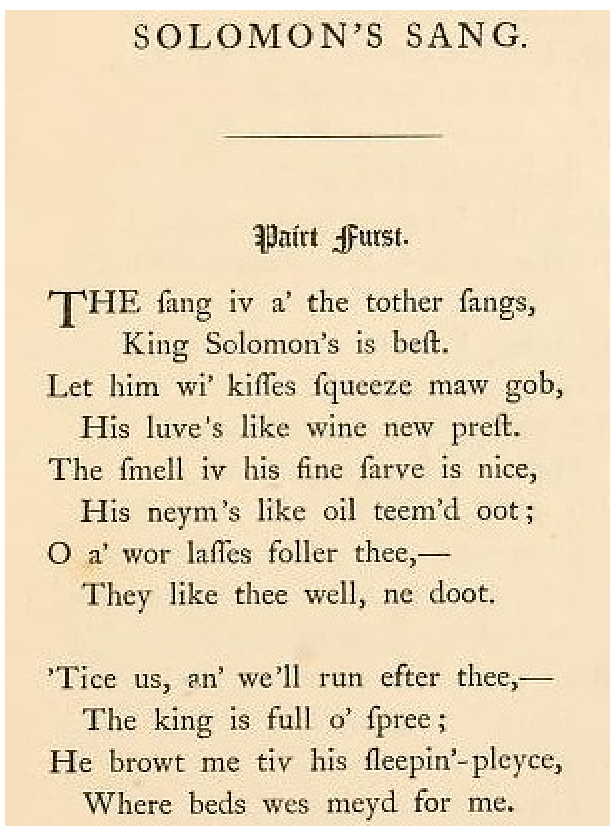


Figure 1-26 Spectrographic representation of FACE and GOAT by a traditional speaker (G27M, WC, aged 21-30, maintenance fitter).

1.4.5 PRICE & MOUTH

The PRICE and MOUTH sets are known to exhibit frequent raised onsets ([eɪ], [ɛʊ]). James Milroy indicates that the PRICE vowel loosely follows the Scottish Vowel Length Rule (J. Milroy, 1996). This is particularly so among young working-class speakers producing more raised onsets than middle-class women (Amand, 2018; J. Milroy, 1996, p. 221). As to the MOUTH set, the traditional realisation of the Newcastle area is a long [uː] thus abiding by the Old English pronunciation (Kolb, 1966, pp. 255-267). In the 1860s was published the *Song of Solomon*, versified in the dialect of the colliers of Northumberland (Robson, 1860), words pertaining to the MOUTH vowel were transcribed with two <oo> (Figure 1-27).



SOLOMON'S SANG.

Pairt Furst.

THE ſang iv a' the tother ſangs,
King Solomon's is beſt.
Let him wi' kiſſes ſqueeze maw gob,
His luve's like wine new preſt.
The ſmell iv his fine ſarve is nice,
His neym's like oil teem'd oot;
O a' wor laſſes foller thee,—
They like thee well, ne doot.

'Tice us, an' we'll run efter thee,—
The king is full o' ſpree;
He browt me tiv his ſleepin'-pleyce,
Where beds wes meyd for me.

Figure 1-27 First two stanzas of Robson's impressionistic transcription of the speech of colliers from the Tyneside area (1860, p. 3).

Heslop slightly complexifies the picture. In the late 19th century, words with an <ou>+<n>C pattern belong to the FOOT/STRUT category: *ground*, *bound* and *found* rhyme with *foot* and *root*, probably a short [ʊ] (1892, p. xix). The traditional monophthong [uː] remains in certain iconic words like *town*, usually written "Toon" which abounds in the urban landscape of Newcastle[31] (cf. Beal 1999). A recently re-published book targeting children was even entitled *Tinseltoon or "One Night in Newcastle"* (2012, first published in 1998[32]) and immediately gained popularity. This considerably contributes to the reinforcement of local identity among both adults and children (Beal, 2000). Beal states that the word *Toon* could very well qualify for Labov's category or stereotype but in the social and cultural context of Newcastle, she says it "would better be described as an icon (in the sense of a symbol of belief or of cultural movement) than a stereotype: it stands for all that the Geordies hold sacred" (Beal, 1999, p. 43). She adds, however that this pronunciation is confined *the* iconic local word and the variants [ɛʊ] or [aʊ] prevail (Beal, 2004).

Among the 44 TLS and 32 PVC speakers analysed for the present thesis, only one used the traditional monophthong in the reading list (G30M, Figure 1-28) but it probable that more speakers in the TLS who have a similar profile use it too.[33] The quality of the

[31] The supporters of the Newcastle football club is called "the Toon Army", a bus company is named "ToonLink", advertising posters for the newly open hotel *Motel One* boast its being "a budget design hotel in the toon", posters for cultural events often include the word Toon. Last but not least, you can drink a stout named "Dark side of the toon" and buy souvenirs proudly exhibiting the word – mugs, cards, T-shirts etc.

[32] Goulding, C. (n.d.). *Tinseltoon*. Retrieved October 17, 2018, from http://www.tinseltoon.co.uk/. The author's interview at the local TV Tyne Tees also provides a good illustration of Tyneside speech at the end of the 1998: https://www.youtube.com/watch?v=XAidSOae6sE.

[33] Among the recently rediscovered reel-to-reel tapes that were subsequently digitised, I found another male speaker who used the [uː] for both *down* and *seahouses* while reading the wordlist (speaker TLSG 512). His wife burst out laughing at the end of the reading task saying he did sound very Geordie.

spectrograms from figure 1-28 to figure 1-30 may not be ideal but the accompanying sounds provide clear distinct variants. In figure 1-28, despite formant transitions between [ɪi] in sea and [uː] in houses (with h-dropping), F1 and F2 are low and remain stable with no visible F3. In figure 1-29 and figure 1-30, formant movements are visible in both F1 and F2 with F2 dropping from a higher onset in the latter than in the former.

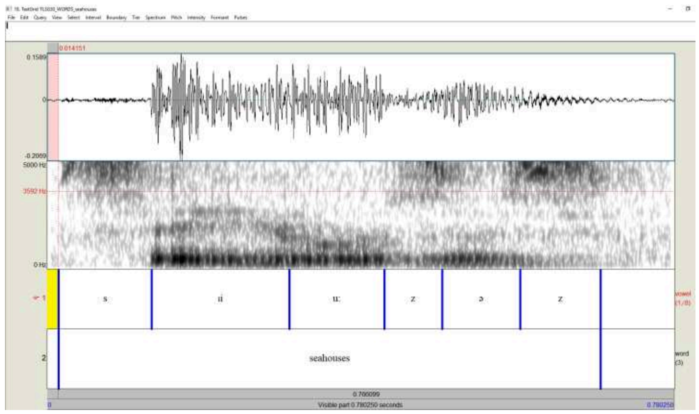


Figure 1-28 Spectrographic illustration of a traditional MOUTH vowel [uː] in *seahouses* (speaker G30M, WC aged 23, millwright, TLS wordlist).

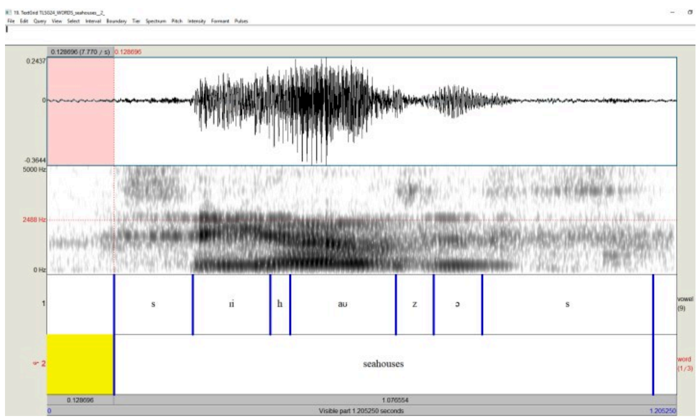


Figure 1-29 Spectrographic illustration of a more common MOUTH vowel [aʊ] in *seahouses* (speaker G24M, WC aged 61-70, nightwatchman previously wire drawer, TLS wordlist).

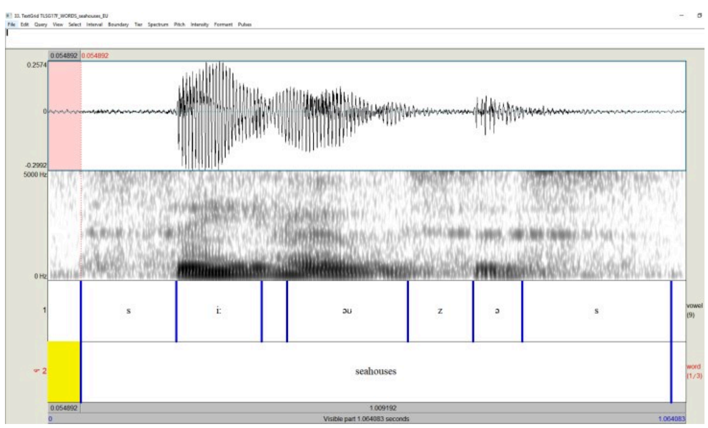


Figure 1-30 Spectrographic illustration of a raised onset in MOUTH [əʊ] in *seahouses* (speaker G17F, WC aged 51-60, retired dinner lady, TLS wordlist).

Let us now look at two PVC speakers. They were both put in the same social class. In Figure 1-31 the F2 onsets of *pint*, *bite*, *out* and *fount* start at a visibly high point than 13BF. 17BF is 16 and wants to continue with 'A'-levels, while 13BF is 19 and has made plans to go to university. 17BF is one of the rare PVC speakers who use raised onsets in both PRICE and MOUTH (with 08BF and 18BF). In the statistical analysis in chapter 7, she was considered as an atypical supralocal speaker with a few prestigious forms whereas 13BF was placed in the group which adopted prestigious features the most. In the TLS original transcriptions, a few men with more traditional pronunciations realised some of their MOUTH vowels as [ɔʊ]/[ʌʊ], which seems to be distinct from the more fronted low variant [aʊ] and to index locality. In a future study, it would be interesting to analyse the formant height of both onsets and offsets since they may provide various forms of indexicality.

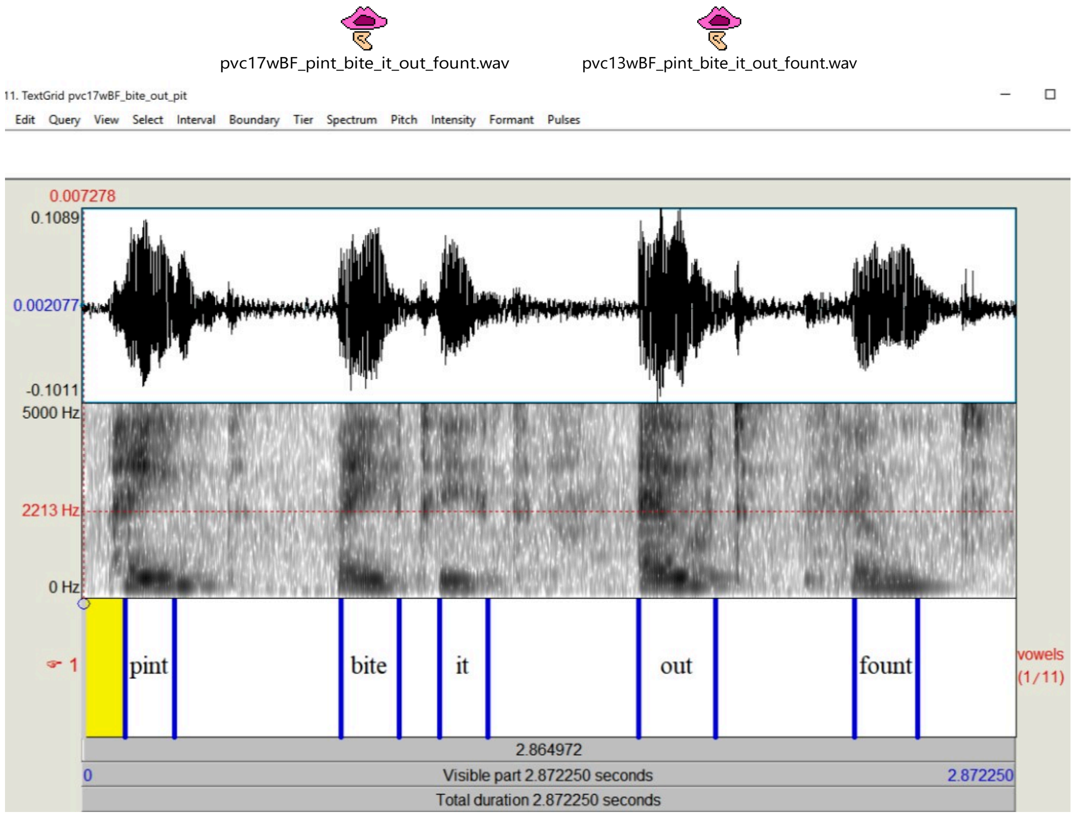


Figure 1-31 Spectrographic illustration of raised onsets in PRICE and MOUTH vowels in *pint* and *bite it*, *out* and *fount* (speaker17BF, MC aged 16, PVC wordlist).

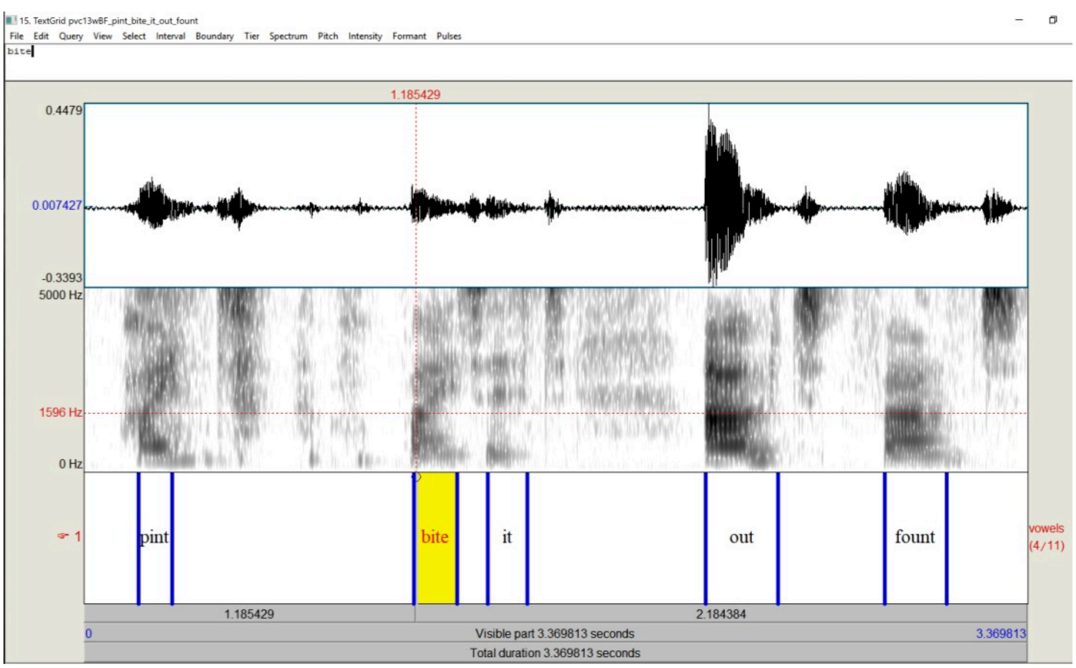


Figure 1-32 Spectrographic illustration of lower onsets in PRICE and MOUTH vowels in *pint* and *bite it*, *out* and *fount* (speaker13BF, MC aged 18, PVC wordlist).

1.4.6 Open lettER to Geordie (un)reduced vowels

The lettER set in TE is known for being either fronter [ɛ] or lower [ɐ] (Watt & Allen, 2003, p. 269). It is often longer in duration than the preceding vowel (Llamas, Watt, French, Braun, & Roberston, 2017). McNeany (1971) shows that this is particularly so in TE localised speech, while non-localised speakers living in Tyneside may favour a more central vowel (Figure 1-33). McNeany is known as the main fieldworker and transcriber of the TLS data, but he was also one of the first to investigate variation among Tyneside English unstressed vowels in the 1970s. Most of his work on the matter is either handwritten or unpublished but he was a pioneer in arguing that reduced vowels do tell a lot about sociolinguistic variation within a dialect and more particularly, in TE. Figure 1-33 is an example of his transcriptions of lettER words form the TLS recordings in his attempt to build variation rules for vowel reduction in TE. His approach was inspired by the *Sound Pattern of English* by Chomsky & Halle (Chomsky & Halle, 1968). A more recent work on TE by Watt and Foulkes (Watt & Foulkes, 2017, p. 156) based on three corpora including the TLS also indicates that variants are generally either [ə] or a more open [a].

In addition, a study by Llamas et al. (2017) has shown that mobile Newcastle speakers tend to use more conservative forms in their final shwas since they have a much higher F2. While older speakers have much longer final schwas compared to the previous vowel in VC# forms, the differences in length is slightly lower among younger speakers. Such results differed significantly from other neighbouring localities like Sunderland (Durham) and Middlesbrough (Yorkshire).

PART II THE RULES OF VOWEL REDUCTION IN LOCALIZED TYNESIDE (L)
and R.P. SPEECH

I a.b.c. (section Nos refer to the groups of items in Appendix A)

There exists a three way alternation between R. P.[ə] ([1reduced]), L [ɛ] and [ʌ], which operates in the following contexts:-

1. Final syllables,[1] whether or not closed by /r/ the vowel (lexical) may be anything which is not high.

	N.L.	L	
e.g. china	[tʃaɪnə]	[tʃeɪnɛ]	[tʃeɪnɑ]
paper	[peɪpə]	[peᵊpɛ]	[peᵊpɑ]
our	[aʊə]	[ɑʊɛ]	[ɑʊɑ]
her(weak)	[ə]	[ɛ]	[ɑ]
traitor	[treɪtə]	[treᵊtɛ]	[treᵊtɑ]

Figure 1-33 The rules of vowel reduction in lettER: speakers with a non-localised speech (N.L.) and a localised one (L) (McNeany, 1971, part II, p. 1).

In the TLS, a lower back vowel in lettER indexes regionality with working-class men scoring higher (ca. 47%) than the rest of the sample of informants (cf. chapter 7)[34]. In Figure 1-34, F1, F3 and F3 are more equidistant than in Figure 1-35 with F2 being closer to F3 in the former and to F2 in the latter. 13BF therefore produces a fronter vowel than 10BM, whose vowel is more similar to the LOT vowel in *totter*.

[34] An intuition is that variation is also internally constrained with a lower back vowel being more likely to occur when preceded by a form of glottalisation as suggested by Brunner & Zygis (2010). This will be in the form of a future study on lettER in TE.

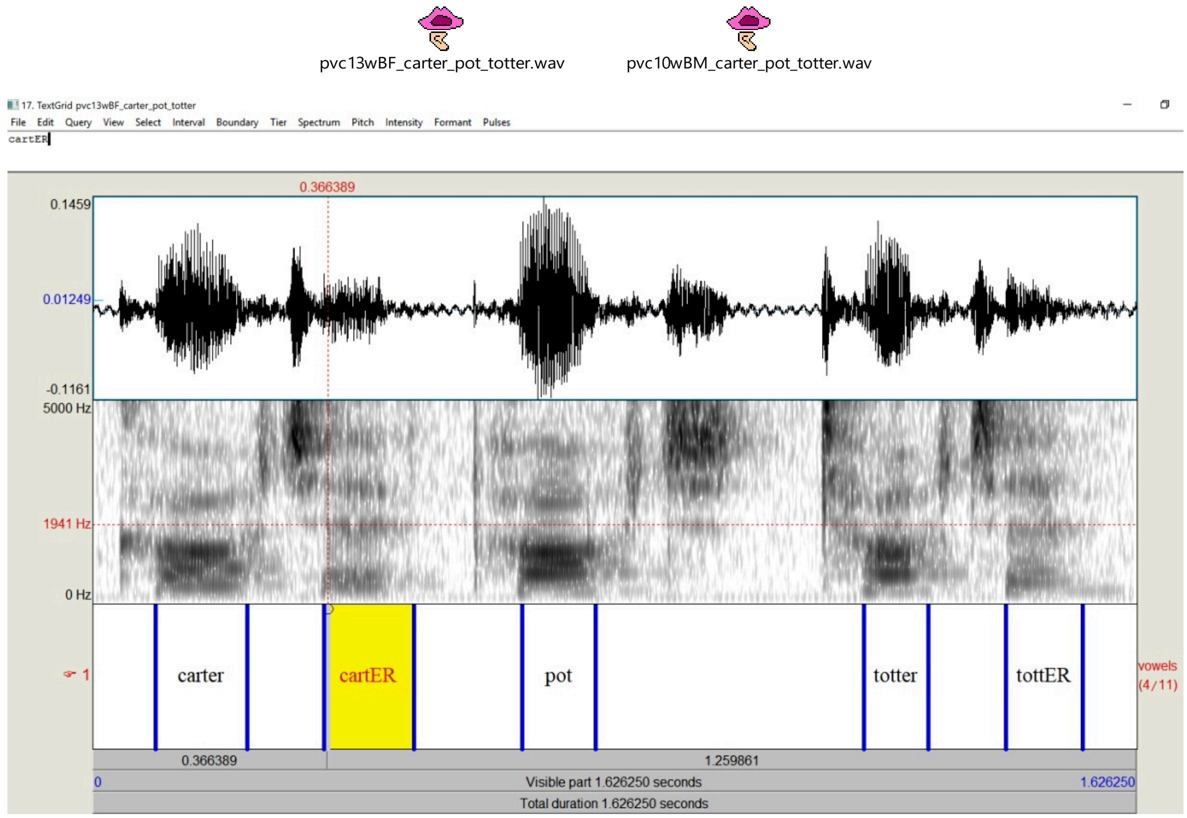


Figure 1-34 Spectrographic illustration of a fronted variant in lettER in the words *cartER* and *tottER* vs. START and LOT vowels *carter* and *pot* (speaker 13BF, MC aged 18, PVC wordlist).

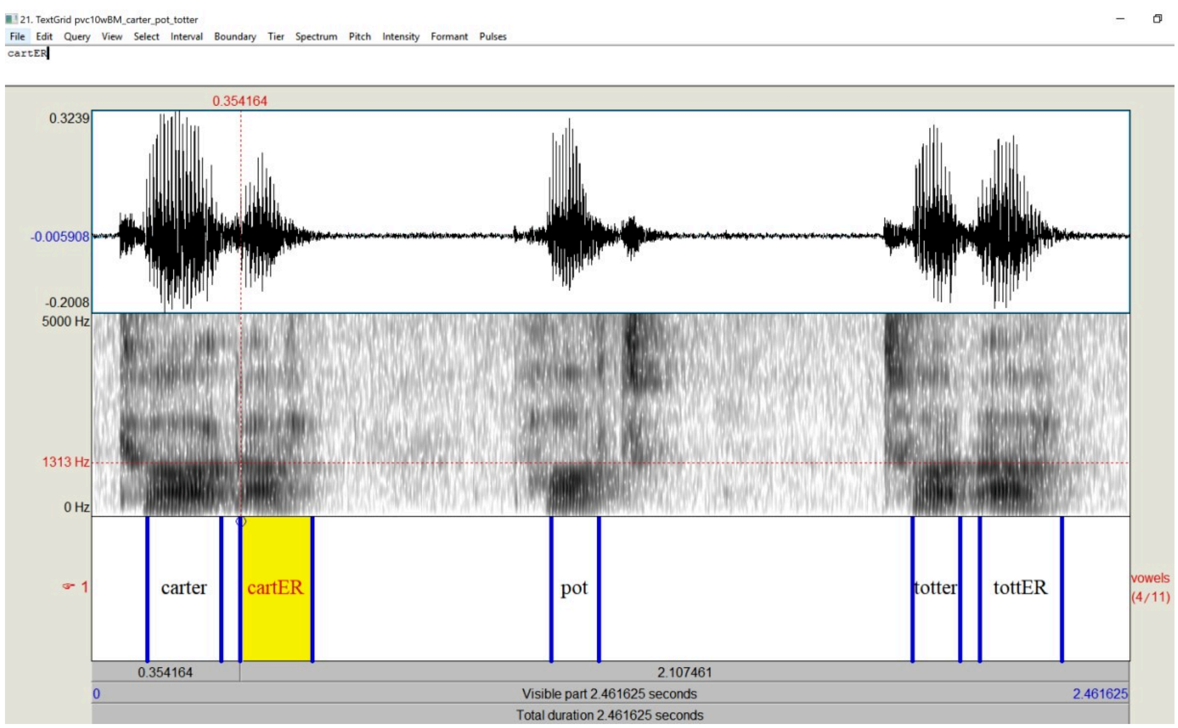


Figure 1-35 Spectrographic illustration of a traditional back-low variant in lettER in the words *cartER* and *tottER* vs. START and LOT vowels *carter* and *pot* (speaker 10BM, MC aged 18, PVC wordlist).

1.4.7 Northumbrian burr

I could not write this chapter on Tyneside English without mentioning one of its iconic accent features. Northumberland is famous for the uvular realisation of <r> ([ʁ]). It is now absent in urban areas and very rare in the countryside surrounding Newcastle. Beal explains that "the burr has been a source of pride to Northumbrians, many of who today will perform the burr as a party-trick even though they would not use it in everyday speech" (Beal, 2008, p. 129).

Ever since the eighteenth century, the burr has been the object of curiosity in Britain. Hugh Jones calls it a "harsh Guttural Sound, or Kind of Burr in the Throat" in the "Counties bordering upon *Wales* and *Scotland*" (1724, p. 12). Defoe also decries the sound:

> I must not quit *Northumberland* without taking notice, that the Natives of this Country, of the antient original Race or Families, are distinguished by a *Shibboleth* upon their Tongues in pronouncing the Letter *R*, which they cannot utter without a hollow Jarring in the Throat, by which they are as plainly known, as a Foreigner is in pronouncing the *Th*: this they call the *Northumberland R*, or *Wharle*; and the Natives value themselves upon that Imperfection, because, forsooth, it shews the Antiquity of their Blood (Defoe, 1753, p. 233).

Both authors and more particularly so Defoe, contributed to the shaping of the Northumbrian burr into collective memory and later on, the pride in such *shibboleth*.

More than a century later, Murray (Murray, 1873) published a description of the burr in a publication on the southern counties of Scotland bordering with Northumberland. The philologist sees it as a compromise between the /r/ pronounced in Scotland, also known as *crhoup* and in England. It is compared to /r/ in French or German:

> The Northumbrian burr, or *r grasséyé*, seems to be a compromise between the Northern trilled *r*, used in Scotland, and the smooth *r* of England ; the Northumbrian, endeavouring at once to retain the consonantal character of the *r*, and to avoid the tip-tongue-trill, exaggerates the final English *r* in ai*r*, oa*r*, produced by a gentle and almost inappreciable tremor of the tongue, into

> a rough vibration of the soft palate. The sound is more advanced than the Arabic g*rh*ain, and, in a softer form, is common in French and German. Anyone who will pronounce forcibly the Parisian *r* in *Paris*, may produce the Northumberland burr, or, as it is called at home, the *crhoup* (k*ru*p). As has been hinted above, the Northern limits of the *burr* are very sharply defined, there being no transitional sound between it and the Scotch *r*. (Murray 1873, pp. 86-87)

This time, neither irony nor contempt associated with the burr can be detected in the text. Plus, basic articulatory features are also mentioned. In the twentieth century, Kolb used the data of the *Survey of English Dialects* to map the presence of the burr in the speech of rural old men in all the villages surrounding Newcastle (Kolb, 1966, pp. 66-379). This is in line with Påhlsson's sociolinguistic study which showed that the Northumbrian burr had become "obsolete" and that it was mainly confined to the speech of older working-class men living in rural and fishing communities (1972, p. 28). Nonetheless, Corrigan points out that the NECTE contains "examples of the last vestiges of distinctive northeastern phenomena" such as the burr (Corrigan, 2012, p. 91).

Unfortunately, instances of the burr remain too few to be the object of a full study in this thesis. A recent interview of a Northumbrian pitman by the BBC in 2000 provides a good example of a Northumbrian burr in various contexts. The first example in Figure 1-36 is a spectrographic illustration of [ʁ] in intervocalic position (*Durham*). In Figure 1-37, the burr is preceded by an unvoiced fricative (*difference*) and a lateral approximant (*already*). The formant patterns across [ʁ] are visible albeit attenuated, which is typical of an approximant.

Figure 1-38 is a good example of "burr-modification" (C Påhlsson, 1972). Beal defines it as "vowels that have become retracted or lowered in (most cases) due to a following posterior /r/, e.g. first [fɔːst], word [wɔːd]" (Beal, 2002, p. 167).

roe1_burr1_Durham.wav roe1_burr1_difference_already.wav

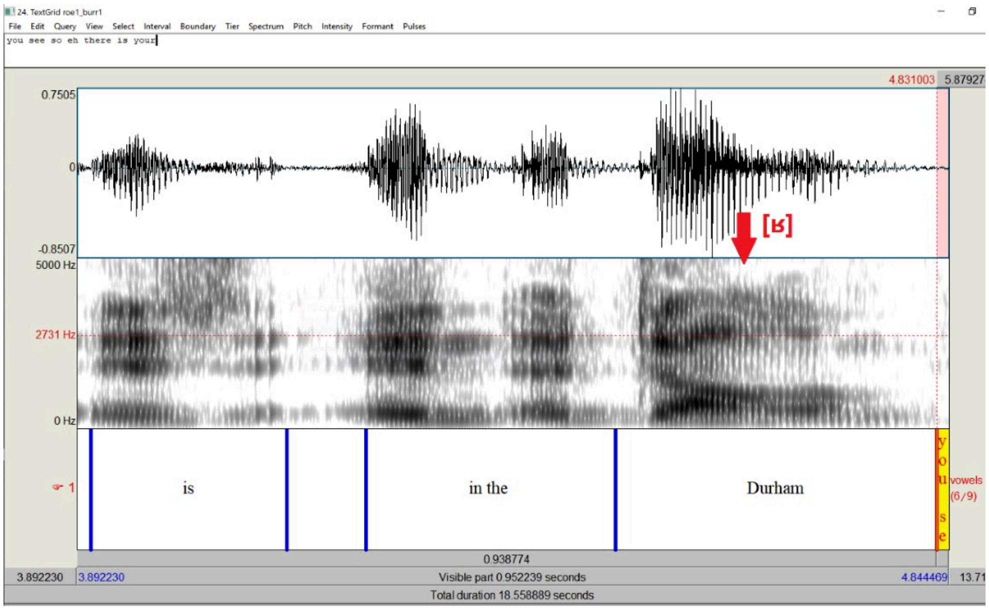


Figure 1-36 Example of uvular [ʁ] in North-East English. Retrieved from https://www.bbc.co.uk/radio4/routesofenglish/storysofar/programme3_1.shtml.

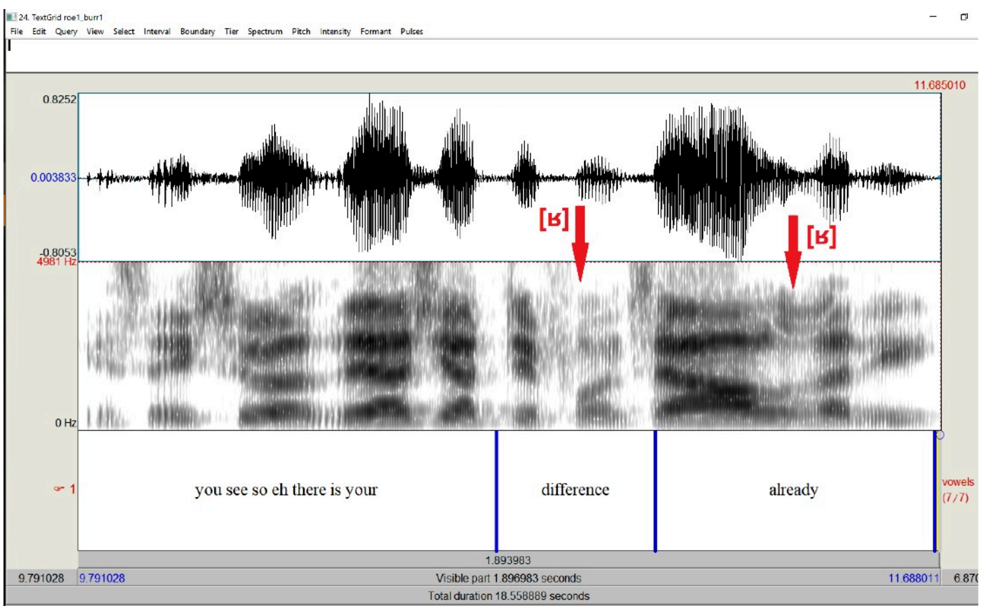


Figure 1-37 Example of uvular [ʁ] in North-East English. Retrieved from https://www.bbc.co.uk/radio4/routesofenglish/storysofar/programme3_1.shtml.

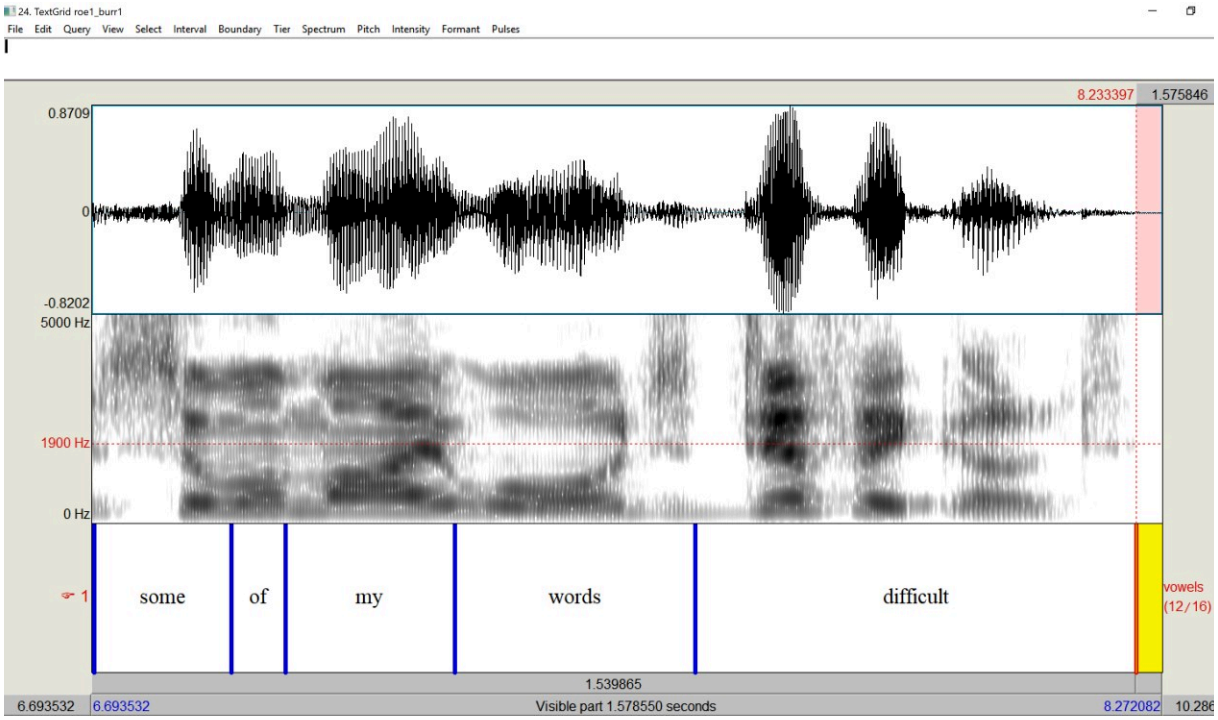


Figure 1-38 Burr-modified vowel in *word*. Retrieved from https://www.bbc.co.uk/radio4/routesofenglish/storysofar/programme3_1.shtml.

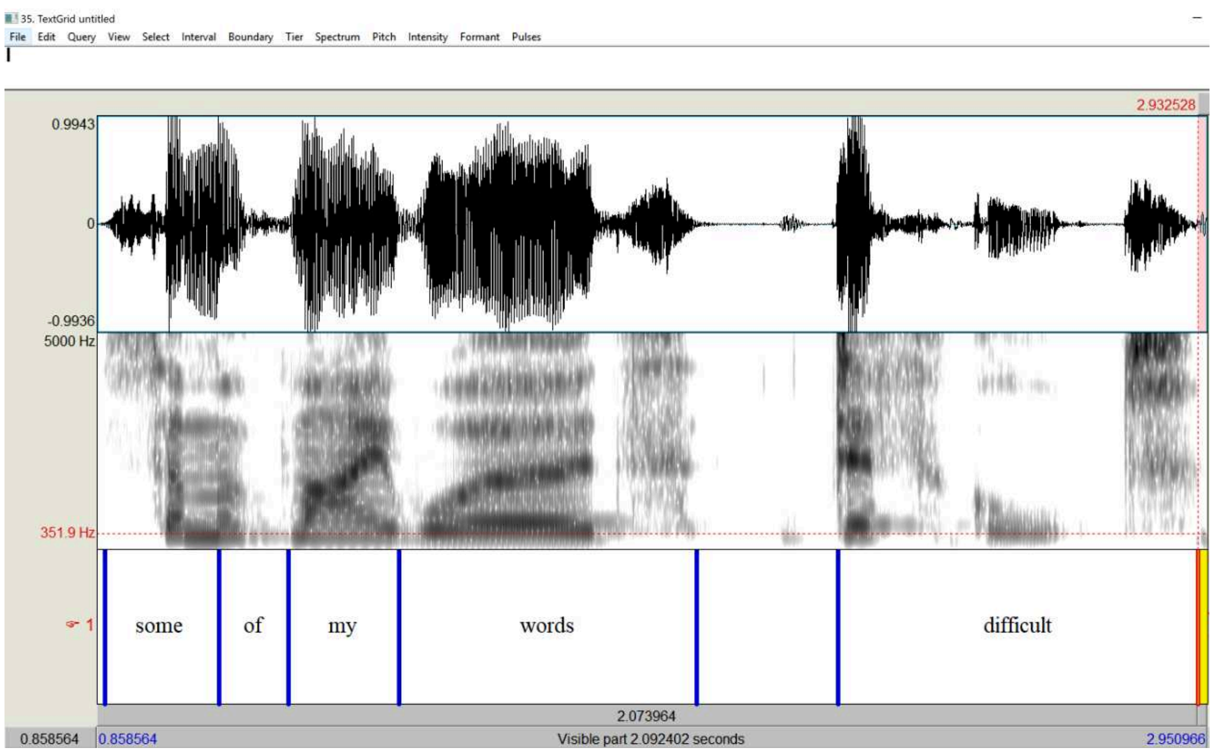


Figure 1-39 R-modified vowel in *word*, non-rhotic variety (recording of my own voice).

CHAPTER 2 Literature review: Towards a Northern "English School of Phonetics", a gradual way towards the DECTE[35]

Que représente aujourd'hui la dialectologie ? Aux yeux du plus grand nombre, peu de choses : une discipline vieillotte, passéiste, folkloriste, un savoir superflu, aucunement rentabilisable, au mieux un violon d'Ingres pour quelques originaux. (Dalbera, 2013, p. 173)

Summary of CHAPTER 2

In the present chapter, I first trace the growing popularity of phonetics (2.1) and dialectology (2.2) separately, both being initially considered as ancillary and minor disciplines in Britain. I then move on to focus on two major nineteenth-century works on Northern-English dialectology, i.e. Ellis and Heslop (2.3), insisting on how their notations of the local pronunciation inspired the very fine-grained transcription scheme implemented by the original TLS team. The following sections (2.4 & 2.5) explain how the recording machines led to a revival in rural dialectology in Britain that coincided with the first studies on urban dialectology on the other side of the Atlantic. The TLS drew inspiration from both movements, namely, the use of recording machines and fine-grained transcriptions (SED) but applied it to urban dialectology with a much wider array of participants with various sociological profiles.

The following chapter traces the evolution of dialectological work in Britain. The history of the field itself helps us understand why the first major works and surveys took place in the margins of Britain, thus slowly reinforcing a theoretical and methodological legacy for the *Tyneside Linguistic Survey* to build up on. The perception of dialectology as an

[35] The title of this chapter hints at Firth's 1946 article entitled "the English School of Phonetics", which aimed to show how much phonetics in Britain had developed and could well "boast a flourishing phonetic school of its own". The last aim of the English school of phonetics was dialectology (Firth, 1946, p. 94).

ancillary discipline for nostalgic folklorists is also what drove the TLS team to draw inspiration from sciences like statistics and biology. They wanted to show that sociolinguistics was more like a science than an act of interest for folklore. The first part deals with the development of dialectology in Britain inspired by studies carried out on the continent. Traditionally, the field was more turned towards lexicology but with the rise of phonetics as the science of speech, dialectologist started to take interest in accents and used it as a tool to document dialectal variation. In the South, phonetics was mainly regarded as a teaching tool to help citizens across the British Empire learn English and pronounced it based on RP standards. The phonetic alphabet would serve as a universal tool for language learners around the world, hence the original name of the International Phonetics Association, *fonètik tîcerz asóciécon* (Howatt & Smith, 2020). But in other academic centres like the North of England and Scotland, dialectologists used phonetics to measure phonetic variation across localities. This was a direct legacy of Ellis's work on *Early English Pronunciation* and on dialects on a national scale (A. J. Ellis, 1889, 1890). In the *Survey of English Dialects*, however, the Phonetic Alphabet of the International Phonetic Association that was used and not Ellis's own alphabet for fine-grained transcriptions, the *palaeotype*. The increasing availability of recording machines contributed to foster research in which dialectology and phonetics worked in symbiosis. The TLS inherited from that tradition in both providing, like Ellis, fine-grained transcriptions and using recording machines which had become more easily available.

2.1 The Birth of an "English School of Phonetics" (Sweet 1877): From a European discipline to the nationalisation of the field

In 1946, Firth felt the need to reassert the British presence in the field of phonetics: "England may now boast a flourishing phonetic school of its own" (Firth 1946, p. 93). While many prominent phoneticians in Europe were from France or Germany, the notion of an "English school of phonetics" began to emerge during the second half of the nineteenth century. Many linguists, however, still had to set foot on the continent in order to get training in phonetics before entire Phonetics departments were created in British Universities. Daniel Jones, Henry Sweet and Joseph Wright, for instance, studied phonetics in Germany. The latter studied phonetics in Heidelberg and his PhD dealt with quantitative and qualitative analyses of vowels. The first half of the twentieth century led to the reassertion of Britain as a credible research hub in phonetics. We therefore notice a nationalisation of the field: "the origins and reaches of *our* notable work in this branch of linguistics and of the share the Society had in its encouragement and propagation to show *how very English* it is [emphases mine]" (Firth, 1946, p. 93). In Firth, there is also a willingness to reassert the position of Britain as having built a phonetic tradition since the eighteenth century such as Sheridan's dictionary (Sheridan, 1780), which comprises detailed phonetic transcriptions of each word: "we have practiced the discipline in some form or other for centuries". Giving authority and credibility to the discipline by mentioning its long usage it is becoming a traditionally English discipline that ensured "continuity in that quality over a long period" (Firth, 1946, p. 93). The following section details the work of 19th century dialectologists in Britain with a particular focus on those having used phonetics to classify dialects in Britain, namely, Ellis, Wright and Bonaparte.

2.2 The first dialectologists: from an "impressionistic" to a more "scientific" approach to phonetic dialectology (Sweet, 1877)

2.2.1 J. A. Ellis (1815-1890), J. Wright (1855-1930) and Louis-Lucien Bonaparte (1813-1891)

The first dialectologists in Britain can be traced back to the nineteenth century with the birth of the Society of English Dialects from 1873-1896. The two main actors were A. J. Ellis and J. Wright, who later funded the York Society of dialectology. Their legacy is taken for granted in English dialectology, and as McDavid put it: "the distribution of linguistic forms in the British Isles is found principally in (…) Ellis's *Early English Pronunciation* (1889) and in Wright's *English Dialect Dictionary* (1896–1905) and *English Dialect Grammar* (1905). These are monumental works, without which we would be helpless" (1953, p. 563). As early as the 1930s, the works of both Ellis and Wright were considered as seminal works. As A. H. Smith declared in a speech during a meeting of the Philological Society:

> ANY observations on modern English dialects would be very properly prefaced by a tribute to the fundamental works in this branch of philological studies – A. J. Ellis's *Early English Pronunciation* and Joseph Wright's *English Dialect Dictionary*. Ellis and Wright undertook tasks which few scholars could and would nowadays dare to equal. (Smith, 1936, p. 76)

While referring to Ellis's considerable contribution to the field of Phonetics in Britain Sweet called him "the pioneer of scientific phonetics in England" (Sweet, 1877, p. vii). He claimed that "England may now boast a flourishing phonetic school of its own" leading to the training of a new generation of phoneticians like "Ellworthy, Hallam and Goodchild" along with "J.H. Murray and H. Nicol" (Sweet, 1877, p. x). This heyday in dialectology that waned a few years after Ellis's death in 1890 would only be revived with Orton and Dieth's post-war *Survey of English Dialects* (Orton, 1962; Orton & Dieth, 1952). The two seminal studies laid the groundwork for the TLS. It is clear that the *Tyneside Linguistic Survey* drew on the work of Ellis who provided phonetic transcriptions of each dialect ranging from broad to narrow. Moreover, although the fieldwork areas of the TLS were restricted to Newcastle and Gateshead, the TLS aimed at developing a survey on a national level, akin to Ellis and Orton's work. The pioneer use of recording machines by Orton's fieldworker also inspired the original TLS team, who recorded people in their own homes. I now provide a literature review of early dialectologists, with a particular focus on early works on Northern English as it helps grasp the evolution of the discipline until the TLS.

While Wright was famous for his *Grammar of English Dialects*, Ellis focused on the phonetic and geographical delimitation of forty-two dialects in Britain via a series of publications from 1869 to 1890. His two most famous pieces of work are *English Dialects: Their Sounds and Homes* (1890) and *On Early English Pronunciation, Part V: The Existing Phonology of English dialects Compared with that of West Saxon* (1889). Henry Sweet stresses the importance of Ellis's contribution to phonetics via his adaptation of the Roman alphabet "for the accurate representation of minute shades of sound" (Sweet, 1877, p. viii). Early forms of a narrow phonetic alphabet for English were born.

Getting rid of complex diacritics as in Lepsius's 'General Alphabet' or 'Standard Alphabet' would thereby ease the work of the writer and printer. Indeed, while there could be as many as 3 diacritics on a single sound, Ellis managed to have many characters printed upside down to increase the number of possibilities with the Roman alphabet only and its marks of punctuation.[36] Stress, for instance, was codified with an "inverted" or "turned" period (A. J. Ellis, 1890, p. xiv). Moreover, Ellis's academic *Palaeotype* and its popularized version of it, the *Glossic transcription*, enabled narrow levels of transcriptions[37] in order to reach greater accuracy in describing the dialects. A broader level is transcribed with a capital letter while the narrower variables were in lower-case letters accompanied by a superscript number or symbol, namely, characters like ^{2} or °, often used in publications on mathematics. This level of detail is reminiscent of TLS itself. TLS original team adopted some of these diacritics to transcribe the recordings, since the International Phonetic Alphabet that they chose to use transcribe the material also included symbols like °.

Ellis's own description in his chapter "Alphabetical Key to the Glossic" (1890) reads as such:

> The varieties expressed by small-letter italics with superior numbers are placed in numerical order after the general symbol, written as a capital, and are generally used only in phonetic discussions . . . The numerous duplicate forms have been designedly introduced for the purpose of assisting the reader in approximating to the sounds. (p. xv)

Figure 2-1 is an example with a "general symbol" followed by the varieties in Glossic and the Palaeotype equivalent in parentheses along with their descriptions:

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[36] For more information on Lepsius's alphabet, you may visit: https://archive.org/details/dasallgemeineli00lepsgoog

[37] The search for systems and codings that would render very narrow transcriptions of speech is also at the heart of the TLS project, which will be described in depth in the next chapter.

A, **general symbol, with three varieties:**

a^1, **pal. (æ), 'short a in bat' and long 'provincial a in Bath,'** ***ba***^{1}***t·***, ***Ba***^{1}***·th*** **; see usual received 'short a,' p. 58.**

a^2, **pal. (ah), a finicking, but educated sound, used much by ladies in such words as ass, pass, laugh, aunt,** ***a***^{2}***s***, ***pa***^{2}***s***, ***la***^{2}***f***, ***a***^{2}***nt***, **commonly** ***aa·s***, ***paa·s***, ***laa·f***, ***aa·nt***, **or** ***aas·***, ***paas·***, ***laaf·***, ***aan·t***, **pp. 38, 58, differing little from** ***a***^{3}.

a^3, **also written** ***aa***^{3}, **pal. (a**^{1}**), fine 'Fr. a in patte,' heard short in place of** ***a***^{1} **in sw. w. and e. England, and long in n. England, p. 58.**

a', **pal. (ah) or (a**^{1}**), used for either** ***a***^{2} **or** ***a***^{1} **when it is advisable to avoid superior figures, p. 68. See** ***a'y***.

AA, **general symbol, with the following varieties:**

aa°, **pal. (a°), an indistinct sound recalling** ***aa***^{1}, **p. 116.**

aa^1, **pal. (a), 'short of a in father,' quite distinct from** ***a***^{1}, **and common in the M. div.**

aa^2, **pal. (*a*), frequently written** ***ah***, **p. 138, to avoid superiors, broader form of** ***aa***^{1}, **liable to be confused with** ***au***, **especially heard in D 33.**

aa^3, **pal. (a**^{1}**), the same as** ***a***^{3}, **which see; p. 154.**

aa^4, **pal. (a**$_1$**), a form of** ***aa*** **noted in D 31, p. 114, as lying very near to** ***aa***^{2}, **but not quite so deep; here it is not generally distinguished from** ***aa***^{1}.

aa$_{\iota}$, **pal. (a**$_{\iota}$**), nasalised** ***aa***, **distinct from the 'Fr. an'** ***ahn'***.

AAŭ, **pal. (ău), a fracture consisting of a short** ***aa*** **gliding on to** ***ŭ*** **; the long form** ***aa·ŭ*** **is heard occ. in 'far'** ***faa·ŭ***, **but the** ***ŭ*** **is generally omitted by Londoners even in the pause.**

Figure 2-1 "Alphabetical Keys" to the Glossic transcription. In Ellis (1890, p. xv).

The explanations he makes of each variety are however difficult to fathom nowadays. Concerning a^2, the description appears rather popularized: "a finicking but educated sound, used much by ladies in such words as ass, pass, laugh" (A. J. Ellis, 1890, p. xv). Another variable, *aa°*, is said to be "indistinct" but "recalling" a long [a]. Yet this attempt at providing narrow levels of transcription was rather new at the time and led Sweet to call him a pioneer in "scientific" phonetics [who] inaugurated the scientific historical study of English pronunciation" (Sweet, 1877, p. viii).

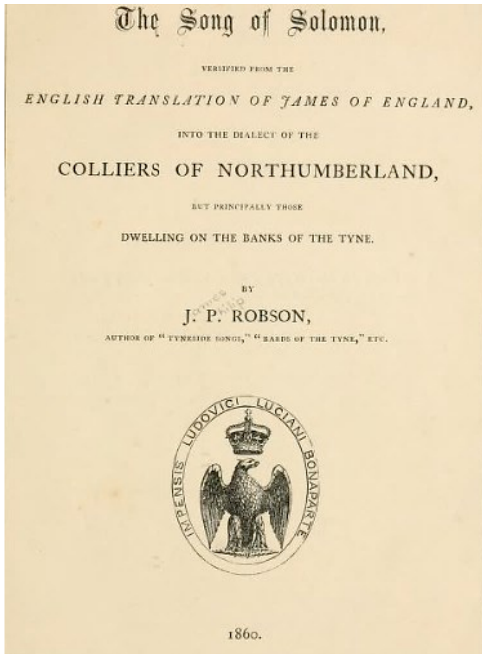
In his attempt to map dialects (fig. 2.3), Ellis tried to divide Britain into ten isoglosses that he named 'transverse lines', which formed the first broad phonetic distribution of English speech' (A. J. Ellis, 1889, pp. 6-7), six divisions and forty-two districts. These divisions were given the geographical names of Southern, Western, Eastern, Midland, Northern, Lowland and Scotland. They were based on the following restricted phonological criteria: "the pronunciation of "some", /r/, "the" and of words like "house" (Ihalainen, 1994, p. 234). According to Ellis, the real issue was "to make these districts wide enough, by resolutely refusing to be led away by small differences" (A. J. Ellis, 1889, p. 1438). Such issues very much a more recent debate in sociolinguistics and dialectometry (Nerbonne, 2006) and more precisely on the TLS (Corrigan et al., 2014): should the discrimination of sociolects be based on single-feature approaches or on aggregate analyses? Today, new forms of aggregate analysis using computers have helped reduce biases due to a restriction of features by the dialectologist. But at the same time, it has raised concerns about the reduction of detailed analysis where variational patterns often emerge. While rendering a more comprehensive and inclusive vision of dialect boundaries, it may also make the latter more blurry since it becomes less visually clear which features help distinguish a dialectal zone from another (Wieling, Shackleton, & Nerbonne, 2013, pp. 31-32).

The task of dialect mapping was also carried out ten years earlier but with fewer details and by Prince Louis-Lucien Bonaparte who happened to be born in Britain and spent a considerable amount of his life there. His paper, delivered to the Philological Society of London and entitled *Classification des Dialectes Anglais Modernes* (1873), is often overshadowed by Ellis's notoriety, hence the rare mention of his contribution in today's works on the history of dialectology in Britain. He was, however, one of the first linguists in England to present a map and a table of the dialects of England to the Society (Figure 2-4). According to Sever Pop, 250 maps in colour were printed out for the Society, one dealing with the Scottish dialects and another one representing England and Wales (Pop, 1950, p. 910). However, although it is specified that Bonaparte himself made the investigation, I later found out that Bonaparte commissioned local writers to translate parts of the Bible like the *Song of Solomon*, the *Book of Psalms*, or the *Gospel of St. Matthew* into their own dialect using a semi-phonetic spelling.[38] At least 10 dialectal versions of the *Song of Solomon* were published in the year 1860 (cf. APPENDIX I). The translation for Tyneside English by a local song writer James Philip Robson (1860) is an impressionistic account of the speech of collieries of Northumberland "principally those dwelling on the banks of the Tyne" (Figure 2-2).

However artificial these transcriptions may be, using the same text to compare dialects enhances comparability and is an approach that is still used today. Bonaparte's collaborative work on Basque dialogues, whose excerpt is displayed in Figure 2-3, provide a good indication of his comparative methodology, which he probably applied when comparing varieties of English. While the translations of the Bible were far from being naturalistic, Bonaparte remains one of the first attempts to create a typology of English dialects on maps based on comparable data materials as displayed in Figure 2-3. His influence on Ellis's (A. J.

[38] Before working on varieties of English, Louis-Lucien Bonaparte worked on varieties of Basque, for which he also commissioned transcriptions of the *Song of Solomon* (Duvoisin, 1859; Iturriaga, Uriarte, Duvoisin, & Inchauspe, 1857). He then replicated this approach when analysing English and Scots.

Ellis, 1889, 1890) or even Orton & Dieth's (Orton & Dieth, 1952) later attempts should not be disregarded.



The Song of Solomon,

VERSIFIED FROM THE

ENGLISH TRANSLATION OF JAMES OF ENGLAND,

INTO THE DIALECT OF THE

COLLIERS OF NORTHUMBERLAND,

BUT PRINCIPALLY THOSE

DWELLING ON THE BANKS OF THE TYNE.

BY

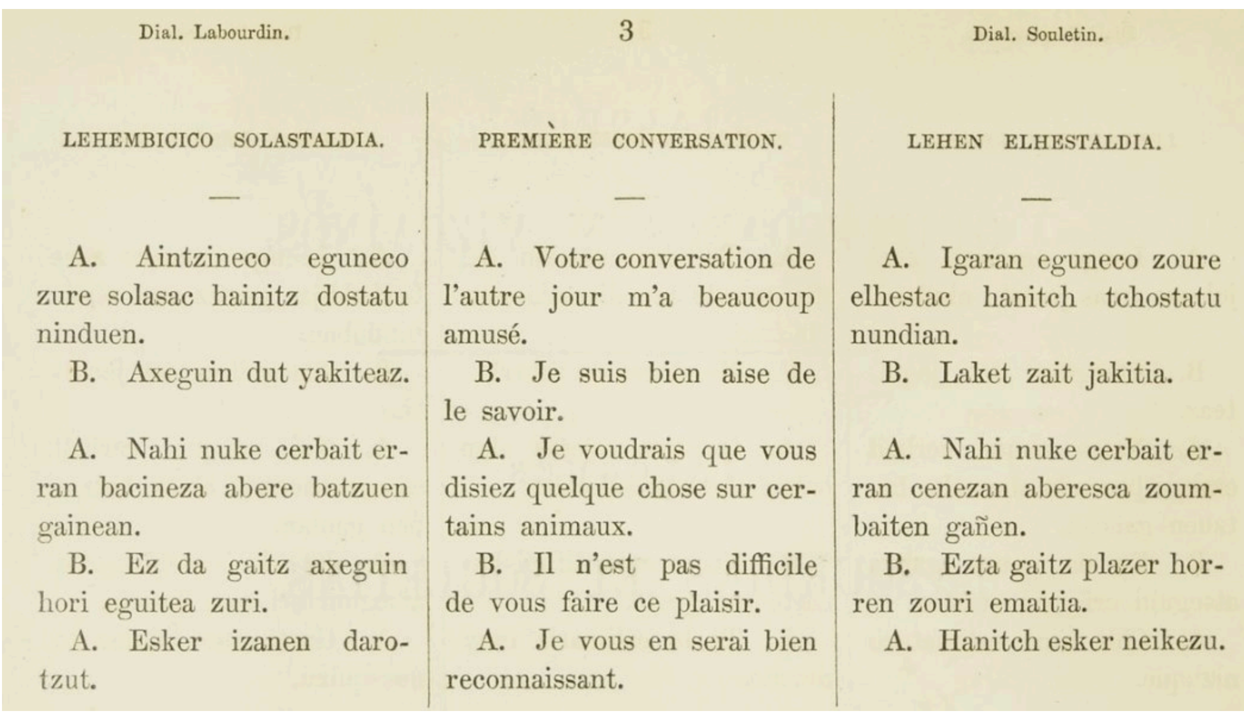
J. P. ROBSON,

AUTHOR OF "TYNESIDE SONGS," "BARDS OF THE TYNE," ETC.

IMPENSIS LUDOVICI LUCIANI BONAPARTE

1860.

Figure 2-2 Front page of the impressionistic transcription of Tyneside colliers: the *Song of Solomon* by local song writer J. P. Robson, commissioned by Lucien Bonaparte.



Dial. Labourdin.	3	Dial. Souletin.
LEHEMBICICO SOLASTALDIA.	PREMIÈRE CONVERSATION.	LEHEN ELHESTALDIA.
—	—	—
A. Aintzineco eguneco zure solasac hainitz dostatu ninduen.	A. Votre conversation de l'autre jour m'a beaucoup amusé.	A. Igaran eguneco zoure elhestac hanitch tchostatu nundian.
B. Axeguin dut yakiteaz.	B. Je suis bien aise de le savoir.	B. Laket zait jakitia.
A. Nahi nuke cerbait erran bacineza abere batzuen gainean.	A. Je voudrais que vous disiez quelque chose sur certains animaux.	A. Nahi nuke cerbait erran cenezan aberesca zoumbaiten gañen.
B. Ez da gaitz axeguin hori eguitea zuri.	B. Il n'est pas difficile de vous faire ce plaisir.	B. Ezta gaitz plazer horren zouri emaitia.
A. Esker izanen darotzut.	A. Je vous en serai bien reconnaissant.	A. Hanitch esker neikezu.

Figure 2-3 A comparison of two Basque dialects (left: Labourdin, right: Souletin) with a translation into French (centre), from (Iturriaga et al., 1857, p. 3): an indicator of Bonaparte's possible methodology for his classification of dialects in the British Isles.

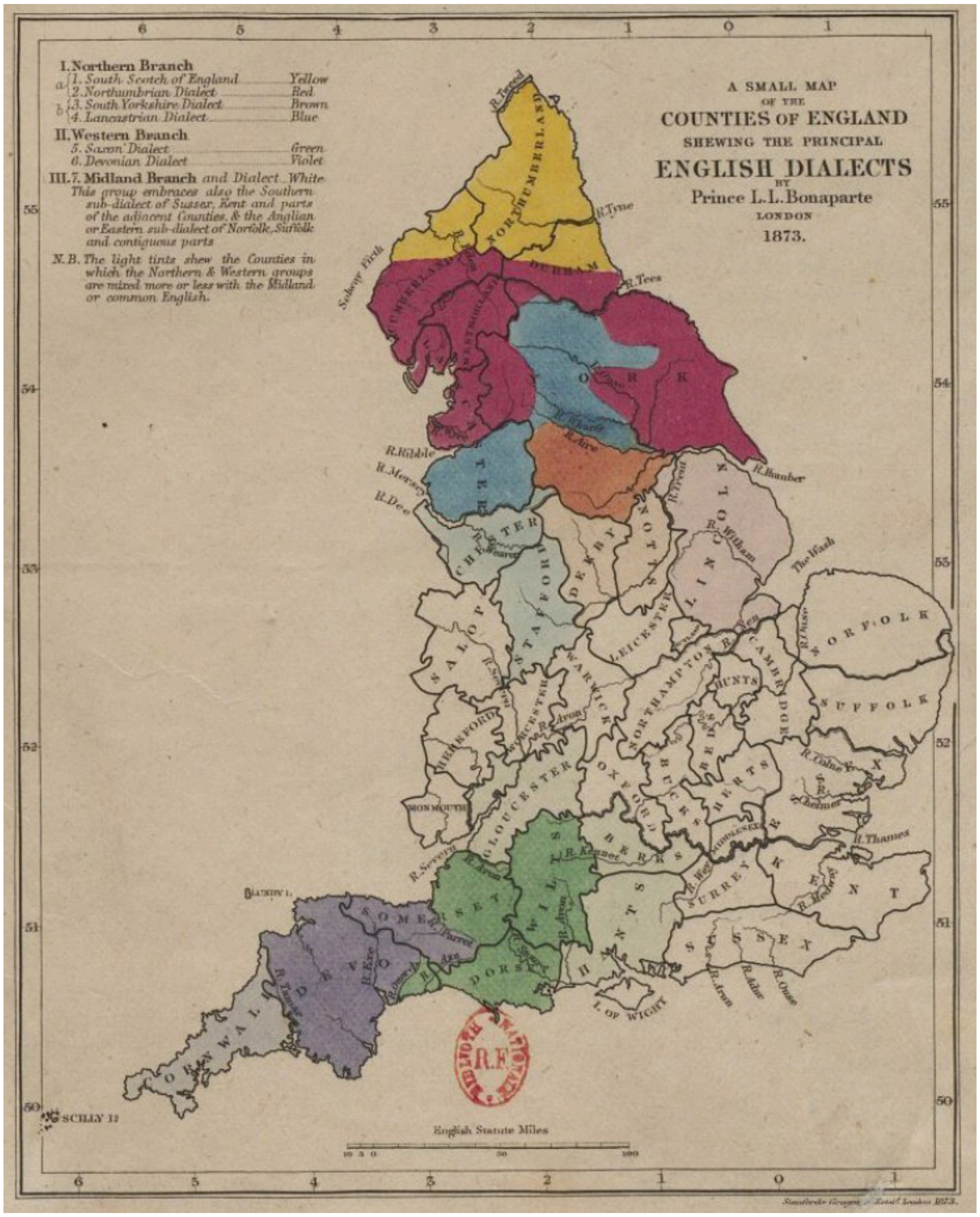


Figure 2-4 Louis-Lucien Bonaparte's map of English Dialects 1873.

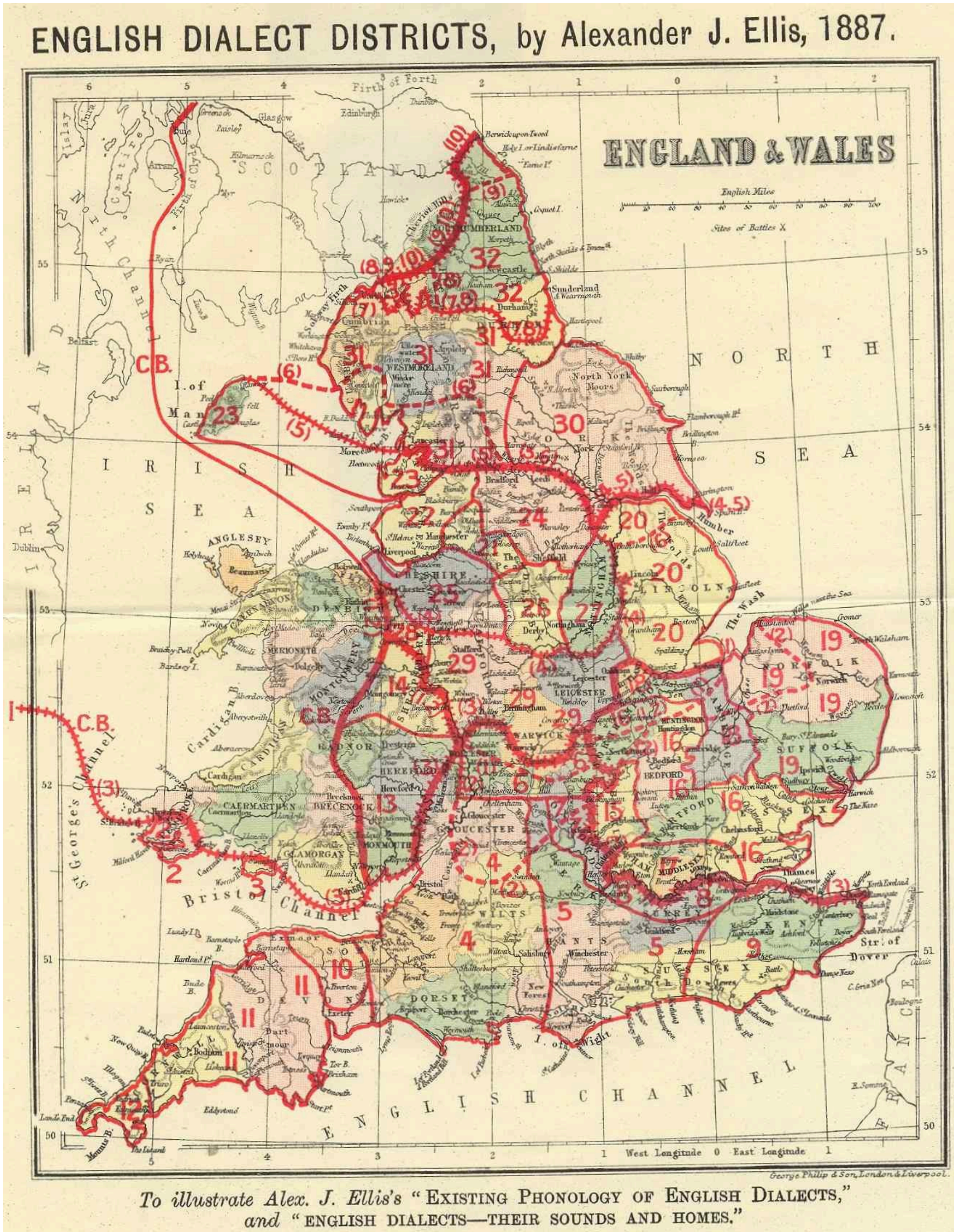


Figure 2-5 Ellis' map of English dialects in 1889 (5th page, unnumbered).

As to Northern English dialects, Ellis's Northern division encapsulated the entire North and East Ridings with some of the West Riding of Yorkshire, northern Lancashire, most of Cumberland and Northumberland, all Westmorland and Durham (A. J. Ellis, 1889). The transverse line with Scotland does not follow the official border but comprises a small section of Western Scotland and excludes part of Northumberland (cf. lines 8 - 9 - 10 on Figure 2-5, see APPENDIX p. 629 for a complete description of the North-East boundary in Ellis (1889, pp. 495-496). Bonaparte divided the North in two: the North-East and the North-West dialects, which corresponds to modern studies on Northern Englishes (Hickey, 2015; Montgomery, 2007; John C Wells, 1982), although certain studies report a degree of convergence with Newcastle English over the past twentieth century (Jansen, 2012, 2013).

Another aspect of Ellis' pioneer work was that his classification of dialects did not so much reveal clear-cut boundaries or small linguistic islets of rural communities, but instead, it showed that geographical dialects are more like a series of continuums of dialects having in common a "particular combination of linguistic features" (Smith, 1936, p. 77). His work therefore foreshadows the birth of more recent disciplines like dialectometry (Nerbonne, 2006) and is a direct legacy of the *Tyneside Linguistic Survey*'s original aim to include a maximum number of features, be they phonetic, morphological or grammatical.

The first stone of English dialectology was thus laid. Yet, a great amount of work remained to be done and as the dialectologist himself put it:

> Although this has a very complete and systematic appearance, I do not disguise myself the real incompleteness of the whole exposition and the great desirability of using it merely as a nucleus round which the results of other investigations may be grouped (A. J. Ellis, 1889, p. 9).

Wakelin, who published *English Dialects: an Introduction*, claimed that "when English dialects are classified again . . . their remnants will be seen to correspond remarkably well with Ellis's results" (Wakelin, 1977, p. 102).

Most of the works cited in this section concerned projects on a national level although some of their methodologies like the use of recordings and various levels of phonetic transcriptions ranging from more fine-grained to broad greatly influences the TLS original team and continue to inspire variationists today. I now turn to a literature review of a less well known 19th century dialectologist whose work dealt with Tyneside English in particular.

2.2.2 Reverend Oliver Heslop (1842–1916), on dialects of the Tyne

Another author on Northern dialects mentioned in Wright's preface should also be more often referred to when studying the history of Tyneside English dialectology, namely, Reverend Olivier Heslop, who, with a team of zealous dialect enthusiasts "spared neither time, trouble, nor expense in helping to make the material [the *English Dialect Dictionary*] as complete as possible" (Wright, 1898, p. viii). In 1892, Heslop published one of the first books on the dialects of Tyneside with an accompanying map of the Northern Dialects (Figure 2-6)[39] and a glossary of words with a spelling that reflected its pronunciation. With large-scale projects it is somewhat harder to focus on subtle variations within a dialect. His work was published on behalf of the English Dialect Society ("Newcastle's Forgotten Son", 2019).

[39] Not all editions comprise a map at the beginning. The online edition cited in this study can be found here: https://archive.org/details/northumberlandw03heslgoog/page/n10 (Accessed 31/07/2019).

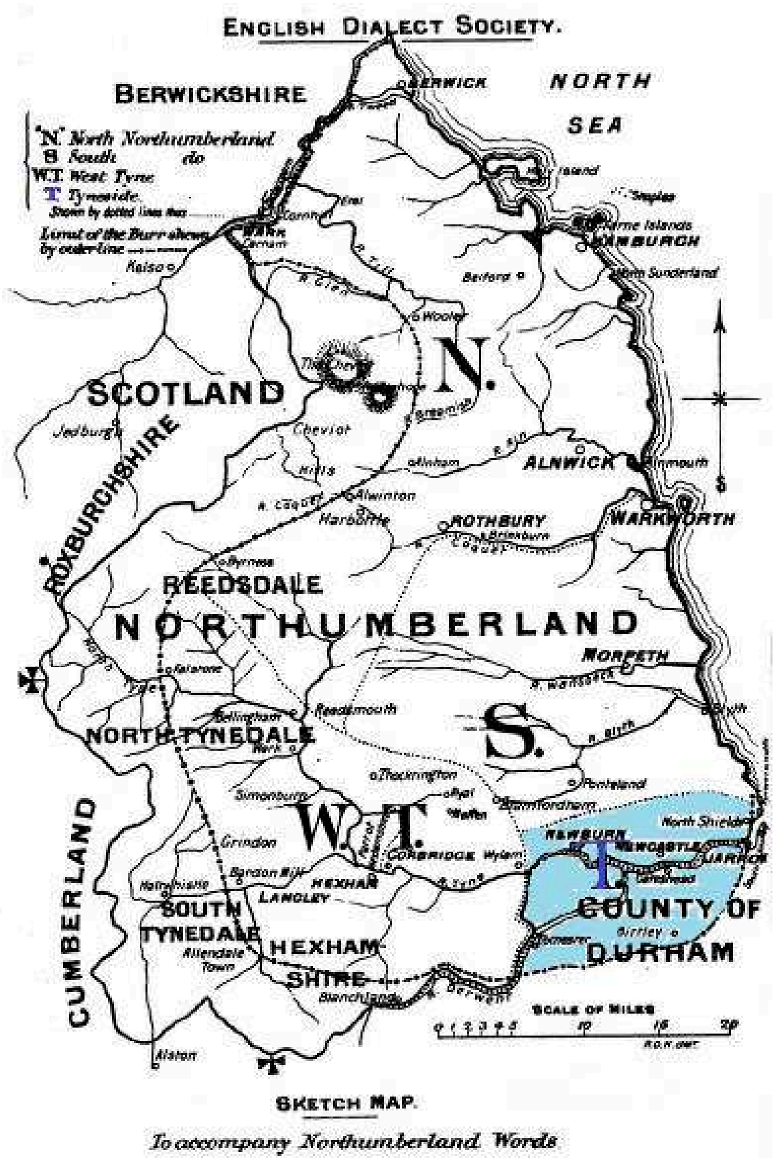


Figure 2-6 Map adapted from Heslop's 1892 (opposite front page) *Northumberland Words*: a glossary of words used in the county of Northumberland and on the Tyneside, (blue area). Source: https://www.flickr.com/photos/britishlibrary/11246254843/in/photostream/.

A few pages of introduction account for the pronunciation specificities and give an attempt to classify the northern dialects in more details than Bonaparte's own classification. Heslop identifies four dialect zones in Northumberland, *i.e.*: South and North

Northumberland, Tyneside and West-Tyne. According to his studies, the latter dialect has a pronunciation system that seems further apart from the others, with vowel pronunciations often differing from the rest of the region. It is uncertain how Heslop gathered the data for this glossary but he reports having travelled to various places and taken notes of everyday conversation of local people (Heslop, 1892, p. xxv).[40] Miners living in tight communities were also considered by Heslop as preservers of the dialect (Heslop, 1892, p. xvi). Since the aim at the time was to report on *purer* or more traditional forms of speech, it is possible that less traditional variants spoken by women like the raised onset in MOUTH or people from more well-off backgrounds using other variants may have gone unnoticed. The TE-lect reported below is therefore probably confined to that of workmen from Northumberland.

Regarding pronunciation, Heslop alludes to the Northumbrian burr, the absence of length opposition in /a/ except for <a>+<ll> as in “wax” vs. “wall” (/a/ vs. /aː/) or the use of a /k/ in words like *church*. It is clear that the grouping of vowel based on Well’s modern lexical sets are less well adapted to Northern varieties of English since the North is known to have undergone a slightly different Great Vowel Shift (e.g. Prichard 2015), but I will nonetheless refer to the four vowels analyses in this thesis using Well’s convention (1982).

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[40] The glossary “originally begun by noting down, on the spot, words and phrases commonly heard in the social life of Tyneside, among the hills and dales of Northumberland, and in the fields and working-places of the district. Thus in the course of observation extending over many years, a considerable number of local words in everyday use was accumulated. As soon as the collection had attained sufficient dimensions it was roughly arranged and classified; and every available publication in the dialect of Northumberland was carefully read, in order to provide illustrative examples of the materials in hand and to add to the stock. Finally, the list, revised and augmented by further research and intercommunication, was collated with *the Glossary of North Country Words*, published by John Trotter Brockett”. (Heslop, 1892, p. xxv)

While a detailed selection of vowel variation by Heslop is provided in APPENDIX IV, I will hone in on FACE, GOAT PRICE and MOUTH, with additional information on the Northumbrian burr.

2.2.2.1 The GOAT vowel

The most complex set of vowels is probably what is now grouped into the lexical sets GOAT/GOAL. According to Heslop's observations, some speakers omit the /l/ in GOAL words like *hold, fold* and *cold*, which leads to a modification of the vowel: "when the *l* is dropped these words are heard as *had, fad, caad*". While those who do not drop the /l/ seem to have a diphthong as Heslop wrote them as *hould, fould, could* (Heslop 1892, p. xviii). This pronunciation is reminiscent of the Anglian variety of Old English as opposed to that of West Saxon and Kentish (Crowley, 1986). Words like *old*, *cold* and *hold* were classified as *al*C in Anglian, being pronounced as *ald*, *cald* or *haldan* but in the other two varieties, they are reported to be realised as *eal*C, i.e. *eald*, *ceald* and *healdan* (Prichard, 2015, p. 53).

CAAN (*p. part.* of *caal*), called. "He's *caan* Bobby efter his granfether." "Aa wis *caan* back hyem agyen." See CAAL, 4 and 5.

Figure 2-7 Glossary entry of *caan* containing semi-phonetic transcriptions of GOAT and FACE words (*hyem*: home, *agyen*: again). From Heslop (1892, p. 119).

GOAT words ending with the digraph <ow> as in *snow* or *blow*, are also pronounced with a long /a/ and may have sounded like today's enregistered *ye knaa* (for *you know*) in TE. Other GOAT words like *stone*, *both*, *loth, bone, whole* and *home* (Figure 2-7) or *oats*[41] along with

[41] The adverb *mostly* is also reported by Heslop to contain a centring diphthong and is transcribed as *myestly* (Heslop 1892, p. xxi).

certain GOOSE words like *moon, soon, pool or fool* are pronounced with the (approximate) respective centring diphthongs [ɪe] and [ɪu]. Only the word *home* pronounced with a centring diphthong can be found in modern Danish and Norwegian today. The TE pronunciation of *home* may have been a result of this influence which took place in the 11th century (Townend, 2002, 2014). Heslop contends that the Danish invasions and settlements on south the Tyne along with the latter's use of the Tyne as "winter quarters and as a port to refit" may have "affect[ed] the manner of speech in each district and give permanence to the characteristic dialect of each locality" (Heslop, 1892, pp. viii-ix). In brief, Heslop noticed a tendency on the part of TE speakers to avoid closing diphthongs and to favour monophthongs or centering diphthongs instead for GOAT, such assertions converge with more recent work on TE (e.g. Watt 1998). The next section discusses variation in MOUTH and PRICE as described in Heslop (1892).

2.2.2.2 MOUTH and PRICE: splits in length

Monophthongs are also often found in MOUTH and PRICE vowels. The author comments on the presence of a length difference between words like *find* pronounced as [ɪ] and words containing the grapheme <ight>, which have longer realisations as in *sight, night* and *light*:

> The short I, as in words like f*i*l or s*i*n, is heard in *rich* (to reach) and *fin* or *find* (to find). EE, the sound in f*ee*l, is heard in *breest* (breast), and in all parts, excepting in North Northumberland, in the words *seet* (sight), *leet* (light), *neet* (night). (Heslop, 1892, pp. xviii, xix).

Other examples of word final PRICE vowel are also reported to have longer realisations as in eye (Heslop 1892, p. 73) which may suggest some form of vowel length rule, similar to the SVLR prior to a diphthongisation of the vowel as reported in the *SED* (Kolb, 1966; Prichard, 2015, p. 61).

A split involving a difference in length is also observed in MOUTH vowels: a short [u] is generally heard in words containing the grapheme <ound> as in *ground*, *found* and *bound*, while a longer [uː] is used in words with the graphemes <ou>~<ow> followed by a plosive. The examples provided by Heslop are *crowd, spout, trout, doubt, proud, out* (Heslop 1892, pp. xix-xxi). Further examples were found in the *coo* entry (meaning *cow*) of Heslop reproduced in Figure 2-8. They reveal that a more diverse phonological environment can also trigger longer realisations of MOUTH words such as word final position, preceding a fricative of the nasal /n/.

COO, a cow. "An akward thing for the *coo*." The pronunciation of the dipthong, now sounded in modern colloquial English as the *ou* in *now*, is in Northumberland a marked peculiarity. *Cooncil*, council, counsel; *coont*, to count; *coonter*, a counter; *coontless*, countless. In Anglo-Saxon *hú*, *thú*, *nú*, *cú*, *brú*, *súr*, are the forms of how, thou, now, cow, brow, sour, all of them

sounded in modern English as *ou*. In Northumberland the words are spoken as *hoo*, *thoo*, *noo*, *coo*, *broo*, *soor* (long *oo* sound as in pool). *Sooth*, *mooth*, *hoose*, *doon*, *broon*, *thoosand*, for south, mouth, house, down, brown, thousand, are further examples of the same *ú* sound.

Figure 2-8 MOUTH vowel in 19th century Northumbrian. Glossary entry for *coo*. (Heslop 1892, pp. 180-182).

Heslop, albeit not as precisely as Crowley (Crowley, 1986), traces the pronunciation of TE back to the Anglo-Saxon period, during which those words also had a long /u/. What emerges from these examples is that shorter realisations of /u/ may have represented a smaller sub-set of the MOUTH vowel while a longer one appears as the most common realisation in this set.

2.2.2.3 The FACE vowel

Very little is found in Heslop (1892) on the FACE vowel. Words pertaining to this set are sometimes semi-phonemically transcribed as <ee> as in *greet* (for great) or simply <i> in the expression *coo-git* (for cow gate) or *brick* (for break). They may also contain an opening diphthong in words like again (*agyen*) as displayed in Figure 2-9.

BRICK, to break.

"Ye'll *brick* yor neck, mind.
Yor high-flown cheps oft fyel an' *brick*."
T. Wilson, *Pitman's Pay*, 1827, pt. ii., v. 95.

DAR, to dare to, to challenge. "Come near me, if ye *dar*." "Aa'll *dar* ye de that agyen." "Aa *dar'd* him ti the door," or "Aa *dar'd* him oot to fight." "Aa *dar* say" is equivalent to "I dare say," or "I suppose." See DOR.

Figure 2-9 Glossary entry of *brick* and *dar* containing semi-phonetic transcriptions of FACE words (Heslop 1892, p. 99 & 219).

The multiplicity of variants in the FACE set suggests a different linguistic history from the Southern Standard British English we know today. It may also be possible that Heslop had not found the FACE vowel of traditional speakers different enough from his own TE-lect except in certain words (I would venture to say that he probably used more monophthongs), which made the vowel go barely unnoticed in the glossary and section on Northumberland speech if traditional speakers also used the monophthongs. One could also venture to say that the phenomenon of FACE-breaking found in Ulster Scots may have been brought by migrants who represented an important part of workmen in the late nineteenth century, early twentieth century (Burnett, 2007), was not considered as a traditional feature of Northumberland and is the result of dialect contact. However, more investigations should be pursued to confirm these hypotheses. The last section concerns Heslop's introductory remarks on the Nothumbrian burr.

2.2.2.4 Northumbrian Burr

An entire section of the book is dedicated to the Northumbrian burr. The burr has long been the object of *enregisterment* on the part of Northerners and an epic poem was even dedicated to the origin of this Northern phenomenon. The Author Richard Dawes satirizes the Masters in rhetoric who claimed to be eradicators of poor taste in speech: "For in their Throat a Burr is Plac'd (…) A Gutt'ral Noise, like Crow and Jays: (…) A rattling Ear-tormenting Yell, / Much us'd 'mong low-lived Fiends in Hell" (Dawes, 1767, p. 12). Contemporary pundits on the history of English claimed that the epicentre of the burr came from France and then spread throughout Europe until reaching Denmark and Norway. Yet popular traditions prevailed over the point of origin of the burr. Legend has it that the feature "began as a personal defect of the celebrated Hotspur [and] was imitated by his companions, and by the Earldom as a whole" – the man also hints in Shakespeare's *King Henry IV* that his speaking was "thick, which nature made his blemish" but it "became the accents of the valiant" (second part, act ii., sc. 3, cited in Heslop, 1992, pp. xxiv-xxv).

Heslop sees it as a "compromise between the smooth English sound and the Scottish trilled *r*" and adds that it "is alleged that the Northumberland people elide the *r* in their speech on account of their inability to pronounce it" (xxii). While the English <r> is a "glide of the palate" and the Scottish a sharp trill "on the point of the tongue", the Northumbrian "*bor*" is "sounded from the tonsils" (xxi). Heslop claims that similar uvular <r>s are found in "many parts of the Continent" and especially in Paris. But instead of looking for pronunciations outside Britain, one could simply peruse the literature on Scandinavian influence after the settlement of tribes in the North-East before the 10th century: <r>s in Danish are said to be generally uvular (Rischel, 2012, p. 810). Heslop mentions the linguistic impact that Danes had on the region: "the evidence of place names affords important confirmation of the extent and nature of the Danish settlements" which took place at the end of the 8th and throughout the 9th centuries (Heslop, 1892, p. ix). Although most place names comprising Danish endings like -*by* are generally situated south of the river Tyne, around Yorkshire, one cannot exclude the fact that dialect contacts had taken place and that certain features like a uvular [ʁ] may have been adopted. The Northumbrian burr is therefore less an "inability" to pronounce a "glide of the palate" than a dialect specificity triggered by languages in contact like Danish or certain varieties of Norman, or Dutch, which also exhibit uvular reflexes of /r/ (van Bezooijen, 2005). This is corroborated by more recent studies on the Scandinavian influence on Northern English during the Viking-Age (Townend, 2002, 2014).

This section was a literature review of early works on TE dialectology. Once the Dialect Society had achieved its purpose to document dialects, the British Isles had to wait about half a century before another large-scale project was initiated, whose fieldwork areas rural places around Newcastle. The next section describes the legacy of the *Survey of English*

Dialects whose focus on non-mobile rural old men triggered interests away from the latter and towards urban dialects like Tyneside English.

2.3 Orton & Dieth: the revival of English dialectology

> *La Grande-Bretagne ne pouvait plus rester en dehors du grand mouvement scientifique pour l'étude des patois sur place, par des personnes bien préparées, et ne pas réaliser son Atlas linguistique*[42] *(Pop 1950, p. 912)*

The dismantling of the Dialect Society led to a slow down on dialect research. Detailed dialect atlases were being created on other European dialects, while Britain's research in that field had come to a near halt with no future projects on the agenda.[43] In 1923, Joseph Wright, aware of the flaws and defects of the previous publications by the Society, called for "a comprehensive atlas of the modern dialects such as has been produced by France and Germany of their dialects". He adds that "an atlas of this kind would enable English scholars to fix the dialect boundaries far more accurately than is possible at present", and "to conclusively" prove "that there was no such thing as a uniform northern, north Midland, east Midland (…) in the M[iddle] E[nglish] period, but that within each principal division there were many sub-dialects each possessing clearly defined phonological peculiarities" (J. Wright

[42] "Great-Britain could but join the great scientific movement to study one's own dialects by well-trained fieldworkers and prepare its own linguistic atlas" [translation mine].

[43] Viereck "talks about a rather long, but in some ways understandable neglect of scientific dialect research"(Viereck, 1964).

& Wright, 1923, p. 3). These comments did not go unnoticed since Eugen Dieth, professor of English at the University of Zurich, quoted Ellis's words to promote a new national survey on dialects (Dieth, 1947, pp. 74-104) based on other European fieldwork techniques and using newly available portable voice recording devices. He shows what an atlas of English dialects could look like by presenting various maps on which regional linguistic specificities were represented.

Other scholars shared similar thoughts. The concluding remarks in Firth's 1946 article also allude to the need for a future revival of British dialectology: "the Society has great responsibilities to the English School and its traditions in planning a resumption of dialect studies in this county" (1946, p. 132). Harold Orton, himself, gave a lecture at Sheffield University and "spoke of the urgent need for an English dialect atlas" (Society, 2019). The need had been expressed both in verbal and written forms by respected scholars in the British academic world: the linguistic atlas was bound to begin at any time.

Despite their credibility, it was felt among scholars that Ellis and Wright's work had served their time and led to a few disappointments: a better survey accompanied by a linguistic atlas should be made. In 1953, McDavid, reviewing the SED questionnaire outlines some of the limitations in Ellis's and Wright's studies:

> A multiplicity of investigators, many with less training than enthusiasm; uneven coverage of the country; recording whatever seemed to the observer to be "dialect" in his locality, without reference to the over-all distribution of the same item of flora, fauna, human activity, or material culture. Consequently the record is spotty, both in lexicon and in grammar. (1953, p. 563)

Regarding methodology, Orton and Dieth clearly tried to give a more thorough and "scientific" representation of dialects in Britain, with precise questionnaires applied all over

Britain, and a multiplicity of informants – “the loyal guardians of natural language” (Pop, 1950, p. x), and with the help of the Yorkshire Dialect Society, founded by Wright himself in 1887. On a technological point of view, although national archives in Switzerland and Austria had already acquired a tradition of recording dialects before World War II (Pop, 1950, p. 275), the use of gramophones in the *Survey of English Dialects* was a turning point in the English School of dialectology. Field workers had hitherto only used their own phonetic transcriptions to account for the phonetics of a variety of English (Lloyd, 2007; O'Connor, 1947). The next section agues in favour of a Northern school of dialectology. Over the centuries, the North (including Scotland) has proved to be a pioneer in dialectology and sociolinguistics. This created a favourable environment for the advent of the *Tyneside Linguistic Survey* at Newcastle University.

2.4 Northern Dialectology: a national engine in the study of dialect

While the academic centres in South Britain more often focused on practical applications to phonetics and the establishment of standards of language via Received Pronunciation dictionaries,[44] it was in the North of England, driven by two eminent linguists such as Alexander Ellis (19th century) and then Harold Orton (second half of the 20th century), with the help of Thomas Hallam, that national-scale projects on dialects in Great-Britain were

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[44] Today Daniel Jones’ work is usually known to the wider public thanks to his pronouncing dictionary of standard English entitled *English Pronouncing Dictionary* and whose first edition dates back to 1917. Its 18th edition from 2011 is still commercialised today. The preface to this last edition clearly highlights that its targeting audience is both “native speakers of English wanting an authoritative guide to pronunciation”, and also “users of English as a foreign or second language all over the world”.

devised. Major dialectologists like Joseph Wright (1898-1905) or Thomas Hallam (1885), published influential works on the northern regions and greatly contributed to the publication dynamics of the English Dialect Society, while in the South, worked on dialectology were scarcer and were published more latterly. Wright, whose legacy in British dialectology is far from negligible was born in Yorkshire, first studied at Leeds University, founded an important engine of research on dialectology, the Yorkshire Dialect Society, and some of his personal contributions were about the Yorkshire dialect (J. Wright, 1892). Although a specialist in Germanic languages, his being born in Northern England is probably what led him to write *A Grammar of the Windmill Dialect* for the Dialect Society in 1892 (fig. 1.1). His study aimed at describing the dialect of West Riding of Yorkshire with "Illustrated by a Series of Dialect Specimens, Phonetically Rendered" and which corresponds to the place where he was born. Mrs. Wright recalls that "he was always glad to return for a time to his own people in the North, to ramble over the moors and talk the racy dialect that he never lost" (E. M. Wright, 1932a, p. 189; 1932b).

Wright also took interest in Northern dialects and published his well-known *Grammar of the Dialect of Windhill, in the West Riding of Yorkshire* (1892). Firth's praise on Wright's contribution to the English School of Phonetics points out that the latter's "work on the Windhill dialect is a model dialect grammar that has never been surpassed anywhere" (Firth 1946, p. 132). The researcher's use of gramophone recordings to build up a grammar based upon "living philology", or contemporary speech based on oral data as opposed to traditional philology based on the study of ancient texts, reflects the urge to resort to state-of-the-art approaches to dialectology. Firth claimed that Wright "would have deprecated any approach to dialect study that could not be described as 'living philology.' The Society has great responsibilities to the English School and its traditions in planning a resumption of dialect studies in this country" (1946, p. 132). The use of gramophones announced a new methodological era in dialectology. The movement was probably led by Wright through the Yorkshire Dialect Society (Smith, 1936, p. 81) and other methods of recordings were investigated to reduce costs.[45]

In the 1940s, northern universities like Leeds and Manchester were training future dialectologist to a much greater extent than universities in the South. Viereck's detailed list of M.A. dissertations sorted by date shows that Leeds was taking the *lead* on research in dialectology, which is not surprising given the fact that the *SED* was being set up in Leeds during the 1940s-1950s (Viereck, 1964, p. 355). For instance, in 1949, out of the seven studies that Viereck lists, 6 M.A. dissertations were directed in Leeds on northern varieties of English, with the exception of a published study on Dorset English (Viereck, 1964, p. 344). Until the 1960s, the vast majority of the dissertations in the field were still being directed in Leeds, with a few studies emerging in Ireland, Wales and Scotland in the 1950s (Viereck, 1964, pp. 344-347). Viereck's list may be incomplete but it provides a fairly accurate picture of the research momentum in the North of England and in the Celtic nations compared to other part of the Isles. This provided an ideal emulation for the TLS to come to life.

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[45] The use of gramophones and recordings were rather pricey, and its use was considered superfluous, albeit not altogether discouraged, by members of the Philological Society: "one is sometimes tempted to believe that the real purpose of these records is their entertainment value . . . [But] the Dialect Society will naturally still proceed along these lines". (Smith, 1936, p. 81)

If the use of instruments in phonetic studies really started in the 1920s – and much later for the London School of linguistics – Northern-British dialectology has kept being a pioneer with regards to their publications and methodological approaches. Namely, building national scale projects like the *Survey of English Dialects*, using recording machines, training fieldworkers (Macaulay & Trevelyan, 1973; Orton & Dieth, 1952; Strang, 1968), and also, anticipating the use of computers to analyse linguistic data (John Pellowe, 1967).

More recently, it was the North (along with Scotland), which was pioneer in organising the "successful series of workshops on Northern Englishes" (Hickey, 2015, p. 1) ever since 2006. It brings together international researchers focusing on Northern English and contributes to emulate research on the matter and fosters the development of a holistic view on northern varieties. The work *Researching Northern English* pays a tribute to these workshops and acknowledges their role in the compilation of this work (Hickey, 2015, p. 1). By contrast, the first Southern Englishes Workshop was organised eight years later. On their website, they mention that the success of the Northern Englishes Workshop is what led researchers on Southern varieties of English to organise their own workshop (cf. screenshot of the website of the first Southern English Workshop in APPENDIX III).

The extreme dynamism of the North regarding dialectology made the field evolve more quickly by looking for other methods of investigations and new fieldworks. Rural areas having been perused extensively, there remained the more complex and socially mixed urban centres. This type of research came to be known as *sociolinguistics* (Bright, 1960) or *urban dialectology* (see Putnam & O'Hern 1955 for early reflections on this field in North America) . In Britain, Viereck (1966), Siverstein (1960) and Gregg (1958) were leading the way with their respective studies on Tyneside English, Cockney and Scotch-Irish and contributed to this shift towards urban dialectology. The *Tyneside Linguistic Survey* (Strang, 1968) was a direct corollary of this evolution in the discipline. The next section sheds more light on urban dialectology in Tyneside (earlier works and the TLS), with regards to their theoretical and methodological frameworks. There follows an account of earlier studies on the TLS itself.

2.5 Post SED British dialectology: from rural to urban dialects Viereck's and Barbara Strang's studies on Tyneside English

After a certain number of contributions of North American works on variationist sociolinguistics, also known as *urban dialectology*, linguists in Britain incorporated some of the methodology in their study but also tried to have an approach of their own: "while Labov's work still exerts tremendous influence, research on English in the British Isles inevitably began to develop its own character, shaped by its architects, and by the influence of neighbouring academic disciplines and traditions" (G. J Docherty & Foulkes, 1999, p. 2). In the 1970s, Britain was starting to shift its interest away from rural dialectology to focus on urban dialects and sociolinguistic variation.

Methodological rigour and empiricism was a motto since many earlier studies had used but a handful of informants – often, old men only – to characterise an entire dialect (e.g. Viereck, 1965). They endeavoured to increase their sample of speakers, include more age groups and both genders. Recording informants was also a big step forward. In this sub-section, only works that are related to the study of Tyneside English will be covered. Dialectology was shifting its interest towards urban centres and socially marked language.

2.5.1 Viereck*'s* approach on Tyneside English (1966 & 1968): from NORMs to NOUMs[46]

Viereck's study aimed at being more systematic and objective, which is a goal he reached in many aspects. It is to be inserted in a new research context, for Orton's *Survey of English Dialects*[47] had just been completed and new tools and protocols had been field tested. This was bound to have a knock-on effect on future studies as Viereck applied some of the protocols to the more geographically restricted area of Tyneside as Orton's introduction to English dialects and his volume on the Northern dialects had been published before 1966 (Orton, 1962; Orton & Halliday, 1962).

During an extended stay in the Gateshead area from 1959 onwards, he carefully selected his adult male informants from 55 to 82 years old and ensured that all had a similar social and educational background so that they would be less likely to exhibit what we now call *dialect levelling* and thus produce more "stereotypical local forms" (Watt, 1998, p. 185). That would enable him to reconstruct the "purest possible dialect" as he termed it. What one notices is a mere shift from the recording of non-mobile older *rural* men found in the SED (aka. NORMS) to that of non-mobile older urban men, which I would venture calling NOUMs.[48]

To justify the exclusive use of male informants in his study, he quotes Orton: "in this country men speak vernacular more frequently, more consistently, and more genuinely than

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[46] NORM, a term coined by (Chambers & Trudgill, 1980, p. 30) refers to speakers refer to non-mobile older rural men, whose speech was deemed to reflect the stereotypical features of a regional rural dialect. I chose the term NOUM to point at similar non mobile older speakers *but* living in urban areas, hence the letter *U*.

[47] For a detailed timeline of the SED visit: http://www.sed-mapper.ch/index.php?do=timeline

[48] A tense vowel [u:] seems particularly suited for this acronym.

women" (1962, p. 15). Gender differences in language have now been widely studied (Gal, 1978; Gordon, 1997; Labov, 2001). More particularly, several studies on TE (J. Milroy, Milroy, Hartley, & Walshaw, 1994; Watt, 1998) also showed that there was a major gender gap with men using more traditional features than women in both their vowels and consonants.

Most of his informants came from working-men hostels in the Gateshead area. They all belong to the working class but had various types of occupation which ranged from manual worker, clockmaker, miner, paver to metal founder and train driver. There was even a former baker who then worked in a glass factory. This time, we know that he recorded his informants using various protocols. The recordings included either pairs of informants using spontaneous speech or interviews between a TE speaker and a fieldworker who provided topics of conversation for both situations. The latter adapted *A Questionnaire for a Linguistic Atlas of England* (Orton & Dieth, 1952) and the *Linguistic Survey of Scotland*, carried out in the latter half of the 1950s under the supervision of Catford,[49] senior lecturer and director of the School of Applied Linguistics at the University of Edinburgh (Watt, 1998, p. 186).

His analysis is more descriptive than quantitative and falls under three types of TE, namely, “broad” TE, “Modified Standard English” and a “mixed” form, in-between the two (Viereck, 1966, p. 51). Like O’Connor (1947), Viereck gives an account of TE variants and then presents a series of texts – three in total – which narrate humorous anecdotes of misunderstandings between Geordies and other dialect speakers. The aim remained nonetheless to ensure representativeness of “continuous free speech” (1966, p. 94). In earlier

[49] For more information about his life and work visit: http://deepblue.lib.umich.edu/handle/2027.42/89901

works, he qualifies his comments much less and claims that "the . . . passages - chosen out of the speech of many informants - represent **genuine dialect** [emphasis mine] as recorded by myself . . . As it is continuous speech, typical forms and repetitions have been preserved" (Viereck, 1965, p. 6). That these texts mirror spontaneous speech is probably slightly biased or, at least does not correspond to our current definition of the term. Watt indicates that the smoothness of the informants' recordings, viz. devoid of any "false starts" could be the sign of speakers that are "accustomed to story- or joke-telling" (Watt, 1998, p. 186). Moreover, the content of the text is far from "naturalistic" and may yield biased results. Yet, the latter are somewhat more detailed than O'Connor's with regards to TE and will be presented below.

Viereck accounts for a richer degree of variation in the GOAT set. If the default variant is a centralized [ɵ] (closed [klɵ:zd], opens [ɵpənz]), some examples of a back vowel [o:] do appear and fall into the "mixed" category according to him – *stone* and *home* for instance are transcribed [sto:n] and [ho:m]. Indeed, traces of older Northumbrian indicate that the GOAT vowel was realised with the opening diphthong [iɛ] as in "stane", standing for "stone". Eventually, another variant of the GOAT set is assimilated with the BATH set, a somewhat idiosyncratic phenomenon in TE. [o] sounds followed by a final <l(+C)> are fronted and open ([a] or [ɑ]) thus leading to comical confusions in Viereck's text as the non TE speaker hears the name of a ship "Ana" [a:na:] instead of the subject and verb "I know" [a:nɑ:]. Although Watt remarked that this phonetic exponent "by no means appear[ed] to be as categorical in modern TE as Viereck would have us believe" (1998, p. 192), the 1970s TLS files abound with such instances. It is probable that what he meant by "modern TE" was the 1990s PVC files only since his 1998 pilot study was strictly focused on this oral sub-corpus of DECTE.

Viereck (1968) overtly claims that he used the SED methodology in his attempt to "[seek] for the oldest features still extant" and adds that "the speech patterns of the lowest social classes are here taken as representative of the whole urban community" (Viereck, 1968, p. 66). His choice of male informants was based on the fact that at the time of his study they represented the majority of the masculine population living in Gateshead. He suggests, though, that "had the composition of the population been different and had it been the aim to investigate the speech patterns of the whole community […] it would have also been necessary to follow a different procedure." (Viereck, 1968, p. 66). Regarding the choice of informants, Barbara Strang, reviewing Christer Påhlsson's study on the Northumbrian burr in the *Journal of Linguistics*, complains that "Viereck's results are incorrectly taken as representing Tyneside generally" (Strang 1975, p. 140). This implies that Viereck's work, due to his choice of informants (one gender, one age group, one area) only partially reflects the way English is spoken in Tyneside and justifies the need for a more thorough study on this variety of English. Therefore, the TLS, and later on, the PVC aimed at providing a more representative account of linguistic variation in Tyneside.

2.5.2 Major works presenting results from the TLS phonetic data

The present section focuses only on the previous studies on the TLS phonetic data because they are more directly linked to the results in CHAPTER 7. I explain the main results of each study (Jones-Sargent, 1983; Herman L Moisl & Jones, 2005; Hermann L Moisl & Maguire, 2008) and how certain methodological shortcomings were progressively addressed. I then explain how this thesis is a continuation of the exploration of the TLS data as it suggests solutions to issues that have prevented certain variation patterns from standing out clearly.

2.5.2.1 Jones-Sargent's classification of TLS speakers based on McNeany's transcriptions (late 1970s early 1980s)

The first work published on the TLS was that of Jones-Sargent (Jones-Sargent, 1983) which comes from her PhD thesis, supervised by John Pellowe (V. Jones, 1978). Her results on the TLS were more often presented to researchers in quantitative linguistics in Europe than to sociolinguists in Britain (1977).[50] Her papers are also hard to find, which is probably why they often went unnoticed in many anthological works on sociolinguistics in Britain, despite the TLS being often briefly cited (Kerswill, 2018; Stuart-Smith & Haddican, 2009). Jones-Sargent did not only publish results on the segmental phonetic features of TE, she also analysed intonational and segmental patterns drawn from the TLS (V. Jones, 1985; John Pellowe & Jones, 1978). But the present thesis, only deals with the segmental aspect of her work.

Jones-Sargent (1983) may have been limited by the slow performances of computers and by the number of variables – linguistic features – that could be included in a single model, but she provided robust results based on the TLS transcriptions for 52 Gateshead & Newcastle informants. She tested various clustering approaches to test the stability of her

[50] It took me a long time to understand her computational and statistical approach since I had a more literary background when I started this thesis. The results appeared drowned in tables and dendrograms. As I talked to other researchers in the field, I realized I was not the only one. But as I read and re-read her book, it made more and more sense, and I was amazed at the degree of detail she had reached in her analysis of the results.

results before opting for the most common technique called Ward. She demonstrated a number of important patterns in the TLS:

- three main groups of speakers emerged from the results: traditional, less traditional and non-localised speakers.

- there was a systematic and social and linguistic gap between the Newcastle (n=7) and Gateshead (n=45) sample.

- education is an important indexicality marker, with non-educated speakers (except for a few people who went to night school or day release) opting for more traditional features.

- the cluster with more traditional linguistic features included speakers whose parents were born in the North. The less traditional one, comprised informants with non-northern parents. The non-localised group contained a group of speakers born in Tyneside or elsewhere in the UK, e.g. south-east London.

- the difference between Gateshead men and women was more striking for diphthongs and reduced vowels than for monophthongs.

- initial /g/, /r/ and the bound morpheme -*ing* were considered as main determinants of speech among the consonants in the model with consonants only.

Jones-Sargent was nonetheless aware that such results could be different, if the structure of the coding was altered. In her concluding remarks, she suggests doing another classification of speakers based on the less fine-grained transcriptions called the PDV as “an extension to the present research” (Jones-Sargent, 1983, p. 246) so as to have “clearer diagnostics” and more obvious “correlation with social group membership” (Jones-Sargent, 1983, p. 292).

I believe that there were actually three main problems that led to slightly confusing results in Jones-Sargent’s work. (1) the number of social variables introduced in the model blurred the overall picture and created issues of multicollinearity with one social variable being strongly linked with other social variables. This may over complexify a model and consequently, the interpretation of its results. (2) Not all variables could be included into the model. This prevented the model to find the main determinants of TE speech based on its entire phonetic system. However, the results remain coherent with previous and subsequent findings. (3) The hierarchical structure of the states could not be taken into account by the then statistical tools. This may have resulted in giving more prominence to certain variants and less to others. Moisl took over the task to analyse the TLS coding and tried to address some of the shortcomings mentioned above.

2.5.2.2 Herman Moisl (2000s): first attempts at reviving the TLS data

Jones-Sargent suggested using the less fine-grained coding called PDV to check whether the main determinants of TE speech differ from the states coding and whether the speakers cluster differently. Herman Moisl took over and collaborated with Jones-Sargent (Herman L Moisl & Jones, 2005) and suggested various ways to reduce noise in the data so as to grasp only the gist of the variation patterns. Another aim was to test the reliability of the clustering results in Jones-Sargent (1983) so as not to get results that may only be based on “forced spurious cluster formations” (Herman L Moisl & Jones, 2005, p. 128):

> The problem was for TLS, and remains for us, that different combinations of distance measure and clustering algorithm in general yield different analyses of the same data set, and that there is no obvious way of selecting the 'best' analysis. How reliable a tool, therefore, is hierarchical cluster analysis for sociolinguistic research? (Herman L Moisl & Jones, 2005, p. 135)

A first attempt to address this methodological issue was to use self-organizing maps (SOM) because they reduce dimensionality, i.e. they get rid of less meaningful variation, and they do not use hierarchical classification. Similar results with SOMs and the hierarchical clusters would potentially mean that Jones-Sargent's classification results are robust enough. Concave areas indicate where the speakers are clustered while the higher the convex shapes are the higher the difference between the speakers is.

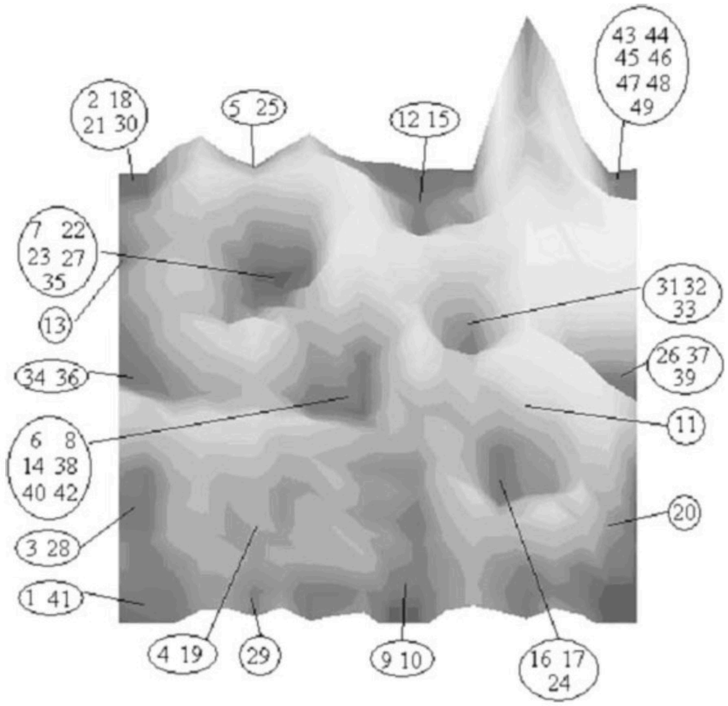

Figure 2-10 3D representation of a self-organizing map based on the TLS PDV coding. Numbers represent TLS speakers. The deeper the whole, the more speakers there are.

The results of the SOM supported one clustering method in particular (complete-linkage, figure 2-10), with the Newcastle group being further apart from the Gateshead speakers (top left group of speakers whose index ranges from 43 to 49). The diagnostics as to what determined those groups in the SOM is not provided. This suggests nonetheless that Jones-Sargent's results are relatively stable despite conclusions in the article that SOM do not seem ideally suitable for assessing the robustness of a clustering analysis based on sociolinguistic data because results from SOMs on the TLS were rather sensitive to the settings used when building the model (Herman L Moisl & Jones, 2005, p. 128 & 145). The present thesis suggests various ways to address the assessment of the robustness of a clustering analysis and provides other reduction of dimensionality approaches that will take into account the hierarchical structure of the TLS coding.

Another important study by Moisl and Maguire (Hermann L Moisl & Maguire, 2008) analysed the PDVs (n = 156, speakers = 63) so as to find out the main determinants of TE speech. One issue with using the PDVs is that the consonants are less well accounted for. Namely, if one has the PDV codes 0214, 2016 or 2018 for the overall unit of /p/, this will mean that the speaker produced an initial, medial or final /p/ but one does not know how the /p/ was actually pronounced. For this, you would need the states. This structural issue does not affect the vowels so much, since the PDV for vowels inform us on the realisation and not the position in a word. But it may be problematic for the GOAT vowel in particular. Watt (1998) identified the centring diphthong in GOAT as a major determinant of speech in TE. Yet, if one used the PDVs, the centring diphthongs will not be taken into account. Only two states correspond to it and are placed with monophthongs under the PDV [uː] or 0120. Schwas are broken down into various overall units and possibilities are less numerous than PDVs for the FACE vowel for instance. This may result in an amplification of the prominence of schwas.[51] The results for stressed vowels were nonetheless coherent:

- the Newcastle group produced more reduced schwas and a pan-northern GOAT vowel.

- a more traditional group of Gateshead speaker uses the vowel variant [ɑː] for GOAT and a raised onset [eɪ] in PRICE. It is exclusively composed of working-class men.

- the second group of Gateshead speakers tended to avoid these variants and is mainly composed of women. A sub-group comprised the working-class speakers and another with both genders of a higher socio-economic status.

If one focuses only on the results for stressed vowels using PDVs, we notice that the results by Moisl & Maguire (2008) are very much in line with those in CHAPTER 7 using states. In the latter, the consonants stand out better because the analysis in this chapter are carried out at a state level. Moreover, the importance of schwa is less overestimated with the use of Multiple Factor Analysis, a reduction of dimensionality technique that balances out the weight between each overall phonetic feature.

So far, I have discussed important studies that helped interpret results from the complex TLS coding. The next section discusses in more detail the origins of the *Tyneside Linguistic Survey* (Strang, 1968), the creation of the PVC in 1994 until their compilation as online corpora published under the name DECTE.

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[51] A separate study using only the reduced vowels with another structural organisation may provide a very interesting sociolinguistic analysis as first carried out by McNeany (McNeany, 1971).

CHAPTER 3 From the TLS to the DECTE corpus: moving from a state-of-the-art survey in the 1970s to a state-of-the-art corpus in the 21st century

Summary of CHAPTER 3

This chapter outlines the theoretical and methodological context in which the present study is situated. This includes information on the context that shaped the creation of the data under scrutiny in this thesis. Namely, the first sociolinguistic project on Newcastle English also known as the *Tyneside Linguistic Survey* (henceforth TLS) and the 1990s project called *Phonological Variation and Change in Contemporary Spoken British English* project (award no. R000234892; henceforth PVC). Eventually, I show how the latter and subsequent studies of this variety of English came to form an online corpus called the *Diachronic Electronic Corpus of Tyneside English* (DECTE).

The main focus of this chapter is on the *Tyneside Linguistic Survey*, for the details pertaining to this survey are less often described than those of the PVC. Thanks to the help of Adam Mearns and Karen Corrigan, I had access to archive materials like TLS reports, applications for grants etc. They proved to be useful primary sources in grasping the theoretical framework of the projects, understanding how the methodology evolved after the very first sample of speakers was recorded, and in measuring the amount of work done over the years.

The TLS started in the year 1965. A first statement plan was presented at an international congress on dialectology and then published in the proceedings (Strang, 1968). The same year, a sample of 60 informants were interviewed to check the “feasibility” of the project (Strang, 1970, p. 2). It took around 3 years to design the survey including the sampling of 150 speakers, to code the linguistic features under scrutiny and to design the statistical programme to classify the speakers on the basis of both their speech and social similarities.

3.1 A nice start: contemporary popularity of the TLS and its dissemination strategies

A 1971 interim report on the TLS, Barbara Strang (SSRC 02 Strang 1971, p. 1) indicates that TLS received and SSRC grant in October 1970, which added credibility to their work and helped them develop the project further. It provided them with money for a Research Associate and to buy more recoding tapes (£3,465). Strang remarks that the TLS was receiving considerable interest with a "steady flow of visitors from almost all parts of the worlds" and "almost daily postal inquiries from those generally interested in its work or more specifically hoping to develop compatible investigations" (SSRC 02 Strang 1971, p. 2). Moreover, the editor of the newly-founded *Journal of Sociolinguistics* had approached them for contributors (SSRC 02 Strang 1971, p.3). The TLS project team was reactive with regard to dissemination and replies to these requests since "over 100 sets of research papers" were sent out in response to those enquiries. Project leader B. Strand boasts that a number of scholarly publications were already citing the project as among "the three most important of its kind in the world" (SSRC 02 Strang 1971, p. 2) and that several papers presenting the projects were underway. At the end of the report, Strang calls for more money on the part of the SSRC for the years 1974-5. She could therefore but hone in on the most positive aspects of the TLS projects but this gives us an idea of the popularity of the project at the time before it fell into oblivion for a few decades. Over the next sections, I will endeavour to explain why the project received so much interest and why it was considered a pioneer in many aspects at the time of its development.

3.2 General aims of the TLS: building a new theoretical framework for urban dialectology

The recordings from the 1960s-1970s that are analysed in the present thesis were gathered and archived as part of the *Tyneside Linguistic Survey* by Joan Beal, Anthea Fraser Gupta, Val Jones, John Local, Vince McNeaney, Graham Nixon, John Pellowe and Barbara Strang. The interviews are restricted to Gateshead (also known as the TLSG files) and Newcastle (the TLSN files). The TLS aimed at synchronically and diachronically identifying variation of speech within the Newcastle and Gateshead areas and examining how variation differs across the social scale. It also had the project of extending the study to a higher number of districts within these urban areas and to extend it to neighbouring areas. This model could then be used for the study of other speech varieties. These aims are described in Jones-Sargent under four main points:

> 1. to identify, and exhaustively characterise, the varieties of speech which co-occur in the area under consideration, (initially the Tyneside conurbation),
>
> 2. to determine the distribution of both the speech varieties and their constituent elements across the relevant social sub-groups (which must also be empirically discovered by the model),
>
> 3. to extend the model to cope with a wider geographical compass,
>
> a. by successive inclusion of more conurbation,
>
> b. by including neighbouring conurbations,

c. by eventually adapting the model to account for other urban varieties of English,

4. to extend the investigation onto a diachronic basis, so that changes through time in these distributions (see 2.), may be measured (Jones-Sargent, 1983, pp. 25-26).

Pellowe and colleagues called this approach the "ecology of varieties of spoken English in urban areas" by which they meant the identification of the "relative commonness or rarity" of each speech variety and their "distribution across social attribute" (John Pellowe, Nixon, Strang, et al., 1972, p. 1). The aim of the TLS was therefore to provide an overall synchronic and diachronic examination of social distribution of speech variants within the Tyneside area and to become a potential survey model for other varieties of English.[52] In addition, they had a clear interest for what is now known as *accommodation* as evidenced in the interview of John Pellow: "the Tyneside Survey . . . is very much more interested in the unconscious adaptation because this is something that has a very important social meaning" (cf. APPENDIX VIII).

Strang (1968) explains the imminent necessity to carry out an urban linguistic survey in the Tyneside area: social stratification which was still very well preserved in Newcastle, was about to be deeply modified by the re-organisation in urban planning in Gateshead, a district on the southern bank of the River Tyne. This was the illustration of counter-urbanisation that started at the end of the 1960s (Britain, 2012; Chaline, 1982): inhabitants in former working-class districts situated close to the heavy industries in decline would soon

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[52] This was the case for the PVC, for which two fieldworks were carried out with the same protocols (Derby and Newcastle).

be replaced by modern buildings,[53] and people were starting to go live in more rural areas and commute to work.[54]

The people in these districts often spoke a variety of English that was deemed highly representative of Geordie English and failing to record them before their relocation would lead to the loss of an invaluable sample of speakers from that dialect. If they were to be relocated elsewhere, it would be extremely complex for linguists to carry out a study on sociolinguistic stratification whose selection of informants was based on the latter's place of residence. However, Strang suggested taking advantage of the opportunity to pick two working-class fieldworks for the survey, viz. the newly relocated working-class from the destroyed slums and the working-class living in a long-lasting undisturbed stratified area. Such a comparison will help provide an estimation of dialect change within a community affected by relocation:

> Since the people affected by the re-housing plans are mainly speakers of localised varieties of English, it becomes necessary to ask whether a recognisable new dialect will be created in the new communities (Strang, 1968, pp. 791-792).

Pellowe did not believe that relocated populations would lose their accent or that they would necessary converge towards a non-local speech. But by examining the survey they

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[53] Such changes completely transfigured Newcastle and are part of the topics of a past exhibition at the Baltic Centre for Contemporary Art in Newcastle called "Idea of North" (May 11th-September 30th 2018). Mixed feelings remain around these projects to make Newcastle the "Brasilia of the North" by clearing all nineteenth-century like slums (as depicted by photographer Nick Hedges) and giving way to Le Corbusier inspired blocks of flats and roads for faster traffic. The projects were full of modernist ideals but were also associated with corruption and scandals, which severely tarnished these visionary aspirations for the city (https://getnorth2018.com/events/idea-of-north/).

[54] Britain suggests that after the SED, research in language variation has focused more on urban areas but the demographic change in rural areas should also be object of detailed research (Britain, 2012).

should be able to predict if people “who are about to be rehoused would tolerate certain forms of rehousing” and if there remained forms of “group loyalty” despite relocation (Pellowe radio interview tape Others_A_side1, cf. APPENDIX VIII for a full transcript).

Besides this fundamental reason, Strang’s motivation for the survey was the representativity of a population. The *Survey of English Dialects* (hence forth SED) led by Orton and Dieth in the 1950s-60s triggered a certain degree of disappointment amongst dialectologists: only a handful of men were chosen and each urban area was carefully avoided by the fieldworkers, while, on the other side of the Atlantic Ocean, research on urban dialectology was already gaining ground with samples that were more representative of the people living in the area under scrutiny (Kretzschmar & Schneider, 1996). The TLS research team decided to select the speakers randomly based on the Electoral Register. Stratification was made according to the rateable value of homes in different polling districts (Pellowe et al., 1972, pp.23-24). This ensured a better representation of speech variation in Gateshead.

Barbara Strang and her research team tried to take these imperfections into account and took what was best in previous studies on dialect. A great innovation was the use of recording machines in the like of the *Survey of English Dialects*. The TLS team also resorted to systematic recordings of the informants, mainly in the years 1971-1972 (A. Mearns et al., 2016, p. 185), taking a sample from various districts of Newcastle and Gateshead comprising distinct social groups. Informants of both genders would be included and their age would vary between 17 and 80 in a similar manner to Shy et al.’s extensive study on Detroit speech (Shuy, Wolfram, & Riley, 1968). The aim was therefore not to map linguistic variation anymore but to study sociolinguistic specificities of a very restricted urban area based on speech archives, whose usage was more sustainable than written questionnaires on local variation. Such undertakings by the TLS were very soon followed by another research team who recorded 130 speakers from Glasgow (Macaulay, 1977; Macaulay & Trevelyan, 1973). This innovative field was called *urban dialectology*.

3.2.1 A landmark for the shift from traditional dialectology to urban dialectology

David Britain remarks that “it must have been particularly exciting to be a sociolinguist in the 1960s.” It was a “new discipline, radically different both from the emerging giant of generative linguistics and from traditional dialectology, but drawing inspiration from both” (Britain, 2010, p. 143). The TLS was among the very first studies to embark on the recent field of urban dialectology. Devising an urban survey like that of the TLS may well have been an exciting adventure, but everything remained to be built and exploring these hitherto untapped grounds was far from easy. In this section, I explain how innovative the TLS framework was for the 1960s-70s.

When the TLS was launched, traditional dialectology had been characterised by a “concentration on geographical variation, with research carried out mainly in rural location” and with the aim to record and preserve non-standard forms (Foulkes & Docherty, 1999, p. 5). But the end of the 1960s saw a change of tack in dialectology towards urban centres. Since the majority of the population in the UK and the US was urban dwellers, linguists and dialectologists increasingly led research on urban areas, as exemplified by the work of Labov (Labov, 1964, 1966b) or Houck (1968)– who presented a methodology applied to the urban dialect of Leeds. In his 1966 article, John T. Wright argued in favour of urban dialectology since focusing on “relic-dialects of the ageing, rural population” would “still leave formidable gaps in our knowledge of the communication network supported by English society at large”. He deplores that the mobility of commuters is rarely taken into account: “the apparent homogeneity of village life may be called in question, since some 20% of the total population of the country live in administratively rural areas, though they may work in towns”. Eventually, he reminds the reader that living in urban areas in far from new and that “three-quarters of the people lived in towns in 1900” and that urban areas should not be ignored by dialectologists anymore (J. T. Wright, 1966, p. 234). Articles on the methodology of urban speech studies such as those by Wright and Houck were often cited in the 1970s including by the TLS team and operate as research manifestos (Pellowe 1972) calling for a change of approach in dialectology. The development of urban dialectology also called *sociolinguistics* was underway.

In an archive document of the TLS at its very premises (Strang & Pellowe, 1969) highlighting its general aims and methods, Strang and Pellowe clearly distance themselves from rural dialectology in favour of sociolinguistics although both fields are interested in documenting variation:

> There are however two quite different branches of linguistic study which take variation as their central object of attention. The first, which we are **not** hereafter **concerned** with, is **dialectology**. . . . Usually such studies rely, for their information, upon a small & diminishing segment of the population – elderly, male, agricultural workers, with a record of continuous local residence since birth. The second branch of linguistics which explicitly studies variation is of much more recent origin and arose from the intersection of linguistic, anthropological and sociological interests. For the sake of brevity it is referred to as ‘**sociolinguistics’**. . . . Very generally the Tyneside Linguistic Survey has a threefold goal which puts it within the subject matter of sociolinguistics. (Strang & Pellowe, 1969, pp. 1-2)

Although the pivotal change from rural to urban dialectology is closely associated with the work of Labov (Foulkes & Docherty, 1999, p. 5), the innovative nature of the TLS project should be referred to in more detail by sociolinguists retracing the early stages of urban speech studies in the UK.[55] The project was presented on the continent by Barbara Strang as early as 1965, i.e. only one year after Labov submitted his PhD on sociolinguistic stratification in New York City (Labov, 1964; Strang, 1968). In addition, unpublished documents explaining the TLS aims specifically claim their theoretical framework to be in line with urban dialectology: "the Tyneside Linguistic Survey is probably unfortunately so-called, in that its methods and implications are intended to have relevance within the whole field of urban dialectology" (TLS_014_[a] archive, undated, p. 1). The TLS was therefore one of the first studies to pave the way for urban dialectology to develop in Britain.

The TLS was also a pioneer work in the sense that it tried not to turn its back to traditional dialectology but endeavoured instead to build a bridge connecting both approaches. Similarly to the SED, the interview between the fieldworker and the informants was recorded on tapes. However, akin to other urban speech studies, more attention was directed towards phonetic and phonology variation (Foulkes & Docherty, 1999, p. 5). A list of words targeting variation in specific vowels and consonants was to be read by the participants. In addition, informants were asked whether they knew and/or used such and

[55] The TLS is often quickly mentioned but its pioneer role is often neglected (e.g. Stuart-Smith & Haddican, 2009). However, the creation of the NECTE and subsequently the DECTE along with the publications around it were crucial in reviving interest in it.

such local words. This task was reminiscent of traditional dialectology whose interest had mainly revolved around lexical variation (Foulkes & Docherty, 1999, p. 4).

Also, similarly to the SED, TLS fieldworkers selected areas where speech would be highly authentic and representative of the local dialect, namely Gateshead, which was and is still famous for having a higher concentration of working-class communities with a strong identification with *Geordiness*. Yet, while the SED included only men because, as Orton puts it, “in this country men speak vernacular more frequently, more consistently, and more genuinely than women" (Orton, 1962, p. 15), the TLS included female and speakers of different age groups and from different social classes, hence the bridge between the traditional rural and the more recent urban dialectology with regards to the selection of fieldworks and participants.

Wright (1966) mentions the need to include various social strata when accounting for the speech of a specific urban area rather than targeting the working-class only. This would indeed amount to merely studying NORMs in disguise. I shall refer to them as *Non mobile Old Urban Men* (NORMs). This is why the TLS intended to record speakers not only from the working class but also from more well-off backgrounds to ensure comparability between social groups (Jones-Sargent, 1983, p. 26; Strang, 1968, p. 790).

3.2.1.1 The TLS: a pioneer in multivariate sociolinguistic data analysis.

Ever since the conception of the TLS project, Pellowe and Strang endeavoured to emancipate themselves from Labovian methodology despite the measurable impact it was beginning to have upon sociolinguistic research and urban dialectology. The TLS team called for the inclusion of more variables and more data from different time stamps: “these aims [latitudinal and longitudinal studies] distinguish our investigation rather sharply from those of other workers on urban speech variation (… Houck 1969, Labov 1966)" (John Pellowe, Nixon, Strang, et al., 1972, p. 1). Although, in his first few articles, Labov claimed to be inspired by quantitative analyses in the social sciences like those in Barber's *Social Stratification* (1957), the Newcastle dialectologists chose to turn toward methodologies prevailing in biology and mathematics. Sokal's work entitled *Numerical Taxonomy* (1966), long remained an influential work amongst researchers of the TLS. The work on the computerized taxonomy of species enumerates a number of mathematical approaches to classify species with the help of digitized databases comprising the characteristics of each individual. According to Sokal, computer should provide more objective classifications of individuals based on many criteria because "the human mind finds it difficult to tabulate and process large numbers of characters [i.e. characteristics] without favouring one aspect or another". He adds that sometimes differences among individuals rather form a continuum which makes classification and reproducible research difficult without computers (1966, p. 3).

His remarks were taken into account by the TLS. A great number of linguistic variables were initially included for the variety space. The analysis would be made by computers to prevent the linguist from favouring certain linguistic features over another or from giving certain features too much or too little importance. Jones-Sargent honed in on some of the flaws that were characteristic of urban sociolinguistics, which were the selection of linguistic features that relied upon subjective choices by the linguists themselves – what Goebl called "cherry picking" (1984). The use of more complex models like multivariate analyses and numerical taxonomies was preferred:

> The initial dramatic findings and claims of sociolinguistic surveys of urban speech now need to undergo critical methodological assessment if the theoretical contribution of the subject is not to be seriously vitiated. . . . Multivariate techniques [however], are appropriate to apply to sociolinguistics data. (1983, pp. 21-22)

She adds that in the TLS model, no explanatory variable was privileged over another so that an unsupervised stratification may appear, the data being supposed to speak by themselves: “no variables are predicted by the model as being key, or defining, characteristics or groups. Rather, the natural groups emerge from the classification process” (1983, p. 24). She adds: “[h]ence the need for a model which exhaustively characterises social and linguistic differentiation” (1983, p. 29). The TLS not only aimed at building computer programmes, as proposed by Sokal (1966), to **classify** Tyneside speakers based on an exhaustive list of characteristics of their speech, akin to morphological differences and similarities within a range of loosely defined species like the imaginary Caminalcules (Figure 3-1). They also wanted to provide **visual representations** of the results of the classification analysis. One possible taxonomic representation which inspired the TLS team was the *phenogram*, or more generally the *dendrogram* reproduced in Figure 3-2.

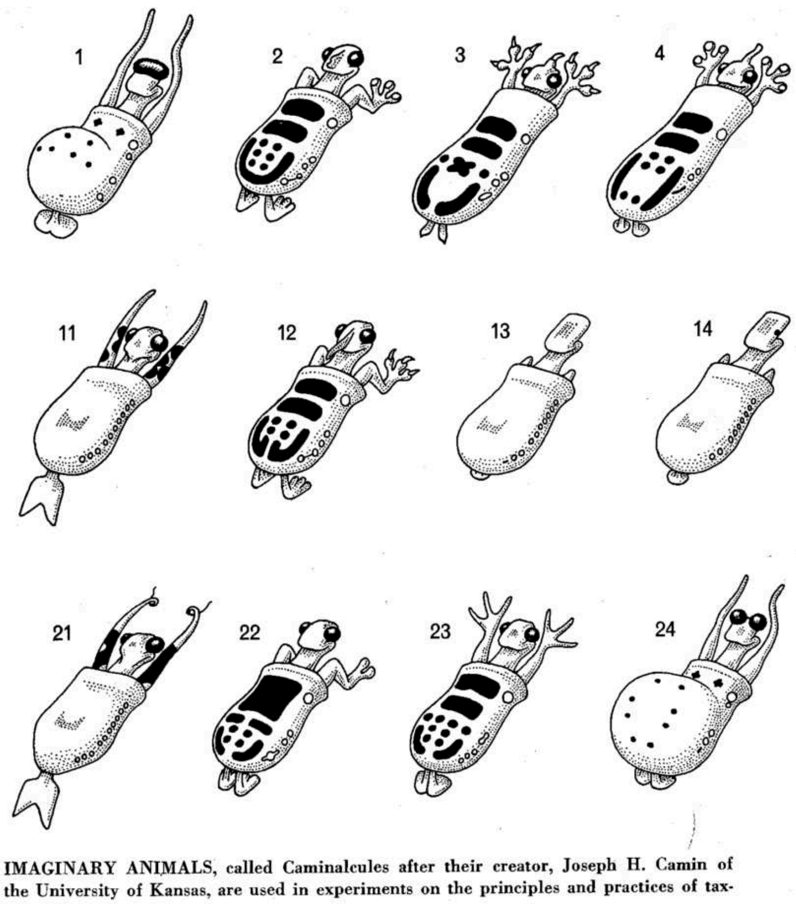

Figure 3-1 Camin's imaginary's animals reproduced in Sokal to illustrate the classification of species based on multiple complex morphological specificities (Sokal 1966, p. 2).[56]

[56] Caminalcules were imaginary animals created by Joseph H. Camin from the university of Texas, mostly for teaching purposes (Sokal 1966, p. 11). Camin published several papers with Sokal but this is the earliest publication I could find that provided a visual representation of the Caminalcules. The latter has remained a major tool for teaching taxonomy to students (Gendron, 2000).

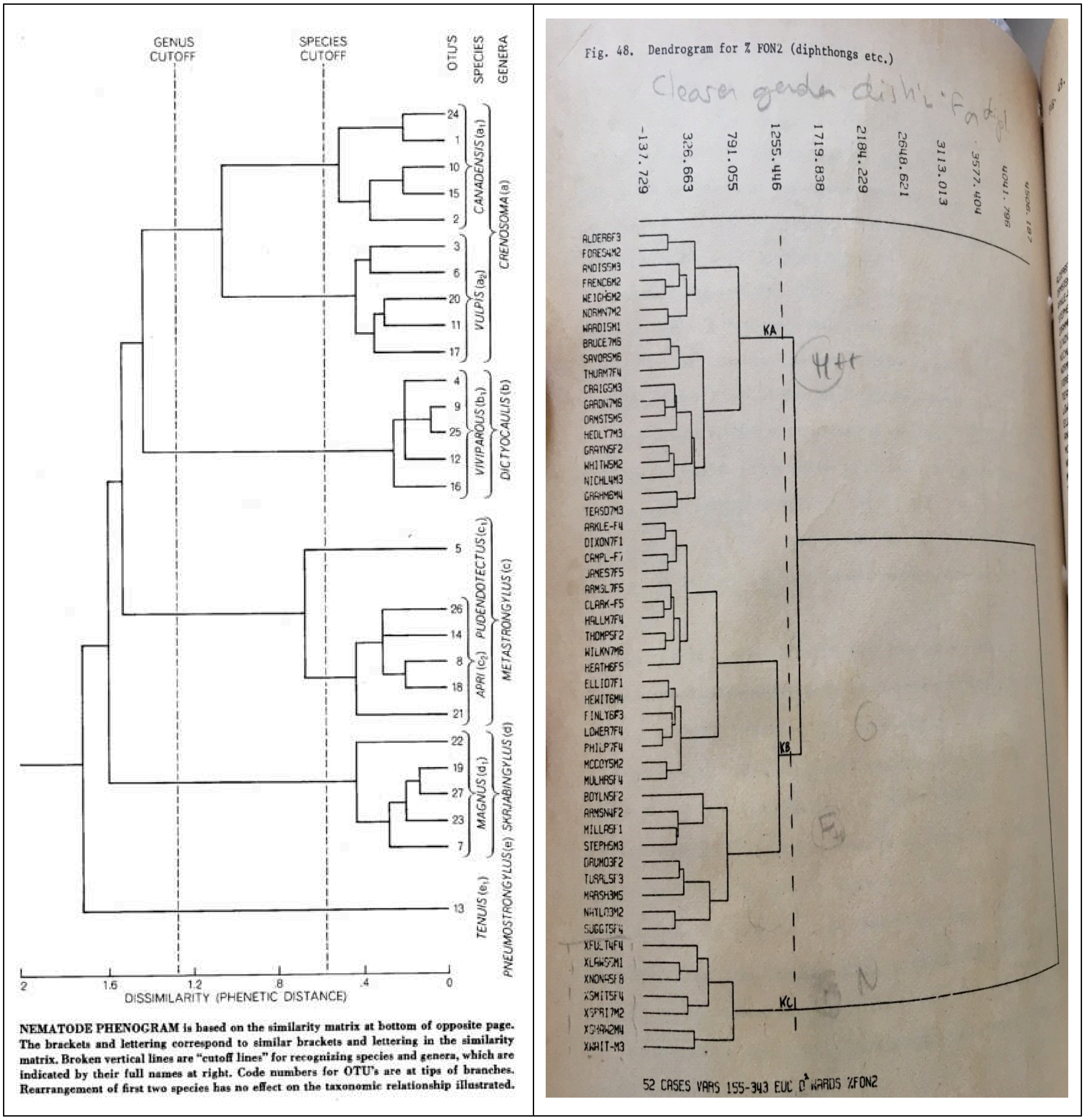

Figure 3-2 Sokal's example of a phenogram classifying various types of worms (1966) vs. dendrogram based on 52 TLS speaker's realisations of their diphthongs, reduced and NURSE vowels (1983, p. 98).

Jones-Sargent (1979, 1983) is a direct application of Sokal's work on sociolinguistic data. She also tried several clustering methods presented in Sokal (1966, p. 8) such as single linkage, average linkage and Ward (1983, pp. 110-115). Using different methods will result in different classifications of speakers. If the speakers are classified in a very different way in all three methods, then clustering may not be an ideal approach for one's dataset. Conversely, if the classification of speakers is stable enough based across all three methods, then the sociolinguistic groups formed by the clustering analysis should be reliable – see the pilot study in CHAPTER 6 of this thesis for more details about the reliability of the classification.

Apart from methodological inspirations from taxonomy & multivariate data analysis, the TLS had to face important issues that pertain to research in urban dialectology. To build their new sociolinguistic framework they had to look at the sociology of communities, the history of migrations in the area and the impact of urban planning on certain communities of Tyneside. They had to think about how to sample their informants, which was much more complex than picking up a few NORMs in a rural area, because diversity, changes in community patterns due to ongoing urban planning makes the choice of fieldworks more complex. It was also believed that the media may have an impact on TE, which is also something that the TLS aimed to measure. I now detail the new theoretical and practical challenges pertaining to urban dialectology that the original TLS team had to take into account.

3.2.1.2 The challenges faced by the TLS pertaining to urban dialectology when designing the survey protocol

In the eye of the original TLS team, urban speech investigation requires "an analysis of speech variation [that is] different in kind from its predecessors" (John Pellowe, Nixon, Strang, et al., 1972, p. 2) and involves more challenges than analysing the speech of people from a village having little contact with other dialects. The term NORM was coined by Chambers & Trudgill to refer to these types of informants, i.e. Non-mobiles Older Rural Men (Chambers & Trudgill, 1980). Pellowe et al. (1972, p. 2) mention at least 5 challenges that would have to be addressed when carrying out the TLS:

> 1. the diversity of geographical origin of a city's constituent members,
>
> 2. the high physical density amongst, but loose, symbolically mediated, social bonding between those members (Goffman, 1961, 1963; Pahl, 1968),
>
> 3. the multidimensional complexity of role structures and group dynamics in terms of commercial, administrative and community pressures (Biddle & Thomas, 1966; Cartwright & Zander, 1968; Silverman, 1970),
>
> 4. the current situation in both urban and rural situations is also massively affected by the mass media, in which a very large number of geographically widespread hearers are exposed to the same acoustic signal simultaneously,
>
> 5. the Tyneside conurbation is affected by high net rates of out-migration and by considerable internal mobility (NRPC 1967, House and Willis 1967).

Let us analyse these points one by one and see how the TLS strived to address these issues. (1) For urban dialectologists, the **diversity of geographical origin** can be an issue regarding speech variation and should be fairly controlled for and detailed metadata, collected. The Industrial revolution led to significant in-migration to the North-East. The period between 1880 and 1920 saw the arrival of migrants from Scotland and Ireland (Renton, 2007) and by 1911, around 37% of people in the North-East were foreign-born or children of migrants (Byrne, 1996). After WWII, other waves of migration from India, Pakistan and the West Indies also had their share in shaping the region sociolinguistically (MacPherson & Renton, 2007, p. 161). Taking such migration trends was therefore vital when devising the methodology of the TLS and more specifically, when selecting informants and collecting their social data (I shall deal with the selection of informants in more depth in a subsequent section of this chapter).

(2) In the 1960s, the North-East underwent major upheavals in urban planning, which completely transfigured **social bonding** within and across communities. Employment in the traditional industries was plummeting in the region, which meant that “many working-class communities were broken up and shipped out to peripheral estates and New Towns”. This had “significant consequences for the coherence and continuity of local culture and identities with longstanding attachments to particular central areas such as Shieldfield, Byker and Scotswood Road” (J. P. Watson, 2010, p. 73). Local authorities were fully aware of social group dynamics and argued that the bonds within grass roots communities were a means to legitimise this new urban planning and relocation itself. Newcastle’s city planner officer Wilfrid Burns wrote in 1963 that slum clearance would have a “devastating effect on the social groupings built up over years”. He adds that “the task is surely to break up such groupings, even though the people seem to be satisfied with their miserable environment and seem to enjoy an extrovert social life in their locality” (Burns, 1963, pp. 94-95). In an interview, Pellowe suggested measuring the relationship between the degree of local accentedness and the dismantlement of these communities, rehoused into blocks of flats.[57] Depending on how rehousing takes place, Pellowe hypothesised that a speaker from

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[57] Reflections upon the social consequences of this massive urban planning are still vibrant today. The local newspaper has written several articles on the matter with pictures of demolition, people being filmed about the impact this has have on their lives. In a recent exhibition about the North, the Baltic several reports on the need to destroy the slums and their communities were on display. It has also been a rising interest among academics (Tunstall, 2012).

Tyneside may either level his speech or reinforce it and suggested building an index measuring such behaviour (see APPENDIX VIII for the full transcript of the interview).

Linguists also regarded changes in the social bonding amongst members of a community as having severe knock-on-effects on speech variation in sociolects. Looser bonds within a community may lead to a decrease in identification with the typical speech and accent of a community and to favour speech variation patterns differing from traditional patterns within that community. This urban transformation led by T. Dan Smith – also known as 'Mr Newcastle' (Elliott, 1975, p. 33) was also hinted at in the TLS project (Strang, 1968, pp. 791-792) and the relocation of the working-class communities who would be dispatched throughout the county was seen as a potential threat to speech homogeneity among working-class Tyneside English speakers or other social groups living in the area. This major change in the urban landscape urged the research team to record speakers as soon as possible before or shortly after their relocation.

(3) **Group dynamics and community pressure** within urban areas also plays a major role in urban dialectology. Wright illustrates his point by referring to McDavid's (1948) sociolinguistic study of post-vocalic /r/ in South-Carolina. The study "showed that certain distributional configurations cannot be solved either by geographical statement or by evidence of settlement history" and that the presence or absence of a retracted or retroflex /r/ "was due to the sub-conscious operation of social forces rather than to explicit notions of elegance" (J. T. Wright, 1966, p. 236). Thus, "a complex of social forces" necessarily implies a "sophisticated approach to the constituent elements of the population before the processes of linguistic sampling can be attempted" (J. T. Wright, 1966, p. 233). The TLS took this

complexity into account. In an interview about the TLS, John Pellowe highlighted that one of the aims of the survey was to observe which local linguistic features remain despite community pressure and change in group dynamics. In order to access information on such dynamics, a long questionnaire was designed. It included 38 questions providing information on the regional background and mobility of the informants and their family, the age and sex of the informants, their education and attitudes towards education, their occupation or former occupations and importantly, their attitudes and contacts with local communities and the region (Jones-Sargent, 1983, pp. 45-46). The idea was to collect as much information as possible to account for speech variation that would not be easily accounted for by sex, age, or class e.g. group dynamics and community pressure. A detailed profile of speakers which "exhaustively characterises their social […] differentiation" (Jones-Sargent, 1983, p. 29) would then help "determine which social factors, and groups of factors, display some regularity with respect to the way the sample is dispersed across linguistic space"(Jones-Sargent, 1983, p. 45), namely, which profiles of speakers favour or disfavour certain linguistic features.

(4) The recent introduction of **TV and radio broadcasting** of BBC English was deemed potentially impactful by Pellowe and colleagues who wanted to include this aspect in their study. In the TLS, question 33a of the social data questionnaire concerned the informants' degree of exposure to radio and TV. That is to say, if they predominantly listened to the radio or predominantly watched TV, if they watched TV only or did not own one (Jones-Sargent, 1983, p. 145). Then, the correlation between the speech of the informants and their exposure to radio or TV were to be assessed. This would help get a first idea whether mass

media would have an impact on dialect change or not. The TLS strove to include as many factors that could account for speech variation and was a real pioneer in that sense too.

The effect of mass media on dialect levelling is still debated among variationists today (Stuart-Smith, Pryce, Timmins, & Gunter, 2013). At the end of the 1990s, Chambers (1998) wrote a chapter on language myths and suggested the effect to be negligible. Nearly a decade later, the issue remained unsolved. Stuart-Smith points out that "[t]he consensus seems to be that since we cannot interact with television characters in the same way as with our friends, neighbours and workmates, represented television dialects are unlikely to affect our own speech". She adds that this consensus, however, is rarely supported by evidence: "for an area of linguistics which is grounded in empirical research, evidence is rarely discussed" (Stuart-Smith, 2007, p. 142). When trying to relate the choice of linguistic variants to mass media exposure, the TLS demonstrates how innovative its methodology was for the late 1960s and early 1970s. In the next section, I continue with the notion of innovativeness with regards to how the collection of detailed social data was carried out, but not with the intention of stratifying the speakers *before* the linguistic analysis but rather, to serve as potential *a posteriori* supporting documentation to account for linguistic variation.

3.2.2 The TLS went beyond the "first wave" (Eckert 2012) in variation studies

Looking back at what she called the *first wave* in variation studies, which started with Labov's *Social stratification of New York City* (1966) and lasted up until the 1980s, Eckert (2012) identified a few drawbacks associated with studies following similar approaches: (1) prioritizing the placement of speakers into "macrosociological categories" without having a representative sample of the area under scrutiny (2012, p. 88) and (2) "interpret[ing] the social significance of variation on the basis of a general understanding of the categories that served to select and classify speakers rather than through direct knowledge of the speakers themselves and their communities" (2012, p. 90). The TLS (John Pellowe, Nixon, Strang, et al., 1972) had already endeavoured to address those issues. Firstly, the selection of Gateshead informants was intended to be a representative sample of the area and is explained in more depth in the next section. Secondly, very detailed metadata are provided – as opposed to solely gender, class, and age – and a long interview enabled the fieldworker to ask the informants about their own perception of the dialect and their relationship with the local community – school and speaking standards, style-shifting, identification with the local area...etc. The aim was to first classify the speakers on the basis of their speech and see if it was correlated with certain social variables, the latter being as exhaustive as possible. Below are some examples of topics covered by the survey. Macrolinguistic indications in parenthesis were added *a posteriori*, to give the reader a general idea of the social profile of the individual. I restricted myself to one informant only but such questions by the fieldworker McNeany were asked to most participants:

<u>School and speaking standards:</u>
Fieldworker: when you were at school did did your teacher ever like used to you know tell you to change the way you talked?
TLSG30M (male, 21-30 years old, millwright): oh they used to try . . . she did a lesson for it . . . course they never (...) never succeeded [laughter]

<u>Style-shifting:</u>
Fieldworker: no matter who you're talking to aye not even you don't you don't think you would change like when you're talking on the phone for instance or…
TLSG30M (male, 21-30 years old, Millwright): I speak the same when I'm on the phone . . . nobody knows what I'm saying [laughter]

Identification with the local area:
Fieldworker: what do you think about Gateshead as a place to live in you know would you say you're very attached to Gateshead?
TLSG30M(male, 21-30 years old, millwright): oh Gateshead I like living here aye aye better than Newcastle for instance.

In this excerpt from the interview of a young millwright from Gateshead and his wife (TLSG30M), information is drawn "through direct knowledge of the speakers themselves and their communities" (Eckert, 2012, p. 90). Such an approach is more similar to those in ethnography and anthropology. This is what Eckert calls the *second wave* (2012, p. 91), which she associates with works by Milroy (1980), who introduced the importance of network in sociolinguistics. The TLS did not go as far as Milroy but its general approach was already beyond what Eckert had called the *first wave* approach in sociolinguistics with the representativeness of its sample and the vast amount of information gathered from speakers regarding the local community, on themselves, their parents, their children if any, on their personal view of both TE in general and of their own speech.

I have hitherto explained how the TLS was a highly innovative work, straddled between dialectology and what came to be known as *language variation and change*. The TLS also tried to avoid preconstructed divisions of speakers that Eckert identify as typical of the first wave in variation studies, which she considers as a mere "filling [of] cells defined by macrosociological categories" (Eckert, 2012, p. 88), which demonstrate that the TLS had already overcome those predicaments. I now proceed to a more detailed description of the selection of informants in the TLS and of the codification of the phonetic variables for future computer use into 5-digit units.

3.2.3 The selection of informants in the TLS

Each informant was selected according to his/her sex, social background and degree of education. The determining criteria for their social background are based on the place of residence. Then, after having contacted each informant and received their consent, the interviewer, preferably someone from the area, engaged in a natural conversation with the informant in the latter's own home. It was believed that someone in the context of his/her own home is more likely to speak at ease in his/her own dialect than in a university lab. Furthermore, the informants were usually not specifically informed that the linguistic and phonetic content of their speech would later be assessed and analysed by researchers. The aim of this protocol was to collect a highly representative sample of the community's speech and to be able to highlight and define "a consistent and coherent structure for the speech of this community"(Labov, 1966b, p. 9).

Urban dialectology raised an important question when selecting informants: how should they be chosen? By using someone's network or selecting the population based on randomisation methods? How should cohorts be constituted (etc…)? At the time of the TLS, "Little or nothing [was] known about how varieties are distributed across the populations of conurbations" (TLS_014_[a] archive, p. 4). Therefore, to select the informants, TLS resorted to a compromise between resorting to a completely random selection of speakers and reaching a sufficient amount of "sociolinguistically influential and interesting group of speakers" that would be "very sparsely represented, if at all, in a random sample" (Jones-Sargent, 1983, p. 26). By this she meant not the working-class but rather the "non-localised" (NL) speakers that are mostly associated with the middle-class or the well-educated. These speakers were handpicked to ensure that enough data would be drawn from a sufficient number of NLs. Therefore balanced cohorts would also enhance comparability between sociolects. Jones-Sargent explains that the selection of informants was composed of three phases (adapted from Jones-Sargent, 1983, pp. 26-27):

> Phase 1 sample:
>
> a) A handpicked sub-sample of 40 speakers known to have NL varieties
>
> b) 60 speakers, resident in a street intuitively judged to be 'middle-class'
>
> c) 150 speakers chosen from the Electoral Register, by wards and polling districts. The selection was normalised according to size of ward or polling district, thus giving every member of the population an equal and calculable probability of selection.
>
> Phase 2 sample:
>
> A second sample was drawn to test the reliability of phase 1 sampling based on an adaptation of Good's (1953) sampling technique (see Pellowe et al. 1972, p. 23).
>
> Phase 3 sample:
>
> A third sample was created based on 150 socially stratified speakers from Gateshead. The social factor used was 'rateable value per dwelling by polling district' (John Pellowe, Nixon, Strang, et al., 1972, p. 24).

Each phase was meant to be exploratory so as to test the adequacy of the method to the linguistic survey (Pellowe et al. 1972, pp. 24-25) and to reach a more empirical and reproducible methodology. How social stratification should be measured was already subject to controversy and sociologists like Mary Haug called for a more empirically based measurement of stratification: "[i]n this general context, overcoming measurement shortcomings in the fundamental sociological concept of stratification calls for top scientific priority for the whole discipline" (Haug, 1977, p. 75). There is no unique way of measuring social stratification among populations. This explains the multiple measurement techniques of the TLS team to select socially stratified informants and the need to gather a lot of extra social data using detailed questionnaire to account for potential variation among people from the same socially stratified group. Despite the complexity of its model, TLS team concludes:

> We thus have a methodology which satisfactorily overcomes the principal problems of investigating the language of an urban community, which does not depend upon rigorous exclusion of large sectors of the population, but accepts and handles the complexity of linguistic variation in such communities (TLS_014_[a] archive, p. 5).

By providing several sampling methods, the TLS endeavoured to address one of the main issues of urban dialectology, namely, showing variation across a sample of speakers that would reflect the population distribution of an entire conurbation.

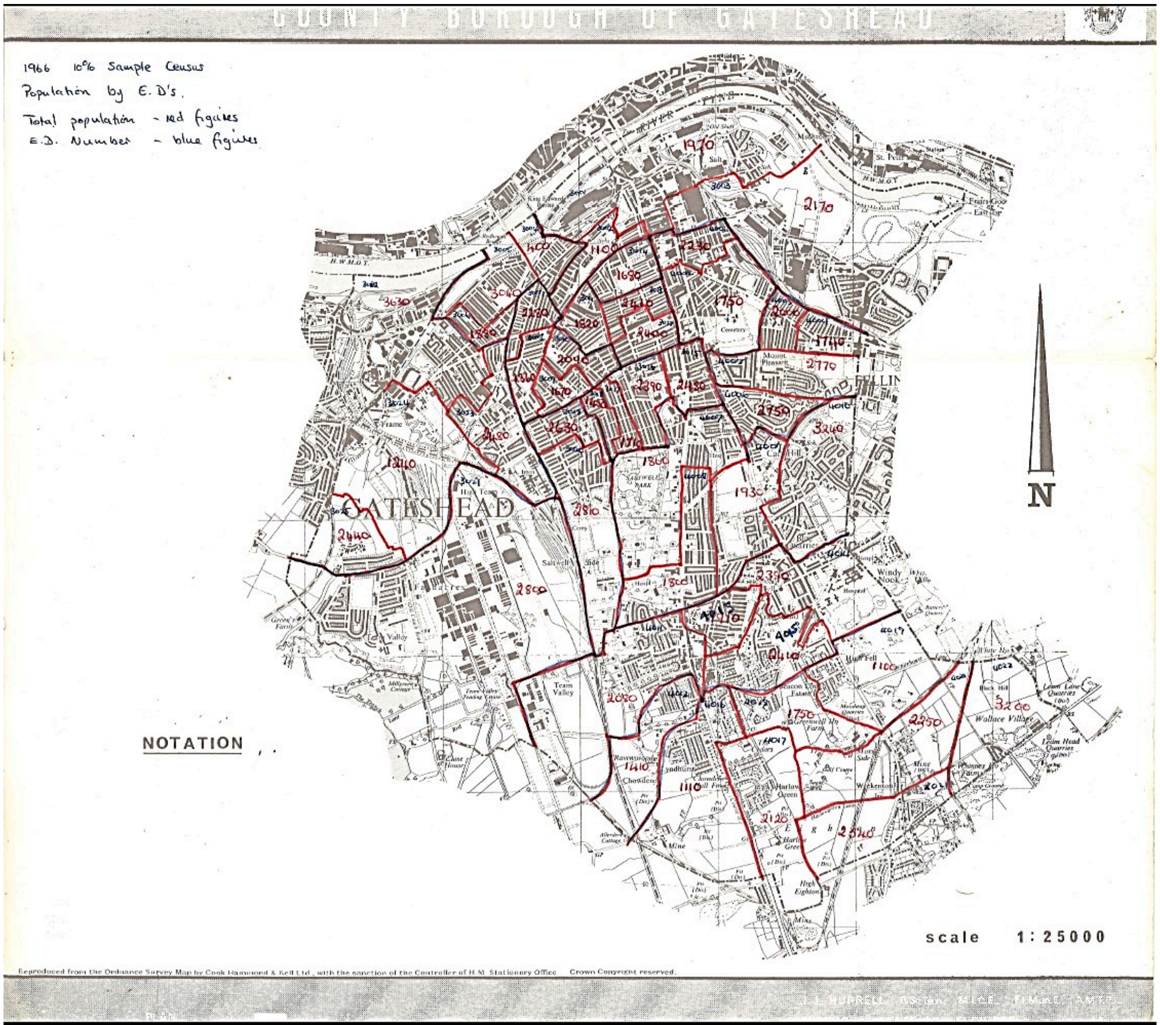


Figure 3-3 Map of Gateshead annotated by the TLS team for the sampling of informants, (based on electoral districts, 1966 census, TLS Newcastle archive).

3.2.4 Building the "social space": TLS social data questionnaire

Since the motto of the TLS was *exhaustivity*,[58] the social data questionnaire included as many as 38 questions. Information gathered from the interview was to "constitute a definition of the dimensions of the social space" (Jones-Sargent, 1983, p. 45). A formal

[58] In the article by Pellowe et al. 1972, which expatiates on the objectives of the TLS, words derived from the term "exhaustive" appear 8 times. Jones-Sargent (1983) frequently uses the term to qualify the list of social and linguistic variables (e.g. pp. 28-29).

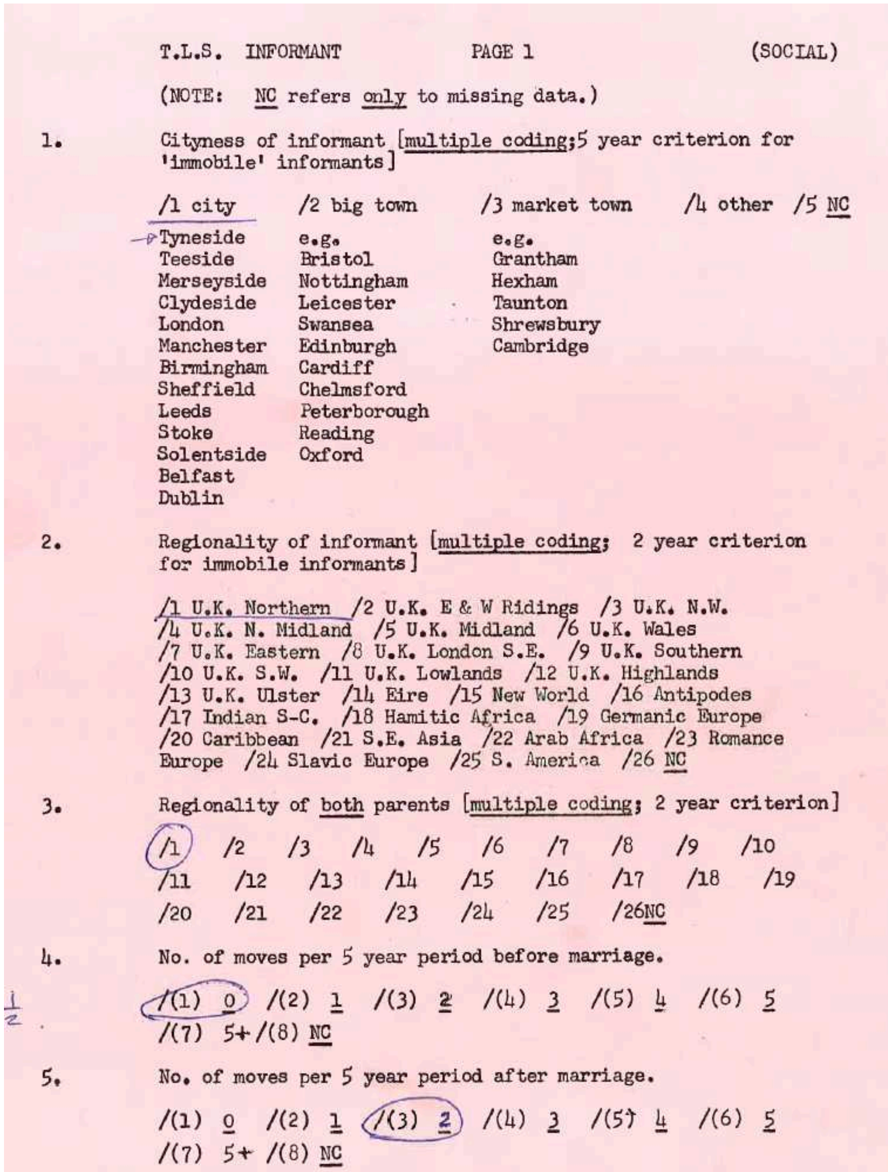
questionnaire in the manner of Houck (1968) in which the informant was required to fill in the questionnaire himself was opted out. Figure 3-4 is an example of the TLS indirect questionnaire and Figure 3-5 illustrates Houck's direct questionnaire for direct comparison. This choice was motivated by the fact that "an atmosphere of free conversation [was] encouraged" so as to gather as much authentic data as possible. However, the interviewer was supposed to keep an eye on the coding sheet and to cover topics related to the questionnaire within the flow of the conversation so as to "attempt to cover them all during the interview" (Jones-Sargent, 1983, p. 45).

Table 3-1 TLS social data questionnaire (Adapted from Jones-Sargent, 1983, pp. 142-146).

Question topic	Description	Question index
Cityness	If informant comes from a city or a market town/smaller	Q1
Regionality	If informant and his/her parents have lived at least two years away from Tyneside area	Q2-3 (informant & parents)
Mobility	Number of moves per 5-year period (before / after marriage)	Q4-5 (before & after marriage)
Age	Age group of informants	Q6
Sex	Sex of informant	Q7
School leaving age	If informant left school before or after legal minimum age	Q8
Tertiary and further education	Educational history	Q9
Attitudinal data towards education	Informant's attitude to his own education and that of his/her children	Q10-11(own education & children's education)
Gender divide in education	Whether boy/girl education should be distinct	Q12
Positive distinction between parental and school roles	Whether parental and school have different roles in the education of a child	Q13
Parental control over children	Direct verbal/physical & indirect verbal/physical control	Q14
Marital status	Whether the informant is married/single/widowed	Q15
Religion	Religion of informant *(omitted in Jones-Sargent 1983, p. 152, due to too few responses)*	Q16
Nuclear family size	How informant's linguistic variation is affected by size and structure of the family	Q17
Gender of offspring	How gender of offspring may affect linguistic interaction between parent and child	Q18
Average age gap between offspring	Along with Q17-18, help measure duration of parents' exposure to younger generations within household *(omitted in Jones-Sargent 1983, p. 152, due to too few responses)*	Q19
Spouse's geographical origin	Distance of spouse's primary regionality compared to that of the informant	Q20
Attachment to local environment	Identification with local environment (place and people)	Q21
Satisfaction with local environment	Satisfaction with local environment and housing conditions	Q22

Interior decoration[59]	Degree of investment in house decoration and furnishing (assessed by the interviewer using a 10-point rating scale)	Q23
Rateable value of dwelling	Formerly used official value given to a building based on size and type, indirectly informing on social status of informant *(omitted in Jones-Sargent 1983, p. 153, due to too few responses)*	Q24
Macro-environmental preference	Whether they aspire to live outside the North or not	Q25
Tyneside consciousness	Presence or absence of positive Tyneside consciousness	Q26
Neighbours	Degree of social involvement with neighbours	Q27
Occupation	Present occupation, former occupation and father's occupation (*based on the 'Social Grading of Occupations' (Hall & Jones, 1950)*)	Q28-30
Job preference	Informant's career ambition and desiderata	Q31
Job satisfaction	Degree of satisfaction of informant's job	Q32
Leisure/hobbies	Type of leisure and hobbies	Q33, 34, 36
Leisure satisfaction	Satisfaction with leisure	Q35
Politics and job type	Whether informant thinks political allegiance should be associated with one's type of occupation	Q37
Voting preference	Informant's political allegiance	Q38

[59] This section stems from works in sociology, see MacMurray 1971 or Cooper 1972 for works that are likely to have been available at the time the questionnaire was created.



T.L.S. INFORMANT PAGE 1 (SOCIAL)

(NOTE: NC refers only to missing data.)

1. Cityness of informant [multiple coding;5 year criterion for 'immobile' informants]

/1 city	/2 big town	/3 market town	/4 other	/5 NC
Tyneside	e.g.	e.g.		
Teeside	Bristol	Grantham		
Merseyside	Nottingham	Hexham		
Clydeside	Leicester	Taunton		
London	Swansea	Shrewsbury		
Manchester	Edinburgh	Cambridge		
Birmingham	Cardiff			
Sheffield	Chelmsford			
Leeds	Peterborough			
Stoke	Reading			
Solentside	Oxford			
Belfast				
Dublin				

2. Regionality of informant [multiple coding; 2 year criterion for immobile informants]

/1 U.K. Northern /2 U.K. E & W Ridings /3 U.K. N.W. /4 U.K. N. Midland /5 U.K. Midland /6 U.K. Wales /7 U.K. Eastern /8 U.K. London S.E. /9 U.K. Southern /10 U.K. S.W. /11 U.K. Lowlands /12 U.K. Highlands /13 U.K. Ulster /14 Eire /15 New World /16 Antipodes /17 Indian S-C. /18 Hamitic Africa /19 Germanic Europe /20 Caribbean /21 S.E. Asia /22 Arab Africa /23 Romance Europe /24 Slavic Europe /25 S. America /26 NC

3. Regionality of both parents [multiple coding; 2 year criterion]

/1 /2 /3 /4 /5 /6 /7 /8 /9 /10
/11 /12 /13 /14 /15 /16 /17 /18 /19
/20 /21 /22 /23 /24 /25 /26NC

4. No. of moves per 5 year period before marriage.

1/2 /(1) 0 /(2) 1 /(3) 2 /(4) 3 /(5) 4 /(6) 5
/(7) 5+ /(8) NC

5. No. of moves per 5 year period after marriage.

/(1) 0 /(2) 1 /(3) 2 /(4) 3 /(5) 4 /(6) 5
/(7) 5+ /(8) NC

Figure 3-4 Indirect questionnaire: example of an original TLS social data sheet to be filled by the interviewer during the interview.

Informant Data Sheet

CELL NUMBER: ________. SEX: M F MARITAL STATUS: S M W(er)

1. IN WHICH AGE GROUP ARE YOU? (show chart) 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15.
2. IN WHAT TOWN AND COUNTRY WERE YOU BORN? V/T/C ________________ CO. ______________
3. WHERE DID YOU LIVE BEFORE YOU WERE 13? V/T/C ____________CO. ______
4. WHERE DID YOU LIVE FROM AGE 13 THROUGH 19? V/T/C/ ________________ CO. ___________
5. AFTER THE AGE OF 19 WHERE IN ENGLAND HAVE YOU LIVED MOST OF YOUR LIFE? V/T/C_______________CO. ___________; V/T/C_________ CO. ______
6. AFTER THE AGE OF 19 HAVE YOU LIVED ANYWHERE ELSE MORE THAN ONE YEAR?

   V/T/C ____________ CO. ____________ YEARS? ____________

   ____________ ____________ ____________

   ____________ ____________ ____________
7. HAVE YOU EVER LIVED IN THE COUNTRY OR ON A FARM? N YEARS? -5 -10 -20 +20.
8. WAS YOUR MOTHER BORN AROUND HERE? Y N V/T/C ________CO. ________
9. WAS YOUR FATHER BORN AROUND HERE? Y N V/T/C________CO. ________
10. HOW OLD WERE YOU WHEN YOU LEFT SCHOOL? ___________
11. WHAT YEAR DID YOU LEAVE SCHOOL? __________(1958)
12. WHAT KIND OF SCHOOL (do, did) YOU GO TO? ______________________
13. If 15/15+ & still in school WILL YOU GET A CSE? Y N. ARE YOU TAKING "O" LEVEL? Y N. ARE YOU TAKING DAY RELEASE? NIGHT CLASSES? Y N.
14. If 16/18 when leaving school DID YOU GET A (GCE, HNC)? Y N.
15. WHAT IS YOUR breadwinner's (JOB, OCCUPATION)? ________________
16. (ARE, WERE) YOU PAID WEEKLY OR MONTHLY: W M.
17. (IS, WAS) YOUR WAGE CALCULATED BY PIECE-WORK OR HOURLY RATE? P-W HR.
18. IN WHICH INCOME GROUP ARE YOU? (show chart) 1 2 3 4 5 6.

INCIDENTAL INFORMATION OR COMMENTS:

Figure 3-5 Direct questionnaire: informant social data sheet from Houck's (1968) study on Leeds English to be filled by the informants themselves.

Out of this myriad of social information, more synthetic social data cards were created so as to get a quick grasp of the speakers' social profile. As shown in Figure 3-6, only 9 elements were retained: where the informants live, where their parents come from, their age, their occupation and that of their father, when they left school and if they had lived outside Tyneside.

TLS/G210 TE040
CITINESS OF INFORMANT: Tyneside
REGIONALITY OF INFORMANT: UK Northern
PARENTS' REGIONALITY: UK Northern
AGE: 71-80 (79)
MARITAL STATUS: Married (widowed)
FATHER'S OCCUPATION: Steevador
INFORMANT'S OCCUPATION: retired office worker
EDUCATION: Left school at 14, no further or tertiary education
NO. OF MOVES OUTSIDE TYNESIDE: 0

TLS/G211 TE052
CITINESS OF INFORMANT: Wearside
REGIONALITY OF INFORMANT: UK Northern
PARENTS' REGIONALITY: UK Northern
AGE: 71-80
MARITAL STATUS: widowed
FATHER'S OCCUPATION: Miner
INFORMANT'S OCCUPATION: prev. domestic worker (cooking/cleaning)
EDUCATION: left school at 14, no F.E.
NO. OF MOVES OUTSIDE TYNESIDE: 0

Figure 3-6 Example of 2 TLS social data cards for two older women.

After a presentation of how informants were selected and how detailed the social data collected by the TLS research team was, I now proceed to a description of the recording protocols of the TLS, which was deemed innovative

3.2.5 Recording protocol of the TLS interviews

The TLS data consists of audio-taped interviews conducted mainly by Vince McNeany. The tapes were recorded onto analogue reel-to-reel tapes, “the standard audio-recording technology of the time” (Allen et al., 2007, p. 19). The recordings were made using portable magnetic tapes. This explains the relatively higher intensity of the informants’ speech compared to that of the interviewer in the tapes with, in some cases, saturation sounds. A great amount of work had to be done to convert these magnetic tapes into digital mp3 and wav files. So far, 37 TLSG files have been digitised and made available on the DECTE website (this will be discussed further in section 3.4).[60] In January 2014 materials from the Gateshead and Newcastle informants were retrieved from John Local and were digitised shortly afterwards (A. Mearns et al., 2016). Among the artefacts, was the recorded protocol for the 1960s-70s recordings.

During the interview, the participants were “encouraged to talk about their life histories and their attitudes to the local dialect” (Allen et al., 2007, pp. 18-19). They were also given the task to read a list of words. This was followed by another task in which the fieldworker asked the informants to provide acceptability judgements on vernacular constructions and whether they used or were familiar with certain local words. The orthographic script of TLSG17 is a good example of how such a task was inserted in the conversation and reads as follows:

> *Interviewer*: I'm going to read out a list of words and eh for each one I want to know firstly if you […] use it yourself and secondly if you're familiar with it […] it may be the case that you

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[60] http://research.ncl.ac.uk/decte/

wouldn't use it yourself but you hear it quite often [...] they're all fairly local words you know ehm what about eh ***aside*** meaning ***beside*** do you ***say it's just aside the fire***.

Informant: yes.

Interviewer: yeah ehm **bairn**

Informant: yes

Interviewer: yes **bait**.

Informant: yes

Interviewer: eh **beck** meaning a **stream**.

(DECTE TLSG17, lines 0465-0471, emphasis mine).

During the interview, many topics were covered: work, everyday life, neighbourhood, voting preference, favourite TV programmes, even attitudes towards the Geordie accent and evaluations of the interviewer's own local accent. On several occasions, other informants like spouses or children joined in the conversation or commented on the main informant's speech.

3.2.6 Building a "variety space" (John Pellowe, Nixon, & McNeany, 1972a): in favour of an approach embracing all linguistic features

Right from the start, the TLS team endeavoured to go against the newly formed sociolinguistic trend – launched by Trudgill in the UK –, which consisted in selecting a limited amount of linguistic features to measure variation among speakers from different social groups: "Trudgill, . . . restricts his selection to sixteen phonemes, whereas the TLS operates on the principle of exhaustive inclusion of variables". To them, having as many linguistic features included in their model, which they called the "linguistic space[61]" would help avoid "the biasing effects of an approach based on a restrictive selection of variables" (Jones-Sargent, 1983, p. 28). In the next paragraph Jones-Sargent provides three advantages for that approach:

1) Minimising the loss of information (richness of information)

2) The possibility to test a wide range of hypotheses (durability of the project)

3) Letting the statistical model decide which variables are relevant and not the linguists themselves (allowing non-predetermined results to emerge)

The choice of linguistic features stems from Pellowe's pilot study (John Pellowe, 1967). Pellowe was originally from Essex and felt the need to become better acquainted with Tyneside English so as to include as many linguistic features as possible in the TLS model – be they phonological, like most studies in urban dialectology at the time, grammatical or even intonational. Pellowe recounts that he spent five years analysing TE from different sources in order to get a better grasp of this urban speech and to select as many linguistic features as possible in future studies:

> Over a period of five years I collected from many sources, both assisted and corrected by all of my acquaintance, spoken variant realisations of English spoken on Tyneside. These sources are: overheard talk in public places, surreptitious recordings later authorised by speakers, miscellaneous tapes in the T.L.S. archive, notes taken of speakers on 'Voice of the North' (B.B.C.

[61] While taking a look at one of the textbooks in multivariate statistics cited by John Pellowe (M. G. Kendall, 1957), I found out that the first chapter dealt with Principal Component Analysis. The latter creates a geometrical space where individuals are plotted based on their variation patterns. It is possible that Pellowe drew inspiration from PCA when coining the term *variety space* for the TLS (cf. CHAPTER 4 for more details about PCA applied in linguistics).

> (Newcastle) daily) – later verified and amplified from the tapes, and data collected for an earlier feasibility study. (John Pellowe, 1967, p. 6)

Based on these observations, he selected two criteria to retain a segmental linguistic variant that is characteristic of TE. Firstly, it had to have been heard used by "at least five different people under comparable stylistic conditions". Secondly, it also had to be "recognised by a hearer (who himself speaks a transitional localised variety) as, at the least, a rare realisation" (John Pellowe, 1967, p. 6). Similar criteria were used to assess grammatical and lexical variation (John Pellowe, 1967, p. 8). Once the variants were identified, they were placed as part of the manifold realisations of their corresponding R.P. vowel:

> this is the case with the item /hɐʊm/ 'home' in the synchronic set /həʊC/. Two localised variety realisations of this are [hˤ ɔ̝: m], [hˤ i̝ ɛ̝ m]. The second of these appears to be the only such variant realisation in the set, but very stable and easy to elicit; I therefore include it as one of the 'variants of /əʊ/'. (There are clearly

Figure 3-7 Selecting variants for the TLS segmental data (John Pellowe, 1967, p. 7).

The prosodic features of TE were also deemed relevant when defining the local variety: "the prosodic system of L[ocal] varieties of Tyneside is extremely characteristic" and is "perhaps the first set of L[ocal] features" that would be noticed by someone new to the area (John Pellowe, 1967, p. 7). The selection of variants was mostly based on the work of Crystal and Quirk and their collaborators published in the 1960s (Quirk, Svartvik, Duckworth, Rusiecki, & Colin, 1964). Following these explorations, 9 linguistic categories were formed.

Table 3-2 The 9 linguistic categories of the TLS (Adapted from Jones-Sargent, 1983, p. 38).

Linguistic variables	Number of variables
a) Paralinguistic and prosodic (Crystal & Quirk, 1964)	58
b) Vowel: - stressed - environment /Vr̲/ - weak forms of stressed syllables - forms always unstressed	 68 22 8 7
c) Consonant	45
d) Miscellaneous properties of syllable and word in continuous speech	33
e) Grammatical complexity	36
f) Fluency (hesitation phenomena etc.)	9
g) Localised lexis (recognition and usage)	2
h) Localised syntax (acceptability and usage)	14
i) Lexical 'resource'	1

As shown in Table 3-2 the list of linguistic features to be analysed was far from limited. The idea was that the most relevant features distinguishing someone with a localised speech from someone with a non-localised one would stand out as a result of a computer analysis. In the present thesis, the main analysis is restricted to vowel variation after a first analysis including both the vowels and the consonants to check with features are the main determinants of speech variation across the entire phonetic system.

Once the linguistic features are chosen there remains the issue of annotation protocols. The vast amount of data that would result from the annotations would not be easily analysed by hand and since Newcastle University had acquired a new computer room at the time of the TLS, the research team adapted the annotation protocols so that the linguistic features would be computer readable. This was meant to enhance the scope and searchability of the corpus to an extent that a human would be challenged if they were to analyse the data by hand on their own. So as to prevent bias due to inevitable divergence in the phonetic transcription of the annotators, only McNeany, a then trained postgraduate student at Newcastle University, transcribed the first 10 minutes of the Gateshead data (John Pellowe, Nixon, & McNeany, 1972b).[62] This was yet another pioneer aspect of the project which will be the object of the next section.

3.2.7 Coding the segmental phonetic data of the TLS

Anticipating a computerized analysis of linguistic data

Despite the lack of a computer within the department of linguistics in 1972, Pellowe, Nixon and McNeany foresaw the prevalence of computer science as a tool to analyse linguistic data. Actually, there was only one terminal shared by researchers in Newcastle and Durham ever since 1969. It was called the *Michigan Terminal System* (MTS) and "brought a marked change" (Page, 1997) amidst the newly formed Newcastle Computer Science department. The TLS team intended to make use of the MTS when treating the data and this is where the first data analyses on the TLS were carried out in the late 1970s by Val Jones-Sargent (Jones-Sargent, 1983, p. 63) who completed her PhD in 1979.

[62] When analysing the SED data, Viereck remarked that the multiplicity of transcribers made comparison between dialects more challenging (Viereck, 1997).

The TLS researchers were not the only ones who anticipated the future use of computing for processing linguistic data. A year before Pellowe published his article on the TLS methodology, *the Maître Phonétique*, which had just been renamed *Journal of the International Phonetic Association*, comprised an editorial entitled "Future Phoneticians". The author, D. B. Fry highlighted the forthcoming hegemony of data analysis with computers amongst phoneticians:

> It would be very surprising if the future does not see … the widespread use of digital computers … For the phonetician it has the immense advantage that it can place the control of experimentation in his hands in return for a very small amount of learning (Fry, 1971, p. 9).

The new *Maître Phonétique* was now turned more towards future quantitative analyses than towards past qualitative methodologies. Similar issues were raised by French historians at the end of the 1960s, early 1970s. The use of computers for data analyses was gaining grounds in a wide array of research fields, which led one historian to declare in 1967 that "tomorrow's historian will either be a programmer or a historian no more" [translation mine] (Le Roy Ladurie, 1973, p. 14).[63] Computerised analyses of data and the shift from qualitative to quantitative was therefore not confined to dialectology but applied to all realms of the social sciences.

There remained a major check to such a technical advancement. Gerd Gigerenzer reminds us that: "[b]efore the advent of personal computers, researchers had little direct contact with the large mainframe computers, and for those who did, computers were a source of constant frustration". He refers to the *Centre for Cognitive Studies* at Harvard to illustrate

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[63] "l'historien de demain sera programmeur ou il ne sera plus."

his point: out of 83 hours of weekly use 56 were "spent on debugging and maintenance" (Gigerenzer, 2001, p. 4), so much so that a technical report of the Centre in 1966 was entitled "Programmanship, or how to be one-up on a computer without actually ripping out its wires" (Gigerenzer, 2001, p. 4). Similar issues were met at Newcastle. Students wrote their computer programs onto punch cards and the result of the analysis would only be ready only after an entire night of processing.[64]

Since the amount of data extracted from the TLS was considerable given the high number of variables and linguistic observations, it took a lot of time for the computer to process the TLS data, even for a sample of 52 speakers. In addition, the TLS had to be split into two main datasets to avoid crashes, i.e. the social and the phonetic data. The latter also had to be divided into 3 main datasets thereby separating the consonants, monophthongs, and diphthongs/NURSE/lettER vowels for three distinct analyses. This thwarted one of the original aims of the survey, which was to test how both the social and the linguistic data relate to one another. The present dissertation intends reach this original goal in analysing both datasets and aims at showing interactions between the social profile of the TLS speakers and variation in their speech.

Crunching linguistic data: the TLS coding scheme

In order to analyse the TLS data with a computer, Pellowe and colleagues proposed a 5-digit coding system for each variety of phonemes according to a precise hierarchical structure. The final coding list for each informant was based on the auditory analysis of

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[64] Gabriel Bergounioux, corpus linguist, PC 2016, Isabelle Cojan, agronomist, PC 2019.

trained linguists. It includes 3 strata ranging from a variety approaching standard Southern British English, called *non-localised* (NL) to *localised* regional and individual pronunciations in spontaneous speech, with both ends of the cline being schematised in Figure 3-8.

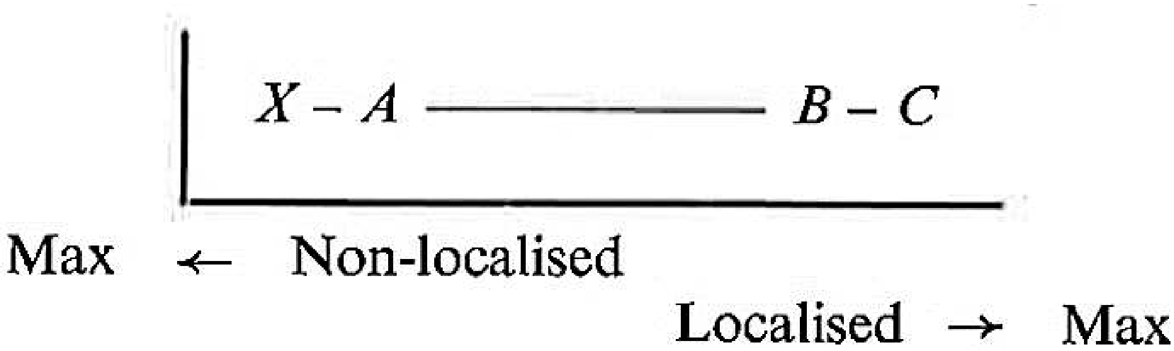


Figure 3-8 Pellowe et al.'s non-localised to localised cline for the TLS project (John Pellowe, Nixon, et al., 1972b, p. 1175).

The first *stratum* or *overall unit* (OU) is defined (1972a, p. 2) as an "arbitrarily chosen abstract phonological symbol which encapsulates the complete lexical set in which it occurs" and whose basis is RP. However, this unit is merely a categorical label whose function is to facilitate comparability. It was not meant to be used for the classification of the TLS phonetic data (John Pellowe, Nixon, Strang, et al., 1972, p. 21). Each OU is illustrated by a series of words called "lexical sets". The definition of the latter differs from that of Wells (J. C. Wells, 1982) in the sense that lexical sets correspond to the finite list of words that are pronounced like the RP based *overall unit*: "an, in principle, totally denumerable list of institutional words". In Wells, the term "lexical set" becomes a "concept" in English variation in which one fixed "keyword" for the whole set "is intended to be unmistakeable no matter what accent one says them in" (J. C. Wells, 1982, p. xviii).

The second stratum corresponds to regional variation and is called *putative diasystemic variation* (PDV) and comprises a *substratum*, namely, individual variation or state. Pellowe and colleague define the PDV as:

> a class of phonetic states which is sociolinguistically discriminable as a class from all other such classes, if any, within a particular overall unit; such that the range of differences of the numbers of lexical set and their composition, in the population at large, is adequately modelled. [The second part of this definition is an effective gloss for 'sociolinguistically discriminable'](John Pellowe, Nixon, et al., 1972a, p. 2).

This means that a PDV is a subcategory of phoneme realisation that corresponds or differs from the OU. From Wells' perspective this would mean more refined categories of lexical sets specifically adapted to one or more accents of English. The third *stratum* is called the state level. It is an even more fine-grained, yet "audibly discriminable" subcategory of phoneme realisation within PDV (John Pellowe, Nixon, et al., 1972a, p. 2).

Lexical set: wall, fork, port, paw, war, all, walk, auction, horse, more, sore, four, door, course... ... ...

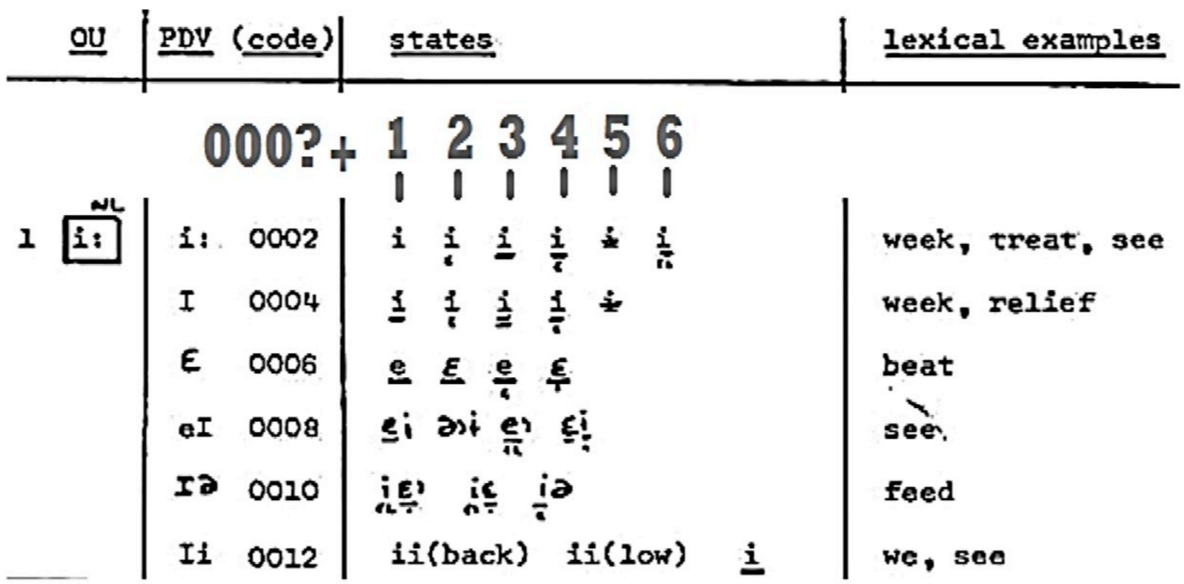
Overall Unit: [ɔ]

Putative diasystemic variants:

1.	(7 states)	ɑ	'fork, war'
2.	(5 states)	ɔ	'walk, wall'
3.	(5 states)	ɒ	'auction, horse'
4.	(3 states)	ɛ	'more, sore'
5.	(6 states)	ɪʊ	'four, more'
6.	(4 states)	ʊə	'door, course'

Figure 3-9 Illustration of the TLS coding scheme (John Pellowe, Nixon, et al., 1972a, p. 3).

So as to facilitate computer analysis of the data, each unit is associated with a numeric code. For instance, the 5 PDV of OU /iː/ are coded with even numbers only (fig. 3-2): 0002 /iː/, 0004 /ɪ/, 0006 /ɛ/, 0008 /eɪ/, 0010 /ɪə/ et 0012 /ɪi/. The states, corresponding to fine-grained transcriptions with diacritics, are identified by the final digit of the PDV code. The level of detail in the transcriptions reflected in diacritics is very much reminiscent of Ellis's own approach (A. J. Ellis, 1889). The variation /ɨ/ is therefore coded 00025. It has to be noted however, that the numbering of the states and PDVs is not an ordinal classification but a simple enumeration of the possibilities of pronunciations of an individual in spontaneous speech.



OU	PDV	(code)	states	lexical examples
		000?+	1 2 3 4 5 6	
1 i: (WL)	i:	0002	i i i i i i	week, treat, see
	I	0004	i i i i i	week, relief
	ɛ	0006	e ɛ e ɛ	beat
	eI	0008	ɛi əi eɪ ɛi	see
	Iə	0010	iɛ iɛ iə	feed
	Ii	0012	ii(back) ii(low) i	we, see

Figure 3-10 : TLS coding scheme: realization possibilities of the lexical set FLEECE (Wells 1982). Adapted from Jones-Sargent (1983, p. 295).

Jones-Sargent indicated that the encoding could have been improved by creating a fully hierarchical structure:

> The organisation of codes does not completely reflect the hierarchical nature of the segmental variables. If it did, the accumulation of state score could be efficiently managed … [and] the use of the PL/1 [programming language] structure could have been an effective programming tool (Jones-Sargent 1983, p. 69).

Jones-Sargent suggested an improvement in the encoding in which the first two digits would represent the overall unit, the following two digits, PDV and the last two, the *states* Figure 3-11. Such an arborescent structure would have facilitated the classification by the computer programme PL/1.

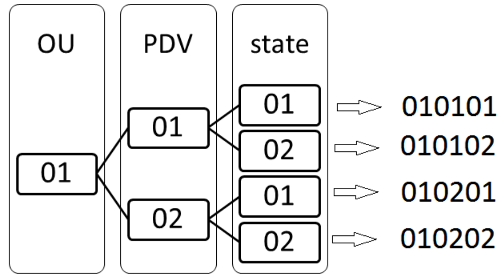


Figure 3-11 Proposition of optimisation of the TLS encoding with a truly hierarchical structure.

The approach above would not only have facilitated the treatment of phonetic data, it would also have enabled relationships between each stratum stand out. **But this did not prevent Jones-Sargent from providing results on the TLS using the scheme as such**. Today, a simple personal computer is enough to deal with such types of encoding despite a lack of hierarchical structure within the PDVs and OUs. Moisl & Maguire did manage to use the codes as such at the PDV level and showed that linguistic stratification was closely linked to the social status of the informants. They used hierarchical clustering based on the 5 digit codes but suggest that acoustic measurements would give more weight to the present results (Hermann L Moisl & Maguire, 2008, p. 68).

Ambitious projects can sometimes be slowed down by the technological limits of their time and the biggest check was the speed of computers. Moreover, the transcription and the encoding of the recording represented great human cost and despite her great interest for the TSL, sociolinguist Milroy deplores that "the very punctiliousness of the Tyneside Linguistic Survey researchers ha[d] led to an imbalance in favour of methodology and theory and a relative weakness on results" (L. Milroy, 1984, p. 207). Milroy's conclusions were probably somewhat hasty since several publications of the results had just been published (seeJones-Sargent, 1983; V. Jones, 1978; John Pellowe & Jones, 1978).

3.2.8 Variation in auditory transcriptions of the files: blessing or curse?

It was the fieldworker himself, Vince McNeany, who was allotted the task of coding the first 10 minutes of each TLSG audio file by hand. Having only one transcriber would prevent issues that the SED encountered, namely, high variation among transcribers – Orton was collaborating with a certain number of co-editors and the phonetic encoding was often given to students who had not always received professional training. This further increased incoherence in the transcriptions and the encoding (Viereck, 1997, p. 80). Nonetheless, a preliminary study by Pellowe, Nixon and McNeany (John Pellowe, Nixon, et al., 1972b) shows that one should consider variability among transcribers of phonetic data a necessary evil rather than a "sad conclusion":

> Ringaard's 'sad conclusion' (1965) that the transcriptions of the phoneticians do not tell us so much about the speech of the locations in which they are working as about the speech of the phoneticians themselves, is only half the truth and **not necessarily** sad anyway. . . . Phonetic transcriptions CANNOT in this sense be true or invariant (John Pellowe, Nixon, et al., 1972b, pp. 1175, 1177).

He added that variation among transcriptions by multiple phoneticians should be included within the model analysing speech variation: "if they are incorporated in research findings in a dynamic fashion, as incorporated here, their topological deformations can contribute further information which can only improve the ultimate inferences" (John Pellowe, Nixon, et al., 1972b, p. 1177). So as to reach the aims of the original TLS team in the present thesis, I shall resort to a statistical technique called *Multiple Factor Analysis* (MFA).

This approach is often used for product rating because it is designed to include rater variation within multivariate models (I shall discuss this approach in more detail in chapter 4 and 7).

3.2.9 TLS 2013: re-interviewing the same informants

More recently, 71 people suspected of having participated in the TLS were sent invitation letters to be re-interviewed after "intensive research in publicly available demographic data" (Buchstaller et al., 2017, p. 10). 6 agreed. Both the 1970s & 2013 interviews were carried out by Newcastle University employees with a pan-northern accent – Vince McNeany and Adam Mearns respectively. Buchstaller and colleagues indicate that while McNeany was in his early 20s at the time of the 1970s interviews, an older speaker was chosen for the 2013 interviews because they "tried to capture the advancing age of the second panel sample" (Buchstaller et al., 2017, p. 27) – Adam Mearns was in his early 40s.

For TLS 2013, the recording conditions and the questions asked to the informants tried to match the original TLS protocols. Based on the social-demographic characteristics of the 6 TLS 2013 informants, I managed to identify them in the TLS metadata file to get their informant ID (Table 3-3). Two speakers Aidan and Fred are social risers and incarnate the shift from traditional manufacturing to an 'eds and meds' economy (Buchstaller et al., 2017, p. 11). Rob and Edith are more socially stable, the former embodying what is left of the traditional manufactures in Newcastle. In the 1970s interview, Nelly represents the 60% of Newcastle women who did not have a professional occupation.[65] Anne is an upward moving

[65] *A Vision of Britain through Time: Female activity rate in Newcastle-Upon-Tyne*. Retrieved from http://www.visionofbritain.org.uk/unit/10142714/rate/CENSUS_FEM_ACTIVE . Accessed 25th March 2019.

working-class since she was promoted to a supervisory rank within her line of work. Fred is also seen as socially mobile since he moves from a student teacher to a full-time teacher endorsing the social responsibilities that are implied by this occupation (Sieber, 1969).

Table 3-3 Socio-demographic information of the TLS 2013 panel sample compared with TLS 1970s. IDs in parentheses are those used in the present thesis. First names are fake names to preserve the participant's anonymity. Adapted from Buchstaller (2017, p. 11).

	1971		2013	
Speaker	**Age**	**Occupation**	**Age**	**Occupation**
Rob (G12M)	**23**	Engraver	**64**	Engraver
Edith (G35F)	**32**	Co-op salesperson, house help	**74**	Retired house help
Aidan	**25**	Welder, starting lecturer	**66**	Retired community college lecturer (**upward** mobility)
Fred (G20M)	**21**	Clerk, student teacher	**63**	Retired religious education teacher (**upward** mobility)
Anne (G15F)	**23**	Seamstress	**64**	Retired seamstress (supervisionary)
Nelly (G05F)	**29**	Nursery nurse / housewife	**71**	Retired housewife

In sum, the TLS is a cornerstone, albeit a long forgotten one, of sociolinguistics in Britain. The complexity of its various phases of interviews, of its coding scheme may seem off-putting at first, but the density of sociolinguistic information captured in this corpus is probably what motivated this thesis in the first place and what led researchers to revive it through the DECTE and to re-interview past participants in 2013. I now move on to describe the second corpus analysed in this thesis (PVC). Since it has been described in depth in other works (J. Milroy, L. Milroy, & G. J. Docherty, 1997; J. Milroy et al., 1994; Watt, 1998, 2000, 2002; Watt & Tillotson, 1999), I only provide a brief description of it.

3.3 1990s: the PVC main actors, methods, and protocol

Recordings were gathered for the Phonological Variation and Change in Contemporary Spoken English project by Gerry Docherty, Paul Foulkes, Jim Milroy, Lesley Milroy, Penny Oxley, David Walshaw, and Dominic Watt. In total, 32 people were recorded by Penny Oxley in June 1994. She also wrote a fieldwork report providing information on how the informants were selected, on their lives and social profiles and how interviews went (Oxley, 1994). Similarly to the TLS projects, informants were selected according to their social and educational backgrounds and the recordings took place in their home. Four social variables were taken into account: speaker sex, speaker age, social class, and speaking style. This time, the interviewer played a different role and I shall call her an *effaced interviewer.* The idea of *effacement* among fieldworkers is mostly found in anthropological work (Addi & Obadia, 2010, p. 101; Palriwala, 2005, p. 152). The PVC interviewer sat in a remote corner of the room while two informants were being recorded for approximately an hour. Her only role was to reignite the conversation between the informants if it was to die out:

> They [the informants] were given to understand that there would be little input or interference from the fieldworker, but on a number of occasions it was necessary for the fieldworker to intervene when the conversation appeared to flag; she asked one or both of the informants

> direct questions in the expectation that this would prompt the conversational partners to resume their interaction (Watt, 1998, p. 132).

This was intended to reduce the *interviewer effect* as the higher degree of intimacy between the two locals would lead to a more authentic speech production than if an unknown interviewer with a higher level of education talked to an informant. By *interviewer effect* is meant "the characteristics and behaviour of the interviewer [which] can be hugely important factors affecting the answers that respondents give" (Kirby et al., 2000, p. 355). The informant is likely to adapt his pronunciation and adapt his *lexis*, hence skewing the results. This is what Labov called the *Observer's paradox* (Labov, 1972, p. 209). Therefore, as Watt pointed out, the asset of the PVC files is its "naturalness". Namely, "the fact that the fieldworker, a local, exploited a set of second-order network contacts ('friends of friends') and made no attempt to 'interview' the informants as such, has resulted in a set of recordings which provide a reliable insight into the ways in which TE is developing in the 1990s" (Watt, 1998, p. 128). At the end of the interview however, the informants were provided with a list of words to read aloud. Both had to read the same list.

The recordings were made using small cassette tapes that were then converted into both mp3 and wav files. A Sony professional-quality DAT recorder with a Sennheiser microphone was placed facing the informants as shown in Figure 3-12.

Figure 3-12 Example of a Sony DAT recorder in the 90s.

Orthographic transcripts were then made. The following excerpt of the PVC 01 gives an account of what was being read at the end of the recordings:

> **Informant:** sheet beetle metre I beat it gate paint fatal later hate it eighty eight bet bent felt fettle better I met him hat ant battle batter drat it cart can't carter pot potter bottle font salt I got it caught daughter chortle haunt I bought it boat total motor […] go boot brood booze brew out loud cow sight side size sigh sighed knife five knives dive dial Friday diary […] I've got to do it tomorrow […] I had to put it off […] he's put in a bid jump up on the tractor he won't do that in a hurry put a comma in it (DECTE corpus PVC01)

As we notice in the excerpt, the wordlist was devised so that a sufficient number of monophthongs and diphthongs within different phonological environments is included, namely, preceded and/or followed by fricatives, stops or nasals. Items that are being read are not confined to isolated words and among them are utterances such as “I beat it”, “I bought it” or “I’ve got to do it tomorrow”. The variety of the data present in the wordlist aimed at giving enough material for research thus triggering a wide array of studies in the future based on the PVC corpus.

The corpus is slightly unbalanced regarding the proportion of younger and older speakers. It comprises 16 older speakers (7 women against 9 men) and 18 younger speakers with 11 women and 7 men. The majority of the youngsters have gone beyond GCSE, i.e. 16 youths out of 20, and the trend is the reverse amongst the older speakers with only one having had a college degree who was then a housewife, but had formerly been a physics teacher.

The first results were published in the form of a thesis (Watt 1998) and were mainly based on **auditory analyses**, which involve concentrating on the "proprioceptive (tactile and kinaesthetic) sensations associated with producing speech" to transcribe fine-grained subtleties of speech (Hayward, 2000, p. 4). This requires a long training period on the part of the transcriber, similar to the one received by McNeany in the early 1970s for the TLS. In a personal communication (14th August 2018), Dominic Watt indicated that spectrographic representations of speech were already available at York University but using them processing several dozens of vowels per speaker took a very long time. For instance, duration of a vowel on a printed spectrogram had to be physically measured with the help of a ruler and a pen. Hand-made transcriptions were therefore much more timesaving.

3.4 2000s-20??: The birth of the NECTE / DECTE corpus

DECTE is part of a collaborative programme called the "Enhanced Repository for Language and Literature Researchers" (ENROLLER), completed in 2011. Thanks to this programme, the DECTE is linked to documents such as the Oxford English Dictionary (OED), the Historical Thesaurus of the OED, and the SCOTS Corpus (Corrigan, 2012, p. 90). The DECTE project was funded by the Arts and Humanities Research Council.[66]

[66] Grant number: AH/H037691/1.

DECTE (Corrigan et al., 2012) is composed of NECTE, the *Newcastle Electronic Corpus of Tyneside English* (Allen et al., 2007; Corrigan, Moisl, & Beal, 2005) and NECTE2. The original intention of NECTE was to "improve access to and promote the re-use of Tyneside recordings from the twentieth century" initially targeting researchers in phonetics/phonology more than the general public (Beal et al., 2014). NECTE encompasses half a century of spoken data on Tyneside with sound files, transcriptions, POS-tagging and phonetic encoding along with metadata. It is composed of the PVC and the TLS (Figure 1-12).

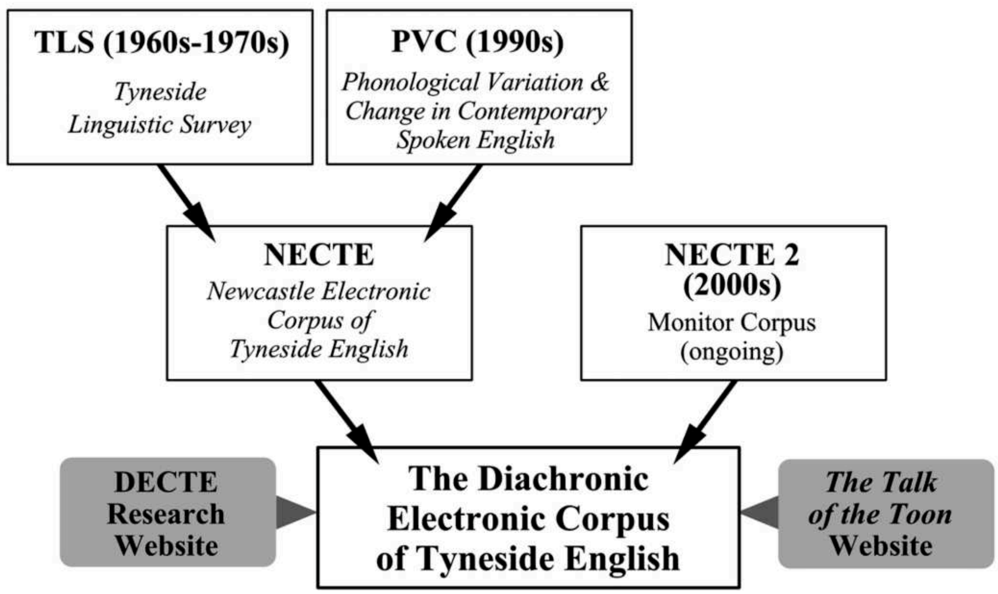


Figure 3-13 The constituent elements of DECTE (http://research.ncl.ac.uk/decte). From (Corrigan et al., 2014, p. 117).

The last part of DECTE is called NECTE2 (2007 to present) is a monitor corpus with files being regularly added. With NECTE2, the geographic reach has spread "beyond the core Tyneside region" (A. Mearns et al., 2016, p. 179) with speakers from other areas of the North-East. The sample of informants includes speakers from a wider range of demographic groups with more fieldworkers involved. Every year undergraduate and postgraduate students from the University of Newcastle are encouraged to participate in the project and to conduct interviews. DECTE has become an "open-ended enterprise" (A. Mearns et al., 2016, p. 180).

In the present section, I only address the issues regarding the phonetic coding of the TLS data but for more details about the orthographic transcriptions and the POS-tagging please read Beal et al. (2014) and Mearns et al. (2016). There are no phonetic transcriptions for the PVC because after "consultation with both the original PVC and with other (socio-)phoneticians" the NECTE team was "encouraged not to provide full sets of transcripts for all the interviews". One of the reasons was that "end users with a phonetics/phonological orientation will generally prefer to undertake their own transcriptions" (Beal et al., 2014, p. 4; Kerswill & Wright, 1990). Regarding the TLS, transcriptions were originally hand-written on index cards and then sent to typists. The first line of the card was the orthographic spelling. The phonetic transcription using a 5-digit coding was written on several lines. Generally, the first line coded the consonants and the second, the vowels. The electronic files were then proofread for accuracy based on the original index cards (Beal et al., 2014, p. 7). So far not all the index cards have been matched with their corresponding audio files.

So as to transform the surveys into a conventional corpus of spoken data, the NECTE research team chose to avail of CLAWS 4 (and more recently, CLAWS 7),[67] a part of speech tagger also used for the British National Corpus. This type of tagging is however not so well adapted to a spoken corpus since it was initially created to deal with written data (Valli &

[67] Constituent Likelihood Automatic Word-tagging System.

Véronis, 1999, p. 3) even though a more recent version of CLAWS was better adapted to speech data (Leech, Garside, & Bryant, 1994, p. 624). For this, XML or extensible mark-up language was deemed the most suitable and most durable language (Allen et al., 2007). The researchers' intuition was indeed sound since, computer scientists themselves had stated a year before that "XML has the advantage of being human-readable" (Alexandrov, van Albada, Sloot, & Dongarra, 2006, p. 381)[68] and it is still widely used today. It has the advantage of being "independent both of the specific characteristics of the computer platforms on which they reside (Macintosh versus Windows, for example), and of the software applications used to interpret them" (Allen et al., 2007, p. 33). Its transferability with respect to other formats and programs that are frequently used in linguistics such as ELAN or CHAT makes it favoured by linguists (Gries & Berez, 2017, p. 393). For instance, the French linguist Christophe Parisse transferred the XML encoding into Praat *via* CHAT. Such a transfer is vital since it considerably speeds up the process of acoustic data extraction (Parisse & Majdoub, 2019).[69]

The current dissemination strategies by the DECTE team have led to the creation of another website called the *Talk of the Toon* which targets the general public (A. Mearns et al., 2016). The collected stories from the linguistic interviews are arranged by topic, i.e. family, the war, shopping, life at school etc. Each recording becomes an *ethnotexte* (Joutard, 1980), that is to say, an oral text spoken by and for members of the same community also referred to as "archive vivante de la parole" (a living speech archive, Joutard 1980, p. 180). The

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[68] The same statement can also be found in Griez & Berez (2017, p. 393)

[69] The web application TEICONVERT by Parisse and Majdoub, which provides free online conversions of various formats for speech data, can be found here: http://ct3.ortolang.fr/teiconvert/index-en.html (Accessed 14/08/2019).

community of speakers is thereby given the opportunity to become actors of their own linguistic history thus enhancing enregisterment (Agha, 2003; Beal, 2009) amongst TE speakers, namely, processes through which a linguistic repertoire becomes differentiable within a language as a socially recognized register of forms. As Johnstone et al. put it regarding Pittsburgh English, Geordie English has also become a sign of "authentic local identity and can be used to project localness" (Johnstone, Andrus, & E, 2006) and the *Talk of the Toon* website is both a means and an end towards the expression of "Teynseyde" English.

3.5 Theoretical framework of the present thesis: intersectionality theories and aggregate approaches

The present thesis draws on the work of two major theoretical frameworks in language variation and change (LVC): intersectionality theories and aggregate-based approaches. These two frameworks require similar methodological approaches with regard to LVC data, such as multivariate approaches and are in line with the original framework and methodology of the TLS. This section is an account of the double frameworks upon which this thesis is based.

3.5.1 Intersectionality theories

Early variationist studies often rely on the analysis of three main social factors, which are class, age and gender (Labov, 1966b; J. Milroy, 1996; Trudgill, 1972), with studies paying more particular attention on the intersection of one factor with another, also known as *interactionality* or *intersectionality* (Labov, 1990).[70] In the PVC corpus, Watt remarks that young MC men, mostly 6th formers[71], converge with more traditional WC pronunciations in GOAT ([ɵː]), while older MC women have a very opposite strategy of using [oʊ], especially when reading a wordlist. Hence gender, class and age interact to produce sociolinguistic groups with distinct variational patterns.

The work by Milroy (1987; Milroy 1992), led variationists to take on a new tack. The density of a network a speaker has, was shown to have an impact on his/her variation variational patterns, thus facilitating or inhibiting language change. Depending on the nature of their network, speakers may be in contact with other varieties of English, which, in turn may affect their speech. Dialect contact was also found to be crucial in modelling theories of linguistic change. The foundations of this theoretical model are found in Trudgill, who defines dialect contact as a possible way of explaining "those changes that take place during or as a consequence of contacts between closely related varieties of a language" (Trudgill, 1986, p. vii). In a context where the diffusion of standard forms through TV and radio broadcasting were deemed directly responsible for language change and more dramatically, to use the words of Orton himself for the "eleventh hour" of dialects[72] (Willis, 1953), Trudgill advocated that accommodation and levelling was more the result of face-to-face interaction than that of

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[70] The term *intersectionality*, is said to have been coined by Crenshaw (1989) who studied the social stratification of ethnic minorities, with a particular focus on the interactional affects of gender and race.

[71] The 6th form corresponds to the last two years of a French *Lycée*, i.e. *première* (year 12) and *terminale* (year 13).

[72] "Harold Orton often told us that it was the eleventh hour, that dialect was rapidly disappearing, and that this [the Survey of English Dialects] was a last-minute exercise to scoop out the last remaining vestige of dialect before it died out under the pressures of modern movement and communication." (S. Ellis, 1992, p. 7)

the media.[73] The original TLS questionnaire to gather social data from the informants also included a series of questions to test the impact of the media on the latter's speech. This, however, will not be dealt with in the present thesis, with the social variables being limited to class, age, gender and education.

More recently, an emerging research agenda has been to identify links between dialect contact and various kinds of mobility (L. Milroy & Gordon, 2003) in understanding the ideological consequences of mobility and dialect contact that lead to speakers repositioning themselves in social-psychological space using linguistic variation. Such repositioning may symbolise particular orientations to real or perceived notions of affiliated and opposing groups (Stuart-Smith, Timmins, & Tweedie, 2007). The present thesis touches on some of these issues when analysing some speakers in more detail.

3.5.2 Aggregate vs. feature-based approaches

Many studies tend to choose a limited amount of linguistic features to build sociolinguistic distinctions among speakers. The features ranged from one, which is known as "feature-based orientation" (Corrigan et al., 2014) to a modest combination of them (Watt 1998). A lot of studies on the DECTE have been single-features studies such as the investigation of relativization in TE (Beal & Corrigan, 2007, 2011), variation in FACE across the life-span of TE speakers (Buchstaller et al., 2017) or variational patterns in the use of intensifiers (Barnfield & Buchstaller, 2009), vowel variation in PRICE in the PVC (J. Milroy,

[73] For a recent analysis of the impact of the media on variation see Stuart-Smith (2007)

1996) and glottalisation (J. Milroy et al., 1994). Several reasons may have led researchers to limit themselves to single-feature based analyses: (1) it is much easier to make sense of variation patterns, and requires less complex statistical tools, (2) space and time allotted per researcher in articles and conferences often precludes in-depth analyses. Key-note speakers however, are often allowed more time and in certain university departments in the Arts and Humanities, longer PhD with more than 80,000 are tolerated.[74] Apart from these two main exceptions, single feature analyses appear much more feasible given the time and space limitations.

More recent studies like that of Corrigan and colleagues (Corrigan et al., 2014) now draw on the work of dialectometrists (Nerbonne, 2006; Nerbonne, Wieling, & Watt, 2018; Wieling et al., 2013) who tend to have an aggregate approach of variation, also identified as *coherence* analysis in LVC. They argue that a bottom-up approach which includes as many features as possible will provide a more accurate picture of the features with regard to one another. Corrigan and colleagues (Corrigan et al., 2014) take the example of the use of the adverb *real* in TE which seems at odds with other adverbs in terms of patterning when they are examined without the broader context of a vast array of features present in the dialect. It is possible that certain apparent inconsistencies within a feature may appear as minor or as "white noise" once the researcher zooms out on the dialect. As Corrigan and colleagues put it "'white noise' refers to the missing data, exceptions and conflicting tendencies which arise, and which we are all familiar with from single-feature methodologies" (2014, p. 126). The

[74] See for instance the requirements of the University of Leister by thesis type and field: https://www2.le.ac.uk/departments/doctoralcollege/zone/final-stage/word-limits (Accessed 14/08/2019).

present thesis draws on a theoretical framework in favour of aggregate analyses to endeavour to see “the wood [or forest] for the trees” (Szmrecsanyi & Kortmann, 2009), since the TLS was originally designed along these lines thought.

CHAPTER 4 Methodological literature review: the use of PCA/MCA & MFA in sociolinguistics and dialectology

Summary of CHAPTER 4

This chapter is a literature review on the methodological framework on which this thesis draws. I present the origins of Multiple factor analysis (henceforth MFA (Escofier & Pagès, 2008)) and show how earlier forms of MFA have been used by variationists and dialectologists alike to find main determinants of speech across social groups (Horvath, 1985; Labov, 2001; Poplack, 1979; Stuart-Smith et al., 2007) or across geographically distinct varieties of a language (Foumio Inoue & Kasai, 1989; Nerbonne, 2006). This is often referred to as *aggregate variation* (Nerbonne et al., 2018) or *coherence* in variation (Guy, 2013) as opposed the more traditional *single-feature* approach (Corrigan et al., 2014). The *aggregate* approach contributes to identifying which phonetic variants co-occur in a variety and whether this relates to some form of indexicality or more subtle forms of interactionality. This approach is very much in line with the original data-driven aim of the TLS project since it can analyse a vast amount of sociolinguistic features at the same time, in order to find which features are determinant in finding sociolects and which speakers sand out from the crowd. MFA helps reduce the dimensionality of complex datasets by showing bigger trends in the data when doing descriptive statistics on the data. It can be used as a preliminary step to cluster analysis. It is similar to Principal Component Analysis (PCA), Correspondence Analysis & Multiple Correspondence Analysis (MCA) but it is strongly recommended to use MFA when analysing the production of many linguistic features that fall into sub-categories, which better mirror the hierarchical relationship lexical sets have with their multiple reflexes. MFA can be coupled with a cluster analysis, which helps bring to the fore, not only the overall importance of linguistic features, e.g. lexical sets, but also how the variants of these features, combined with social characteristics, determine the identification of speaker groups.

4.1 Introduction: from a single-feature to an aggregate sociolinguistic analysis of variation

The original aim in dealing with the TLS was to consider informants as complex individuals loosely pertaining to sociolinguistic classes which are in many ways, *amorphous* (Jones-Sargent 1983) in a similar way to Camin's Caminalcules (Sokal, 1966) found in figure 3-1. As Jones-Sargent pointed out, the clustering methods she used did not take into account the hierarchical structure of the 5 digit coding and considered each state as an independent variable without taking into account the dependency within the lexical set.

This chapter presents a way to address this limitation and deals with Multiple factor analysis, henceforth MFA (Escofier & Pagès, 2008). It explains how it may be useful when carrying out a linguistic analysis. This approach is very much in line with the original aim of the TLS project since it can analyse a vast amount of sociolinguistic features at the same time, be they categorical or numeric, find which feature are determinant in finding sociolects and which speakers sand out from the crowd. MFA helps reduce the dimensionality of complex datasets by showing bigger trends in the data when doing descriptive statistics on the data. It can be used as a preliminary step to cluster analysis. It is similar to Principal Component Analysis (PCA), Correspondence Analysis & Multiple Correspondence Analysis (MCA) but it is **strongly recommended to use MFA when analysing the production of many linguistic features that fall into sub-categories**, e.g. vowel variants within several lexical sets.

To my knowledge, MFA has not yet been used in sociolinguistics and dialectometry. MCA has long been used in sociology and as early as the 1970s by French sociolinguists Coquin-Viennot & Esperet (1977), while PCA is common in the Japanese school of dialectometry (Foumio Inoue, 1986b; Fumio Inoue & Kasai, 1982; Foumio Inoue & Kasai, 1989). More recently, it has been used by several American and European linguists such as Labov (2001), Nerbonne (2006), Shackleton (2005, 2007, 2010), Moisl (Hermann L Moisl, 2012) and Turton (Turton, 2017), to name but a few.

I first define PCA and MCA that are widespread in research papers, present certain linguistic studies that have used PCA and MCA and guide the reader through the interpretation of results. Then, light is shed on the lack of flexibility and adaptability of PCA and MCA when applied to sociolinguistic data. Secondly, the MFA approach is defined. It is a method that draws both on PCA and MCA computations. The advantages MFA provides to the field of sociolinguistics are listed, along with an explanation on how to interpret results from this approach.

4.2 PCA and MCA in variationist studies and change and why MFA is better suited for LVC

4.2.1 Multiple Correspondence Analysis (MCA): a general overview

MCA is sometimes seen as an “extension” to Correspondence Analysis. It is a useful tool in descriptive statistics when the dataset comprises nominal data, and more specifically, when there are more than three variables. Although there are subtle but important other differences between the two methods, CA can accept only two dimensions while MCA can accept a table with more than two dimensions (Husson, Lê, & Pagès, 2011, p. xii & p. 132).

As Robert W. Schrauf puts it, MCA is an asset for linguists with complex datasets because it “facilitates the analysis of the inter-relation of variables, attending to the quality and strength of association between them" (Schrauf, 2013, p. 24). MCA in the social sciences is often associated with the work of Pierre Bourdieu at the end of the 1970s (1984). But what inspired Bourdieu the most, was the work developed by Jean-Paul Benzécri in the mid-1960s[75] (Benzécri, 1968, 1973; 1981 applied to linguistics; 1992 for a translation into English). Benzécri had applied the method to linguistics as well – the formula was then improved by Greenacre (1984, 1993). Benzécri's early works were closely related to linguistic data analysis, which created a bridge between statistics and the social/linguistic sciences. In an article on programming in 1967, he explicitly states that part of the programming methodology he presents is for the purpose of computerized linguistic data analysis (Benzécri, 1964, p. 32). Also, with the help of about 30 collaborators, he published an entire volume on MCA and how it may be applied to linguistic data (Benzécri, 1981). In France, this volume paved the way to a large number of studies on written corpora using MCA which were often published in *Les Cahiers de l'analyse des données* [the Data Analysis Workbooks] (Baudoin, 2016, p. 3; Brunet, 2014).

MCA can be used as an efficient preliminary step to cluster analysis, since it reduces the dimensionality of a dataset into a limited amount of factors. From a geometric point of view, i.e. when represented visually, these factors are called dimensions. The cluster analysis is therefore more easily interpretable. To historians Lemercier and Zalc (2008), MCA

[75] During the summer of 1965, Benzécri travelled to the United-States and presented correspondence analysis to *Bell Labs* but the expected success turned into failure, which gradually alienated him from contemporary Anglo-Saxon scholars (Armatte, 2008, p. 6). His work fell into oblivion and is still very little known outside France.

presents the advantage of making unobtrusive patterns stand out more clearly from large sets of qualitative data:

> L'analyse des correspondances multiples apparaît avant tout comme un outil d'exploration de corpus touffus permettant d'en repérer les **traits saillants**, un moyen de faire émerger des motifs d'un **magma de données**, même si ce n'est pas son seul usage possible.[76] (Lemercier & Zalc, 2008, p. 59)

MCA is therefore an efficient tool to summarize a set of data and to find general trends. Its visualisation maps, also known as factor maps, are also much more appealing than long output tables. Distances between levels of variables, such as the choice of vowel variants within a lexical set can be mapped on a plot. Distances between individual speakers can be mapped too.

4.2.2 Some limitations with regards to MCA and other similar approaches

MCA and other similar approaches are not devoid of limitations. The models can be quite sensitive to the amount of variables and levels that are included in it. The researcher has to know his data quite well to be able to interpret the results unless MCA is used for highlighting general trends only. Writing about MCA applied to historical data, Lemercier & Zalc remind the reader that these methodologies, viz. MCA, PCA, etc., can never perfectly reflect the structure of a true reality. The results are highly dependent on the inclusion or

[76] "Although this is not its only possible usage, multiple correspondence analysis is first and foremost, a tool for large corpus exploration. It helps spot out general tends and is a means to make patterns stand out from informationally dense datasets." (Lemercier & Zalc, 2008, p. 59; translation mine).

exclusion of variables and on the way variable levels were coded by the researcher in the dataset (Lemercier & Zalc, 2008, p. 65).

In the field of linguistic research, the approach has often failed to become as widespread as regression analysis. A programme called VARBRUL[77] (Cedergren & Sankoff, 1974; Sankoff, 1975) was created to help sociolinguists perform logistic or multinomial regressions so as to investigate what influences choice of a particular variant within a linguistic feature. Because vast amounts of variables may be included in an MCA model, interpretation is less easy than the traditional "stargazing" (Vuong, Ho, & La, 2019), which consists in over relying on p-values only when inspecting a model. In addition, regression models help shape one's research question in a particularly straightforward way, whereas MCA, PCA, MFA can drown you into this "magma" of information despite its initial aim to make general trends stand out if one does not remain focused on answering precise research questions. The more subtle task is also to **delve deep enough into the interpretation of the results and go beyond the general trends** to uncover linguistic patterns that have not yet been reported fully enough.

One final limitation which concerns MCA more specifically, is that it can only deal with categorical data, which excludes the use of acoustic values in a sociophonetic analysis (Shackleton, 2005) or of the Levenshtein scale to measuring pronunciation differences across dialects (Heeringa, 2004). However, variationist research involving the study of transcribed variants of a linguistic feature can be analysed with MCA, despite its impossibility to take the

[77] VARBRUL stands for **Var**ia**b**le **rul**e. The equivalent package in R is called *Rbrul* (Ezra Johnson, 2009).

hierarchical relationship a feature has with its own reflexes. After having listed the pros and cons of MCA, I now explain how to build a set of data in view of a sociolinguistic analysis and interpret results.

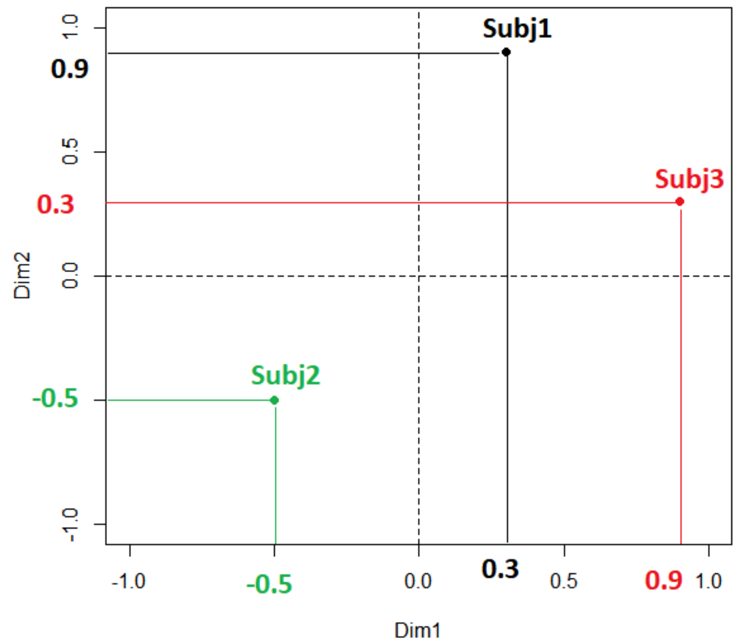
How to build a dataset for an MCA analysis and interpret its visual outputs

Regarding data configuration, there should be only one speaker per row, and what characterises the speaker is placed in different columns as shown in Table 4-1.

Table 4-1 Example of a dataset configuration when using MCA.

Speaker	FACE	GOAT	PRICE	Gender	Class
AF	[eː]	[o]	[eɪ]	F	WC
AF	[eː]	[o]	[aɪ]	F	WC
CM	[eɪ]	[oʊ]	[aɪ]	M	MC
...					

Once the table is created, the counts for each variant are computed by the analysis. Each speaker is attributed a row profile. Chi-square distances are calculated among rows and each speaker is given a set of coordinates based on the degree to which they follow a particular trend summarised by the factors/dimensions. **One factor** allots **one coordinate** per individual. These coordinates of each individual are placed on a **factor map** that usually displays **two factors**(i.e., two axes, cf. Figure 4-1). **The individuals are then placed on the factor map based on two coordinates** (one per factor). This is very similar to the creation of a geographical map using latitude and longitude. Factor maps can also be plotted with a third axis, which makes a 3D plot.



	Dim1	Dim2
Subj1	0.3	0.9
Subj2	-0.5	-0.5
Subj3	0.9	0.3

Figure 4-1 Example of how a factor map of individuals (Subj) is drawn from CA loadings on the factors, *aka* Dim).

Let us take a simple example with two qualitative variables (questions 1 & 2) and two levels each (yes/no). In Figure 4-1 are plotted 3 individuals. Subj 1 is better defined by the characteristics of factor 2, and Subj 3, factor 1. Subj 2 is negatively defined by factors 1 and 2 and it is necessary to investigate which other factors best represent him/her. When a large group of individuals share the same characteristics, they represent a certain trend in the data and their coordinates will be closer to where both axes cross. A *trend* is first defined by the average profile of individuals in the data, which is where the axes cross. But looking at it from another perspective one can say that what makes the trend in itself is also how far certain individuals are scattered on either side of the origin. The latter are the atypical speaker and they are just as important in a sociolinguistic study as the speakers following the general trends.

To illustrate this point, here is one of Benzécri's handbook examples (Benzécri, 1992, p. 126) on how to apply CA to questionnaire data (Figure 4-2). The questionnaire comprised two questions answered by 12 participants. Half of the participants answered yes to both questions. As to the remaining answer possibilities (yes/no, no/no and no/yes) there are only 2 participants per answer type. Since the 6 participants who replied yes to both questions are more numerous, they will be placed closer to the crossing of both axes because they represent the general trend. Subjects that are not characterised by this trend are usually found closer to the extremities of one or both axes.

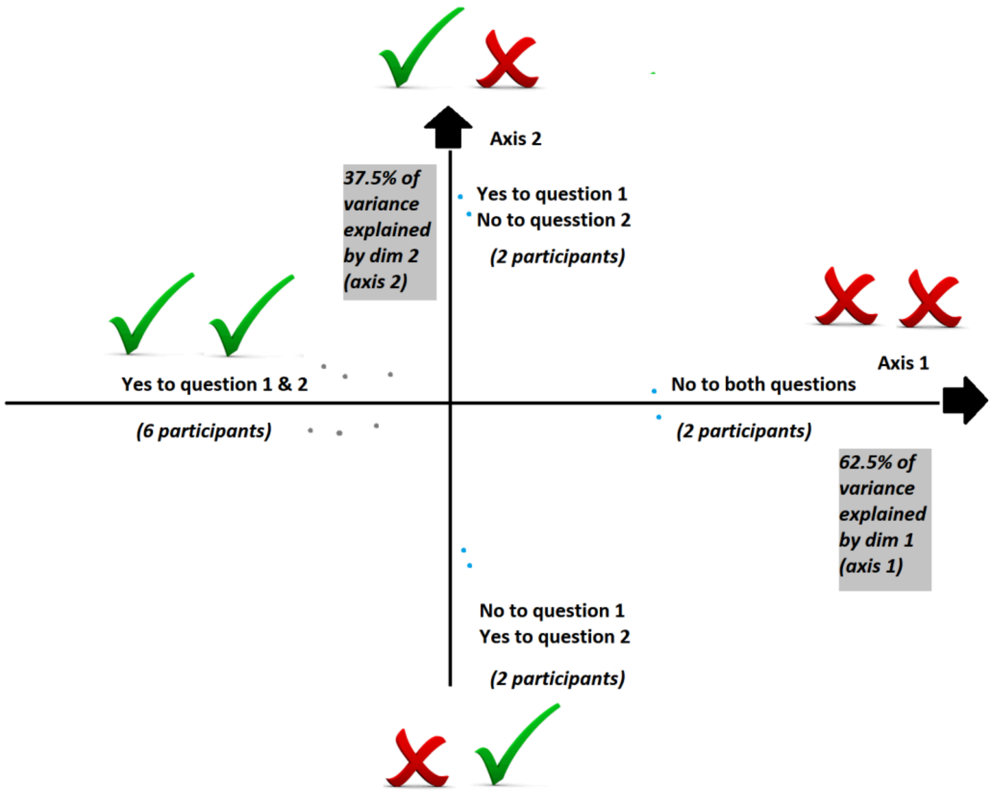


Figure 4-2 Benzécri's factor map showing results from a questionnaire with 2 yes/no questions answered by 12 participants (adapted from Benzécri, 1992, p. 126).

Outputs of the analysis are called loadings and answer several questions regarding data. They inform us on:

1) The proportion of **explained variance** in the data, viz., how well a set of factors help explain different trends in the data.

2) Which **group of variable levels** (e.g., types of food or linguistic variants) in particular help define the various profiles of individuals in the sample?

3) Which dimensions cumulatively give the highest explained variance?

4) Which **groups of speakers** can be found in the data and what characterises each group?

5) Which individuals best characterise the group they are in, and which have more atypical profiles?

The above information given by an MCA is clearly useful for anyone interested in group vs. individual dynamics and in what constitutes trends in datasets that comprise three or more linguistic features. The next section is a more recent illustration of an example of an MCA factor map used in the social sciences, which was published in the late 1970s. The MCA factor map provided such a straightforward visualisation of complex social paradigms that it subsequently paved the way to an extensive use of it in the field.

4.2.3 A famous example of MCA in the social sciences: Bourdieu's Food Space chart, inspired by Benzécri pioneer work on MCA

In order to give you a more precise idea of how MCA works, I shall use an example that made this statistical approach widespread in the social sciences after sociologist Pierre Bourdieu published a schematised version of it (Bourdieu, 1979; 1984 translation into English). The latter examines food choices based on people's income and cultural background. It is now known as Bourdieu's Food Space chart.

Figure 4-3 is an updated illustration of Bourdieu's own schematized factor map (1984, p. 186) published in the journal *Gastronomica* (M. Watson, 2012). It corresponds to a "tell me what you eat and drink and I'll tell you who you are" statement. Both axes represent major factors influencing people's food habits: the income of the participants (*economic capital*) and their cultural education (*cultural capital*). On either side of each axis, are plotted food products usually favoured by participants. We notice that certain types of food are characteristic of a particular socio-economic group. On the picture, we see that people with higher income tend to favour expensive food and drinks like wine or truffle oil, while participants with lower income are more inclined to buy cheap fast food such as chips. But when participants have higher scores of *cultural capital*, they tend to indulge more on heritage food or slow food and less towards quick microwaveable products.

In this modernised food space chart (Figure 4-3) the two axes represent two consumer types each. Consumers with no marked preferences for one type or another are generally at the centre of the chart while participants with a very marked consuming habit are at the far end of the chart. Participants can be made invisible for clarity sake, which is the case here, as only variable levels are displayed in the chart (i.e., food preferences). It helps answer an interesting question: if an individual opts for certain types of food or drink, what other food products is he/she likely to choose too? In sociolinguistics we can get answers to a similar question: if an individual opts for certain linguistic features, what other features does he/she generally produce too? With a factor map, we get an immediate overview of the food practises/linguistic realisations of all individuals in the data and whether different types of eater/speaker groups emerge from the data.

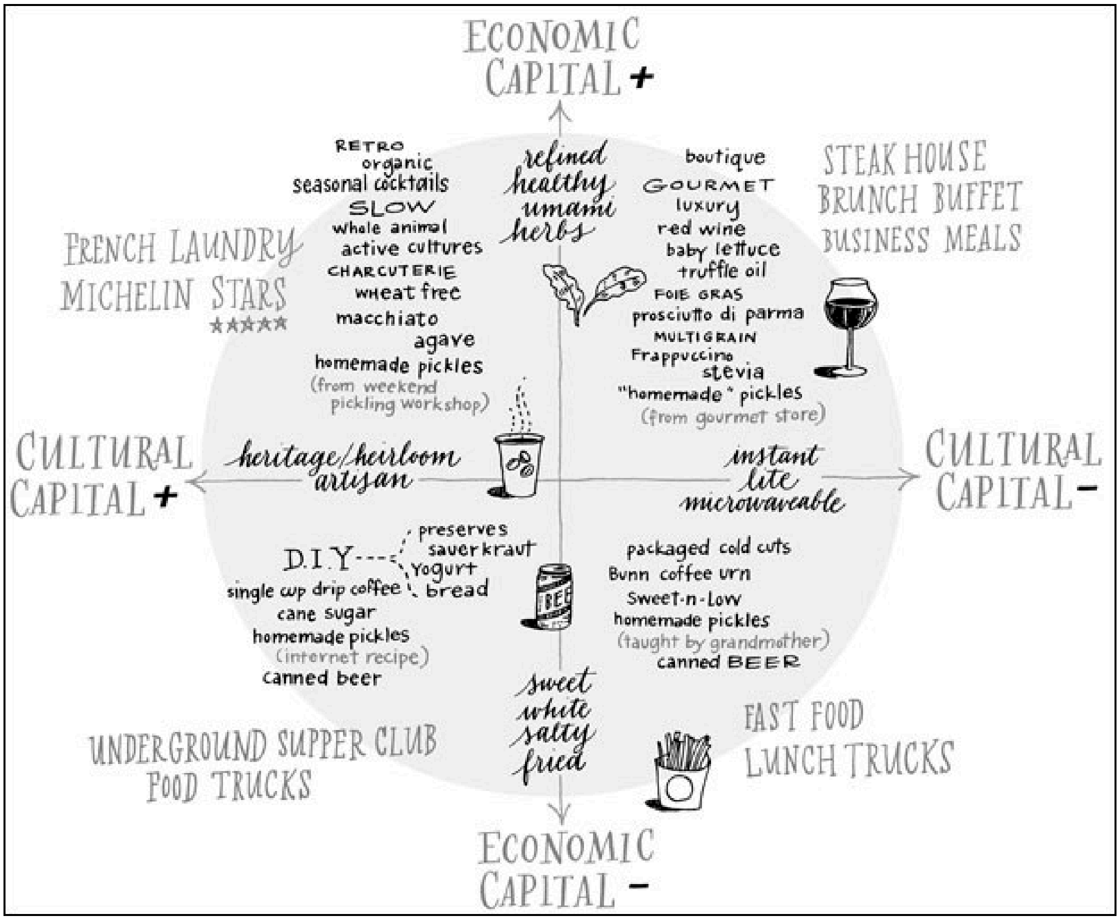


Figure 4-3 Adaptation of Bourdieu's Food Space chart (Bourdieu, 1984, p. 186) by Leigh Wells and published in *Gastronomica* (M. Watson, 2012).

MCA can provide a map that displays individuals rather than their food choice, or a map with both the individuals and their food preference. If the number of individuals is very high, it is possible to make individuals that contribute the most to the structure of the data appear more clearly on the factor map as in Figure 4-4 (dots represent individuals with digits as their index number and stars indicate individuals with a greater contribution to the data analysis).

When individuals are far away from where the two axes cross, it means that the variables summarised by either one or two dimensions greatly contributes to their identification, contrarily to those who are close to where the axes cross. For example, individuals that are high up on the economic capital axis are wealthy and the food that they choose reflects their socio-economic status. The closer they are to a particular axis and the further away they are from the centre of the map, the more they are characterised by one factor only. However, if they are influenced by both factors, individuals are placed diagonally to both axes. Participants who prefer food at the bottom left corner of the map could very well be eco-friendly students with a low income but with a higher educational background.

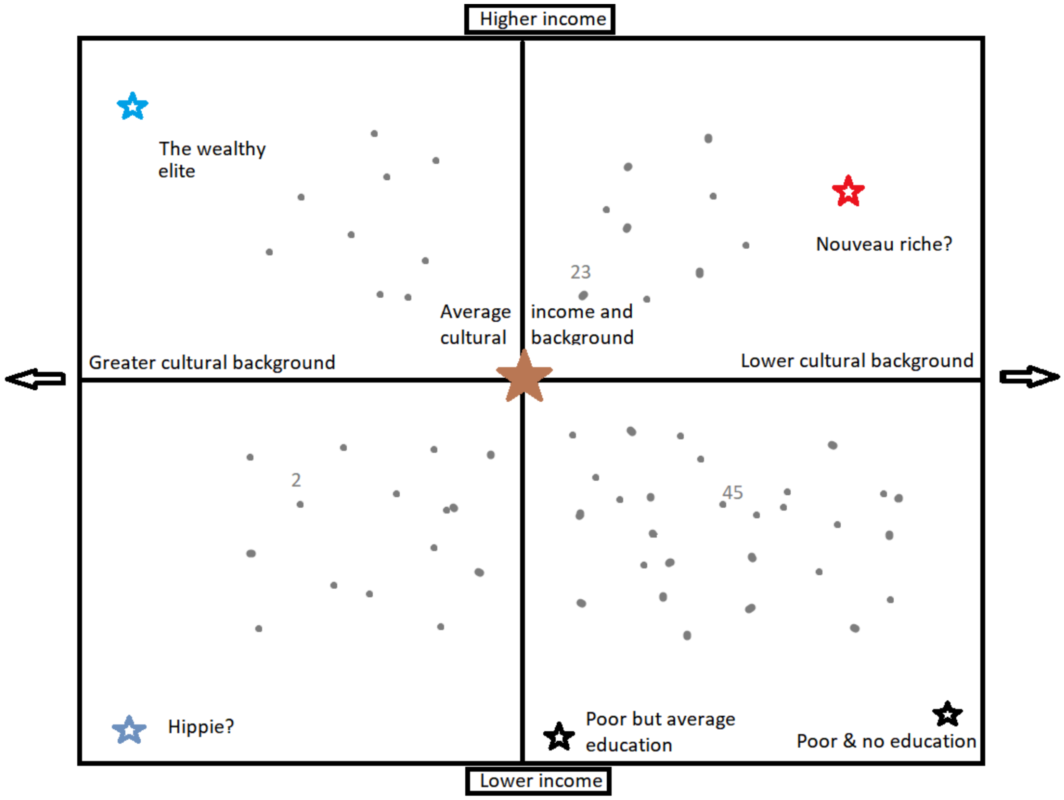


Figure 4-4 Schematized factor map of individuals based on Figure 4-3.

Some individuals are located at the centre of the map. This indicates that their income is close to both the average income AND the cultural background category that contains the highest number of people (cf. the bigger star at the centre of Figure 4-3 and the yes to questions 1 & 2 in Figure 4-2). Many other factors may influence the position of an individual on this factor map, such as food allergies, attitudes to food in the family, geographical environment during childhood, etc. At first sight, descriptive analyses with MCA may appear too simplistic. In MCA, however, the default factor map is based on the two most important factors but other factors can also be used to plot a second map as shown in Figure 4-5. By doing so, the data is scrutinized from another angle and other patterns may appear. Some participants' consumption of gluten-free food may not necessarily be due to their being wealthy or educated. It may simply be because they have food allergies that prevent them from eating white bread or other types of staple goods. It is therefore recommended to plot other dimensions because they may reveal the subtle patterns that render a data investigation more thorough.

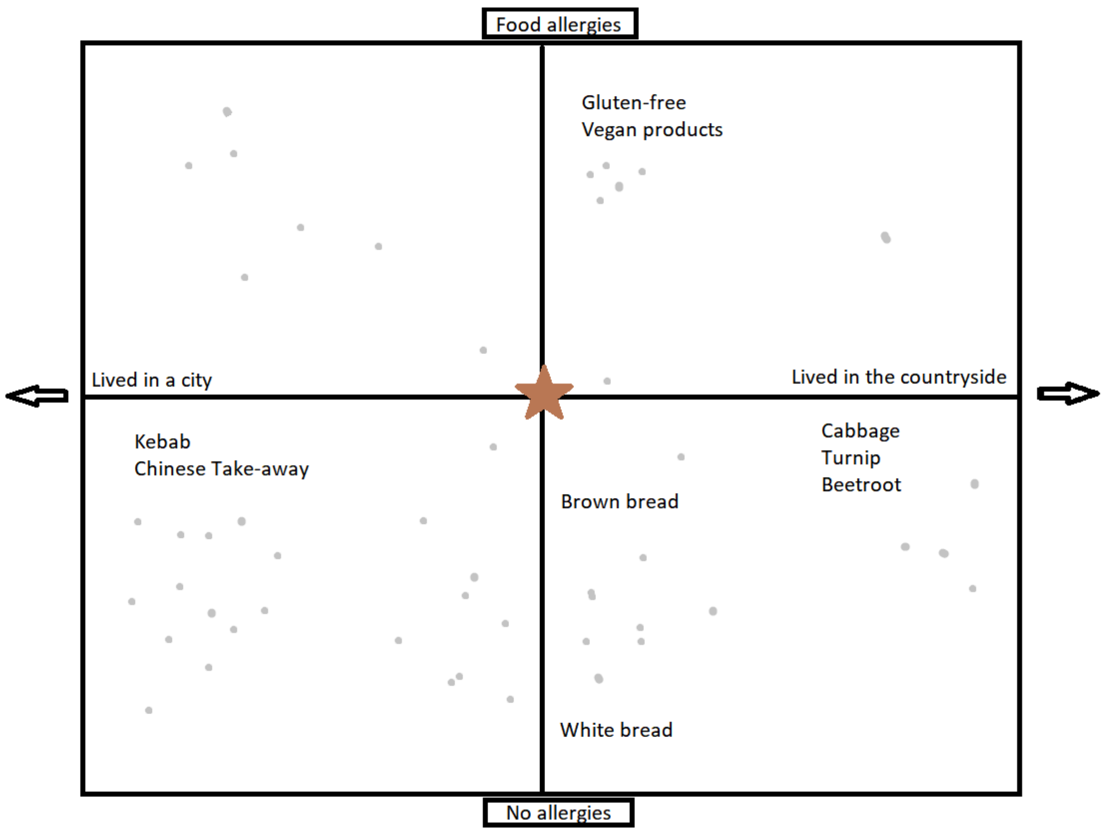


Figure 4-5 Schematized MCA factor map based on the fictitious third (x-axis) and fourth factors (y-axis) of Figure 4-4.

4.2.4 MCA in linguistics

Such analyses can easily be applied to many sub-fields of linguistics. Statistician Benzécri himself, wrote an entire book on possible applications to linguistics and lexicology

(Benzécri, 1981). In the 1990s, he also used it for a corpus analysis of two literary genres in Greek and of biblical texts (Benzécri, 1991, 1997).

In the 1970s, two French sociolinguists published the results of a detailed questionnaire on how adolescents (n=210) in their last year of secondary school linguistically interact with people in their daily environment. In their introduction, they explain their willingness to expose this statistical method rather than honing in on the results of the study so that readers who are new to MCA may understand it in more depth[78] (Coquin-Viennot & Esperet, 1977, p. 24). Their aim was to show the potential of the method to linguists and sociolinguists.

The approach was later used in Acadian French dialectometry by Flikeid and Cichocki at the end of the 1980s and more recently by Cichocki in 2006 (Cichocki, 2006; Flikeid & Cichocki, 1988). According to Cichocki, CA or its related MCA is deemed particularly useful to dialectometry because it makes interactions between linguistics and geographic location more visible: "[a]n important contribution of CA toward such an explanation is the visual representation of localities, linguistic features, and spatial factors in a joint space". He nonetheless included other statistical techniques complementary to CA "including those that perform formal tests of significance, to take into account the role of spatial factors" (Cichocki, 2006, p. 540).

[78] In their introduction, they cite an article in psychology that used MCA to analyse the result of a study on fear and anxiety issues in adolescence. They remark that it is not easily accessible since it takes for granted that readers already know about the main principles of MCA before reading the articles (Zlotowicz, 1972).

Correspondence analysis has also been used by linguists in second language acquisition research. Tono (2000), Abe (2007) and Kobayashi (Kobayashi, 2013) are known for having conducted CA analyses to examine learner proficiency levels. Cauvin (2017) used it to assess the prosody of French learners and native speakers of English and Amand & Touhami (2016) suggested using it as a tool to measure and map the progress of French learners of English in the acquisition of the lack of release in the final plosives /p/, /t/ and /k/.

CA and MCA are very useful tools in linguistics but can only be provided with qualitative variables, which may be an issue when using acoustic data in phonetics. Another similar statistical method is therefore needed and principal correspondence analysis (PCA) or factor analysis (FA) are one of the most frequently used methods in such cases. We shall now provide details of these methodologies before moving on to MFA as it is more complex than PCA and MCA though it is closely related to them.

4.2.5 PCA: a tool for multivariate quantitative data analysis

PCA is reported to be have been used by sociolinguists and dialectologists as early as the 1970s. Since the approach enables the simultaneous analysis of multiple linguistic features it helps undercut criticism towards language variation regarding the absence of preliminary analyses as to which variants are the main determinants of a speech variety and which have a major role in distinguishing a set of varieties. This is directly in line with the original TLS project. In addition, the approach has also proved to provide new insights in variationist studies using acoustic data. Feeding formant values to the model considerably frees the phoneticians from the traditional F1/F2/(F3) plots and provides keys diagnostics on acoustic variation in a sample. The methodological framework of this thesis mainly draws on works by dialectologists and variationists with aggregate-feature approach. This section starts by a brief account of the origins of PCA, then lists several studies in sociolinguistics and dialectometry that have adopted the approach and end with studies integrating formant values to measure aggregate variation on vowels because variation across vocalic variants is also another important aspect of the present thesis. The studies are presented in chronological order.

A brief account of the origins of PCA.

The work by Tabachnick & Fidell (2013)[79] is often used as a reference guide by linguists and provide us with a clear definition of the method:

> Principal components analysis (PCA) and factor analysis (FA) are statistical techniques applied to a **single set of variables** when the researcher is interested in discovering **which variables** in the set **form coherent subsets** that are relatively independent of one another. Variables that are correlated with one another but largely independent of other subsets of variables are combined into **factors**. Factors are thought to reflect the **underlying processes** that have created the correlations among variables (2013, p. 612; emphasis mine).

This definition of PCA and FA is very similar to that of MCA or CA but the main difference resides in the type of data used for the analysis. In actual fact, PCA is often used as an umbrella name for MCA & CA as the latter derive *from* PCA. Certain graphs resulting from a PCA analysis will also look different and require explanation on how to read and interpret

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[79] Tabachnick and Fidell's first edition of the volume dates back to 1996 and is considered by dialectologist Nerbonne as an "excellent resource for understanding PCA, FA and their differences" (2006, p. 467).

them. They have the advantage of revealing interactions between all or a selection only of quantitative variables in a dataset. PCA output tables also provide the researcher with statistical tests and precisions on the degree of interactions between variables and on variation between individuals within a given dataset.

To understand PCA in a very broad sense of the term, let us use James X. Li's comprehensive teapot snapshot metaphor (Figure 4-6). If you wish to take a 2D picture of a teapot that best renders its 3D volume, you need to rotate the tea pot several times until you find the right angle that shows as many aspects of its shape as possible – lid, body, foot, handle, thumbpiece, spout, depth, width and height. When you draw two perpendicular lines corresponding to the length and width of the teapot, you will find that the best angle is when the average of the length of these two lines is the largest. The two axes are the first (in red) and the second (in green) principal components (factor/dimension). The range of both axes correspond to the eigenvalues which are given in a covariance matrix.[80] Eigenvalues are good indicators of how much variation is explained by one factor or a combination of factors. Usually, the higher the number of variables, the lower the eigenvalue for each axis since the data is more complex and cannot be explained using only two dimensions and it is necessary to analyse the other dimensions as well. If the data is very well explained by two factors, then it may not be necessary to peruse the remaining dimensions, especially if you are interested in trends rather than special cases of variation.

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[80] The following website provides a very comprehensive explanation of how covariance is computed by hand and on a spreadsheet: https://www.wikihow.com/Calculate-Covariance.

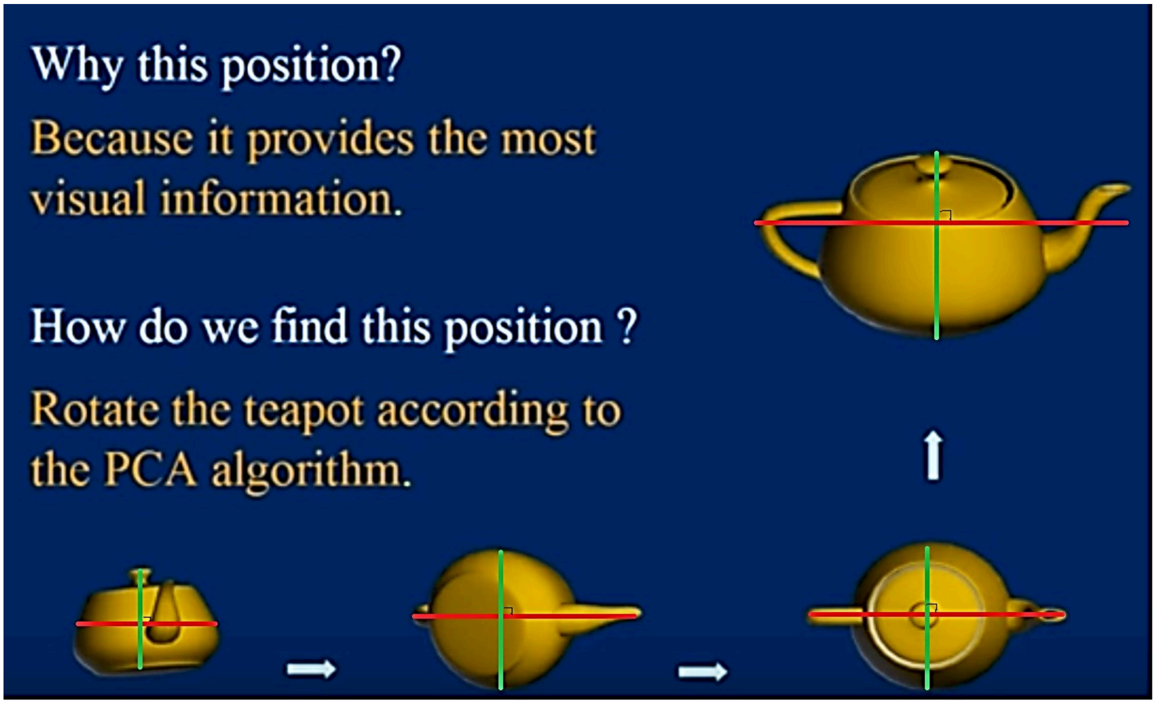

Figure 4-6 James X. Li's comparison of PCA to the capture of a PCA snapshot (adapted from https://www.youtube.com/watch?v=BfTMmoDFXyE).

The origin of PCA dates as far back as the early 1900s and draws on the work of Karl Pearson (K. Pearson, 1901). It provides an alternative to traditional linear regression, when the structure of the data is more complex and cannot easily be modelled with a simple line of best fit.

PCA was later developed, among others, by Hotelling (1933) and Benzécri (1973) and is one of the most famous methods in multivariate analysis. John Pellowe, one of the major actors in the TLS project in the 1970s must have been influenced by PCA since a book on statistics in multivariate analysis often cited by him contains a chapter on the approach (M. G. Kendall, 1957). PCA has been used for a wide range of purposes such as DNA-sequence analysis (Michel, 1986), craniology (Schaal et al., 2017), the relationship between personality type and procrastination (McCown, Johnson, & Petzel, 1989) and language variation in sociolinguistic data (Labov, 2001; Stuart-Smith et al., 2007; Turton, 2015).

4.2.6 PCA in sociolinguistics and studies in dialectometry: a start in the early 1980s

The present thesis draws on the work of the studies using PCA. The PCA model is fed with variant counts for each speaker and the social data is superimposed onto the linguistic groups to see if speakers are sociolinguistically stratifiable. Some studies in dialectometry (Foumio Inoue & Kasai, 1989) and LVC (Stuart-Smith et al., 2007) also coupled PCA with a cluster analysis. They will be presented in this section. The thesis also builds on the work of more recent studies on variation in TE (Corrigan et al., 2014) and in applied statistics (Husson, Josse, & Pagès, 2010). They suggest taking advantage of the reduction of dimensionality entailed by a PCA analysis to perform a cluster analysis with the PCA results. Cluster diagnostics are then paired up with MFA results both statistically and visually, and provide complementary information on trends, speaker groups and possible symmetry across variants of linguistic features. This section provides a literature review of studies that directly helped build the methodological framework of the present thesis on sociolinguistic variation in TE.

William Labov: an advocate of PCA for sociolinguistic data analysis

William Labov was also an advocate of PCA and used it to measure the evolution of sound change by the model with formant values. In his second volume of *Principles of Linguistic change*, he comments on the importance of the method when measuring sound change: “Multiple regression and principal component analyses have played a major role in extracting the underlying regularities that govern language change” (Labov, 2001, p. 519). He adds that: “[PCA] is particularly useful when linguistic variables form a coherent cluster of related movements, which is the case with the vowel system” (Labov, 2001, p. 354). He also suggests that to have better insight on his data it was necessary to combine it with other analytical and visualising methods: “the combination of these with extensive cross-tabulations and graphic displays was needed to display the full regularity of the relations involved” (Labov, 2001, p. 519).

When Labov wrote about PCA in 2001, he mentioned one of its main limits, which was its inability to accept both linguistic (numeric variables) and social variables simultaneously. PCA had to be paired with a regression in order to get a full sociolinguistic analysis:

> [A] principal components analysis only accepts the linguistic data. If its output can be shown to converge with the results of the regression analyses in this chapter, it will provide strong confirmation of both sets of results (Poplack 1981, Horvath 1985, and Sankoff 1988). (Labov, 2001, p. 354)

Today, other forms of PCA accept both linguistic and social data, such as Factor Analysis for Mixed data and Multiple Factor Analysis (Escofier & Pagès, 1994; Husson et al., 2011) which we will use in our next chapter.

Poplack (1981)[81] and Horvath (1985)'s idea to use PCA is probably what inspired Labov into adopting it in his volume on social factors in language change (2001). It was also adopted by Stuart-Smith & Tweedie (2000) in a variationist analysis on consonants in Glaswegian. However, the potential of PCA remains largely untapped. Linguists only use one possible graph[82] available in PCA, i.e. the factor map of individuals, and take very little time to explain how the method works and how to interpret the graph in detail. They generally do not show output tables of the PCA analysis, which give precious information about how variables co-occur and about individual variation. PCA has also gained interest among dialectologists (Nerbonne, 2006; Shackleton, 2007, 2010), but the rather austere look of the output tables and the abstractedness of dimensions render the interpretation of dialect data difficult. In the next section we deal with other forms of visualisation that makes PCA more approachable and provide examples of interpretation.

Poplack: a pioneer in the use of PCA on Puerto Rican Spanish

In *Research Methods in Linguistics*, Walker J. A. (2013) writes that, to [his] knowledge, the earliest use of PCA in sociolinguistics is Horvath and Sankoff's (1987) study of English in Sidney, Australia, but there are earlier studies by Poplack (1979, 1982). Horvath also used PCA in an earlier study of Sidney English (1985) but explains that the method was suggested

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[81] Poplack analysed variation in the plural form of Puerto Rican Spanish. She first used a multiple regression analysis with the program VARBRUL, and compared it with results from a PCA analysis. To create the PCA analysis, she took the proportions of each variant realisations. Her work was supervised by Labov, who was probably among to first to examine Poplack's work.

[82] Poplack (1982) writes that the purpose of PCA is limited to providing "a graphic representation of the data, highlighting the major parallels and distinctions among the speakers with respect to their differential use of the variant" (p. 65).

to her by David Sankoff (1985, p. 52) and that PCA had been used in linguistics by Poplack as early as 1979 (p. 53).

Poplack's dialect studies included PCA and regression analyses with the VARBRUL program designed by Sankoff. She analysed variation in the plural forms /n/ and /s/ of monolingual Puerto Rican Spanish living in North Philadelphia (1979) and New York City (1982). These two forms tend to be weakened or deleted in this variety of Spanish, i.e., *bailaba**n** una**s** nena**s** muy bonita**s***, which means: "some very pretty girls were dancing" or literally, "were dancing / some / girls / very / pretty".

With the use of PCA, she furnished a complementary analysis to multivariate regression, an approach which prevails in variationist studies. She highlighted certain limits concerning regressions which can be sensitive to sample size and outliers. She also warned that "with a small sample, one or two individuals, atypical of their peers, can seriously distort the results for the extralinguistic parameters" (1979, p.60). She added that "this can also lead to spurious statistical interaction effects among the extralinguistic factor groups, compounding the interaction problems known to exist among social factors" (1979, p.60). Although she decided to use regressions with VARBRUL, she compared the results with a PCA analysis, thus evaluating the "seriousness of the dangers" above-mentioned, offering a more "global view of the data" and providing a "novel" approach to the field of language variation (1979, p.60).

PCA is not devoid of constraints but Poplack managed to circumvent one of them, which is that one cannot include sociological data. She simply superimposed the social data onto the results of the linguistic data, which is reminiscent of Jones-Sargent's own approach on the TLS (see Jones-Sargent 1983, p. 315 ff.). However, with this method, the statistical link between the social data and the linguistic data did not seem directly available and it was the task of the linguist to find apparent links between the two. This may be one of the major reasons why subsequent investigators gave up on the approach. Today, other forms of PCA such as Factor Analysis of Mixed data and Multiple Factor Analysis offer a solution to these limitations (Husson et al., 2011).

At first sight, for a linguist, PCA results may not be easy to interpret, but the strength of the method lies in the possibility to create multiple visual representations of the results, which are very approachable. However, PCA loadings provide a vast amount of insight on the data on a micro and macro level, i.e. on individual linguistic behaviour and on general trends. It would be a real pity to leave the loadings untapped. Indeed, despite dedicating a full chapter on a PCA analysis in her thesis, Poplack mostly used it as a tool for graphs, almost like a prop to a multivariate regression. In her 1982 article based on her 1979 dataset, she writes that the purpose of PCA was mostly limited to providing "a graphic representation of the data, highlighting the major parallels and distinctions among the speakers with respect to their differential use of the variant" (p. 65). Poplack draws much of her interpretation on the graphical representation of the PCA analysis only. She does not make much use of the PCA loadings since they appear difficult to interpret, especially for researchers who have not been trained to scan and interpret results across long lists of digits.[83] Nonetheless, these output tables provide a goldmine of interesting details regarding the co-occurrence of variables and peculiarities of each individual. **Poplack** may have unveiled only a few of the many advantages of PCA for sociolinguistic data, but she **remains a pioneer in applying PCA analyses to sociolinguistic data and should be recognised as such**.

Horvath's use of PCA in her study on Australian English

Barbara Horvath also foresaw the importance of PCA in dialectology: "because the technique can be used with a large number of variables, it holds the promise of being useful to dialect studies" (Horvath 1985, p. 154). Her point meets that of John Pellowe in the fact that multivariate analyses like PCA can help build a bridge between the traditional 'atomistic' approach of sociolinguistic studies and the 'integrated' approach of dialectology. By 'atomistic' she meant that the statistical tool sociolinguists use to analyse their data conditions them to 'concentrate on only one linguistic feature' (p. 154) which counts as a dependent variable in the VARBRUL or regression analysis of this kind. 'Integrated' approaches mean the integration of a maximum amount of linguistic features to conceive dialects as 'integrated wholes' (p.154). She suggests using both regression analysis and PCA, hence the need to bridge the two approaches to gain hindsight on one's data: "there is no

[83] Textbooks in statistics generally use a metalanguage does not always resemble that of a linguist, which renders comprehension harder for a linguist. During the course of this thesis, I often found it difficult to use both academic languages and distinct rigorous methodologies for the purpose of providing detailed results without neglecting one or the other. Such an issue is at the centre of an upcoming conference (NWAV48), which call for papers reminding linguists "not lose sight of **our** larger theoretical and applied goals despite the naturally fascinating details of our data and methods" [emphasis mine]. Retrieved 12th September 2019 from: https://nwav48.uoregon.edu/.

need to choose between an integrated approach and the atomistic approach; a descriptively adequate account of a dialect would demand both approaches".

Her study on Sidney English contains several PCA analyses and provides a lot of information on how PCA operates and how to perform it on linguistic data such as vowel, consonant and intonation variation (cf. Figure 4-7 for her operational description of PCA analysis for sociolinguistic data). Unlike Poplack, she uses more dimensions to analyse her data. Akin to Poplack she bases her analysis more on graphs than on loadings – even though these graphs all stem from the PCA output tables. A cluster analysis based on the principal components could have been helpful in providing reliable groups of speakers. However, her application of PCA on several linguistic studies help readers get a better understanding of the method. Her work with PCA remains one of the first in sociolinguistic studies.

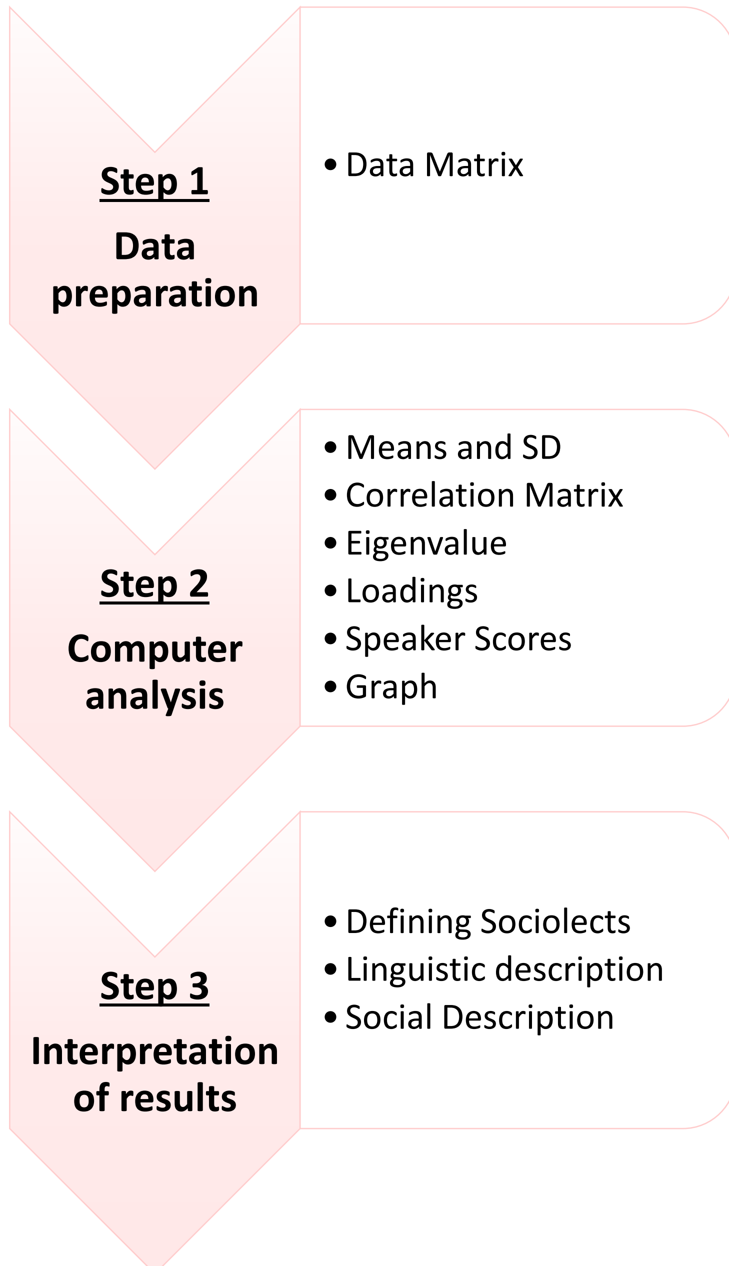

Figure 4-7 Operational description of PCA for sociolinguistics. Adapted from Horvath (1985, p. 55).

Stuart-Smith & Tweedie's analysis of consonantal variation in Glaswegian English (2000)

Stuart-Smith & Tweedie (2000)[84] & Stuart-Smith et al. (2007) used PCA to measure variation across 8 consonants in Glaswegian English. The PCA factor map was used to interpret results. It revealed a major split between middle-class adults and working-class adolescents who had higher scores of TH-fronting and L-vocalisation for instance.

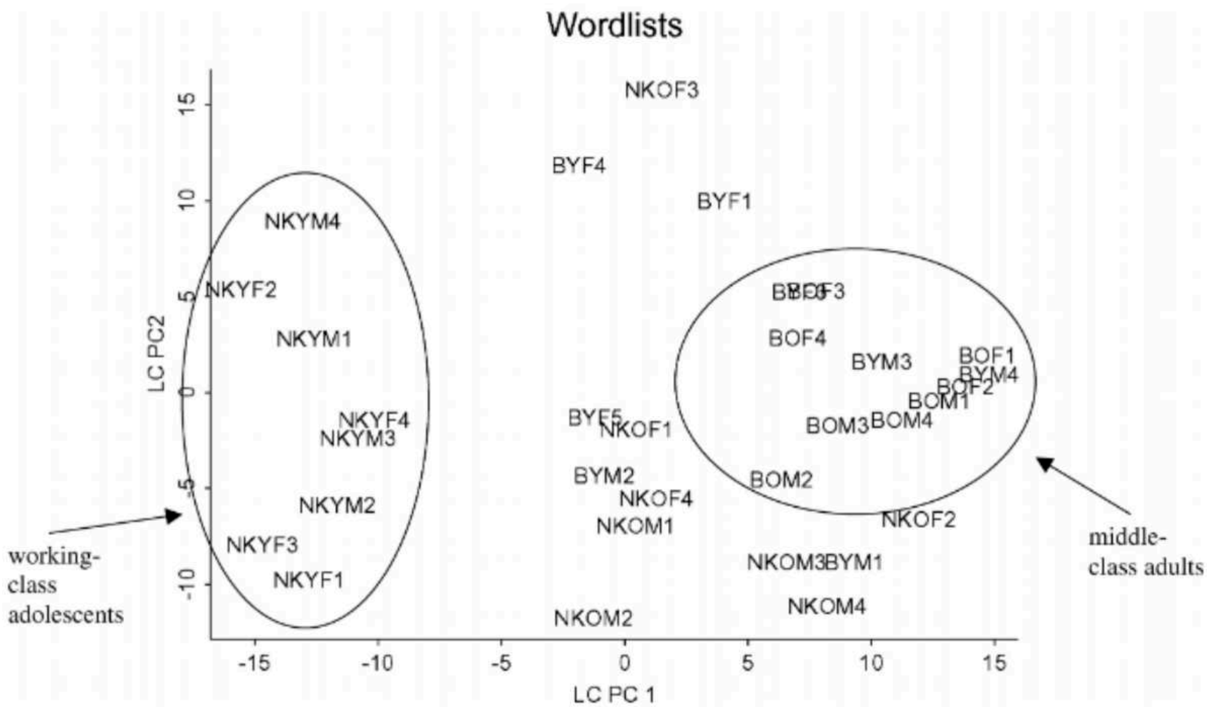

Figure 4-8 Factor map illustrating the class & age gap between speakers of Glaswegian English on the basis of 36 variants across 8 consonants (from Stuart-Smith et al 2007).

84 For a more detailed presentation of the results with PCA, visit https://www.gla.ac.uk/schools/critical/aboutus/resources/stella/projects/accent-change-in-glaswegian/final-report/annexe-3/#fig2.

From a methodological point of view, it would have been useful to know how much variation is explained by the first two principal components (LC PC1 & LC PC2, Figure 4-8) because it measures the quality of representation of the speakers on the factor map, and consequently, the reliability of the distinction between speakers. This said, on Figure 4-8, the WC adolescent and MC adult speakers appear far enough from each other on either side of the horizontal 0 axis, thereby suggesting a clear variational trend. Moreover, looking at other principal components may reveal subtler variation among the adolescents themselves such as what makes MKYF1 & MFF2 so far apart on LC PC2 but so similar on LC PC1. The present section was a literature review of both early and more recent uses of PCA in variationist linguistics. I now turn to uses of PCA in dialectometry.

4.2.7 PCA in dialectology & dialectometry: a more visible start in the early 2000s

Early uses of PCA and Factor analysis can be found in the Japanese school of dialectology in the early 1980s such as Fumio Inoue (井 上 史 雄) and Hisako Kasai (河西秀早子)'s publications (1986b; 1982; 1989). These publications were known by variationists studying varieties of English and served as a theoretical and methodological for applications to Glasgow and Toronto Englishes (Cichocki, 1988). In Europe and the US, it became more visible in publications about a decade or two later. The following section illustrates how the aggregate approach in dialectometry evolved to include an analysis of formant values when inspecting dialectal differences across vowels. I start with early uses of PCA in Japanese dialectometry since early works on English dialectology and sociolinguistics directly draw on the work of Inoue and move on to more recent studies in Europe and the US.

The Japanese school of dialectometry

The work of Inoue seems to have had some influence on the work of linguists interested in dialects and sociolects of English or in the field of perceptual dialectology since it is regularly cited by the latter (e.g. Cichocki, 1988; Kerswill, 2002; Key, 1987; Viereck, 1997). Several of Inoue's articles were translated into English which made his work accessible internationally (Foumio Inoue, 1986a, 1996). Inoue and Kasai (1989), attempt to find more objective isoglosses based on the production of standard forms of Japanese by geographical region. To do so, they resorted to a Factor Analysis[85] and found four important dimensions, which revealed four main dialectal areas in Japan. Inoue & Kasai commented on the fact that the result of the factor analysis "does not completely coincide with the dialect divisions in the past, which were set up by means of addition or superposition of selected isoglosses; but on the other hand it shows objectively the gradual differences of dialects of Japan" (1989, p. 228). They add that the method "provides insight into the genesis and diffusion of dialect forms" and that it "produced good results as far as the Japanese dialects are concerned, in which the capital moved from west (Kyoto) to East (Tokyo), and in which eastern and western cultural centres contrast" (1989, p. 228).

[85] It is not clear whether Inoue and Kasai used PCA or FA since the term factor analysis can sometimes refer to either approaches. They mention having tried several of these methods and retained principal factor analysis (Inoue & Kasai 1989 p. 228).

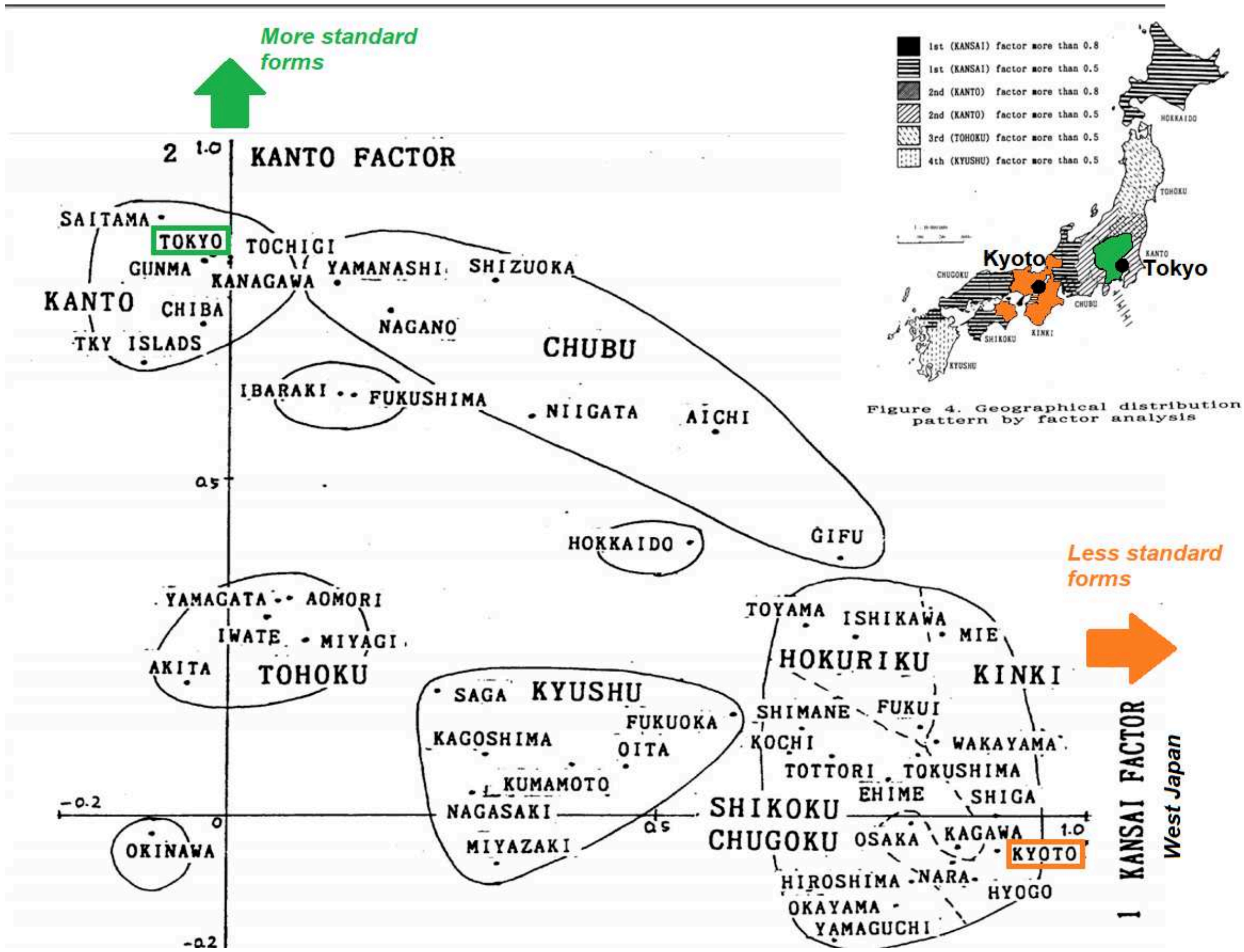

Figure 4-9 Factor analysis performed by Inoue and Kasai on Japanese dialects. Adapted from Inoue & Kasai 1989, pp. 224 & 226).

Figure 4-9 is an example of a PCA analysis performed by Inoue & Kasai in 1989. The results help build a classification of Japanese dialects and the creation of dialect maps which do not always coincide with dialect maps using traditional approaches (map at the top). The most striking opposition is the Kanto/Kansai reflected by the first two principal components. Less standard forms of Japanese appear on the right hand-side of the graph and coincide with the Kyoto area while more standard ones are found around Tokyo. These results help measure the continuous diffusion of dialectal forms.

Nerbonne's 2006 analysis of transcribed data

Nerbonne's analysis is reminiscent of Inoue and Kasai's dialectometric work in the sense that he used data from a linguistic atlas to map overall pronunciation differences with the help of factor analysis. He explored variation across all the reported and transcribed vowels from the LAMSAS corpus of American English from the Middle and South Atlantic states (Kretzschmar, 1994) in order to find which variants tend to co-occur within a linguistic zone and how. He is clearly opposed to single feature analyses and deplores the frequent lack of "examples [in studies] where different phonemes were treated the same under FA in a way which suggests a more uniform trend" (Nerbonne, 2006). A regional opposition between [ə] and [ɨ] emerged from the FA analysis, which corroborates Kurath and McDavid (1967, p. 168). His analysis, which reveals the importance of reduced vowels in distinguishing dialects is also found in Shackleton (2005, p. 146) in a study on differences between varieties of English across both sides of the Atlantic, and in Moisl & Maguire (2008) on the TLS-coding data using PDVs.

There is reason to believe that these results are partly due to the statistical analysis itself and to the number of variants coded for these reduced vowels. In factor analysis and PCA, the variants are considered as independent from one another and not part of an overall unit, which may skew certain parts of results based on aggregate dialect/sociolinguistic data. Plus, if variants for reduced vowels have a binary distribution (reduced/un-reduced) as in the PDV coding used by Moisl & Maguire (2008), while stressed vowels have many more variants, then the straightforwardness of the binary distribution will overshadow the importance of the more complex distributional patterns of the variants for the stressed vowels (Pagès, 2013).

Shackleton's study of American and English dialect data (2005).

Shackleton uses several statistical approaches that complement each other. His PCA analysis on Kurath and McDavid's (1961) *Pronunciation of English in the Atlantic States* (PEAS) and Kurath and Lowman's (1970) *Dialect Structure of Southern England* (DSSE) reveals an East vs. West linguistic opposition in England and another one between Massachusetts and Virginia in the United-States. His findings reveal the influence of English from the South East of England on New England speech and the southwestern influence on southern varieties of American English. The strength of his methodology relies on his use of multiple statistical tools to answer various aspects of his research question.

FA or PCA for formant analyses? Clopper & Paolilo 2006 analysis of vowel formants and duration on North-American English vowels.

Clopper & Paolilo's article (2006) is one of the first studies in dialectology to have carried out a factor analysis (henceforth FA) with formant and duration values – an earlier study which inspired the authors is that of Bachorowski & Owen (1999) which used PCA and successfully classified a number of speakers based on acoustic properties of their speech. FA, in the narrow sense of the term is but another dimensionality reduction technique which is rarely found in French statistical textbooks but better known in Anglo-Saxon literature (Chavent, Kuentz, & Saracco, 2007, p. 1).[86]

Clopper & Paolilo highlight the advantages of the method compared to PCA for phonetic data analysis, one of them being its ability to lower the impact of error variance: “factor analysis differs from PCA in permitting different variables to have different error variances”. They add that this particular asset of FA “is necessary in [their] study, as the phonetic measures used here, vowel formant frequencies and vowel duration, have different source statistical distributions” (Clopper & Paolillo, 2006, p. 447).

Leionen’s (2008) use of PCA in vowel formants of 91 Swedish dialects.

Leionen’s study (2008) deals with the identification of Swedish dialects based on vowel formants – corner vowels [i], [æ], [ɑ] [u]. Since basic PCA cannot take into account social data or gender differences, she had to perform two separate PCAs for men and women. A Factor Analysis of Mixed Data (FAMD) or a Multiple Factor Analysis (MFA) could have been very useful to address this gender issue. In addition, for each vowel, the dataset includes F1, F2 and F3 values, which means that there are subsets of variables. MFA takes these groupings into account and balances the weight of both the groups and the variables included in those groups.

[86] In a broad sense of the term, Factor Analysis is the umbrella name for all dimensionality reduction techniques such as CA, MCA, PCA, etc. French scientists make a distinction between both terms: the narrow sense of the term is called *analyse en facteurs* and the broader one, *analyse factorielle.*

Leionen goes as far as analysing nine factors to identify dialect differences but she comments on the need to include a greater variety of linguistic features (p. 10). Indeed, on a surface level, the study resembles what Horvath calls an *integrated* approach since several vowels are analysed, but it is possible that other monophthongs, diphthongs (p. 10), syntax or lexicon play a major role in distinguishing dialect boundaries. More advanced forms of PCA would be ideal for such integrated studies. In this study, the weight of individuals was not analysed – probably because of the high amount of speakers (n=1014). The package `FactoMineR` (Lê, Josse, & Husson, 2008) provides tools to highlight individuals that contribute the most to a PCA dimension or factor.[87]

Ferragne's (2008) classification of dialects in the British Isles based on segmental and suprasegmental features.

Ferragne's study provides one of the most recent classification of 14 dialects of the British Isles. Data was taken from the corpus Accents of the British Isles. His study is also an aggregate approach since he used both rhythm and vowel frequencies and duration to classify the dialects. Time and space precluded an analysis of consonants. On a methodological point of view, he is one of the first to have used reduction of dimensionality techniques like Multiple Dimensional Scaling to classify the dialects of the British Isles other than through the constraints of dialect maps (Kolb, 1966; Orton & Halliday, 1962). Indeed,

[87] François Husson's Youtube Channel and MOOCS in English and French (Husson, 2018) are excellent materials for a step-by-step understanding of multivariate analysis and performing them via statistical programs like Rstudio: https://www.youtube.com/user/HussonFrancois/videos.

the similarity of two urban dialects like Newcastle and Ulster is harder to enhance on a map since they are not geographical neighbours.

With regards to Newcastle, which was part of the fieldworks analysed, Ferragne remarks that aggregating the acoustic features of the FACE vowel does not necessarily give a faithful account of variation. Newcastle having at least three variants (centring diphthong, closing diphthong and monophthong), if the formant trajectories of all the variants are averaged, what comes out is but a monophthong (Ferragne 2008, p. 260).[88] In the present study, FACE was found to be the main determinant of TE, and by inclusion, of Newcastle. However, the classification was then conducted on 11 monophthongs (Ferragne 2008, p. 323), which excludes FACE. It is possible that important information on the distance of the Newcastle dialect with other dialects like Ulster whose speakers also exhibit centring diphthongs in FACE (GREGG, 1958) may have been missed. In addition, individual variation amongst **Newcastle was found to be one of the most highly variable dialects with respect to monophthongs**, which rendered any vowel trapezium based on average values less "reliable" for Newcastle (Ferragne 2008, p. 255). This highlights the limitations of traditional acoustic studies on diphthongs and lead to the conclusion that the reflexes of a diphthong pertaining to a lexical set should be first identified and considered as separate levels, but without losing the information that they belong to same set, and then dealt with acoustically.

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[88] "à quoi correspond la moyenne entre les valeurs formantiques d'une diphtongue fermante et d'une diphtongue centripète ? À une monophthongue. . ." (Ferragne 2008, p. 260)

Major works in dialectometry with aggregate approaches were reviewed in this section. What follows is an overview of how the French school of PCA could help enhance the results of LVC and dialectal data by providing a wider array of visualisation techniques.

4.2.8 PCA visualisation *à la française*

This section shows the peculiarities of the French school of PCA, more specifically, its correlation circle, and how it may be a useful tool when carrying out an integrated sociolinguistic study.

Seeing is understanding: the French school of PCA

PCA is quite distinct from other approaches, with the correlation circle as its “marque de fabrique” or hallmark (Brunet, 2014) when a PCA *à la française* is carried out – other aspects of the French school of multivariate data analysis are explained in more detail in Susan Holmes (2008). It is particularly enriching when there are not too many variables. In a paper presented at a conference on textual data analysis in Nice, statistical engineer and linguist Valérie Baudoin highlights the fact that in PCA *à la française*, visualisation methods are given a much more important role than in other PCA schools, because they make the analysis more approachable and thus more popular:[89]

> L'accent mis sur les méthodes de visualisation est une clé pour comprendre le succès de l’analyse des données “à la française” . . . Cette approche diffère des approches

[89] As I was looking for articles using PCA in worldwide databases, I was surprised to find that when articles used PCA analysis *and* presented their results with a correlation circle, at least one author was of French origin or had studied statistics in France. In a personal conversation with statistician François Husson, I was informed of this divide between the French approach and other schools of PCA.

> hypothéticodéductives (largement répandues dans la littérature anglo-saxonne) beaucoup plus austères en termes de présentation des résultats .[90] (Baudoin, 2016, p. 20)

Indeed, to render the same amount of information without this graph, you need several output tables, hence the synthetic quality of a correlation circle. Visualisation methods of PCA *à la française* comprise two main graphs. Namely, a correlation circle to visualize which variables are correlated with one another (Figure 4-10) and a more traditional factor map of individuals, similar to the one seen in our fictitious example in MCA in Figure 4-4.

Correlation circles provide a good overview of how variables interact with one another. It is particularly useful in the study of the co-occurrence of linguistic features that define sociolinguistic groups. The circle displays all the variables included in the model in the form of arrows. The circle is crossed by two perpendicular axes which are the dimensions or factors. Each dimension encompasses several linguistic features and forms a general trend. These general trends in the data have to be interpreted by the linguist himself but the output table confirms which variables define a particular dimension. In his work on dialect data, Robert Shackleton used PCA and remarks that when "applied to a data set of linguistic features, PCA may isolate groups of variants or features that tend to occur together and that, with any luck, have a structural linguistic interpretation" (Shackleton, 2007, pp. 67-68). As always, PCA may perform a data analysis, interpretation remains the work of a linguist, but a

[90] Visualisation methods are key elements in the French school of data analysis … the approach differs from hypothetico-deductive ones that have a more austere way of presenting results – they are widespread in the anglo-saxon litterature of data analysis (translation mine).

correlation circle can offer a visual support to the interpretation of co-occurrence via long tables of factor loadings.

To interpret a correlation circle as shown in Figure 4-10, one must look at how lines stemming from the centre of the circle are placed within the circle. They represent the linguistic variables. For illustration purposes, we drew a correlation circle which presents results of a fictitious dataset that includes the productions of speakers from the North of England and RP speakers. Variants of a vowel set or of a consonant are considered as variables. Proportions of each variant are provided for each speaker. If two variables are close to each other in the circle, thus forming an acute angle, they are positively correlated, i.e. they tend to co-occur. For instance, the graph indicates that when speakers produce a TRAP vowel with an [a], they generally also produce a BATH vowel with the variant [a] and STRUT, [ʊ]. If two lines form an obtuse angle, the variables that they represent are negatively correlated (they do not co-occur) and when they form a right angle, it means that there is no correlation among them.

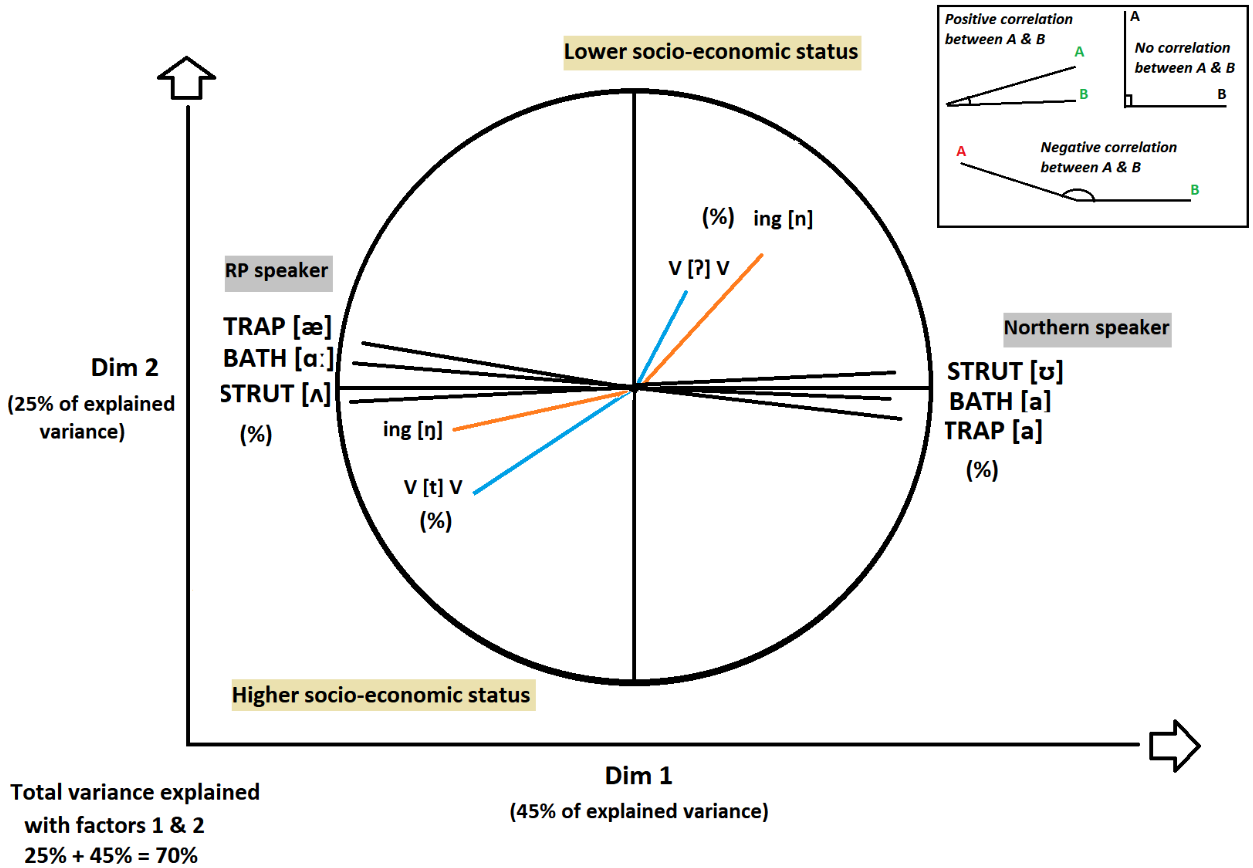

Figure 4-10 Example of a correlation circle with fictitious sociolinguistic data.

The correlation circle displays the choice of variant in the TRAP, BATH and STRUT sets. If we observe productions on the right hand side of the graph, we notice that the linguistic features are typical of a Northerner. On the left hand side of the graph, we see the co-occurrence of RP features. The first axis is easily interpretable as Northern British and RP at either end. This is the first factor or dimension (Dim 1), which explains 45% of the explained variance in the data.

The second factor involves the production of –*ing* as apical or velar and to a lesser extent, the proportion of intervocalic glottal stop. Since the latter features are present in both groups (RP and Northern standard), they are less correlated with the chosen vowel variants. Age or socio-economic status may account for variation in –*ing* and in the production of /t/ between two vowels. Loadings from the analysis along with a correlation circle with the other factors provides precious hindsight for the interpretation of less obvious variation on the graph and will be discussed in more details in the presentation of our results.

If one is content with only general trends in the data (RP vs. Northern English), then one may limit the analysis to dimensions 1 and 2 only. However, the other factors may explain subtle variations in the data and are worth having a look too. Once again, for illustration purposes, we created a correlation circle using dimensions 3 and 4 and which reveals another trend in this fictitious data (Figure 4-11).

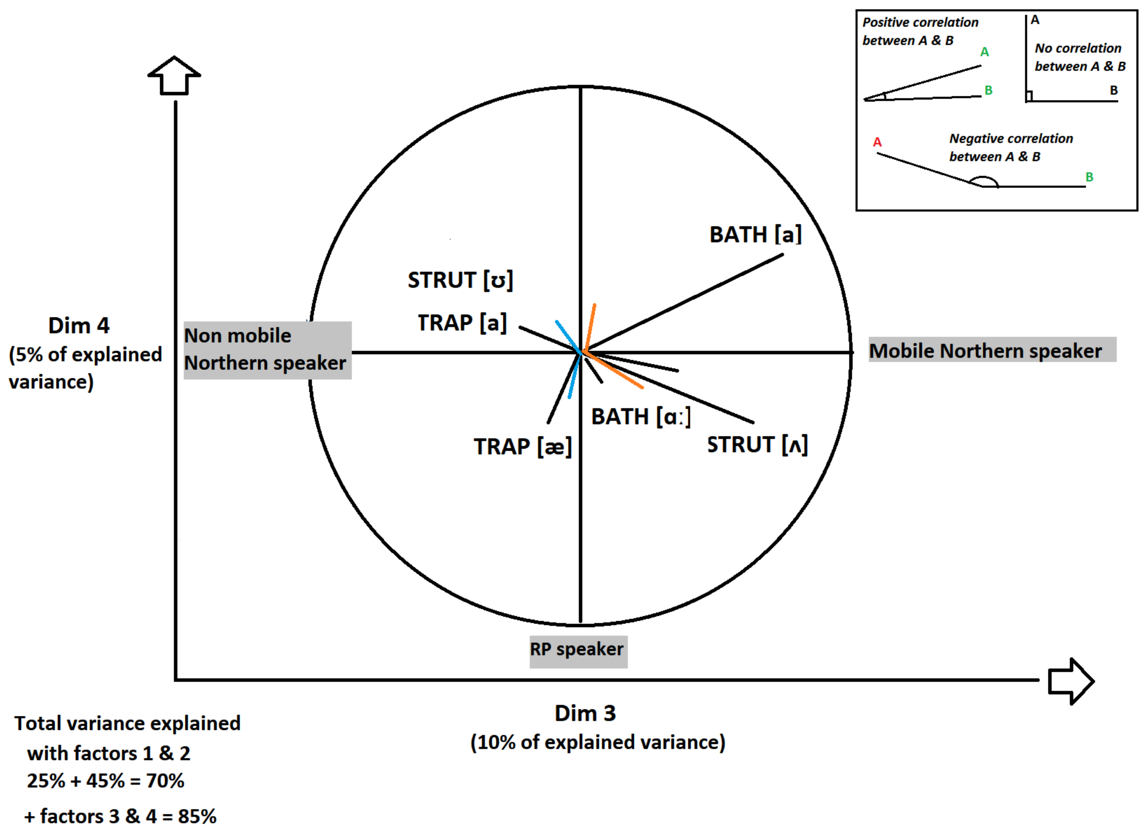

Figure 4-11 Illustration of a correlation circle using factors 3 & 4 (Dim 2 & 4).

In this circle (Figure 4-11), only two variables are close to the edge of the circle, the Northern realisation of BATH and the RP realisation of STRUT. The closer a variable is to the edge of the circle, the better they represent the factor. The two lines form an acute angle, which means that they are rather positively correlated. Such indications drive the linguist to observe his data more clearly to check which sub-group of speakers have kept the Northern pronunciation of BATH but produce an RP STRUT variant, as this may be indicative of intersectionality in the variation patterns within this sub-group. We could hypothesize that among the recorded speakers there are mobile Northerners who have lived in an environment influenced by RP (this is where going back to raw data and detailed metadata is crucial). Factor 3 highlights the distinction between mobile and non-mobile Northern speakers while factor 4 may indicate other subtleties in the data. When adding factors 3 and 4 the proportion of explained variance rises by 15% (10% + 5%) so it is worth taking into account more than two factors.

In this section, we have shown how to interpret PCA correlation circles from more than just the first two dimensions and how to grasp the importance of each factor within the PCA analysis, thereby revealing larger trends in the data and more subtle ones. PCA remains an approach that needs quantitative variables only, despite the current possibility to add social data as supplementary variables that are not directly included in the model, otherwise one may use Factor Analysis with Mixed Data (FAMD). **Due to its lack of flexibility, PCA is not necessarily the best approach for sociolinguists and dialectologists having an aggregate approach to variation**. In the following section, we suggest using a method that combines the advantages of both MCA and PCA, and that takes into account groupings or sets of variables in the data, i.e. variants within a lexical set, which could be very useful for researchers in the above-mentioned linguistic fields. The approach is called Multiple Factor Analysis.

4.2.9 Why MFA is better suited for sociolinguistic data: a general overview of Multiple Factor analysis

Multiple Factor Analysis (MFA) was designed by Brigitte Escofier, a student of Benzecri's, and Jérôme Pagès in the 1980s (Escofier, 1983; Escofier & Pagès, 1984; 1994, English version; 2008). It is now often used in sensory and consumer science research and in a wide array of fields, ranging from ecology, agriculture to broadcasting, neuroimaging and economy, to name but a few. Hervé Abdi et al. also provide a recent detailed review and comprehensive explanation of MFA (Abdi, Lynne, & Valentin, 2013).

MFA uses elements from both PCA and MCA. Abdi et al. call it a "simple, elegant, versatile and robust technique … [and] and ideal tool for the very large datasets of modern science" (2013, p. 173). It can accept qualitative and quantitative variables, which means that the limitations of PCA, which cannot accept mixed data (Labov, 2001), are overcome by MFA. Its specificity and advantage suit the very needs of a sociolinguist. For instance, it can analyse variation of the reflexes within each lexical set or consonant. The lexical sets or consonants are called *groups of variables* and the reflexes are the *variables*.

By taking into account groupings of variables, the weight of each variables is balanced out so that one variable does not have too much or too little weight (Pagès 2013, p. 77 ff.). The result of an excessive weight on the part of a variable is that the interpretation of the resulting sociolinguistic groups relies mainly upon the dominant variable(s) even though many other variables have been included in the model. In sociolinguistics, researchers often face the issue of having **unbalanced groupings** with regard to either linguistic or social features. This may create a bias if one performs a multivariate analysis like PCA or MCA. MFA takes into account the sub-groups – providing that the linguist indicates which variables form groups – and attributes different weights to each group to compensate for the lack of balance in the data. MFA also provides the **overall effect of a group of variables**, which makes it an ideal tool for sociolinguists. Last but not least, PCA/MFA, can deal with **redundant variables**, which is often the case for social variables in a sociolinguistic analysis, without causing issues of multicollinearity (Tabachnick & Fidell, 2013, p. 89).

Certain limitations have been found, however. If observations comprise cohorts that are known to significantly differ in the measured variables, e.g. formant values or fundamental frequencies between men and women, then MFA is less suitable than another approach called dual MFA (Lê, Husson, & Pagès, 2007; Lê & Pagès, 2010). Leionen (2008) had to perform two separate PCA analyses on Swedish vowel formants for male and female speakers. This would have been an issue when using MFA as well. But with dual MFA, it would be possible to carry out an analysis that takes into account acoustic differences that may be related to gender. One major issue is that including yet another statistical approach like dual MFA to one's set of tools meant that the time allotted to the linguistic interpretation of the results would be considerably reduced. Moreover, in MFA, multiple preliminary tests as to how much noise should be taken out, how much of the variability is explained by the principle components, along with the time entailed to examine the long and diverse factor loadings, considerably increases the steepness of the learning curve. Eventually, its versatility, which enables the researchers to look at the data from so many angles and points of views either deters them from going beyond the general trends given by the first two components or drives them into an ocean of variation ranging from broad trends to inter and intra-group dynamics, from nondescript median speakers to stereotypical and extreme speakers. Plus, when an existing interactionality effect is pointed out by MFA, it has to be coupled with a regression model to answer this narrower question in a more straightforward way.

4.2.10 Statistical limitations in the 1970s-80s when analysing the TLS

4.2.10.1 Including all the variables

When presenting her results, Jones-Sargent remarked that social correlates of TE phonetic variation would better be studied if the "whole segmental [phonetics] subspace could be processed in one run, at state level, instead of being split into batches not exceeding 200 variables" (Jones-Sargent, 1983, p. 254 footnote). This led her to adapt the initial holistic methodological aim of the TLS original team so as to meet the restrictions of the statistical program that she had at her disposal. The 566 linguistic variants were split into 2 separate datasets, i.e. the monophthongs, on the one hand, and the diphthongs and unstressed vowels, on the other. A cluster analysis was performed on both datasets. She observed that differences in the clustering of speakers in each dataset pointed at the importance to include all the segmental phonetic features in order to build a more accurate sociophonetic profile of the TLS informants. A fully integrated approach would be brought forward in a later study once she would have access to a program which would accept all 566 variables at the same time. An improved version of the programme she used existed and was called CLUSTAN 1C but it was not yet available at Newcastle University which had CLUSTAN 1A (Jones-Sargent, 1983, p. 254 footnote). Nonetheless, knowing that an updated version of CLUSTAN could meet the requirements of the TLS holistic aim provided hopes that further research on the TLS-coding would be possible in the near future.[91]

Another important fact about Jones-Sargent's study (1983) is that she included as many social variables as possible which would lead to issues of collinearity, a phenomenon she was fully aware of (Jones-Sargent, 1983, p. 252). She chose to keep them all to avoid skewing the results as a consequence of an over-simplified sociolinguistic reality of the data itself, which was coherent with the original TLS data-driven approach. One limitation that resulted from this methodological choice is that sociolinguistic patterns were much harder to interpret because of the excessive amount of detail also contributed to skewing the results. In this chapter, only gender, age category and class based on the informant's last profession were retained. Detailed metadata were kept in a separate file and were consulted when necessary – former occupation and birthplace proved important when accounting for individual variation.

4.2.10.2 Taking the hierarchical structure of the data into account

Eventually, Jones-Sargent deplored the then inability of CLUSTAN to take into account the "structuring of the coding frame", which meant that "states scores [were] treated as independent and unrelated variables in the classification procedures (Jones-Sargent, 1983, p. 221). In order to address this issue, she suggested to assign "more weight" to certain

[91] CLUSTAN 1A itself however, was not devoid of assets. The latter had already the advantage of enabling clustering with "mixed mode data" (numeric linguistic data and binary-only qualitative social data). Out of the two types of data, one had to be "masked" (Jones-Sargent, 1983, p. 247), what is called *supplementary variable* in MFA. However, "diagnostics for all the social data were produced for all the social variables in respect of the linguistic clusters" (Jones-Sargent, 1983, p. 248). Such diagnostics are also provided in the MFA analysis.

features" in the classification or to use the PDVs (Jones-Sargent, p. 234) – as done by Moisl and Maguire (2008), though the latter also poses structural issues. Such limitations can be addressed with MFA since the lexical set/state structure is taken into account. Depending on how many states there are within a lexical set, weights are redistributed to render each lexical set as important as any other set, thus preventing biases due to the uneven numbers of states recorded per lexical set.

This section was a literature review of the methodological approaches of major studies in aggregate dialectology and aggregate sociolinguistics. Based on this overview, several needs were found: **the need to enhance visualisation**, and more importantly, to take into account, the various types of **hierarchical structure that are inherent to LVC** and dialect data. The following chapter deals with the data used for the present thesis and provides details on the methodology carried out for this study on language variation and change in Tyneside English.

CHAPTER 5 Data & Methodology

Summary of CHAPTER 5

This chapter first outlines the methodological approaches taken by the original research teams of the TLS and the PVC and what methodological decisions I took to revisit the data. The information includes for both sub-corpora, the selection of participants, the type of interview chosen, the social data questionnaire, the recording material, the transcription and coding of the phonetic data and the later digitisation of the interview data. The remainder of the chapter comprises the decisions taken to deal with the phonetic data (auditory and acoustic) along with the choice of the statistical analysis for both the auditory and acoustic data from the TLS and the PVC.

5.1 TLS & PVC data

5.1.1 TLS: informants

37 informants living in Gateshead and 7 in Newcastle were used for the present study. Among the Gateshead speakers are 20 women and 17 men (Table 5-1) with middle-aged speakers being the most numerous (n=20) and younger or older speakers counting only 8 and 11 individuals respectively. The sample of Newcastle speakers includes 2 younger men as well as 2 middle-aged men. There is also an older woman and 2 middle-aged women.

Table 5-1 Distribution of TLS speakers by gender and age decade (n=44).

Gateshead speakers				Newcastle speakers			
Age group	**Women**	**Men**	**Total**	**Age group**	**Women**	**Men**	**Total**
17-20	2	0	2				
21-30	4	5	9	21-30	0	2	2
31-40	6	4	10	31-40	0	1	1
41-50	5	3	8	41-50	2	1	3
51-60	2	0	2				
61-70	0	5	5	61-70	1	0	1
71-80	1	0	1				
Total	**20**	**17**	**37**		**3**	**4**	**7**

Table 5-2 Distribution of TLS speakers by gender and 3 age groups (n=44).

Gateshead speakers				Newcastle speakers			
Age group	**Women**	**Men**	**Total**	**Age group**	**Women**	**Men**	**Total**
Younger (17-30)	6	5	11	Younger (17-30)	0	2	2
Middle-aged (31-50)	11	7	20	Middle-aged (31-50)	2	2	4
Older (51-80)	3	5	8	Older (51-80)	1		1
Total	**20**	**17**	**37**		**3**	**4**	**7**

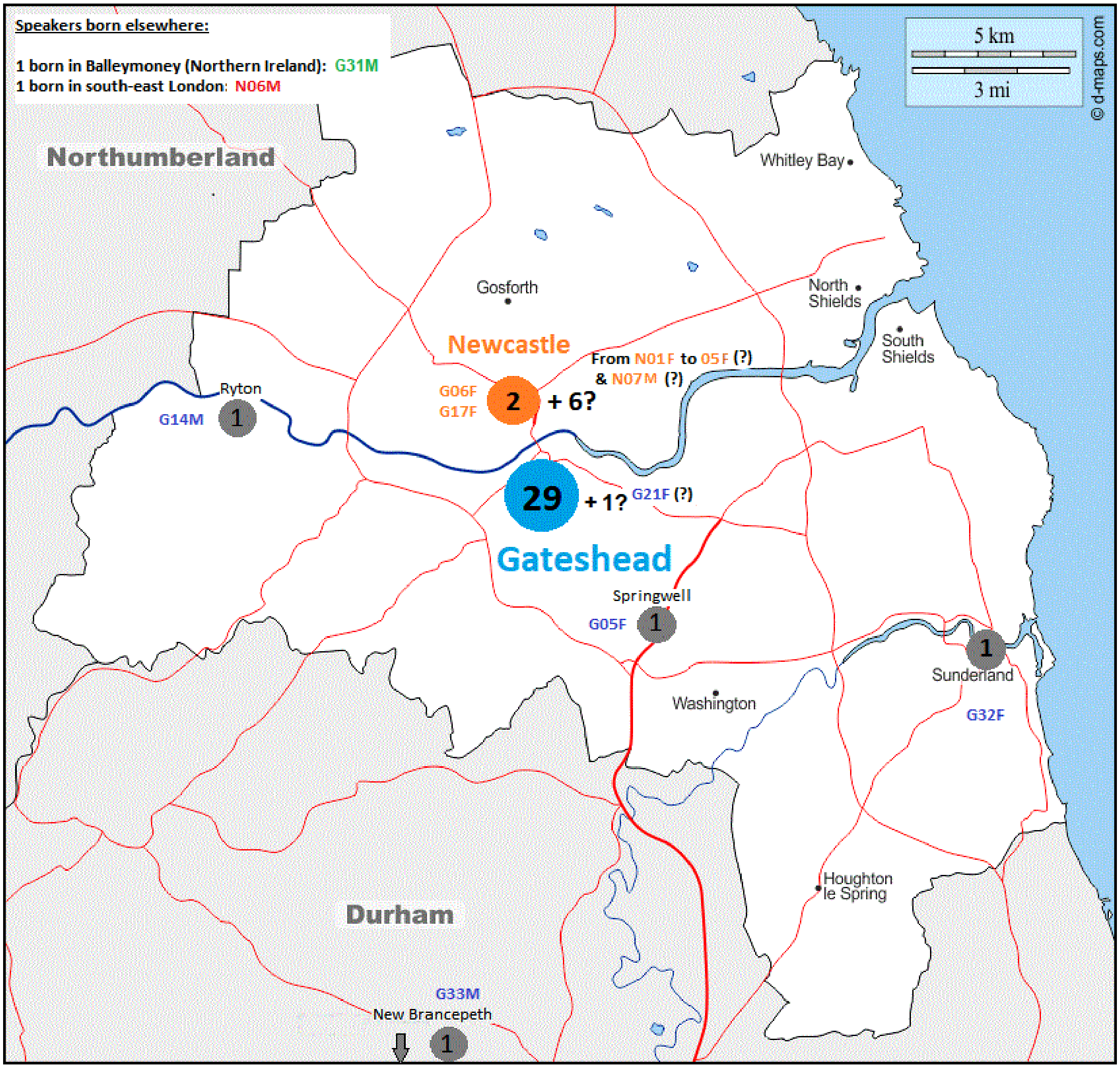

Figure 5-1 TLS speaker birthplace, known and conjectured, i.e. followed by (?). Based on Adam Mearns's TLS metadata table. Retrieved March 01 2019 and adapted from https://d-maps.com/carte.php?num_car=112556&lang=en. Copyright 2007-2019 by d-maps.com.

The metadata is more detailed for the Gateshead speakers. At the time of the interview, social information was gathered by Vince McNeany and then a larger file with very detailed information was compiled by Adam Mearns (A. J. Mearns, Moisl, Corrigan, & Beal, 2014). If there is little information about the birthplace of the Newcastle speakers, we know that a great majority of the Gateshead speakers were born in Gateshead (29). Figure 5-1 represents where the speakers were born. In blue are speakers from the Gateshead sample and in orange, from the Newcastle one. A question mark was placed beside the speakers' index name when birthplace was unsure. Two speakers were born outside this area, i.e. N06M and G31M, who were born in south-east London and Balleymoney (in the North of Northern Ireland). Balleymoney is a region where Ulster-Scots is spoken, a language which includes vowel variants that are similar to traditional features of Newcastle English, more specifically, a centring diphthong for FACE, also known as FACE-breaking (Gregg 1963, cf. APPENDIX IX) and a raised onset in PRICE.

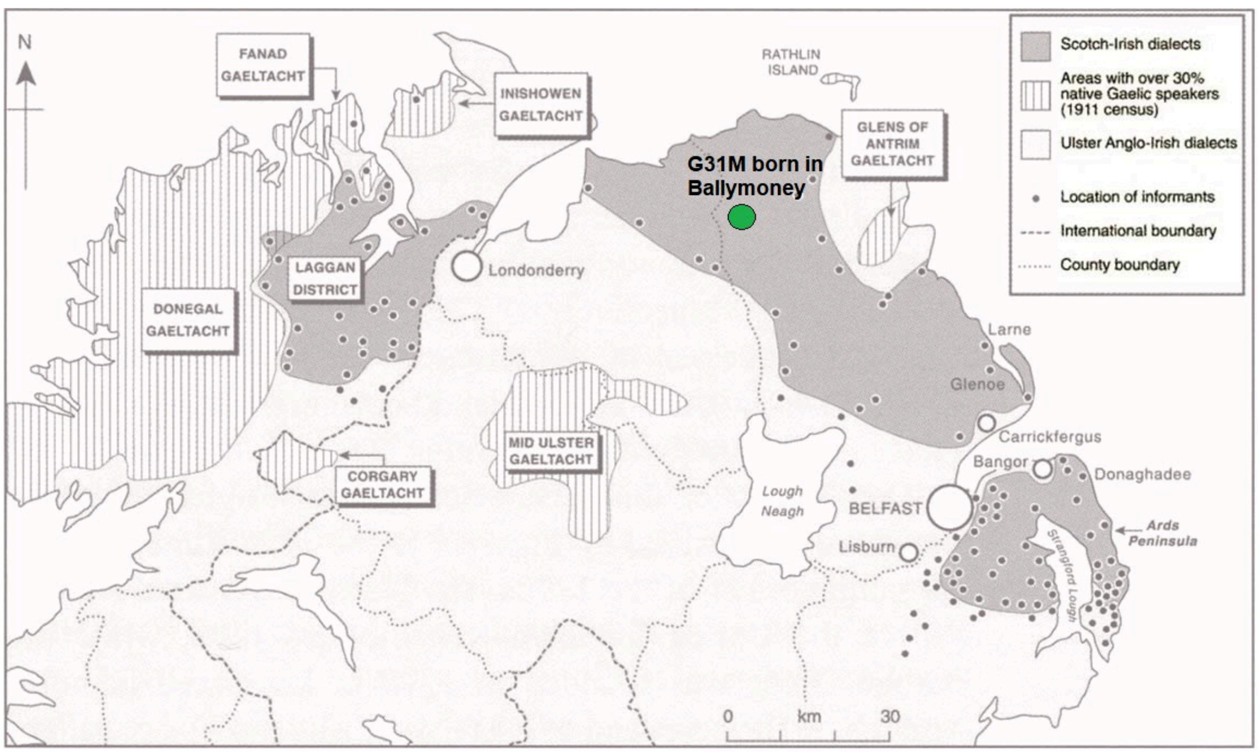

Figure 5-2 G31M's birthplace in the context of Ulster Scots dialect boundaries (Gregg 1972) (Retrieved March 01 2019 and adapted from https://www.libraryireland.com/gregg/mapping-ulster-scots.php).

Table 5-3 Distribution of TLS speakers by fieldwork, gender and occupation (current or former).

Gateshead women	TOTAL	20		Newcastle women	TOTAL	3
Housewife or retired	**12**			**Inspectional, supervisory, non-manual (lower grade)**	**1**	
Sewing industry or tailor	**6**					
Sewing machinist	4			**Skilled manual and routine non-manual**	**2**	
Tailor	1					
Cutter or designer	1					
Catering business	**4**					
Shop worker	**3**					
Factory worker: paper mill & other	**2**					
Home help	**1**					
Cleaner	**1**					
Nurse	**2**					
School secretary	**1**					
Employment exchange worker	**1**					
Civil servant	**1**					

Gateshead men	TOTAL	17		Newcastle men	TOTAL	4
Painter / Plumber	**2**			**Unskilled manual**	**1**	
Stroreman	**2**			**Skilled manual and routine non-manual**	**1**	
Driver	**3**			**Managerial & executive**	**1**	
Miner (1 retired, 1 former miner)	**2**			**Unknown**	**1**	
Skilled workers	**5**					
Millwright	1					
Wire drawer	1					
Maintenance fitter	1					
Engraver	1					
Cast operator	1					
Student (teacher training)	**1**					
Gas Board Marketing Retail Officer	**1**					
Railway engineer	**1**					

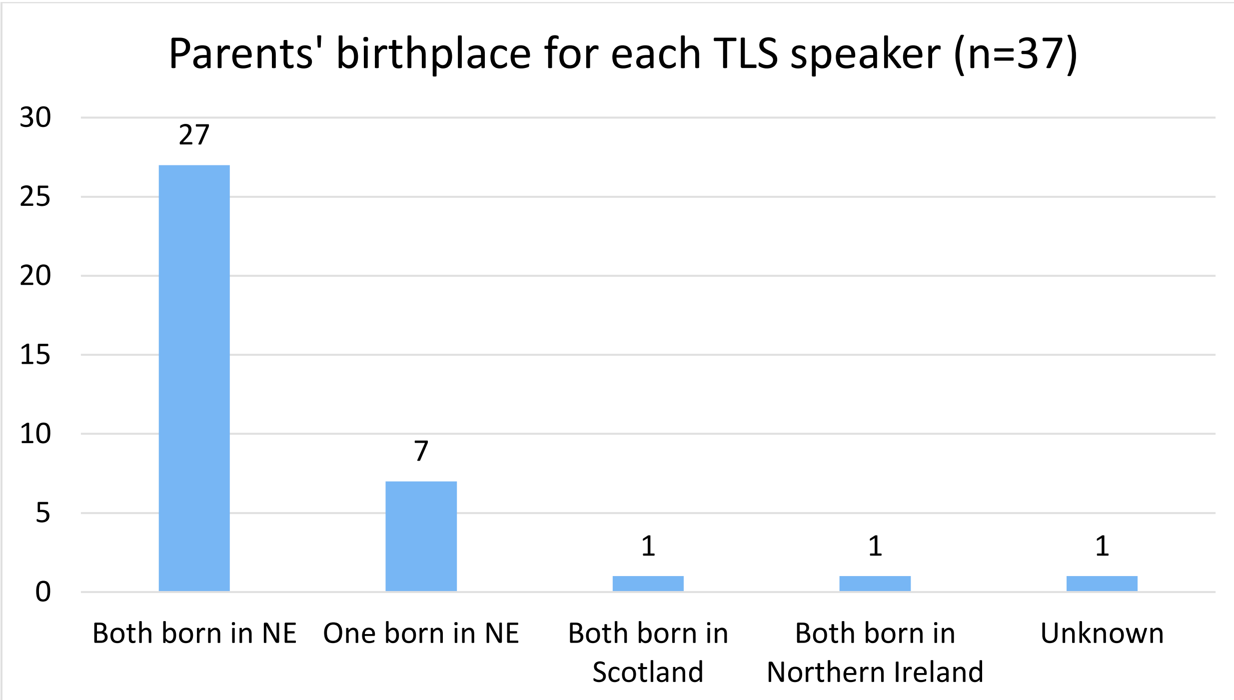

Figure 5-3 Parent's birthplace by region for each TLS Gateshead speaker (n=37, NE: North-East).

5.1.1 PVC: informants

The majority of speakers were selected from the electoral wards of Woolsington and Westerhope (Figure 5-4) since the General Census of 1991 "provide evidence that there is a social contrast between the two areas on several socio-economic dimensions" (Oxley, 1994, p. 1).

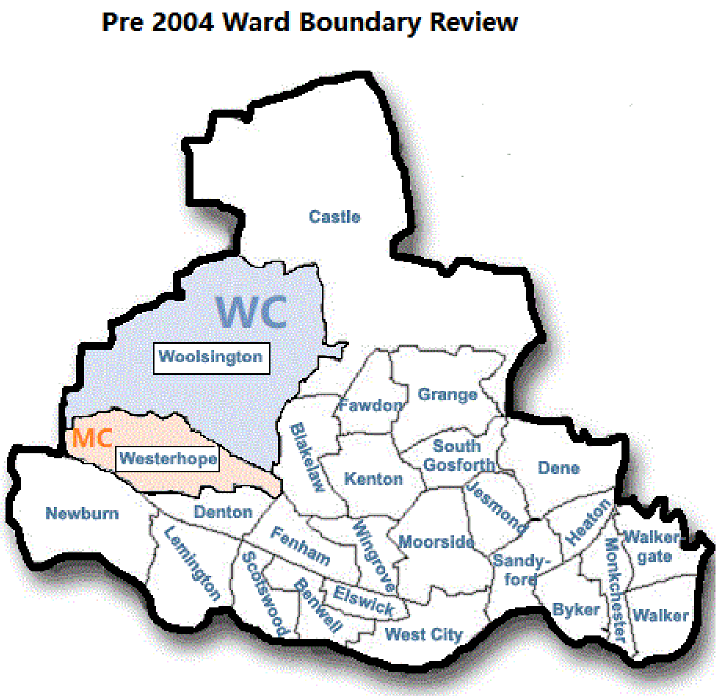

Figure 5-4 Pre 2004 Ward Boundary used to build the PVC sample of speakers (adapted from: http://www.politicsresources.net/area/uk/loc04/Pages/newcastle/elections.html#Ward%20Results %201982%20-%202003).

Table 5-4 PVC speakers by class gender and age decade (top) and by age group (bottom).

Working-class speakers				Middle-class speakers			
Age group	**Women**	**Men**	**Total**	**Age group**	**Women**	**Men**	**Total**
17-20	6	5	11	17-20	4	4	8
41-50	2	0	2	41-50	0	2	2
51-60	0	1	1	51-60	4	0	4
61-70	2	3	5	61-70	0	1	1
71-80	0	0	0	71-80	0	1	1
Total	**10**	**9**	**20**		**8**	**8**	**16**

Working-class speakers				Middle-class speakers			
Age group	**Women**	**Men**	**Total**	**Age group**	**Women**	**Men**	**Total**
Younger (17-20)	6	5	11	Younger (17-20)	4	4	8
Older (41-70)	4	4	8	Older (41-70)	4	4	7
Total	**10**	**9**	**19**		**8**	**8**	**16**

Table 5-5 PVC speakers' occupation, be it their former job or most recent one.

Working class speakers			Middle class speakers	
Women			Women	
Shop worker	1		Office worker	3
Factory worker	2		Physics teacher	1
Mechanic	1		Banking (retired)	1
School cook	2			
Secretary (sollicitor's office)	1		Secretary	1
Office worker	1			
Treasurer at golf club	1			
Student (6th former)	4		Student (6th former)	2
Men			Men	
Painter / plumber	2		History teacher	1
			Local goverment officer	1
Bus driver (1 unemployed, 1 retied)	4		Postmaster	1
			Business owner	1
Mechanic	2			
Student (6th former)	2		Student (6th former)	4
Student (post A-level)	2			

.

It should be remarked that there are two fathers and sons among the PVC sample: 02AM & 01AM the working-class cohort, and 11AM & 10AM in the middle class. There are also three mixed sex dyads in the working-class, namely speakers indexed 04 to 06 – 04 & 05 being married couples and 06, a brother and his sister. This had an impact on how the interviews were conducted. The wives tended to take a "noticeably dominant role in the conversation, their husbands appearing quite content to let this happen" (Oxley, 1994, p. 5). The fieldworker explained that she had to address the male speakers directly to ensure "sufficient data from" them (Oxley, 1994, p. 5). She did the same after 30 minutes of conversation on the part of the brother & sister dyad (dyad 06). As she noticed the conversation flagging, she "attempted to prolong it by asking several questions" (Oxley, 1994, p. 7). Apart from these special cases, her role was to be as unobtrusive as possible.

5.1.2 TLS: Auditory data

The TLS auditory data is analysed in CHAPTER 7. It is composed of McNeany's original transcriptions of the first 10 minutes of the TLS interview material and of my own transcriptions of the TLS wordlist which takes place after the sociolinguistic interview. The total number of items for the interview data amounts to 105,204 with 9,428 items with FACE, GOAT, PRICE and MOUTH only. The details are provided in Table 1-1. The occurrences of GOAT and PRICE are much higher and can be ascribed to the high number of "I" and "you know" in the corpus. The number of items varies from one speaker to the next but mean and median occurrences do not differ greatly. Proportions of variants per lexical set are detailed in CHAPTER 7.

Table 5-6 Number of TLS state items per lexical set: total and per speaker (n=9,428).

SUM FACE	**1705**	**SUM GOAT**	**2515**
SPEAKER MEAN	39	SPEAKER MEAN	57
SPEAKER MEDIAN	36	SPEAKER MEDIAN	57
MIN	16	MIN	11
MAX	75	MAX	107
Q1	29.3	Q1	46
Q3	48	Q3	70
SUM PRICE (including *I*)	**4186**	**SUM MOUTH**	**1022**
SPEAKER MEAN	95	SPEAKER MEAN	23
SPEAKER MEDIAN	99	SPEAKER MEDIAN	21
MIN	19	MIN	6
MAX	151	MAX	55
Q1	82	Q1	17
Q3	110.75	Q3	28.75

Most variants were used for transcribing the FACE, GOAT PRICE and MOUTH lexical sets as shown in Figure 5-5. The former two had a much wider array of variation possibilities than the latter. High variability may be due to the position of the vowels in a word, the fundamental frequency, the preceding/following phonemes. Variability due to internal factors will be analysed in a future study. Some states had digits that went beyond the present coding (marked as *?* in Figure 5-5) such as state 01045 or 01145. Variants that are crossed out did not occur in the TLS transcriptions of the 37 retained TLS speakers.

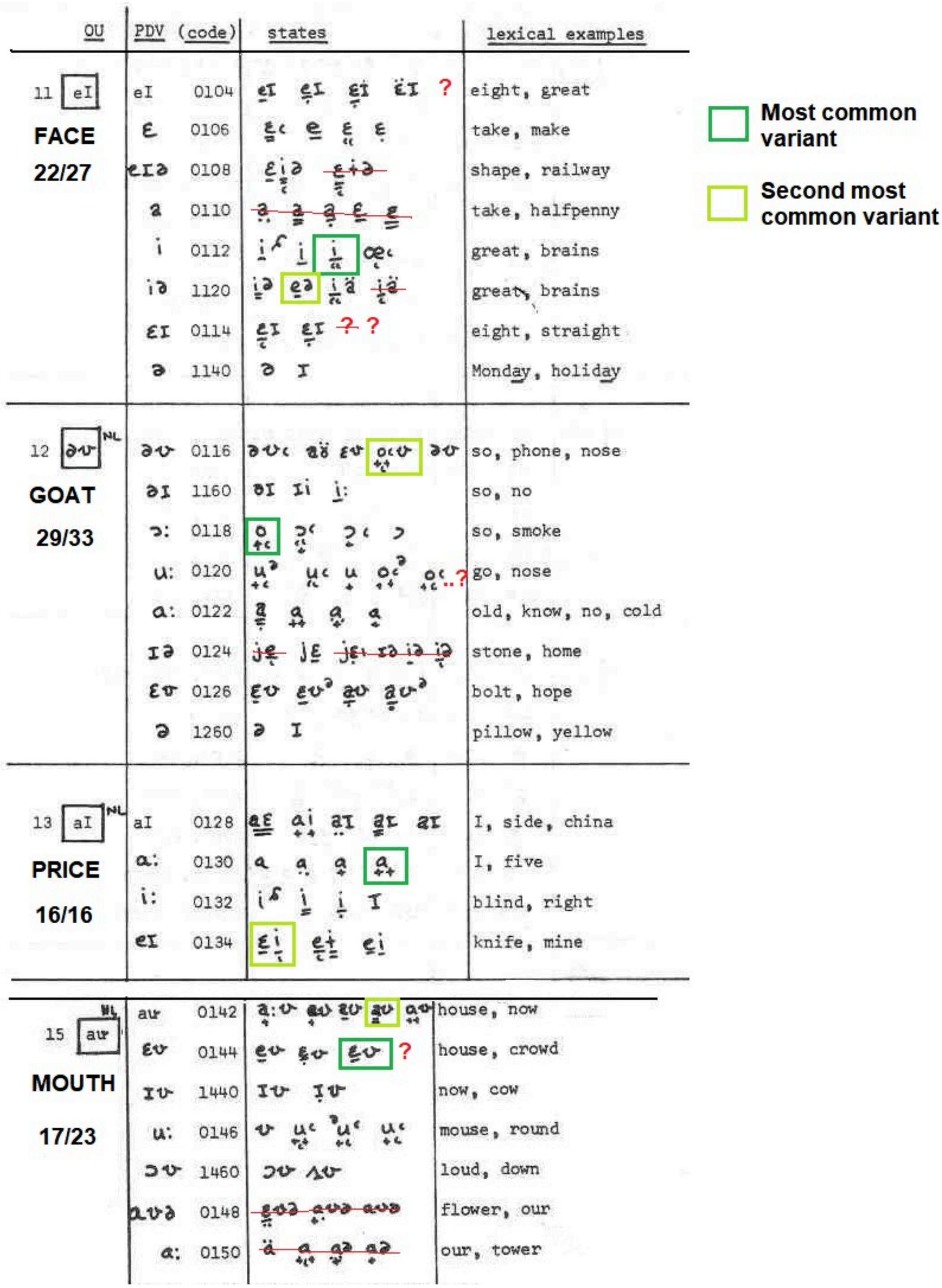

Figure 5-5 TLS coding scheme for FACE, GOAT, PRICE and MOUTH. Adapted from Jones-Sargent 1983, p.297-298. NL: non-localised variant. OU: overall unit. PDV: putative diasystemic variant. Question marks represent codes that existed in the TLS interview data but not in the coding scheme above. The variants that are crossed out in red did not occur in the date.

5.1.3 PVC: Auditory data

5.1.3.1 Inter-rater reliability

The PVC wordlist data was rated both by Watt (1998) for FACE and GOAT and by myself. The FACE and GOAT vowels had already been assessed by James and Lesley Milroy. Percentage scores of the variants were compared using *Minitab* 10. Pearson product-moment correlation coefficients showed "an extremely high level of correspondence… (FACE: r= 0.939, $p < .002$; GOAT: r = 0.959, $p < .002$)" (Watt & Milroy, 1999) (n4 p.45). I did not have access to the rating by J. and L. Milroy so I compared my rating with that of Watt only.

I first considered Watt's fine-grained IPA transcription (Figure 5-6) and matched them with his broader transcriptions (Watt, 1998). Hence [eə] or any vowel ending with a schwa or superscript schwa was labelled as a centring diphthong (CED). Initially, I used Watt's 4 main variants of GOAT but this seemed ill-adapted to the word "polka", which was often pronounced as an open [ɒ] and rarely as [oː]. I could not code both variants as a single monophthong (M), nor could I use the label MC which was for variants of the central monophthong [ɵː]. I therefore chose to add the label MO to refer to the open vowel [ɒ].

Then, to measure the agreement between Watt's transcription and mine, I opted for Cohen's kappa statistics (unweighted) since it is better suited for assessing inter-rater reliability based on nominal data than the Pearson product-moment correlation test (Cohen, 1960). Agreement between the two raters was deemed statistically significant (kappa statistics = 0.638, Z = 25.577, p-value < 2.2e-16). Based on Landis and Koch's judgement for the estimated kappa, there is "Substantial agreement"[92] here (Landis & Koch, 1977).

[92] If kappa is less than 0, "No agreement", if 0-0.2, "Slight agreement", if 0.2-0.4, "Fair agreement", if 0.4-0.6, "Moderate agreement", if 0.6-0.8, "Substantial agreement", if 0.8-1.0, "Almost perfect agreement" (Landis & Koch, 1977)

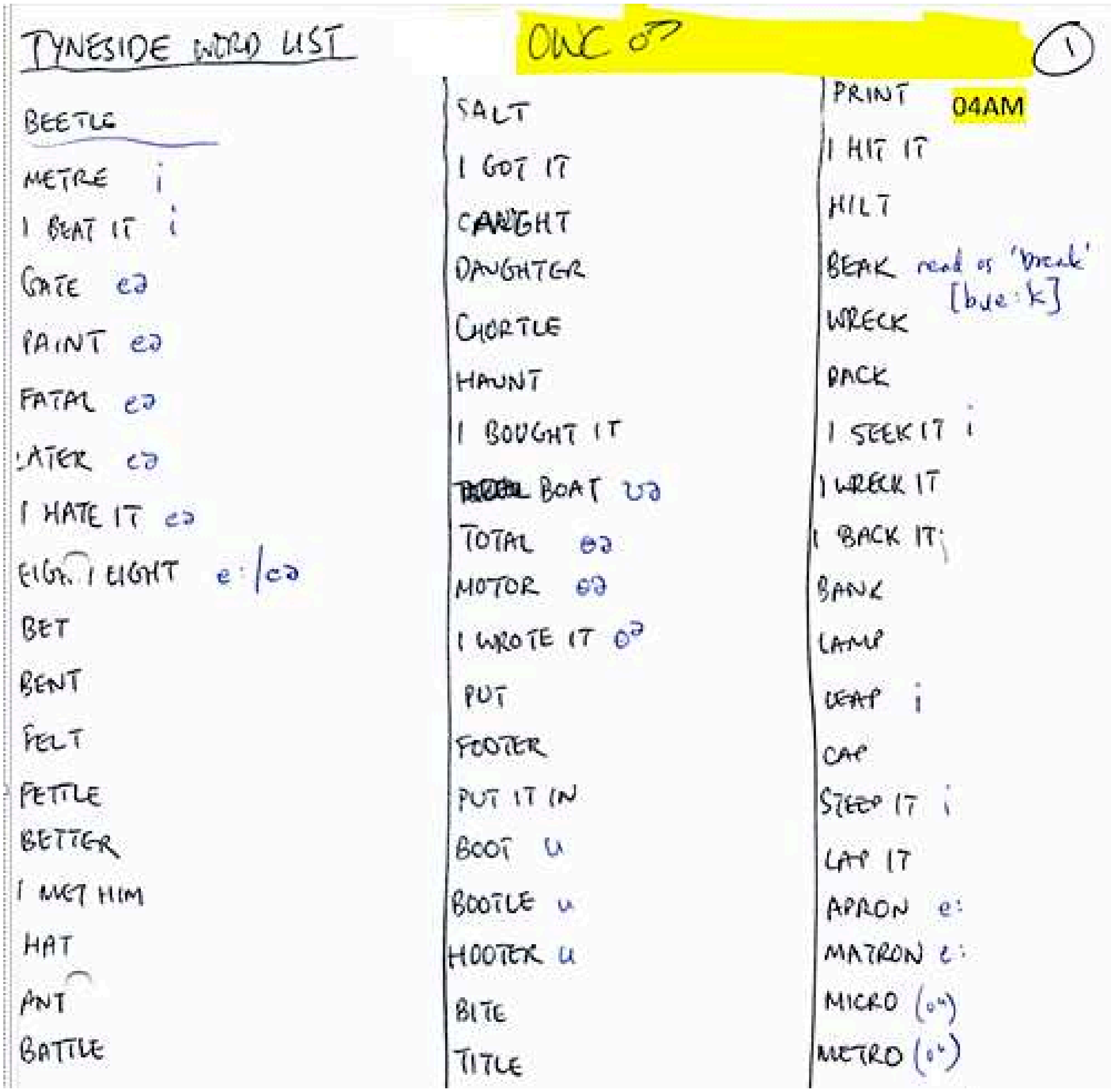

Figure 5-6 Watt's fine-grained IPA transcription of the PVC wordlist (speaker 4AM).

5.1.4 Linguistic variables

The present thesis hones in on the FACE, GOAT, PRICE and MOUTH lexical sets for the following reasons:

1) Viereck's study (1968) reports that vowels in TE are directly concerned by the loss of traditional features in the area. Since several corpora of TE are available in the DECTE, I decided to measure the loss of traditional features between the 1970s (TLS) and the 1990s (PVC).
2) More recent studies on TE in the PVC corpus (wordlist and conversational style), such as those by Watt and Milroy (1999) and Watt (1998), revealed a front-back symmetry in FACE and GOAT interacting with gender and class. Although several studies have analysed the TLS-coding (e.g., Jones-Sargent 1983, Moisl & Warren 2008) no detailed assessment of the FACE and GOAT symmetry has been carried out in the TLS. Moreover, symmetry in FACE and GOAT is reported to correlate with demographic indices of class within TE in both the TLS (Jones-Sargent 1983) and the PVC (Watt 1998).
3) Another diphthong, PRICE, was analysed by James Milroy (1996) on the PVC conversational material. The analysis showed that TE speakers loosely followed the Scottish Vowel Length Rule (SVLR e.g. MacMahon 1991) but that class also determined the use of traditional raised onset. The feature is favoured by working-class speakers – except among older women – with younger speakers having higher scores than older ones. A similar pattern was found for middle-class speakers, but they all had much lower scores of raised onsets.

4) MOUTH has rarely been studied despite the monophthong [uː] being highly enregistered in the area. While FACE and GOAT are said to work in *lockstep* (Watt 1999), it would make sense to analyse PRICE in parallel with MOUTH and to look for a potential symmetry despite the fact that PRICE reflexes are partly ruled by internal factors.
5) Preliminary statistical analyses of the TLS-coding comprising the entire phonetic system of TE revealed that FACE GOAT PRICE and MOUTH were considered as main determinants of sociolinguistic stratification in TE among other features like the STRUT or KIT, the bound morpheme -*ing* or intervocalic /t/.

Now that the choice of the linguistic variables has been justified, the justification of the statistical analysis applied to the TLS & PVC corpora is provided in more detail.

5.1.5 Statistical analysis of the auditory data

The statistical analysis used to analyse the data had to respect the original aim of a data driven approach. I had to find a multivariate approach of the data that would accept a very large number of variables (566) and took into account the fact that phonetic features belonged to an overall unit, other, which would otherwise increase the skewing of the results. Multiple Factor Analysis (Escofier, 1983; Escofier & Pagès, 1984, 1994, 2008) appeared as an ideal method to balance out the weight of variables within each overall unit. It also had the advantage of filtering out the noise in variation. For instance, certain states were used once by certain speakers, or everyone used the same reflexes of a vowel or a consonant. These variants cannot be considered as a main determinant of TE speech and belong to variation noise. The approach was also combinable with cluster analysis (Husson et al., 2010), thereby making the clusters more stable due to the filtering of the noise. The use of both contribute to a better understanding of sociolinguistic data in terms of aggregate approaches and group/individual variation patterns. It is also more flexible because it accepts quantitative and qualitative data simultaneously. It therefore seemed particularly adapted to our research questions for the TLS and the PVC. At a later staged, it even proved a useful tool for spotting dyadic convergent and divergent patterns in the PVC wordlist material.

In the pilot study, I used the scores of the FACE, GOAT and PRICE variants only from PVC wordlist material. I first assessed the clusterability of the PVC wordlist data so as to make sure that groups are not randomly forced into clusters. Then, I tested a more widespread approach to reduce dimensionality (PCA) and combined it with a cluster analysis as recommended by Husson et al. (2010). This served as testing ground (1) to check how much can be extracted from this statistical tool to serve the needs of a sociolinguist and if so (2) to learn how to use it and interpret the wide array of loadings from a PCA analysis before moving on to MFA, which at first sight, seemed less straightforward to understand as is had never been applied to sociolinguistics – to my knowledge. The PCA analysis helped confirm that there are indeed variation patterns that are not random and that sociolinguistic groups that are in line with Watt's study of the same data (1998) emerge from the analysis. I then endeavoured to find the ideal number of speaker clusters to highlight more subtle sociolinguistic trends intersecting with gender, class and age, and to find how each cluster is characterised in terms of FACE, GOAT, PRICE variation.[93] I then highlight that PVC may not be the ideal tool and conclude that MFA would provide better results.

In CHAPTER 7, I question the default parameters of the MFA and cluster analysis to find the most parsimonious model, i.e. a model which would still provide more information about variation patterns in the TLS transcriptions than the previous studies by Jones-Sargent (1983) and Moisl (2005). The best compromise seemed to use the default reductionality dimension parameters of the MFA (5 dimensions) but to cut the tree lower than where it was advised to cut so as to make more sociolinguistically different groups emerge as a result of interactionality, i.e. the multiplicity of social factors intersecting to produce complex systems of identification between speakers in a social matrix (Crenshaw 1991; Eckert & McConnell-Ginet 1992; McCall 2005; Levon 2011; Eckert 2014).

5.1.6 TLS & PVC acoustic data

CHAPTER 8 is a first step in testing the reliability of the more recent transcriptions I made of the TLS & PVC wordlist material by matching the transcriptions with hand corrected formant trackings using Ferragne's praat script to edit formant trajectories (Ferragne, 2019) – the approach mentioned below will be applied to the TLS coding data in a future study. This script was fundamental since what I wanted to measure was precise formant trackings and not the median formants across the entire vowel. Incorrect formant tracking, which occurs a

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[93] When I started the pilot study, I had not thought of adding MOUTH to test whether it worked in lockstep with PRICE like FACE and GOAT. Also, I had not fully grasped the advantage of Multiple Factor Analysis but was later advised to use it by François Husson given the hierarchical structure of the data (PC, 10 November 2017).

lot with sound archives, would result in severe inconsistencies during the acoustic analyses. Formants, however are rather resistant to time and quality, as Jane Stuart-Smith once remarked (Stuart-Smith, personal communication, 8 February 2017). Since I did not have many vowels per speaker, I really needed to keep as much data as possible and a formant editor proved very useful and Ferragne's script was particularly easy to use.

It seems particularly important to explain what it means technically to deal with older sound archives stemming from sociolinguistic interviews recorded in the homes of informants. The noise and the quality makes it less ideal for acoustic analysis, yet, akin to inscriptions on old stones, vowel formants remain fairly resistant to time. Extra work and tools is needed to get satisfactory results. The whole process from sounds to formant tables is detailed below so as to (1) guide younger researchers who wish to analyse sound archives or fieldwork spoken data. (2) To make the data as reproducible as possible.[94]

Before resorting to Ferragne's script, I tried various ways of aligning the data but found that forced aligners (Bigi, 2012) were not always the best tool for this kind data unless one simply wants to build a searchable database to serve as a pre-processing step to an acoustic analysis.[95] The work of a trained researcher proved easier and faster but limited the amount of variables to a few phonetic features like strong and weak vowels. At first, I wanted to align every single phoneme uttered by each informant in the TLS interview material. But I

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[94] Hand-correction is probably the least well reproducible step but one could envisage having several trained hand correctors and resort to inter-rater statistics to test the reliability of the correction. Future research on the TLS & PVC will take this suggestion into account.

[95] Aligners keep getting regular improvement and it is possible to train them with a particular variety. I just realised that it might take me just as long to train the programme, then run it on TE speech, then correct the errors etc., that I thought it best to find other solutions.

then realised that if every phoneme were to be aligned to their wave-form equivalent, I would have to build a very complex *Praat* script that would not only extract acoustic data from the vowels only *and* get measurement points at a 5 ms step. I would also have had to insert additional praat script lines of code to retrieve the word in which the phoneme is, probably from another tier with an alignment at a word level – which also takes a very long time[96] – and ideally retrieve the preceding and following phoneme when there is one or when it is not omitted to coarticulation in speech. The amount of work ended up being disproportionate so I decided to focus on the TLS-coding data as such and see how I could improve the previous statistical analyses (Jones-Sargent, 1983; Hermann L Moisl, 2012) and dig deeper into group and individual variation patterns.

However, since one of my missions in this thesis was to perform an acoustic analysis, I searched for the wordlist data in both the TLS and the PVC to build a speech annotation protocol that would speed up and improve the formant extraction process, which would help me deal with spontaneous speech in future studies. I drew inspiration from production management principles to improve efficiency during the extraction of the acoustic data (Anderson & Carmichael, 2016). The workflow is as follows:[97]

1) Cut the audio section where the wordlists are read into distinct sound files to prevent praat from crashing with a longer file.
2) Add textgrids automatically using a first *Praat* script (cf. APPENDIX X).

[96] This means you are aligning the files twice.

[97] The steps may appear as rather numerous but this is the best I could do after various trials and error. Textgrid labels are slightly different between the TLS and PVC but this did not impact our main study and relabelling is relatively easy using the following workflow.

3) Annotate all the vowels so that they may be used for future studies. Type one character within the boundaries that will *not* be labelled XX (cf. section 4, *infra*). Make sure the number of boundaries remains the same across all sound files. If a speaker omitted a word or misread a word, create a boundary for the vowel all the same. The acoustic and auditory data for this vowel will subsequently be labelled as *NA*.
4) Use a second *Praat* script to label all empty cells in the textgrids (cf. APPENDIX XV). I decided to label it XX. This will be a way to prevent the next *Praat* script from automatically filling in these unused boundaries.
5) Build an item list for each batch (TLS & PVC) in a simple text file. The line will not only contain the word in which the vowel is inserted but also the lexical set, the preceding & following phoneme (Table 5-7). The first element of each line is merely the ID of the measured item within each textgrid. The second element is the word itself. When capital letters are added to the word as in metRE, it means that the reduced letter is being measured, otherwise, it is the stressed vowel. In third position is the lexical set, then the preceding and following phoneme. A # symbol indicates that the vowel is either in initial of final position. In sentences like "I beat it" (lines 5 to 6, PVC), it was deemed relevant to indicate that the pronoun *I* was followed by /b/ but that it was preceded by nothing, hence the use of #. Since the wordlist was rather long for the PVC, I hypothesised that by the end of the wordlist the reading style had become more casual among certain speakers. I decided to separate the wordlist into 4 parts which I named *Quarter* to test that hypothesis. Eventually, the little stars * have a special function, which I detail in

the following point. * were used to mark the vowels I am particularly interested in for the thesis, i.e. FACE, GOAT, PRICE and MOUTH. At a later stage, I used them to find the latter more easily and carry out an auditory analysis on them.

Table 5-7 List of items to be inserted in the text grids. Left: PVC wordlist material, right: TLS.

1_sheet_FLEECE_ʃ_t_1stQuarter_ 2_beetle_FLEECE_b_t_1stQuarter_ 3_metre_FLEECE_m_t_1stQuarter_ 4_metRE_lettER_b_t_1stQuarter_ 5_I_PRICE_#_b_1stQuarter_* 6_beat_FLEECE_b_t_1stQuarter_ 7_it_redi_t_t_1stQuarter_ 8_gate_FACE_g_t_1stQuarter_* … *301 items*	1_find_PRICE_f_i_n_*AI EI 2_mind_PRICE_m_i_n_*AI EI 3_fly_PRICE_l_y_#_*AI EI 4_bill_KIT_b_i_l_ 5_well_DRESS_w_e_l_ 6_men_DRESS_m_e_n_ 7_head_DRESS_h_ea_d_ 8_back_TRAP_b_a_k_ … *103 items*

6) Once the lists are ready, use a third *Praat* script to fill in the boundaries that are not labelled as XX (cf. APPENDIX XVI). All the textgrids are filled in simultaneously.
7) Remove the XX labels from empty boundaries using the praat script in cf. APPENDIX XV.
8) Duplicate this tier and give it another name. This will be used at a later stage.
9) Use one tier for the auditory analysis: find each vowel with a *[98] and transcribe the is with a simpler label as IPA to further speed up the auditory analysis, e.g. AI for

[98] NB: instead of typing ctrl+F and press OK each time to find *, just type ctrl+G to repeat task indefinitely.

[aɪ]. With *Praat* you would have to type: *a/ic* to get the proper IPA transcription, which makes one loose more time in the annotation process.[99]

10) The other tier did not include the auditory labels and was used for the acoustic analysis as keeping the tier with the auditory annotation would later result in working file by file and not in batch (cf. point 8, *supra*). Having identical tiers with identical content across files, then help filter only FACE, GOAT, PRICE and MOUTH vowels.

11) The sound files and their textgrids are now ready for the formant editor and formant extraction with Ferragne's script. Start with the automatic correction function is obligatory. Pretend you want to discard each vowel individually so that they may be hand corrected afterwards.[100]

12) The hand correction requires you to draw the formant tracking using a number of points that you can define yourself. It is important to place a point where the formant tracking starts forming an elbow, when there is one. But points have to be placed from left to right only.[101] F3 trajectories were rarely visible but since some were, I decided to include F3 in the hand-correction process but it could not be included in the acoustic analysis.

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[99] Capitalisation of AI just helped me see the label more distinctly as it stood out from the rest of the items on the line.

[100] For reasons that were unknown to me, certain vowels made the whole programme crash so I had to discard them and repeat the whole process until another vowel made the programme crash again. However, each vowel that has been hand-corrected is automatically saved as an individual file. Hence, not everything is lost when the programme crashes. Despite this minor predicament, this programme was the most user-friendly I could find.

[101] A touch screen proved particularly useful in this case. I just had to follow the darker formant trackings.

5.1.7 Statistical analysis of the acoustic data

I then used Generalized Additive Mixed Models (Fasiolo et al., 2018; S. Wood, 2017) to analyse formant trajectories and test whether the categories identified by the annotators are also distinguished in height and/or shape by the model. The data construction was a bit complex too. The formant trajectories were placed in separate files after the formant extraction. I then used an Excel macro to correct the files in batch, then an R script to merge the files together so that they may be ready for the statistical analysis.

This chapter listed all the methodological processes carried out in the present thesis. The next chapter assesses whether Principal Component and cluster analysis are well adapted to an apparent-time construct aiming at analysing coherence in the FACE, GOAT and PRICE lexical sets based on spectrographic and auditory annotations.

PART II
Auditory analysis

CHAPTER 6 Pilot study: which tools should be used for analysing coherence and sociolinguistic stratification in the PVC wordlist material

Summary of CHAPTER 6

This pilot study analyses variation in the PVC data wordlist material of the 33 speakers. The pilot study is restricted to FACE and GOAT since they are known to work in "lockstep" (Watt 1998). As the aim of this thesis is to analyse coherence in variation, the lexical set PRICE is also included in the pilot study. At first sight, MOUTH did not appear as a relevant sociolinguistic variable since there was very little variation in the PVC wordlist, but the investigation of the TLS interview material (CHAPTER 7) revealed the importance of this highly enregistered feature in determining sociolinguistic groupings. Principal component analysis (PCA) followed by a cluster analysis was used to **investigate sociolinguistic stratification** and to analyse **coherence** in the variation of FACE, GOAT and PRICE among each groupings of speakers in a style that is known to elicit more formal and careful speech, i.e., the reading of a wordlist (Watt 1998, Labov 2001, Stuart Smith et al. 2007). In the first section, I check the clusterability of the PVC data, i.e. whether the distribution of variants follow a certain coherent pattern or not. Several clustering methods are compared with each other so as to find the approach that relies on all four lexical sets to create the groupings of speakers. If so, the cluster analysis will produce meaningful linguistic groupings. The next section analyses the results in terms of coherence, sociolinguistic groupings, paragons and extreme speakers. The concluding remarks point at an important disadvantage in using PCA for sociolinguistic studies because it is more *variant centric* and may result in certain variants appearing more important than they really are. It is therefore suggested to use a *feature centric* approach which takes into account the relationship between a linguistic feature and its variants. The approach is called Multiple Factor Analysis (MFA). This approach will be used in the main study of CHAPTER 7.

6.1 Introduction

The aim of this pilot study is to provide "an enriched description" of sociophonetic data by combining PCA with hierarchical clustering, as suggested by Husson et al. (2010). I first check whether the sociolinguistic groupings based on FACE, GOAT and PRICE are in line with Watt's findings with FACE and GOAT. Then, coherence within the variants is investigated upon.

With regards to how the data is analysed, the pilot study draws on the work of Moisl (2012, 2015) in terms of reduction of dimensionality (PCA) and on those of Jones-Sargent (1983) and Moisl (2015) regarding the choice of the appropriate clustering approach. PCA was used as a pre-processing step before applying clustering to the data because it reduces noise in the data and balances out the weight between each variant. Various clustering methods were also tested to assess the stability of the clusters and hence, the stability and reliability of the linguistic groupings. The PVC wordlist material served as a methodological testing ground before applying the statistical approach to the much larger and complex TLS-coding material. Since studies have already been made on the PVC, highlighting important trends on variation in FACE, GOAT (Watt, 1998) (Watt & Milroy, 1999) and PRICE (J. Milroy, 1996) in Tyneside English, it was anticipated that the results of the PCA & clustering analyses would be more easily interpretable and understood than if the TLS-coding had been analysed straight away.

The pilot study addresses the following **methodological** issues: (1) is PCA suited for auditory sociolinguistic data? (2) How can the stability of clusters be measured in an aggregate sociolinguistic study? (3) Can we improve the results by taking into account the hierarchical structure of the data, i.e. by taking into account the fact that variants belong to specific linguistic features such as lexical sets, by using a *feature centric* approach called Multiple Factor Analysis (MFA)? From a **sociolinguistic** point of view, other questions arise: (4) **sociolinguistic groupings**: are the initial sociolinguistic 8 cohorts[102] recreated in the statistical analysis and what does this tell us concerning levelling in FACE, GOAT and PRICE? (5) **Levelling**: Which speakers are more inclined to use supralocal variants, is the class and gender gap shrinking for these linguistic features, thus indicating levelling? (6) Knowing that FACE and GOAT work in *lockstep* (Watt 1998), what does the addition of PRICE bring to the sociolinguistic landscape of the PVC corpus?

6.2 Methodology

6.2.1 Data

For this pilot study, I chose to revisit Watt's 1998 study of FACE and GOAT and combine it with Milroy's analysis of the PRICE vowel since they are reported to be relevant markers of indexicality in TE. They both used the PVC corpus for their analysis of Tyneside English. I focused on the PVC wordlist only and transcribed each of the three above-mentioned lexical sets based on auditory and spectrogram analyses. Watt's proposed variants were used for FACE and GOAT as listed in **Table 6-1.** For PRICE, only 3 variants were retained ([ɑː], [aɪ] & [eɪ]). They also correspond to the three main variants of PRICE in the TLS (Moisl & Maguire 2008). In total, 1823 items were measured. (Table 6 2). Also, the word *polka* was taken out of the

102 Middle class vs. working class groups of younger and older men and women (8 cohorts).

study because of a potential GOAT/GOAL split – it was mostly realised with an open back monophthong [ɒ].

Table 6-1 Distribution of FACE, GOAT and PRICE variants in the PVC wordlist (pilot study).

FACE		GOAT		PRICE	
[ɪə]	(138) 28%	[ʊə]	(19) 5%	[ɑː]	(21) 2%
[eː]	**(246) 50%**	[oː]	**(163) 44%**	[aɪ]	**(729) 74%**
[eɪ]	(106) 21%	[oʊ]	(67) 18%	[eɪ]	(237) 24%
		[ɵː]	(121) 33%		
NA*	(4) 1%	NA	(1) 0%	NA	(3) 0%
Total	(494) 100%		(371) 100%		(990) 100%

* *NA (i.e. not available), indicates that the vowel was either not recorded or misread.*

Table 6-2 Distribution of items per speaker in FACE, GOAT and PRICE in PVC wordlist (pilot study).

	FACE	*GOAT*	*PRICE*	*Total*
Items per speaker	15	12	30	57
Items all speakers (n=33)	494	371	990	**1823**

6.3 Statistical analysis

I then performed a PCA analysis to first reduce noise in the data, verify Watt's observations that FACE and GOAT work in *lockstep* (1998) and see if PRICE also worked in *lockstep* with those two lexical sets. Then, a cluster analysis was made based on the PCA results. I assessed the clusterability of the data and the reliability of dendrograms by comparing several clustering methods as advised by Jones-Sargent (1983) and Moisl (2008, p. 68) and deemed an important step when carrying out future studies using cluster analyses on the TLS data. The more similar the results are with other methods, the more reliable the tree. These steps are summarised in Table 6-3.

Table 6-3 Workflow for PCA & clustering applied to sociolinguistic data.

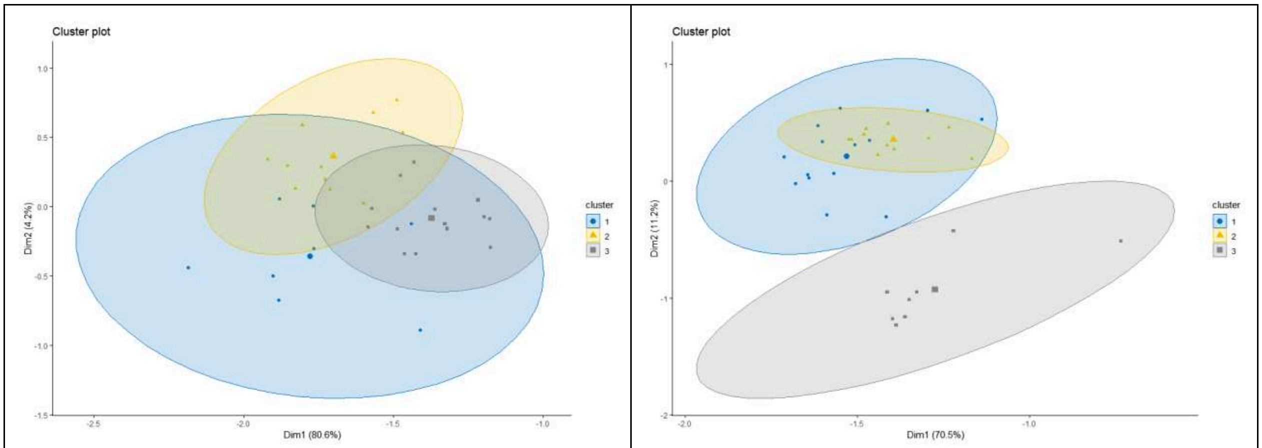
PCA check 1	• Is the data suitable for a PCA analysis (ideally 3 numeric variables)?
Clustering check	• Is the data clusterable? • If so, reduce noise with PCA, then perform clustering analysis. • Is the default clustering method (Ward) reliable enough? • If so, is the automatically created number of groups sociolinguistically relevant?
PCA check 2	• How well do the PCA dimensions explain variation in the data? • It is sociolinguistically relevant to use the first two dimensions in the PCA analysis (the first 2)? • Which variants enable us to interpret speaker variation using the first 2 dimensions?
Interpretation	• Which variants co-occur? • How is each group characterised sociolinguistically? • How far are individuals speakers placed from the centroid of their own group? • General conclusions

6.4 Cluster & PCA preliminary verifications

6.4.1 Clusterability of the PVC wordlist material

Question: *how can I tell if variation in the PVC forms clear enough patterns to create groups of speakers that are statistically similar?*

Before resorting to a cluster analysis, it is necessary to do a clustering tendency assessment, which determines whether a given dataset contains meaningful clusters of individuals and not artificial clusters with an underlying random structure (Lawson & Jurs, 1990). If you perform hierarchical clustering on a random dataset as in Figure 6-1, you can still get clusters but they may not be meaningful. Looking at both graphs, it is difficult to tell whether the clusters make sense or not. What we want to know is whether variation in the PVC wordlist creates enough distinct patterns to separate speakers into meaningful sociolinguistic groups.



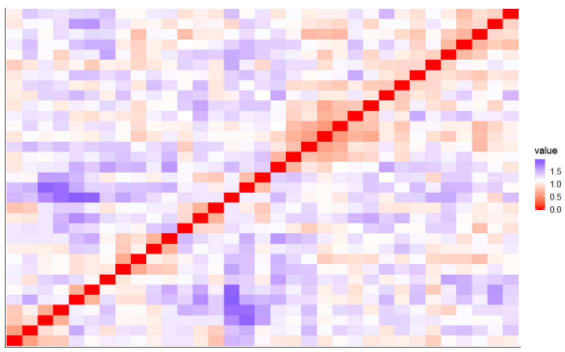
Random data (k=3) | PVC data (k=3)

Figure 6-1 Clustering tendency assessment 1. Left: random dataset, right: the PVC WL data.

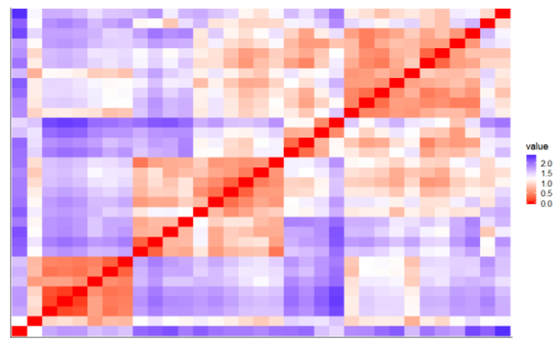
To do so, I resorted to the Hopkins statistics using the package `clustertend` (Luo & Zeng, 2015). It measures the probability that a given dataset is generated by a uniform data distribution, in other words, the probability that a dataset contains meaningful clusters or not. **The null hypothesis** is that the dataset is uniformly distributed, i.e, that is has **no meaningful clusters**. The alternative hypothesis is that the dataset contains meaningful clusters. A set of data is deemed **clusterable** if the H value is **below the 0.5 threshold** – H stands for Hopkins.

To complement the H value, more obvious visual tools can also help assess the clusterability of the data. It is called VAT or visual assessment of cluster tendency (Bezdek &

Hathaway, 2002). On the left hand side of Figure 6-2 is a random dataset based on the PVC data, on the right, the actual PVC dataset with all the variants of FACE, GOAT, PRICE and MOUTH (10 variables in total). The VAT for the PVC data forms 3 red patches (3 groups of speakers with high similarities) but the random dataset does not have very distinct red patches, which sheds light on low clusterability.



Random data (h-value = 0.53)



PVC data (h-value = 0.28) 3 visible groups

Figure 6-2 Clustering assessment 2: with visual assessment of cluster tendency (VAT) and Hopkins statistics (h-value). Left: random data, right: PVC WL data.

Moreover, the H value for the random dataset is slightly above the 0.5 threshold, which means it is highly probable that it does not contain meaningful clusters. The H value for **the PVC dataset falls below the threshold (*H* = 0.28) and is therefore clusterable**. We can proceed with a cluster analysis of the PVC data knowing that it will give us meaningful sociolinguistic groups.

6.4.2 Assessing the reliability of Ward's clustering approach

Question: *If I change the clustering method, will I get very different sociolinguistic groups?*

Depending on the clustering method, speakers can be grouped differently, especially if variation among speakers is high. When exploring clustering methods for the TLS auditory data, Jones-Sargent remarked "it must be borne in mind that different statistical techniques mould the data into different kinds of structure" (Jones-Sargent, p.116). It is often suggested that "that there is no best choice and researchers may need to employ different techniques and compare their results" (Bratchell, 1989, cited in Yim & Ramdeen, 2015). A useful approach would be to compare dendrograms made with various clustering methods (Ward, single-linkage, average, centroid) and compare their respective cophenetic correlation coefficients. Such coefficients enable to measure of how faithfully a dendrogram preserves the pairwise distances between the original unmodeled data points (Sokal & Rohlf, 1962).

The aim of this section is to gauge the reliability of the Ward's approach, which is the default clustering method that will be used after the PCA analysis. If clusters do not differ so much from one method to the next, then the clusters will be deemed stable enough with the default method (Ward). To do so, I first identify the method that is the most distant to the Ward approach using a similarity coefficient. I then test the reliability by inspecting another type of similarity index. If the latter index remains low enough, the clustering approach will be considered as steady enough. I will choose the Ward approach to analyse sociophonetic variation in the TLS with all the phonetic variants and in the PVC (FACE, GOAT, PRICE and MOUTH) in the main analysis (CHAPTER 7).

Figure 6-3 is a visual representation of the similarities between the trees – the darker and fuller the circle, the more similar the methods. Table 6-4 displays the coefficients computed out of the 4 dendrograms based on variation in the PVC wordlist. A coefficient close to 1 indicates a high degree of similarity, and a -1 score means complete difference. The figures indicate that the *average* and *centroid* approaches are the methods that are closest to all other methods, while *single-linkage* is the least similar to the other methods. *Average* is probably the best compromise among all other methods. It is to be noted, however, that *Ward* and *single-linkage* have 8 speakers with a different position in either tree, while *average* and *centroid* have 6 misaligned speakers. This implies that a substantial drop in cophenetic coefficients results in the misalignment of only two additional missaligned speakers.

Table 6-4 Matrix of correlation coefficients among the cophenetic values resulting from 4 clustering methods applied to the PVC wordlist data (Sokal and Rohlf 1962, 1: identical trees, -1: no match).

Dendrograms	***Ward***	***Single***	***Average***	***Centroid***
Ward	1.00	0.68	**0.93**	0.77
Single	0.68	1.00	0.84	**0.93**
Average	**0.93**	0.85	1.00	**0.92**
Centroid	0.77	**0.93**	**0.92**	1.00

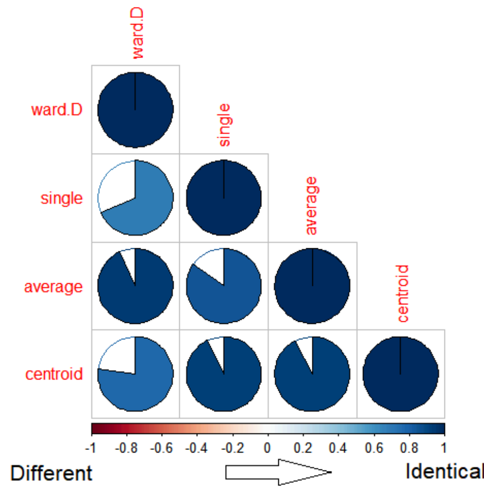


Figure 6-3 Visualisation of cophenetic correlation indexes, comparing the similarity of different clustering trees of the PVC wordlist data (in red: classification methods).

Ward and *single-linkage* are the most distant methods which means that they reveal two different aspects of variation in the PVC wordlist material. ***Ward*** and ***single-linkage*** will now be compared so have to have two different points of view on variation. I will examine the differences between dendrograms resulting from both approaches to check how they may complement each other with respect to sociolinguistic **group variation** and to the identification of **atypical speakers**.

6.4.2.1 Ward vs. single-linkage, or how to spot atypical speaker in a crowd of individuals.

Question: if I use two very different clustering methods, are my sociolinguistic groups completely different? Which method takes into account a maximum number of lexical sets to make the groups?

Ward's distance, which we chose as the main clustering approach earlier on, may be sensitive to the shape and size of clusters but "it can easily fail when clusters have complicated forms departing from the hyperspherical shape" (Almeida, Barbosa, Pais, & Formosinho, 2007). In other terms, "clusters that are shaped like spheres in a space of more than three dimensions … and they can fail to separate clusters of different shapes, densities, or sizes" (Downs and Barnard 2002, p. 15). This is particularly pertinent for the group of traditional speakers, which is much less dense and spherical than the above supralocal group as found by Amand and colleagues (2018) in a preliminary study of the PVC wordlist.

It was also observed that **Ward's method was less sensitive to atypical speakers** because once a group is formed, the algorithm maximises intergroup distances. This is the reason why, in this pilot study, we try another approach called the single-linkage method (Sneath, 1957). Clustering is not only useful to detect groups in a dataset, it can also be used to detect outliers and the approach called *single-linkage* "has been shown to produce good results with sets of clusters of various sizes and shapes" regarding the identification of outliers (Almeida et al., 2007). *Single-linkage clustering* is a "common clustering procedure [and] a global optimization method which at each stage maximizes the minimum intercluster distance; it is also an agglomerative scheme" (Fisher & Van Ness 1971, p. 97) . It is also called *minimum* or *nearest neighbour clustering*. It computes all pairwise dissimilarities between the elements in one cluster and the elements in a second cluster. In other words, "the proximity between two clusters is the minimum distance between any pair of items (one from each cluster), that is, the closest pair of points between each cluster" (Downs and Barnard 2002, p.8). It then considers the smallest of these dissimilarities as a linkage criterion to group individuals together and generally produces long and *loose* clusters. As Yim & Ramdeen remark on this approach, when applying three different methods to psychological data, "single linkage is sensitive to outliers, but it is impervious to differences in the density of the clusters" (2015, p. 17) . Contrarily to Ward's Euclidean method, with the **single-linkage** approach, **atypical speakers** in the PVC data will stand out better, thereby guiding the researcher when carrying out an analysis on individual variation. It can help select which individuals should be looked at in more depth.

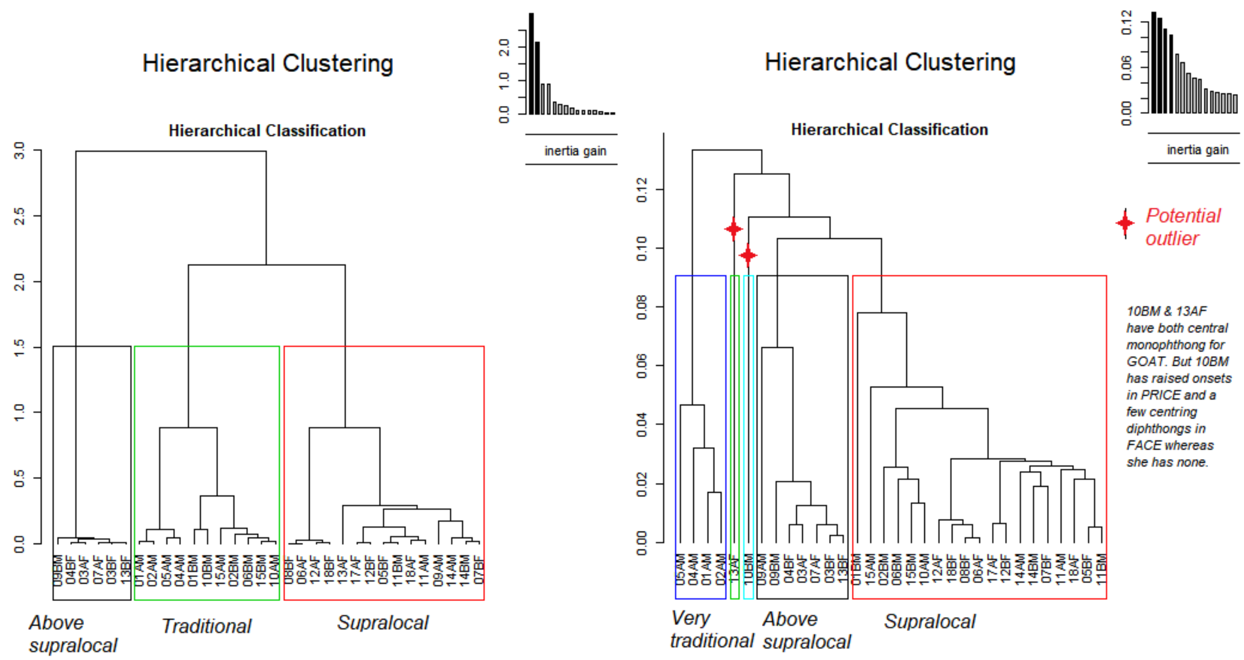


Figure 6-4 Dendrograms from a hierarchical cluster analysis: big trends with Ward (left) vs. atypical speakers highlighted with single-linkage (right).

The dendrogram with single-linkage in Figure 6-4 (right) splits the PVC speakers into two main groups (the higher the node, the greater the difference), excluding 10BM and 13AF from the rest of the group because they had very high scores of [ɵː] in GOAT. The tree then separates the very traditional speakers from the rest, i.e. the supralocal and above supralocal speakers. Within the above supralocal group, 9AM is singled out at a relatively high node, which means he is the most atypical speaker of the group. 9AM used variants across the entire above supralocal/traditional spectrum, with a preference for the above supralocal variant in FACE (60%) and the central monophthong for GOAT (45%). The rest of the above supralocal group avoided traditional variants in FACE and GOAT – with 2 speakers having a few raised onsets in PRICE. This explains why 09AM was categorized as supralocal with the Ward approach.

Among the traditional men, 05AM is the one that stands furthest away from the rest of the group. He is the one who uses local variants the most systematically and he excluded all supralocal and above supralocal exponents in FACE and GOAT. Although MOUTH was not included in the model, I realised that 05AM was part of the working-class older men with the highest score of raised onsets (33%) – two older men also have 33% raised onsets but they are from the middle class. In the Ward tree, 05AM is categorised as a traditional speaker and the differences there may be between the other traditional speakers are ironed out a little. In the supralocal group created by the single-linkage approach, 01BM is also deemed atypical for a working-class young man. His scores indicate that he is the only one in his class and across both genders to use a central monophthong exclusively for GOAT. This is why he is paired up with 10BM in the Ward tree because they have identical variation patterns for GOAT.

Hence, **single-linkage** sheds light on **atypical variation patterns** in individuals whereas **Ward** endeavours to find an ideal way to make **overall group patterns** stand out. Despite two very opposed methods of clustering, the groupings of speaker remain very similar and seems to indicate that the clustering method provides sociolinguistically reliable clusters of individuals. Yet, just by looking at the two trees (Figure 6-4) we do not know if they are deemed similar enough statistically. We need an index measure to gauge the difference between trees that stem from various methods.

The comparison of dendrograms had long been an issue in biology and taxonomy. This has resulted in the implementation of coefficients to measure the degree of similarity between two dendrograms (Sokal & Rohlf, 1962). In hierarchical clustering, it is possible to test whether two dendrograms based on two different methods provide a similar classification by using similarity coefficients and tanglegrams. I first tried two different types of similarity indexes to test for the significance of the similarity between the two trees: Baker's Gamma (Baker 1974) and cophenetic correlation coefficient (Sokal 1962). Both methods suggest that the two trees are similar enough despite their differences – Baker's Gamma: 0.66, cophenetic correlation coefficient: 0.68.

With *tanglegrams* (Pagès 2002, Bansal et al. 2009), it is possible to visually represent differences of categorisation made by a pair of trees to further identify which speakers will remain in similar groups no matter the clustering method and which will be recategorised in a different group – which is harder to do just by putting the trees side by side. The more stable speakers will provide reliable information on group variation while the others should be used to analyse individual variation in sociolinguistics. This approach can be used a pre-processing step, as way to get to know one's data better and spot interesting aspects one might not have seen when looking at proportions only. It also leads to a more qualified view of one's results than just abiding by default parameters.

Figure 6-5 represents a tanglegram, a graph that matches the leaves of different trees and shows how the PVC speakers have been grouped depending on the method used (left:

Ward, right: single-linkage). The coloured lines correspond to identical alignments of speakers between the two trees whereas the **black lines** signal **mismatches**. Such graphical representations are often used in computational biology the compare the evolutionary histories of species. If crossings are too numerous, with a maximum entanglement index of 1, the embedding can hardly be analysed (Wotzlaw et al. 2012). Consequently, a low entanglement index, with a minimum of 0, indicates that the two methods classify the speakers in a very similar way. Ward and single-linkage produce significantly similar results with a reasonably low entanglement index (0.48). The two trees are then comparable and can be used as dendrograms giving complementary information of the data, such as the detection of outliers or in the "selecti[on of] an appropriate number of clusters" (Fowlkes & Mallows, 1983 p. 568).

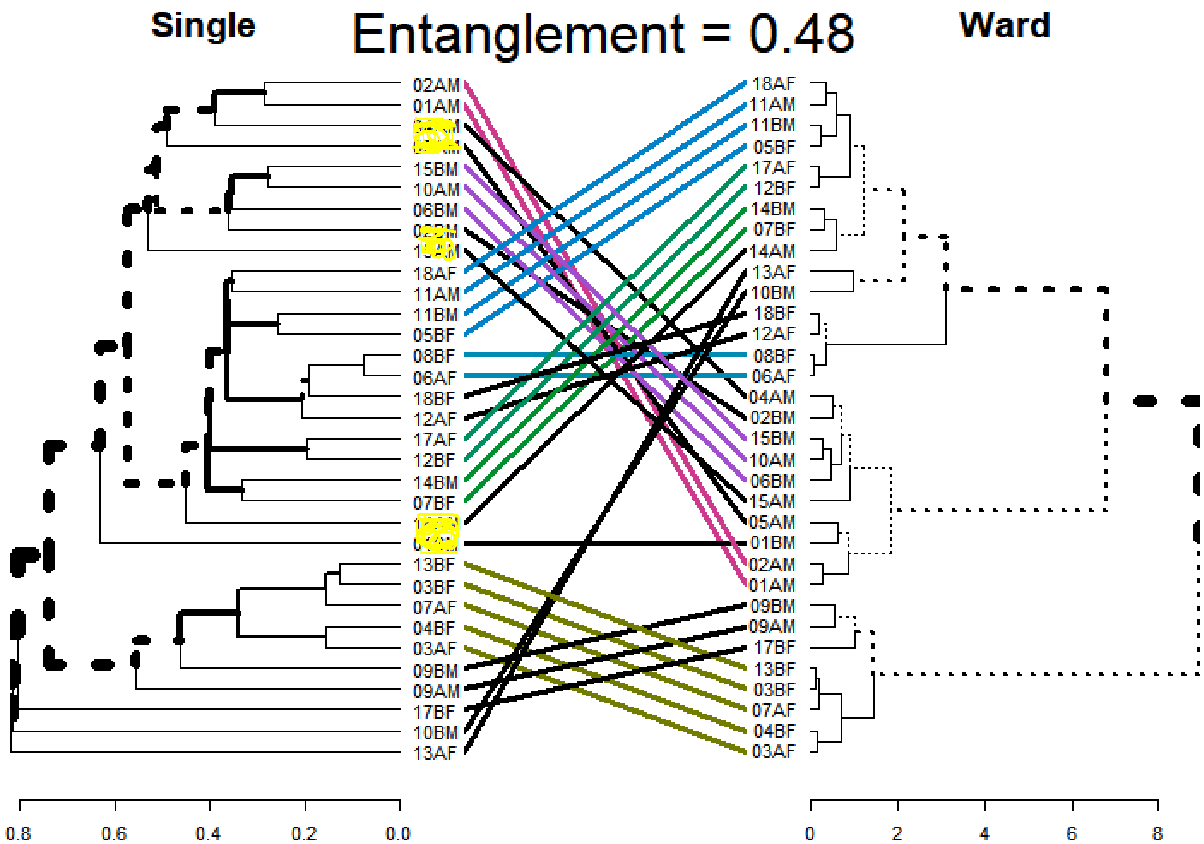


Figure 6-5 Tanglegram comparing the alignment of dendrograms using single-linkage (left) and Ward (right).

In Figure 6-5, 12 speakers are highly affected by the clustering method but they are often not completely recategorised. The pairs 15AM/02BM and 04AM/05AM in the single-linkage approach are split up in Ward. In the second tree, 02BM and 04AM are brought together and 05AM is deemed closer to 15AM. If we look at the scores of these individuals we understand why. Single-linkage seems to have used certain variants of the GOAT vowel as criteria to pair the speakers up (cf. Table 6-5). 15AM & 02BM are the two most supralocal speakers (91% & 36%), while 04AM & 05AM have identical scores in [ʊə] (36%). Ward appears to use variants of FACE and PRICE. 02BM & 04AM have the highest scores for [eː] and 15AM & 05AM both score 67% in the low onset [aɪ] of PRICE. We can see that grouping strategies are different and become more complex as we inject more lexical sets into the model. Since Ward uses more variants to group speakers that are less easily clusterable, it is the most suitable approach for an aggregate study of variation.

Table 6-5 Recategorised speakers from single-linkage to Ward.

SINGLE-LINKAGE							*identical scores*		*more supralocal*			
speaker	sex	age	class	FACE_ɪə	FACE_eɪ	FACE_eː	**GOAT_ʊə**	GOAT_oʊ	**GOAT_oː**	GOAT_ɵː	PRICE_aɪ	PRICE_eɪ
15AM	M	Young	WC	80%	0%	20%	0%	0%	91%	9%	67%	33%
02BM	M	Older	WC	60%	0%	40%	0%	0%	36%	64%	72%	28%
04AM	M	Older	WC	67%	0%	33%	36%	0%	18%	45%	56%	44%
05AM	M	Older	WC	100%	0%	0%	36%	0%	0%	64%	67%	33%
WARD				*high scores*		*more supralocal*					*identical scores*	*similar scores*
speaker	sex	age	class	**FACE_ɪə**	FACE_eɪ	**FACE_eː**	GOAT_ʊə	GOAT_oʊ	GOAT_oː	GOAT_ɵː	**PRICE_aɪ**	PRICE_eɪ
15AM	M	Young	WC	80%	0%	20%	0%	0%	91%	9%	67%	33%
05AM	M	Older	WC	100%	0%	0%	36%	0%	0%	64%	67%	33%
02BM	M	Older	WC	60%	0%	40%	0%	0%	36%	64%	72%	28%
04AM	M	Older	WC	67%	0%	33%	36%	0%	18%	45%	56%	44%

In sum, the data is clusterable because variation is *not* random (enough), and a change in the clustering methods does not affect the results in a significant way as it recategorisation from single-linkage to Ward affects only a few atypical individuals. This means that the clusters are relatively stable irrespective of the clustering approach on may use. The **Ward** approach is more satisfactory because it performs well at **identifying relevant sociolinguistic groups** and **uses several lexical sets** to determine where speakers should be grouped similarly to the single-linkage method. I therefore opted for the Ward approach. The next section lists the PCA and clustering analysis (Ward method) of the PVC data.

6.5 Results of the pilot study: the PVC wordlist data

6.5.1 Selecting the number of dimensions for the analysis of the results

Question: how relevant are the first two dimensions in simultaneously explaining variation in FACE, GOAT and PRICE?

The first step in a PCA analysis is to check whether the first few principal components or *dimensions* (or sometimes *factors*) summarise enough variation within the data and to determine which dimensions should be discarded so that the model remains parsimonious enough for the cluster analysis (Tabachnick & Fidell, 2013, p. 649). This is done by observing the eigenvalues, namely, how much variation is explained when one or more dimensions are selected.

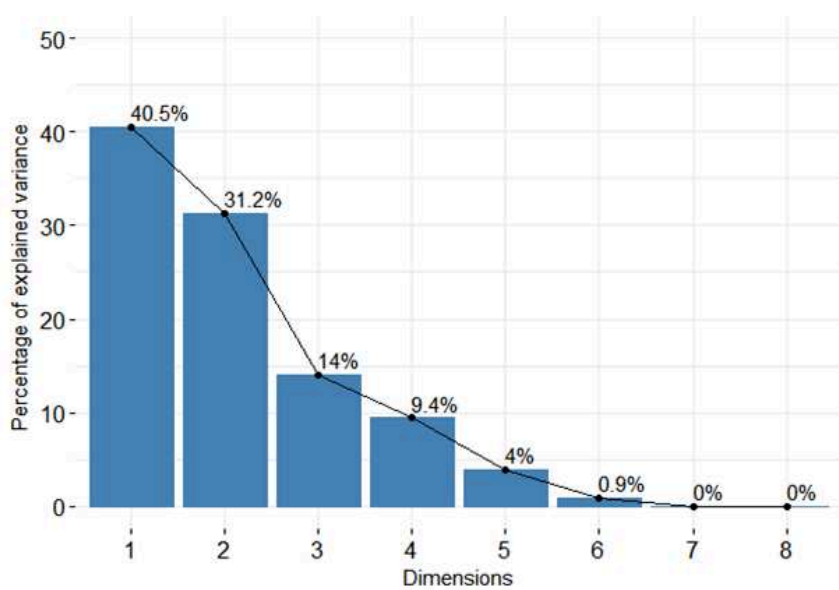


Figure 6-6 PCA scree plot representing the percentage of explained variance per dimension in the PVC wordlist.

The scree plot in Figure 6-6 represents the percentage of explained variance per dimension. The first two dimensions are the most important since they explain 71.7% of the variance in the data (40.5% + 31.2%). Based on analyses by Husson et al. (2011, p. 226), an ideal percentage of explained variance for the first dimension should amount to at least 24% in a dataset like the PVC with 9 variables and 33 speakers. With 40.5%, the rule of thumb is more than reached. The latter will be retained for the main descriptive analysis but since dimensions 3 to 5 also contribute to the explained variance to a substantial degree, they will not be disregarded in the analysis. Indeed, if we take dims 3 & 4 into account, we get 95.1% of explained variance.

For the cluster analysis, we can also take dim 5 into account since the difference between the score of explained variance is divided by 4 between dim 5 and dim 6 (4% vs. 0.9%). Another way of determining which dimensions should be retained is to observe the drop in the comparative score of explained variance between one dimension and the next (Tabachnick & Fidell, 2013, p. 649). The drop between dim 5 and dim 6 is the final largest one, which suggest that after dim 5, the dimensions can be discarded for the cluster analysis.

We now know that dims 1 and 2 will give us the general trends regarding sociophonetic variation in the PVC wordlist, and that inspecting dims 3 and 4 will give us specific details about variation by specific sub-groups of speakers. For this pilot study, I chose to focus only on major trends which are delivered by dim 1 and 2. Using a correlation circle on dim 1 and 2, will not only summarise the various speaker types, it will also indicate which vowel variants co-occur. Namely, when speakers use a supralocal variant in FACE, will they necessarily also use supralocal variants in GOAT and PRICE? I shall address this issue in the following section.

6.5.2 Which variables co-occur in the PVC reading list?

The PCA analysis proved useful at getting to know whether speakers were coherent in their choice of variant. This can be checked on the graph called *correlation circle*. I first explain how to interpret this correlation circle and then draw conclusions with respect to the variational coherence between the 3 lexical sets.

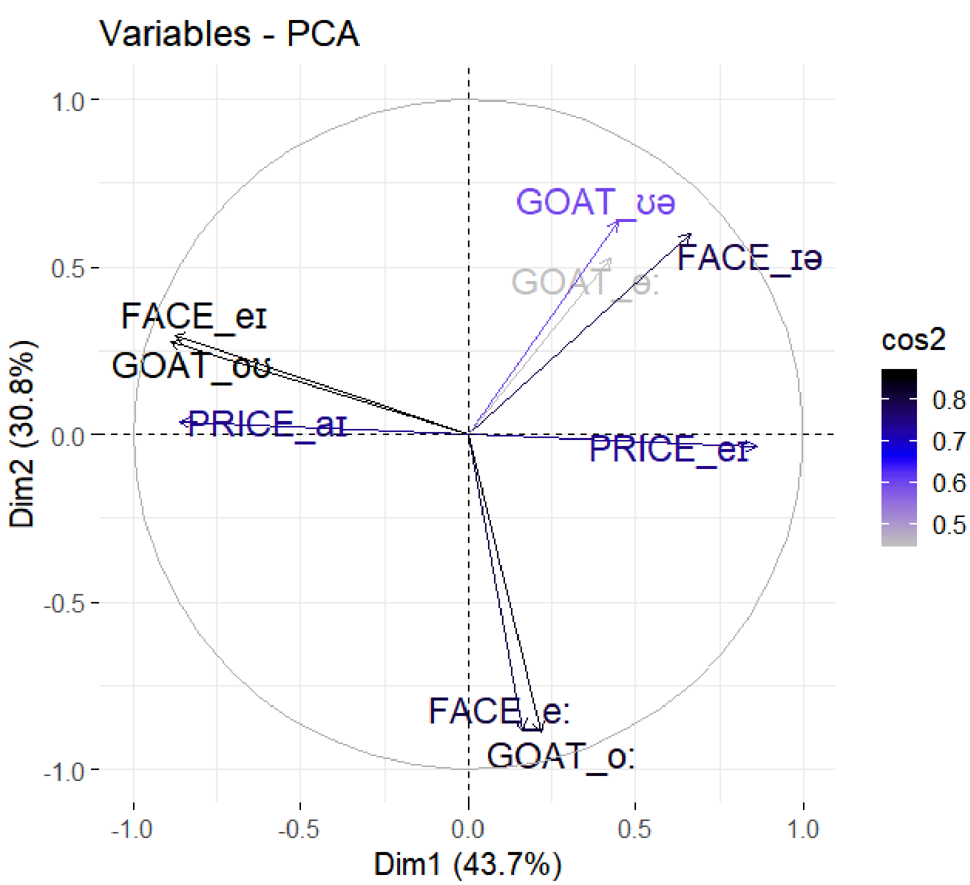


Figure 6-7 Correlation circle of the vowel variants of FACE, GOAT and PRICE based on the first two dimensions. The darker the variables, the better they are represented by the two dimensions.

The correlation circle in Figure 6-7 indicates which vowel variants co-occur. It is a geometrical representation of the results given by dims 1 and 2. Converting correlation coefficients into cosine values is a strategic way to represent multiple correlations on a graph in a clear and simple way. When arrows are **close** to each other, the variables that correspond to these arrows are **positively correlated**. If arrows form a **90° angle**, they are **not correlated** to each other. When arrows point in **opposite directions**, the corresponding variables are **negatively correlated**. Above supralocal pronunciation of GOAT and FACE are nearly perfectly superimposed, which means that they are positively correlated and that speakers tend to produce the two above supralocal variants in a very systematic way. This is also the case for the supralocal GOAT and FACE variants but to a slightly lesser extent. Local pronunciations of GOAT and FACE also co-occur but are less strongly correlated to each other because GOAT has more than one traditional variant, while FACE has but one.[103] Interestingly, variation in PRICE is more correlated with GOAT and FACE among above supralocal and traditional speakers but not so much among supralocal ones. FACE and GOAT exponents may work in lockstep for them, but they do not correlate with the PRICE set. This suggests that either supralocal speakers frequently use both [aɪ] and [eɪ] in their speech or that these speakers can be divided into two groups with a reasonably balanced number of individuals: those who frequently resort to a raised onset and those who prefer a low onset. Symmetry

[103] Moreover, cosine score for the traditional variants of GOAT are quite low (blue colour), which means that one might need dim 3 or 4 to find out which speakers favour the less stigmatised variant [ɵː] and which prefer [ɪə].

and coherence amongst speakers depends on the linguistic group you belong to and that levelling across variants does not always operates at the same pace.

Let us now check which speakers are more predominantly traditional, supralocal or above supralocal in their speech. One has to remember that the correlation circle represents the most salient variational coherence across the speakers. To observe the link between the speakers and the variants, the correlation circle and the factor map can be placed side by side, as exemplified in Figure 6-8. Together, they inform on the type of coherence observed for each individual. Individuals on the **left** are **above-supralocal** speakers, while those on the **right** are more **traditional**. **Supralocal** speakers are those scattered at the **bottom** of the graph. We see that the position of the arrows on the correlation circle determines the position of the speakers. On has to bear in mind, however, that not all the arrows condition the position of the speakers on the factor map. The closer the arrows are to the rim of circle, the better they are represented by the two dimensions chosen (in black in the above graph). This means that all 3 variants of FACE and the supralocal and above-supralocal variants of GOAT determine the position of the speakers the most in dims 1 & 2, compared to PRICE and the traditional variants of GOAT.

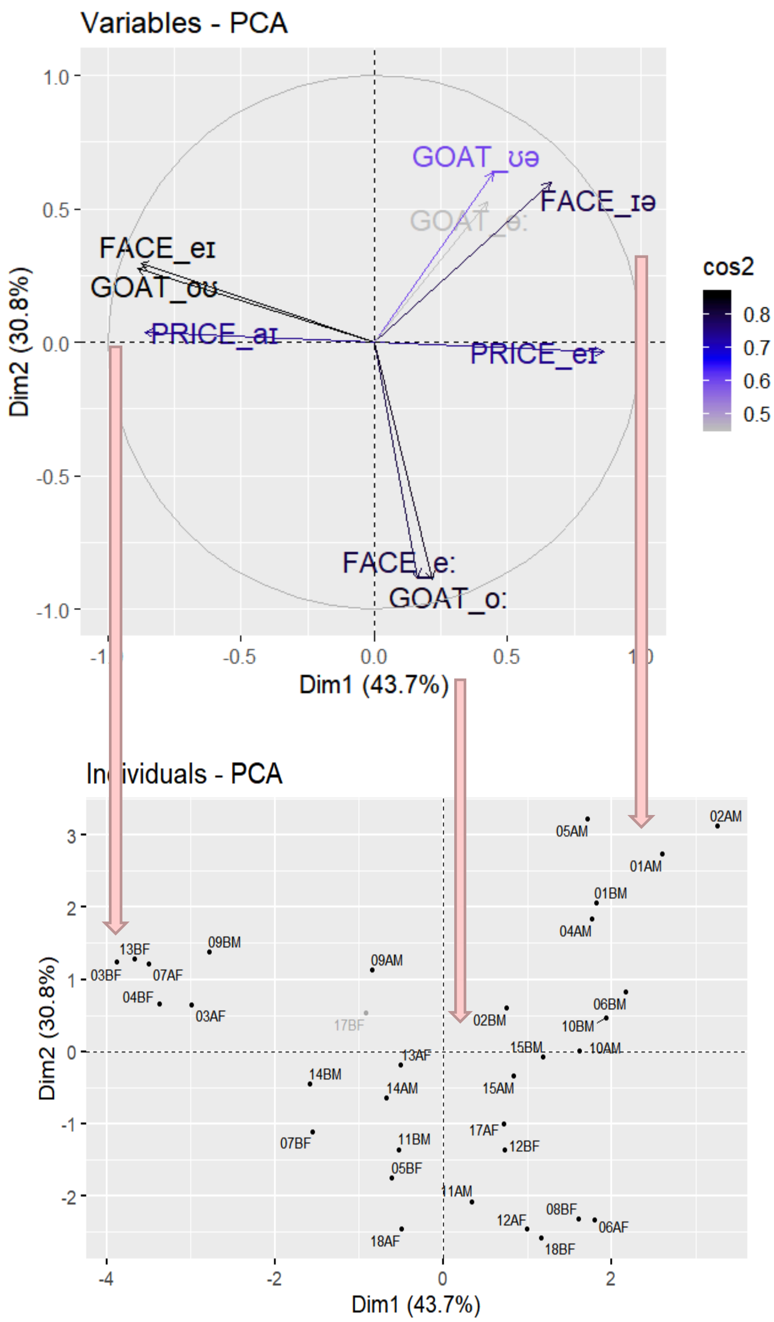


Figure 6-8 Coherence in FACE, GOAT and PRICE among individual speakers.

The speakers on the edges of the factor map are easily classifiable just by looking at the graph, i.e. 03BF & 02AM. But when speakers are in-between two or even three speaker types like 14BM or 13AF, interpretation is much less straightforward. A cluster analysis is therefore needed to know where to draw the lines between the speakers.

6.5.3 Using cluster analysis: finding sociolinguistic groupings

The first cluster tree, which used the PCA results to create groups of speakers, is based on Euclidean distances (method = "Ward"). Before looking at the results of the cluster analysis, it is important to find how many sociolinguistic groups would best represent the PVC data based on the speakers' choice of variants in FACE, GOAT and PRICE. In general, this is computed automatically in `FactoMineR` (Le et al. 2008), but the resulting number of groups may not necessarily be of interest to the researchers, especially if they already know the major trends in the data. It is therefore important to look at more subtle sub-groups. This is relevant for the PVC corpus since various studies have already highlighted major trends concerning FACE, GOAT and PRICE (Watt 1998, Milroy 1996). Figure 6-9 shows the proportional gain of explained variance when a supplementary group is created in the cluster analysis. 56% of the variance is explained when having only 3 groups (Ward's approach, automatically suggested number of clusters by `FactoMineR`). These groups correspond to Watt's grouping of TE into traditional/supralocal/above-supralocal speakers.

However, if we use the suggested number of groups provided by the single-linkage method, i.e. 6, not only do we get an uptick in the rate of explained variance (79% instead of 56%) but we also reveal more subtle sub-groupings with less inter-speaker variation. In the subsequent sections, I will use the **3-cluster analysis** to highlight **major trends**; the one with **6 clusters**, to first see how these 3 major groups are subdivided and secondly, to find more interesting **nuances** regarding variation patterns among the speakers.

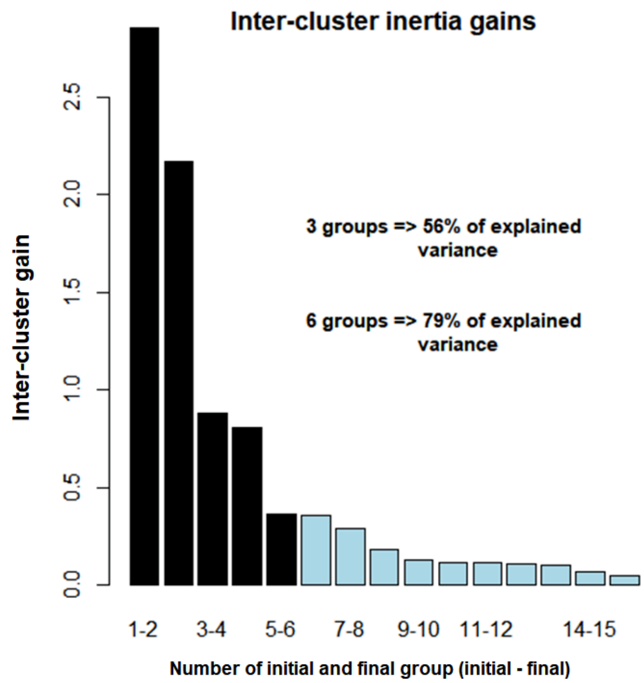


Figure 6-9 Information gained about variation in the data when a supplementary group is created.

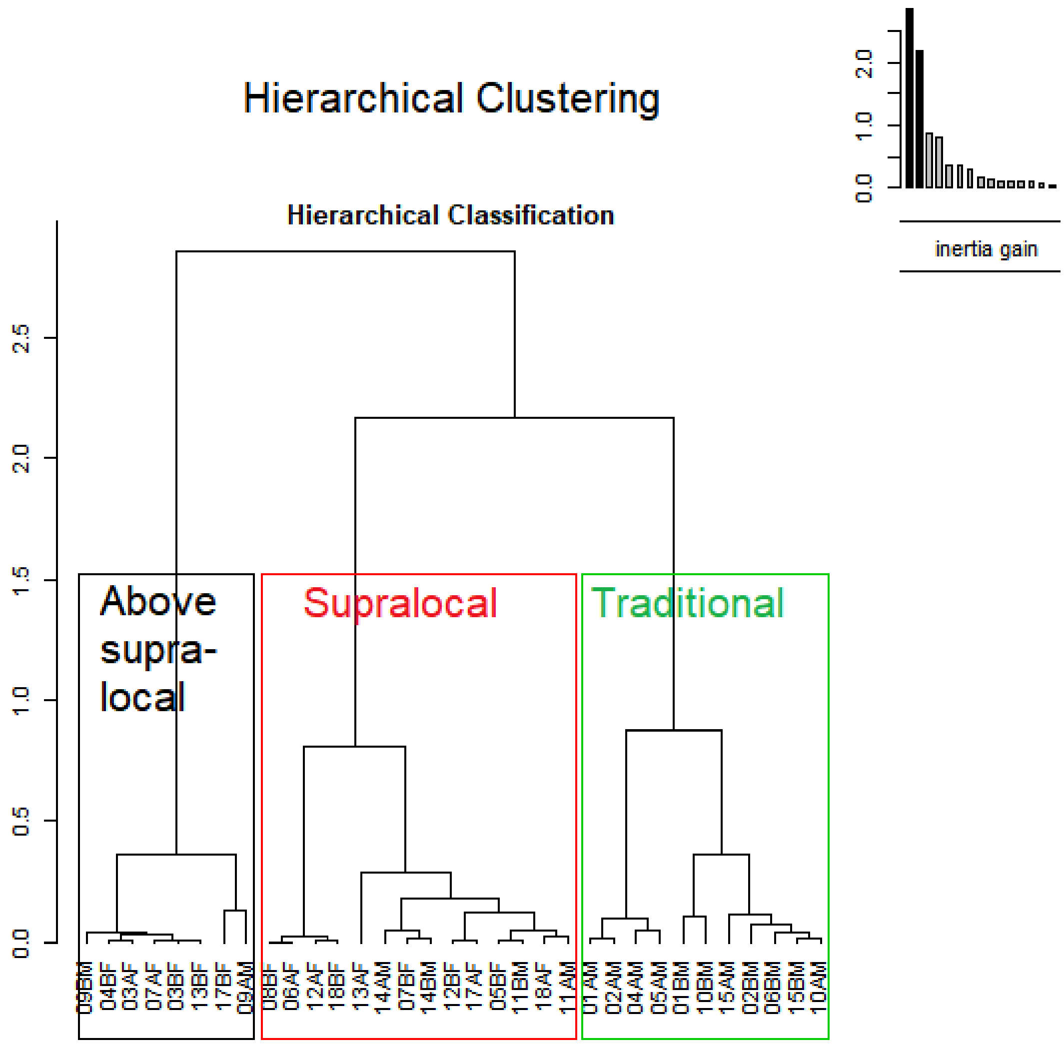


Figure 6-10 Dendrogram: hierarchical clustering in 3 clusters based on the first 5 principal components of the PCA analysis (method: Ward).

Figure 6-10 is a hierarchical clustering tree based on the first 5 principal components of the PCA analysis. Looking back at the proportions of variants for each speaker which serve as data for the cluster analysis, we observe that the first group (from left to right) comprises the speakers with the highest proportion of prestigious variants. We call it the "above supralocal" group. It is mostly composed of women (speakers indexes ending with an F refer to women). The second group comprises men only and refers to the speakers with a high proportion of traditional variants. The third group comprises more than half of the speakers (18/32) and gathers the individuals that have higher scores of supralocal variants. It includes similar proportions of speakers from either gender (8 men & 10 women). The analysis highlights a clear-cut gender gap with women at the prestigious end and men at the other end of the continuum. The supralocal group includes both genders, but is seems to be composed of at least two sub-groups separated by major differences since the first node in the supralocal cluster is relatively high. An analysis in 6 clusters will enable us to find more sub-groups within this continuum, thereby leading to a more precise understanding of variation within the three groups.

The 6-cluster dendrogram (Figure 6-11) indicates that the above supralocal group is homogeneous enough to remain undivided. As expected, the traditional one comprises two types of speakers: those who frequently use the central monophthong [ɵː] for GOAT and those who favour the stigmatised centring diphthong [ʊə]. In the supralocal group, the clustering analysis highlights patterns that were hitherto difficult to observe when inspecting proportions alone. Looking back at proportions, I noticed that all the speakers of that cluster use a majority of supralocal variants in GOAT and FACE, but some distinguish themselves from the rest by a more frequently raised onset in PRICE, thus moving them slightly closer to the local group. We then hypothesised that PRICE played a major role in identifying a sub-group of supralocal speakers. This can be verified by checking the output tables that resulted from the cluster analysis. Indeed, the hierarchical clustering analysis based on PCA presents the advantage of showing which vowel variant(s) significantly helped determine the creation of clusters and to identify the general characteristics of each group based on their variation in FACE, PRICE and GOAT (Table 6-6).

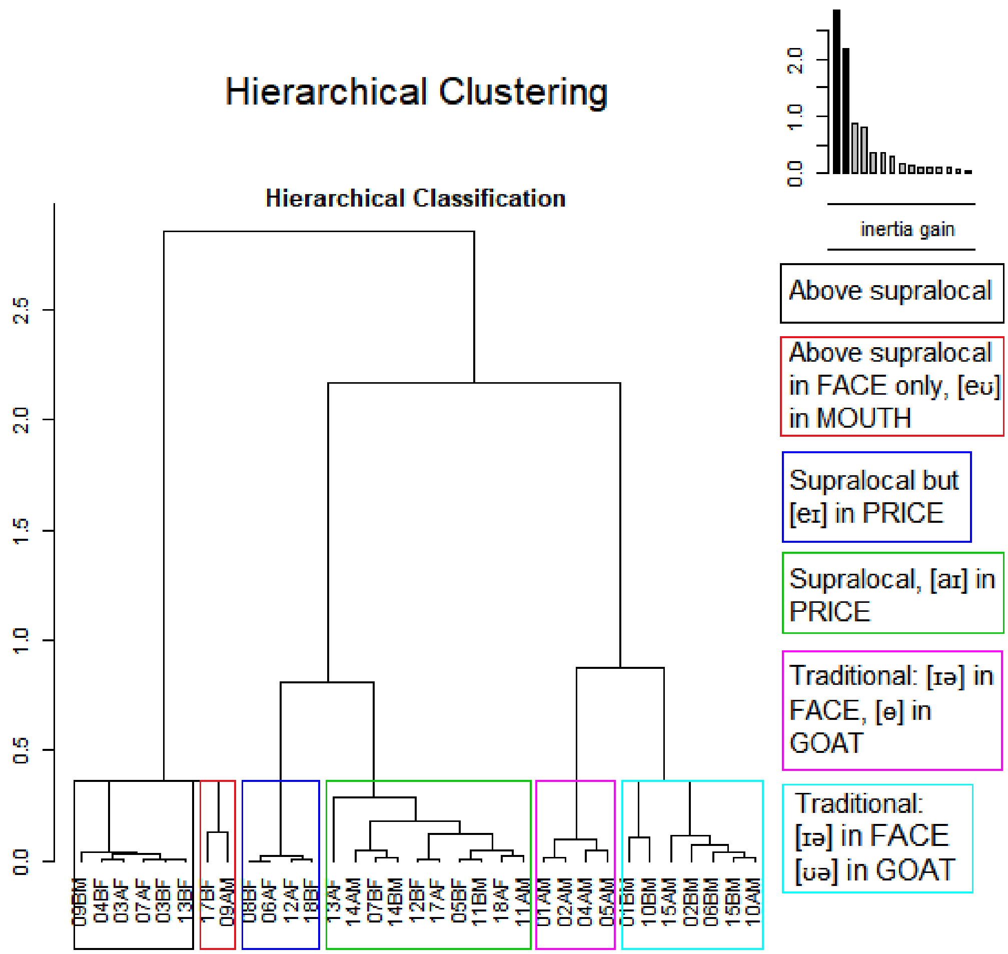


Figure 6-11 Dendrogram: hierarchical clustering in 6 clusters based on the first principal component of the PCA analysis.

Table 6-6 Table indicating the role of each variable to the creation of clusters in general (in italics, supplementary variable, left: 3 cluster, right: 6 clusters).

3 clusters	Correlation to cluster	p-value	6 clusters	Correlation to cluster	p-value
FACE [eɪ]	0.94	1.34E-18	GOAT [ʊə]	0.98	8.22E-22
GOAT [oʊ]	0.84	1.23E-12	FACE [eɪ]	0.95	3.68E-16
FACE [ɪə]	0.68	4.52E-08	GOAT [oʊ]	0.89	5.77E-12
FACE [eː]	0.67	6.32E-08	FACE [ɪə]	0.87	2.82E-11
GOAT [oː]	0.63	3.40E-07	FACE [eː]	0.85	3.59E-10
GOAT [ɵː]	0.43	2.25E-04	PRICE [aɪ]	0.73	4.56E-07
GOAT [ʊə]	0.35	1.58E-03	PRICE [eɪ]	0.73	4.56E-07
PRICE [aɪ]	0.26	1.01E-02	GOAT [oː]	0.66	1.00E-05
			GOAT [ɵː]	0.42	8.89E-03

Table 6-6 displays the results of the clustering analyses in 3 and 6 clusters. In the 3-clusters analysis, all variables have a significant impact on the separation of individuals into specific clusters, but FACE and GOAT mostly determine the separation (GOAT [oʊ]: correlation ratio=0.84, FACE [eɪ] correlation ratio=0.94). Pronunciation in PRICE remains significant but to a lesser extent *(p* < .005 for PRICE vs. *p* < .000001 for GOAT). In other words, the classification of speakers relies mostly on their use of prestigious and supralocal variants in FACE and GOAT. The correlation coefficient to the cluster ranges from 0 to 1 and indicates whether variation in a vowel exponent forms clear patterns that help separate speakers into clusters (higher correlation coefficient, e.g. FACE [eɪ]) or whether variant scores are more heterogeneous (lower correlation coefficient, e.g. GOAT [ɵː]).

After an assessment of the pros and cons of keeping 3 or 6 sociolinguistic groups (Table 6-7), we have observed that the 3-cluster analysis relies primarily upon coherence in FACE and GOAT. But in the 6-cluster analysis, PRICE accounts for the coherence in speakers nearly just as much as GOAT and FACE. What remains to be examined is the cluster diagnostics for each individual cluster. This enables one to know which variants characterise the clusters and whether these variants are markers of indexicality or not.

Table 6-7 Assessing the pros and cons of creating 3 or 6 groups of speakers (pilot study).

3 speaker groups	6 speaker groups
The groupings are in line with Watt's (1998) three groups of traditional, supralocal and above supralocal speakers based on FACE and GOAT.	The groupings take into account the asymmetrical coherence in FACE, GOAT PRICE and MOUTH within the supralocal group of speakers.
An overview of phonetic variation with as little noise as possible.	More detailed information about variation among speakers but also more noise.
Lower proportion of explained variance (70%).	Higher proportion of explained variance (95%).
FACE and GOAT predominantly determine the creation of speaker groups.	The three lexical sets more evenly determine the creation of speaker groups.
The clusters are less stable since atypical speakers are included in certain groups, they do not ideally belong to sociolinguistically. There is more heterogeneity.	The clusters are more stable since they match the recommended number of clusters in the single-linkage approach. Atypical individuals stand out and the remaining groups are more homogeneous.

6.5.4 Which variants of FACE, GOAT and PRICE characterise each of the 6 sociolinguistic groups?

6.5.4.1 Overall affects found in the metadata

Gender, and less so, class, are significantly linked to the characterization of the linguistic groupings. Age was not deemed significantly important enough. This means that speakers do not only have phonetic variation patterns in common, their social profile is also significantly similar. A chi-square test between each social variable and the clusters was performed. The diagnostics are listed in Table 6-8.

Table 6-8 Overall diagnostic for the social data (PVC pilot).

	p.value	df
sex	0.005	5
class	0.011	5

However, this only tells us that **some** linguistic clusters are also characterized by gender and class; other diagnostics will tell us **which**.

6.5.4.2 Social characteristics of the clusters

Speaker clusters tend to form a continuum. At one end (cluster 1) are the most above supralocal speakers, while at the other end, i.e. in cluster 6, are the most traditional men.

Cluster 1: speakers in cluster 1 are predominantly middle-class (ca. 86% vs. average 47%) with only one female speaker from the working-class. Categorical use of velar forms in *-ing*.

Cluster 2: neither characterised by class nor gender, nor age.

Cluster 3: characterised by men only (100% vs. average number of men 53%).

Cluster 4: characterised by women only (100% vs. average number of women 47%).

Cluster 5: neither characterised by class nor gender, nor age.

Cluster 6: men only (although not significant) and categorical use of apical forms in -*ing*.

Although some factors like age did not appear as significant, visualisation methods highlighted a certain overall affect of age crossed with gender and class interacting with gender. Figure 6-12 is a factor map of speakers coloured as function of age. When one sets aside pairs 13 and 09, all other young speakers are systematically on the right hand-side of the graph, which indicates that they favour more traditional pronunciations. The gap between younger men and women is striking, with men on the top right corner and younger women below the zero axis for dim 2.

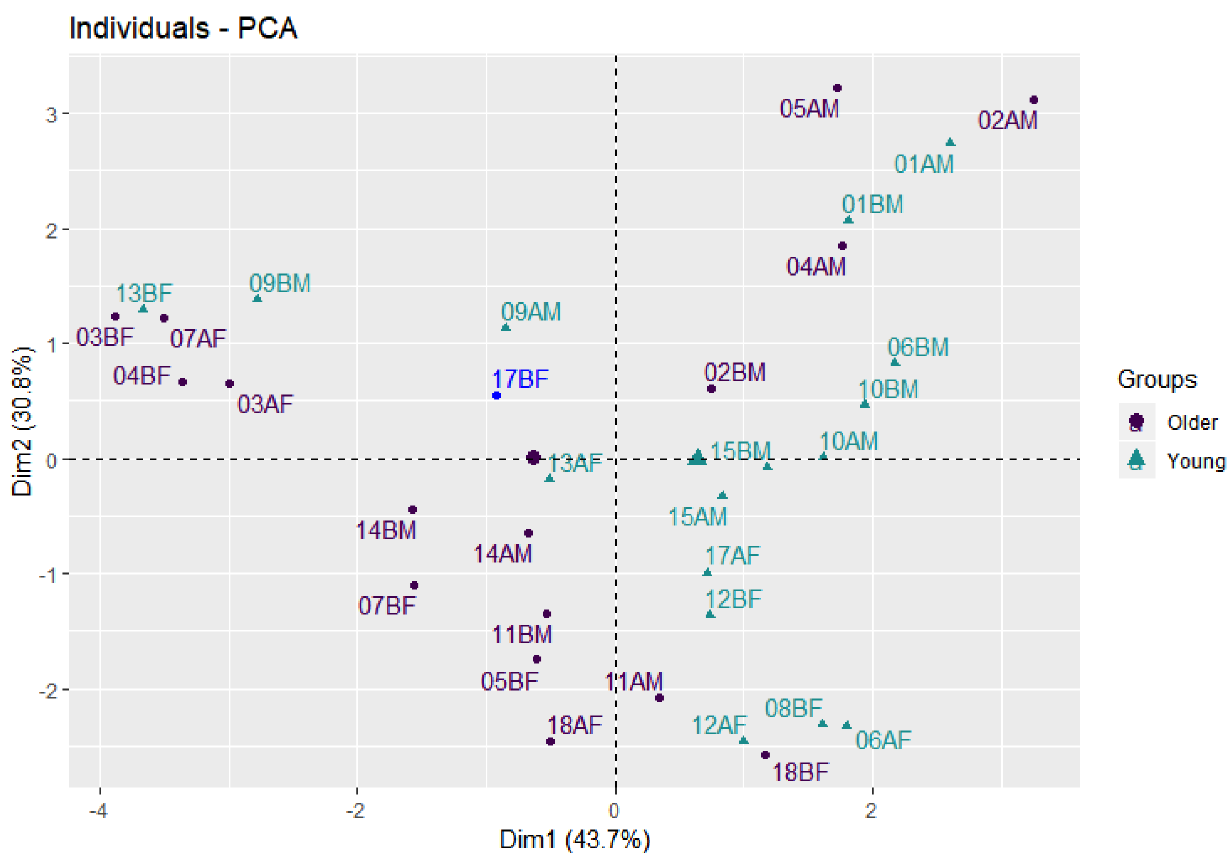


Figure 6-12 Speakers coloured by age group (triangle: young, circle: older, bigger shapes: centroids, 17BF: supplementary individual).

Let us now observe whether a similar gender gap is found among speakers of the same class, regardless of their age (Figure 6-13). The gender gap is just as glaring amongst the working-class speakers, while it is not so clearly delineated amongst middle class ones.

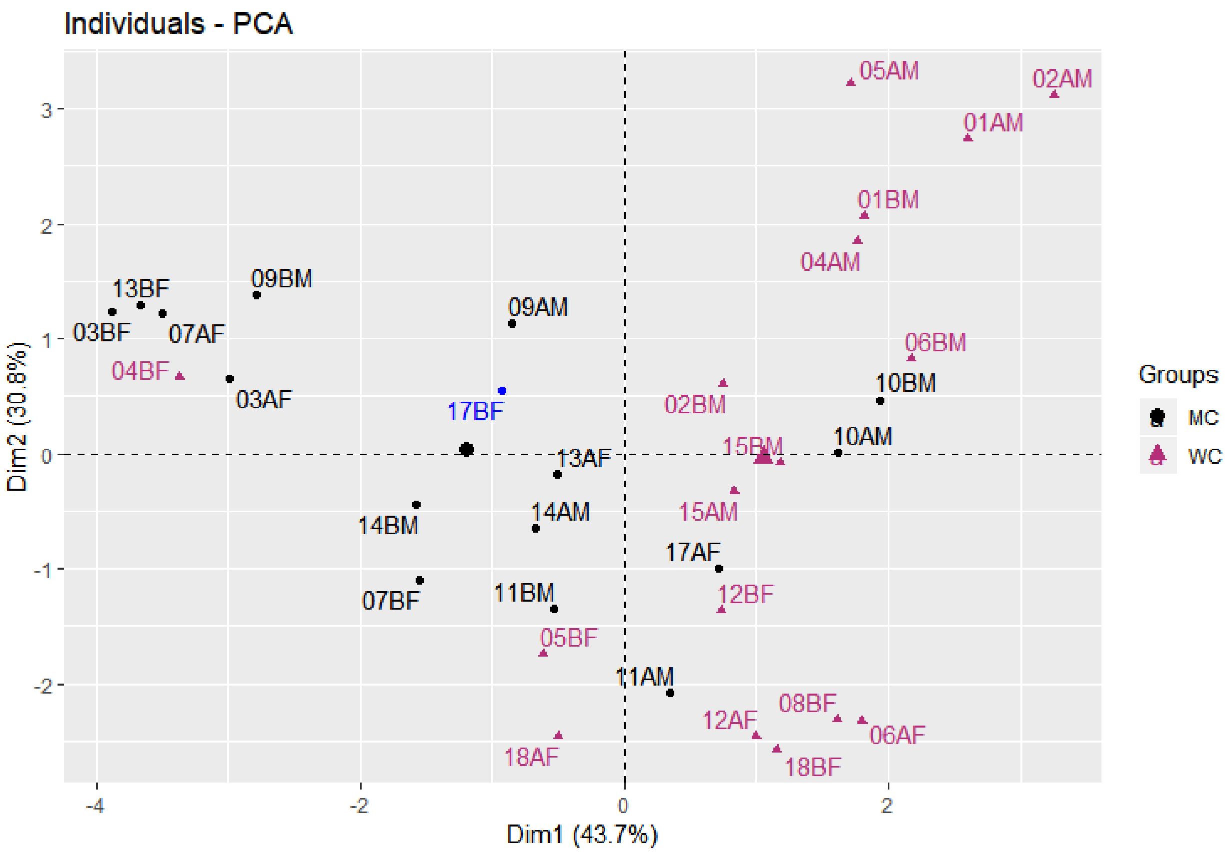


Figure 6-13 Speakers coloured by class (triangle: young, circle: older, bigger shapes: centroids, 17BF: supplementary individual).

Now that we have inspected the cluster diagnostics and used age and class colouring on the factor map to look for potential interactions, let us examine which choice of variants characterise each cluster.

6.5.4.3 Linguistic characteristics of the clusters

The output of the cluster analysis presents the characteristics of each cluster (k=6) compared to the overall mean in the data. Table 6-9 describes how each group differentiates itself significantly from the overall mean regarding vowel variants. This is given by the p-value in the last column. "Mean" and "Sd in category" refer to mean percentage and standard deviation within a vowel variant in cluster 1. Overall mean and standard deviation indicate the average proportion of produced variant and the corresponding standard deviation of all 32 speakers. The v-test for a particular variant in a cluster indicates if the mean score for that variant within the cluster is lower or greater than the overall mean of the sample. Husson et al. (2011) compare it to a "'standardised'" deviation between the mean of those individuals with the category q and the general average" (Husson et al., 2011, p. 155). As a rule of thumb, a "value of the v-test greater than 1.96 corresponds to a p-value less than 0.05" (Husson et al. 2010, p10) and means that the cluster has significantly higher scores than average for a given variant. A negative v-test that is inferior to 1.96 indicates that the group significantly disfavour a particular variant (coloured in red). Let us now proceed to the interpretation of the cluster diagnostics.

Table 6-9 Description of cluster 1 based on the percentage of each vowel variant (PVC pilot).

Cluster 1 above supralocal (n=6)						
Category	v.test	Mean in Cat	**Overall mean**	Sd in Cat	Overall sd	p-value
GOAT [oʊ]	**4.92**	**73%**	**18%**	**17%**	**29%**	**8.49E-07**
FACE [eɪ]	**4.77**	**81%**	**22%**	**2%**	**33%**	**1.83E-06**
PRICE [aɪ]	**3.03**	**95%**	**66%**	**5%**	**26%**	**2.41E-03**
FACE [ɪə]	-2.19	0%	28%	0%	34%	2.88E-02
FACE [eː]	-2.50	19%	51%	2%	34%	1.23E-02
GOAT [oː]	-2.51	11%	43%	12%	35%	1.21E-02
PRICE [ɐɪ]	-3.03	5%	34%	5%	26%	2.41E-03

Speakers in cluster 1 are characterised by amounts of prestigious variants that are above grand mean (i.e., the average of the average of each cluster, column "Overall mean") with local or supralocal ones ranging from below average to non-existent. The standard deviation within cluster 1 indicates that variation is low in FACE and PRICE (less than 6%). Proportions of [oʊ] tend to vary by just under 20%, thus showing that variation is rather high in GOAT despite the overall similarities in the choice of variants among speakers in cluster 1. The supralocal variants are generally disfavoured since their score are below 20%. These speakers clearly have above supralocal realisations.

Table 6-10 Description of cluster 2 based on the percentage of each vowel variant.

Cluster 2: atypical supralocal speakers (n= 2)						
Category	v.test	Mean in category	**Overall mean**	Sd in Category	Overall sd	p-value
MOUTH_eʊ	3.16	67%	14%	33%	24%	0.00155746
FACE_eɪ	2.09	70%	22%	10%	33%	0.03645664

There are only 2 young middle class speakers in cluster 2 (09AM & 17BF). They use the prestigious variant in FACE but favour a raised onset in MOUTH only, which is quite rare in the PVC. Overall, [aʊ] for mouth is used 14% of the time, while they have a common score of 67% for this variant (09AM 33% vs. 100% for 17BF). GOAT variants do not help characterise this pair of speakers since 17BF clearly favours the above supralocal variant (64%) and 09AM, the central monophthong despite 27% of [oʊ] realisations.

Table 6-11 Description of cluster 3 based on the percentage of each vowel variant.

Cluster 3: typical supralocal speakers (n=10)						
Category	v.test	Mean in category	**Overall mean**	Sd in category	Overall sd	p-value
FACE_eː	3.43	82%	51%	15%	34%	0.00060627
PRICE_aɪ	2.49	83%	66%	15%	26%	0.01268377
GOAT_oː	2.07	62%	43%	23%	35%	0.03867858
PRICE_eɪ	-2.49	17%	34%	15%	26%	0.01268377

In cluster 3 (Table 6-11), speakers have a typical supralocal pronunciation with clear above average scores of [oː] and [eː] in GOAT and FACE and they use predominantly use the low onset in PRICE.

Table 6-12 Description of cluster 4 based on the percentage of each vowel variant.

Cluster 4: Supralocal but more frequent raised onset in PRICE (n=4)						
Category	v.test	Mean in category	Overall mean	Sd in category	Overall sd	p.value
GOAT_o:	3.04	93%	43%	4%	35%	0.00234043
FACE_e:	2.76	95%	51%	3%	34%	0.00577556
PRICE_eɪ	2.67	68%	34%	8%	26%	0.00756757
GOAT_ɵ:	-2.00	7%	33%	4%	28%	0.04503664
PRICE_aɪ	-2.67	32%	66%	8%	26%	0.00756757

In Table 6-12, cluster 4 comprises supralocal speakers that tend to produce more raised onsets in PRICE (around 68% against 34% in general among all speakers). The standard deviation in PRICE within cluster 4 is reasonably low which suggests that speakers have similar scores for [eɪ]. In FACE and GOAT, they are overwhelmingly supralocal.

Table 6-13 Description of cluster 5 based on the percentage of each vowel variant.

Cluster 5: traditional with [ɵ:] (n=4)						
Category	v.test	Mean in category	Overall mean	Sd in category	Overall sd	p.value
FACE_ɪə	3.02	63%	28%	20%	34%	0.00253912
GOAT_ɵ:	2.68	58%	33%	31%	28%	0.00735927
Cluster 6: traditional (n=7)						
GOAT_ʊə	5.58	41%	5%	5%	13%	2.42E-08
FACE_ɪə	3.63	87%	28%	12%	34%	2.82E-04
GOAT_o:	-2.21	7%	43%	8%	35%	2.74E-02
FACE_e:	-2.32	13%	51%	12%	34%	2.05E-02

Table 6-13 displays the variants that most contribute to the characterization of cluster 5 and 6. The fifth group comprises 4 men with a clear preference for the central monophthong in GOAT. In the 6th group, there are much higher proportions than average of traditional [ʊə] and [ɪə] (positive v.test). They consequently disfavour their supralocal equivalents (negative v.test). PRICE is absent from the list of variants, which indicates that speakers do not have a clear preference for one variant over the other.

In sum, choosing to form three clusters renders a more simplified view of the data: above supralocal, supralocal and traditional. FACE and GOAT help group speakers more than PRICE (cf. Table 6-6). However, standard deviation is bound to be higher since greater diversity is included in one group. On the contrary, forming 6 groups brings to the forth two kinds of supralocal speakers: the more local ones in their PRICE vowel and those whose PRICE vowel works in lockstep with FACE and GOAT. Two middle class speakers also seemed to differentiate themselves with MOUTH. This highlights the importance of including PRICE and MOUTH in the model.

We can now answer several questions raised at the beginning of this chapter:

(4) are the initial sociolinguistic 8 cohorts recreated by the statistical analysis and what does this tell us concerning levelling in FACE, GOAT and PRICE?

6 main groups ideally represent this sample of 33 speakers in their variation of FACE, GOAT and PRICE: those who use the most prestigious variants (1 & 2), those who favour the supralocal variants on all three lexical sets (3) and those who use a few traditional variants in PRICE only (4). Two other groups use more Geordie-sounding exponents but the former realises more centring diphthongs in GOAT (6), while the latter uses a central monophthong instead (5).

(6) Knowing that FACE and GOAT work in lockstep (Watt 1998), what does the addition of PRICE bring to the sociolinguistic landscape of the PVC corpus?

PRICE gave more variational nuance among the supralocal group, showing a more gradual continuum along the supralocal/local cline.

Several key questions have been answered so far but what remains to be determined is: **to what extent is individual variation similar within each group?** Since dendrograms only show distances between the speakers based on the height of the node that splits them apart, we cannot see the distances between the speakers very clearly. A tool for addressing this particular issue is the factor map of PCA *combined* with the results of the clustering analysis by the use of colour codes or polygons on the factor map. This has the advantage of showing group variation and individual peculiarities simultaneously and in an easily interpretable manner. Let us now explore the usefulness of factor maps for sociolinguistic data using the PVC corpus.

6.5.5 Looking at speaker clusters using factor maps

PCA does not only reduce noise in a set of data, it also provides visual tools like factor maps to render interpretation of clustering results easier. In factor maps each speaker is allotted coordinates to represent distances (Euclidean) between and within speaker-groups. In Figure 6-14, speakers are placed on the factor map according to the first two components or dimensions of the PCA analysis because they summarise variation in a most efficient manner. The analysis in three clusters is then superimposed onto the factor map using colours (black, green and red) and reveals peculiarities within the data that can be overlooked when using only a dendrogram. Husson *et al*. 2010 recommend the "simultaneous use of the three methods [to] enrich the descriptive analysis" (2010, p.5). The factor map presents the advantage of displaying distances between speakers more clearly than a dendrogram, thus revealing inter and intra-group variation more precisely.

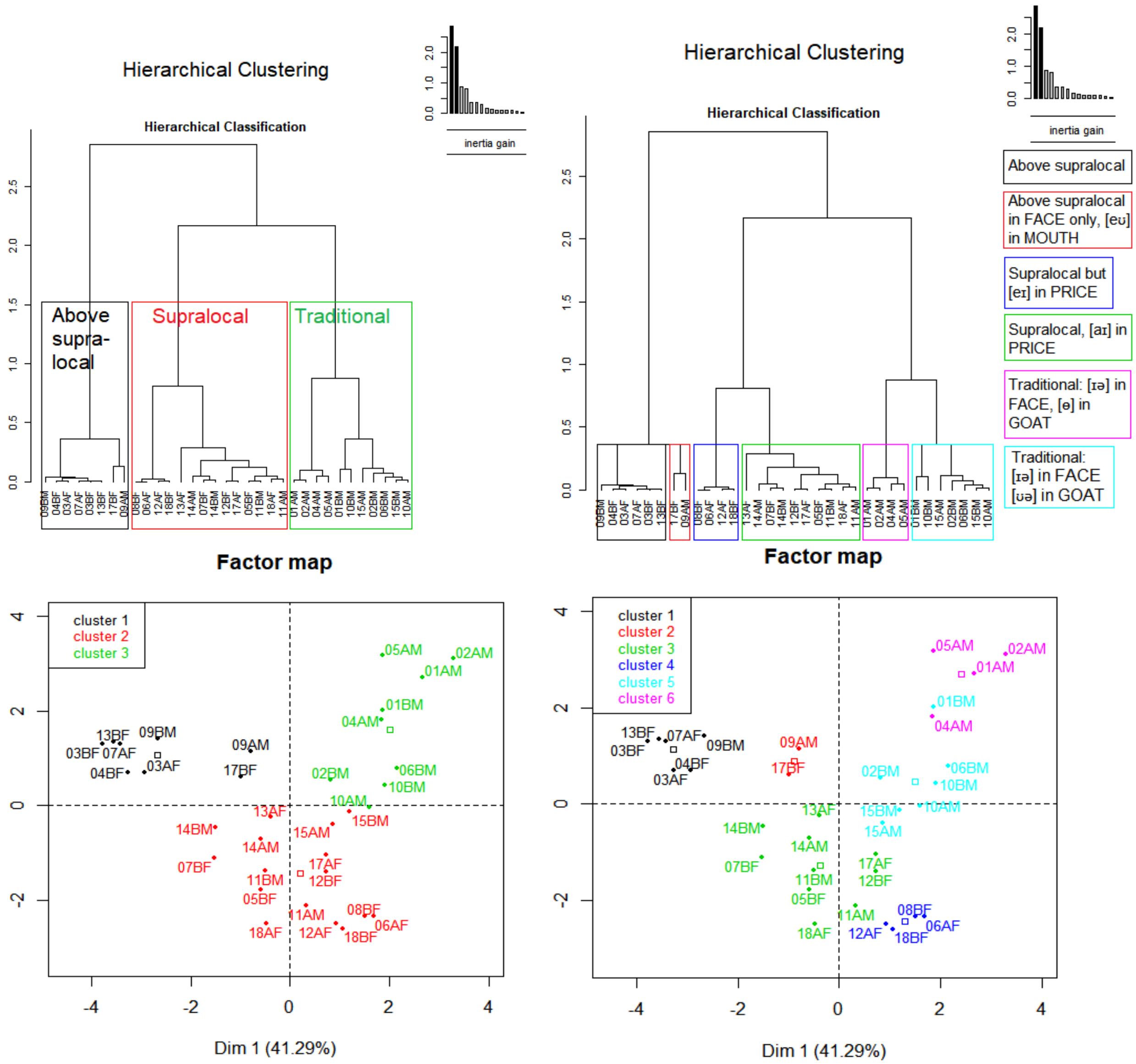


Figure 6-14 Representation of 3 (left) vs. 6 clusters (right) on the map induced by the first two principal components. Top: clustering trees, bottom: factor map with individuals coloured by cluster.

The 3 cluster analysis on the factor map highlights interesting patterns. Overall, contrarily to age, both variables significantly contribute to the identification of the groups (sex: $p < .01$, class: $p < .05$). Hence, the clusters, which were based only on linguistic variation are sociolinguistically relevant. We see that cluster 1 on the left is more compact although 2 speakers are much further away from the group. Their position, which is close to the zero axes, indicates that their choice of variants correspond to that of speakers in general (most frequent productions for all lexicalset). They are more supralocal than the other women on the left. Speakers in cluster 3 are much more spread out which means that their variation patters differ much more than in cluster 1. We clearly see that in cluster 2, some supralocal speakers are either verge towards above supralocal speakers (14BM) and others have higher scores of traditional variants (15BM).

Only one speaker in cluster 1 is a MC male (9BM) while the remaining speakers are MC women (except for 04BF). The interaction between class and gender (middle class women) is put to light despite the presence of one atypical speaker. Cluster 2 clearly groups supralocal speakers of both genders, age group and class. This indicates that the levelling process towards a Northern standard was probably well under way in the 1990s and concerned most sociolinguistic groups, whether man or woman, young or old, working class or middle class. Cluster 3 is akin to a mirror image of cluster 1 in the sense that it includes only WC men and not a single woman. However, similarly to cluster 1, cluster 3 includes speakers of both age groups. Once again, we observe a class/gender interaction effect with age being irrelevant in the creation of the three groups.

In sociolinguistics, or forensic linguistics, we are often interested in finding speakers that are the most representative of their group and those are the most stereotypical. The package `FactoMineR` (Lê et al., 2008) provides clues in that respect. Among the numerous output tables, we can find out which speakers are the closest to a group's *centroid* (*paragon*) and which ones are the furthest away from other groups, thereby suggesting that they are either *atypical* or a *stereotypical* representation of their sociolinguistic group. Being *atypical* represents a speaker who may use the variants of two distinct sociolinguistic groups. A *stereotypical* speaker means that he/she has the highest score of a variant that is typical of a linguistic group, making him/her a near caricature within the group. Depending of the research question, the type of data, extreme individuals may be leaders of linguistic change or preservers of traditional forms. This issue is dealt with in the following section.

6.5.6 Who are the paragons and who are the stereotypes in each sociolinguistic group?

When the number of speakers is very high, it is difficult to choose, which speaker is the most representative of a sociolinguistic group under scrutiny. You may get average productions per variant in tables Table 6-9 to Table 6-13 but one may prefer to get an actual speaker whose productions are close to average. This speaker type is called a *paragon*. You can also look at speakers that are the most distant from the centroids of other groups. In most cases they are stereotypical speakers. Exploring *paragons* is particularly useful when comparing sociolinguistic groups from two different corpora of the same variety but recorded at different time period. This answers the following questions: what kind of social profile is linked to a stereotypical Geordie in a corpus from the 1970s, and how does he/she sounds like in the 1990s? At this stage of the study, we could but superficially explore this methodology. After discovering the fieldwork report by Penny Oxley (1994), I realised that the issue of *paragons* and extreme speakers was much better addressed when matching them with the detailed metadata provided in the report. Hence the real potential of this type of clustering output is dealt with in more depth in chapter 7. Therefore, only basic interpretations are provided here.

The cluster analysis output in Table 6-14 helps determine which individual is closest to the *centre of gravity* of a given cluster, also known as *barycentre* or *centroid*. That particular speaker is then called a *paragon*. 03BF, 12AF and 04AM have the smallest distance value from the centres of gravity of cluster 1, 2 and 3 respectively. This means that they best represent the speakers in the cluster they are in and could be the model individual or *paragons* of each group. Looking at proportions, none of them are speakers with the most extreme values, but they are clearly predominantly above supralocal (03BF), supralocal (12AF) and local (04BM).

Table 6-14 Individuals sorted by Ward's Euclidean distance between each individual and the centre of its cluster (3 cluster analysis, first four closest speakers to the centroids of each cluster).

Cluster 1	**03AF** **0.62**	07AF 0.81	04BF 1.05	13BF 1.06
Cluster 2	**12AF** **0.78**	11AM 0.84	05BF 1.06	11BM 1.10
Cluster 3	**04AM** **1.59**	06BM 1.75	01BM 2.02	02BM 2.08

Table 6-15 Most distant individuals from the centroids of the clusters they do not belong to (the greater the numeric value, the greater the distance of an individual from the other two clusters).

Cluster 1	**03BF** **4.90**	13BF 4.73	07AF 4.72	17BF 4.34
Cluster 2	**18AF** **4.70**	18BF 4.60	13AF 4.54	06AF 4.37
Cluster 3	**02AM** **5.73**	01AM 5.09	05AM 5.03	01BM 4.41

Speakers with a more stereotypical pronunciation can also be identified in the cluster analysis output table.

Table 6-15 presents the first four individuals with the greatest Ward's distance from the centre of gravity of the clusters he/she does not belong to. For instance, in cluster 1, 03BF (older, middle class woman) is the most extreme speaker because across all lexical sets, she has the highest scores of above supralocal variants. In cluster 1, some speakers appear both in Table 6-14 and

Table 6-15. This is due to the fact that there are only 6 speakers in this group. 09AM and 17BF (Figure 1-1, bottom left) pull the centre of gravity towards the right, which somewhat skews the results. 18AF (older, working-class woman) has the highest scores of supralocal variants across all lexical sets. 02AM (older working-class man) produces more raised onsets in PRICE than the rest of the speakers from cluster 3 (78%), is very traditional in FACe (93% of [ɪə]) and uses both central monophthongs (55%) and centring diphthongs (45%) in GOAT.

Interestingly, while most speaker pairs present similar amounts of the same variant (e.g., speakers 18), speakers 03 are not only in separate groups, but 03BF is also the most extreme speaker in cluster 2 whereas 03AM is the paragon of cluster 1. Women appear to be leading the supralocal variants since the most extreme speakers of cluster 2 are women, contrarily to paragons in that cluster which include both men and women. Women in cluster 1 overwhelmingly predominate, so they are *de facto* leaders of the above supralocal group. It is the reverse in cluster 3, with men favouring the most local pronunciations

How to deal with individual peculiarities?

Despite belonging to cluster 3, 9AM is at the crossroads of all three clusters since he uses variants that are typical of each of the three groups (Table 6-16). His most common variant in FACE is the above supralocal one, but in GOAT, it is the local central monophthong that prevails.

Table 6-16 Proportions of FACE and GOAT variants by degree of accentedness by speaker 9AM. Overall proportions are in parenthesis.

Speaker 9AM	*Above supralocal*	*Supralocal*	*Traditional*
FACE	[eɪ] 60% (22%)	[eː] 27% (51%)	13% (28%)
GOAT	[oʊ] 27% (18%)	[oː] 18% (43%)	[ɵː] 45%, [ʊə] 9% (33%), (5%)

Although his above supralocal variants in FACE and GOAT are more numerous than the average amount per speaker, he remains in the traditional group because [ɵː] is exclusively produced by speakers in cluster 3. However, the model attributed coordinates to him that make him closer to cluster 1 on the factor map because of his uncommonly greater proportions of FACE and GOAT above supralocal variant. Since the clustering tree is flattened up for the sake of clarity, such subtlety regarding speakers would not have been visible, hence the usefulness of a factor map to complement the dendrogram.

6.5.7 Concluding remarks

The pilot study was a methodological exploration to check whether PCA followed by a clustering approach best served our sociolinguistic research questions: how many sociolinguistic groups can be reconstituted based on linguistic variation only? If so, is social stratification relevant among those groups? Can we find leaders of sound change? I took more time to explain the methods because they are relatively new to our field of linguistics. First, I wanted to check if the default clustering method (Ward) was reliable before moving on to a much larger dataset like the TLS-coding data: it is reliable and single linkage can be used to spot atypical speakers. Then, I checked whether the Ward approach used more than one lexical set to create linguistic groupings of speakers. The PCA factor map also proved useful to see the actual two-dimensional distance between the speakers because dendrograms are inconveniently flat and linear. PCA in its simplest form however, does not take into account the hierarchical structure of the data into lexical sets and variants. One variant may therefore determine the sociolinguistic grouping of speakers more than others, which is what happened when I tried to add MOUTH as an active variable in the model – it was therefore counted as a supplementary variable in the pilot study. The results were strongly determined by whether speakers used a raised onset or not in MOUTH, whereas only 3 speakers out of 33 had a few instances of raised onsets in the reading list. In the next chapter, I use the same methodology for the TLS and the PVC but use MFA instead, which was introduced in chapter 4. MFA has two advantages compared to PCA: it accepts the lexical set/variant hierarchical structure and balances out the effects of lexical sets and not of each individual variant. We also get to know the general effect of FACE, GOAT, PRICE and MOUTH in characterising speakers.

Concerning the choice of variables, using MFA for TLS-coding data will be precious in determining whether, out of all the 566 phonetic variants, FACE, GOAT, PRICE and MOUTH, significantly contribute to the characterisation of sociolinguistic groups. Then, *paragons* and extreme speakers will offer important clues regarding the degree of levelling of Tyneside English from the 1970s to the 1990s.

CHAPTER 7 Revisiting the auditory analyses of the TLS and the PVC: apparent & real time studies of FACE, GOAT, PRICE and MOUTH

Summary of CHAPTER 7

The present analysis investigates variation in the TLS (1970s) and PVC (1990s) corpora of Tyneside English, with a particular focus on the reflexes of FACE, GOAT, PRICE and MOUTH. The chapter examines how the social meanings of phonetic variation in Tyneside is influenced by a complex relationship between speaking style, social class, education, age and gender. The four above-mentioned lexical sets and their reflexes from 77 speakers (TLS: 44 & PVC 33) were analysed together using a multivariate approach called MFA which takes into account the hierarchical relationship between the lexical sets and their respective variants (Escofier & Pagès, 1984; Husson et al., 2011). The approach also provides visual representation of the co-occurrence among variant per sociolinguistic groups. Combined with a cluster analysis, MFA helped build a sociolinguistic characterisation of the speakers. Both the sociolinguistic groups and the individual variational dynamics were brought the fore. Results showed that FACE is the most important determinant of TE speech out of the 4 lexical sets in both the PVC and TLS, and so, despite the differences in style, sampling approaches and transcription schemes. In both corpora, the pan-northern pronunciations of FACE and GOAT are used by all speakers but to varying degrees, with three main groups of speakers emerging on the basis of a continuum measuring the degree accentedness: traditional, supralocal and above-supralocal, which corroborates Watt's findings (1998). A more detailed analysis of the entire TLS interview material, which included consonants, stressed and reduced vowels, revealed 4 sociolinguistic groups of speakers from Gateshead that were determined by a criss-cross of gender, education and class. Style seems to have a strong influence on the traditional MOUTH variants [u] and [ɛʊ]. While it is often heard among the TLS & PVC WC in the interview/conversational material, they are almost absent when the latter read the wordlist.

Introductory remarks

so I'm planning to do about a hundred and fifty of these [recordings] eh in Gateshead you see and when I've done that we should know something about eh you know h how much eh all the different kinds of speech that there are (McNeaney, TLS interview TLG24).

The present chapter analyses the fine-grained phonetic transcriptions carried out by the original TLS team. The aim here is to revisit previous analyses of these transcriptions (Jones-Sargent 1983, Moisl & Maguire 2009) and to suggest methodological solutions to problems raised by the latter. New results are then interpreted based on these methodological adjustments. In this sub-section, I first highlight issues and limitations raised in the literature on the TLS data and then provide an outline of the present chapter.

The aim of this chapter is to address the methodological limitations found in Jones-Sargent (1983) and Moisl (2015) & Corrigan et al. (2014), by (1) including **all** linguistic variables in the data analysis, (2) taking into account the **hierarchical structure** of the coding scheme, (3) **reducing the dimensionality** as advised by Moisl and Maguire (2008), (4) avoiding redundant social variables to **prevent collinearity** issues, and finally, (5) providing improved **data visualisations** along the lines of the French school of PCA to facilitate the interpretation of the multivariable analysis of this complex dataset.

Here is a brief outline of this chapter. I first describe the data and methodology (7.1.1 & 7.1.2) used to analyse the TLS and PVC transcription data. Sections 7.2 to 7.7 provide the results of the MFA analysis on the TLS interview and wordlist materials. The next section (7.8) is an MFA analysis of the PVC wordlist data with an exploration of the variation within and across dyads. Sections 7.18 onwards provide a real-time study of levelling in TE based on variation in the TLS and the PVC auditory data.

7.1 Data & methodology

This section analyses variation across the TLS data using the original TLS transcriptions of spontaneous speech by 44 speakers (37 from Gateshead, 7 from Newcastle). As a brief reminder, the fine-grained transcriptions were made using a 5 digit coding scheme (called the *states*), which included variants of all the consonants and lexical sets of English. This amounts to 566 linguistic variants spread out throughout 63 groups (consonants or lexical sets). Initial, medial and final stops were treated as separate groups. The following social variables were included: age, sex, birthplace, further education and class. To perform an aggregate sociolinguistic analysis, namely, an analysis that includes a vast number of linguistic features, I chose to use **Multiple Factor Analysis** in the sense of Escofier (Escofier, 1983), since it addresses most of the issues and technical challenges encountered by TLS researchers in the past.

7.1.1 Data construction

Providing information on how one's dataset was built is just as important as explaining how the data was gathered as conclusions are drawn from this constructed dataset. To build the dataset for the MFA analysis as shown in Table 7-1, I first extracted all the TLS states for all 44 speakers from the XML files on the DECTE website. I then converted this data into a long format file, which means that each occurrence of a *state* becomes an individual line, all of them adding up to more than 100,000 lines. I then retrieved the lexical sets and family of consonants for each *state*, also known as *overall unit* along with their subcategories, the PDV (putative diasystemic variant) and transcribed the states in IPA. The social data was then added to the table.

Table 7-1 Example of how a data set should be structured for MFA.

Groups of variables =>	**Social data**		**Lexical set: FACE (total per set= 100%)**		
Subject (as row names)	**Sex**	**Age**	**FACE_[eː]**	**FACE_[eɪ]**	**FACE_[ɪə]**
Speaker 1	F	30	90%	10%	0%
Speaker 2	M	76	40%	0%	60%
....					

After this major step, I used the pivot table function in Excel to get proportions of each *states* per *overall unit* for each speaker, as exemplified in Table 7-1. Information pertaining to each state became a column. The metadata were then added to the file with proportions using an R-script. The *states'* individual codes were preceded by the first letters of the lexical set it belongs to, e.g. FA_11201, for the *state* 11201 ([i̠ə]), which belongs to the FACE set. *Overall units* for consonants were coded using IPA in the like manner: tMed_02881, with *tMed* standing for a medial /t/ and 02881 for [ɹ][104]. The file was then ready for MFA and for a hierarchical clustering analysis based on the reduced dimensionality obtained through MFA – as recommended by Husson and colleagues (2014). The various steps of the MFA and clustering are discussed in more detail in the next section.

7.1.2 Statistical analysis: a brief outline of the MFA approach

A Multiple Factor Analysis followed by a hierarchical cluster analysis was used to find which groups of variables (linguistic and social) contributed to the separation of speaker into distinct clusters. The statistical tool enables me to deal with the following questions: which linguistic features help differentiate speakers across the social ladder (the original aim of the TLS project) and which variants of the lexical sets FACE, GOAT, PRICE and MOUTH co-occur (the aim of the present thesis) in each groups of speakers?

MFA can serve a wide array of purposes and can deal with a high amount of variables. It is sometimes necessary to go beyond the first two components which present only the big trends in the data, because they do not always answer the research question of the sociolinguist, who might have more specific points to address. Other dimensions are therefore investigated in this thesis viz., up to 5. The approach is as follows:

1. Find **major trends** in the data using the first two dimensions since they explain the highest amount of variation in the data.

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[104] [ɹ] corresponds to a median click realisation of /t/ according to the 1978 IPA chart ("The International Phonetic Alphabet," 1978, p. 1). It has fallen into disuse and is now transcribed as [ǁ]. This variant probably corresponds to the laryngised pronunciation of /t/ in TE which is found to be characteristic of traditional speakers in the TLS data.

2. Perform a **cluster** analysis based on dimensions 1 & 2.

3. Use the **social data** as a **supplementary** variable to prevent bias in the construction of the dimensions.

4. Find **which dimensions** best explain the sociolinguistic variation of FACE, GOAT, PRICE and MOUTH, be it in the dataset with all the states or the one with the four lexical sets only.

5. Perform a **cluster** analysis of the speakers based on the dimensions that are best explained by the 4 lexical sets above (the cluster analysis was consolidated using k-means and by default, used the first five dimensions[105] to build the clusters).

6. Analyse the ***paragons*** (median) and **extreme** speakers for each relevant cluster.

7. **Compare models** including the default 5 dimensions (ncp=5)[106] and with 10 dimensions: what sociolinguistic information is gained and what is lost?

8. Find the model with **the best compromise**, keeping as much information that is sociolinguistically relevant for the study of the 4 sets.

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[105] Using 5 dimensions can help include the right amount of complexity to build clusters that include more information on speaker variation than just the overall variation patterns in the sociolinguistic data.

[106] The term *ncp* is an abbreviation for "nombre de composantes principales" or *number of principal components*, often simply called *dimensions*. It is used in the R package `FactoMineR` (Lê et al., 2008) to indicate how many dimensions should be retained in the model (5 by default). Although most functions are in English in the package, this one was kept in French. I prefer not to translate this abbreviation because it does not correspond to any useful R parameter, whereas *ncp* does and also because the term is transparent enough despite the fact that *component* is placed before *principal* in French.

The preliminary analyses of the PVC data in the pilot study led to a questioning of the suggested number of clusters[107] provided by `FactoMineR` along with the default number of dimensions used to compute the cluster analysis (5 dims) because more subtle sociolinguistic patterns did not emerge so well and speakers were grouped into the three main speaker TE-lects found by Watt (1998), viz, above-supralocal, supralocal and local. However, certain sub-groups of speakers could be found when inspecting the factor map. 6 MFA models were used to analyse the TLS & PVC data as summarised in Figure 7-1. The first one (MFA 0) included all the variables, i.e. both the linguistic and social ones. However, including the social data as fully active variables would yield false positive sociolinguistic clusters. The social data was therefore excluded from the main analysis (similarly to Jones-Sargent 1983) and considered as a group *of supplementary variables* (MFA 1), which Jones-Sargent called "masked" variables (1983, p. 247). MFA 2 included 10 dimensions, instead of the default 5, but kept the default parameters in the creation of clusters but it seemed that more noise was created. Some information was lost regarding the sub-division of male speakers, who initially formed two clusters, while clusters with only one speaker emerged. This means that atypical speakers were given more importance than variation between sub-groups of speakers. The model was not considered parsimonious enough. MFA 3 proved to be the best compromise since the default 5 dimensions were retained but this time the main groups of speakers were split into sub-groups, thus forming smaller and more homogeneous groups with less

[107] The number of clusters is suggested by `FactoMineR` as follows: once the hierarchical clustering has been computed, a dendrogram appears in the plot window. A dark horizontal line indicates where the best height for cutting the tree is. This means that the number of clusters suggested by the programme varies according to the data structure.

variance. This enables more precise cluster diagnostics for each sub-group than the broader diagnostics given by the larger clusters from the model with default parameters (MFA 1), without getting too much noise in the results. MFA 4 provides a classification of speakers based on variation in FACE, GOAT, PRICE and MOUTH. The aim of this model was to make the variation patterns among these 4 sets emerge more clearly and to see how close the classification of the TLS speakers is compared to the classification of the same speakers with more variables. MFA 5 & 6 respectively investigate variation across the TLS & PVC wordlists.

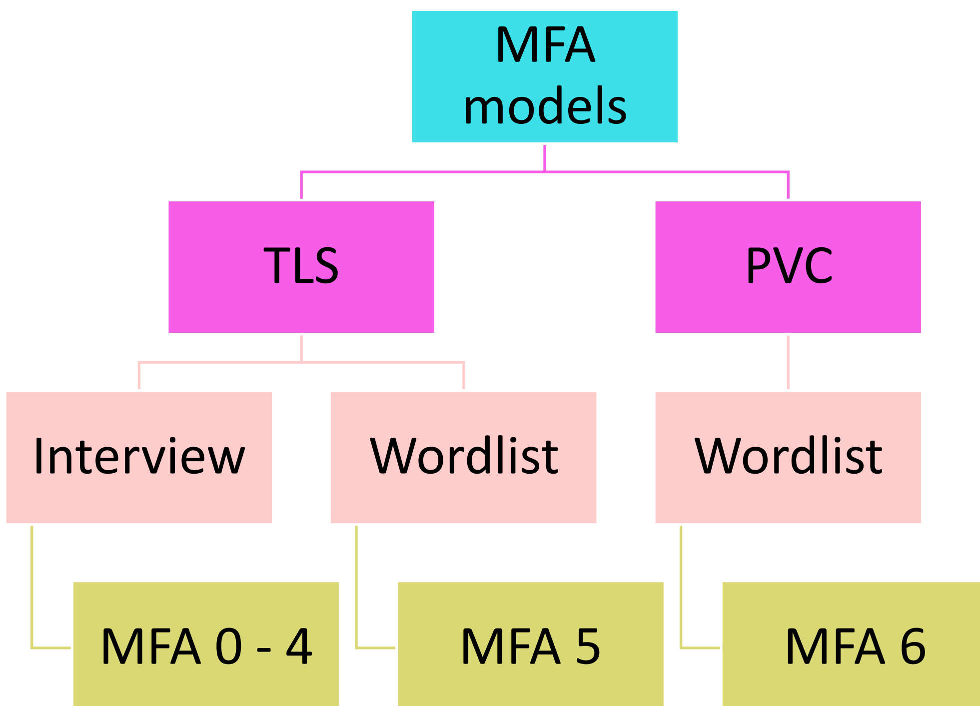

Figure 7-1 Summary of MFA models used for the TLS & the PVC data.

MFA 0-4

- 0: all TLS states, social data as active variables, 5 dims, default number of clusters
- 1: all TLS states, **social data as supplementary variables,** 5 dims, default number of clusters
- 2: all TLS states, social data as supplementary variables, **10 dims**, default number of clusters
- 3: all TLS states, social data as supplementary variables, **5 dims, more clusters**
- 4: **the 4 lexical sets**, social data as supplementary variables 5 dims, **default number of clusters**

MFA 5

- 5: TLS wordlist, the 4 lexical sets, other linguistic variables as supplementary, 5 dims, default number of clusters

MFA 6

- 6: PVC wordlist, 4 lexical sets, other linguistic variables as supplementary, 5 dims, default number of clusters

Figure 7-2 Summary of statistical parameters used in each MFA model.

TLS Results: variation in the TLS-interview and wordlist materials

In the results section of this chapter, I analyse variation in the TLS-coding data based on all variants at first, and then only FACE, GOAT, PRICE and MOUTH, which I will refer to as the *4 sets*. I move on to an analysis of the TLS & PVC wordlist material honing on the above-mentioned 4 lexical sets. I start by observing general proportions of variants in each of the four lexical sets under scrutiny and move on to a detailed multivariate analysis (MFA + clustering) so as to find out: (1) how frequent certain **variants co-occur** in the TLS, (2) which variants are the most salient **markers of indexicality** (TLS-coding, all variants), (3) how many **sociolinguistic groups** are to be found in TE speech in both the TLS and the PVC (reduction in the number of reflexes between the 1970s and the 1990s?) and (4) which speakers can be considered as a **median or atypical speaker**.

7.2 Proportions of variants in FACE, GOAT, PRICE and MOUTH (TLS-interview, all states)

Before I proceed with the MFA analysis, it is important to visualise broad trends in the data by looking at the number of variants retained per lexical and consonantal set when McNeany (1972) transcribed the TLS recordings. This gives us a first indication of whether supralocal variants were already gaining grounds among the working-class of Tyneside compared to the 1990s Newcastle PVC survey and if the non-localised speakers from Newcastle do retain a few local features in their speech.

7.2.1 A bewildering diversity of variants?

At first sight, the number of recorded variants per lexical set is bewildering and is indicated in brackets below each set in Figure 7-3. In fact, the number of those occurring *above chance* level is much lower.[108] FACE only has 3 and GOAT, 6 including 2 variants that are likely to have been uttered in the expression *you know*. PRICE has two main variants too and one which reflects the local/casual pronunciation of the pronoun *I*. Although MOUTH has 7 variants with scores above chance level, they can be aggregated into 4 categories: the raised onsets, the lower onsets, the retracted onsets and the monophthong [u].

[108] To get the threshold, divide the total number of occurrences by the total number of variants. Then examine the number of occurrences in each variants to see which variants have scores above chance level.

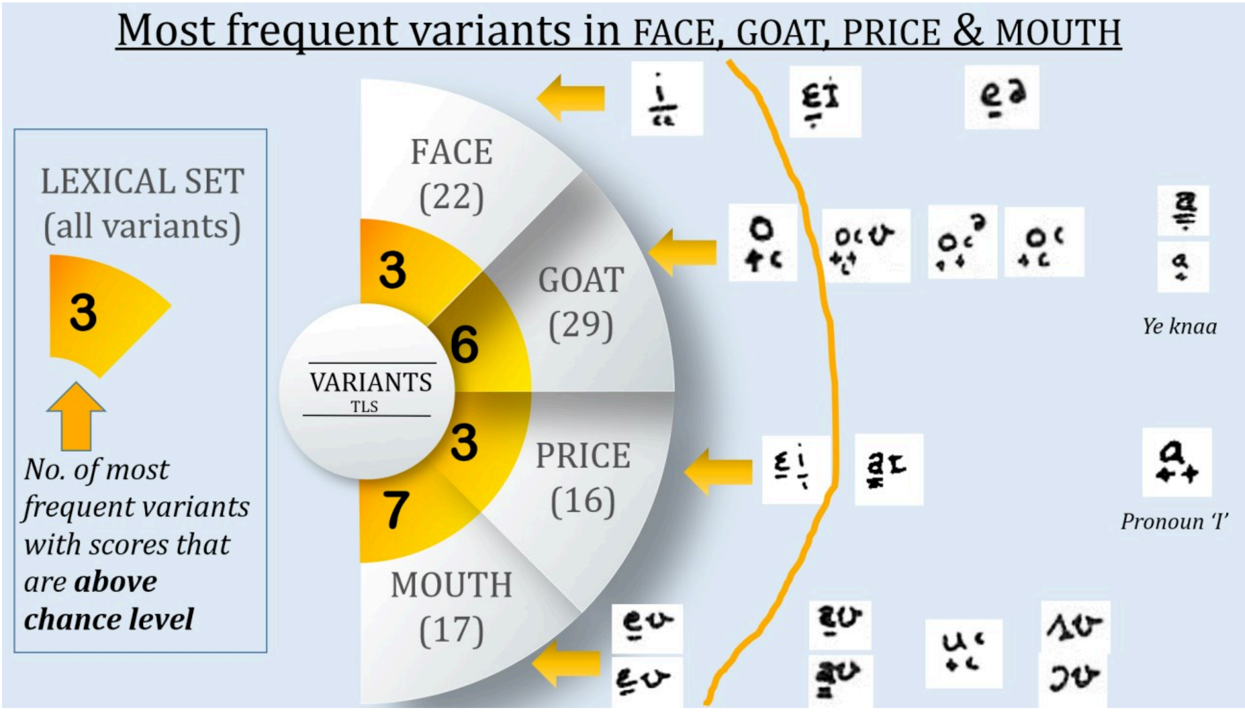

Figure 7-3 Most frequent states of FACE, GOAT, PRICE and MOUTH occurring above chance level (TLS-coding data).

The variants on the left hand side of the yellow line are the variants with the highest score within their respective lexical set. I provide details as to how variants scores are broken down by lexical set.

7.2.2 Variation in FACE

The pie chart in Figure 7-4 displays the frequencies of each variant with a group score that is equal to or above 1% – chance level being around 4.54%. Yet, since we know that some forms are already vestigial, we can anticipate that they will have a low score. We also know that traditional pronunciations only remain in certain words but they are powerful indicators in profiling a speaker, even though the local variant was uttered in one word only. Even a score of 1% should not be disregarded. Hence, we chose to group variants in the *other* category only when their score was below 1%.

In the graph, several variants are associated with supralocal forms: the 2 variants of [i̞], more often described as [eː] in Watt (1998). These 2 monophthongs account for 61% of all realisations, a phenomenon which can be ascribed to the speaking style itself in which many speakers monitored their speech during the interview with the field worker to sound less broad than when speaking in a more relaxed conversation. It may also be that levelling in FACE, which was also found the PVC corpus, was already well underway in the 1970s.

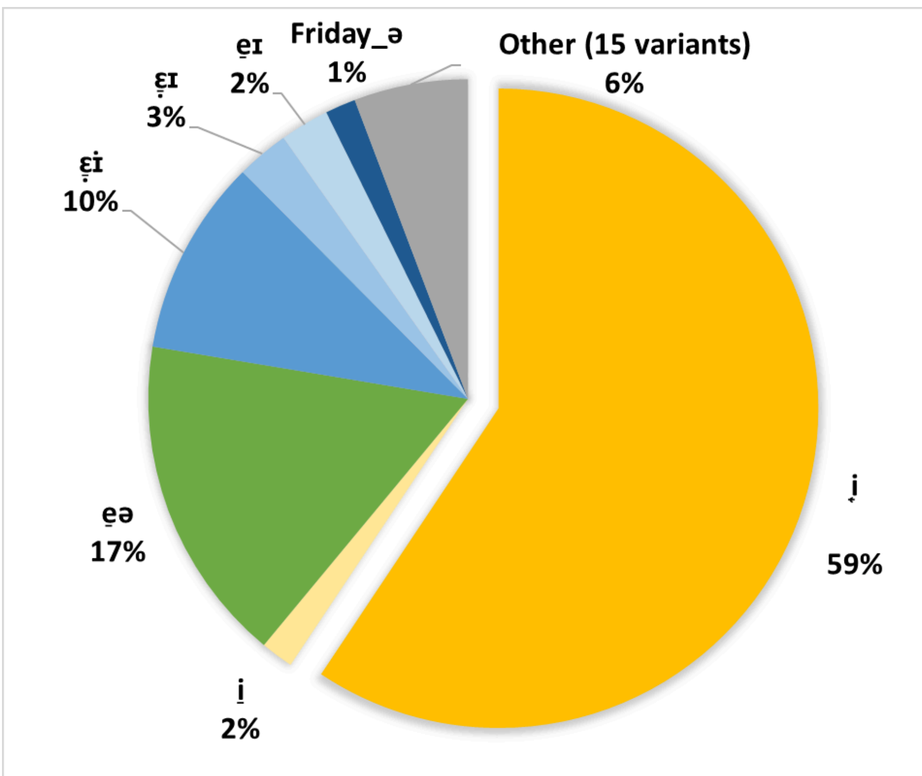

Figure 7-4 Percentage use of FACE variants in the TLS-coding data.

However, the score for the traditional centring diphthong remains rather high as it is slightly higher than that for all the prestige variants (closing diphthongs). Nonetheless, given the very small amount of non-localised speakers from Newcastle, the scores for the high prestige variants were expected to be much lower. It is possible that a few working-class Gateshead speakers were able to style-shift to a certain extent during the interview.

7.2.3 Variation in GOAT

GOAT scores are similar to those for FACE but with slightly higher percentages for both traditional and high prestige forms thus amounting to 21% and 18% respectively (Figure 7-5). Supralocal forms in mid-back monophthongs still got a score of 54%. Also, a higher number of rare variants placed in the *other* section were reported but account for a similar proportion of all realisations to those in FACE (7% and 6% respectively).

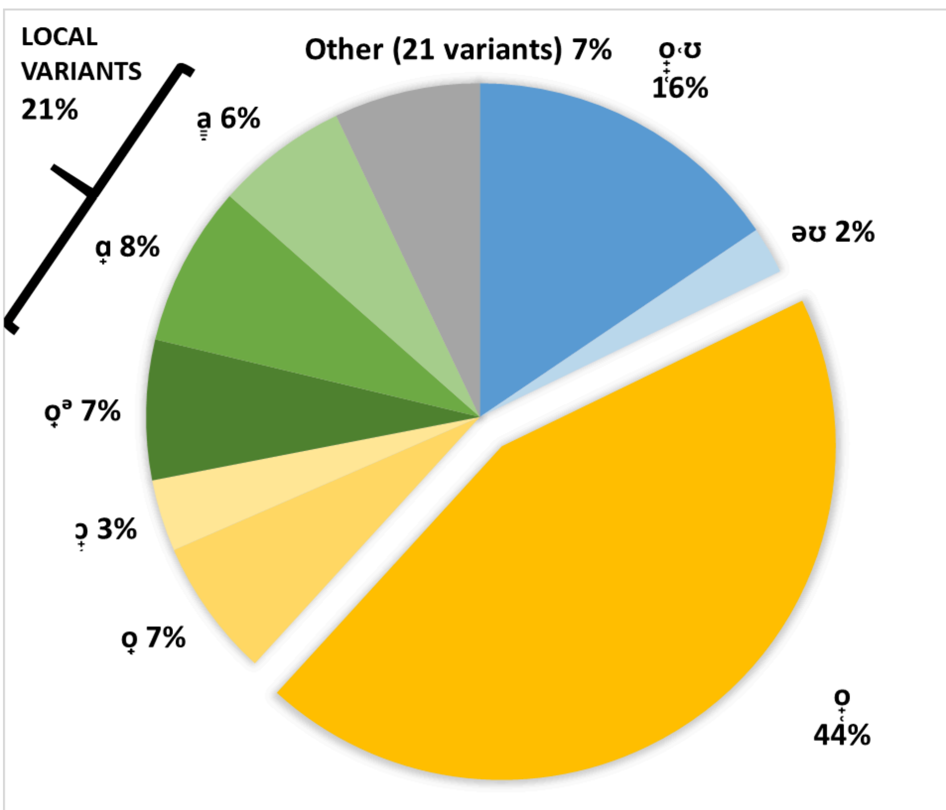

Figure 7-5 Percentage use of GOAT variants in the TLS-coding data.

7.2.4 Variation in PRICE

Regarding PRICE, one has to take into account the high frequency of first person pronouns in the corpus that are mainly pronounced with a low-back monophthong [ɑ] (Moisl & Maguire, 2008). These pronouns are bound to appear more frequently in interview speech data than read speech with a 3rd person narration or a wordlist, which rarely contains the pronoun – except in the PVC wordlist which comprises 10 occurrences of *I*. Once again, scores for traditional and more prestigious forms appear to be neck and neck – 25% for the raised onset and 21% for the lower onset forms respectively. Akin to FACE and unlike GOAT, there is only one major traditional form.

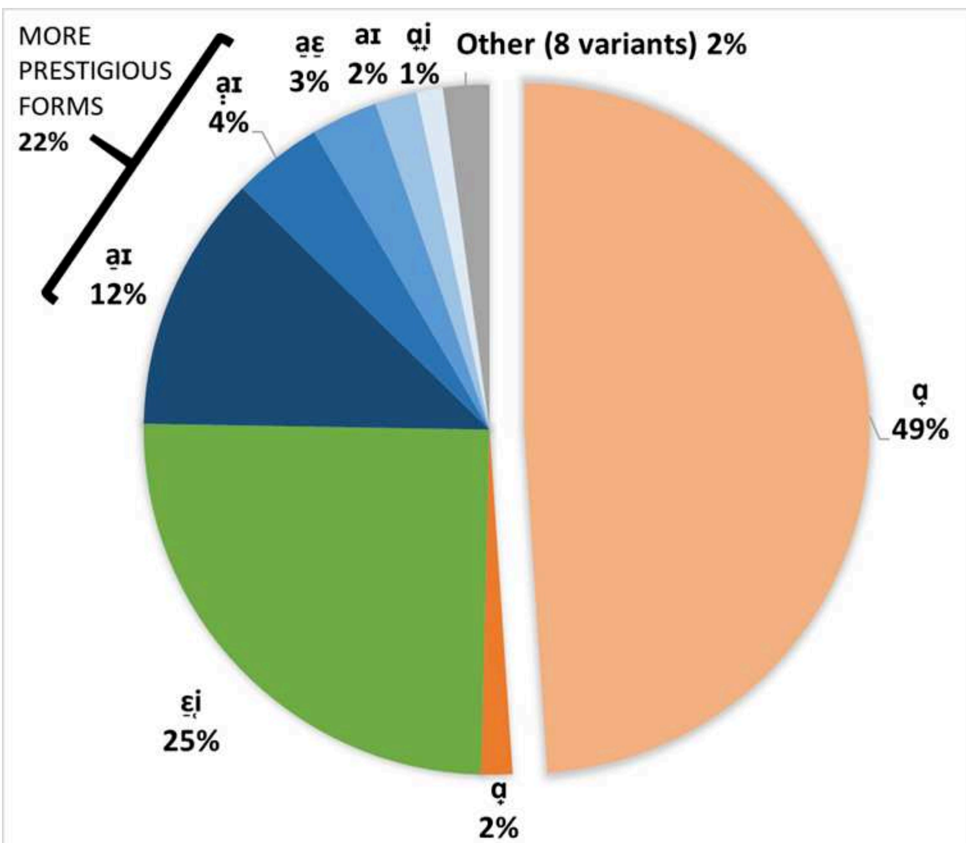

Figure 7-6 Percentage use of PRICE variants in the TLS-coding data.

7.2.5 Variation in MOUTH

Concerning MOUTH values, raised and fronted onsets prevail, which is in line with Beal's description of TE (Beal, 2004, p. 124). The fronted onsets account for 47% of all realisations and raised, retracted onsets, 19%. Vestigial forms occur more often than expected reaching a combined rate of 10%. More prestigious variants with a lower onset ([aɪ]) have similar results to PRICE with both scores being around 20%.

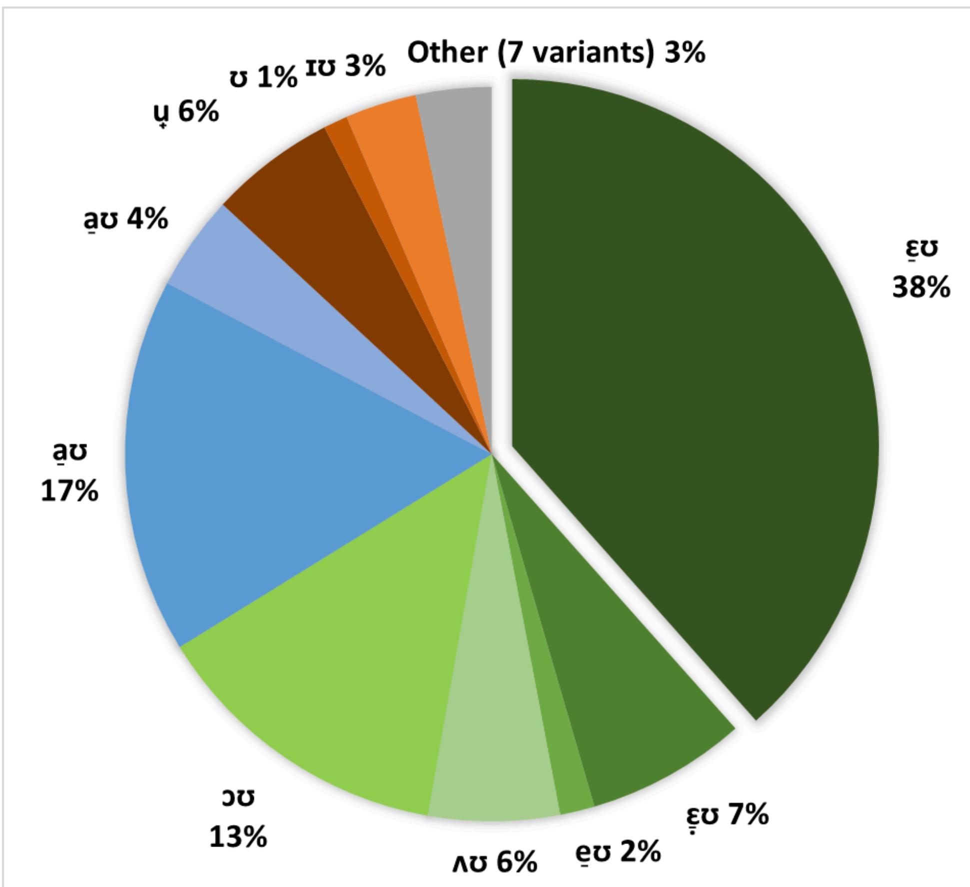

Figure 7-7 Percentage use of MOUTH variants in the TLS-coding data.

Overall, similar patterns of local/supralocal/high prestige variants were identified in FACE and GOAT. FACE comprised a more reduced array of local variants, which renders the traditional centring diphthong more salient. One should also bear in mind that the high scores of open monophthongs in GOAT can be ascribed to the high frequency of the marker *you know*, often pronounced with an open [ɑː] in broad TE and transcribed as *ye knaa* or *y'knaa*[109] (Sanderson, 2013, p. 19; D. Simpson, 2013, p. 33) in eye dialect (Krapp, 1926).

At this stage of the analysis, it is difficult to determine whether raised onsets in PRICE and MOUTH are more indicative of supralocal or traditional forms. This issue will be addressed during the process of clustering speakers into distinct sociolinguistic groups. In the next section, I deal with such issues as the social correlates of speech variation in Tyneside English in the TLS interview and wordlist data and the PVC.

[109] The following interview on *the Talk of the Toon* website is a good illustration of how *you know* is pronounced by older speakers from Tyneside: https://research.ncl.ac.uk/decte/toon/dectefiles/decten2y07i012.html (Accessed on the 18th October 2018).

7.3 Apparent-time study 1a of TLS-coding data, an integrated approach of phonetic variation

7.3.1 Statistical analysis: preliminary steps (TLS-coding, all states)

A few preliminary steps are needed to get interpretable results. One has to know whether choosing MFA over PCA is preferable given the structure of the data. Then, the percentage score of explained variation provided by the first dimension of the MFA has to be verified. If it is high enough given the structure of the data, then one may interpret the results with confidence. Eventually, one has to find the dimensions that best represent variation in the data through the prism of both the social data and variation in FACE, GOAT, PRICE and MOUTH by inspecting the latter's contribution scores in the first 5 dimensions. I then show why it is necessary to consider the social data as a supplementary and not active group of variables in the model. Eventually, since the MFA analysis is followed by a cluster analysis, it is important to determine the ideal number of sociolinguistic groupings based on variation across all states, and then across FACE, GOAT, PRICE and MOUTH only.

7.3.1.1 Preliminary step (1): is MFA suitable for analyzing variation in the TLS-coding data?

Pagès (2013, p. 124) provides an important preliminary step to justify the use of MFA over PCA. One method is to look for canonical correlation coefficients that result from an MFA analysis (Table 7-2) and take the highest coefficient across the entire table (0.98, dim 1) and the highest value of a dimension with a higher rank like dim 5 (0.87, highlighted and underlined). This gives us a range within which the coefficients for the lexical sets should be inside the first or second dimension. If at least two lexical sets have coefficients between 0.98

& 0.87, then we can see that two or more lexical sets have a *common factor*. This is the case here because FACE and GOAT are within this scale (0.91 & 0.89, signalled by the curly bracket in Table 7-2) and PRICE is not far behind (0.85). Using MFA is therefore a reasonable choice for analysing variation in the TLS.

Table 7-2 MFA canonical coefficients (range: from 0 to 1). TLS interview material, all states.

SETS	DIM 1	DIM 2	DIM 3	DIM 4	DIM 5
FACE	**0.91**	**0.89**	**0.88**	**0.78**	**0.76**
GOAT	**0.89**	0.70	**0.75**	0.51	**0.87**
MOUTH	**0.71**	0.52	**0.68**	0.67	0.62
PRICE	**0.85**	0.67	0.68	0.57	**0.82**
/l/	**0.98**	0.74	0.56	0.91	**0.44**
. . .					

7.3.1.2 Preliminary step (2): checking for non-randomness in the distribution of phonetic variants

A second preliminary step is to check if the score for the first dimension is high enough. In the TLS-coding dataset with all the states, there are no less than 566 linguistic variables and 44 speakers. The score is expected to be fairly low and yet the first dimension explains 13.7% (Figure 7-8), which is fairly high given the complexity of the data. To assess this score, Husson and colleagues (2011) provide a table with ideal scores for a first PCA[110]

[110] A similar table was not provided for MFA. These values can therefore only give us an approximate idea of the quality of the MFA model.

dimension depending on the number of individuals and variables. This was obtained by comparing the "0.95 quantile of the distribution of the percentages obtained by simulating data tables of equivalent size on the basis of a normal distribution" (2011, p. 35). The table goes as far as 200 variables. With 45 speakers (a number close to the TLS data), the ideal score for dim 1 is 9.4%, whereas the one for the TLS data which has 566 variables and 44 speakers is 13.7%. By comparison, this percentage is already higher than the model with 75 variables only. Hence the first dim of the TSL data is highly reliable and **variation in the TLS is not random**. Let us now see how much variance is cumulatively explained depending on the number of dimensions you choose.

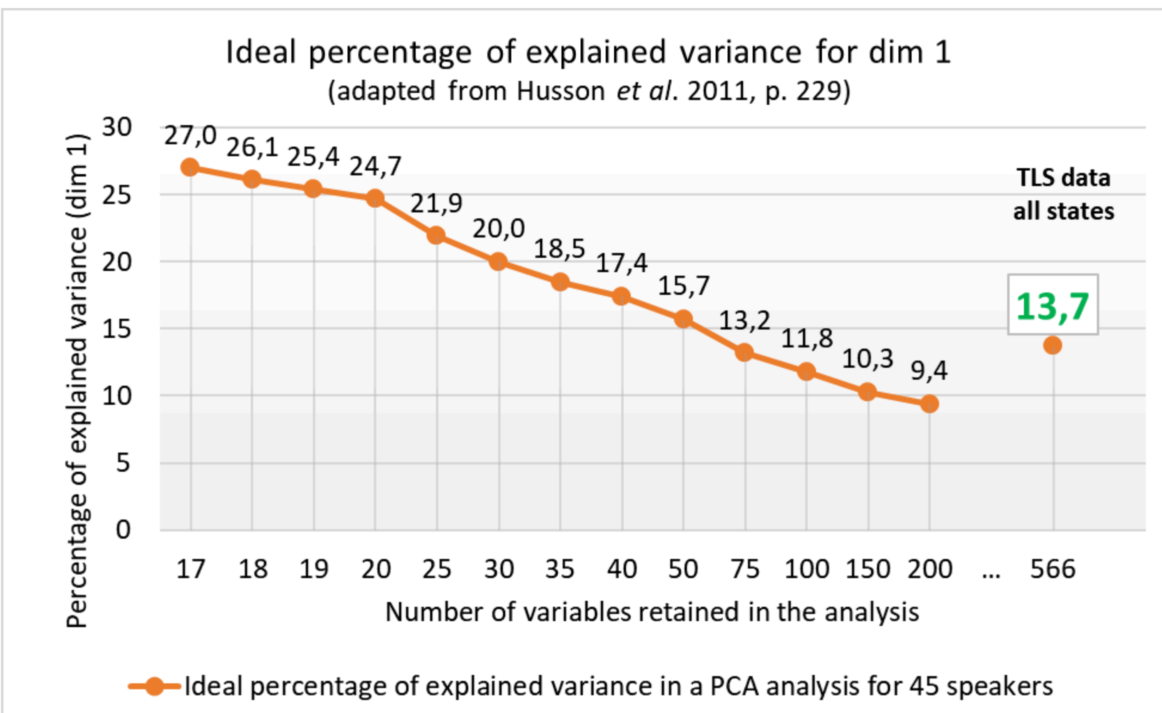

Figure 7-8 Ideal percentage of explained variance for dimension 1 vs. percentage in TLS data, all states (adapted from Husson et al. 2011, p. 229).

The values provided in Figure 7-8, however, were based on PCA analysis and the percentage of explained variance may vary depending on the structure of the groups of variables. The TLS data is also special in the sense that the values for each group of variables on the same line add up to 1. As a consequence, a fake set of data with the same structure was created with random values adding to 1 for each group of variables.[111] Given the complexity of the data, many more trials with random data should be carried out, but the figures below should give us an idea of whether the TLS data has an explainable structure (Figure 7-9 & Figure 7-10).

[111] The simulated dataset was created using the following Python code: https://github.com/numpde/speakers/tree/master/mfa_fakes

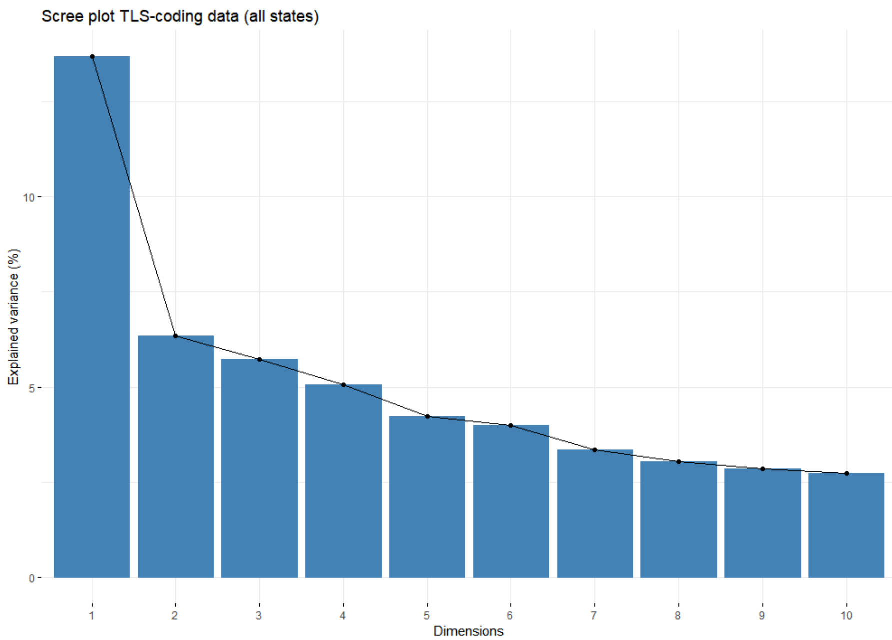

Figure 7-9 Percentage of explained variance in TLS-coding data.

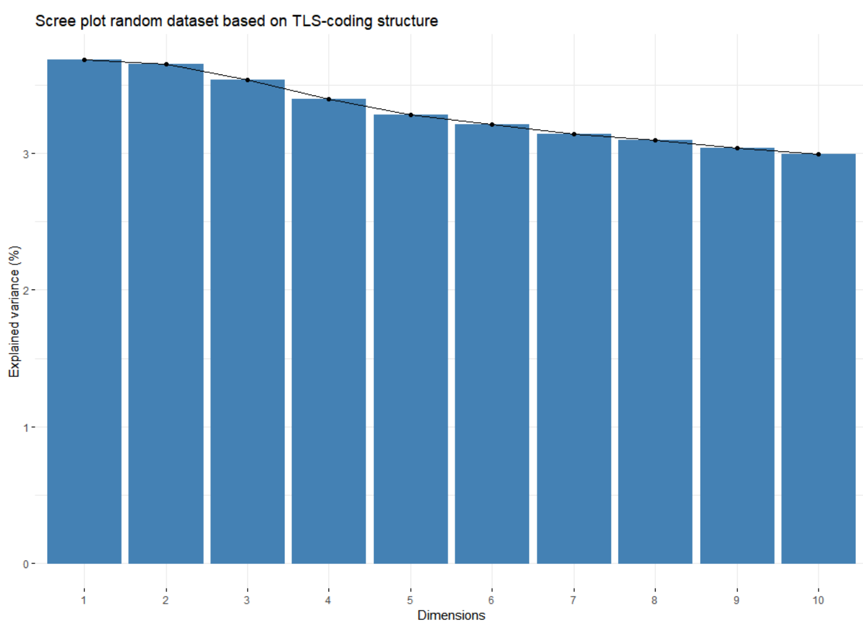

Figure 7-10 Percentage of explained variance in random data with identical structure.

In the random dataset, only 4% of variation is explained, while in the TLS the amount reaches about 14%. More testing should be made but this example suggests that the TLS-coding data is far from being random. I now proceed to an analysis of the dimensions to check how much structural information is retained and how much noise should be excluded from the analysis.

7.3.1.3 Preliminary step (3): getting the ideal number of dimensions to explain sociolinguistic variability

In most studies using MFA, only the first two dimensions are examined in an MFA because they account for major trends in the data but the default parameters of MFA/PCA and MCA in `FactoMineR` take into account the first 5 dimensions (henceforth, *dim*), the rest being mainly considered as noise. Cluster analyses are then performed based on the first 5 dims only (by default). This has the advantage of providing the analyst with general tendencies in the data. In language variation, the number of dimensions retained depends on how much variation is explained by the first two and on what kind of research question the variationist wishes to answer. Broad linguistic patterns are expected to emerge with the first two dimensions, while more subtle nuances will be visible when including a few more dimensions into the model.

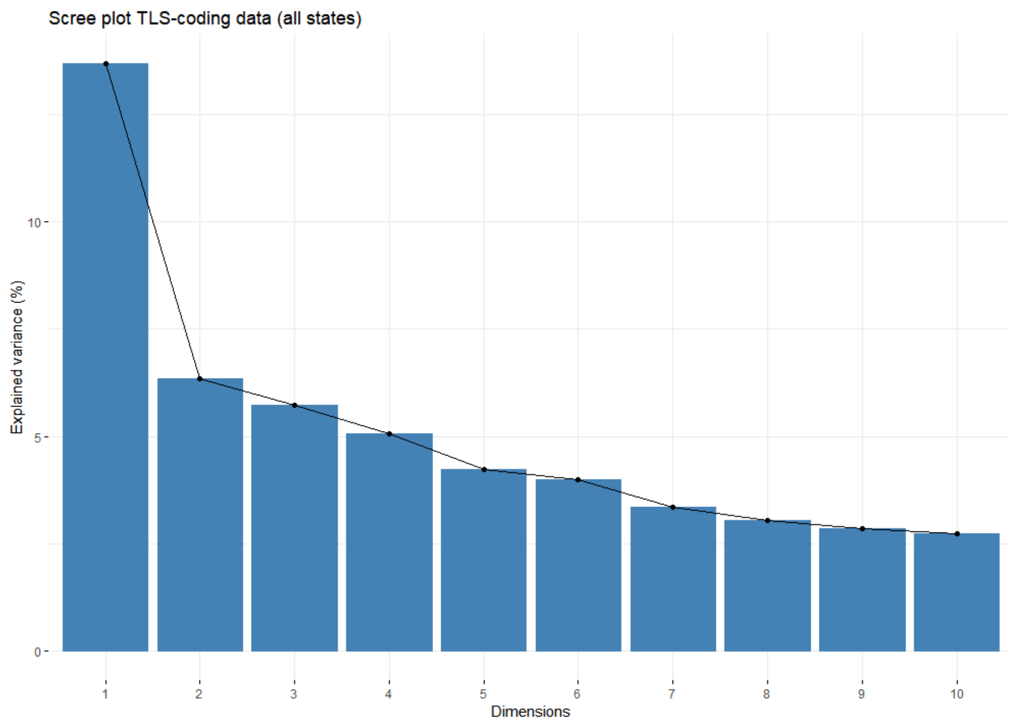

Figure 7-11 MFA Scree plot: percentage of explained variance for the first 10 dimensions (linguistic variables only).

As a rule of thumb, one should consider including a dimension if the next one on the right drops considerably. Dims 1 & 2 should definitely be looked at and the score keeps dropping until levelling off between dim 5 & 6. It then keeps dropping but only very gradually.[112] If you include only the first 5 dims into the model, you get 34.6% of explained variance[113], which is already a fairly good score given the complexity of the data (566 variables). But adding the next 10 dimensions would give us 50.8%.

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[112] Another way to know how many dimensions should be retained is to observe eigenvalues directly (Escofier & Pagès, 2008). In MFA, eigenvalues are considered as indicators of variation. If the eigenvalue for the first dimension is equal to the number of variable groups (n=64) then the first dimension explains the variation fully.

[113] To get the cumulated explained variance just add the scores for each dimension given by the scree plot (Figure 7-11).

A model including 10 dims was performed but it turned out that the default parameter (5 dims) is enough. The 10 dim model highlighted two main variational patterns among Gateshead women but neglected those among men. The best compromise was to keep dimensionality low – as recommended in Moisl & Maguire (2008) for the TLS – with 5 dims, but to increase the number of clusters. That is to say, cutting the clustering tree lower to highlight more details regarding the sub-groups of speakers. Since major trends are already cited in the literature – the North/South Tyneside, men/women gaps between speakers (Jones-Sargent 1983, Moisl & Maguire 2008) – it was deemed relevant to study the variational patterns a bit deeper. With the 5 dim model and a lower cutting level, the 2 variational patterns among Gateshead women were retained and 2 main speech patterns emerged among men too. Based on both the pilot study in 0 and on Watt's findings on the PVC (1998), it is hypothesised that there are two main degrees of accentedness among men – traditional and supralocal – and that women either have high scores of supralocal variants or of prestige variants.

7.3.1.4 Preliminary step (4): finding the best 2 dimensions to map both the social data and FACE, GOAT, PRICE and MOUTH

As in PCA, a major issue in MFA is to find the dimensions which reveal trends in the data that address the researcher's specific questions. The aim of this section is to investigate which dimensions best reveal information primarily concerning the **4 lexical sets** FACE, GOAT PRICE and MOUTH together with **the social data** only so that they stand out amidst the 566 variables. To do so, it is first necessary to observe the importance of each dimension in explaining variation in the data with the use of a scree plot as illustrated in Figure 7-12 and to scrutinise the output table of the MFA (Table 7-3). We then check if there is one dimension where the contributions of each of the 4 lexical sets are even so that we can analyse them as a variational system and match the variational patterns with the dimension where social data is also well represented. By selecting the right dimension, we get the maximum information as to how linguistic features are determined by external constraints. Dim 1 is the most important dimension (Figure 7-12) with a rather high percentage score of 13.7%. Dims 2 to 5 are also important because between 7 and 8% of explained variation is gained when they are included successively into the model. It drops to 1% with dimension 6. Hence, 5 dimensions are retained because this is where more information is gained each time a supplementary dimension is included into the model. As a reminder, 5 dimensions is also the default number of components for all forms of PCA in `FactoMineR`.

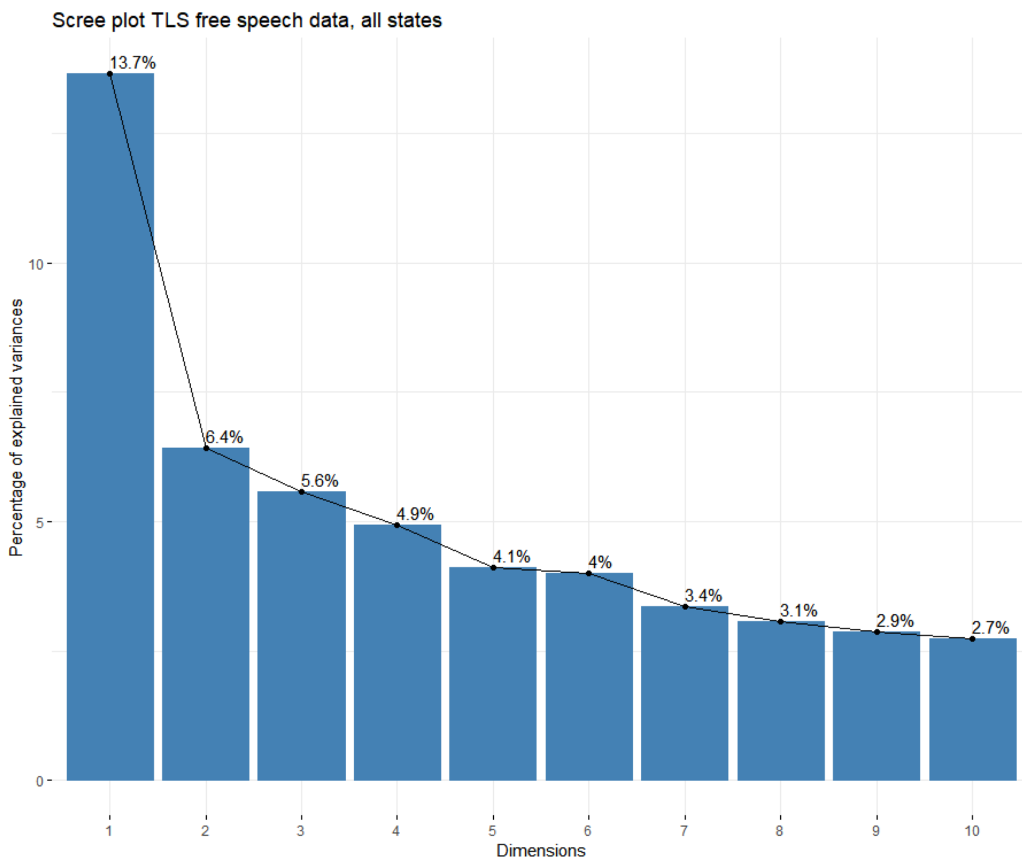

Figure 7-12 Scree plot: percentage of variance explained by the first 10 dimensions (all states).

After an estimate of the number of dimensions needed for the study, it is important to check which groups of variables best contribute to each dimension so that we know what to look for in a given dimension.

Table 7-3 Contribution of 8 TE lexical sets to the construction of the first 5 dim (in %).

Group (n=63)	Dim.1	Dim.2	Dim.3	Dim.4	Dim.5
SOCIAL	1.66	**3.95**	2.63	1.76	1.26
FACE	2.57	2.87	**3.07**	**3.79**	3.43
FOOT	2.61	1.34	2.53	**5.26**	4.11
GOAT	1.21	2.16	**3.84**	0.77	**5.12**
letter commA	2.42	0.92	2.97	0.3	1.73
MOUTH	1.06	1.65	**3.41**	2.42	1.93
NURSE	1.44	2.33	3.02	1.76	0.97
PRICE	1.95	2.14	**3.01**	1.95	**5.73**
STRUT	2.62	2.3	2.91	3.04	3.21

If all groups of variables (lexical sets or consonants) were to contribute to a dimension evenly, they would contribute to around 1.59% namely, the total contribution divided by the total number of variable groups (100/63=1.59). Hence, for instance, group contributions that are around twice this amount should definitely be worth exploring. GOAT and PRICE and FACE are important in dim 5 (5.12%, 5.73% & 3.43%) but FACE contributes slightly more to dim 4 (3.79%). However, similar proportions for the four sets are found in dim 3, which means that since their importance is similar, we can observe variation patterns based on all 4 lexical sets.

We now know that dim 2 best concerns the social values, dim 5 GOAT and PRICE and dim 3, all four lexical sets. This can also be evaluated visually from Figure 7-13 to Figure 7-15. What changes from one graph to the next are the contribution scores per dimension (both axes). Based on Table 7-3, the pairs of dimensions 2 & 3 and 2 & 5 were prioritised in order to best differentiate the speakers sociolinguistically through the prism of GOAT, PRICE, FACE and MOUTH.

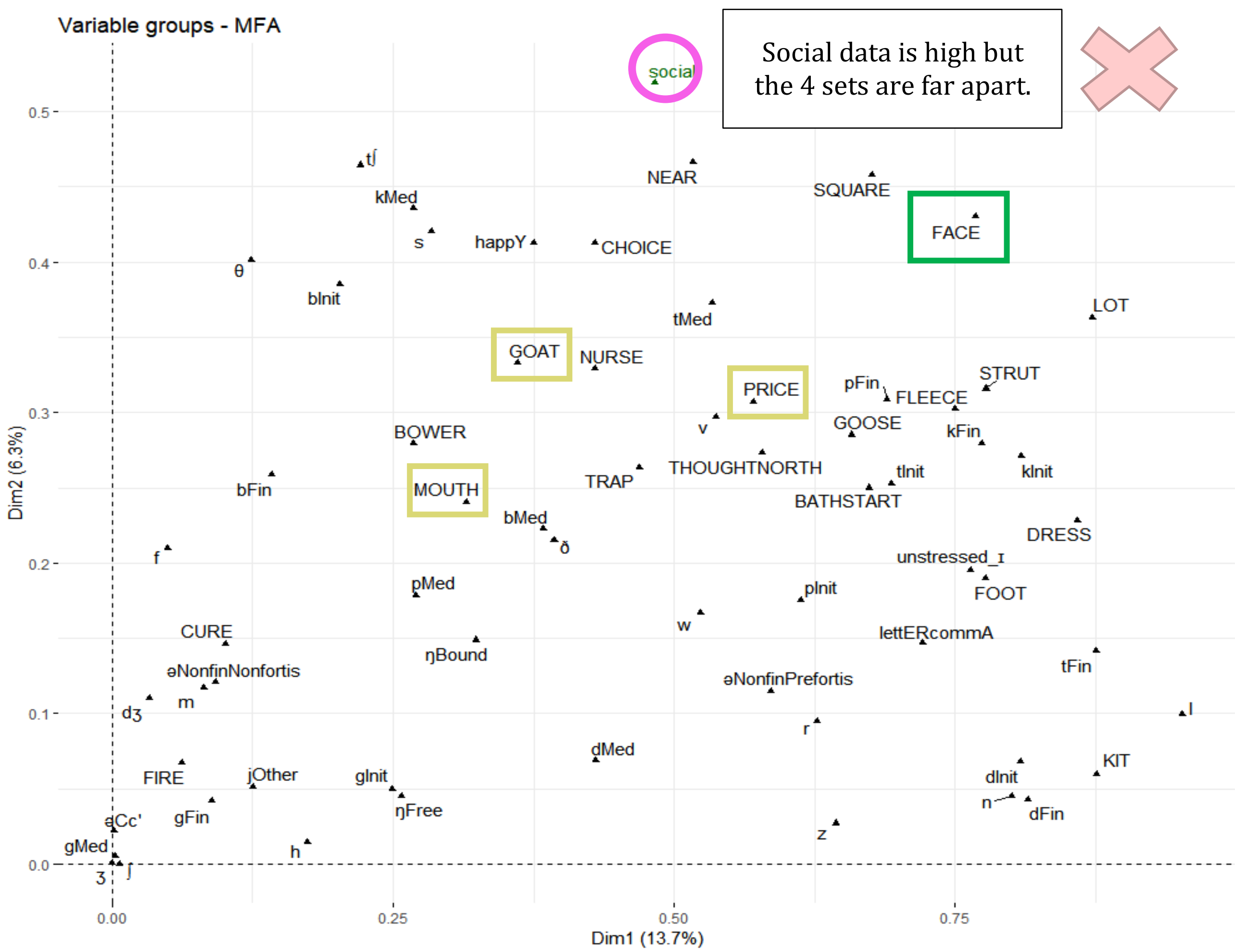

Figure 7-13 Representation of all features (social & linguistic) in dim 1 & 2 (all states).

Figure 7-13 is a graph representing the groups of variables. In terms of sociolinguistics, this would mean the **graph of the features** and *not* of the variants. **When a feature is high on both dimensions, it is considered as main determinant in a given lect.** Despite a high score for the social data, only FACE contributes greatly to the creation of dim 1 & 2 out of the 4 selected sets. Greenish squares indicate unsatisfactory importance of the lexical set in both dimensions (low coordinates) while a green square (FACE) suggests that the lexical set greatly contributes to the specification of speaker variation (high coordinates). This pair of dimensions is not ideal in order to address the research questions in the present thesis.

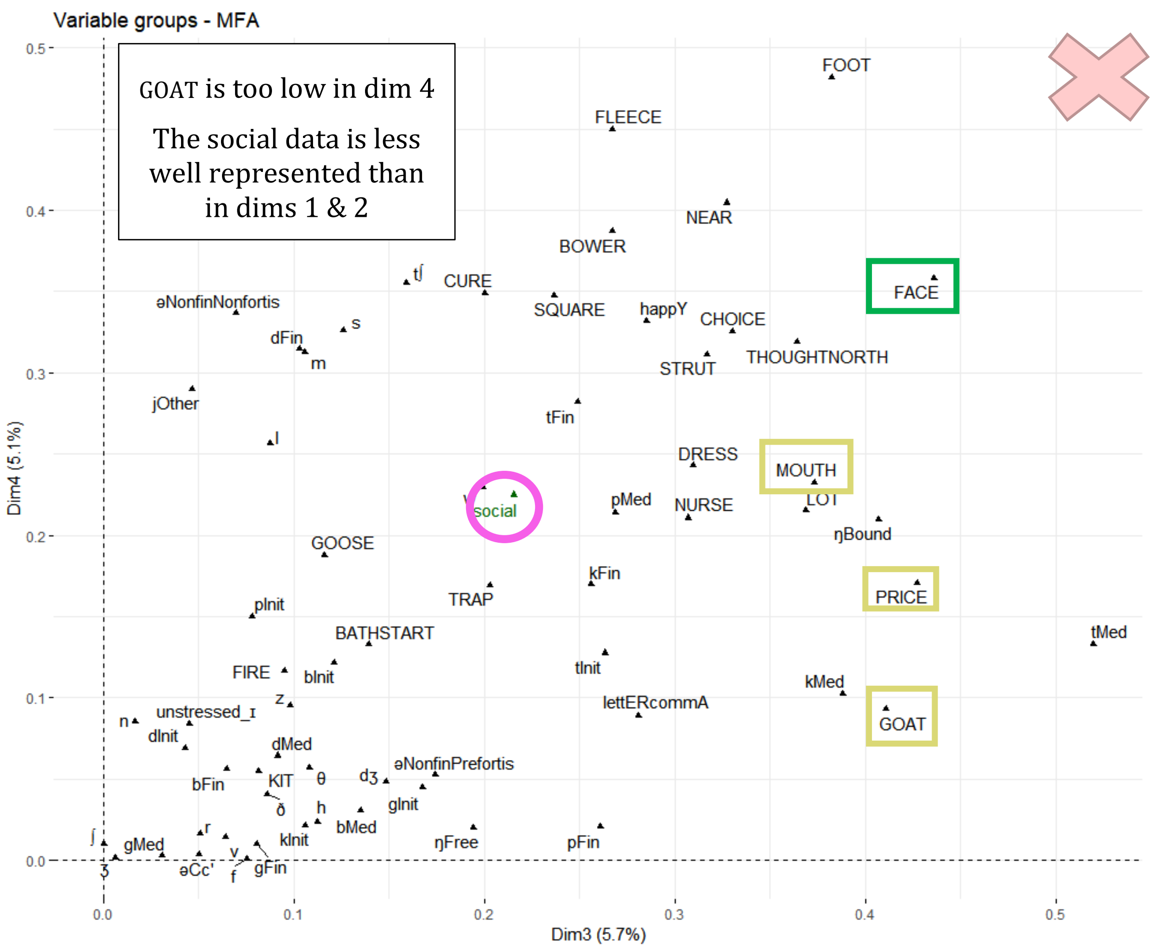

Figure 7-14 Representation of all features (social & linguistic) in dim 3 & 4 (all states).

In Figure 7-14, we notice that the 4 lexical sets are well represented by dim 3 but the social data is not in these two dimensions. This pair of dimensions is better with regards to the linguistic variables but not to the social ones. PRICE, MOUTH and GOAT (in green) still have lower coordinates than FACE in dim 4 despite having similar scores in dim 3.

Hence, **dim 3 and 2** appear as the **best compromise** here (Figure 7-15): the group of social variables is the highest contributor of dim 2 and the 4 lexical sets are among the top 7 contributors out of 63 in dim 3. Based on these observations, I will show how the factor map using dim 1 & 2 differs from the one based on dim 2 & 3.

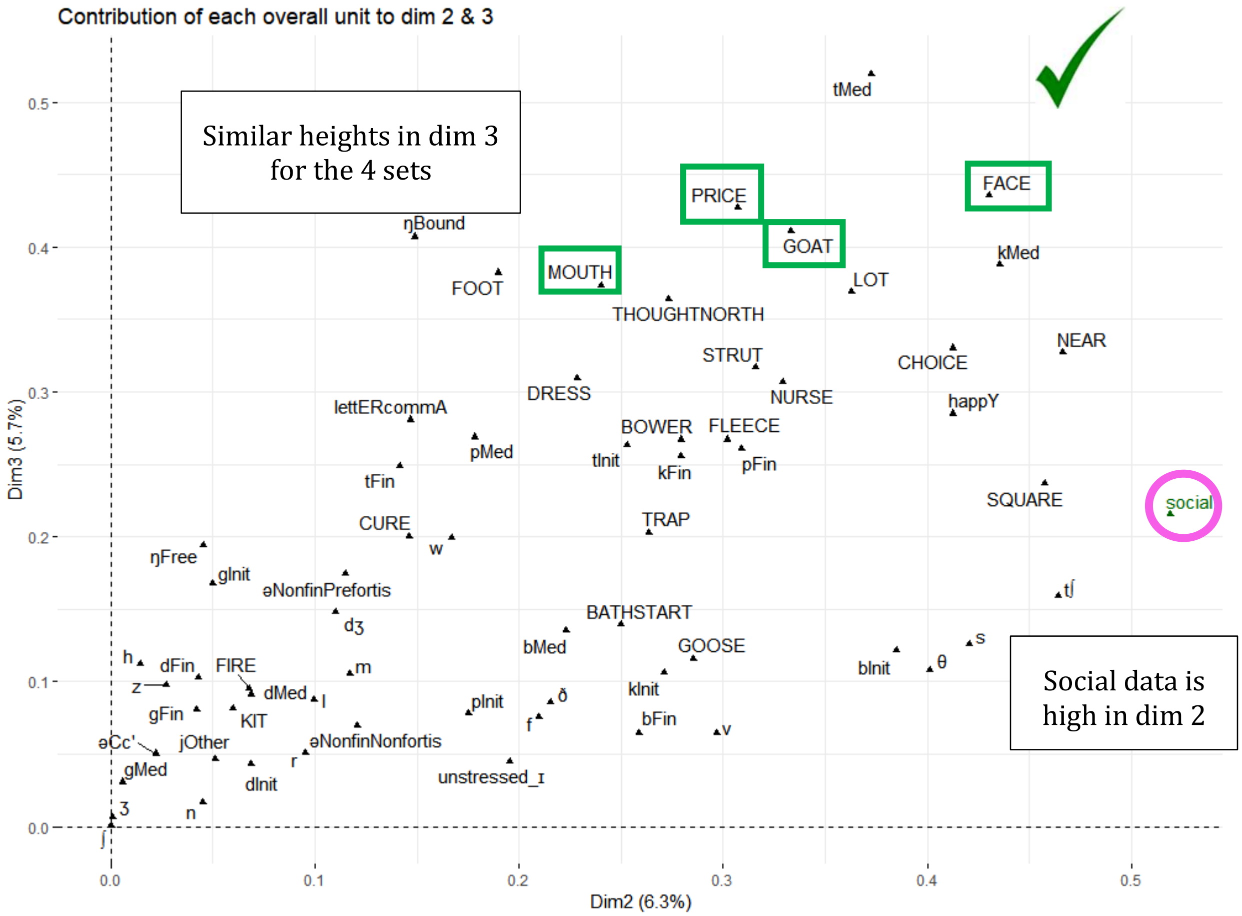

Figure 7-15 Representation of all features (social & linguistic) in dim 2 & 3 (all states): best compromise.

To confirm the role played by all 4 sets in dim 3, it is possible to visualise the top 30 groups of variables (out of 63) that best contribute to that dimension (Figure 7-16). The red dotted line indicates the level of significance with higher scores meaning significant contribution to distinguishing speakers in general. Although the pronunciation of /t/ in intervocalic position (tMed) is by far the most important phonetic feature, GOAT rates second and PRICE, FACE and MOUTH follow shortly after intervocalic /k/ and LOT. FACE, MOUTH and PRICE are not too far behind and have very similar scores.

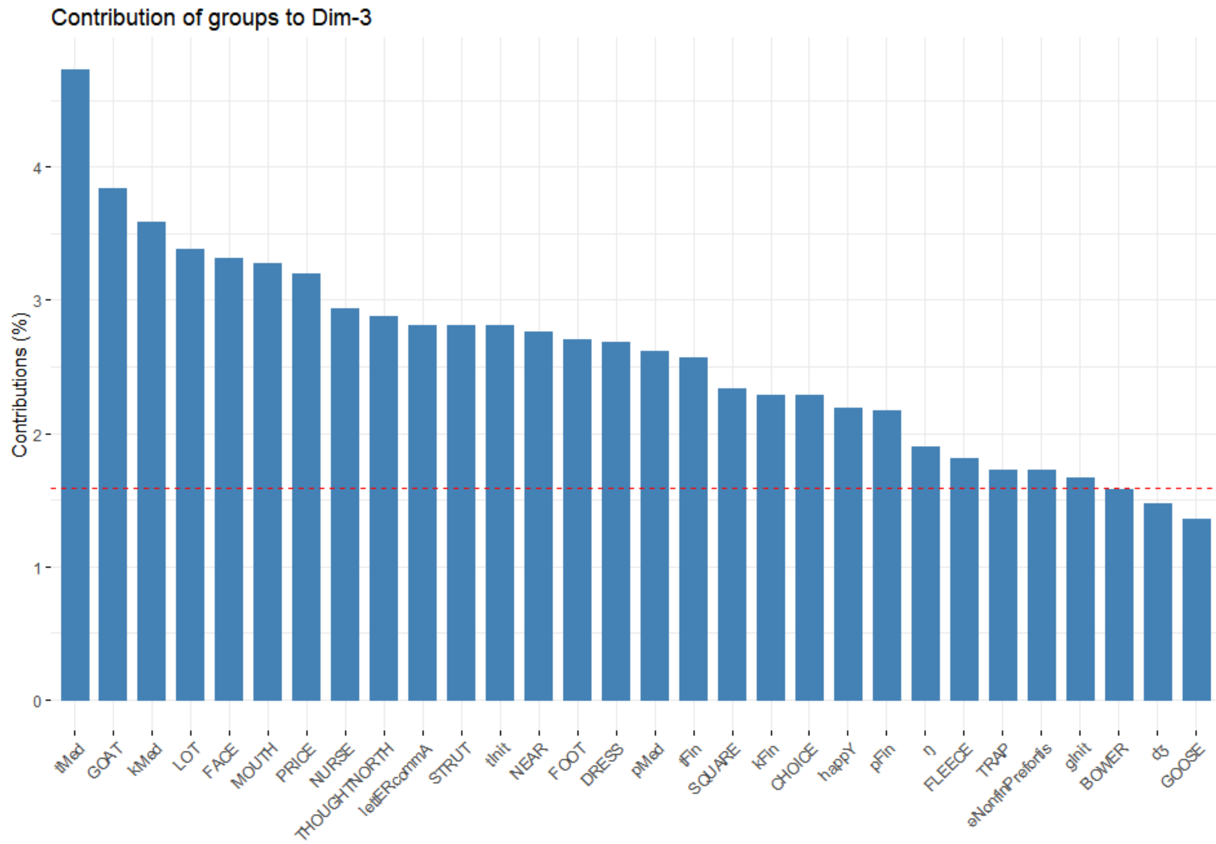

Figure 7-16 Percents of contribution of the first 30 groups of phonetic features (n=63) to dim 3 (all states). Red dotted line: significance level.

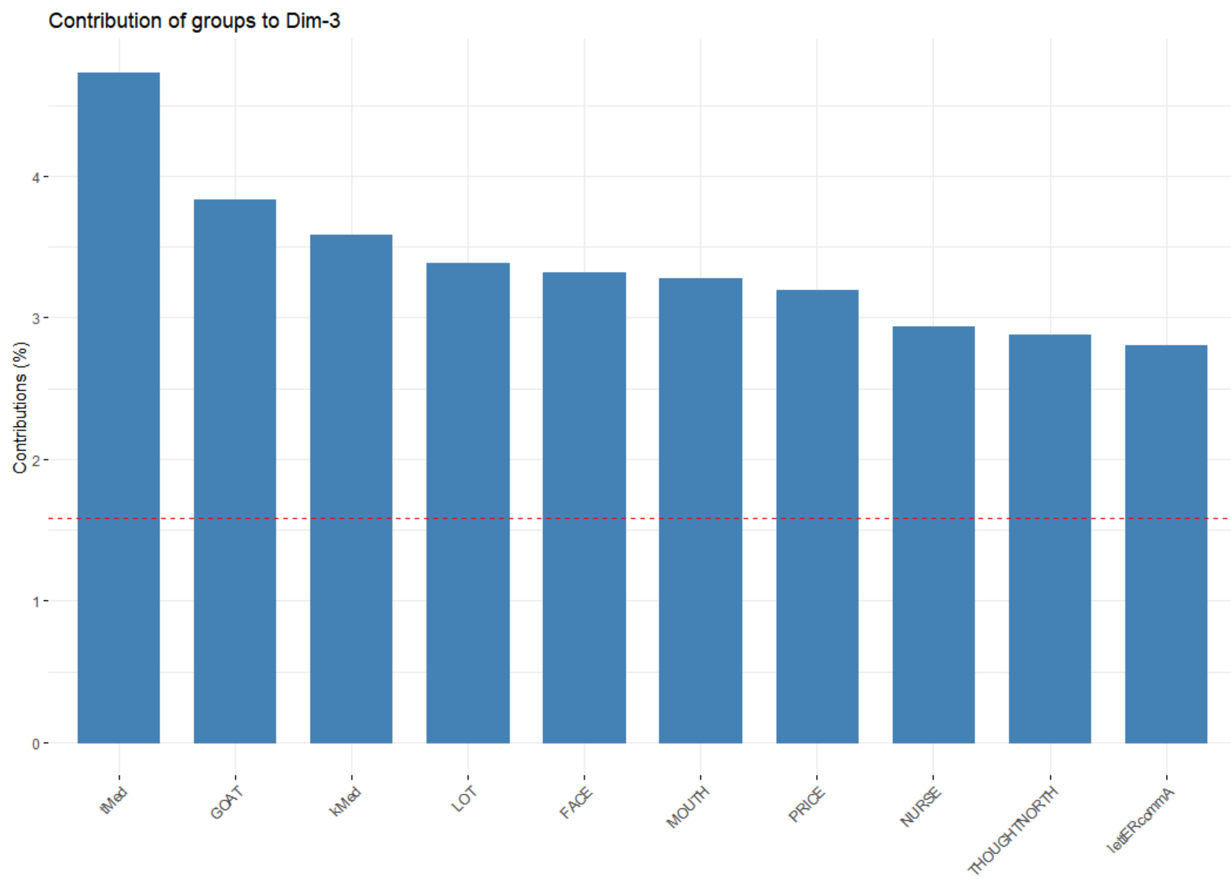

Figure 7-17 Percents of contribution to dim 3: top 10 groups of phonetic features. Red dotted line: significance level

A good way of double checking their importance is to look at cosine squared values (cos^2), which reveal the quality of their representation in the dimension.[114] In some cases, variables have high contribution scores and lower squared cosine values because the contribution scores are affected by the number of variants a lexical set has, whereas squared cosines are not. Figure 7-18 shows that although the order of importance has slightly changed putting intervocalic /t/ and /k/ as the first 2 most important variables, the 4 lexical sets still

[114] This verification was directly recommended by François Husson (PC, 2018).

remain among the ten most important ones. Interestingly, MOUTH overtakes FACE, which reinforces the need to fully include it in the study, contrarily to what was done in the pilot study.[115] It is therefore clear that **the third dimension is the best candidate** when looking at how variants of the 4 sets co-occur. I shall now plot the speaker clusters onto a factor map using dim 2 to show the effect of the social variables and dim 3, to separate the speakers along a traditional/above supralocal cline.

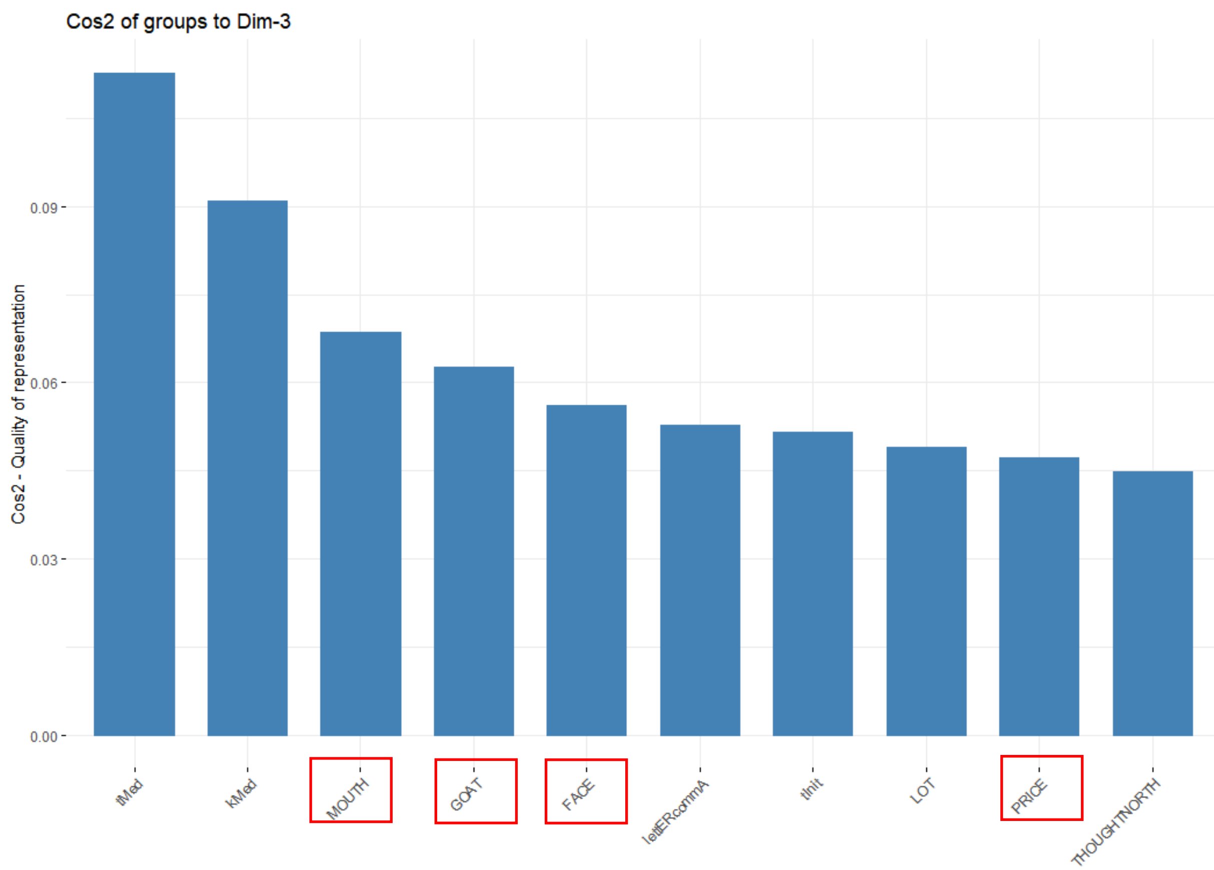

Figure 7-18 Quality of representation on dim3, (cos^2, ncp = 5): top 10 groups of variables.

[115] In the pilot study using PCA, I did not include MOUTH as an active variable because it took up too much importance and overshadowed the other lexical sets. With MFA, the weight of each lexical set (i.e. group of variables) is balanced out. MOUTH can now be included as an active group of variables.

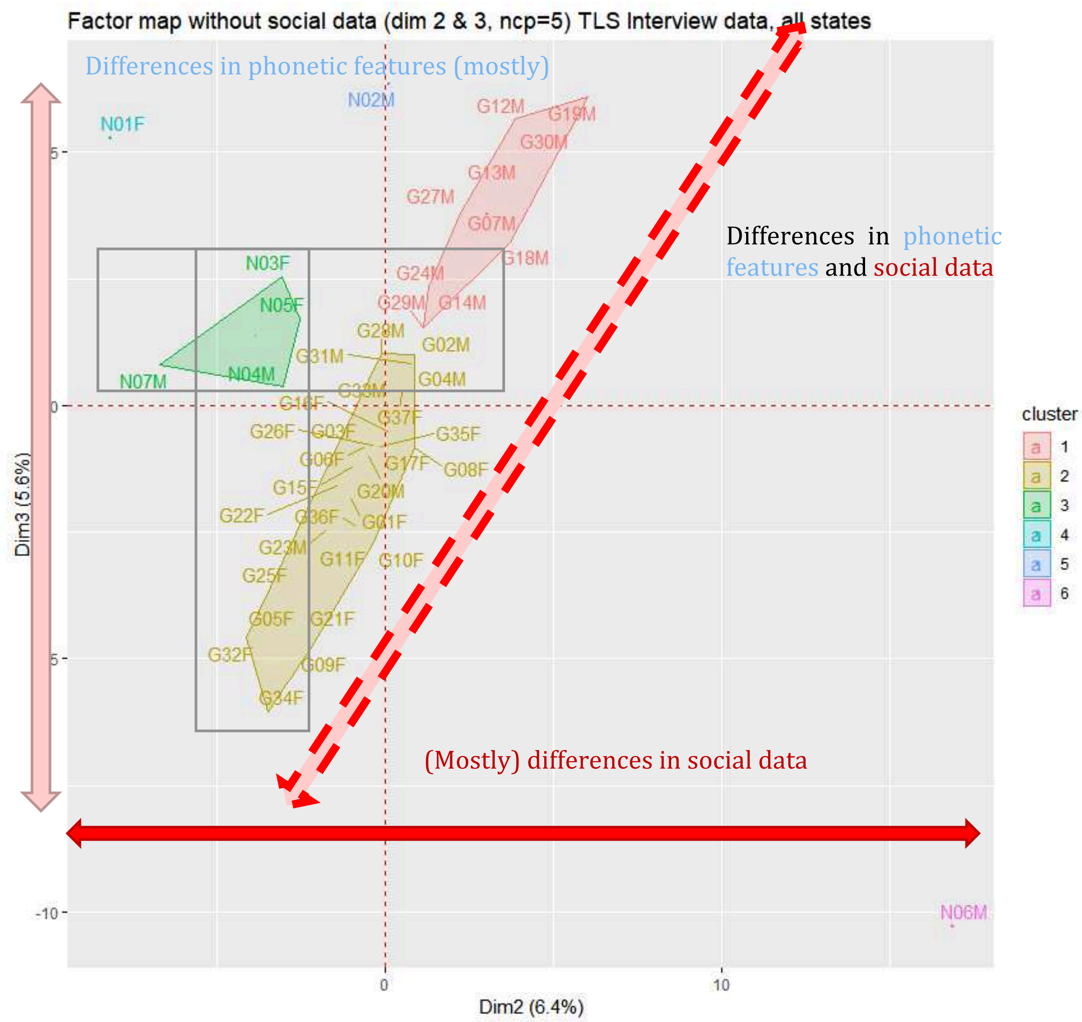

Figure 7-19 Factor map without the social data (dim 2 & 3, all states).

Figure 7-19 is the result of the cluster analysis projected onto the factor map with dimensions 2 and 3. The social data was added as a supplementary group of variables in the MFA analysis to prevent bias. **Three groups are clearly distinct**: clusters 1 and 2 distinguish themselves both socially and phonetically since they are aligned diagonally. **Cluster 3, composed of Newcastle speakers**, appears in between the two groups of Gateshead speakers in dimension 3 (phonetic features), but on dimension 2, it is aligned with the Gateshead speakers at the lower end of cluster 2. This suggests that investigation should not so much concern what differs between the 4 Newcastle and the 37 Gateshead, but rather, what features are shared between them. Now, what we need to know is which **social variables** best separate the speakers into distinct clusters**.**

7.3.1.5 Preliminary step (5): excluding the social data from the main model to avoid skewing the results

The first five dimensions of the MFA analysis on all the states (n = 566) were used to perform a hierarchical cluster analysis. The social attributes were added as a *supplementary* group of variables since the social data will separate speakers based on their social attributes and may enhance differences among certain speakers who have similar linguistic profiles. For instance, pan-northern speakers are generally found among both the middle and working class. If the social variables were to be active in MFA, some speakers may be put in different clusters, only because they do not belong to the same class and so, despite having similar scores of supralocal variants. Hence, a major issue with this approach is that it can lead to biased results as to how much the pronunciation of the panel speakers is defined by social characteristics. It is advisable to consider the variables as a *supplementary group of variables*. Nonetheless, if other linguistic features were to be added to the model as nominal data or numeric data, it would have been preferable to add them as active variables – unless the researcher choses to keep them as supplementary for a specific reason. I therefore proceed to **an analysis with the social data as a supplementary group of variables**.

Using the social data as active variables may skew the results since the dimensions and the grouping of clusters will also be based on sex, class, birthplace and education. In other words, it may result in a different grouping from that resulting from a model with linguistic variables only, thus skewing the results. Consequently, in this section, an MFA was performed with the social data as supplementary variables, so as to group speakers **only based on how they speak**, with the social data merely **superimposed** on the graph, as recommended by Jones-Sargent (1983). The significance of the effect of the social variables is still provided in the diagnostics but the latter do not directly contribute to the creation of the dimensionality reduction nor does it force the cluster analysis to group the speakers based on their social attributes.

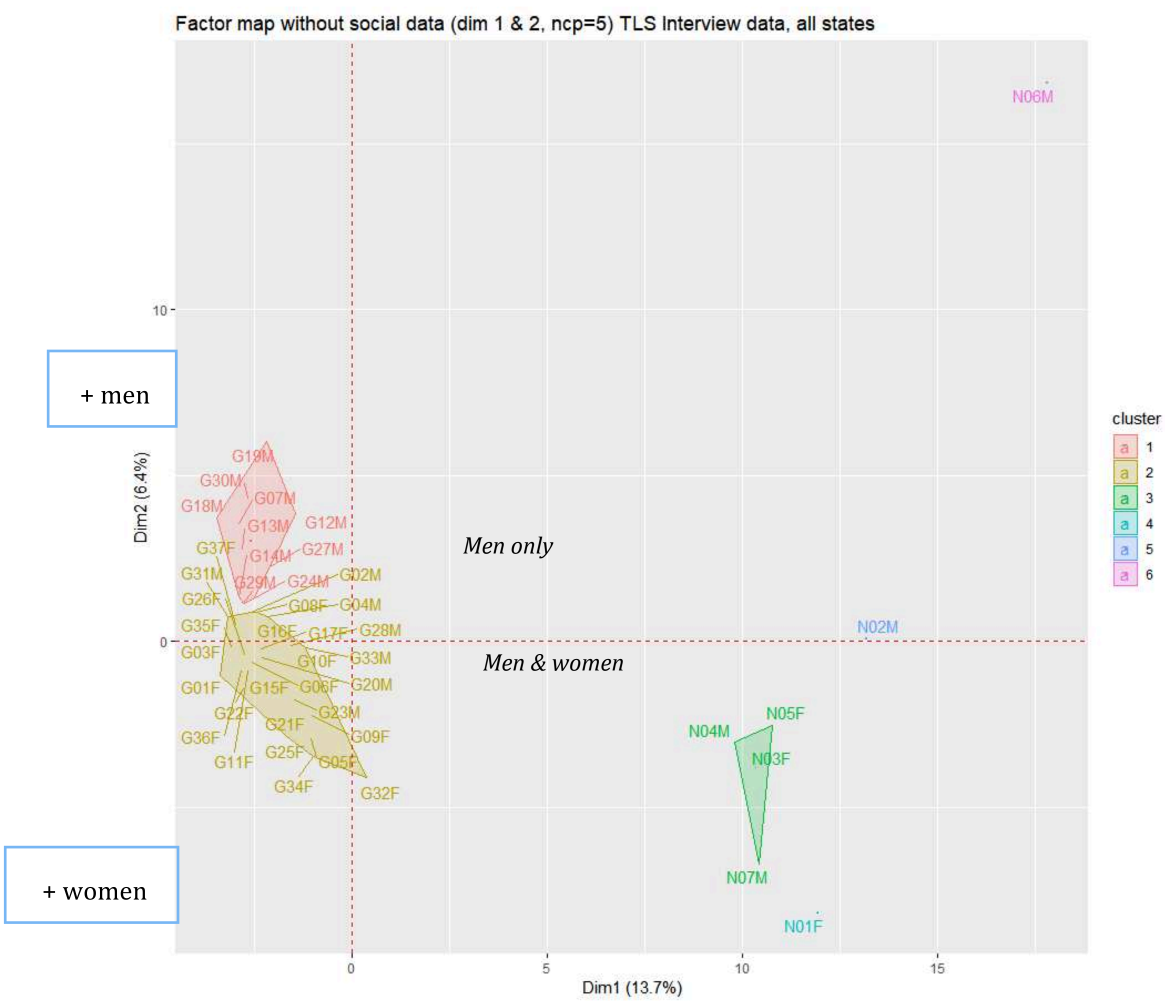

Figure 7-20 Factor map without the social data (dim 1 & 2, all states).

In Figure 7-20 (factor map) and Figure 7-21 (tree), we observe a cluster that is exclusively composed of Gateshead men. The second cluster has both men and women that are exclusively from Gateshead. As coordinates for dim 2 decrease, the number of men in the towards the bottom of the polygon decreases. Only 4 Newcastle speakers out of 3 are grouped into cluster 3 (N03, N05, N05 and N07). N01, N02 and N06 remain on the outskirts of the graph. We can confirm that these are atypical speakers because their position in the graph is exclusively based on their phonetic variation.[116]

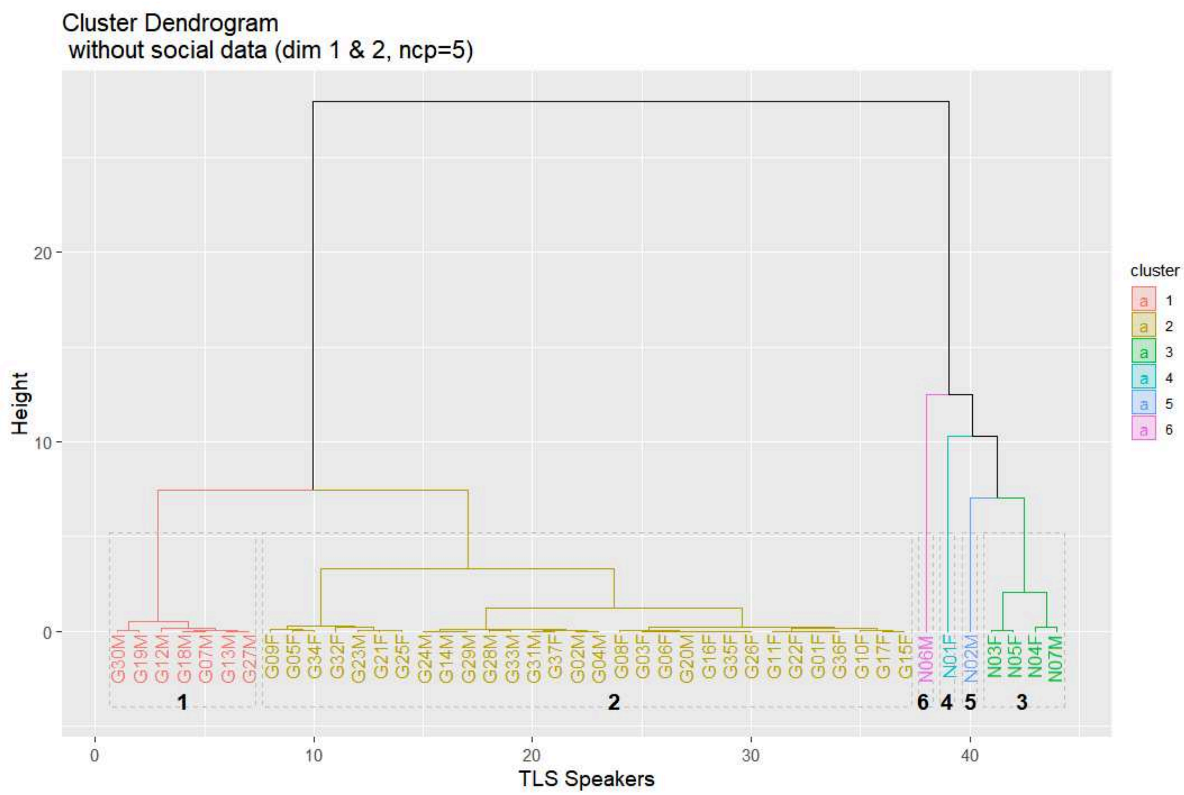

Figure 7-21 MFA 1. Hierarchical cluster tree: dim 1 & 2 (social data: supplementary variable, all states).

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[116] Part of the variation can be ascribed to the fact that the transcriber was not McNeany but another trained transcriber.

A major issue with this model (MFA 1) is that there are only two clusters of Gateshead speakers, whereas we saw at least 3 major choices of variants in FACE and GOAT: the above supralocal variants, the supralocal and the traditional variants. While the men in cluster 1 are expected to be the most traditional speakers, it is unlikely that the scores of high prestige variants are produced solely by the Newcastle speakers. More linguistic groups of speakers can probably be brought to the forth. To do so, it is possible to observe the dendrogram displayed in Figure 7-21. The large cluster 2 can be sub-divided into at least 3 smaller clusters. This implies that there are at least three distinct variation patterns in cluster 3 and that there are at least 4 major types of variation patterns among the Gateshead speakers. The next model keeps 5 dimensions but the tree resulting from the MFA analysis is cut lower to observe if the classification of speakers is in line with the literature on TE, i.e., that there are at least supralocal, traditional and above-supralocal speakers.

7.3.1.6 Preliminary step (6): getting the best number of sociolinguistic groups

The tree made with the default parameters (MFA 1) in Figure 7-21, showed a large group of individuals (cluster 2) with 2 subgroups that are predominantly female and a third one with a majority of men. It would be worth exploring these sub-groups and examine what linguistic features are characteristic of each sub-group. It is also possible to get an indication of how much of the data is explained by breaking down this large group into 3 smaller groups. This involves cutting the tree at a lower level, where differences between individuals are smaller but still significant and are relevant on a sociolinguistic point of view.

The proportion of explained variance in the data increased from 87% to 96% when creating 3 sub-groups out of the larger cluster 2, which means that we gain around 10% of information by cutting the tree slightly lower (cf. Figure 7-22).[117] If this explains more sociolinguistic variation within the initial cluster 2, then this would be the best approach. Namely, we keep the dimensionality with 5 dimensions to avoid too much noise but we increase the number of linguistic groups, i.e. clusters, to ensure a more detailed and more sociolinguistically relevant analysis.

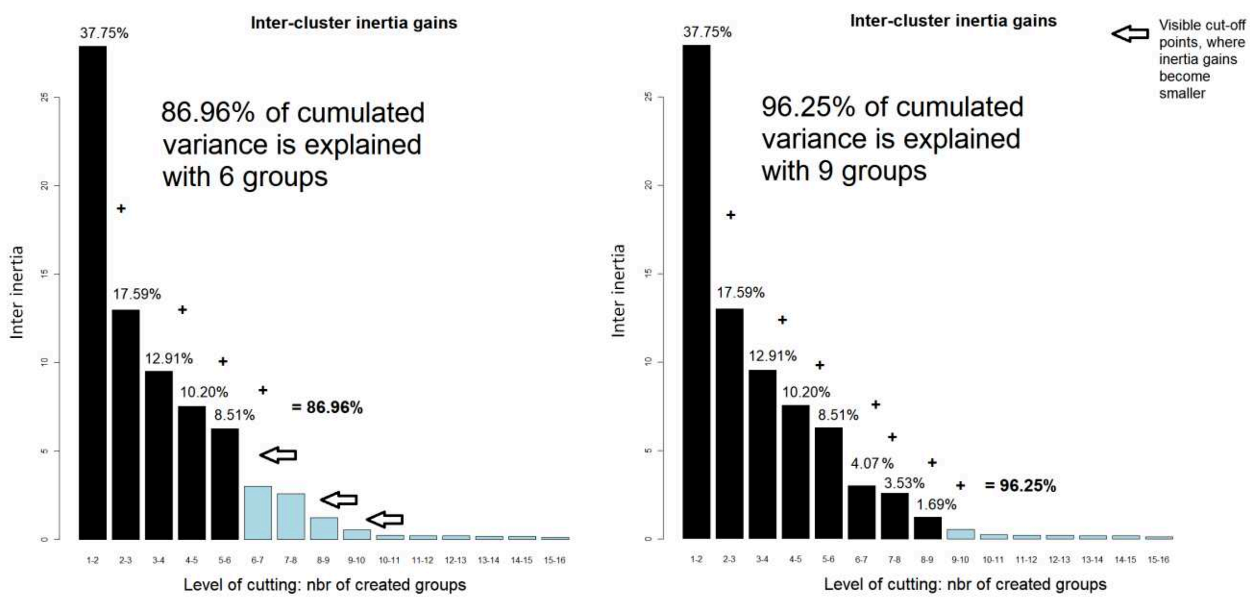

Figure 7-22 Proportion of variance explained per number of groups (left: k = 6, right: k = 9).

On the new factor map with 9 clusters (Figure 7-23, tree) there are 4 clearly defined groups of Gateshead speakers: two male groups and two female groups. They are scattered along a diagonal axis forming a continuum starting from traditional to above supralocal (cluster 2 and cluster 4). The working-class men (cluster 2) are further apart from the other

[117] For more details about intra-cluster inertia, see Husson et al. (2011, p. 184).

Gateshead speakers. Interestingly, the centroid of the second group of men (cluster 3) is closer to that of the women (cluster 1) with no further education than it is to the working-class men. Although we can hypothesise that these more supralocal men have similar features to the women with no further education, what now remains to be identified is the social and linguistic features characterising this group.

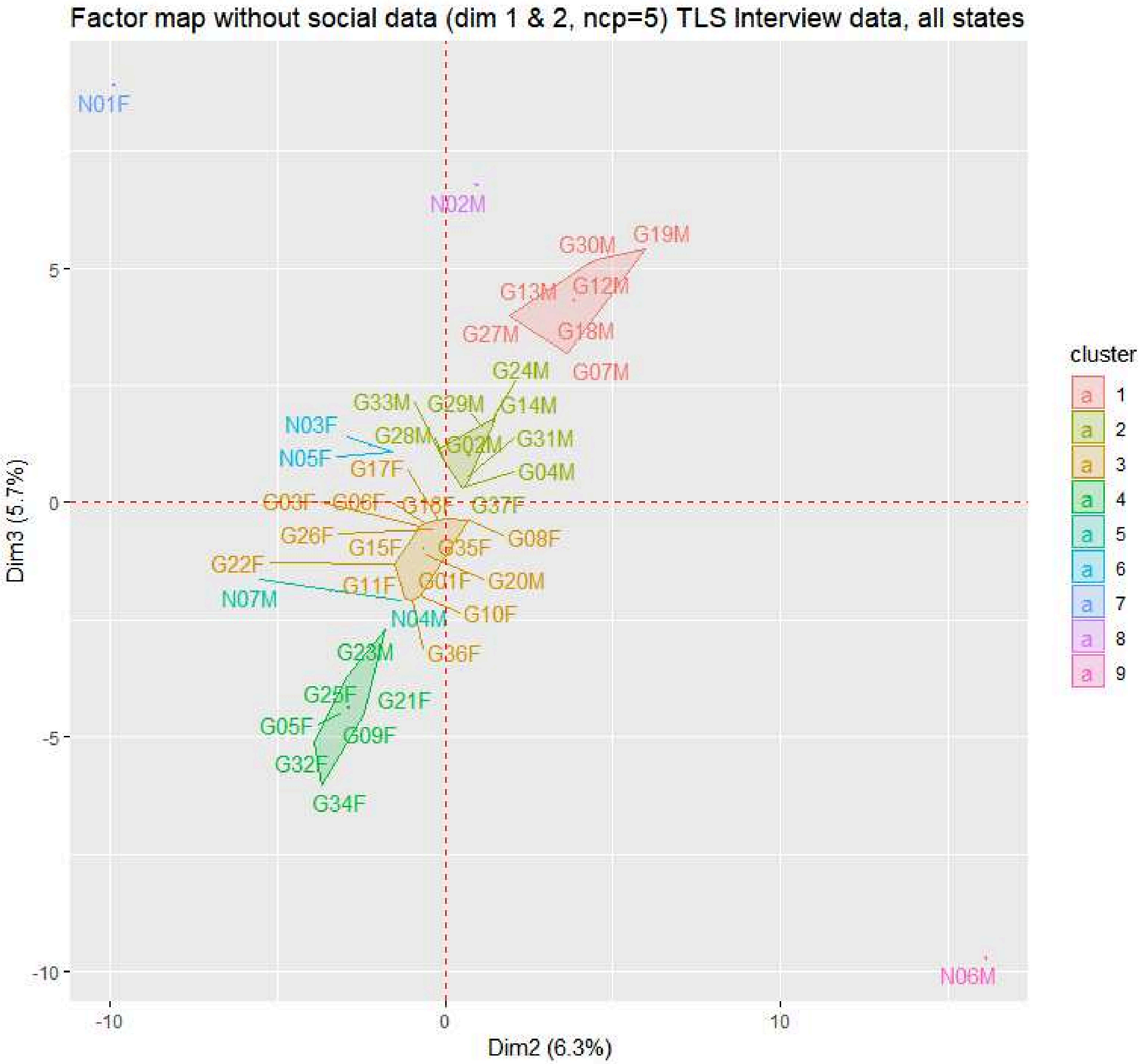

Figure 7-23 Factor map with 9 clusters (dim 2 & 3, ncp=5) TLS-coding data (all states).

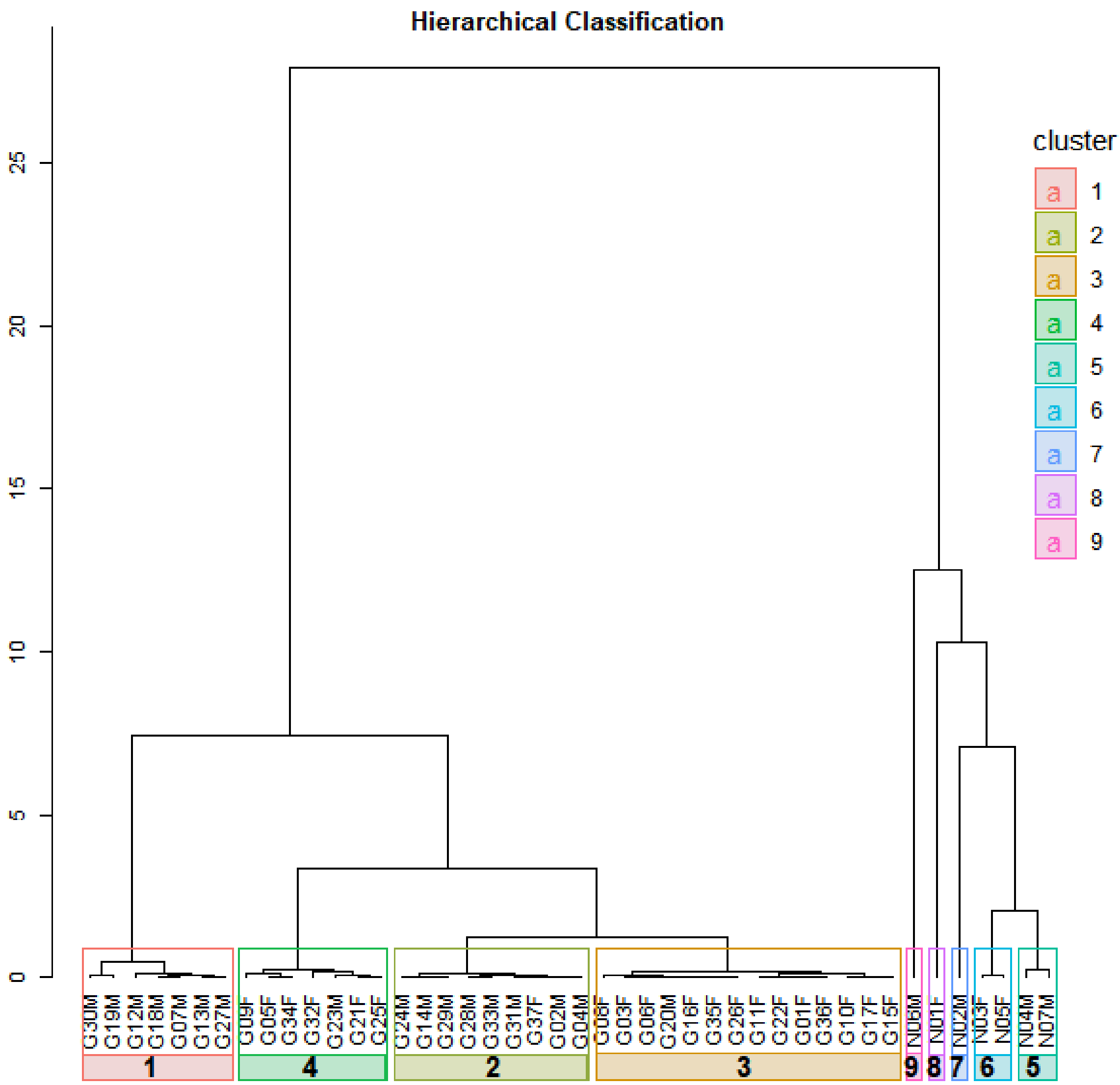

Figure 7-24 Tree: TLS-coding data (all states). Social data: supplementary variable, k=9.

MFA analysis

7.3.2 Main determinants of TE speech in the TLS-coding data

The original aim of the TLS was to have a data-driven approach with respect to how variation patterns in TE. The TLS original team wanted to let the statistical analysis decide in lieu of the linguist which phonetic features best determined the groupings into several Tyneside English lects (TE-lects). Previous approaches in finding the main determinants of TE speech used reduction of dimensionality techniques (e.g. PCA, Moisl 2015) that were more **variant centric** rather than **feature centric**. Since some features had fewer variants, and others, more than twenty two variants, some variants may have been allowed more weight than others regardless of whether they belong to the same feature or not. MFA is more feature centric in the sense that the weight of each feature is balanced out, regardless of whether it has two or twenty variants.

By observing the coordinates of each overall unit in the *features plot* (Figure 7-25), one sees that **FACE is by far the main determinant of TE-lects**. Its coordinates are high on the two most important dimensions (dim 1 & dim 2), which means that FACE helps discriminate speakers along two axes. This suggests that if one analyses the speakers using FACE only, a great proportion of explained variance will still be retained. There are at least 3 variation patterns for FACE. SQUARE and LOT are not far behind, nor are NEAR, STRUT and medial /t/. Reduced vowels do not appear as important as in Moisl and Maguire's study (2008), despite lettER/commA and unstressed /ɪ/ being amongst the 14 main determinants of dim 1 and happy, amongst the 8 most important features in dim 2. This said, the third dimension also revealed a relatively even importance of FACE, GOAT, PRICE and MOUTH as illustrated in section 7.3.1.

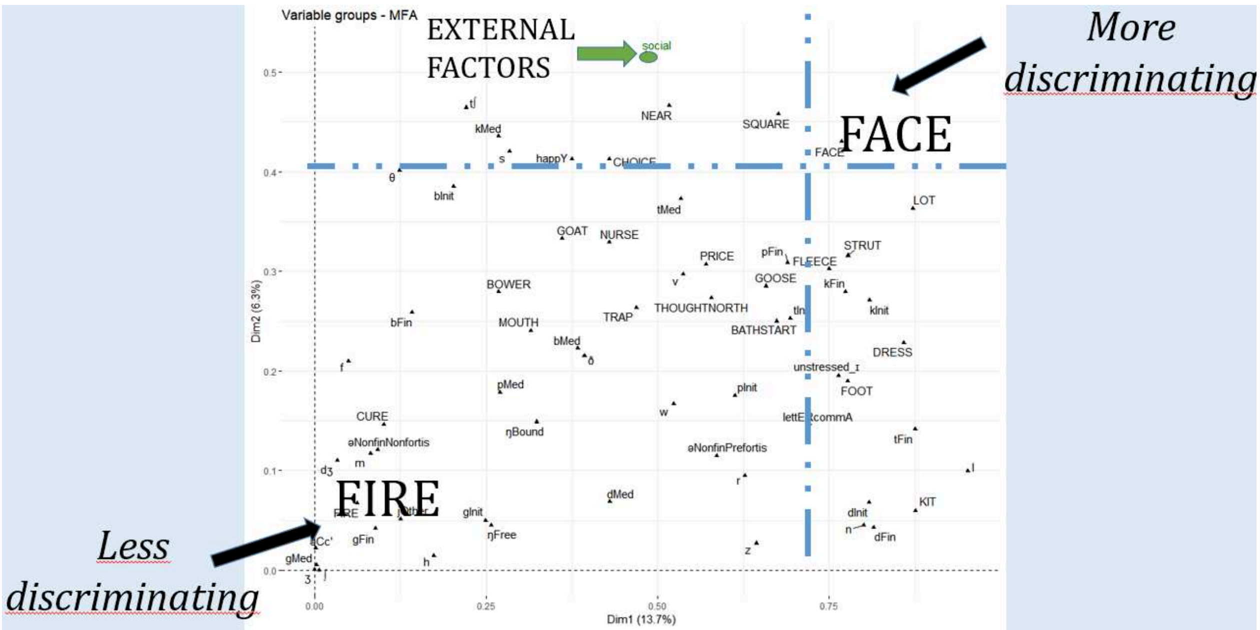

Figure 7-25 Features plot indicating the main determinants of TE-lects.

Now that we know that FACE is the main determinant of TE-lects in this sample, I shall explore variation based on external factors like gender, social class and education.

7.3.3 External factors: gender gap

In the TLS, the gender gap is particularly striking, especially at both ends of the traditional/above supralocal continuum (Figure 7-26). Most men (in blue) are situated in the top right square of the graph, whereas women occupy the bottom left square. The simplified correlation circle (FACE variants showing only) on the side of the factor map informs us that the speakers with lower coordinates favour above supralocal variants. Speakers in the middle of the graph are supralocal speakers and those at the top, are the traditional TE speakers.

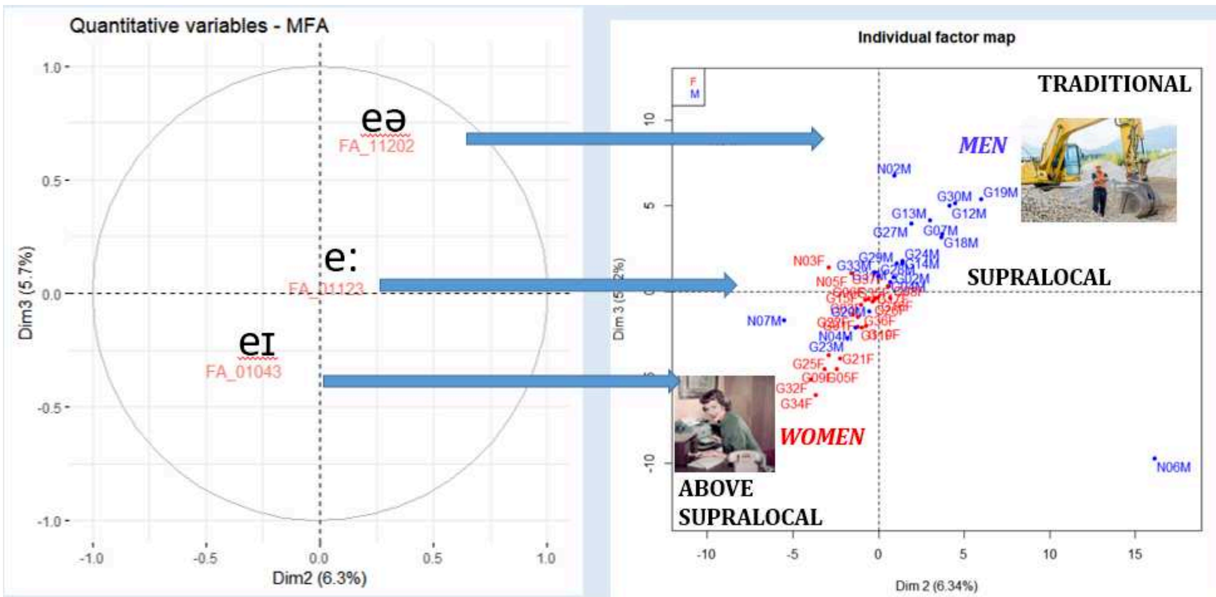

Figure 7-26 Simplified correlation circle (left) and factor map of individuals coloured by gender (left) TLS-coding data.

G34F, who is the female speaker with the lowest coordinates is a school secretary, and G19M, the Gateshead speaker with the highest coordinates works as a digger driver. This leads us to think that class may also have an impact on variation across the TE speakers of this sample.

7.3.4 External factors: class

Although the class gap is not as clear-cut as that for gender, most of the lower middle-class speakers are scattered towards the bottom of the factor map in Figure 7-27 despite two Newcastle speakers (N01F & N02M) and a Gateshead speaker having higher coordinates.

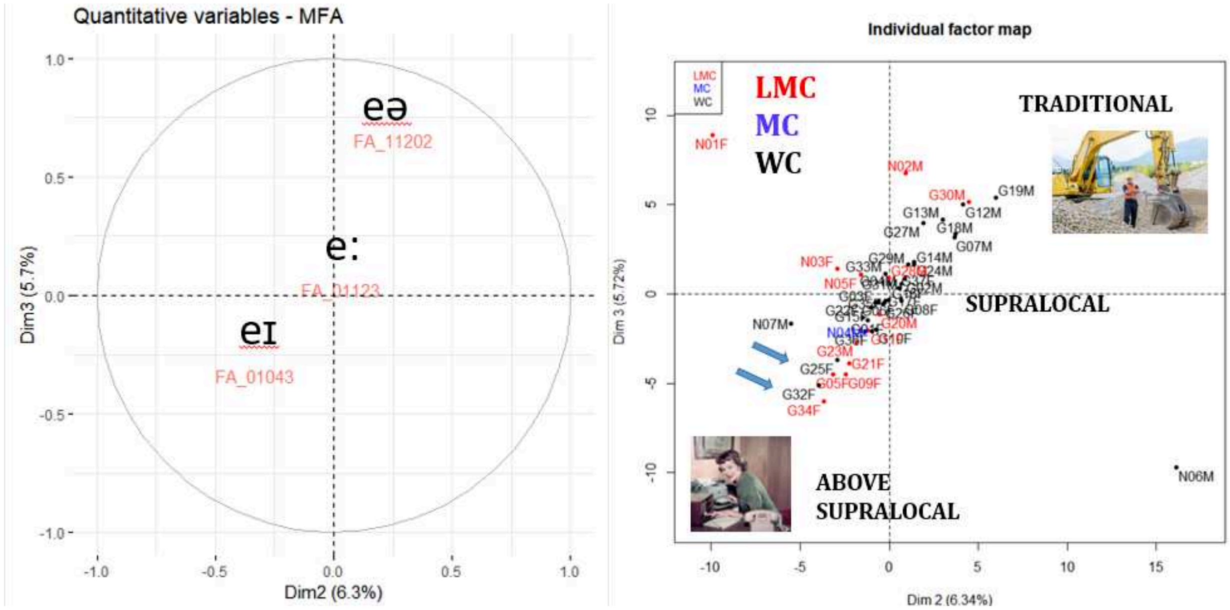

Figure 7-27 Simplified correlation circle (left) and factor map of individuals coloured by gender (right) TLS-coding data.

While most working-class speakers are gathered around the supralocal area (crossing of the two zero axes), two WC women (G32F & G25F) are grouped among their LMC counterparts. I decided to explore another social factor, which may account for the use of more standard forms amongst these two WC women, namely, education.

7.3.5 External factors: education

In the factor map, speakers are coloured as a function of their educational background. Most speakers left school at minimal age and were trained at work (in black). Most speakers with higher scores of above supralocal variants did have further education, including G25F, age fifty, who went to college at a later stage in her life. She also indicates having been taught elocution. G30M, age 23, millwright, also went to college for 5 years (day release), but this does not seem to have impacted his variation pattern. G32F, school cook, is the only WC woman having had no further education but she seems to be a team-leader amongst the school cooks and does the book work for expenses related to the canteen. Her superior position towards the other school cooks along with her probably frequent interactions with the headmaster of the schools regarding book work matters may lead her to style-shift more than an ordinary school cook (Coupland 1980). She also claims that as a child, she "was never allowed to speak Tyneside" [TLS interview of G32F].

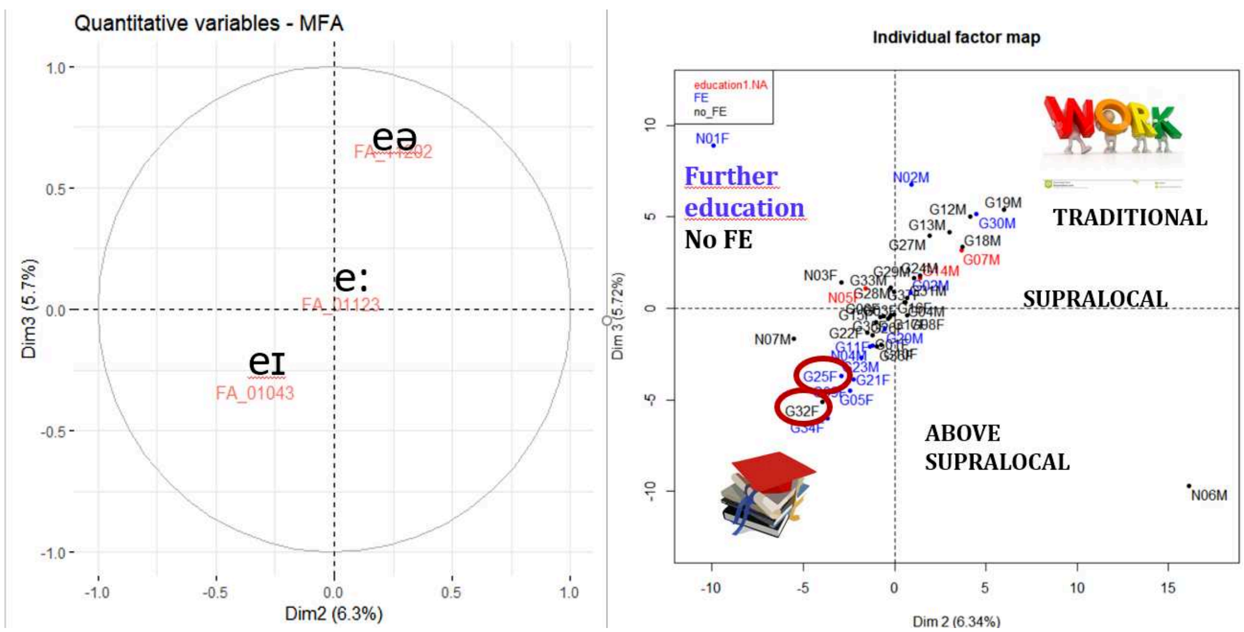

Figure 7-28 Simplified correlation circle (left) and factor map of individuals coloured by education (right) TLS-coding data.

Overall, education appears as a confounding factor for the middle-class speakers. The speech of only one working-class woman seems to have been affected by further education (G25F). This said, her father's original birthplace (Lincolnshire) may also have a slight impact on her speech, but more should be investigated upon with regards to this hypothesis.

The MFA analysis plots the speakers on a factor map based on their speech but after an examination of factors related to the position of the speakers on the map, it is rather difficult to group these speakers just through eyeballing. The cluster analysis is now needed to improve the interpretation of the results. I now proceed to an analysis of clusters resulting from the MFA/cluster analysis and interpret the social and linguistic diagnostics.

7.3.6 Cluster diagnostic 1a: social profile of the speakers (TLS-coding, all states)

Overall, all 4 social variables but age significantly characterised the linguistic groupings (Table 7-4).

Table 7-4 Cluster diagnostic: overall social predictors (k=9, ncp=5).

Social variable	p. value	df
Birthplace	< .0000001 ***	24
Sex	< .0001 **	8
Class	< .001 **	16
Education	< .05	16

Table 7-5 lists the social characteristics of speakers in each cluster. They are reported in Figure 7-23. Interestingly, all clusters are gender polarised with one member of the opposite sex being present in clusters 2, 3 and 4 (Figure 7-23). This confirms the clear-cut gender gap found in the MFA analysis and shows that certain speakers are atypical since they are placed in a less predictable cluster. Although class did not appear as a significant predictor for the cluster of traditional men due to one speaker (G30M, young millwright), the class divide is obvious.

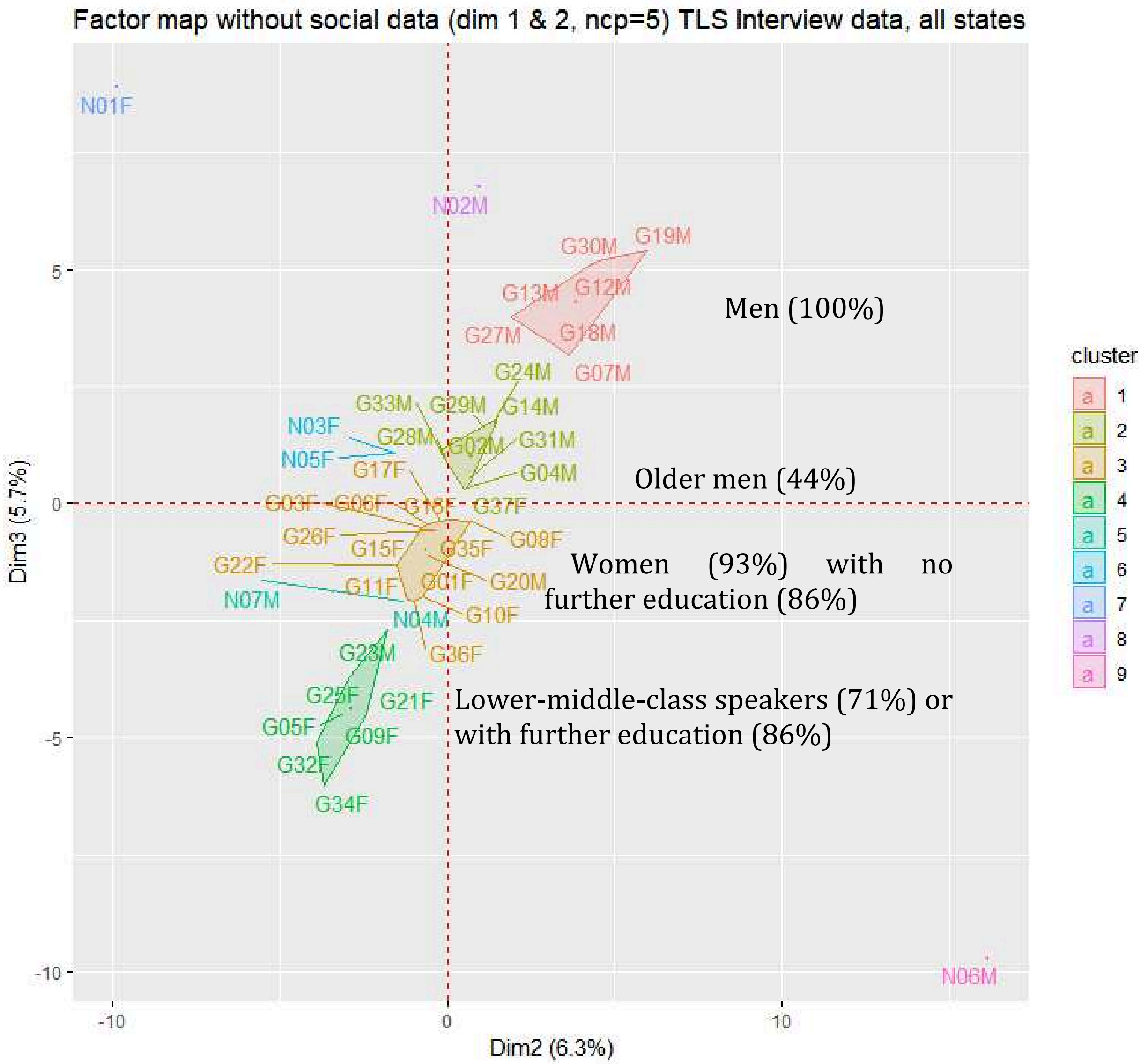

Figure 7-29 Factor map with 9 clusters (dim 2 & 3, ncp=5) TLS-coding data (all states).

Table 7-5 Social predictors per cluster (k=9, ncp=5, v-test critical value = 1.96).

Social var.	% in cluster 1 (local)	p-value	v-test
Men	100% (total: 47.73%)	< .001 **	2.96
	% in cluster 2 (8 man/1 woman)		
Men	88.89% (total: 47.73%)	< .01 *	2.68
Old	44.44% (total: 15.91%)	< .05	2.23
	% in cluster 3 (13 women/1 man)		
No further education	92.86% (total: 52.27%)	< .001 **	3.69
Women	85.71% (total: 63.64%)	< .05	2.02
	% in cluster 4 (5 women/1 man)		
Further education	85.71% (total: 29.54 %)	< .01 *	3.18
Lower middle class	71.43% (total: 29.54%)	< .05	2.35
	% in cluster 5 (N07M, N04M)		
Born North Tyneside	100% (total: 18.18%)	< .05	2.17
Middle class	50% (total: 2.27%) N04M: managerial executive, N07M: job unknown but the most mobile speaker of the sample	< .05	2.00
	% in cluster 6 (N03F, N05F)		
Born North Tyneside	100% (total: 18.18 %)	< .05	2.17

Since FACE is the main determinant of TE-lects in the sample and has three main variants [eɪː], [eː] and [ɪə], it would have been less surprising to find three main groupings of speakers. Let us now observe the linguistic diagnostics for each cluster to **investigate why FACE cannot be the *only* lexical set to determine TE-lects**.

7.3.7 Cluster diagnostic 1b: linguistic profile of the speakers (TLS-coding, all states)

Before analysing the tables, it is important to know that not all significant phonetic predictors were reported back to the cluster diagnostics below. I decided to hone in on the four lexical sets and a few other vowels when relevant. The variants that appeared as predictors but occurred below chance level were not included.

Gateshead: traditional men

Cluster 1 is only composed of men. The variants that characterise them are all traditional forms of TE. Despite, lettER being the most important predictor, FACE, GOAT, PRICE and MOUTH have one of more variants characterising the speakers as well. MOUTH is the 8th most important speech determinant of traditional TE men. The raised onset in PRICE is nearly twice as frequent as the average score in the sample. So is the centring diphthong in FACE. The monophthong in MOUTH is about 4 times as high as the average [u] realisations across all speakers. About 47% of low GOAT monophthongs probably correspond to realisations in the expression *you know*. Retracted onsets in MOUTH reaches scores above 50%. The low v-test scores for [ɔʊ] (2.26, critical value: 1.96) means that the variant is not exclusive to this group of speakers.

Table 7-6 Phonetic variants contributing to the creation of the clusters (ncp=5, red: top predictor, sd: standard deviation within the cluster, v-test: critical value 1.96).

Phon var.	% in cluster 1 (traditional men)	p-value	v-test
lettER [ɑ]	**48.27%** (av. 14.47%, sd: 18.48%)	< .0000001 ***	5.22
MOUTH [ʌʊ]	**21.61%** (av. 5.79%, sd: 15.85%)	< .00001 ***	4.24
MOUTH [ɔʊ]	**30.10%** (av. 13.40%, sd: 20.47%)	< .05	2.26
MOUTH [ṳ˓̟˞]	**23.83%** (av. 5.57%, sd: 13.89%)	< .00001 ***	4.00
GOAT [a̠̝̞]	**22.04%** (av. 6.41%, sd: 14.63%)	< .00001 ***	3.78
GOAT [a̟]	**24.95%** (av. 7.78%, sd: 21.56%)	< .01	2.99
PRICE [ɛ̠i̠˞]	**40.66%** (av. 24.88%, sd: 7.87%)	< .001 **	2.55
FACE [e̠ə]	**35.04%** (av. 16.60%, sd: 9.41%)	< .01	2.53
MOUTH [ɪʊ]	**7.16%** (av. 3.15%, sd: 5.71%)	< .01	2.22

Gateshead: less traditional men (cluster 2)

While most groups are characterised by FACE, GOAT, PRICE and MOUTH, we observe that men in cluster 2 produce traditional exponents of MOUTH and GOAT but produced just as many supralocal variants as the traditional men in GOAT. Although they do not reduce their schwas in the given context (either followed by a consonant or before a fortis), their NURSE vowel is not burr retracted (Beal 1985, p. 42, Påhlsson 1972). This may suggest that vowel sets do not level at the same pace in this group of less traditional men and that MOUTH, STRUT and schwas (pre-fortis or schwa + final consonants) are more resistant to change. I was surprised to see that FACE did not characterise this group in the diagnostics. An inspection at individual productions revealed that some speakers used the traditional centring diphthong and others, the supralocal monophthong. Hence, **FACE is not always ideal in determining groups and**

one must analyse the speakers based on the coherence between other lexical sets. Another interesting feature among the less traditional male speakers is their use of the **central monophthong in GOAT**. This corroborates Watt's founding in the PVC data: [ɵː] is used as an identity marker among less traditional men who will avoid the more "stigmatised" centring diphthong [oə].

Table 7-7 Phonetic features characterising the less traditional men (cluster 2).

Phonetic var.	% in cluster 2 (8 men/1 woman)		
MOUTH [ɔʊ]	40.95% (av. 13.40%)	< .0001 ***	4.35
NURSE [e̠]	23.48% (av. 8.66%)	< .0001 ***	4.08
GOAT [o̹̟] (Watt's [ɵː])	18.69% (av. 6.69%)	< .001 *	4.89
STRUT [o̟˂]	67.35% (av. 45.84%)	< .05	2.46
SCHWA [ɛ̠] _C# ~ fortis_(R)#CoV	66.40% (av. 41.56%)	< .05	2.25
GOAT [a̟]	17.80% (av. 7.78%)	< .05	4.16
PRICE	**Not significant**		
FACE	**Not significant**[118]		

[118] Only an extremely rare variant of FACE was recorded as barely significant (p= 4.860657e-02). Its overall score was only 0.09% and 0.46% in the cluster. It was not considered significant enough.

Gateshead: more traditional women

Traditional women have a variational pattern of their own. They tend to choose **one variant** per lexical set – unlike the traditional men who sometimes use 2 to 3 variants per lexical set. These women have much higher proportions of supralocal [oː] in GOAT than the less traditional men (84% vs. 19%). FACE and GOAT supralocal variants work in lockstep as they both score around 30% above average. They tend to use raised onsets in both MOUTH and PRICE, which means that among traditional women, the two sets also work in lockstep. The scores of the raised onsets in PRICE are relatively low because the pronoun *I* often pronounced with the monophthong [a]/[ɑ] was included among the PRICE words but had the pronoun been included, the scores would have soared.[119]

Table 7-8 Phonetic features characterising the less traditional Gateshead women.

Phon var.	% in cluster 2 (supralocal & women)	p-value	v-test
MOUTH [ɛ̞ʊ]	85.53% (av. 38.43%)	< .0000001 ***	5.58
GOAT [o̞]	84.07% (av. 43.96%)	< .000001 ***	5.13
lettER [ɛ̞]	76.67% (av. 44.45%)	< .000001 ***	4.80
FACE [i̞]	90.37% (av. 59.36%)	< .001 **	4.19
PRICE [a̝]	58.14% (av. 48.92%)	< .01	2.27
PRICE [ɛ̞i̞]	33.10% (av. 24.88%)	< .01	2.08

119 This was the case for the bound morpheme -*ing*, which I had initially forgotten to separate from the free morpheme -*ing* in the TLS-coding data. Apical variants were rather scarce in free -*ing*, which considerably lowered the average score of the alveolar variant in -*ing*. Once the corrections were made and the MFA/clustering model was carried out anew, the bound morpheme became an important predictor of the groupings: the traditional speakers of cluster 1 had an almost categorical use of apical variants, while above supralocal women disfavoured it and used the velar one instead (80% vs. average of 21% for [ŋ]).

Gateshead: speakers using high prestige variants

The most above supralocal speakers (further education, LMC) tend to make a distinction between STRUT and FOOT, with STRUT being more central. The lower onset variants in PRICE add up to a realisation of 54.5%, which is rather high given the fact that the remaining variants are probably the pronoun *I*. MOUTH is also very often realised with a low onset. As Milroy (1996) points out, raised onsets in PRICE are generally an effect of class or education. It is probable that MOUTH follows the same pattern. Higher scores in the low onset in both vowels are probably due to the speakers' higher socio-economic or educational status (cf. Table 7-5). Such scores are probably not the result of supralocalisation but rather, the speakers just simply retain the variants pertaining to their higher social status.

Table 7-9 Phonetic features characterising the above supralocal Gateshead women.

Phon var.	% in cluster 4 (high prestige)	p-value	v-test
STRUT [ɤ̈]	49.21% (av. 13.14%)	< .0000001 ***	5.58
MOUTH [a̞ʊ]	73.91 (av. 16.51%)	< .0000001 ***	5.50
PRICE [a̞ɛ̞]	18.47% (av. 3.11%)	< .000001 **	5.10
PRICE [aɪ]	9.82% (av. 1.23%)	< .00001 **	4.61
FACE [e̠ɪ]	12.48% (av. 2.48%)	< .00001 ***	4.43
lettER [ə]	26.68% (av. 10.41%)	< .01 ***	3.49
FACE [ɛ̝i]	33.08% (av. 9.94%)	< .01 ***	3.10
GOAT [əʊ]	11.93% (av. 02.28%)	< .01 ***	2.93
PRICE [a̞ɪ]	26.21% (av. 12.06%)	< .01 ***	2.63

FACE and GOAT are generally pronounced with a monophthong, with a few closing diphthongs for GOAT. Looking at individual productions, one sees that only speakers at the bottom end of the factor map use the high prestige variants in FACE above chance level (G32F ca. 50%, G25M: ca. 86%, G34F: ca. 90%). The three speakers are coherent in GOAT too: G32F ca. 49%, G25M: ca. 57%, G34F: ca. 90%.[120] The phenomenon is either an affect of style due to the observer effect or an effect of levelling towards an above-supralocal norm. Watt (1998) showed that in the PVC, middle class women are more prone to style-shifting than the rest of the speaker cohorts. I believe that these TLS supralocal women are prone to style-shifting in front of the recording machine and the interviewer just as much as the PVC middle-class women are. In cluster 4, what makes them apart from the women with a lower socio-economic status is mainly the low onsets they use for PRICE and MOUTH along with a central STRUT vowel, often heard in the midlands. Most speakers from both clusters of Gateshead women have high scores of supralocal variants in FACE and GOAT but a few more extreme speakers from the above supralocal group use the closing diphthongs which are disfavoured by the more traditional group of female speakers. Hence it is not necessarily the high scores of a variant which determines the peculiarity of the linguistic group of speakers but it is also the latter's use of rarer variants like the closing diphthongs in FACE and GOAT.

[120] Several variants from the same PDV were added up to get these percentages, which is why they are considered as an approximation.

7.3.8 Discussion

In the 5 dim models with 9 clusters, **all social variables are significant external constraints to phonetic variation in the data except age**, similarly to the model with 10 dims. Increasing the number of clusters showed more socially coherent groups of speakers: two male and two female clusters, with higher and lower degrees of accentedness respectively. The traditional men are best identified with their open lettER vowels, frequent monophthongal realisations in MOUTH and a centring diphthong in FACE, which is in line with was is reported in the literature. Less traditional men and traditional women clustered around the supralocal zone in the factor maps (cluster 2 & 3) could have led us to group them together as supralocal speakers. However, apart from a few men with occasional supralocal variants in FACE, a lot of other features makes the two clusters rather distinct from each other: men have a retracted onset in MOUTH, while women choose a raised onset. Both use a monophthong in GOAT but it is centralised amongst men, and low and back among women. FACE is therefore not an ideal predictor for speakers with intermediate position along the traditional/above supralocal cline, especially for less traditional male speakers. Instead, one should look for a central monophthong in GOAT.

The **coherence in FACE, GOAT, PRICE and MOUTH is more symmetrical among traditional women** who favour monophthongs in the first two sets and raised onsets in the last two. Above supralocal women also have monophthongs in FACE and GOAT but the symmetry is somewhat disrupted by their use of closing diphthongs reaching around 10%. The score may appear as low but it is ten times the average score of the sample for these variants. These women prefer low onsets in both PRICE and MOUTH. They also have a split in

STRUT and a central lettER vowel, which separates them from more traditional/supralocal northern speakers and draws them closer to speakers in the midlands (Łodzikowski & Malarski, 2012; John C Wells, 1982). It appears that **working-class women are taking the lead with respect to levelling towards pan-northern features in FACE and GOAT,** whereas in PRICE they favour the raised onset, which pertains to their class (Milroy 1996). A study of the PVC conversation material would enable us to draw conclusions regarding levelling in MOUTH, but brief inspections suggests that raised onsets are heard among younger women from both the working class and the middle class, and that the monophthong is still used by traditional working-class male speakers despite a very high variation for that vowel even in the same word environment.

So far, I have honed in on the co-occurrence patterns of the 4 lexical sets included in a system of 63 groups of variables with a total of 566 phonetic variants. The results confirm the remark by Corrigan and colleagues that "aggregate analyses can and do work well in combination with feature centric approaches" (Corrigan et al., 2014, p. 114). I now investigate the patterns of the same 4 sets without the other 59 groups of linguistic features. This will help see how stable the sociolinguistic groups are when dimensionality is considerably reduced to four lexical sets only. Aggregate approaches (Nerbonne 2006), which favour the inclusion of a maximum of linguistic features for statistical analyses, can be time consuming and may not always be applicable to every study on language variation. Therefore, in the next sub-chapter, I investigate whether a compromise between an aggregate and a feature-based analysis may be reached in the TLS data with MFA. It will address the following research question: **what do FACE, GOAT, PRICE and MOUTH tell us regarding the levelling stages in Tyneside English?**

7.4 Apparent-time study 1b of the TLS-coding FACE, GOAT, PRICE and MOUTH variants (TLS 4 sets data)

7.4.1 Statistical analysis (TLS 4 sets)

7.4.1.1 A justification for the present model with the 4 sets only

The aim of the present section is to find groups of speakers based on variation in FACE, GOAT, PRICE and MOUTH since they are all major determinants of speech in TE. The methodology in this section is an intermediate stage between the aggregate approach carried out above and a traditional sociolinguistic one, i.e. a single-feature approach. The number of linguistic variants drops from 570 to 89 in model MFA 4. As for the linguistic *features*, their number is reduced from 63 to the vowels FACE, GOAT, PRICE and MOUTH. In the TLS-coding all states data, it is very likely that some of the variational patterns across the 4 sets had hitherto been considered as noise due to the high number of variants used for each lexical set. By reducing the dataset to the 4 sets only, I wanted the MFA to analyse variation across these 4 lexical sets more deeply, as the model with all 63 features may have allotted more importance to other more straightforward variational patterns like bound -*ing*, or intervocalic /t/ which ranks first in dim 3, thereby potentially ironing out more intricate variation patterns within each of the 4 sets.

The 5 social variables of sex, age, class, education and birthplace were retained and so were all the states per lexical set: 22 for FACE, 29 for GOAT, 16 for MOUTH and 17 for PRICE. The 5 social variables are supplementary variables and the 84 phonetic variants, active variables. In this section, I first proceed to preliminary statistical analyses. Then, the co-occurrence of variants in the 4 sets is examined. The cluster analysis based on the MFA provides us with new sociolinguistic groups which will be commented upon.

7.4.1.2 Preliminary step (1): getting the ideal number of dimensions to explain variation in (TLS 4 sets)

As indicated by the scree plot in Figure 7-30, dimensions 1 to 5 should at least be tapped since they cumulatively explain slightly more than 40% of the variance. The percentage for dim 1 lies within the range of an ideal percentage given the number of variables included in the model (n=84, 12.5%) as is should ideally be between 13% and 12% for a model with 75 to 100 variables (Husson et al. 2011, p. 229).[121]

[121] This indicator is based on a PCA analysis and not on MFA. In the future, I intend to test the reliability of the score of explained variation in dim 1 by comparing it with scores stemming from simulated datasets analysed by an MFA analysis.

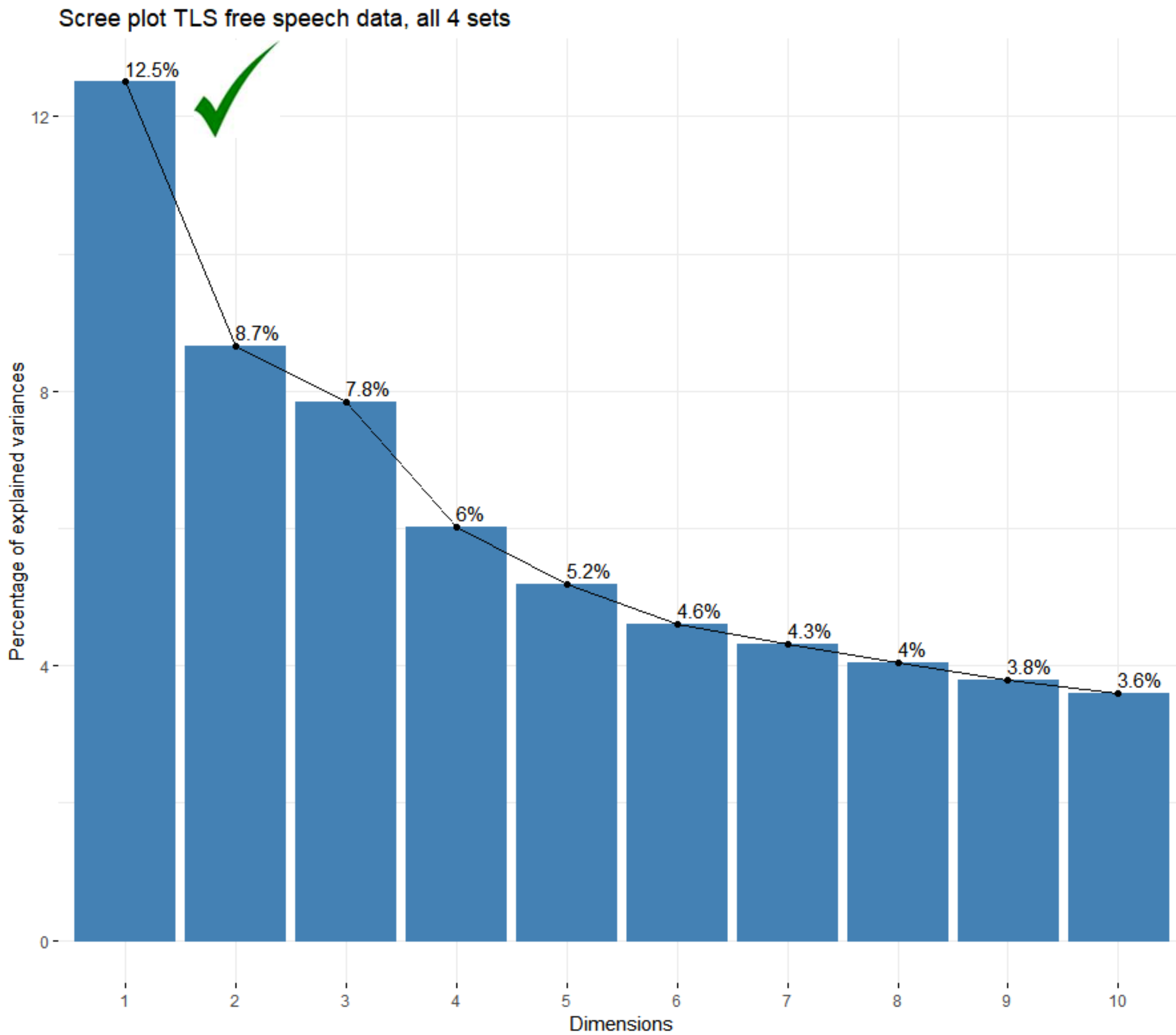

Figure 7-30 Scree plot of MFA results including the states for FACE, GOAT, PRICE and MOUTH (n=88).

Table 7-10 Contribution of FACE, GOAT, PRICE and MOUTH to the first 10 dimensions.

LEXICAL SET	DIM 1	DIM 2	DIM 3	DIM 4	DIM 5	DIM 6	DIM 7	DIM 8	DIM 9	DIM 10
FACE	22.89	32.04	13.72	31.91	17.83	21.02	23.4	33.48	37.03	26.47
GOAT	22.67	22.28	34.67	29.41	40.9	18.1	32.54	29.53	27.67	23.8
MOUTH	25.82	9.04	32.99	17.17	24.49	30.25	23.07	10.5	17.06	22.69
PRICE	28.62	36.64	18.61	21.51	16.77	30.63	21	26.5	18.23	27.04

In dimension 1, all 4 sets provide an even contribution, which means that variation among speakers evenly relies upon all 4 lexical sets (Table 7-10). Lexical sets may have higher scores in other dimensions such as GOAT in dim 5 but the score for the other lexical sets in that dimension are much lower. Hence, dim 1 should be prioritised among the rest since what is being investigated here is not so much how each lexical set individually performs well in classifying the speakers but, rather, **how these four lexical sets simultaneously contribute to the creation of the clusters** and how their different variants co-occur. I now examine the co-occurrence of the variants in the 4 sets.

7.5 Coherence: overall symmetry of variants in the 4 lexical sets (PVC WL)

7.5.1 Co-occurrences of the phonetic variants (TLS 4 sets)

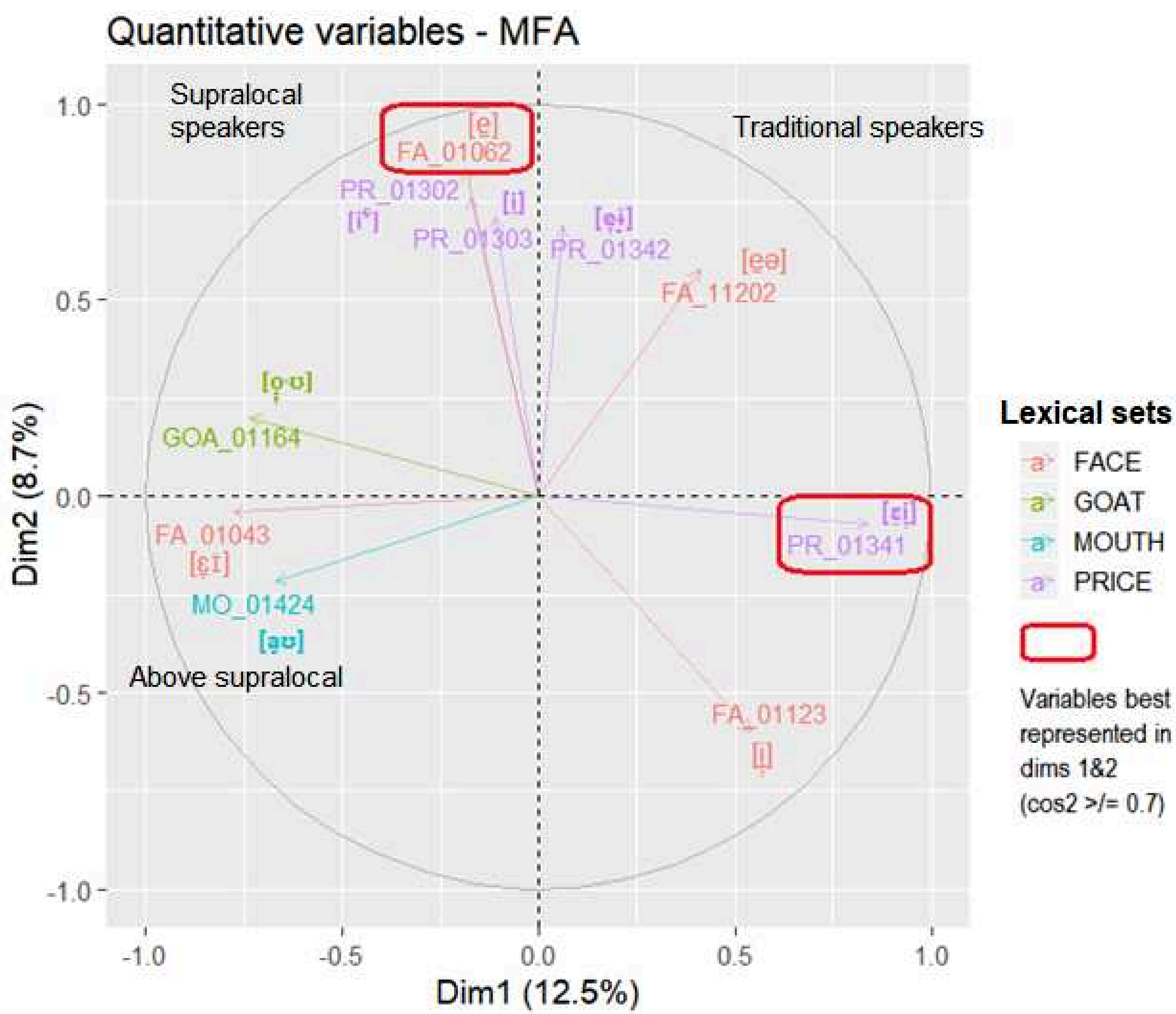

Figure 7-31 Correlation circle displaying the 10 most correlated variables to dims 1 & 2. The 5 digit series represent the original coding in states.

The correlation circle in Figure 7-31 displays the first 10 variables that are correlated the most with dimensions 1 and 2, with FACE (*state* 01062) and PRICE (*state* 01341) being the best indicators since their squared cosine is superior to 0.7 – the closer the arrows to the rim of the circle, the better represented they are in the dimensions. It is clear that at least two main groups of speakers stand out, i.e. those adopting high prestige supralocal variants of FACE, GOAT and MOUTH (arrows pointing towards the left) and those with a more traditional pronunciation.

The trends become even clearer when one extreme speaker was removed (N02M), as Figure 7-32 demonstrates. This young man who lives in Newcastle has the highest diversity of variants spanning from local to high prestige, which somewhat blurs the more general trends in the model. By his high variability, he tends to overshadow more straightforward variational patterns found among most speakers. First of all, as Figure 7-32 illustrates, four phonetic variants have a squared cosine superior to 0.75 as opposed to only one vowel exponent that is equal to 0.72 when including the atypical speaker (Figure 7-31). Secondly, the three expected types of speakers stand out. On the left, are the speakers that favour high prestige variants with a closing diphthong in FACE and GOAT. They are the more radical leaders of levelling in TE. At the bottom-right corner of the correlation circle are the more moderate ones, preferring a pan-northern pronunciation in FACE and GOAT. MOUTH is the best indicator of very traditional speakers (top-right), since they use the traditional monophthong [u̟̜˓]. Conversely, the local variant of PRICE is torn between the pan-northern speakers and the more *Geordie sounding* ones. Indeed, the arrow is placed in between the supralocal variants of FACE/GOAT and traditional variant of MOUTH. This indicates that a majority of pan-northern speakers have retained the more local raised onset despite a greater degree of levelling in FACE and GOAT. PRICE seems to resist change the most.

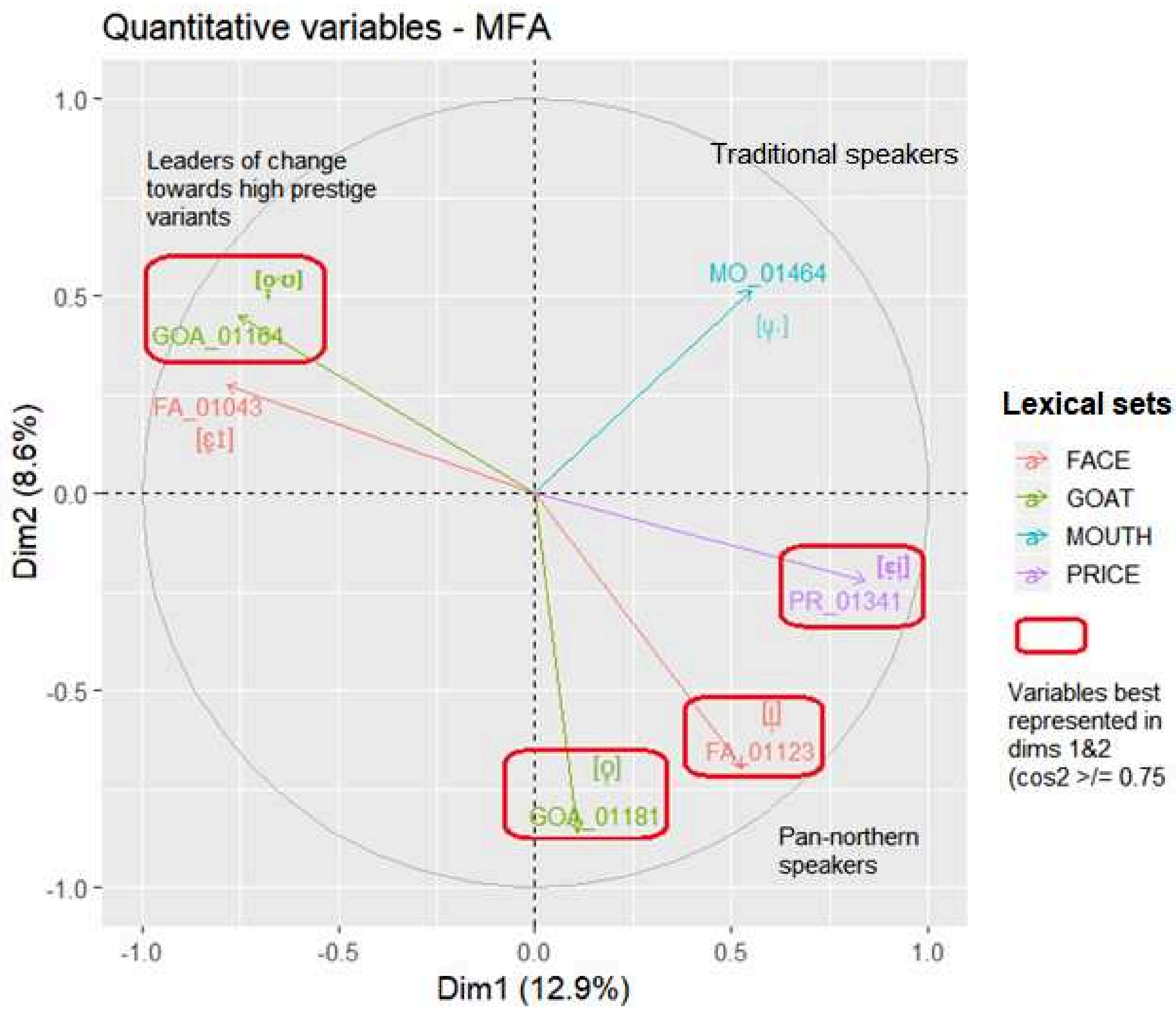

Figure 7-32 Correlation circle displaying the 6 most correlated variables to dims 1 & 2 (N02M as supplementary individual).

In sum, the high dimensionality formed by the TLS coding is coherently reduced to highlight the following linguistic trends: there are three main groups, the very **traditional** speakers, the **pan-northern** ones and those adopting **high prestige** variants. We now need to know who belongs to each of the three main groups and if certain social variables significantly affect the speakers' linguistic preference.

7.6 Sociolinguistic stratification and interactionality (TLS 4 sets)

Now that we know the general trends pertaining to the 4 lexical sets, let us examine how the speakers differ from one another by looking at the hierarchical clustering tree in Figure 7-33. Since adding the atypical speaker N02M did not modify the classes of speakers in a very significant way, we chose to leave it as an active individual in the model.

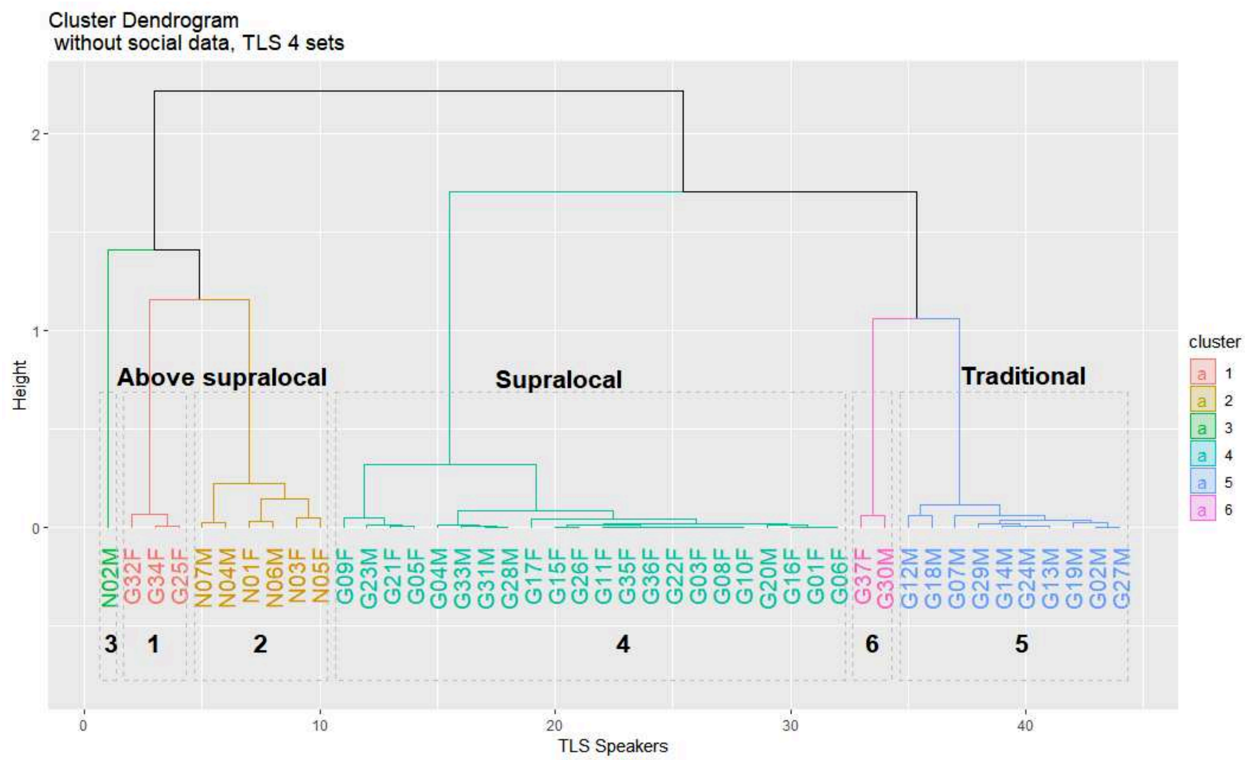

Figure 7-33 Dendrogram MFA on TLS interview data (all 4 sets, social data supplementary).

The cluster analysis based on the MFA results reveals that speakers are grouped differently depending on whether all states are included (Figure 7-21) or whether we keep only the 4 sets under investigation (Figure 7-33). We still notice the North/South Tyneside cleavage between the Newcastle and the Gateshead speakers (p-value = 0.002) but Gateshead speakers now form 4 sub-groups. A small group of 3 Gateshead women is clustered around the Newcastle speakers (G32F, G34F and G25F). The rest of the Gateshead informants is divided into two main clusters revealing a significant gender-gap (p-value = 0.003) in the production of the 4 sets: an exclusively male cluster and a second one which is mainly female (6 men out of 22 women). Such results are in line with Moisl & Maguire (2008). G37F and G30M are in a separate branch.

In this model, the extreme speakers are more visible (above supralocal women and traditional men) but the subgroups of Gateshead speakers revealed by the full model are less distinct (less traditional men and more traditional women) since both groups are now considered as supralocal. However, by decreasing the level of cutting, 3 groups of Gateshead women emerge: the very above-supralocal women (G32F, G34F), the slightly above-supralocal women (G09F, G21F and G05F) and the supralocal women in cluster 4. A lower level of cutting in the tree also makes the less traditional men distinct from the traditional women. The model with 4 sets provides similar information to the one with all the states, which means that little information is lost if one focuses on the 4 sets.

With the 4 sets model, N02F is seen as the most atypical speaker, while the Londoner, N06M is included in the group of Newcastle speakers. This can be explained by the fact that most of the Newcastle speakers are expected to produce closing diphthongs in FACE and GOAT, which is also characteristic of the South of England regardless of class. Neither age nor class appeared as having a significant effect on the creation of the groups since they are absent from the cluster diagnostic. It should be reminded though, that class and birth place are confounding factors since most Gateshead and Newcastle speakers in this sample were selected on the basis of their socio-economic background. Class is therefore implicit when referring to birthplace.[122] I shall continue the description of the results by taking a closer look at the factor map with the above-mentioned clusters.

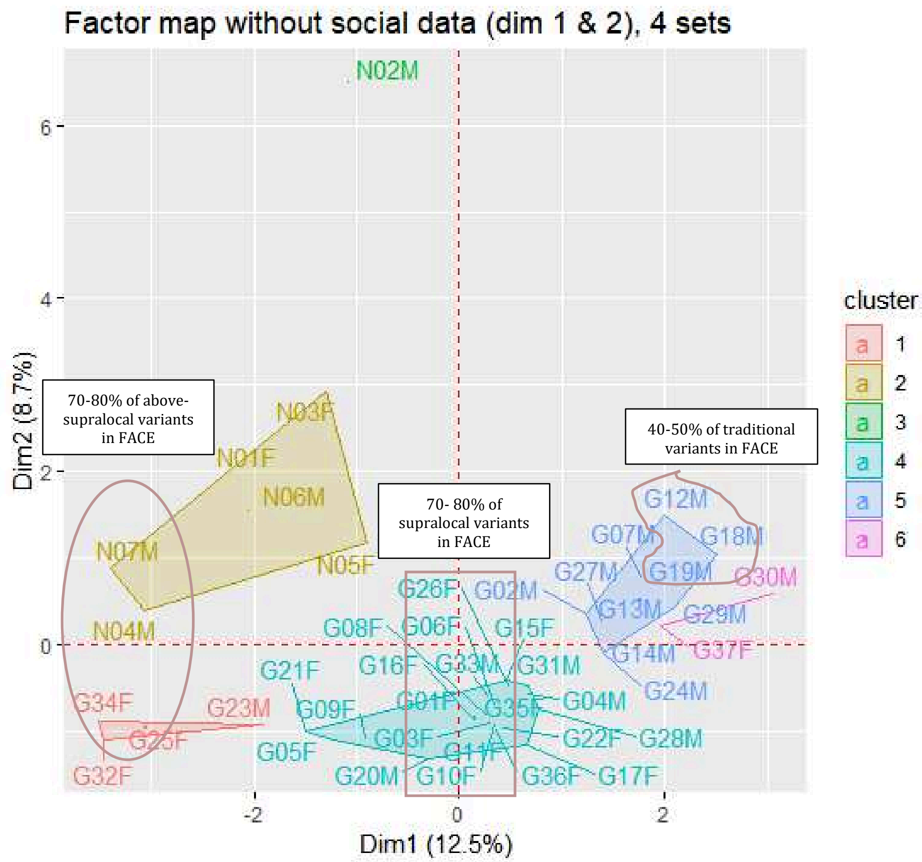

Figure 7-34 MFA factor map with clusters TLS-coding (all 4 sets).

Figure 7-34 reveals a gap between panel speakers from the northern shore of Tyneside and those from the southern shore on both dimensions. 4 Gateshead speakers (cluster 1) differ from those from Newcastle (cluster 2) only on dim 2. Conversely, the group

[122] Some speakers were not born elsewhere but since they were living in one of these two cities they are referred to as either Newcastle or Gateshead speakers.

of Gateshead male speakers in cluster 5 appears similar to cluster 2 on dim 2 but not on dim 1. This means that they share certain vowel variant preferences but not all. Based on the point of view of the dim 1 & 2 factor map, the Newcastle speakers differ the most from cluster 4, a group mainly composed of female speakers from Gateshead. Let us now investigate the effect of the social variables on the creation of speaker groups.

7.6.1.1 Cluster diagnostic 1a: social profile of the clusters (TLS 4 sets)

Overall, only two social variables had an effect on the separation into groups of informants, namely, birthplace and gender (p-value < 0.001, df = 15 & 5 respectively). Age and class were not significant overall but the latter proved relevant for cluster 5. This is fully in line with the research made by Moisl & Maguire (2008) who used the less detailed phonetic coding (the PDVs) and more Gateshead speakers.

The effects of the social variables on the constitution of each cluster are listed in Table 7-11. Three groups were not built using the social data (1, 3 and 6). They comprise less than 4 speakers, sometimes even 1 (cluster 3) and should be considered atypical speakers because variation in their pronunciation of the 4 sets does not follow the general patterns of the Gateshead and Newcastle men or women. It will be necessary to investigate these speakers' social trajectory further. In cluster 2, a great majority of speakers were born in north Tyneside (83%), N02 being the only one from Newcastle that was not included. Cluster 4 indicates that female speakers from Gateshead have different pronunciation strategies than those in cluster 5, which is exclusively composed of working-class men. In cluster 4, however, there are 6 men whose variation and social trajectory should be studied in more depth.

Table 7-11 Contribution of the social variables per cluster (v-test critical value = 1.96).

Social var.	% in cluster 1 (above supralocal)	p-value	v-test
No effect	~	NS	NS
	% in cluster 2 (above supralocal)		
Birth: north Tyneside	83.33% (in full sample: 18.18%)	< .0001 **	3.62
	% in cluster 3 (only N02M)		
No effect	~	NS	NS
	% in cluster 4 (supralocal)		
Gender: women	76.19% (total: 52.27%)	< .01 **	2.95
	% in cluster 5 (traditional men)		
Gender: men	100% (total: 47.73%)	< .0001 ***	3.80
Class: WC	100% (total: 68.18%)	< .05	2.51
	% in cluster 6 (G37F, G30M)		
No effect	~	NS	NS

Cluster 1 did not have any social variables significantly associated with it. However, the social profiles of these speakers makes them stand out from the rest of the Gateshead sample from one way or another. G34F & G23M both have office jobs. G32F & G25F have either one or both parents born outside Tyneside, which led G25F say during the interview that they spoke a “mixed dialect” at home. She is now a housewife, but before getting married she worked as a cutter and designer for gowns in a high end department store at Newcastle. G32F is a school cook, so she would have been expected to be among the women with higher supralocal/local scores. But in her interview, she declares doing book work and supervisionary work, which suggests that she is higher in the hierarchy than an ordinary school cook. She also mentions not being allowed to talk Tyneside when she was a child but is now able to adapt to her colleagues who speak broader forms of TE:

> [TLSG32F]. . .well I was never allowed to talk Tyneside. . . eh while I was a child but ehm I now have a Tyneside accent and I'm I'm not ashamed of it I'm quite pleased with it but if I was eh talking maybe at work and they were talking broad Tyneside then I may break into it <pause/> a little bit. . . when I talk Tyneside it's abnormal .

This probably explains why her use of broader TE forms is not frequent enough for her to be put in the cluster with the supralocal/local forms. Her work environment appears to have an impact on her positive attitude towards the accent – "I'm quite pleased with it". Let us move on to investigate which vowel variants are favoured per cluster.

7.6.1.2 Cluster diagnostic 1b: linguistic profile of the clusters (TLS 4 sets)

The cluster diagnostics based on the TLS 4 sets are displayed in Table 7-12. Speakers with similar proportions are then grouped together. The 4 Gateshead speakers in cluster 1, for instance, produce about 8 times more above-supralocal FACE and GOAT variants than the average proportions in the entire sample of informants. The Newcastle speakers in cluster 2 have similar speech patterns, yet the onset is more open in FACE and further back in GOAT and PRICE, which would indicate even higher prestige variants, closer to an above-supralocal level converging more with speech variation found in the South of England. However, they tend to have retained a more traditional variant in MOUTH, with a raised onset (about 29% vs. an average of 7%). This is also favoured by the atypical speaker N02M in cluster 3 and the group of traditional Gateshead women (cluster 4). MOUTH and PRICE clearly exhibit a reverse prestige pattern with a raised onset in PRICE indexing a more traditional working-class profile and in MOUTH, a more prestigious supralocal form.

Cluster 4 is predominantly female, with all the speakers living in Gateshead (

Table 7-13). Speakers in Cluster 4 adopt the supra-local forms of FACE and GOAT, which corroborates the contention that levelling is led by women in this area (Buchstaller et al., 2017; Foulkes & Docherty, 1999; Hermann L Moisl & Maguire, 2008; Watt & Milroy, 1999). If we briefly return to Figure 7-34, we notice that most men are plotted on the right hand side of the cluster polygon, thereby placing them closer to the traditional working-class men of cluster 5. However, the group keeps a few local features, albeit not stigmatised ones such as the raised onset in MOUTH and a low back monophthong in PRICE, which, as suggested by Moisl & Maguire (Hermann L Moisl & Maguire, 2008, p. 29), is first and foremost associated with the pronoun “I” for Northern English in the SED (Orton & Halliday, 1962).

Table 7-12 Top phonetic variants for clusters 1 to 3. G: Gateshead, N: Newcastle.

Phon var.	% in cluster 1 (G: 3 women, 1 man)	p-value	v-test
FACE [e̠ɪ]	20.08% (av. 2.48%)	< .0000001 ***	5.68
PRICE [a̠ɛ̠]	26.55% (av. 3.11%)	< .0000001 ***	5.66
MOUTH [a̠ʊ]	83.27% (av. 16.51%)	< .00001 ***	4.65
GOAT [əʊ]	20.24% (av. 2.28%)	< .0001 ***	3.96
Phon var.	**% in cluster 2 (N: 3 women, 3 men)**	**p-value**	**v-test**
GOAT [o̟̟̜ˑʊ]	76.35% (av. 15.53%)	< .0000001 ***	5.42
FACE [ɛ̞ɪ]	16.90% (av. 2.65%)	< .0001 ***	4.07
FACE [ɛ̈ɪ]	3.34% (av. 0.54%)	< .0001 ***	4.00
PRICE [ɑ̟i̟]	8.44% (av. 1.23%)	< .001 **	3.80
MOUTH [ɑ̟̟ʊ]	2.96% (av. 1.96%)	< .001 **	3.37
MOUTH [ɛ̞ʊ]	28.89% (av. 7.05%)	< .01 *	2.87
Phon var.	**% in cluster 3 (only N02M)**	**p-value**	**v-test**
PRICE [ɑ̟]	33.48% (av. 4.39%)	< .0000001 ***	6.55
GOAT [u̟̜ᵊ]	5.24 (av. 0.48%)	< .0001 ***	6.47
FACE [e̠]	72.21% (av. 15.53%)	< .0001 ***	6.09
PRICE [e̠̜ɨ̳]	10.71% (av. 1.65%)	< .0001 ***	5.52
GOAT [ə] (in unstressed final syllables like “pillow”)	9.82% (av. 1.23%)	< .001 **	4.12
MOUTH [ɛ̞ʊ]	41.62% (av. 9.94%)	< .0001 ***	3.61

In the group of working-class men (cluster 5 in

Table 7-13), we observe three variant preferences for GOAT: two low vowels [ɑ̟] and [a̠̞] and a more central one [o̟̜˂]. Differences in the former 2 appear negligible and the pair of variants could be grouped together. They correspond to Watt's mention of [aː] as an "increasingly recessive feature" (Watt, 2000, p. 73). They appear in much higher proportions than in the PVC data, which would indicate that variation drops to a smaller number of possible exponents in the GOAT set as levelling is gaining grounds from the 1970s to the 1990s.[123] The central monophthong identified as the preserve of young men in the PVC data is produced about 3 times as much in this group.

[123] It is possible though that a traditional sociolinguistic interview will lead to a greater use of the pronoun *I*, than a dyadic conversation between friends.

Table 7-13 Top phonetic variants contributing to the creation of clusters 4 & 5.

Phon var.	% in cluster 4 (G 16 women, 5 men) supralocal	p-value	v-test
GOAT [o̟̜]	76.54% (av. 43.96%)	< .00000001 ***	5.83
FACE [i̠̜]	85.41 (av. 59.36%)	< .0000001 ***	4.92
MOUTH [ɛ̠ʊ]	65.57% (av. 38.43%)	< .000001 ***	4.60
PRICE [ɑ̟]	57.11% (av. 48.93%)	< .0001 ***	2.82
Phon var.	**% in cluster 5 (G 10 men) traditional**	**p-value**	**v-test**
MOUTH [ɔʊ]	40.31% (av. 13.40%)	< .000001 ***	4.54
MOUTH [ʌʊ]	19.11 (av. 5.79%)	< .000001 ***	4.45
FACE [i̠ə]	41.06% (av. 16.60%)	< .00001 ***	4.18
GOAT [ɑ̟]	26.66% (av. 7.78%)	< .00001 ***	4.10
GOAT [a̠̣]	18.24% (av. 6.40%)	< .0001 ***	3.57
PRICE [ɛ̠i̜]	41.45% (av. 24.88%)	< .0001 ***	3.34
MOUTH [ʉ̟˓]	2.67% (av. 0.71%)	< .0001 ***	3.30
GOAT [o̟̜˓] (a more central vowel cf. Watt 1998)	19.94% (av. 6.69%)	< .0001 ***	3.29

The centring diphthong in FACE is about 2.5 times more used among the working-class men (41%) than across the entire sample of informants (16%). There were 22 states recorded by McNeany in the data, which would mean that if the proportions were distributed evenly, each variant would account for about 4.5% (100/22=4.54), yet average proportions of the centring diphthong is just above 3.5 times this amount (16.60/4.54=3.66). This indicates the prevalence of the traditional value in FACE among many TLS speakers. Raised but retracted onsets in MOUTH would reveal the presence of other traditional variants in the set. The enregistered monophthong epitomised by the word *Toon* which abounds in the Newcastle urban landscape nowadays is also produced 3.7 times more than average.

Table 7-14 Top phonetic variants contributing to the creation of cluster 6.

Phon var.	% in cluster 6 (G37F, G30M) *rarer variants*	p-value	v-test
GOAT [ɛ̠ʊ]	10.95% (av. 0.70%)	< .000000001 ***	6.24
MOUTH [ʊ]	13.39% (av. 1.06%)	< .000000001 ***	5.72
GOAT [ɪi]	8.21% (av. 0.54%)	< .000000001 ***	5.71
MOUTH [ʉ̟˞]	52.98% (av. 5.57%)	< .0000001 ***	5.21
GOAT [jɛ]	0.83% (av. 0.04%)	< .0000001 ***	4.58
GOAT [ʉ̟]	0.83% (av. 0.04%)	< .0000001 ***	4.58
MOUTH [ɪ̟ʊ]	4.17% (av. 0.19%)	< .0000001 ***	4.58

Only two speakers are in cluster 6, which is the closet group to the middle-class speakers in the dendrogram (Figure 7-33). Higher scores (ten times above average) of what I will call the stereotypical *Toon vowel* [ʊ] is what makes this pair of informants isolated from the rest of the sample. We observe the nearly extinct neutralisation of the FACE ~ GOAT contrast observed in Jones (1911) in words like [tjɛk] *take* and [bjɛθ] *both*.

7.6.2 Discussion

To conclude on this section, here are the chief patterns that have emerged from the final MFA model with 5 dims and more clusters (Table 7-15). The latter revealed two types of speakers that produce more high prestige variants than average. One is composed of Gateshead speakers and the other (3 women, 1 male), of 6 Newcastle speakers, with the latter having more raised onsets in MOUTH than the former. Most supralocal speakers from Gateshead are women (16 women vs. 5 men), while traditional ones are men only (cluster 5). Raised onsets in MOUTH seems to be typical of Newcastle female speakers (cluster 2) and of supralocal Gateshead women (cluster 4). The pair of speakers in cluster 6 produced very rare variants that are absent from the PVC corpus. Levelling towards the unmarked northern mainstream variants is well underway. 26 Gateshead speakers out of 37 disfavour the traditional variants, which are already in steep decline in the TLS. Except for G37F, women exclusively favour either the unmarked or prestigious variants. Interestingly, the classification with the 4 sets only provides a less clear-cut class and gender stratification than the model including all sates (MFA 4) except among the traditional speakers who are exclusively composed of men.

However, a major advantage of the full aggregate-analysis is that one can see which variants characterise the speaker groups the most, other than the 4 sets. For instance, among the vowels, lettER, STRUT and NURSE, played an important role in characterising the sociolinguistic groups. This provided a better overview of variation in TE. Moreover, reducing the complexity of the data may also give us a distorted vision of the linguistic reality of the sampled speakers. This was mainly the case of N06M, the *Londoner* (see Figure 5-1), whose characterisation mostly relied on consonantal variation. His position in the factor map changed considerably in the 4 set model. This said, for the rest of the speakers, the classification remains rather steady in both models. The data including all the phonetic features, provided a more fine-grained account of variation among less extreme speakers, which depends on proportions of apical forms in bound -ing or their realisation of plosives. If one aims at finding sociolects in Tyneside, I believe that the fours lexical sets are not enough although their give fairly similar results.

Table 7-15 Summary table of the phonetic features that best characterise each group.

Cluster 1 (G: 3 women, 1 man, a few high prestige supralocal variants)
Higher proportions than average of closing diphthongs in FACE and GOAT. Low onsets in PRICE and MOUTH.
Cluster 2 (N: 3 women, 3 men, more high prestige supralocal variants)
Higher proportions of closing diphthongs (especially GOAT) but more raised onsets in MOUTH than average.
Cluster 3 (only N02M: supralocal in FACE but local for the other sets)
Mixed variants: monophthongs in FACE but higher scores of raised onsets in MOUTH and PRICE. A few centring diphthongs in GOAT.
Cluster 4 (G: 16 WC women, 6 men, more supralocal)
Supralocal variants (monophthongs) in GOAT and FACE but high proportions of raised onsets in MOUTH than average.
Cluster 5 (G 10 WC men: more traditional)
High proportions of centring diphthongs in FACE and traditional monophthongs in GOAT (central or back and open). Retracted onsets in MOUTH and raised ones in PRICE. Old fashioned and enregistered monophthong variants in MOUTH.
Cluster 6 (G37F, G30M: very rare variants)
Differences confined to the GOAT and MOUTH set. Presence of old fashioned and enregistered monophthong variants in MOUTH. Raised onsets or opening diphthongs in GOAT.

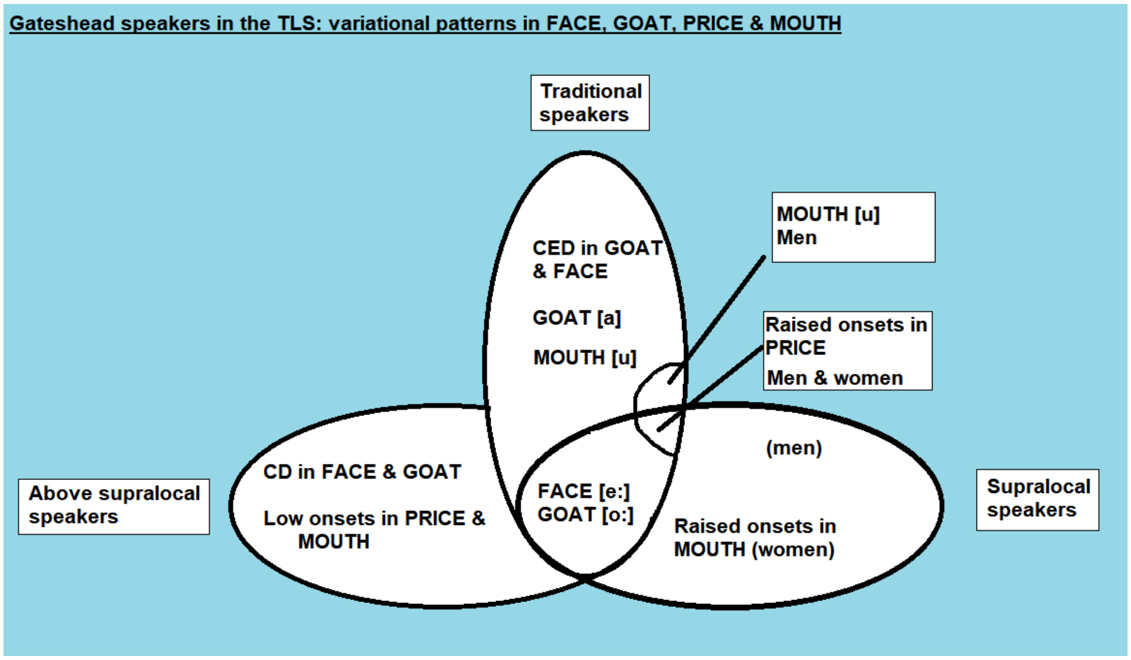

Figure 7-35 Schematised representation of variational patterns in the TLS 4 sets (Gateshead speakers).

I have hitherto focused on the TLS interview data, transcribed by McNeany (1972). However, for some speakers, I managed to retrieve the wordlist data and transcribe it too. This would enable a TLS/PVC comparison based on the same style. I also wanted to see whether the world list in the TLS would trigger even more unmarked variants than in the interview data – as shown by Watt between the conversational and the wordlist material in the PVC (Watt 1998).

7.7 Apparent time-study 1c of the TLS wordlist material

The literature indicates that read speech is expected to trigger more supralocal and high prestige variants than interview speech, especially among older women (Watt 1998). Certain comparisons can prove useful based on what we already know about the speaker's variant distribution. It is predicted that style-shifting amongst the standard speakers will be lower among the older WC male and that it will be higher among women.

7.7.1 Data

7.7.1.1 The TLS speakers with available wordlist data

The wordlist is situated in the last third of the TLS recordings, contrarily to the part which was phonetically transcribed – first ten minutes of the interview. Some tapes were damaged towards the end of the interview.[124] The wordlists of all 37 TLS speakers could therefore not be retrieved. The audio files for the 7 Newcastle speakers are yet to be matched to the original phonetic transcriptions[125] so they will not be part of the analysis. I extracted the wordlist data for 21 Gateshead informants, a majority of whom happen to be women (Table 7-16). At first sight, it may be advisable to focus more on individual productions one by one, but since we know which speakers are paragons and who the extreme speakers are, we can tap into the paragons to provide a reliable estimate of variation by cluster (Figure 7-36). Also, with the extreme speakers we can wonder whether the 2 speakers with the highest scores of high prestige variants in the interview data (G32F & G34F) will have even higher figures when reading the wordlist and whether the extreme local speaker (G19M) style-shifts to a similar extent.

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[124] Could this be due to a simple error? If one redigitised the tapes with newer technology, would this make any improvement?

[125] The audio files for the Newcastle speakers were not readily available. In the future, I intend to reconstruct their speech by converting the 5-digit phonetic transcriptions into normal spelling. Then the speaker's productions will be compared to the newly digitised files pertaining to the Newcastle sample and will be aligned to the sound whenever I find a match.

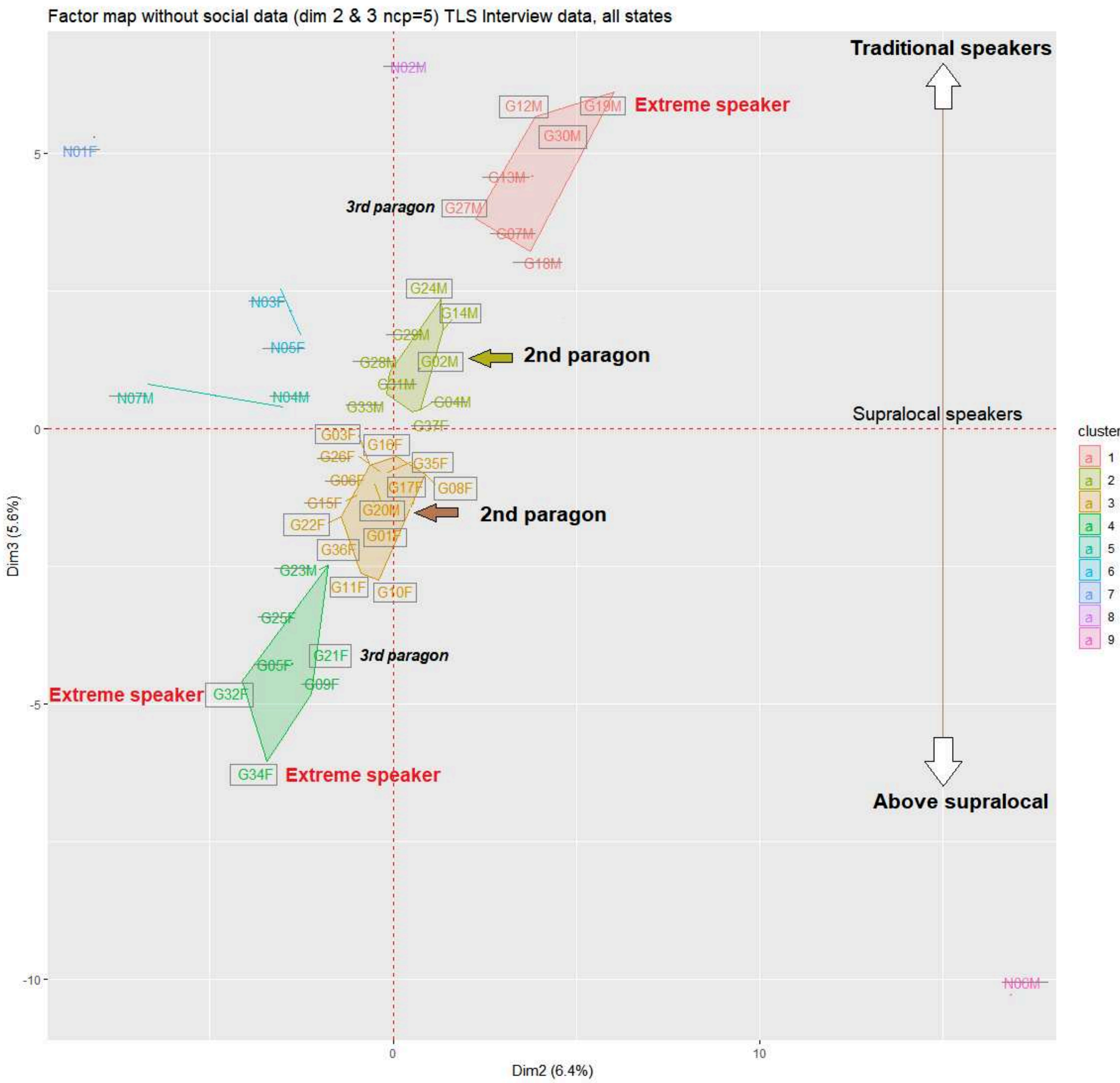

Figure 7-36 Gateshead informants in the TLS wordlist data with paragons and extreme speakers.

Table 7-16 Distribution of men and women per age category and class.

Age and class sex (n=21)	Women (n=14)	Men (n=8)
Y (n=7)	**3**	**4**
LMC	1	2
WC	2	2
MA (n=13)	**10**	**3**
LMC	2	0
WC	8	3
O (n=1)	**0**	**1**
WC (n=1)	0	1

7.7.1.2 TLS wordlist material

The TLS wordlist data comprises the following words. The highlighted ones were retained for the analysis since they belong to the lexical set of either FACE, GOAT, PRICE or MOUTH.

find mind fly bill well men head back farm wall daughter down take straight cold alone poor fire four tower path after earth year me field been new moon school revolution but none seven one long holiday room book good maker wafer happy Harry Mary yes better something fall which apple television absent realise Newcastle sea houses method concert descend chocolate explain industry condemn tissue with film

In total, 103 items were measured:

- stressed vowels,
- reduced vowels,
- intervocalic /p/, /t/ and /k/
- -*ing* (*something*)
- Schwa insertion in the words *film* and *apple*
- [sj] or [ʃ] in *tissue*

FACE items (n=6): *take, straight, maker, wafer, explain, holiday*

GOAT items (n=2): *cold, alone*

PRICE items (n=4): *find, mind, fly, realise*

MOUTH items (n=2): *down, sea-houses*

7.7.1.3 Methodological approach: TLS wordlist data

The TLS wordlist data comprises all the lexical sets. However, words are not evenly distributed by lexical set and phonetic environment, which made me consider the need to measure variation by word and individual in all 4 sets. After a spectrographic inspection of the data, I annotated each vowel exponent belonging to the 4 sets based on Watt's coding scheme (1998) of Tyneside English for FACE and GOAT, since it is simpler than the original TLS coding-scheme. It also proved well adapted to the TLS wordlist data when transcribing each word. Moreover, the MFA carried out on the 4 lexical sets in the TLS interview material revealed 3 major sociolinguistic types of speakers which also correspond to the 3 main types found in the pilot study on the PVC.

The first type refers to speakers with high levels of prestige variants, the second one, informants using supralocal forms predominantly and eventually, those with higher scores in the traditional variants. FACE variants were transcribed as [eɪ], [eː], and [ɪə] and prevail in each type respectively. GOAT had 4 variants with a closing diphthong [oʊ] as a prestigious form, a back monophthong [oː] for the supralocal speakers and a central monophthong [ɵː] along with a centring diphthong for the traditional speakers [ʊə]. For PRICE, I found a raised onset [eɪ] and lower onset [aɪ] was enough since the first person pronoun is absent from the list. The latter is often realised as [ɑ] (state: 01304) with scores reaching 48.9% of all PRICE variants in the TLS interview. MOUTH vowels were also transcribed with two variants, namely, a raised onset [ɛʊ] and a lower onset [aʊ]. In total, 11 variants will be examined.

In case the amount of data from the 4 lexical sets would be too low to establish reliable clusters of speakers, additional linguistic data such as the -*ing* realisation in *something*, that of intervocalic stop as in *better*, *daughter*, *maker*, and *happy* or that of /l/ in *film* were included as supplementary variables in the MFA model. Differences of pronunciation among speakers appeared particularly salient in the wordlist audio files and all these features were also considered as main determinants of TE speech in the MFA 1 model. In *tissue* I noticed a ratio of 5:12 for productions of /sj/ and /ʃ/ (4 speakers did not read this word). The reason for adding these linguistic variables was twofold: (1) it provided me a general overview of the speakers' consonantal realisations interacting with the 4 lexical but without modifying the model. The literature on TE also indicates that markers of indexicality is not confined to vowels (J. Milroy et al., 1994; Christer Påhlsson, 1972). (2) I wanted to use this smaller and more controlled TLS sub-corpus to test future possibilities for a wider integrated approach with both consonants and vowels.

7.7.2 Preliminary step (1): evaluating the contribution of the first two dimensions (TLS WL)

Dim 1 & 2 contribute to explain 54.9% of the variation. Husson et al. (2011) recommend a dim 1 score of about 27% when the model has 17 variables. In model MFA 5 the score is 29.3% for 11 active variables. The score is therefore well above the rule of thumb for dim 1. The proportion of variance explained slows down considerably after the 4th dimension. This means that the default parameters of keep 5 dimensions for the MFA & cluster analysis is enough.

Now that the proportion of explained variance and the number of dimensions to be retained has been checked, it is possible to examine the co-occurrence of variants in the 4 sets and to determine which variants characterise speaker groups. Namely, are we expected to find changes as to what characterises the above-supralocal, supralocal and traditional speakers from one style to the next?

7.7.3 Results & discussion (TLS WL)

Overall, the general patterns observed in the TLS wordlist data in Figure 7-37 are coherent with those from the interview data. Once again, we find the three main types of speakers, namely, local, supralocal and above supralocal. The two extreme speakers with a high degree of high prestige forms remain extreme speakers (G32F & G34F). The supralocal women G08F, G10F and G17F, who have very similar phonetic realisations in the interview data are also close in the wordlist data. Their position on the map (bottom left) indicates that they produce almost exclusively supralocal variants of GOAT and FACE. I mention only GOAT and FACE because their arrows are closer to the rim of the circle, making them the most reliable variables for dims 1 and 2, contrarily to MOUTH. In fact, the three women have identical realisation distributions on all 4 sets, namely, they have exclusive monophthongal realisations in GOAT and FACE, but produced raised onsets only in MOUTH and raised half of their PRICE vowels.

G30M, G19M and G12M remain the most traditional speakers and G35F (working class middle-aged) is the most median speaker since she is always close to a zero axis in both the interview and wordlist data. In FACE, she is equally torn between high prestige variants (n=3) and supralocal ones (n=3), whilst for GOAT, she has categorical use of the supralocal monophthong (n=2). G21F and G22F have very similar patterns, with both supralocal and high prestige vowel realisations. I first observed the 2 speakers' age and was surprised to see that G21F was young and G22F, middle-aged. Indeed, I would have expected the younger speaker to be more supralocal but when I checked their class, I realised that the former was from a higher background (LMC) than G22F (WC), which would explain why their profile converged.

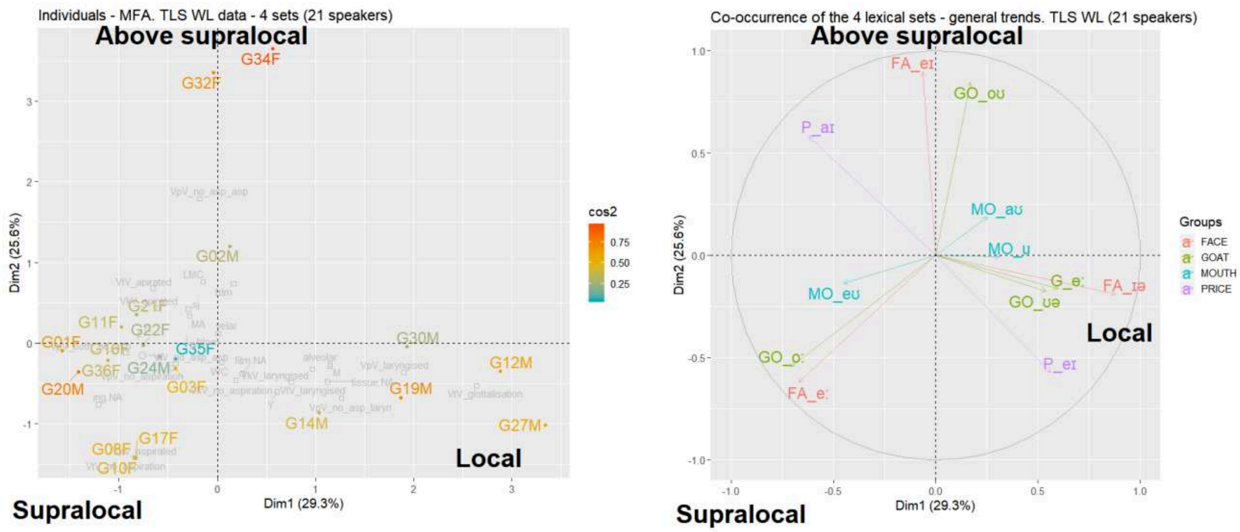

Figure 7-37 Individuals (left) ranging from high cos² (stereotypical speakers) to low cos² (speakers with heterogeneous variability), and their corresponding variant realisations (right).

However, certain curiosities emerge from the wordlist data: G27M, who was the least extreme speaker among the traditional male informants, is now the most extreme local speaker. This suggests that other phonetic features in his interview speech are more supralocal. Scores in the wordlist indicate a clear favour for centring diphthongs in FACE. G02M was one of the paragons of the male supralocal speakers when looking at his entire phonetic data system (TLS interview data, all states). But in the wordlist, he seems to have style-shifted to a much higher degree than most other speakers, contrarily to G14M who is also part of the male supralocal speakers. The latter's intermediate position is at the threshold between local and supralocal speakers in both the interview and the wordlist. Half of G02M's FACE variants are closing diphthongs, and he has low onsets for PRICE and MOUTH. Yet, he also produced 2 centring diphthongs in FACE and he favoured a back monophthong in GOAT, which brought him down and away from the 2 above supralocal female speakers.

7.7.4 Variational distribution of the 4 sets by age, gender and class (TLS WL)

Based on the interview data, we know that class and gender are significant predictors for variation in the 4 sets. I chose to add age since I noticed significant differences among the younger speakers (male vs. female), a group which happens to be more evenly distributed than the other cohorts.

7.7.4.1 Distribution of FACE variants by cohort

The radar chart proved a very useful tool to plot variation in FACE across cohorts (Figure 7-38). Each cohort is placed at one extremity of the cobweb. Axes represent variant distributions percentagewise. Variants are represented by colour (M: monophthong, CED: centring diphthong, CLD: closing diphthong). Absent values were coded as NA, viz. not available. Before, I move on to individual variation, I will provide you with general distributions by cohort first.

All the men realised at least 25% of their FACE vowels with the traditional centring diphthong; older and middle-aged men, more than 25% and young working-class men, more than 65%. The closing diphthong is characteristic of middle-aged women, and to a lesser extent, middle-aged men from the young working-class and lower middle-class women. The supralocal monophthong is very frequent among the lower middle-class young speakers and the two young working-class women in the sample use it exclusively. **Sociolinguistic patterns in the wordlist mirror those from the interview data**, but the **gap between the working class young men and women is particularly striking**.

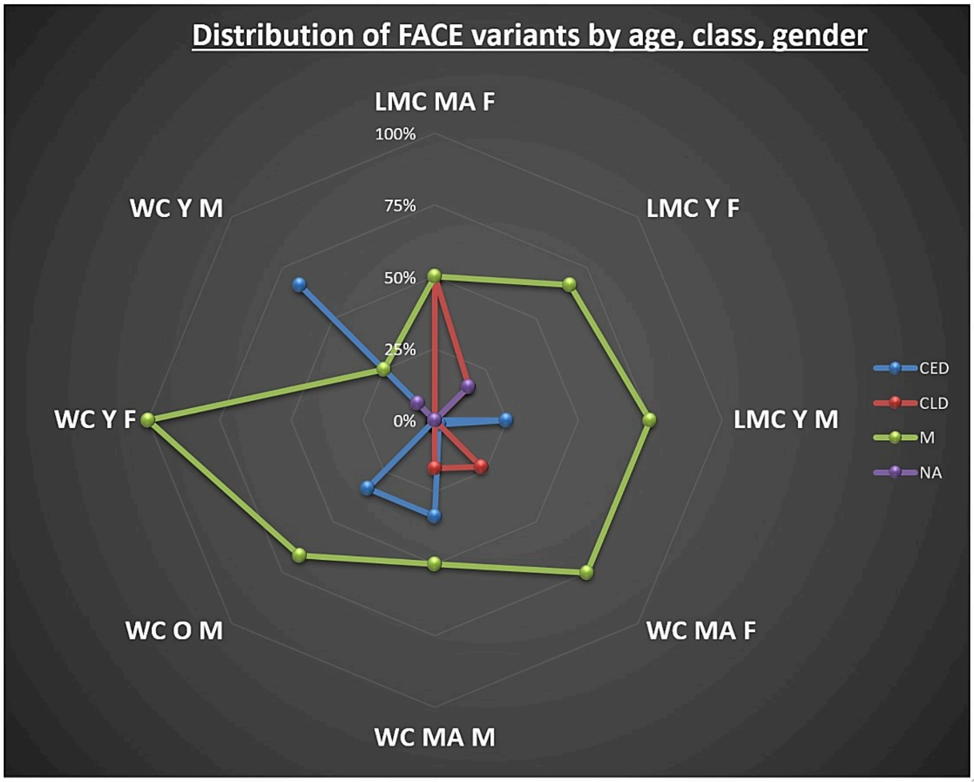

Figure 7-38 Radar chart of FACE variants by age, class and gender in percentage (TLS WL data). Words: *take, straight, maker, wafer, explain & holiday.*

Table 7-17 Distribution table of FACE variants by age, class and gender in percentage (TLS WL data).

Speaker groups	M	CLD	CED	NA
LMC	**63.3%**	**23.3%**	**10.0%**	**3.3%**
Middle-aged	**50.0%**	**50.0%**	**0.0%**	**0.0%**
F	50.0%	50.0%	0.0%	0.0%
Young	**72.2%**	**5.6%**	**16.7%**	**5.6%**
F	66.7%	16.7%	0.0%	16.7%
M	75.0%	0.0%	25.0%	0.0%
WC	**66.7%**	**14.6%**	**17.7%**	**1.0%**
Middle-aged	**68.2%**	**21.2%**	**10.6%**	**0.0%**
F	75.0%	22.9%	2.1%	0.0%
M	50.0%	16.7%	33.3%	0.0%
Old	**66.7%**	**0.0%**	**33.3%**	**0.0%**
M	66.7%	0.0%	33.3%	0.0%
Young	**62.5%**	**0.0%**	**33.3%**	**4.2%**
F	100.0%	0.0%	0.0%	0.0%
M	25.0%	0.0%	66.7%	8.3%

7.7.4.2 Distribution of FACE variants by individual

Individual productions reveal a certain degree of variability within the cohorts although the general patterns remain identical overall with women opting for high prestige variants, especially middle-aged ones and centring diphthongs being the preserve of men, except for G03F. The latter, along with G02M, were the only speakers to have three types of variants in their wordlist repertoire. In this style, G02M is the only male speaker to have realised closing diphthongs. In the interview speech he is closest speaker to the cluster of working-class women with no further education that we also have in the wordlist. Had we managed to recover more speakers for the wordlist like G33M or G04M, we would have been able to check if they style-shifted to the same extent as G02M.

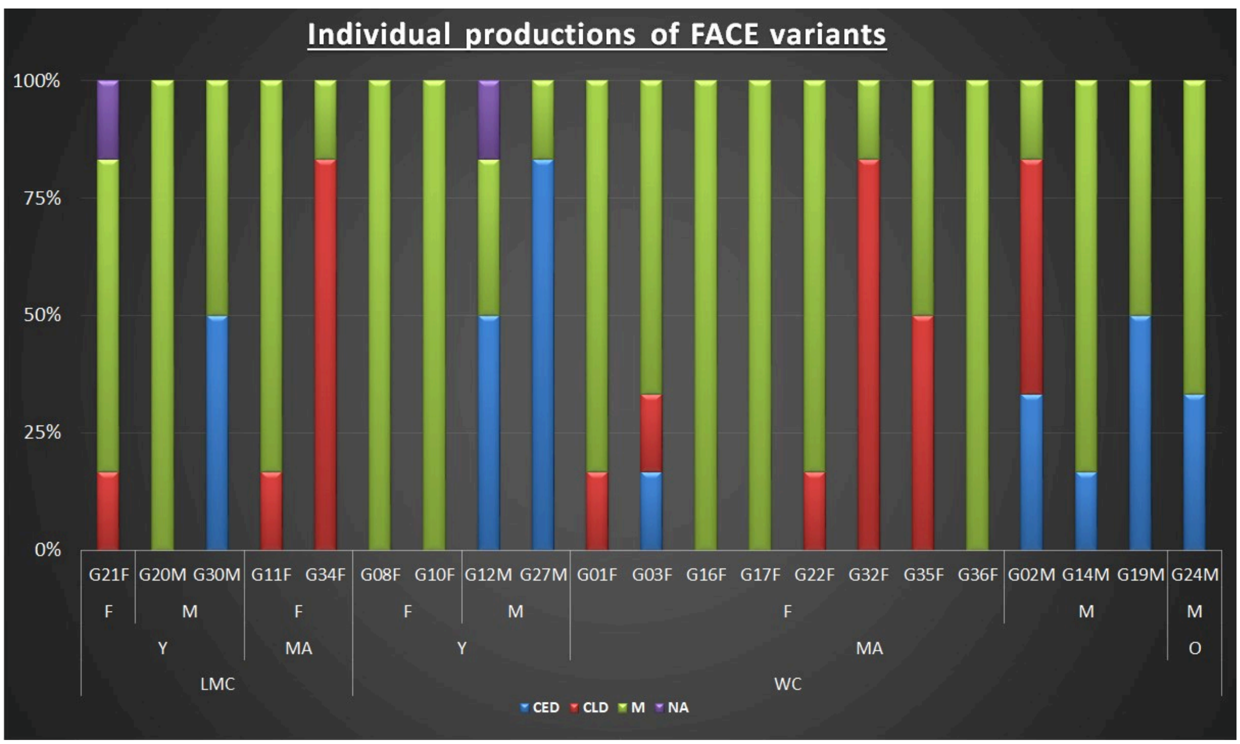

Figure 7-39 Individual productions of FACE variants, TLS wordlist. *take, straight, maker, wafer, explain & holiday*.

All the working-class men used at least a couple centring diphthongs, with the young men having the highest scores. G27M has a 5:1 ratio of centring diphthongs to monophthongs. Among the women, it may be interesting to delve into what makes G34F/G32F and G11F/G22F two distinct pairs of speakers. Despite being middle-aged women from two separate social classes (LMC/WC), the first pair of speakers clearly favours the high prestige variants whilst the latter, the supralocal monophthong.

7.7.4.3 Distribution of GOAT variants by cohort

The TLS wordlist contained only two GOAT words: *cold* and *alone*, which do not often trigger centring diphthongs even among traditional speakers (Watt 1998). The supralocal variant is therefore expected to prevail in these two words. Indeed, Figure 7-40 reveals high values for monophthongs (green dots, coded as M). Only young and middle-aged or working-class men produced central monophthongs (MC), while middle-aged women from either class, along with young men from the lower middle-class realised a few high prestige forms (CLD). Interestingly, young women exclusively favoured the supralocal vowel regardless of their class. Similarly to FACE, the gap between young WC men and women is very high. Moreover, high prestige and supralocal variants are also equally distributed among LMC middle-aged women.

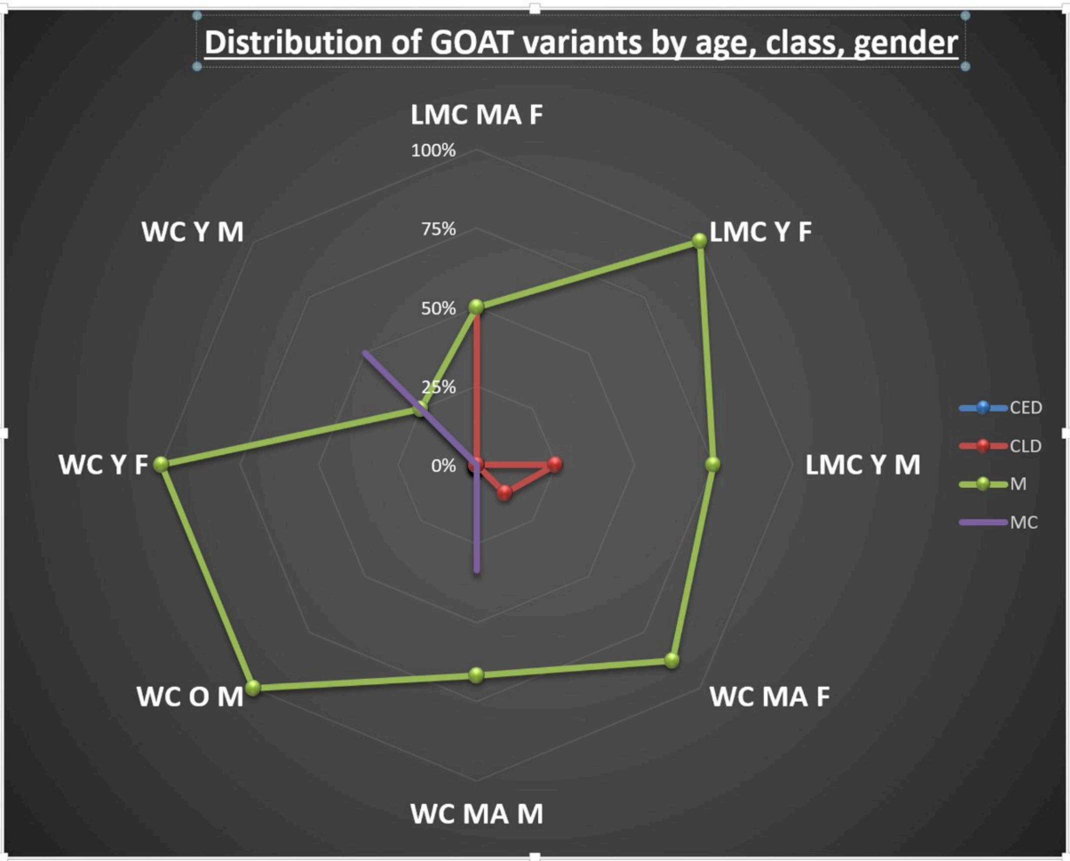

Figure 7-40 Radar chart of GOAT variants by age, class and gender in percentage (TLS WL data) Words: *cold* & *alone*.

Table 7-18 Distribution table of GOAT variants by age, class and gender in percentage (TLS WL data).

Speaker groups	CED	CLD	M	MC
LMC	0.0%	30.0%	70.0%	3.3%
Middle-aged	0.0%	50.0%	50.0%	0.0%
F	0.0%	50.0%	50.0%	0.0%
Young	0.0 %	16.7%	83.3%	0.0%
F	0.0%	0.0%	100.0%	0.0%
M	75.0%	25.0%	75.0%	0.0%
WC	0.0%	9.1%	81.8%	9.1%
Middle-aged	68.2%	21.2%	10.6%	0.0%
F	0.0%	12.5%	87.5%	0.0%
M	0.0%	0.0%	66.7%	33.3%
Old	66.7%	0.0%	33.3%	0.0%
M	0.0%	0.0%	100.0%	0.0%
Young	62.5%	0.0%	33.3%	4.2%
F	0.0%	0.0%	100.0%	0.0%
M	25.0%	0.0%	25.0%	50.0%

7.7.4.4 Distribution of GOAT variants by individual

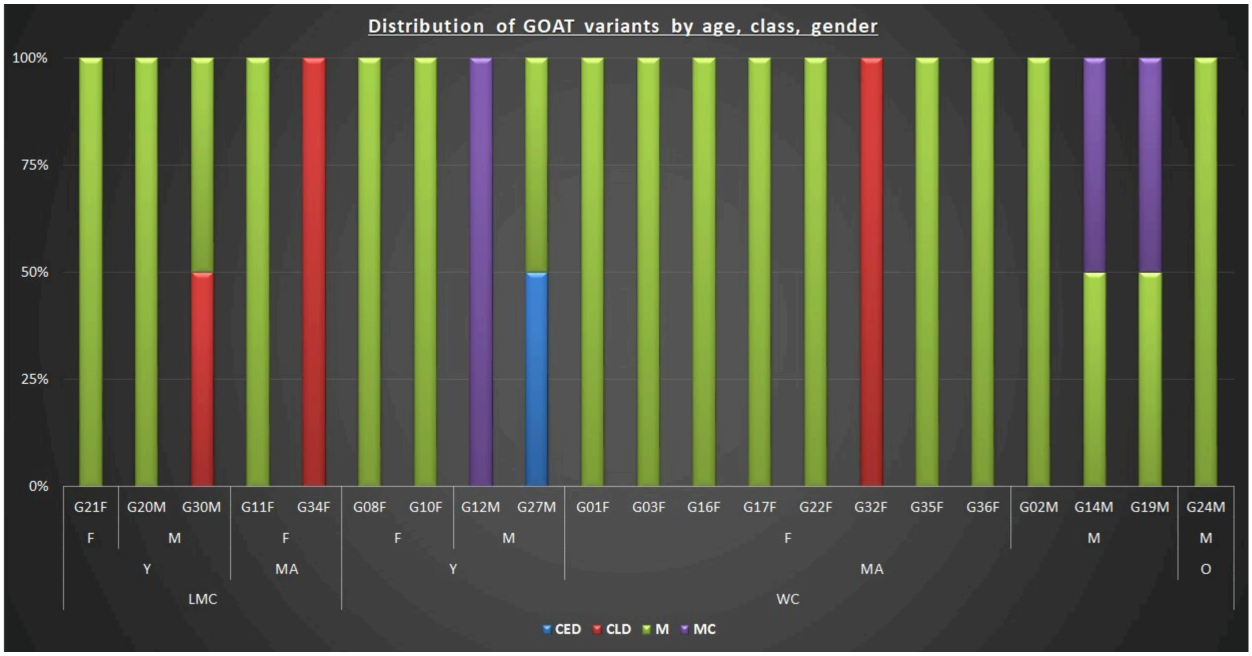

Figure 7-41 Individual productions of GOAT variants, TLS wordlist. Words: *cold* & *alone*.

G27M is the only one who produced a centring diphthong either in *cold* or *alone*, while his other younger male counterpart G12M produced a central monophthong for both. Two WC middle-aged men out of 3 uttered one word with the latter. G32F and G34F exclusively favoured the high prestige variant, which makes them, once again the most above supralocal speakers of the sample.

Overall, FACE and GOAT variation patterns in TE from the 1970s also operate in lockstep in a similar way to TE in the 1990s. Supralocal forms are already the norm in the 70s although traditional speakers produced more traditional forms than in the PVC data from the 90s.

7.7.4.5 Distribution of PRICE variants by cohort

In the wordlist, the 4 words *find*, *mind*, *fly* and *realize* were chosen. TE follows the Scottish vowel length rule (SVLR) to a certain degree with class being an important external constraint (Milroy 1996). While the last two should have a low onset (AI), the first two words of the list are expected to be produced with a raised onset (EI) at least among working-class speakers, which is the case for young WC men and women, as illustrated in Figure 7-42. LMC women disfavour the raised onset completely. The old WC man from the sample clearly favours more supralocal forms than what would have been expected of him based on the previous study on all the TLS states. As in FACE and GOAT, in PRICE he avoids local variants, despite a few centring diphthongs in FACE. Once again, the young men are the least supralocal speakers from LMC, since they had few raised onsets.

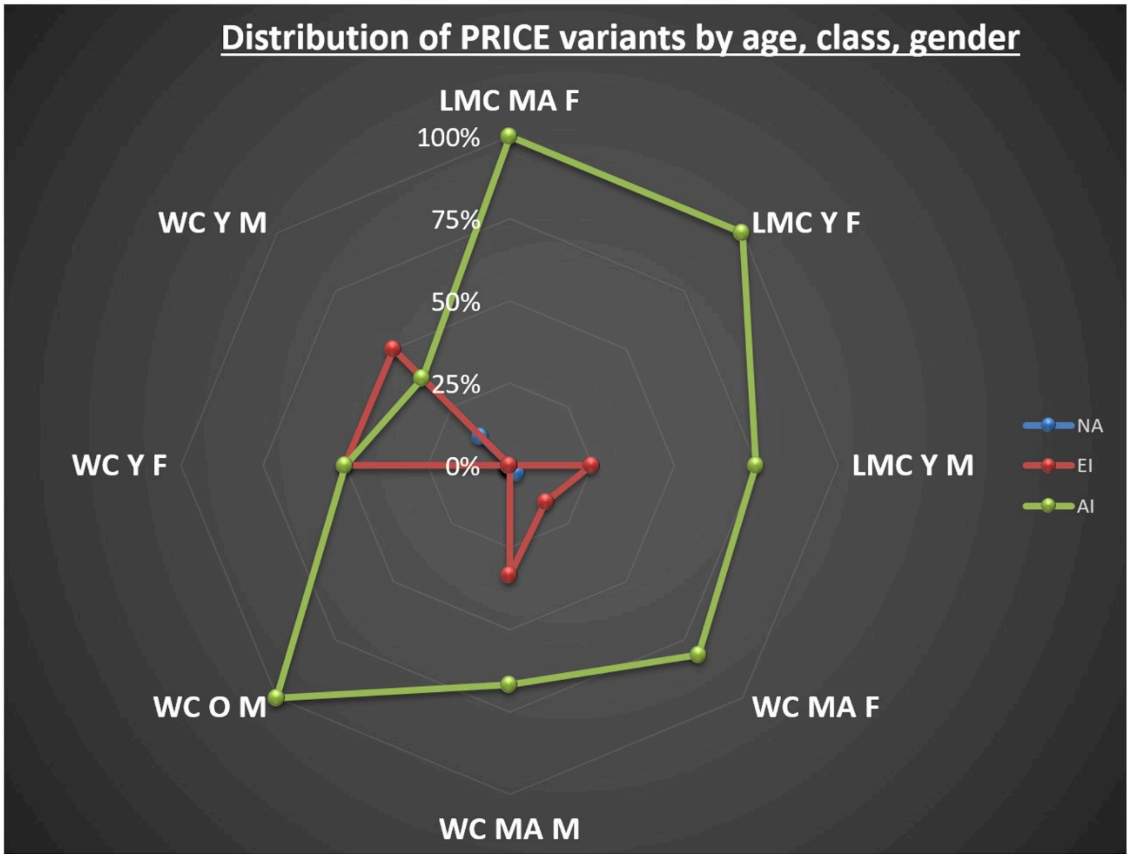

Figure 7-42 Radar chart of PRICE variants by age, class and gender in percentage (TLS WL data). Words: *find, mind, fly* & *realize*.

Table 7-19 Distribution table of PRICE variants by age, class and gender in percentage (TLS WL data).

Speaker groups	EI	AI	NA
LMC	10.0%	90.0%	0.0%
Middle-aged	0.0%	100.0%	0.0%
F	0.0%	100.0%	0.0%
Young	16.7 %	83.3%	0.0%
F	0.0%	100.0%	0.0%
M	25.0%	0.0%	75.0%
WC	26.6%	70.3%	3.1%
Middle-aged	20.5%	77.3%	2.3%
F	15.6%	81.3%	3.1%
M	33.3%	66.7%	0.0%
Old	0.0%	100.0%	0.0%
M	0.0%	100.0%	0.0%
Young	50.0%	43.8%	6.3%
F	50.0%	50.0%	0.0%
M	50.0%	37.5%	12.5%

7.7.4.6 Distribution of PRICE variants by individual

Nearly half of the speakers produced a lower onset in all 4 words, and 9 speakers out of 21 seem to have strictly respected the SVLR, with 9 WC speakers out of 16 having at least one raised onset (Figure 7-43). G30M is the most traditional speaker among the young LMC men since he appears to follow the SVLR in this wordlist. He also had a few centring diphthongs in FACE. Conversely, his male counterpart is consistently supralocal in all 4 sets. All 4 younger WC speakers have the same pattern – except for G27M for which one word is missing. Among the WC speakers, middle-aged women are more supralocal than the rest for they have higher values of low onsets.

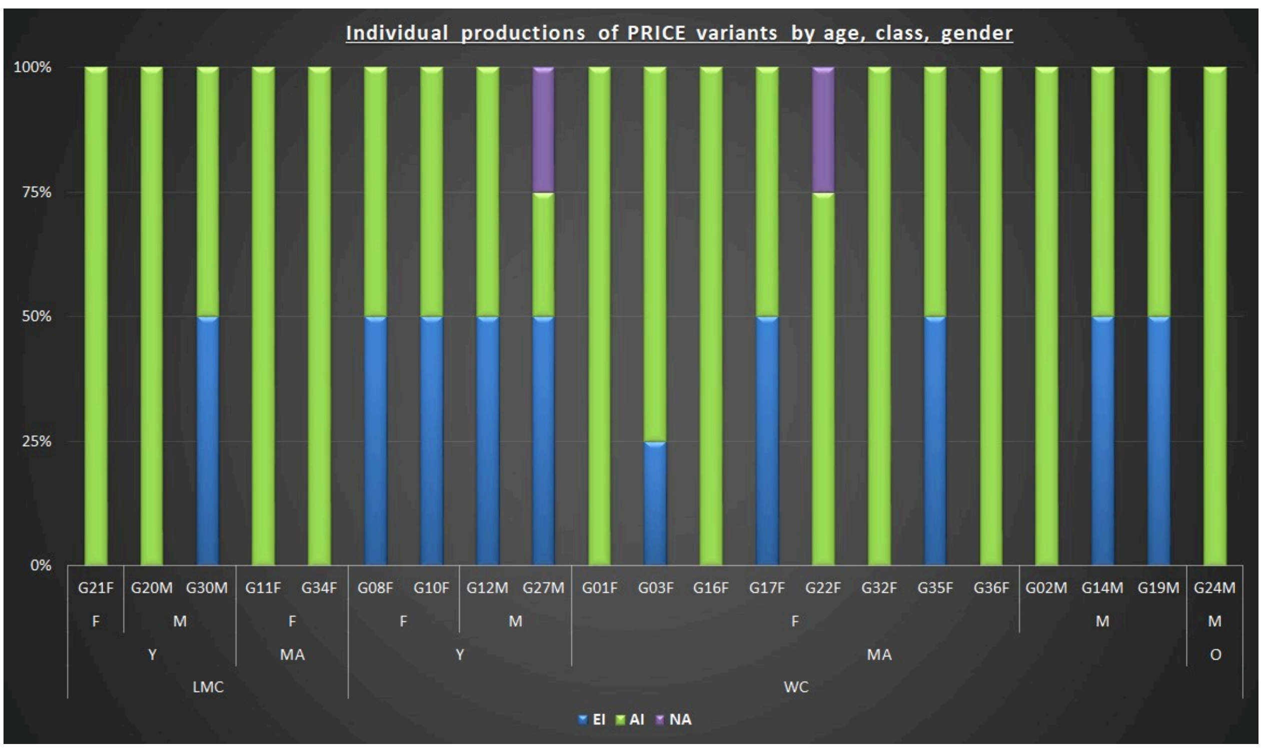

Figure 7-43 Individual productions of PRICE variants, TLS wordlist. Words: *find, mind, fly* & *realize*.

We have described variation across the PRICE words in the TLS wordlist and showed that both external and internal constraints seem to operate in this set. Let us now examine if variants in MOUTH follow similar trends.

7.7.4.7 Distribution of MOUTH variants by cohort

Two words were chosen for this lexical set, namely, *down* and *sea houses*. Distributions of MOUTH in the radar chart (Figure 7-44) highlight the fact that young and middle-aged WC women prefer a raised onset. LMC and WC men produce a lower onset.

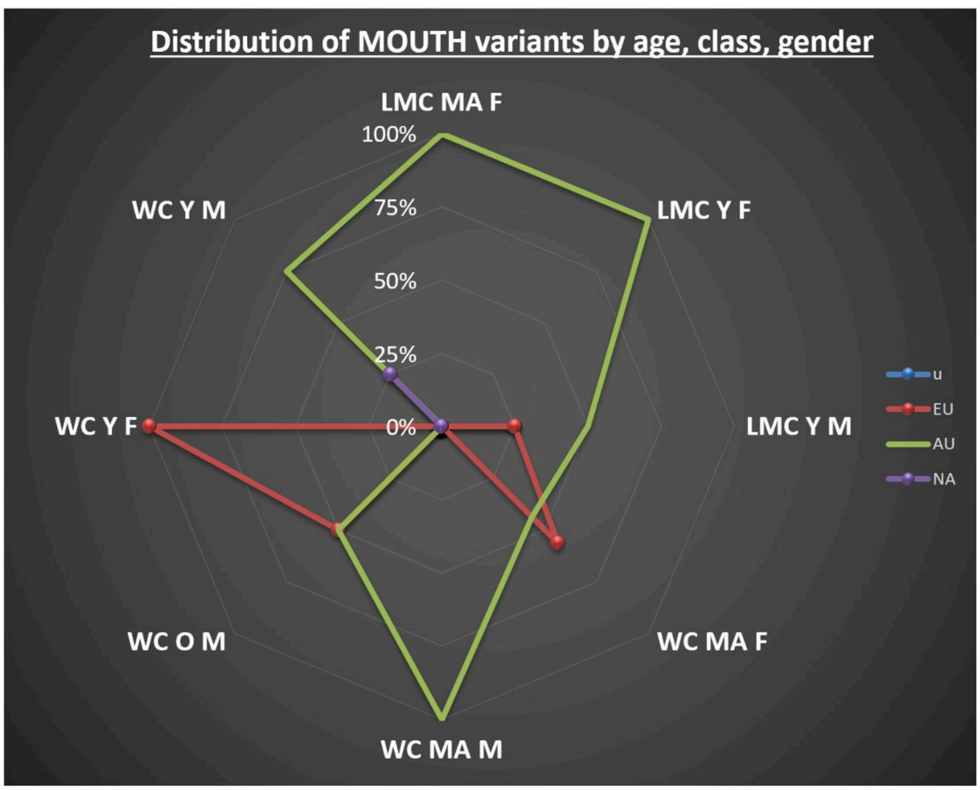

Figure 7-44 Radar chart of MOUTH variants by age, class and gender in percentage (TLS WL data). Words: *down* & *sea houses*.

7.7.4.8 Distribution of MOUTH variants by individual

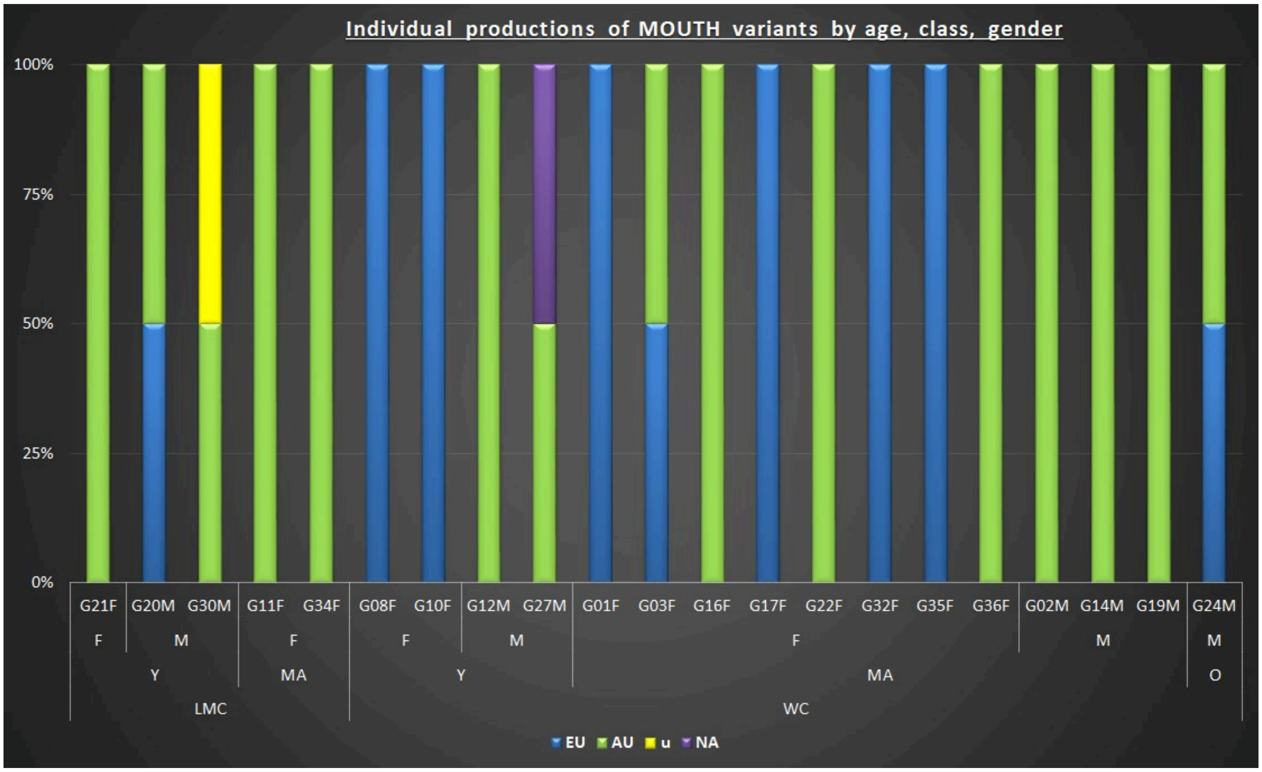

Figure 7-45 Individual productions of MOUTH variants, TLS wordlist. Words: *down* & *sea houses*.

Individual realisations in Figure 7-45 reveal that G34F and G23F differ only in the MOUTH set. G30M show another rare pattern since he is the only one to have used a monophthong. It is possible that the nuclei differ from the middle-aged LMC women and WC men, since the TLS coding data showed that onsets were more often retracted among WC men. An acoustic study would be advisable here.

7.7.5 Co-occurrence of the variants in the 4 lexical sets (TLS WL)

The MFA analysis indicates that FACE, GOAT and PRICE are well represented in dim 1 & 2 (Figure 7-46 & Figure 7-47). The major degrees of accentedness are clearly defined despite the small amount of data: the arrows on the right show that speakers who used the centring diphthong in FACE, also do so for GOAT, with a few traditional ones opting for the central vowel. The pattern is strikingly similar to that of the PVC wordlist data (Amand et al., 2018). FACE and GOAT also work in lockstep among the supralocal and above supralocal speakers (Watt 1998) – bottom left and top, respectively. In general, we see that speakers with a raised onset in PRICE also have a more traditional pronunciation in FACE and GOAT while those using a lower onset tend to favour high prestige variants. This is not the case for supralocal speakers where neither of the PRICE variants are correlated with the two vowels: the two PRICE arrows form a right angle with the supralocal exponent of FACE, which indicates a lack of correlation between the linguistic features (Figure 7-47). Hence, both variants are used by supralocal informants.

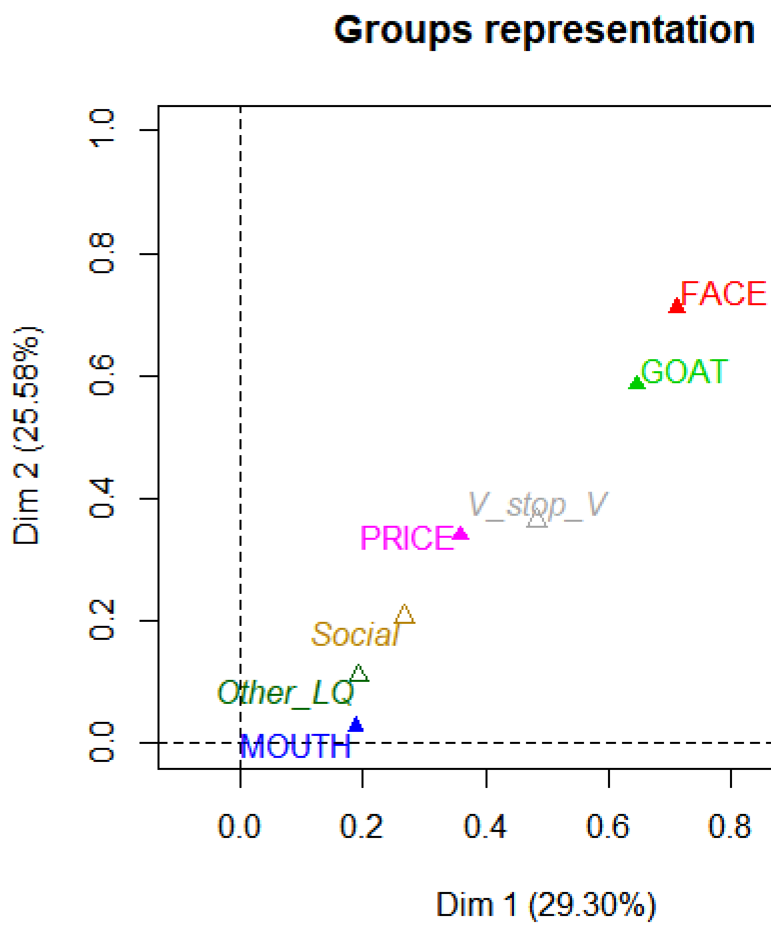

Figure 7-46 Degree of representation of the linguistic features by dim 1 & 2 (TLS wordlist data). The higher the score, the better the representation.

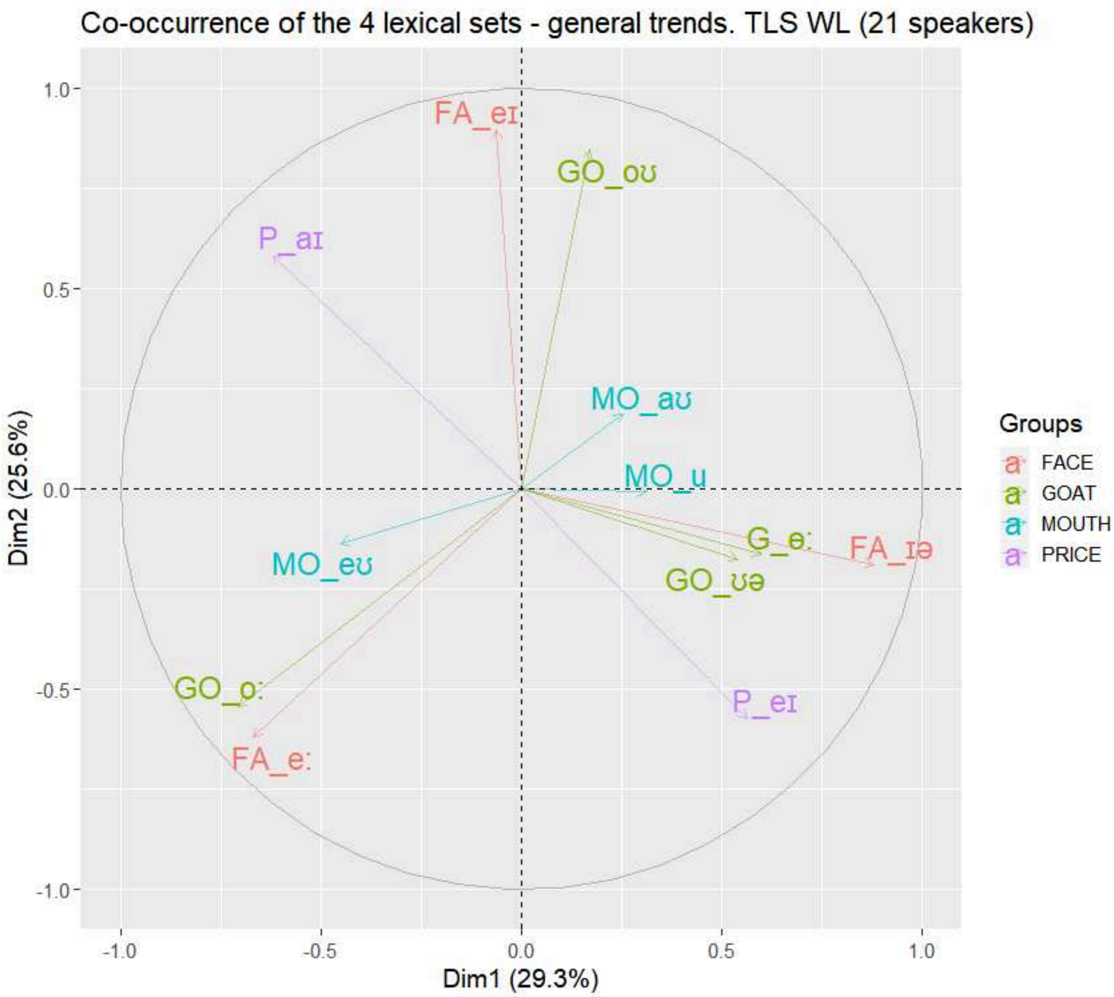

Figure 7-47 Co-occurrence of lexical set variants: dim 1 & 2 (TLS wordlist data, 21 speakers);

Trends in MOUTH are not well explained by dim 1 & 2 as shown by the short arrows[126] (cf. also Figure 7-46). But dims 3 and 5 are ideal for observing how speakers are separated based on the MOUTH variants they generally use (Figure 7-48).

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[126] As a reminder, long arrows representing a variable, e.g. dim 1 & 2, should be the one to take into account when interpreting the position of the individual speakers on the corresponding factor map representing dim 1 & 2. Here, it is clearly FACE, GOAT and PRICE.

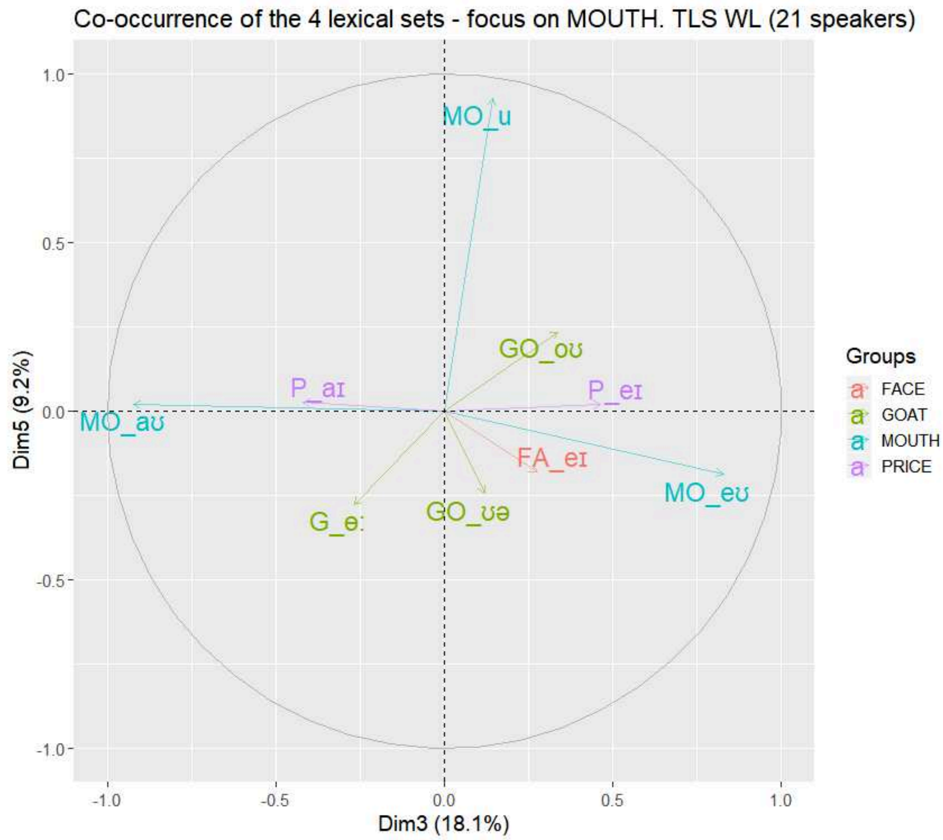

Figure 7-48 Correlation circle with MOUTH variants: dim 3 & 5 (TLS WL data).

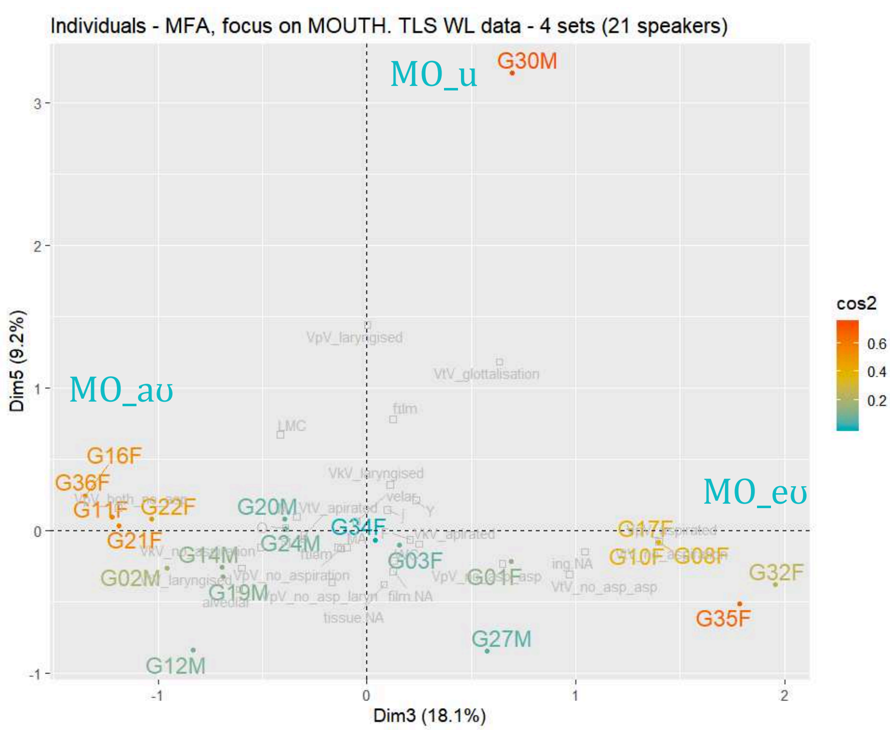

Figure 7-49 Factor map of individuals mainly based on variation in MOUTH: dim 3 & 5 (TLS WL data).

7.7.6 Building groups of TLS speakers (TLS WL)

The cluster analysis based on the TLS wordlist reveals a high coherence with the MFA model of the interview data with the 4 sets only Figure 7-50. This demonstrates that the spectrographic/auditory analysis that was carried out with the same number of variants identified in the PVC for the present thesis is coherent overall with the original more detailed TLS transcription. There is an 85.7-90.5% match with the TLS coding clusters (4 sets only) depending on whether G30M is considered as classified correctly or not – in both models he is in a separate cluster. Two men were grouped with the women in the TLS wordlist MFA analysis, G02M and G24M. In the interview speech data with 4 sets only, they belong to the group of traditional men but they are the least traditional since their position is at the periphery of cluster 5, namely, close to the most traditional/supralocal women of cluster 4 (Figure 7-50). The degree of accentedness of G12M, G19M and G14M is the same in both models and ranges from very traditional to less traditional. G02M, however, is surprisingly close to the two women producing high prestige variants.

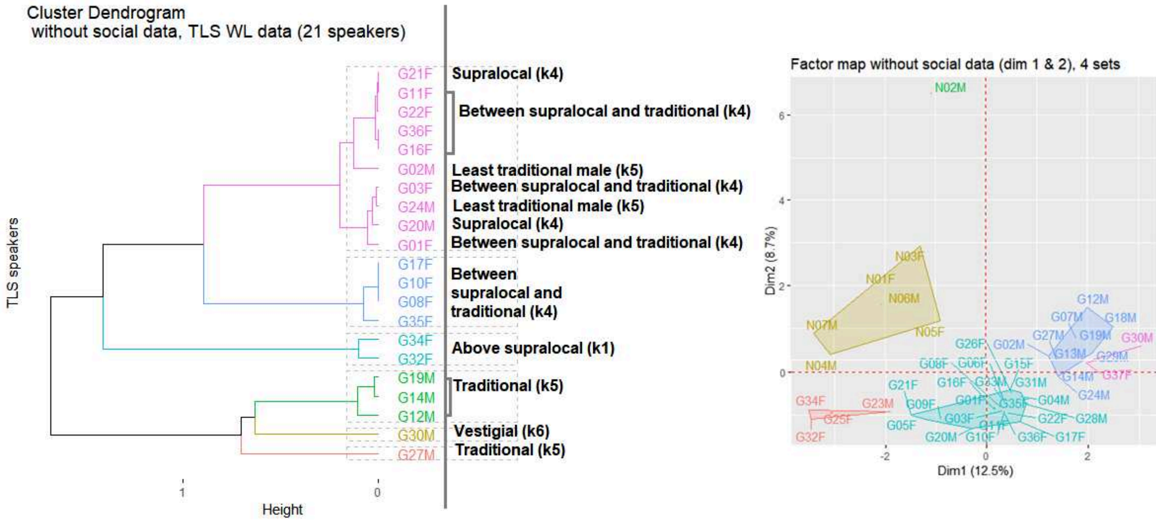

Figure 7-50 Tree with the 21 speakers from the TLS WL data (ncp=5) with cluster affiliation from MFA with the 4 sets only cf. Figure 7 32.

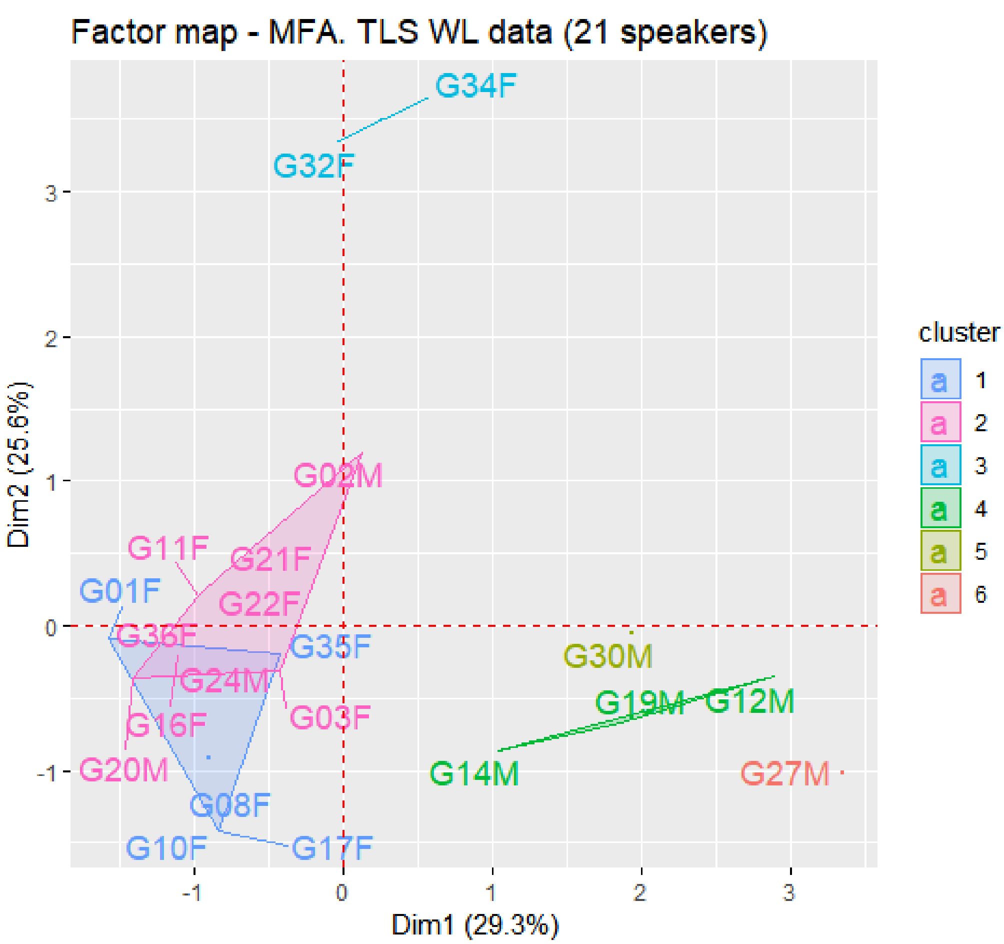

Figure 7-51 Factor map with clusters: dim 1 & 2 (TLS WL data).

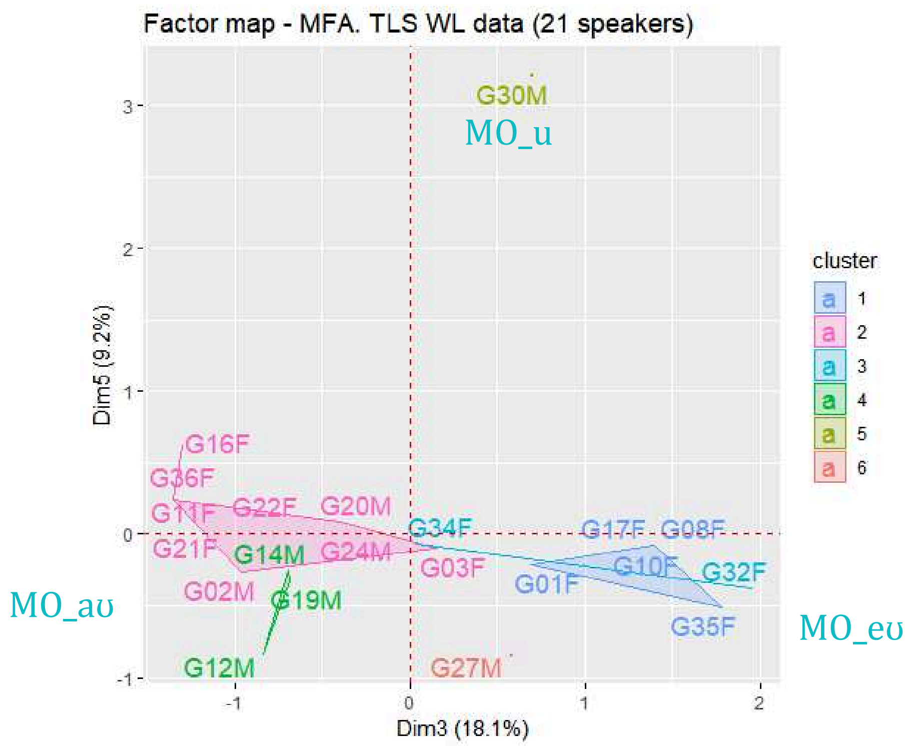

Figure 7-52 Factor map with clusters, focus on MOUTH: dim 3 & 5 (TLS WL data).

If we focus only on the representation of MOUTH in dims 3 & 5, we see that the variant with a raised onset is the preserve of female speakers. Now, G34F and G32F, the pair of above supralocal women, are at odds with one another: G34F, the school secretary, has a lower onset while G32F, the school cook, has the highest scores of raised onsets in MOUTH. It is difficult to determine whether variation in MOUTH is determined by social factors other than gender, but it is clear that the female speakers in cluster 1 with higher scores of raised onsets are those who have worked in some form of factory environment. For example, G35F now works in a shop but has worked in no less than 3 factories as a sewing machinist (cf. TLS interview of G35F).

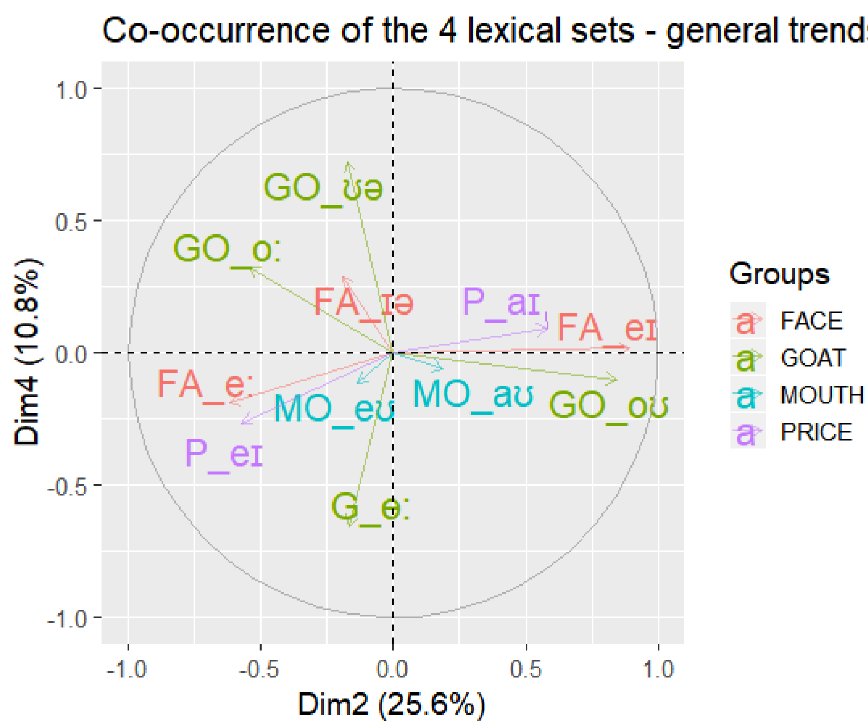

Figure 7-53 Correlation circle with focus on GOAT: dim 2 & 4 (TLS WL data).

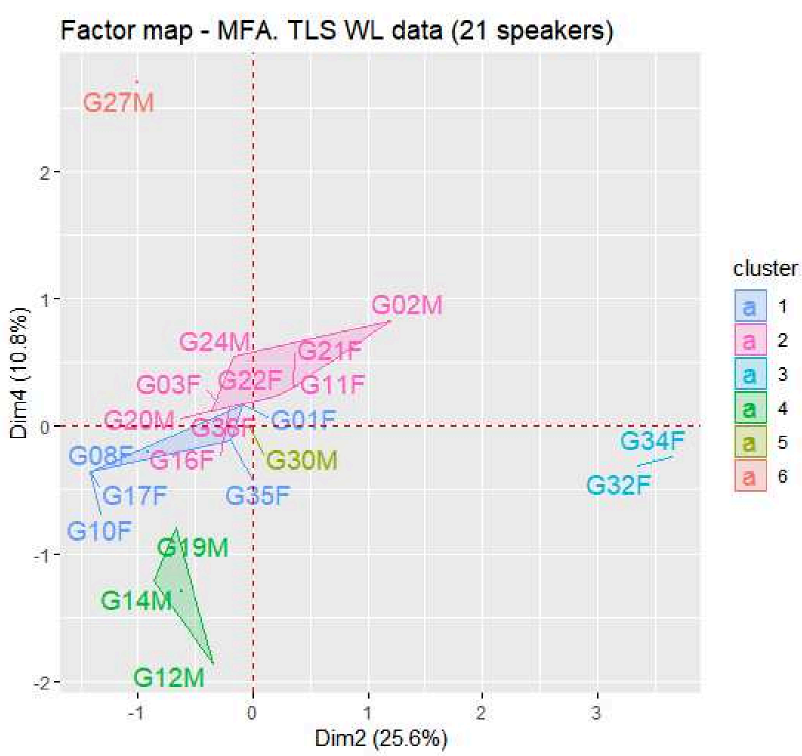

Figure 7-54 Factor map with clusters, focus on GOAT: dim 2 & 4 (TLS WL data).

If we now focus on traditional variants in GOAT, we find that speakers in cluster 4 (G12M, G14M and G19M) are more inclined to use a central monophthong, while G27M used a centring diphthong (Figure 7-53 & Figure 7-54).

Variation between a raised/lower onset in MOUTH and a centring diphthong/central monophthong in GOAT are not clearly linked to the 5 social characteristics included in the analysis. Such subtle differences in **MOUTH** are not enough to index group membership but **may contribute to differentiate a school cook from school secretary (G32F & G34F), who otherwise have identical FACE and GOAT variation patterns**. The GOAT words that were selected for the TLS wordlist were not those that generally trigger a centring diphthong, which decreases the possibility to find a clear pattern, but what we do see, is that the central monophthong along with the centring diphthong are the preserve of men. G27M, who chose a centring diphthong, is among the two men in the wordlist sample that work in the field of industry while the men who centralise their GOAT vowels are either middle-aged drivers (G14M, G19M) or a young engraver (G12M). These subtle differences in occupational profile may also account for the speakers' variation in GOAT in a similar way that women with no further education were placed at one end of the cluster depending on their having worked in a factory or not (Figure 7-23).

In this section, I have shown that sociolinguistic patterns in the TLS data are very similar despite a reduced number of variants with a 90% cluster match between the coding used for the TLS based on Watt's coding (1998) and McNeany's detailed coding. This suggests that further annotations can reliably be made on the rest of the TLS interview speech data, without getting into exceedingly fine-grained transcriptions of variants. I now endeavour to shed light on how TLS speakers style-shift from the interview to the wordlist and which of the FACE, GOAT, PRICE and MOUTH lexical sets are more affected by style-shifting.

7.7.7 Style-shifting: TLS interview vs. wordlist

Looking at style-shifting between the TLS interview and the wordlist was not an easy task. The number of tokens and the nature of the tokens differs greatly between the two corpus materials, and the coding is much simpler in the wordlist material. Instead of precisely taking into account the scores for each state, I chose to determine whether a speaker was more supralocal, above-supralocal or traditional in FACE, GOAT, PRICE and MOUTH and to compare their overall profile in both styles, as Figure 7-55 illustrates. Green cells indicate no apparent style-shift between both materials. Letters in red suggest the presence of style-shifting. Cells which have remained white indicate a less straightforward style-shift. One error in the coding of the wordlist for MOUTH was not to have made a distinction between a low onset and a retracted onset. I will therefore only draw partial conclusions for MOUTH.

Speaker	sex	age	class	educat	style-shift	FACE_INT	FACE_WL	GOAT_INT	GOAT_WL	MOUTH_INT	MOUTH_WL	PRICE_INT	PRICE_WL
G11F	F	MA	LMC	FE	in PRICE	supralocal	supralocal (1 CLD)	supralocal	supralocal	raised	low	raised	low
G21F	F	Y	LMC	FE	no	supralocal (some CLD)	supralocal (1 CLD)	some CLD	supralocal	low	low	low	low
G34F	F	MA	LMC	FE	no	above supralocal	above supralocal	above supralocal	above supralocal	low	low	low	low
G20M	M	Y	LMC	FE	no	supralocal	supralocal	supralocal & [ɵː]	supralocal	raised	half	low	low
G30M	M	Y	LMC	FE	in PRICE & GOAT	supralocal & some CED	traditional	supralocal & [ɵː]	supralocal & 1 CLD	mainly [u] & raised	1 raised & 1 [u]	raised	half
G01F	F	MA	WC	no_FE	in PRICE	supralocal & some CED & CLD	supralocal (1 CLD)	supralocal & some CLD	supralocal	raised	raised	raised	low
G03F	F	MA	WC	no_FE	in PRICE	supralocal & some CED	supralocal & (1 CED & 1 CLD)	supralocal	supralocal	raised	half	raised	low
G08F	F	Y	WC	no_FE	in PRICE	supralocal	supralocal	supralocal	supralocal	raised	raised	raised	half
G10F	F	Y	WC	no_FE	in PRICE	supralocal	supralocal	supralocal	supralocal	raised	raised	raised	half
G16F	F	MA	WC	no_FE	in PRICE & MOUTH	supralocal	supralocal	supralocal	supralocal	raised	low	raised	low
G17F	F	MA	WC	no_FE	in PRICE	supralocal	supralocal	supralocal	supralocal	raised	raised	raised	half
G22F	F	MA	WC	no_FE	in PRICE & MOUTH	supralocal	supralocal (1 CLD)	supralocal	supralocal	raised + low	low	raised + low	low
G32F	F	MA	WC	no_FE	in MOUTH	above supralocal	above supralocal	above supralocal	above supralocal	low + 10% raised	raised	low	low
G35F	F	MA	WC	no_FE	in PRICE	supralocal	half CLD half supralocal	supralocal	supralocal	raised	raised	raised	half
G36F	F	MA	WC	no_FE	in PRICE	supralocal	supralocal	supralocal	supralocal	raised	raised	raised	low
G02M	M	MA	WC	FE	in PRICE & GOAT	traditional	2 CED, 3 CLD, 1 mono	traditional	supralocal	retracted onset	low	raised	low
G12M	M	Y	WC	no_FE	in PRICE & GOAT	traditional	traditional	traditional	[ɵː]	retracted onset	low	raised	half
G14M	M	MA	WC	NA	in PRICE & GOAT	supralocal & CED	supralocal (1 CED)	traditional	1 supralocal 1 [ɵː]	retracted onset	low	raised	half
G19M	M	MA	WC	no_FE	in PRICE & GOAT	supralocal & traditional	half CED half supralocal	traditional	1 supralocal 1 [ɵː]	retracted onset & some [u]	low	raised	half
G24M	M	O	WC	no_FE	in PRICE & GOAT	supralocal & traditional	supralocal (2 CED)	traditional & [ɵː]	supralocal	retracted onset	half	raised	low
G27M	M	Y	WC	no_FE	no	supralocal & traditional	traditional (1 supralocal)	supralocal & traditional	1 supralocal 1 [ʊə]	retracted onset	low	raised + low	raised & 1 low

Figure 7-55 Estimation of style-shifting from the interview to the wordlist material.

Overall speakers are coherent in both styles, which explains why the clusters made out of the wordlist and those out of the interview are very similar. However, **PRICE appears to be the feature undergoing style-shifting the most**, with a majority of speakers increasing their low onsets in the wordlist – the reverse was never found. Style-shifting in MOUTH always went towards low onsets as well. **Those who did not style-shift in PRICE happened to be LMC speakers** (LMC: 4/5, WC: 1/16), mostly because their onset was already low. G30M was the one with higher scores of [u] in MOUTH in the interview material and remains the only one to have used the variant once (out of 2) in the wordlist. G19M had a few [u] variants in the interview but did not use any in the wordlist.

7.7.8 Language ideology & education to account for style-shifting

In one of the first classics works of sociolinguistics by Labov (1963), language and ideology around language considerably determines variation patterns in individuals. Milroy also stresses on the importance to analyse the meta-awareness by speakers regarding sociolinguistic indexing (L. Milroy, 2004). The collection of TLS interviews provides sparse evidence for individuals' orientation towards language and language ideology. I had but to piece together the fragments with care and to furnish the reader with some necessary speculation to account for less typical variation patterns found in this chapter.

Some women (G01F, G03F, G21F) and a man (G20M) used variants from all three TE-lects in FACE Figure 7-55, which seemed surprising. Although this can be but conjectures, it is possible that their somewhat mixed profile is linked to their attitude towards the local accent, the constraints within their workplace or whether they took elocutionary lessons. Some tend to look down on broad Tyneside (G03F, middle-aged, WC): "[I don't approve of] the very broad [Tyneside] this ye divn na and that oh I think it sounds terrible" [TLS interview G03F]. G32F is also a middle-aged working-class woman and had similar views on TE: "the broad Tyneside I don't think it it is t too good I don't mind a slight accent but eh broad Tyneside no I don't like it" [TLS interview G32F]. The two speaker's negative attitude towards an excessively broad TE accent may also be a simple rejection of what is associated with men but it may also reflects why these two speakers adopt a more supralocal or above supralocal forms of TE. G22F also style-shifted to lower onsets in PRICE and MOUTH. She not only disapproves of local accent but admires her niece who took elocutionary classes and wishes she could speak like newsreaders [TLS interview G22F].

According to some speakers from the TLS recordings, the nature of the job may considerably change one's accent – hence the expression of "public school English" referring to a form of RP. G21F, young LMC, indicates that her job as a social worker requires her to style-shift and adapt to the speech of the people asking for help to find a job:

> If I get a a chap that speaks broad Tyneside he's not going to be at ease if I talk all sort of lardy da[127] and the other way round if I get a commercial and I talk broad Tyneside he's going to think oh it is an opinion people get you know they think because someone talks in a local accent that they're a grade below. [TLS interview G21F]

G20M used to work at the dole and also remarks on the importance of not having an affected accent to adapt to the people he is helping out: "well you know when I used to work in the dole . . . you know I didn't use to put on like any sort of affected" [TLS interview G20M].

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[127] Dictionary entry as *la-di-da*, referring to snobbish manners or someone considered as posh.

One of the most above supralocal WC school secretary from Gateshead also implicitly admits having to monitor her speech in front of parents and that a strong accent may harm communication between her, the parents and the pupils: “eh you possibly do find yourself talking down to some people say some parents come to school eh have to make sure that they understand you possibly eh speak to them a little differently you you don't like to talk down to them but I think possibly you have to and also to the children to some extent” [TLS interview G34F].

School also seems to have had an impact on some of the speakers’ accents. G20M adds that the more prestigious school he went to may have led him to speak in a more formal way than his own brother who went to an “ordinary” secondary school: “I've probably changed you know I went to a grammar school. . . you know my brother just went to an ordinary secondary modern school. . . you know I suppose there was a difference between the way I'll talk now and the way he talks now” [TLS interview G20M]. G34F indicates having had elocution classes at school may have altered her speech: “ I remember when I was at school I was quite interested in drama and connected with that I had some elocution lessons it probably changed from that date I was very conscious of it then we drilled very conscientiously” [TLS interview G34F].

One of the most traditional speakers (G19M, a digger driver) was also prone to style-shifting in PRICE, MOUTH and GOAT but his attitude differs greatly from the few women cited above. To him, in-group membership annihilates dislikes of an accent pertaining to the in-group: “if I was a Londoner and hearing a Tynesider I might eh say it's terrible that the way them talk eh you know but when you're amongst we it doesn't occur to you”. These comments confirm the presence of class-based language ideologies which relate to processes of sociolinguistic differentiation relating to the immediate local context. This also confirms the speaker's awareness of active maintenance of norms by close peer networks no matter the geographical area.

He adds that despite being on the phone or with colleagues from the south of England, his accent could only be altered for a very short amount of time: "[on the phone] I try and speak eh a bit more refined then all of a sudden it deserts us like and I'm back to normal again" [TLS interview G19M]. G19M & G30M (young millwright) indicate that changing their accent is not something they can choose nor aspire to do, either because their attitude towards a broad accent is not as negatively regarded probably due to its association with masculinity, or more simply, because of the network of male friends they belong to.

It is interesting to note that both working-class men and women style-shift but their attitudes also reflects the phonetic variants they adopt. Men have a more traditional way of speaking and fully accept broad Tyneside speech. Women frown upon broad Tyneside and wish everyone could talk the same: they favour supralocal/local variants. It is clear that the speakers in the TLS are more prone to differentiation from middle-class and more well-off people, with one admitting that moving to a "posh" area would result in being excluded from the rest of the neighbourhood (G05F, LMC). But what I found most striking was that within the working-class itself the sociolinguistic polarisation is enhanced by gender-based language ideologies which serve to differentiate.

So far, I have carried out a quantitative and qualitative analysis if the TLS material. I now proceed to an analysis of the PVC wordlist data using MFA so as to identify if there are signs of levelling across the 4 vowel sets.

PVC results: variation in the PVC wordlist

7.8 Data

The data includes productions of 32 speakers from the PVC corpus.[128] All speakers read a wordlist, which aimed at analysing both vowel and consonant variants of the speakers. Eight cohorts were constituted on the basis of class (working/middle class), age (younger/older) and gender (male/female). The vowels sets under scrutiny are FACE, PRICE MOUTH and GOAT. After several preliminary tests, we have also decided the pronunciation of the suffix –*ing* into the model using MFA as a supplementary data, since it is also strongly linked to the variation patterns of the data. The data included each individual speaker as an observation with the frequency of the vowels and consonant variants as variables. Class, age and gender counted as "supplementary qualitative variables" (Husson et al. 2010).

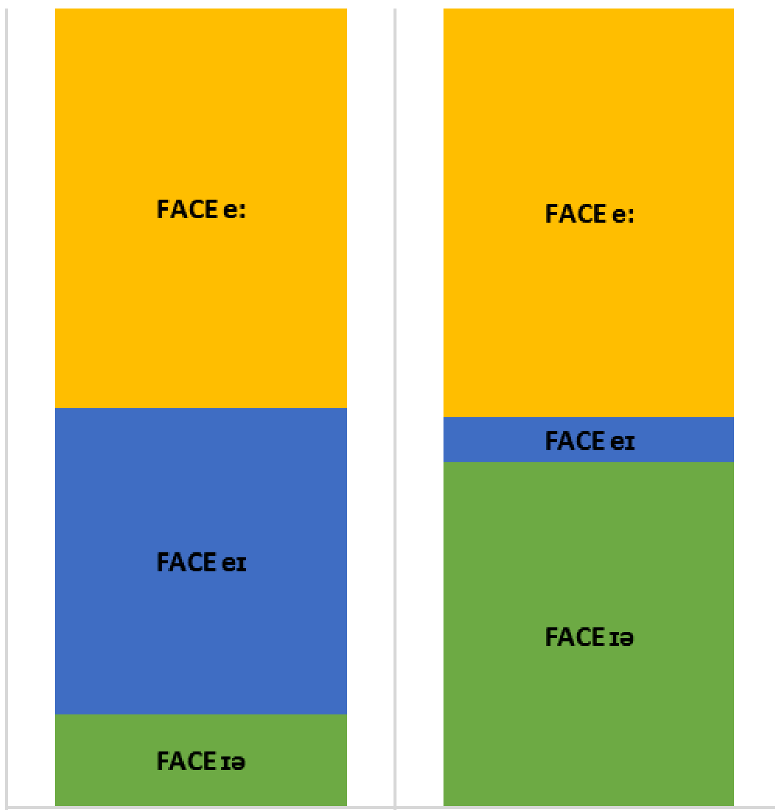
In this section, I proceed in a similar way to the TLS data analysis. I first present the overall proportions by lexical set, verify that MFA should be preferred to PCA and proceed to the MFA analysis and the clustering analysis based on the MFA.

[128] Preliminary results were presented during the 8th Northern Englishes workshop (Amand, 2018) but with a PCA analysis only. One speaker was missing (17BF) and MOUTH had not been included in the analysis. I chose to add the latter and found the missing speaker to enable comparison with her dyadic partner, 17AF.

7.9 Proportions of variants in FACE, GOAT, PRICE and MOUTH (PVC WL)

7.9.1 Variation in FACE

Percents of FACE variants are reported in Figure 7-56. Supralocal forms have similar scores across social classes but the most striking difference lies in the clear-cut choice of prestigious forms by middle class speakers and of traditional ones among the working-class (X^2 (2) = 42.39, p < .0001). There are probably a few atypical speakers in both classes because some in the MC have used the traditional form and some in the WC, a few closing diphthongs. The MFA analysis will help spot these speakers and check for other external affects.



	MC	WC
FACE e:	50,00%	51,18%
FACE eɪ	38,33%	5,69%
FACE ɪə	11,67%	43,14%

Figure 7-56 FACE variants by class PVC WL style (%).

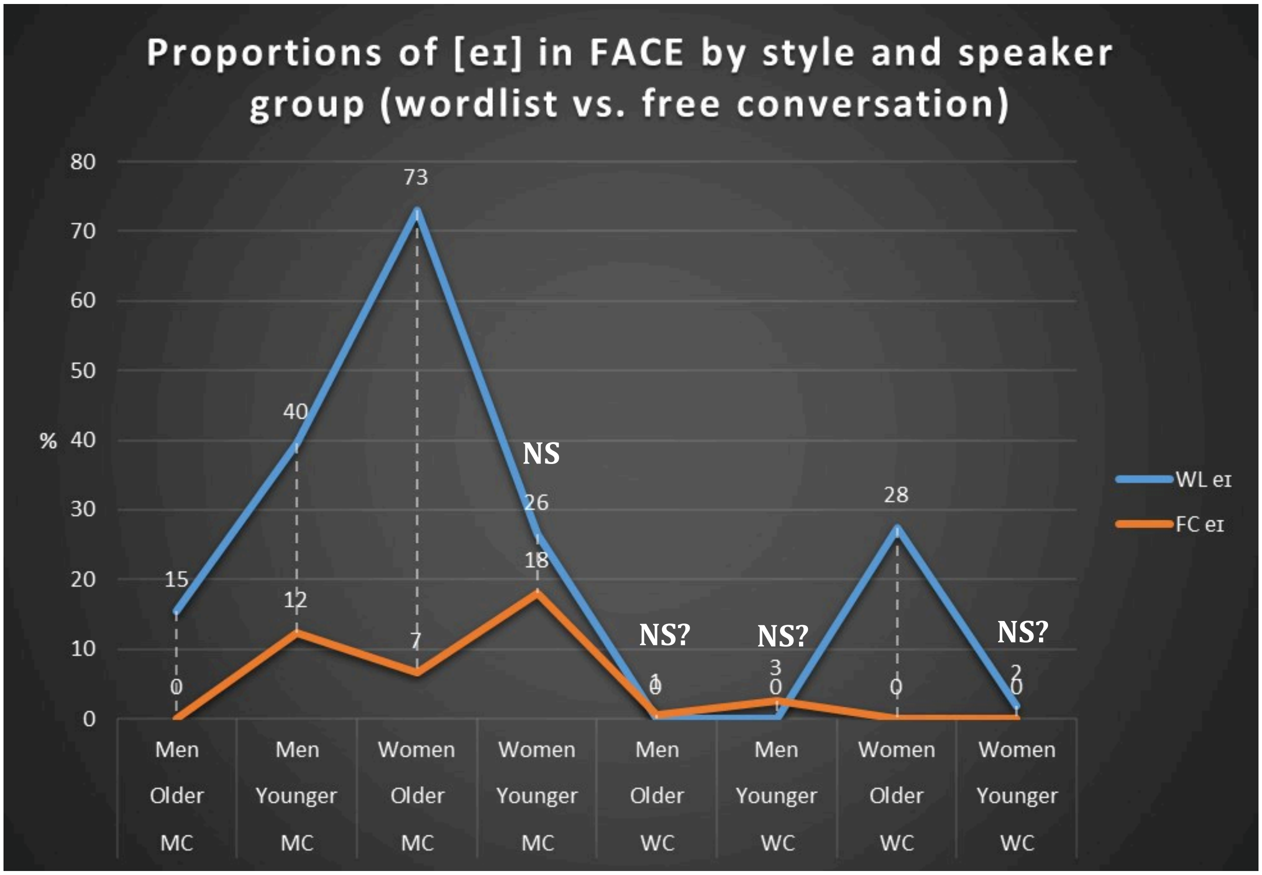


Figure 7-57 Percentages of closing diphthongs in FACE by style and speaker group. WL: wordlist, FC: free conversation, NS: not significant (proportion test[129]). In Watt 1998, p. 230[130].

The results for the centring diphthong in the WL are known to differ from the free conversation material because MC speakers and older WC women tend to style-shift. They significantly increase the number of centring diphthongs as the level of formality increases in the context of the reading task (Watt 1998, p. 230). Watt's results depicting the discrepancy between percentages in either style are reproduced in Figure 7-57. Taking style-

[129] Proportion tests require at least five occurrences, otherwise the test's approximation is rather poor (Agresti, 1990, p. 49). I chose to add a question mark after NS whenever a count was below 5.

[130] The data was reproduced thanks to the tables p. 223 (FC) & 228 (WL).

shifting into account will be crucial when comparing the PVC WL material with the TLS interview data as scores for the prestigious variant in the PVC WL are enhanced by the reading task among MC speakers and older WC speakers.

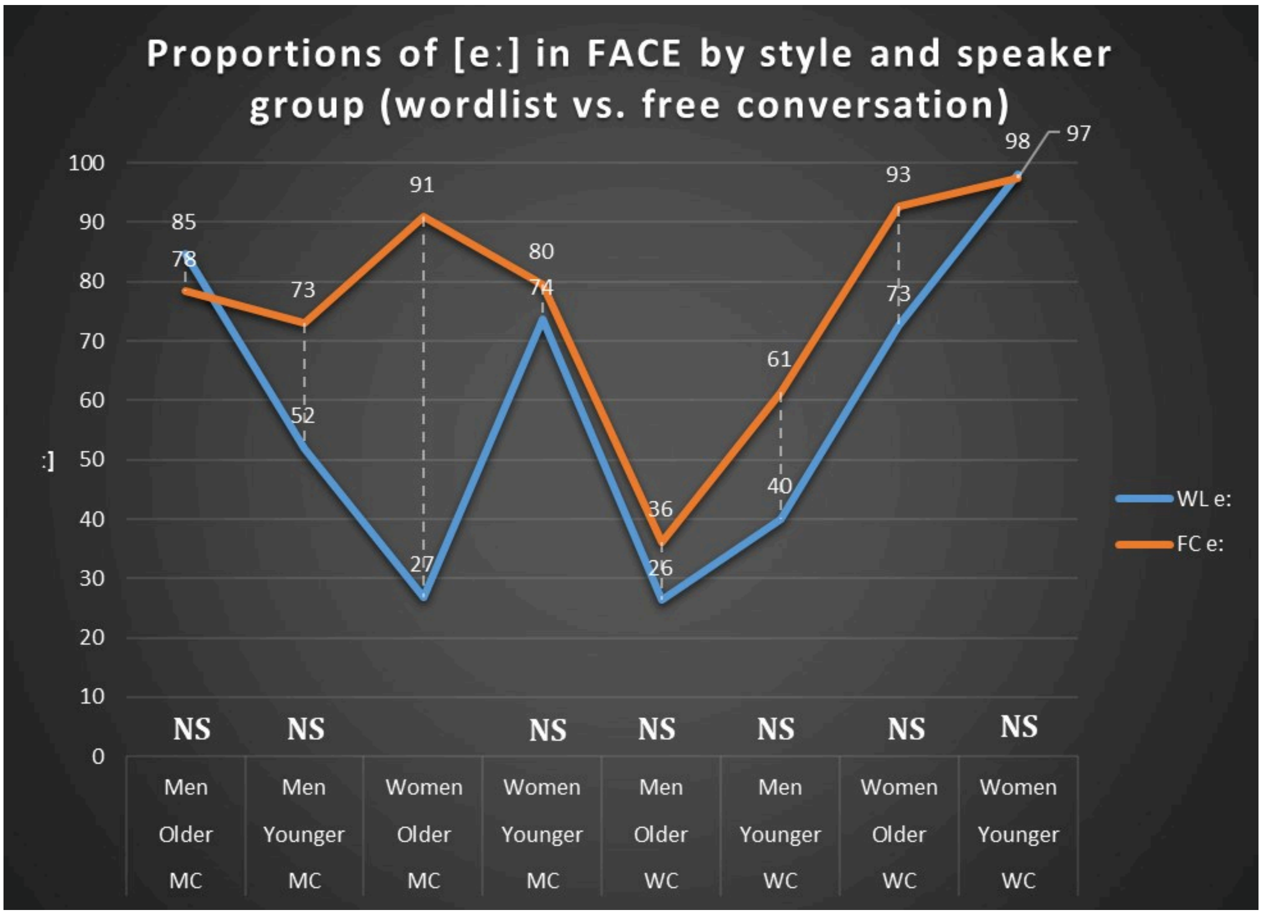
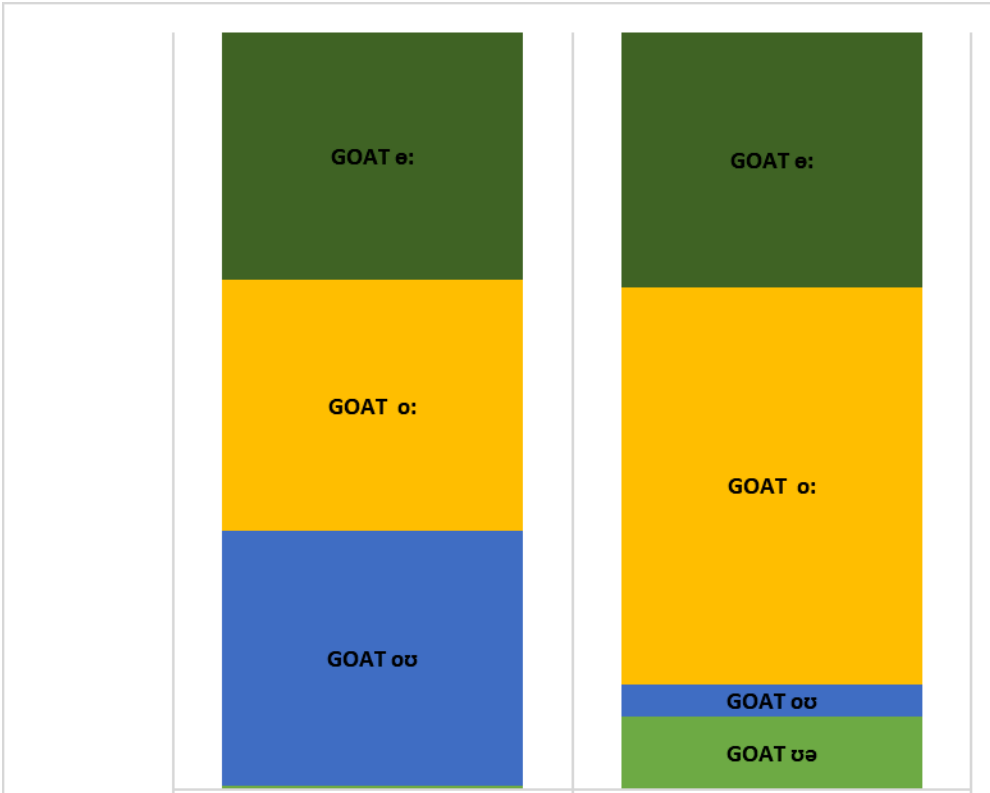


Figure 7-58 Percentages of monophthong [eː] in FACE by style and speaker group. WL: wordlist, FC: free conversation, NS: not significant (proportion test). Based on tables in Watt 1998, p. 223 & 228.

Style-shifting differences in the FACE variant [eː] are reported in Figure 7-58. Differences in style are not significant except among older MC women *(p* < .0001, 95% CI: 68.5-84.3). This means **that these women will be categorized as staunch above supralocal speakers in the MFA analysis**, while in fact, they should be placed in the supralocal group if one wishes to focus on the way they speak when placed in a more casual situation. The question of variant proportions by speaker group and that of style-shifting will be returned to in the discussion of GOAT variants in the next section.

7.9.2 Variation in GOAT

The GOAT vowel has a fourth variant, which slightly alters its variational symmetry with FACE (Watt 1998). Figure 7-59 compares the GOAT variants by class cohort. At first sight, only the prestigious closing diphthong demonstrates the same patterning as FACE. This can be ascribed to the fact that speakers who adopt above supralocal forms use a more reduced number of variants (Watt & Milroy, 1999, p. 41) per vowel contrarily to supralocal or traditional speakers, thereby making their use of the prestigious forms pattern in a similar way across each social class and each lexical set. The central monophthong [ɵː] has equivalent scores in either class but it is mostly produced by younger men. In the working class, the proportion of the supralocal monophthong [oː] is well above chance level.



	MC	WC
GOAT ɵ:	32,67%	33,69%
GOAT o:	33,24%	52,41%
GOAT oʊ	33,52%	4,28%
GOAT ʊə	0,57%	9,63%

Figure 7-59 GOAT variants by class PVC WL style (%).

Figure 7-60 and Figure 7-61 charts the ratios of face variant use by speaker cohort and style. In Figure 7-60, the focus is on the prestigious variant [oʊ]. In conversational style, the variant is found only among women and younger men. During the reading list, style-shift is obvious among older women of both social classes and among young middle-class men. Younger women of both classes do not style-shift and remain steady in their use of the locally prestigious pan-northern variant [o:] (Figure 7-61). This means (1) that their position in the MFA & cluster analysis based on the WL also reflects their speech pattern from the conversational style, and (2) that a comparison with an equivalent cohort from the TLS material will be reliable. More details will be provided in MFA 6 on the traditional variables.[131]

[131] For more details, cf. Watt 1998, p. 232 ff.

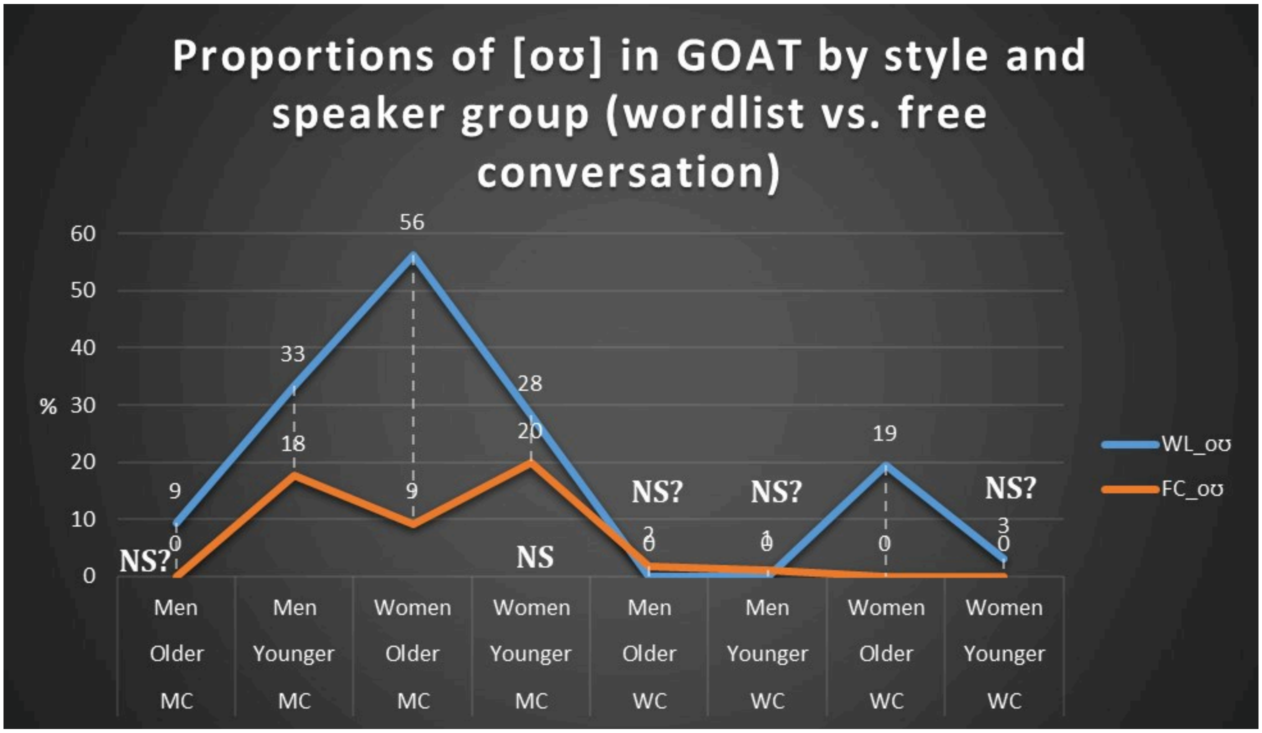


Figure 7-60 Percentages of monophthongal [oʊ] in GOAT by style and speaker group. WL: wordlist, FC: free conversation, NS: not significant (proportion test). Reproduction of Figure 7-15 in Watt 1998, p. 241[132].

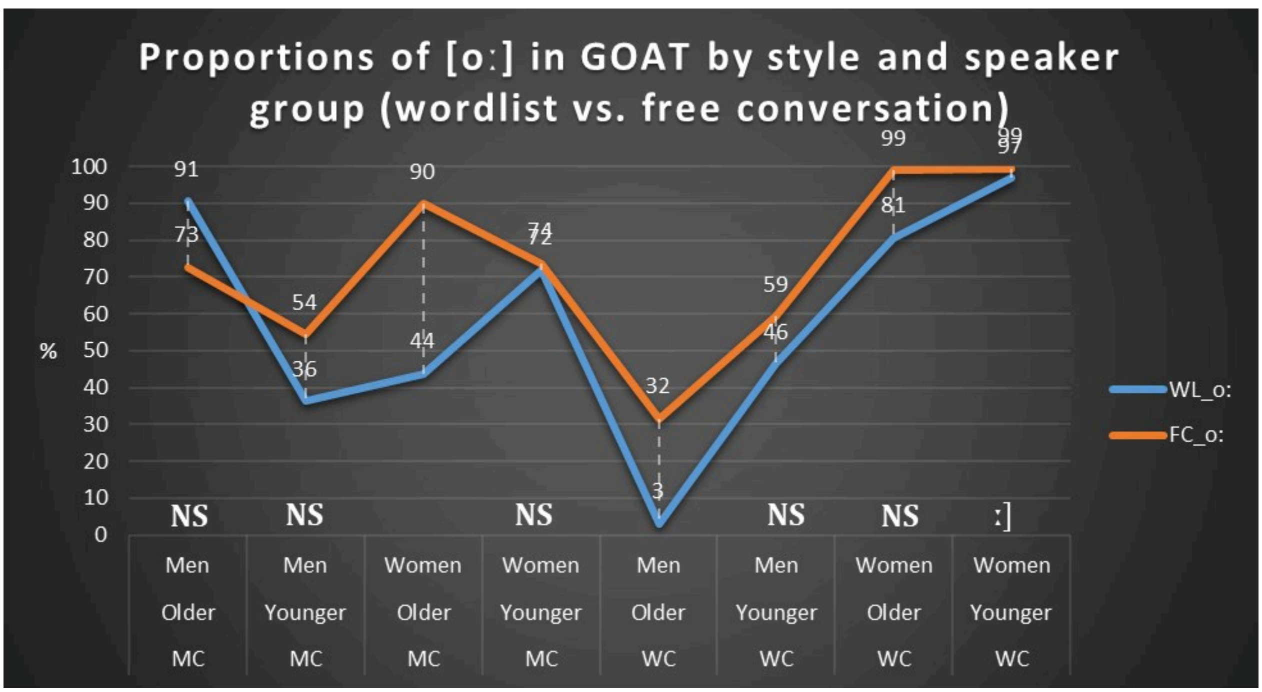


Figure 7-61 Percentages of monophthong [oː] in GOAT by style and speaker group. WL: wordlist, FC: free conversation, NS: not significant (proportion test). Reproduction of Figure 7-14 in Watt 1998, p. 241[133].

7.9.3 Variation in MOUTH and PRICE

Only a handful of variants were recorded for the MOUTH set in the PVC wordlist as Figure 7-62 illustrates. Raised onsets are very rarely used and should be even less so, if two female speakers in either class did not have atypically high scores for this variant. Variation is not determined by class in this set (X^2 (1) = 0.03, p=0.86).[134]

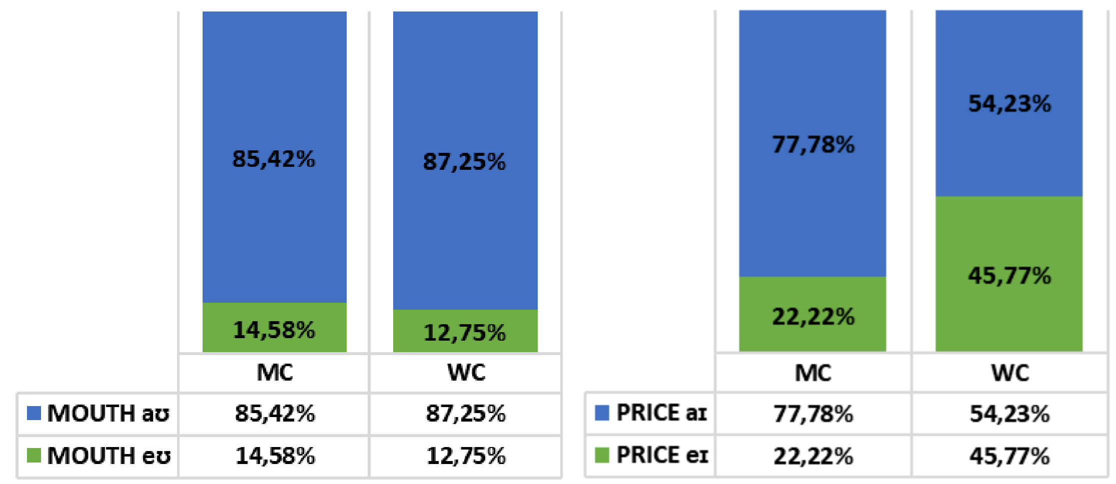


Figure 7-62 Percents of PRICE & MOUTH variants (low vs. high onset, PVC wordlist).

Raised onsets in PRICE are much more frequent across speakers. A Chi-square test confirmed the lack of similarity in proportions between the two classes (X^2 (1) = 11.33, $p < .001$). The MOUTH variant [eʊ] in the PVC has its score dwindle considerably compared to proportions found in the TLS, where it is particularly frequent among women. This could be

[132] The exact figure was reproducible as it is based on the frequency tables p. 233 & 239 in Watt 1998.
[133] The exact figure was reproducible as it is based on the frequency tables p. 233 & 239 in Watt 1998.
[134] The p-value was obtained by performing a proportion test.

ascribed to the formality of the reading style. Looking at the proportions in the reading list might suggest that there is an affect of style. However, the two TLS young WC women whose wordlist was retrievable used the raised onset systematically in both styles. Whereas 5 in 8 older WC women used it systematically (4/8) or only half of the time (1/8). In the interview material, most of them used the raised variant above 70% of the time except for G32F who favours the prestigious variant (the school cook supervisor). This demonstrates that style-shifting is enhanced among older women and that younger women tend to remain constant in both styles.

7.10 Apparent time-study 2 of the PVC FACE, GOAT, PRICE and MOUTH variants (wordlist material)

7.10.1 Preliminary step (1): is MFA better suited for analysing variation in the PVC?

It is possible to verify which analysis would be better suited for the PVC data, namely, should we perform a PCA or an MFA? Canonical coefficients are useful indicators and are detailed in depth in Pagès (2013, p. 124). If two groups of variables have high coefficients in the same dimension, we can say that some linguistic patterns operate in lockstep among these two groups. The latter are said to share “common factors” (Pagès 2013, p. 124). An MFA is advisable in this case. As reported in Table 7-20, the highest coefficients for FACE, GOAT are in dimension 1 and their value is very similar (0.94 & 0.93 respectively). The two sets are therefore *common factors*. PRICE is best represented in dimension 1 but the coefficient is lower than the former. This implies that there is some sort of symmetry with FACE and GOAT but it is somewhat looser. MOUTH has its highest score in dimension 3 contrarily to the rest of the lexical sets, which means it has a variational logic of its own. **The PVC wordlist material is therefore better suited for an MFA analysis than for a PCA analysis because variation in the lexical sets operates with some degree of linguistic symmetry**. The table also points at the necessity to explore dimensions 2 and 3 to investigate the respective dynamics between FACE and GOAT and MOUTH alone. Let us now observe which vowel exponents tend to co-occur, thereby making major trends apparent.

Table 7-20 MFA canonical coefficients (range: from 0 to 1). PVC wordlist material, 4 sets.

SETS	DIM 1	DIM 2	DIM 3	DIM 4	DIM 5
FACE	**0.94**	**0.86**	0.41	0.25	0.21
GOAT	**0.93**	**0.89**	0.37	**0.76**	0.29
MOUTH	0.11	0.42	**0.83**	0.19	0.28
PRICE	**0.73**	0.17	0.49	0.05	0.44

7.10.2 Preliminary step (2): dimensions enhancing variation across the 4 sets (PVC WL)

Explained variation in dim 1

Dim 1 & 2 contribute to explain 61.9% of the variation (Figure 7-63). Husson et al. (2011) suggest that an ideal score for dim 1 is about 21% when the model has 12 variables and 35 observations.[135] In the PVC data, the score is 34.4% for 11 active variables. The score is therefore well above the rule of thumb for dim 1. The proportion of variance explained slows down considerably after the 4th dimension. This means that the default parameters of keep 5 dimensions for the MFA & cluster analysis is enough.

[135] As mentioned earlier, this ideal score is based on simulated datasets with a simpler structure analysed with PCA and not MFA, but it provides a general idea on the quality of the PVC model.

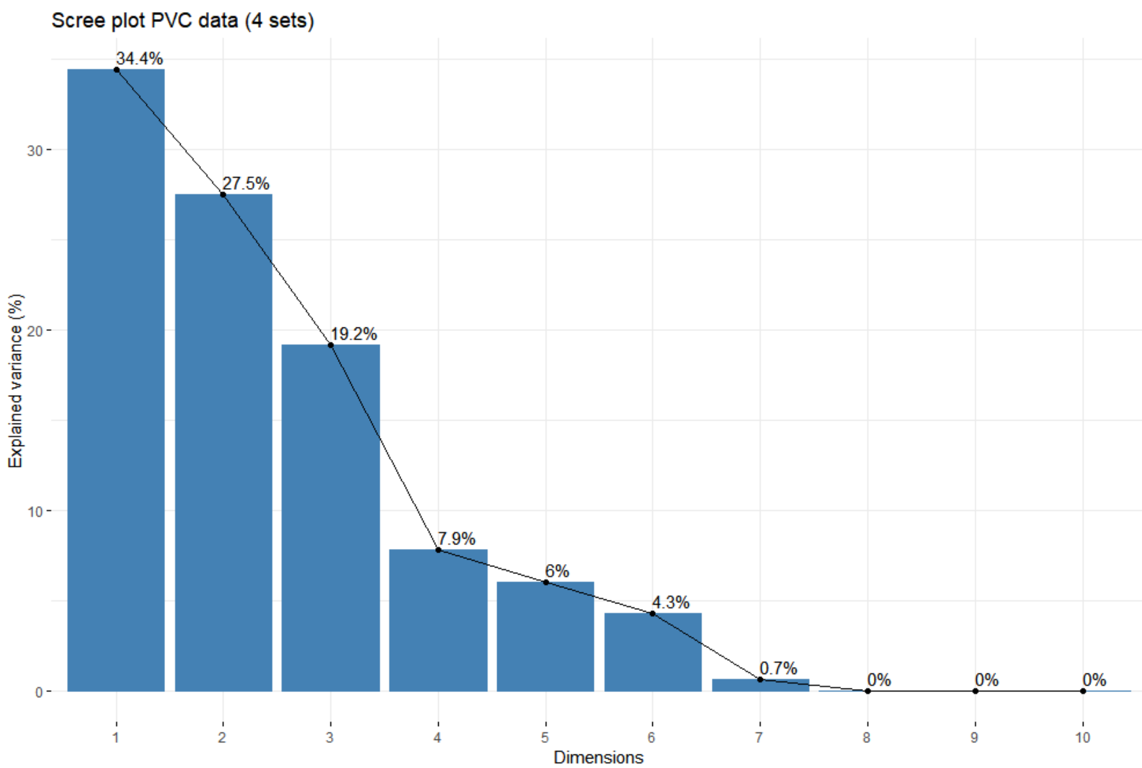
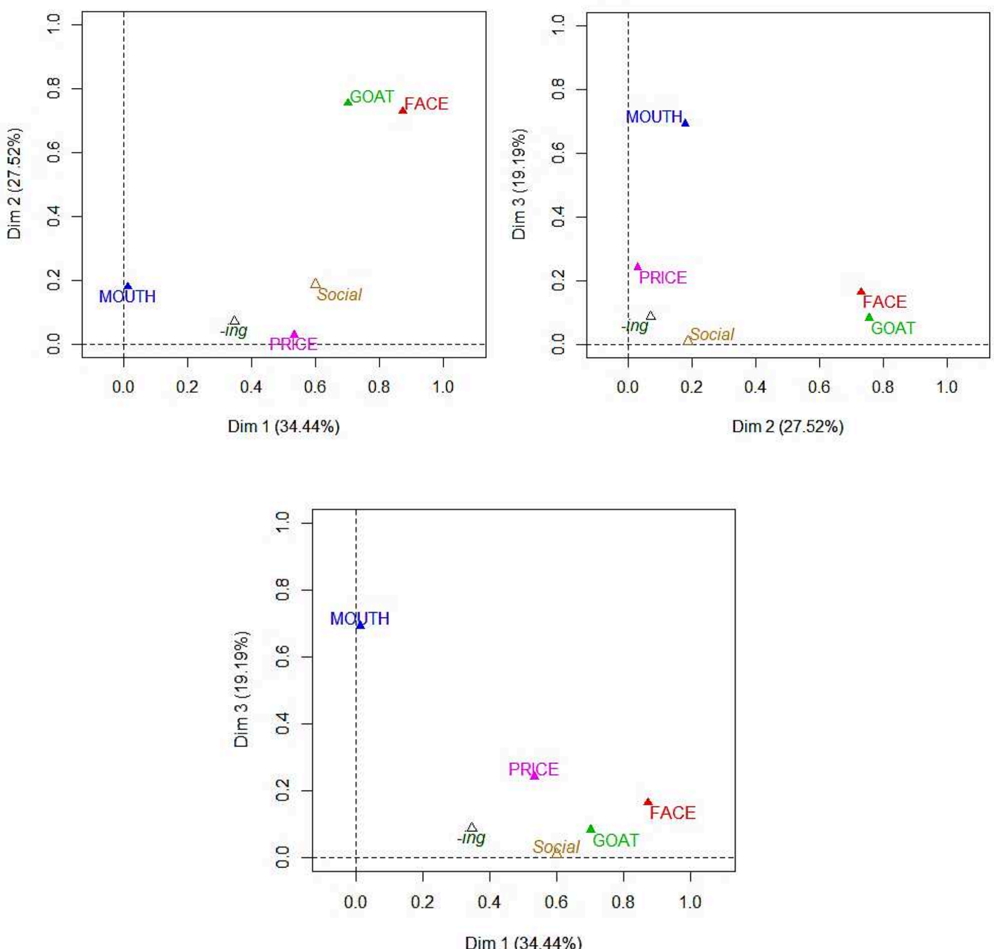


Figure 7-63 Scree plot PVC data (4 sets).

Dimensions that best represents the symmetry across the 4 sets

Looking at the graphs showing the importance of the lexical sets per dimension in Figure 7-64 will tell us in which dimensions the 4 lexical sets are best represented simultaneously. This means that when the speakers will be plotted on the factor map, they will be placed according to their scores on the 4 sets and not just 2 for instance. In graph (1), only FACE and GOAT are used to distinguish the speakers in dim 1 & 2. In graph (2), MOUTH is high on dim 3, FACE and GOAT, on dim 1 but PRICE is too low. The best compromise is graph (3) because all 4 sets have a reasonably high score. In the following analysis, dim 1 & 2 will be used to study FACE and GOAT, and dim 1 & 3, to study all 4 sets. Dim 1 will also be helpful in taking into account the social variables because it is where they have the highest contribution score (0.6 in dim 1 vs. 0.2 in dim 2).



(1) (2) (3)

Figure 7-64 Contributions of the 4 lexical sets per pairs of dimensions: looking for the ideal symmetry.

Now that the dimensions have been examined with regards to their contribution to the overall variational structure and to the sociolinguistic variables, I turn to an analysis of the co-occurrence of variants in the PVC WL corpus.

7.11 Coherence: overall symmetry of variants in the 4 lexical sets (PVC WL)

The present section explores co-occurrence in dim 1 & 2 because this is where the major variational trends are but it will also examine dim 1 & 3 to highlight those pertaining to the 4 sets simultaneously.

7.11.1 Co-occurrence in FACE, GOAT, PRICE & MOUTH (PVC WL)

In Figure 7-65, the high prestige and pan-northern variants co-occur and the arrows for FACE and GOAT are very close to one another. This means that when speakers use the closing diphthong in FACE, they will almost exclusively use the closing diphthong in GOAT too, which is fully in line with Watt's results showing that the two vowels work in lockstep (Watt, 1999). As to the traditional features of GOAT, however, results are more complex because there are 2 variants as opposed to one recorded for FACE. But overall, traditional speakers are coherent in their variation of FACE and GOAT.

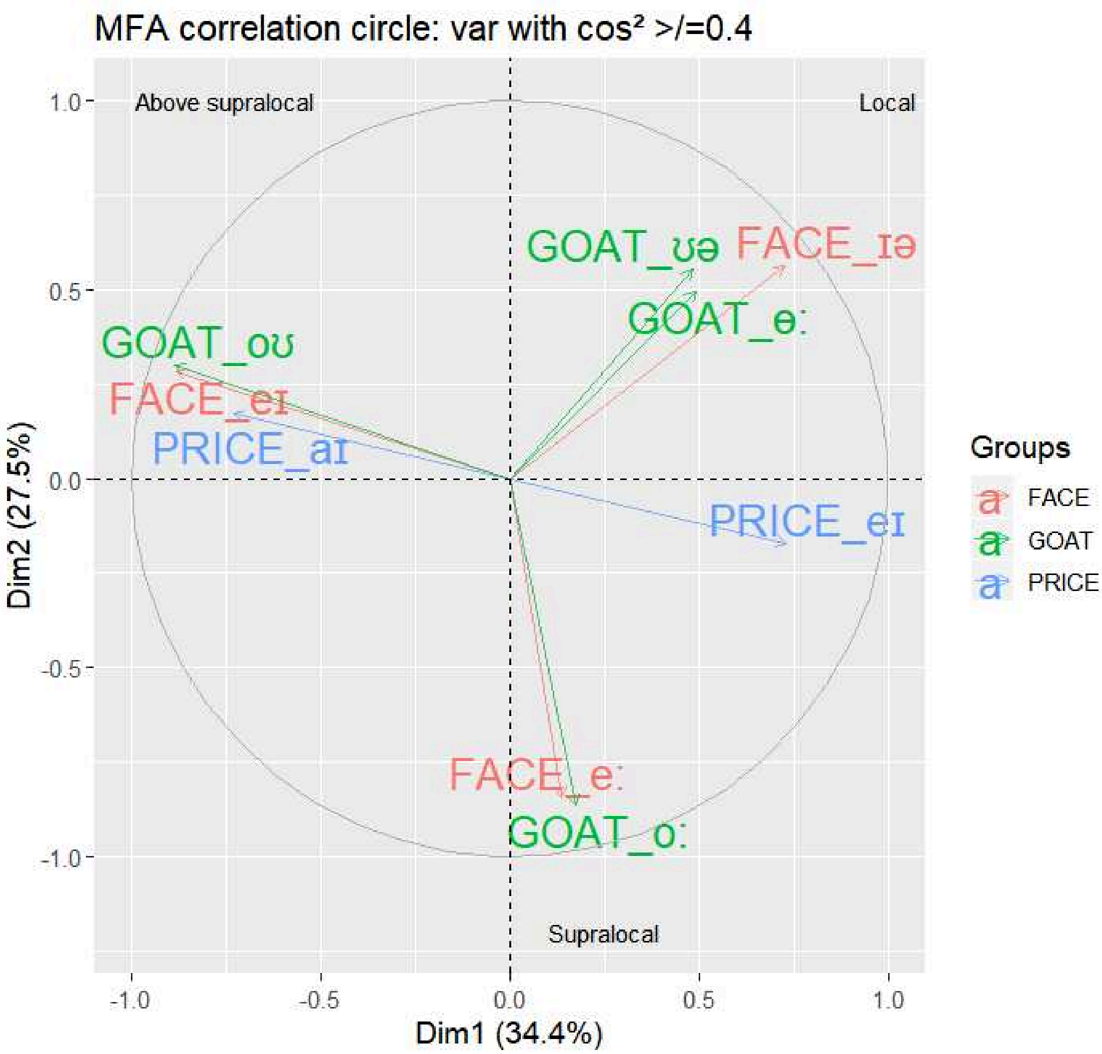


Figure 7-65 Correlation circle PVC wordlist material: focus on FACE, GOAT and PRICE (dims 1 & 2).

The PRICE set is less well represented by these dimensions, but we can observe that a low onset is generally favoured by the above supralocal speakers, while the supralocal and traditional speakers in FACE and GOAT tend use similar amounts of raised onset. This explains why the arrow representing the raised onset in PRICE is placed in between the traditional and supralocal speakers.

Dimensions 1 and 3 are of interest because together, they highlight interactions between all lexical sets (Figure 7-66). Onsets in MOUTH and PRICE are slightly positively correlated with their raised on lower counterparts and variation patterns in MOUTH are less clear than the other sets.[136] Unlike PRICE, a raised onset in MOUTH is not clearly linked to the working class (J. Milroy, 1996) or any specific speaker profile with the exception that it is mostly heard among women. This can be ascribed to the fact that vowel realisations of MOUTH with a low or back onset were grouped together, unlike the TLS which made a distinction between [aʊ] and [ʌʊ]/[ɔʊ]. It was harder to distinguish the mid-low onsets from the back onsets but a discrimination between a raised/fronted and a low/back onset was easier probably because of a potential *perceptual magnet effect* going on during the auditory analysis of these vowels and so, despite the help of a spectrogram (see Feldman, Griffiths, & Morgan, 2009; Kuhl, 1991).

[136] It may be necessary to verify whether the retracted onset in MOUTH, which typical of the traditional male speakers, is not a relevant sociolinguistic variant.

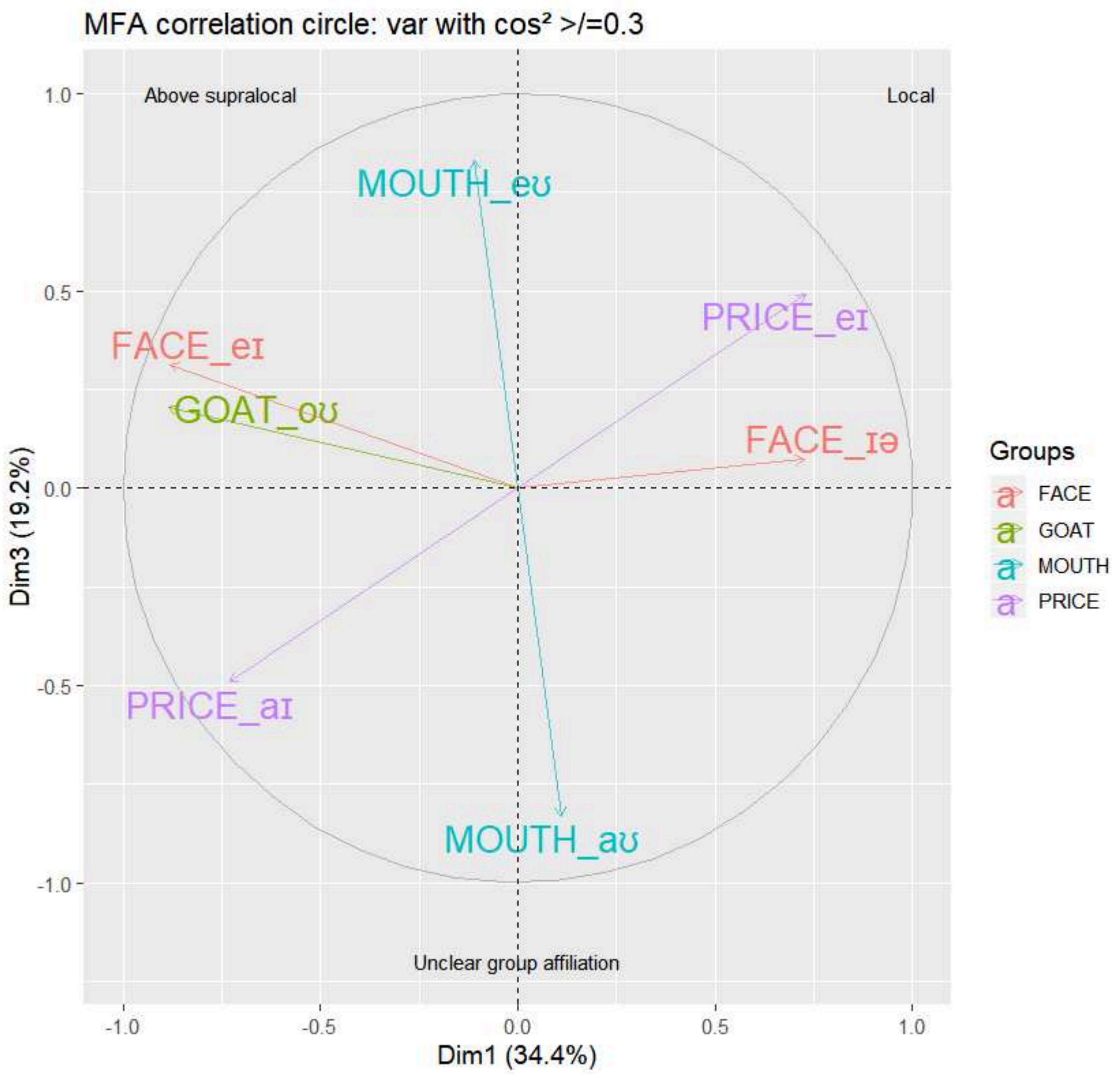


Figure 7-66 Correlation circle PVC wordlist material: focus on MOUTH and PRICE (dims 1 & 3).

In this section, co-occurrence patterns have been identified. Judging by the correlation circle, patterns in FACE, GOAT & PRICE correspond to the three main trends: above-supralocal, supralocal and traditional. Variation in MOUTH is less clearly identifiable contrarily to the TLS data. A cluster analysis is now performed to identify sociolinguistic groups and sub-groups of speakers.

7.12 Sociolinguistic stratification and interactionality among PVC speakers (PVC WL)

The present section examines which speakers correspond to each of the three speaker profiles identified in the correlation circle, i.e. above supralocal, supralocal and local. The affiliation is represented graphically in Figure 7-67. First, we notice a wider gap between the first group of speakers on the left (5 women and 1 male only, 19% of all speakers) and the rest of the speakers which are themselves divided into two major sub-groups: one with 11 men and one female (37%) and the largest one with 10 women and 5 men, thus accounting for 47% of the speakers. Within the last 2 clusters, a sub-division into 3 groups is obvious and suggests the need to cut the tree lower to observe variation patterns within each sub-group in more depth.

The external factor gender sharply divides the speakers and not all same sex dyads are in the same cluster like 09AM & 09BM or 13AF & 13BF. All 3 mixed sex dyads have their speakers in distinct clusters, namely 04AM & 04BF and 05AM & 05BM who are husband and wife and 06AF & 06BM who are siblings.

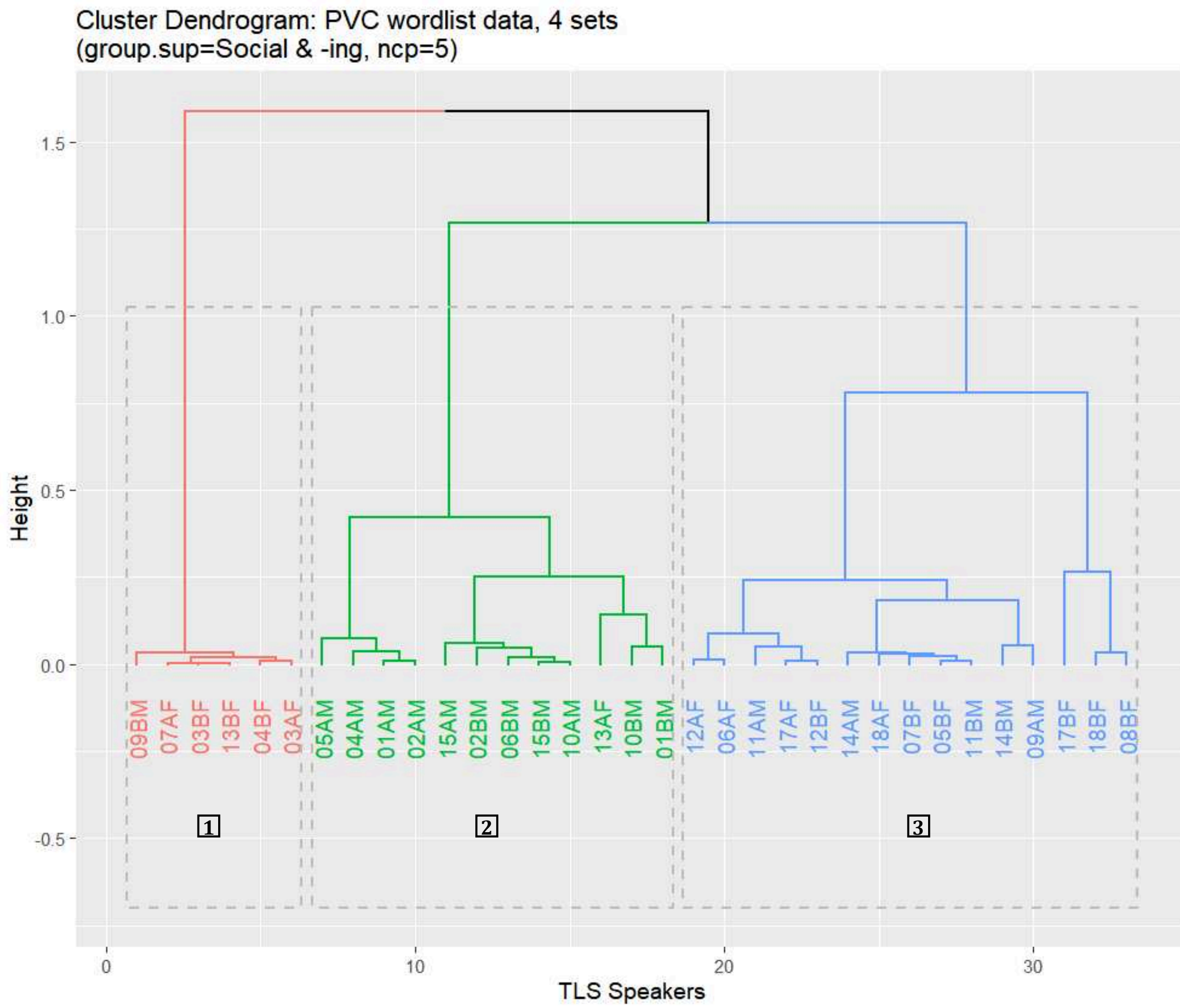


Figure 7-67 Tree based on MFA analysis of PVC wordlist material.

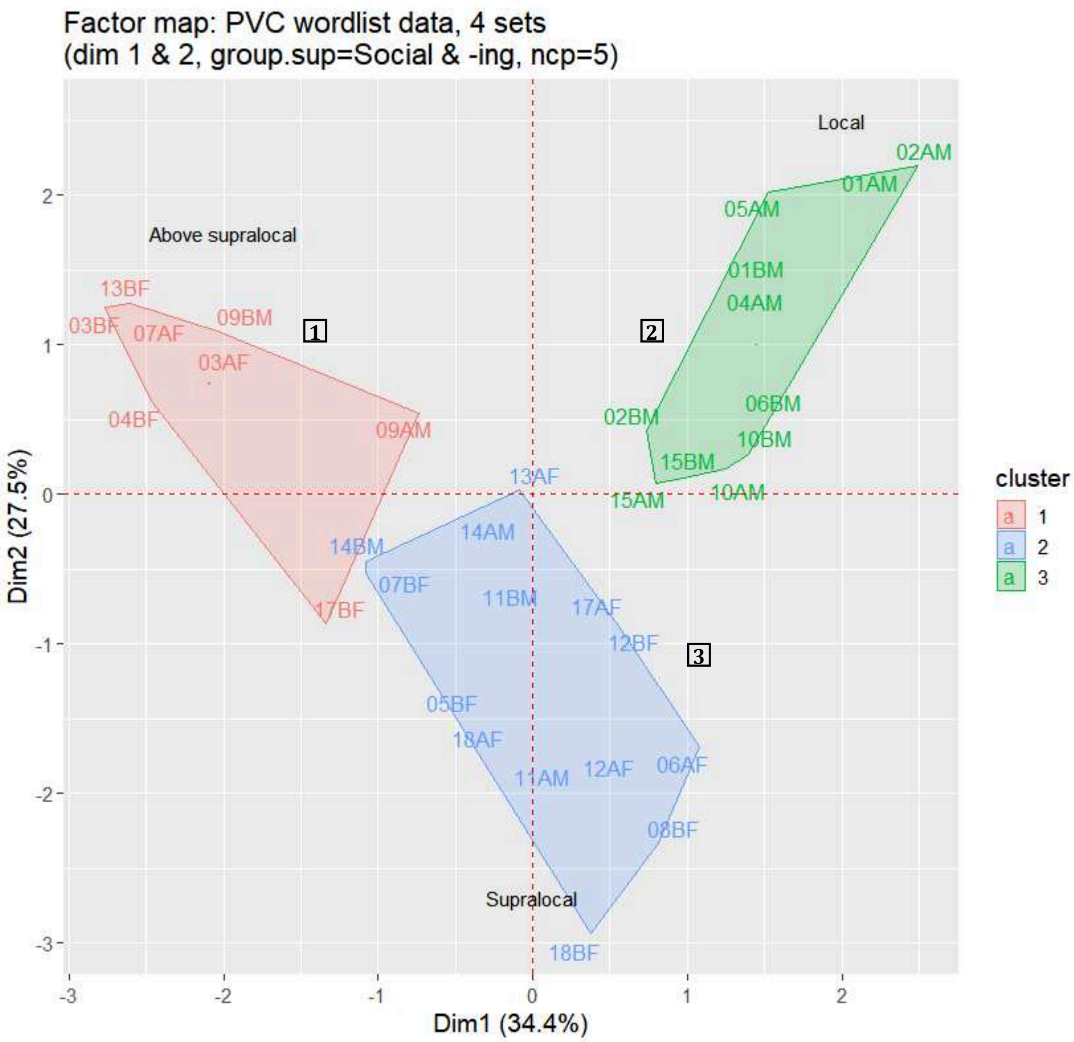


Figure 7-68 Factor map with clusters based on MFA analysis of PVC wordlist material.

So far, the tree could not tell us the linguistic profile of the speakers but with the factor map (Figure 7-68), we now learn that cluster 1 corresponds to speakers using high prestige variants. Men on the right are the traditional speakers (cluster 4). The three major speaker profiles found in Watt (1998) are clearly brought to the fore by the default parameters of the MFA.

Interestingly, while 13BF is a speaker that uses a lot of high prestige variants, 13AF is placed very close to where both zeros cross. This means that her profile is at the crossroads of all three accents profiles (above supralocal, supralocal and local). 03BF, 18BF and 02AM are the most extreme speakers with the highest scores of vowel exponents pertaining to their group – above supralocal, pan-northern and traditional respectively. They are somewhat the stereotypes of their respective groups. 17BF is in-between the above supralocal and supralocal profiles, while 09AM uses a few pan-northern and traditional features despite using a small majority of high prestige variants.

7.12.1 Social profile of the clusters: external factors

Figure 7-69 demonstrates that all social variables account for the distribution of the variants in FACE, GOAT and PRICE in dim 1 & 2 – MOUTH being less well represented by the first two dimensions. Most women are either supralocal or above, whilst men are either local or very local. The opposition between the middle class (left) and the working class (right) is represented along a horizontal axis and so is the external factor age. But since the centroids of younger and older speaker are relatively close to each other, the variable may not have a strong overall effect on variation across all 3 sets. Finally, the interaction between gender and class is rendered obvious in this data and is in line with the founding by Trudgill on variation in -*ing* in Norwich English (Trudgill, 1972). What is interesting though, is that the pan-northern speakers seem to alternate between both forms. However a more specific focus on the 4 lexical sets precludes further discussion of such effects.

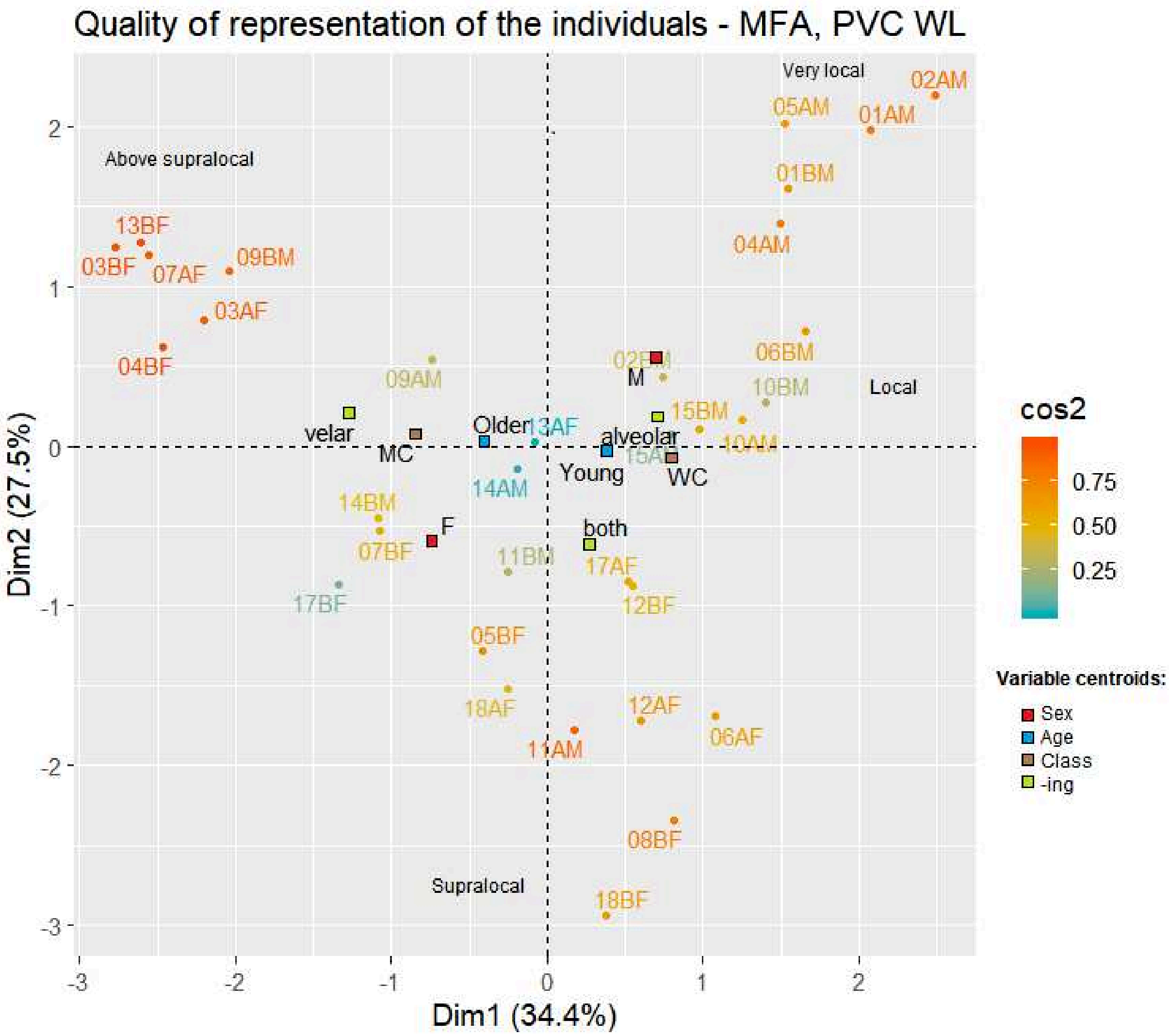


Figure 7-69 Quality of representation of the individuals: social variables & *-ing* (PVC WL).

So far, we have interpreted the role of the social characteristics of the speakers with the help of a factor map, yet we do not know which of these variables significantly determine variation in this sample. I now turn to consider the cluster diagnostics for the social and linguistic data to check how the PVC speakers are sociolinguistically stratified.

7.12.1.1 Overall effect of the social variables (with –*ing* as supplementary variable)

Sex and class are the two significant external factors for the PVC wordlist when the tree is cut into 3 main groups. The primacy of gender over class is confirmed and aligns with Watt & Milroy (1999)'s investigation of the PVC material, despite the fact that each vowel variant (FACE, GOAT and NURSE) was analysed separately.

Table 7-21 Overall effect of the social variables.

SOCIAL & LINGUISTIC VAR	P-VALUE	DF
SEX	< .001	2
CLASS	< .05	2

7.12.1.2 Effect of the social variables by cluster (with –*ing* & social as supplementary variables, k=3)

The cluster diagnostics of the social variables reveal the effect of class for clusters 1 and 3 (Table 7-22). Those adopting the high prestige variants (cluster 1) are overwhelmingly middle class, regardless of gender as opposed to those with a more traditional pronunciation who are exclusively men and mainly working class. As anticipated, exclusive use of the velar or the alveolar form of the bound morpheme -*ing* is class polarised with middle-class and working-class men at either end but variation is less clearly defined in the group of women in cluster 2. Although age appears as slightly determinant on the graph (Figure 7-69), it was not significant in this model with 3 clusters.

Table 7-22 Contribution of the social variables per cluster (v-test critical value = 1.96, k=3).

Social var.	% in cluster 1	p-value	v-test
Middle class	87.50% (in full sample: 48.48%)	< .01 *	2.41
-*ing*: velar only	62.50% (in full sample: 30.30%)	< .0.5	2.05
	% in cluster 2		
Female	71.43% (in full sample: 48.48%)	< .0.5	2.15
	% in cluster 3		
Male	100% (in full sample: 51.51%)	< .0001 ***	4.00
Working class	81.81% (in full sample: 51.51%)	< .01 *	2.36
-*ing*: alveolar only	72.72% (in full sample: 45.45%)	< .01 *	2.10

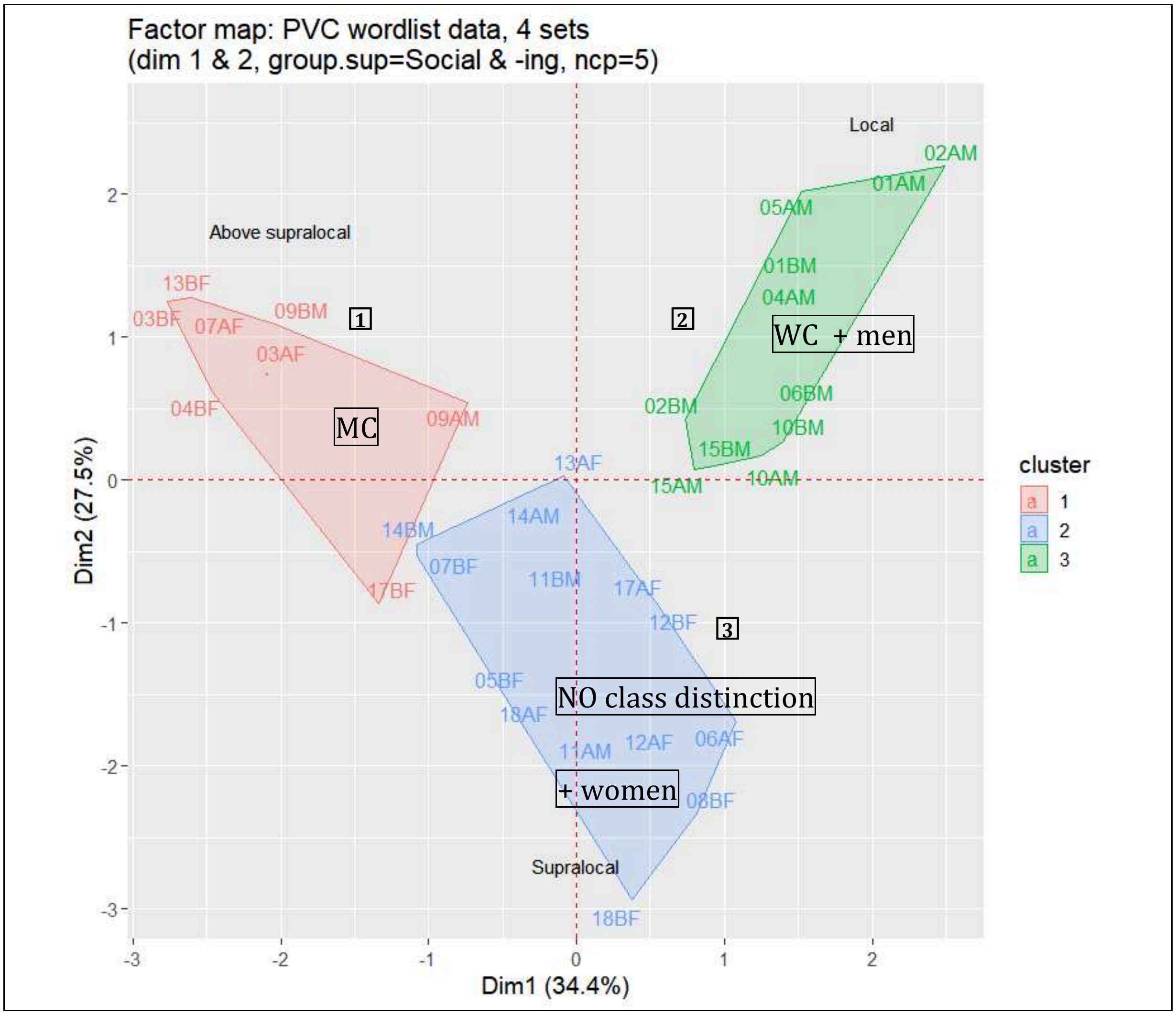


Figure 7-70 Factor map displaying the significant social variables (class & gender) in the PVC WL.

7.12.1.3 Overall effect of the linguistic variables (with –ing as supplementary variable)

The overall cluster diagnostic for the linguistic variables is displayed in Table 7-23. At this level of speaker groups, MOUTH is not a significant determinant of sociolinguistic groups in the PVC sample. All of the variants from the other lexical sets are, which suggests that FACE, GOAT, and to a lesser extent PRICE, contribute to the separation of speakers into the above supralocal, the supralocal and traditional clusters.

Table 7-23 Overall effect of the vowel variables (k=3).

Phonetic variable	P-VALUE
FACE [eɪ]	8.98E-19 ***
GOAT [oʊ]	1.01E-12 ***
FACE [ɪə]	3.02E-12 ***
FACE [eː]	5.26E-11 ***
GOAT [oː]	p < .0001 ***
GOAT [ɵː]	p < .01 *
GOAT [ʊə]	p < .05
PRICE [eɪ]	p < .05
PRICE [aɪ]	p < .05

This overall table tells us that speaker clusters are defined by these variants but it does not tell us which variant characterises which cluster. Let us now inspect the cluster diagnostic for each individual cluster.

7.12.2 Linguistic profile of speakers: FACE, GOAT, PRICE and MOUTH

7.12.2.1 FACE and GOAT best determine the three main cluster

The diagnostics for each cluster are listed in Table 7-24 and are reported onto the factor map in Figure 7-71. They confirm what was indicated by the correlation circle: FACE and GOAT variation patterns are symmetrical. Speakers in clusters 1 & 3 have more clear-cut choices with regard to PRICE. The above-supralocal group uses the low onset significantly more than average (83% vs. 66%), while the traditional one uses the raised onset more (51% vs 34%). No PRICE variants are recorded in cluster diagnostic for the supralocal speakers. This can either mean that speakers in this cluster use both variants indiscriminately or that a few speakers favour the raised onset and others, the low onset. In each cluster FACE is the main determinant, which means that if one wishes to build 3 sociolinguistic groups based on a single-feature, it should be FACE.

Table 7-24 Vowel variants contributing to the creation of the clusters (ncp=5, red: top predictor).

Phon var.	% in cluster 1 (above supralocal)	p-value	v-test
FACE [eɪ]	78.33% (av. 21.51%)	< .0000001 ***	5.46
GOAT [oʊ]	61.90% (av. 18.46%)	< .000001 ***	5.17
PRICE [aɪ]	83.33% (av. 65.65%)	< .05	2.17
Phon var.	**% in cluster 2 (supralocal)**	**p-value**	**v-test**
FACE [eː]	85.48% (av. 50.60%)	< .000001 ***	5.01
GOAT [oː]	71.10% (av. 43.11%)	< .0001 ***	3.93
Phon var.	**% in cluster 3 (local)**	**p-value**	**v-test**
FACE [ɪə]	71.51% (av. 27.88%)	< .000001 ***	5.13
GOAT [ɵː]	56.20% (av. 33.19%)	< .001 ***	3.33
GOAT [ʊə]	14.88% (av. 5.23%)	< .01*	2.87
PRICE [eɪ]	51.01% (av. 34.35%)	< .05	2.55

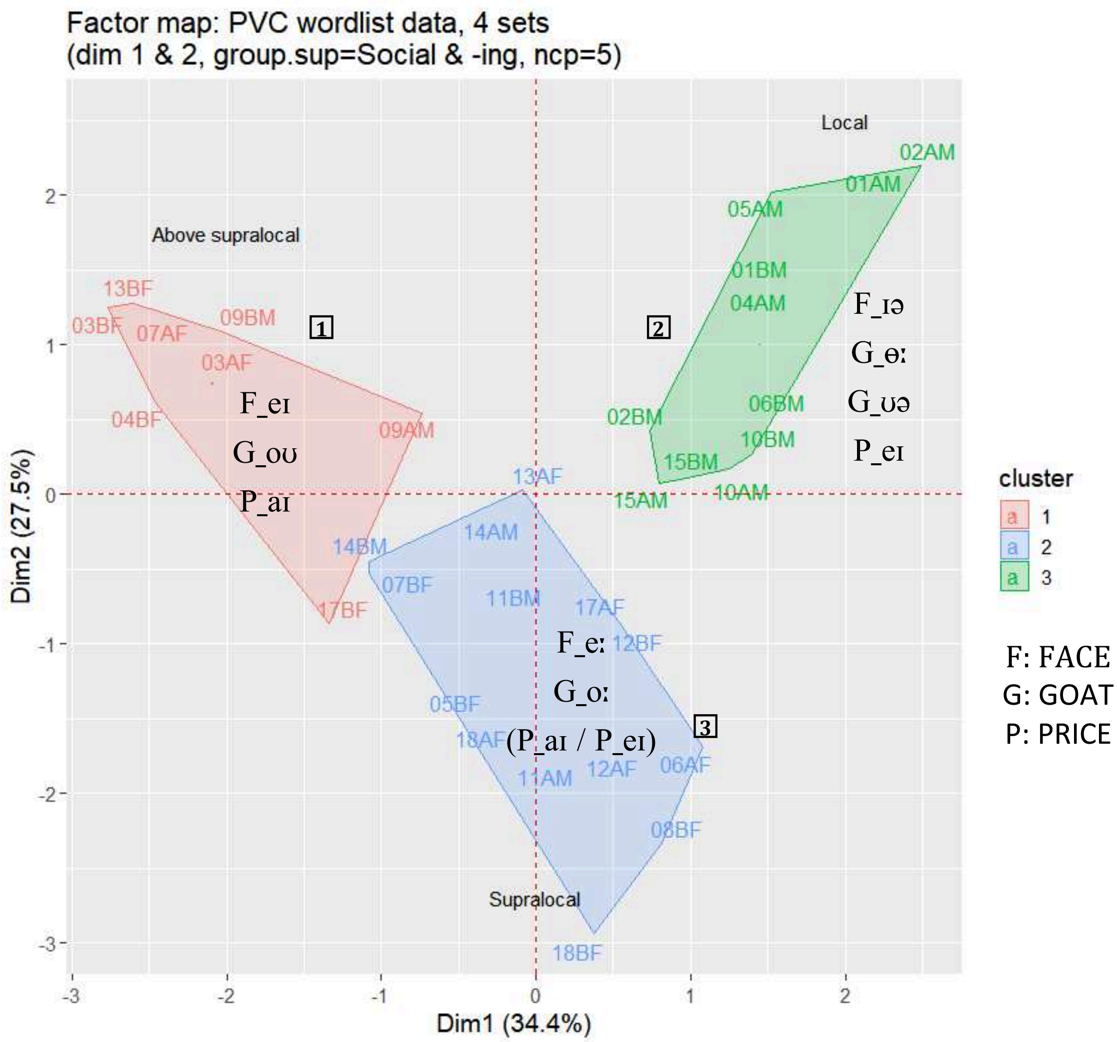


Figure 7-71 PVC factor map displaying the significant linguistic variables.

So far, only the general trends have been uncovered by the MFA analysis with default parameters. However, on the factor maps in Figure 7-68 & Figure 7-72, there appears to be two supralocal groups: one is much closer to the above-supralocal group, while other speakers are aligned with the local speakers on dimension 1. This suggest that there may be two types of supralocal speakers. Likewise, the group of traditional men is quite spread out, which means that the male speakers near the zero axis use more supralocal forms than 02AM for instance. Similarly, 09AM & 17BF are clearly much closer to the supralocal groups but their proportions of high prestige variants may be slightly higher than those in cluster 2.

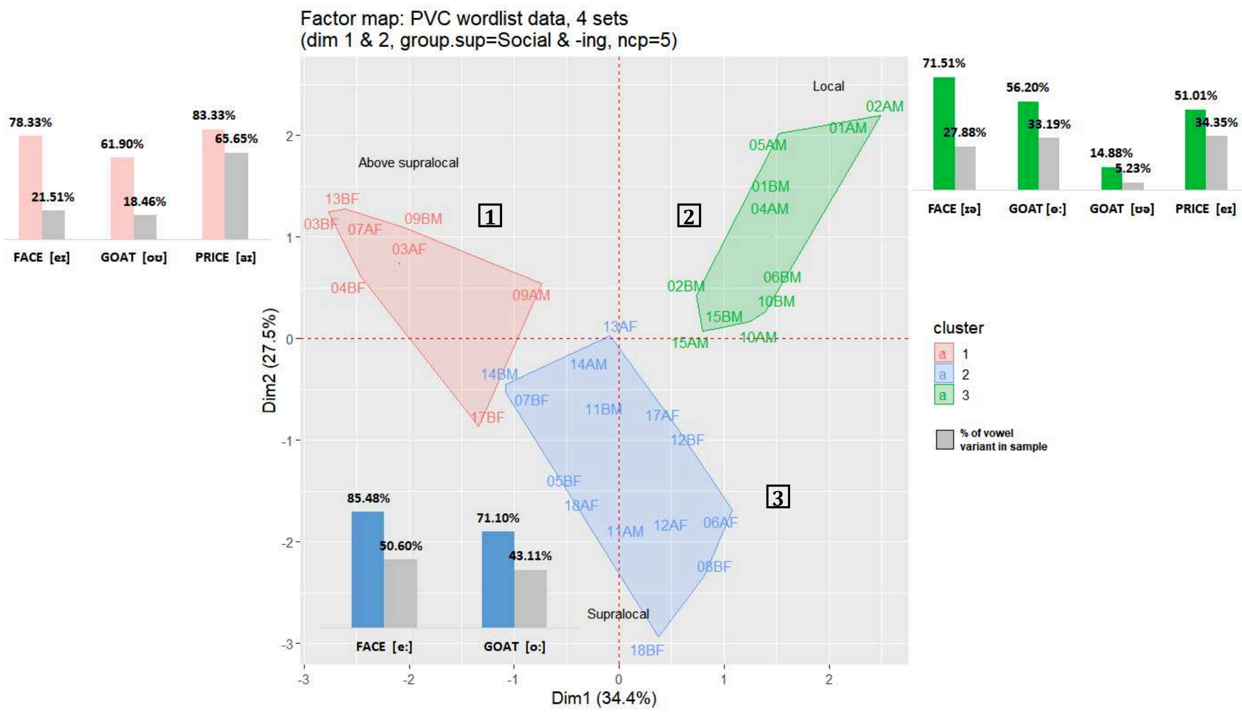


Figure 7-72 Factor map with % of FACE, GOAT and PRICE (in clusters vs. across the whole sample).

So far, the diagnostics have helped determine the linguistic profile of the two most extreme clusters (the above-supralocal and the traditional clusters) based on FACE, GOAT and PRICE. But information on variation patterns in PRICE for the supralocal cluster were not clearly defined by the cluster diagnostics using default level of cutting. However, it is very likely that supralocal speakers do not realise an equal share of raised/low onset in their speech and that some favour one over the other. For instance, 14BM is on the far left of the polygon and has an exclusive use of low onset. 6AF is among the two speakers with the highest scores of raised onsets (78%), the traditional speaker, 02AM, being the other speaker. 14BM is an older middle-class speaker, whereas 6AF is a younger working-class woman. It is hypothesised that an interaction of age and class may account for a more complex variation pattern in PRICE. I now investigate variation in PRICE among the supralocal group.

7.12.3 Variation in PRICE in PVC supralocal speakers: intersectionality between class, age

Observing the tree to look for potential sub-groups

The clustering tree based on the MFA analysis (Figure 7-73) separates the supralocal speakers into three smaller clusters, which points at not 2 but at least 3 different uses in one or more lexical sets. The aim of this section is to investigate the role that PRICE has in the distinction of supralocal speakers.

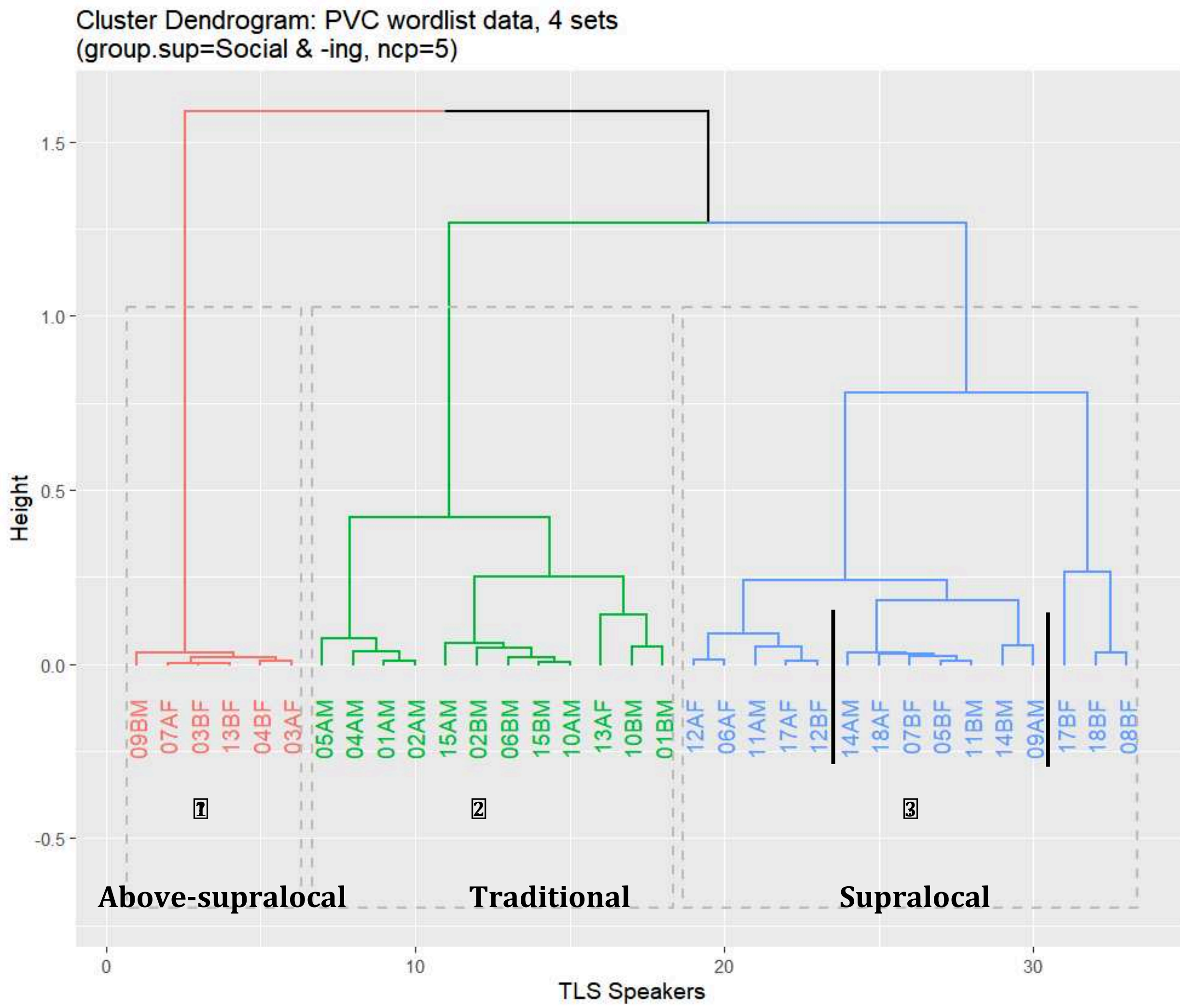


Figure 7-73 Tree: Sub-groups of supralocal speakers (PVC WL).

Looking at individual proportions of PRICE *variants*

Individual proportions of PRICE variants are now examined. Speakers are ranked based on their scores for the PRICE variants. Potential interactions between external factors were also tested. Table 7-25 reveals two major sociolinguistic polarities with regard to the use of PRICE variants: the highest scores of raised onsets are among WC speakers and at the bottom of the table, there is a concentration of middle-class speakers who avoid it completely. 19

speakers out of 33 used more than 30% of raised onsets. This included a small majority of speakers from the working class. Among them are 6 young middle-class speakers. The age pattern reverses as the score for the low onset reaches 70%. Among the middle-class speakers at the bottom of the graph the 4 working-class speakers belong to the age category of older individuals. A logistic regression model is needed to check the significance of these suspected age/class interactions.

Table 7-25 PVC speakers ranked according to their score of raised onsets in PRICE (PVC WL).

speaker	sex	age	class	PRICE_aɪ	PRICE_eɪ
06AF	F	Young	WC	22%	78%
02AM	M	Older	WC	22%	78%
08BF	F	Young	WC	28%	72%
17BF	F	Young	MC	28%	72%
06BM	M	Young	WC	33%	67%
10BM	M	Young	MC	33%	67%
18BF	F	Older	WC	35%	65%
01AM	M	Young	WC	39%	61%
12AF	F	Young	WC	44%	56%
10AM	M	Young	MC	44%	56%
01BM	M	Young	WC	50%	50%
15BM	M	Young	WC	56%	44%
04AM	M	Older	WC	56%	44%
12BF	F	Young	WC	59%	41%
17AF	F	Young	MC	61%	39%
15AM	M	Young	WC	67%	33%
05AM	M	Older	WC	67%	33%
09AM	M	Young	MC	67%	33%
11AM	M	Older	MC	67%	33%
02BM	M	**Older**	WC	72%	28%
05BF	F	**Older**	WC	83%	17%
11BM	M	Older	MC	83%	17%
18AF	F	**Older**	WC	89%	11%
03AF	F	Older	MC	89%	11%
07AF	F	Older	MC	89%	11%
07BF	F	Older	MC	89%	11%
09BM	M	Young	MC	94%	6%
04BF	F	**Older**	WC	100%	0%
13AF	F	Young	MC	100%	0%
13BF	F	Young	MC	100%	0%
03BF	F	Older	MC	100%	0%
14AM	M	Older	MC	100%	0%
14BM	M	Older	MC	100%	0%

A logistic regression was used to describe variation in PRICE and check for potential affects. The pronoun *I* is absent from the data. The variant was the dependant variable, while age, sex and class counted as independent variables. The results of the regression indicate that a raised onset in PRICE is favoured among younger speakers *(p* < .00001), working-class speakers *(p* < .00001) and to a smaller extent, men (p=0.6). I also checked whether the words in which the PRICE vowel was read out had an impact on the choice of a raised onset or not. A conditional inference tree revealed more subtle patterns than the regression. It will operate as a *post hoc* test.

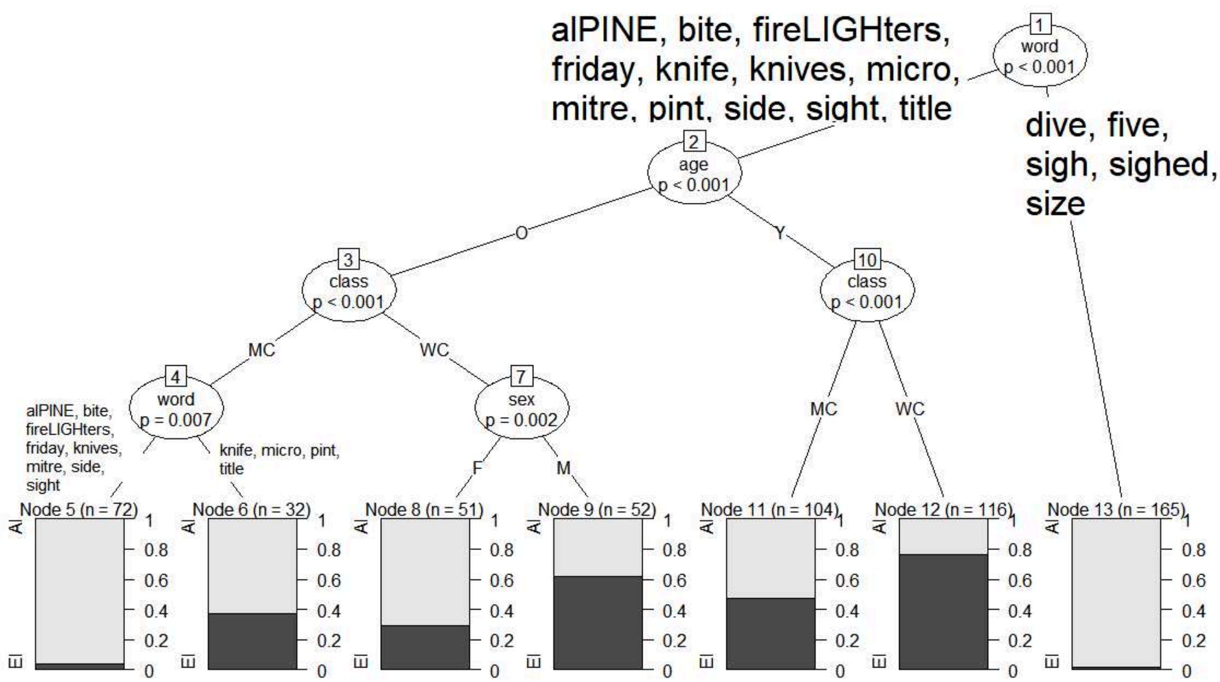


Figure 7-74 Conditional inference tree of variation in PRICE by age, class and word read (PVC WL).

Conditional inference trees help visualise the results of a classification analysis. Figure 7-74 indicates that word is an important factor to be taken into account. The words *five, dive, sighed and size* were generally pronounced with a raised onset above 98% of the time (node

13) no matter the cohort. Age is seen to interact with class in node 10 as working-class young speakers favour raised onsets more than middle-class ones (ca. 80% vs ca. 50%). Older WC had higher scores of raised onsets (ca. 60%) while the scores for women remains twice as low (ca. 30%). Words like *knife, micro, pint and title,* appear to follow the Scottish vowel length rule among MC speakers.

7.12.4 Variation in MOUTH: who still uses a raised onset?

In the reading list, only 3 women are reported to have more than 35% of raised onsets. 2 are young and 2 are from the working class. Those with a score of 33% are predominantly composed of middle-class men, with only one from the working class (mixed pair dyad 5AM). This explains why MOUTH is not among the main determinants of TE in the PVC WL.

Table 7-26 PVC speakers ranked according to their score of raised onsets in MOUTH (PVC WL).

speaker	sex	age	class	MOUTH_aʊ	MOUTH_eʊ
17BF	F	Young	MC	0%	100%
18BF	F	Older	WC	17%	83%
08BF	F	Young	WC	50%	50%
05AM	M	Older	WC	67%	33%
09AM	M	Young	MC	67%	33%
11AM	M	Older	MC	67%	33%
14BM	M	Older	MC	67%	33%
17AF	F	Young	MC	83%	17%
02BM	M	Older	WC	83%	17%
05BF	F	Older	WC	83%	17%
09BM	M	Young	MC	83%	17%
04BF	F	Older	WC	83%	17%
06AF	F	Young	WC	100%	0%
02AM	M	Older	WC	100%	0%
06BM	M	Young	WC	100%	0%
10BM	M	Young	MC	100%	0%
01AM	M	Young	WC	100%	0%
12AF	F	Young	WC	100%	0%
10AM	M	Young	MC	100%	0%
01BM	M	Young	WC	100%	0%
15BM	M	Young	WC	100%	0%
04AM	M	Older	WC	100%	0%
12BF	F	Young	WC	100%	0%
15AM	M	Young	WC	100%	0%
11BM	M	Older	MC	100%	0%
18AF	F	Older	WC	100%	0%
03AF	F	Older	MC	100%	0%
07AF	F	Older	MC	100%	0%
07BF	F	Older	MC	100%	0%
13AF	F	Young	MC	100%	0%
13BF	F	Young	MC	100%	0%
03BF	F	Older	MC	100%	0%
14AM	M	Older	MC	100%	0%

In the MFA, variation in MOUTH is best rendered in dimension 3 (Figure 7-75). Speakers with high dim 3 coordinates are indeed those exhibiting more frequent raised onset in MOUTH. The further the speaker is from the rest of the sample, the more his/her MOUTH score deviates from the average score. The factor map is another way of representing the high scores of raised onsets in 17BF, 18BF, 8BF.

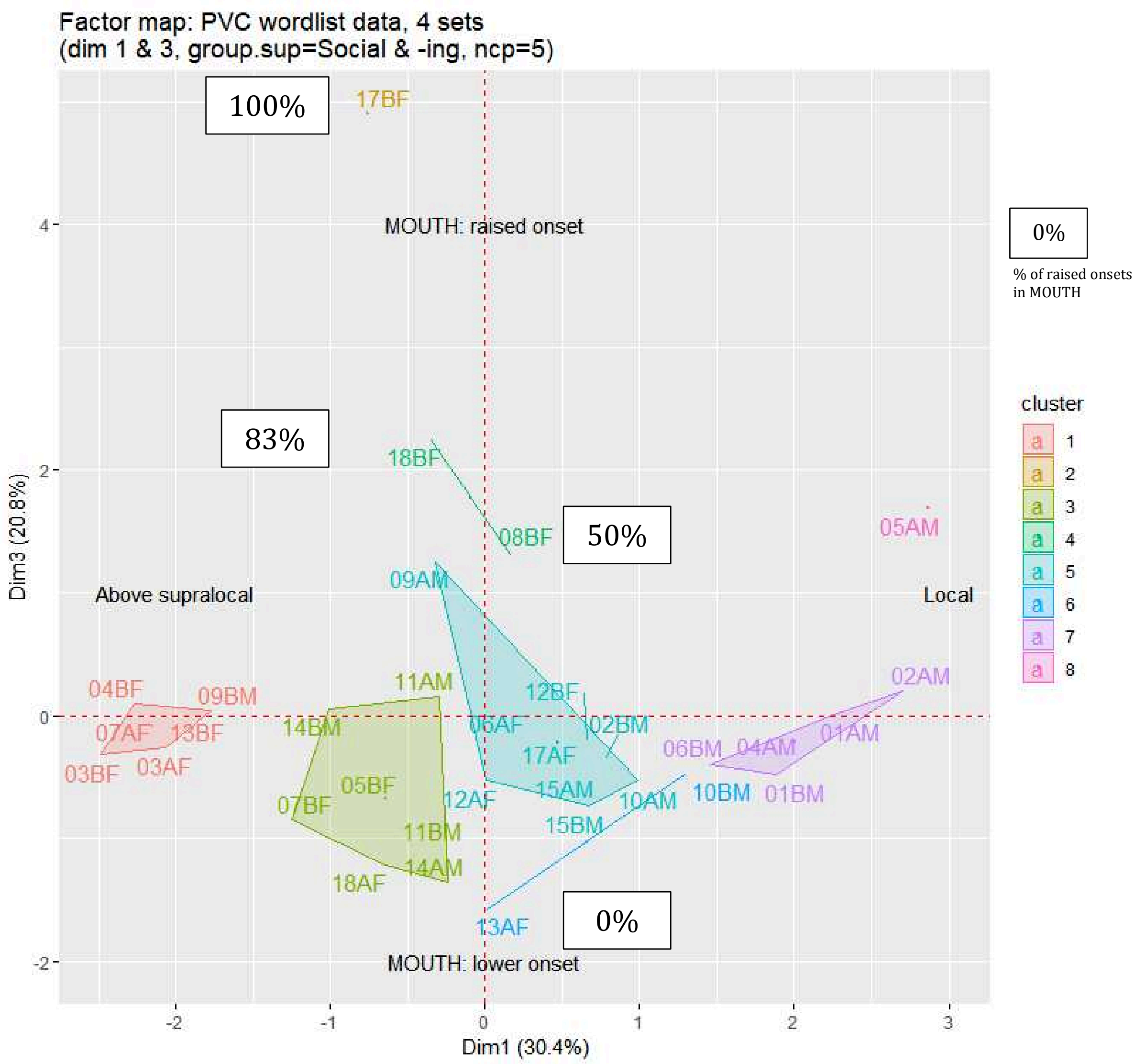


Figure 7-75 Factor map with clusters based on MFA (PVC wordlist, k=8, dim 1 & 3).

Since too few speakers used a raised onset, it was not deemed relevant to perform a regression on the MOUTH data. I now turn to variation in GOAT among traditional speakers since variation amongst them as it provides information on dynamics of levelling in GOAT.

7.12.5 Variation in GOAT across the traditional speakers

Traditional speakers are also divided into three groups:

1) Those that have a more frequent central or open GOAT vowel variant (13AF, 01AM & 10BM, cluster 6).

2) Those who have a levelled in GOAT but not in FACE (cluster 7).

3) Those who have retained the traditional values of both FACE and GOAT (cluster 8).

Table 7-27 Vowel variants contributing to the creation of the clusters (ncp=5, k=8).

Phon var.	% in cluster 1 (above supralocal)	p-value	v-test
FACE [eɪ]	78.10% (av. 21.51%)	< .0000001 ***	4.99
GOAT [oʊ]	66.23% (av. 18.46%)	< .000001 ***	5.77
PRICE [aɪ]	91.27% (av. 65.65%)	< .05	2.88
Phon var.	**% in cluster 2 (17BF, raised onset in MOUTH)**	**p-value**	**v-test**
MOUTH [eʊ]	100% (av. 13.64%)	< .001 **	3.58
Phon var.	**% in cluster 3 (supralocal, low onset in PRICE)**	**p-value**	**v-test**
PRICE [aɪ]	90.74% (av. 65.65%)	< .05	2.56
FACE [eː]	76.11% (av. 50.61%)	< .05	2.01
Phon var.	**% in cluster 4 (supralocal)**	**p-value**	**v-test**
FACE [eː]	90.67% (av. 65.65%)	< .01 *	2.83
GOAT [oː]	77.27% (av. 43.11%)	< .05	2.36
Phon var.	**% in cluster 5 (supralocal, raised onset in MOUTH)**	**p-value**	**v-test**
MOUTH [eʊ]	66.67% (av. 13.64%)	< .001 **	3.16
GOAT [oː]	95.45% (av. 43.11%)	< .05	2.17
Phon var.	**% in cluster 6 (local, central monophthong)**	**p-value**	**v-test**
GOAT [ɵː]	96.97% (av. 33.19%)	< .001 **	3.16
Phon var.	**% in cluster 7 (traditional in FACE)**	**p-value**	**v-test**
FACE [ɪə]	68.00% (av. 27.88%)	< .001 **	2.82
Phon var.	**% in cluster 8 (traditional in FACE and GOAT)**	**p-value**	**v-test**
GOAT [ʊə]	40.91% (av. 13.64%)	< .0000001 ***	5.58
FACE [ɪə]	86.67% (av. 27.88%)	< .001 **	3.63

7.12.6 Model speakers and stereotypes in each sociolinguistic group

With the 3-cluster model, working-class speakers are more represented among the paragons and stereotypical speakers, as displayed in Figure 7-32. I prefer to use the term *stereotypical* rather than that of *leaders* of sound change. 04BF may be from the working-class cohort but her part-time job clearly reflects that of a social riser. From a linguistic point of view, her job involves contact with members of the golf club who are generally people from the middle or upper middle class (Holt, 1998) and explains why her speech is levelling to a greater extent than her working-class female counterparts 05BF and 18BF. The latter two have a different career trajectory altogether. The occupation of 04BF's father, a pitman, is coherent with the speaker's working-class background but as she left school, she went on to work as a clerk at the Newcastle *Chronicle's* offices. Conversely, 05BF and 18BF first worked in a factory before respectively becoming a shop assistant in a bakery and a school cook.

Table 7-28 Paragons and stereotypes in clusters 1 to 3 (Ward Euclidean distance, red: WC, blue: MC).

Cluster 1 (above supralocal)	Cluster 2 (supralocal)	Cluster 3 (local)
Paragon		
04BF **Part time treasurer (golf club)** **62 years old**	**05BF** **Shop (bef. factory)** **62 years old**	**04AM** **Bus driver (retired)** **63 years old**
(0.77)	(0.62)	(3.93)
Stereotype[137]		
17BF **Student (wants to do A-levels)** **16 years old**	**18BF** **School cook (bef. factory)** **50 years old**	**02AM** **Painter** **62 years old**
(4.81)	(4.63)	(4.83)

As to 04AM and 02BM, they perfectly fit the profile of older working-class men with a traditional pronunciation. 17BF is much closer to the supralocal speakers however and cannot be said to be a "stereotype" of the above supralocal speakers. What MFA actually says regarding these speakers (as opposed to the paragons) is that they are the most distant speakers from the centroids of the clusters they do *not* belong to. In most cases this corresponds to stereotypical speakers, but one should always proceed to a verification with the help of the factor map. I therefore checked the second paragons of cluster 1 (Table 7-29) who clearly corresponds to one's expectations of the speakers with high prestige variants based on Watt's results (1998). The paragon is a middle-class sixth-former whose father is a manufacturer's agent and whose mother works a part-time secretary. The stereotype

[137] By stereotype is actually meant the speakers who are the most distant from the centroids of the clusters they do not belong to.

speaker is an older middle-class woman who graduated in Physics at Newcastle University and obtained a teaching qualification to teach this subject.

Table 7-29 Second paragon and stereotype of cluster 1.

Cluster 1 (above supralocal)	
Paragon 2	
09BM **A-level student** **17 years old**	
(0.81)	
Stereotype 2	
03BF **Former physics teacher** **59 years old**	
(3.81)	

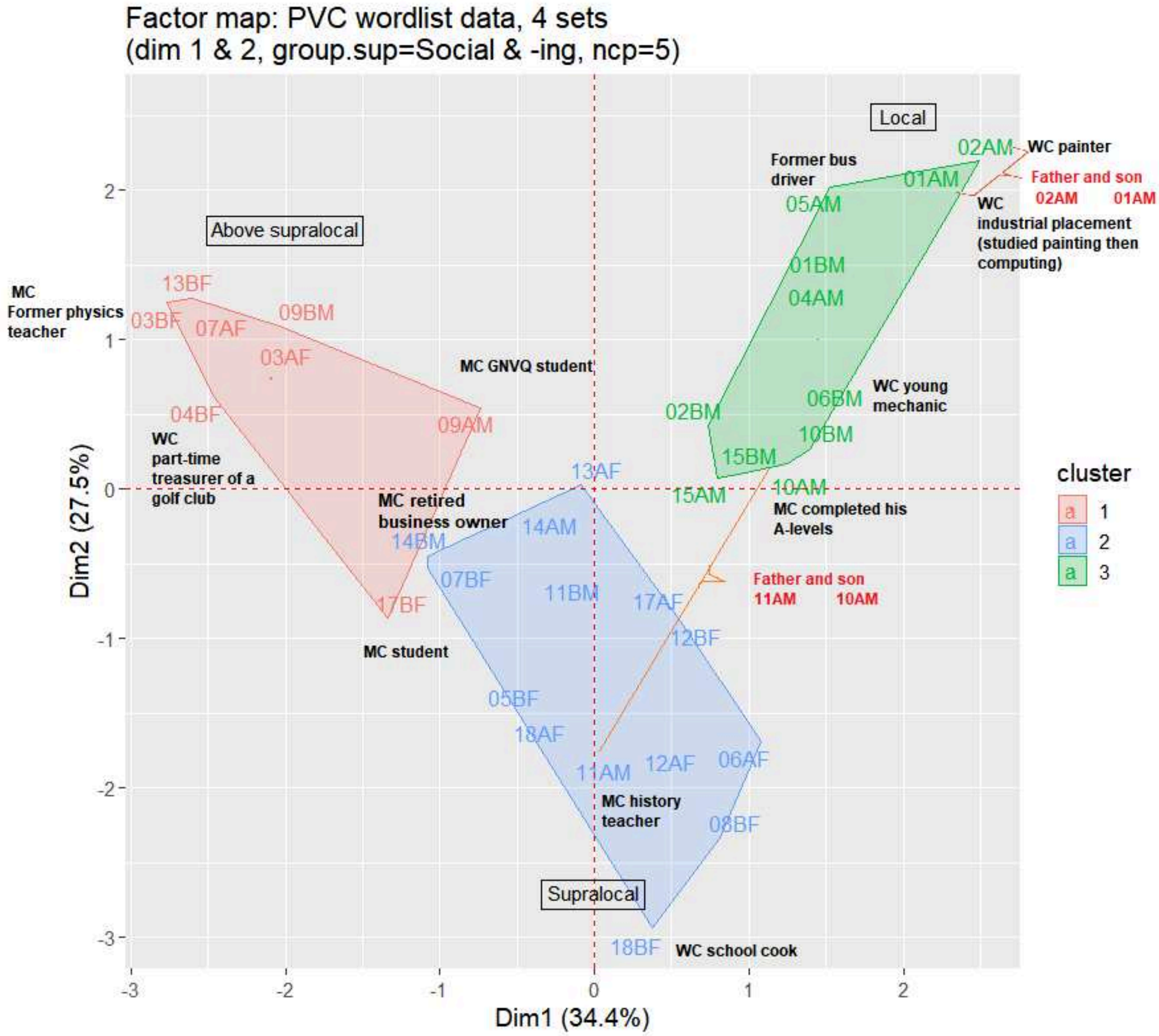


Figure 7-76 Factor map of PVC speakers with selected informant's occupations.

7.12.6.1 Atypical vs. typical speakers based on the major co-occurrence patterns of variants.

In order to check which speakers are atypical with regards to the co-occurrence of their vowel variants, Pagès (2013, p. 105) recommends using the individuals' within inertia values, akin to a variation index allotted to each speaker. The higher the value, the more atypical the speaker is. However, to use this index, there must be at least 3 groupings of active variables. Since we have 4 groupings (FACE, GOAT, PRICE and MOUTH), we can use this index. The latter can also be used to detect "anomalies and thus a certain type of errors" (Pagès 2013, p. 105, translation mine).[138]

Figure 7-77 graphically represents the degree of atypicality of individuals with regards to the co-occurrence of their vowel variants. For instance a very atypical speaker would be someone who uses a high prestige variant for FACE but a traditional one in GOAT, while a typical speaker would be coherent in his/her choice of variant, e.g. high prestige variants for both sets. Among the ten less typical speakers are those adopting the above supralocal speakers, except for 14AM, one of the most in-between speakers and 05AM, a traditional speaker. 17BF is by far the most atypical speaker with a maximum within inertia value of 13.65 as opposed to a mean of 3.03 (median = 2.71, min=0.11 for 12BF). Looking at 17BF's scores for each lexical set (Figure 7-78), we see that she was able to use high prestige values in FACE and GOAT while reading the wordlist (80% & 64% respectively) but retained more traditional values in MOUTH and PRICE with respective scores of raised onsets of 100% and 72%. She is clearly atypical because she does not have a symmetrical variation pattern within both pairs of lexical sets but the first pair has variational patterns that are more typical among middle-class women but the second pair reflects more traditional, working-class speech patterns. Being thus straddled between two sociolinguistic groups makes the task to stratify her sociolinguistically much more problematic. This incoherence may be due to pressure from two social communities with opposing standards. Indeed, among middle-class

[138] For more details about partial individuals and within inertia of individuals, see chapter 5 in Pagès (2013).

women, more prestigious variants are expected in a more formal context pertaining to a reading task but at the same time, peer pressure just as strong among speakers belonging to this kind of age-group (Trudgill, 1988, p. 34), especially in "late adolescence". This may drive her to opt for "higher levels of non-standard forms" (Labov 2001, p.119) concomitantly with more prestigious variants indexing her affiliation to women from the middle-class.

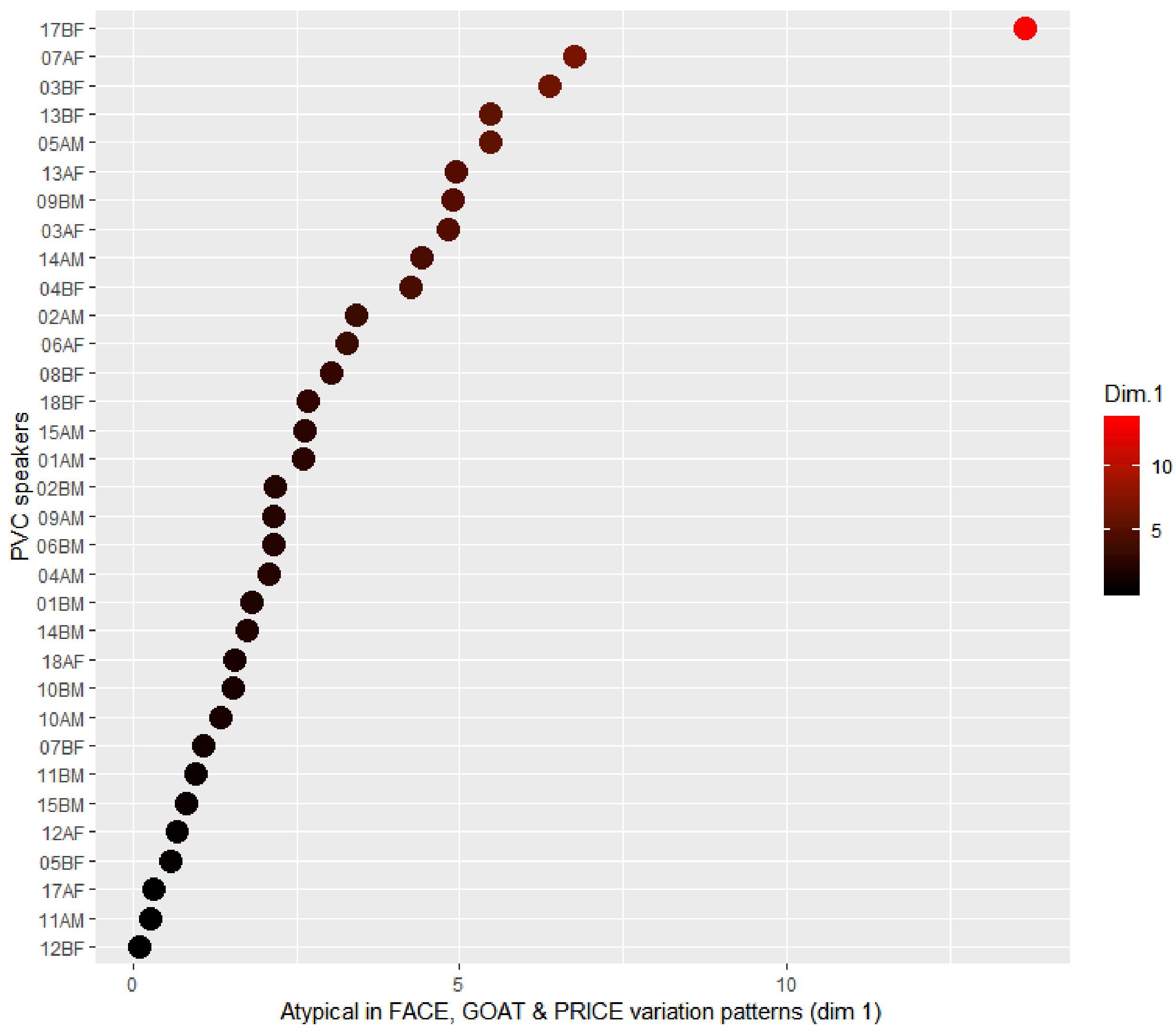


Figure 7-77 PVC speakers ranked by atypicality in terms of co-occurrence patterns in FACE, GOAT and PRICE and MOUTH (high values: atypical patterns, low values: typical patterns, within individual inertia values).

	17BF FACE	17BF GOAT	17BF MOUTH	17BF PRICE
Central monophthong	0%	9%	0%	0%
Monophthong	20%	27%	0%	0%
PRICE_raised onset	0%	0%	0%	72%
MOUTH_raised onset	0%	0%	100%	0%
Closing diphthong	80%	64%	0%	0%
Low onset	0%	0%	0%	28%

Figure 7-78 17BF (most atypical, MC female, 16): FACE, GOAT, MOUTH and PRICE values, PVC WL.

	12BF FACE	12BF GOAT	12BF MOUTH	12BF PRICE
Central monophthong	0%	36%	0%	0%
Monophthong	87%	64%	0%	0%
PRICE_raised onset	0%	0%	0%	41%
Centring diphthong	13%	0%	0%	0%
MOUTH_low onset	0%	0%	100%	0%
PRICE_Low onset	0%	0%	0%	59%

Figure 7-79 12BF (most coherent, WC female, 17): FACE, GOAT, MOUTH and PRICE values, PVC WL.

12BF is a young WC female age 17. She is the most coherent speaker with a majority of supralocal values in all 4 sets. She does retain a reasonable amount of raised onsets in PRICE, which is predictable given her class (Milroy 1999). Let us now observe atypicality in MOUTH through the prism of dim 3 (Figure 7-80). It is not surprising to find the three speakers with a raised onset – 18BF, 08BF and 17BF – are deemed atypical since the low onset prevails across the sample (86.36% vs. 13.64% for the raised onset).

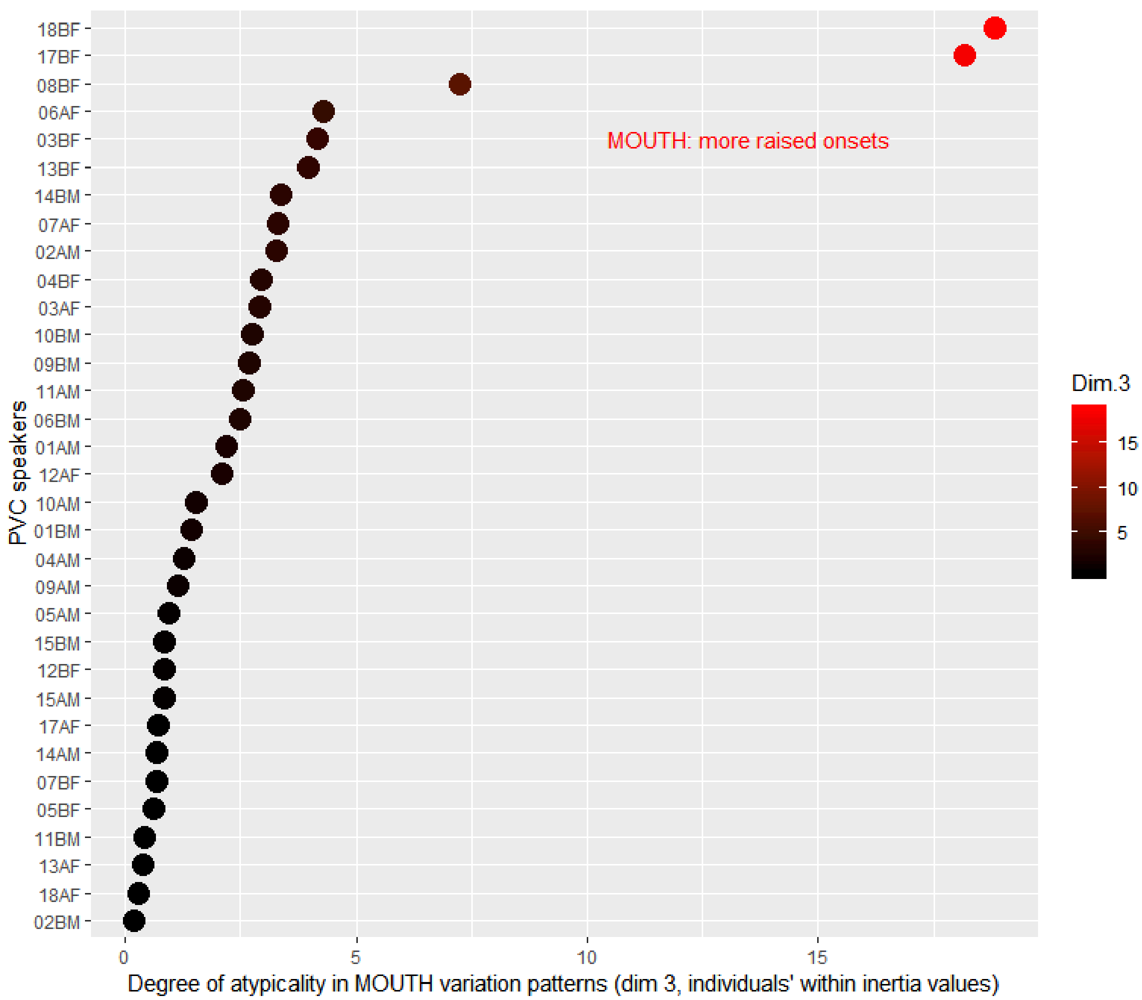


Figure 7-80 PVC speakers ranked by atypicality in terms of co-occurrence patterns in FACE, GOAT and PRICE (high values: atypical patterns, low values: typical patterns, within individual inertia values).

We now know which speakers are the most coherent in their variation patterns of the 4 sets and which are atypical, but we do not know the degree of similarity between dyadic partners placed in the same clusters and of those placed in different clusters, nor in which lexical set or sets they tend to differ from each other. I first analyse the same sex dyads and then proceed to the mixed sex dyads separately since sex is the most important factor determining variation.

7.13 An exploration of dyads (PVC WL)

As reminded in Watt & Milroy (1999), values by social cohort are sometimes defined by one individual with very high scores for one variant, which blurs the general trend within each social group; hence the importance to "treat figures warily" when using proportions by social cohort (1999, p. 38). With MFA, this problem is considerably reduced since we only use the linguistic variants to make groups, the social data characterising the groups of speakers only when statistically relevant.

So far, only group values were examined. The *graph of partial individuals* in MFA enables to examine which dyad are atypical in their variation and how and where speaker variation differs. Here is a definition of this type of graph in sociolinguistic terms, with a schematised graph for illustration purposes (Figure 7-81). For each individual, more detail is given as to why they are placed at that particular spot on the factor map. Their position is a synthesis of all of their variant scores. In the French school of PCA, this spot is called an *isobarycentre* (Pagès 2013, p. 158) but can simply be translated as centroid. From each *isobarycentre*, legs spread outwards. These legs are called *partial points*. There are as many *partial points* as are there are linguistic features. The direction of the legs is based on the variant scores within their corresponding feature. For instance, a high score of traditional features in FACE will result in a partial point placed within the traditional zone in the factor map. But if the same speaker has its GOAT vowel level towards a pan-northern variety. The *partial point* for GOAT will point towards the supralocal zone.

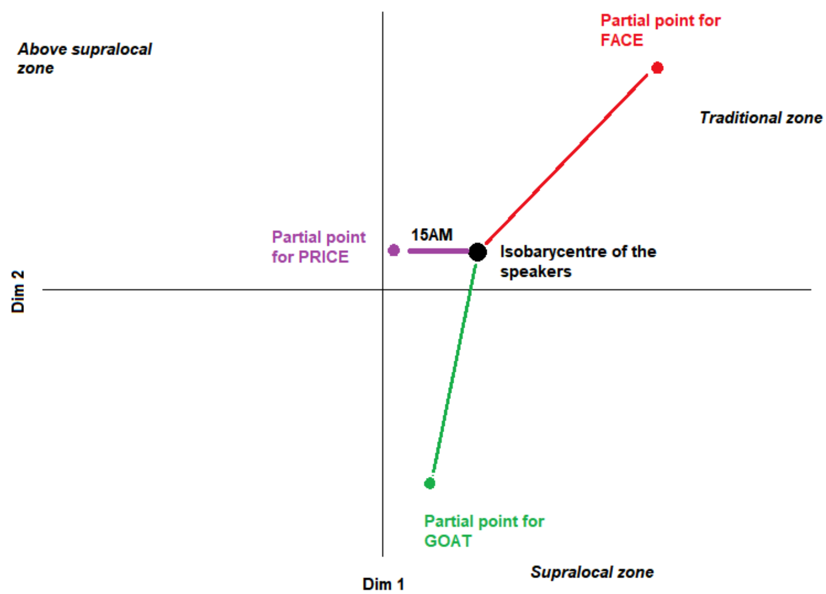


Figure 7-81 Example of a graph of partial individuals in MFA

One could simply look at each pair of individuals and compare the scores for each lexical set directly in the dataset, but the graph of partial individuals in MFA is useful to visually represent which dyads have similar variation in each lexical set, and which do not. I start with an analysis of same-sex dyads and move on to explore the mixed-gender ones.

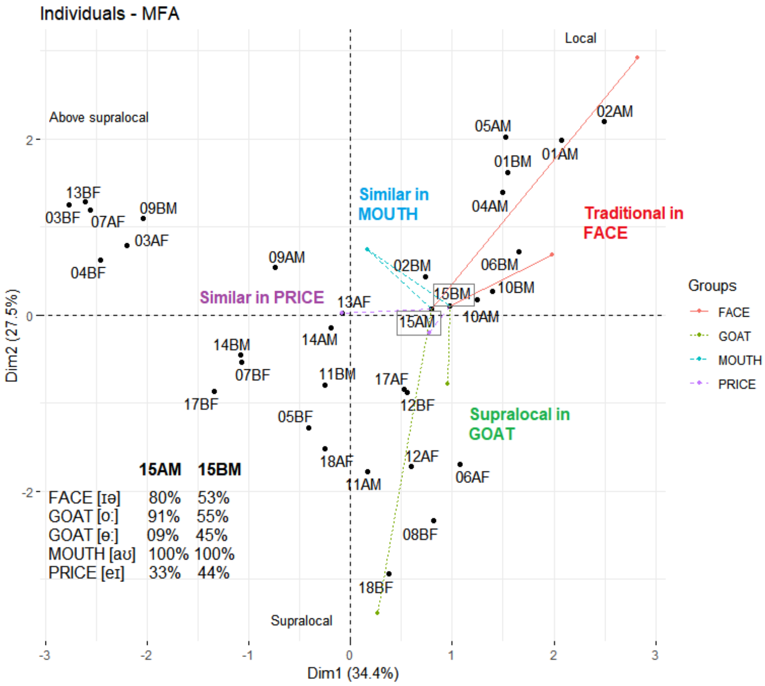
7.13.1.1 Similar profiles: same sex dyads

Since time and space precludes an analysis for each and every single dyad, I chose to hone in on one pair of speakers with very similar profiles (15BM & 15BF, Figure 7-82) and another one with slightly similar profiles (03BF & 03AF, Figure 7-83). 15AM has parents with typically WC occupations, his father being a bus driver and his mother, a cleaner. His traditional FACE values (80%) are significantly higher than those of 15BM (53%) – whose widowed mother works in an office – and correspond to the scores of a bus driver born in the area (cf. 05AM and 04AM who are both former bus drivers and have high scores for the traditional FACE variant). 15BM uses the traditional central variant [ɵː] much more and has more raised onsets in PRICE (44%). He seems to be avoiding the 'old-fashioned' variants but favours less marked traditional variants, which is reminiscent of the distribution patterns of young men in Labov's Martha Vineyard's study who used a fronted /ay/ and /aw/ to reassert their local identity. Watt & Milroy (1999) suggest that the variant [ɵː] may have become 'reallocated' (Britain, 1997) "as a prestige variant because of its similarity to the centralised nucleus of RP [əʊ]" (Watt & Milroy 1999, note 7 p. 45). It is possible that 15BM either reasserts his local identity as a working-class man with more frequent raised onsets in PRICE but using the 'reallocated' GOAT variant [ɵː] that is more prestigious for a working-class man than the centring diphthong [ʊə].

The social status of 15AM & 15BM's parents seem to have an influence on the speakers' distribution of the 4 vowel variants. The former has speech patterns that would be expected of a bus driver born and bred in the area (high score of [ɪə] for FACE), while the latter favours less marked variants, as would his own mother who works in an office. By means of illustration, 18AF is a WC woman having worked in an office: she uses monophthongs in FACE and GOAT but has kept a few raised onsets in PRICE. 15BM, being a man, is simply expected to have more traditional values comparatively.

03AF & 03BF are middle-aged, middle-class women. They both worked for a major engineering company in Newcastle called Northern Engineering Industries (N.E.I. Parsons, in Oxley's report). Their variation is identical in FACE and MOUTH (80% for [eɪ] and 100% for [aʊ]) but not in GOAT and PRICE: 64% VS. 91% for [oʊ] and 98% vs. 100% for [aɪ] for 03AF and 03BF respectively (cf. Figure 7-83). The speaker with higher percentages of prestige variants is 03BF, which is not very surprising given the fact that she has a university degree in Physics and worked as a teacher for some time (Oxley 1994, p. 19). Indeed, various studies such as that by Prichard and Tamminga (2012) and Wagner (Wagner, 2008) have shown that speakers who "attend nationally-oriented institutions of higher education are most likely to reverse their speech away from the direction of the local sound changes" (Wagner, 2012, p. 377). In this corpus, we know that these women do not necessarily reverse their speech for every speaking styles as they use the pan-northern variant overwhelmingly in the conversational material (Watt 1998). If one considers that the main local sound change is the adoption of the pan-northern variant (Haddican, Foulkes, Hughes, & Richards, 2013), then we can rather say that they either converge or diverge from it depending on style.

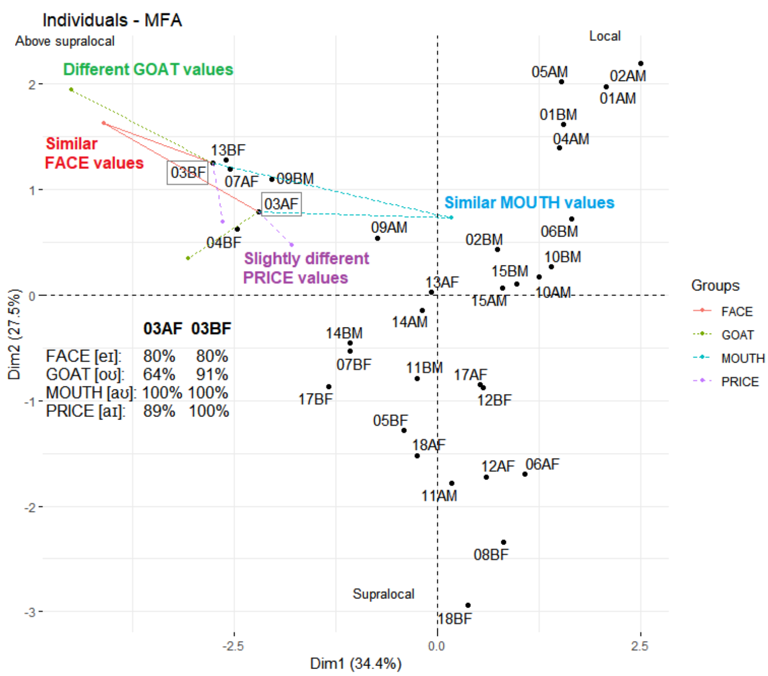
What we observe in this sub-part is that while the two pairs of speakers have similar vowel distributions across the 4 sets, GOAT is the vowel that shows the highest amount of variation even among the above supralocal pair of speakers 03AF & 03BF who have a more limited distribution in this lexicalset, i.e. the back monophthong and the closing diphthong.



"**[15AM]** aged seventeen years has just completed the first year in the sixth form at Rutherford High School studying Chemistry, Biology and Geography, He is well motivated and planning to to go on to university. The youngest of five children he has been the only one at home for some years until recently when one of his sisters returned. His father is a bus driver and his mother a cleaner. They live in Benwell." (Oxley 1994, p.7)

"**[15BM]** also seventeen years old has been friendly with [15AM] since starting high school and is also studying for 'A' levels in Maths, Geology and Geography. He too plans to go to university. He lives in Fenham with his mother who is a widow and works in an office in Newcastle and an older sister." (Oxley 1994, p.7)

Figure 7-82 Dyad 15, young WC men: very similar profiles.



"**[03AF]** aged fifty-four years was born in Heaton and left school at fifteen to work in the office of N.E.I. Parsons* until she left to bring up her family. She returned to work later for Tyne Tees Television and was responsible for hospitality. She continued in that post for twenty-two years until taking early retirement due to arthritis. She and her husband now live in Amble and have two married daughters and two granchildren." (Oxley 1994, p.19)

"**[03BF]** aged fifty-nine was born in High Heaton and attended the same Junior school as Brenda. She was later a pupil at the Central High School and obtained a degree in Physics at Newcastle University. After graduating she started work at N. E, I, Parsons where she met Brenda. Having brought up her family she completed a P.G.C.E. course and taught for several years until she and her husband bought a newsagent's shop in Morpeth. She is currently unemployed." (Oxley 1994, p.19)

**Northern Engineering Industries, an engineering firm in Newcastle formerly known as Reyrolle Parsons and originally specialising in steam turbines. https://www.gracesguide.co.uk/NEI, accessed on the 18th November 2018*

Figure 7-83 Dyad 03 middle-aged MC women: slightly less similar profiles.

Let us see now on what grounds the MFA/cluster analysis places a pair of self-selected dyadic partners in two distinct clusters. Do certain lexical sets matter more than others in defining a speaker as above supralocal, supralocal or local?

7.13.1.2 Different profiles: same sex dyads

07AF and 07BF are two middle-aged women with a middle-class background. They both attended the same commercial college and had the same first job (Oxley 1994, p. 20). While 07AF is still working part time doing secretarial work, 07BF is retired after having worked in a bank. It is possible that being retired, the social pressure on language standards is alleviated and may result in a drop in prestigious variants on the part of 07BF. Although we do not know 07AF's linguistic trajectory from adolescence, early adulthood to middle-age, we can infer that she is in a phase of linguistic "retrenchment" (Chambers 2003, p. 195), namely, a shift from a more frequent use of non-standard variants to a clear disfavour of the latter. Wagner explains that "speakers in this life stage have greater responsibilities at work and at home, and have slowed down their earlier frenetic attempts to 'define' themselves, becoming relatively settled in their tastes and opinions", which can result in higher scores of prestige variants (2014, p. 375). 07BF, being retired, is now free from any market pressure and it is possible that disengagement from the market place may have contributed to her shifting away from the middle-aged retrenchment – which favours prestige variants over the unmarked ones– to the re-adoption of pan-northern variants.

Unlike adolescents, middle-aged speakers have not often been studied in great depth and are labelled by Eckert as a "vast wasteland in the study of variation" (Eckert 1997, p. 165). They should not be merely viewed as the age-group with the lowest score of traditional/stigmatising features in a curvilinear age-graded variation patterns (Labov 2001, Trudgill 1988) but as "developmental and graded too" (Eckert 1997, p. 158). Differences in distribution patterns of GOAT and PRICE between these two speakers with apparent similar social profiles points at Eckert's appeal to view middle-aged speakers as a complex group with its own development of variation strategies stemming from awareness of prestige and local forms, gender norms in their community or more complex aspects of their social identity (Wagner 2012, p. 376).

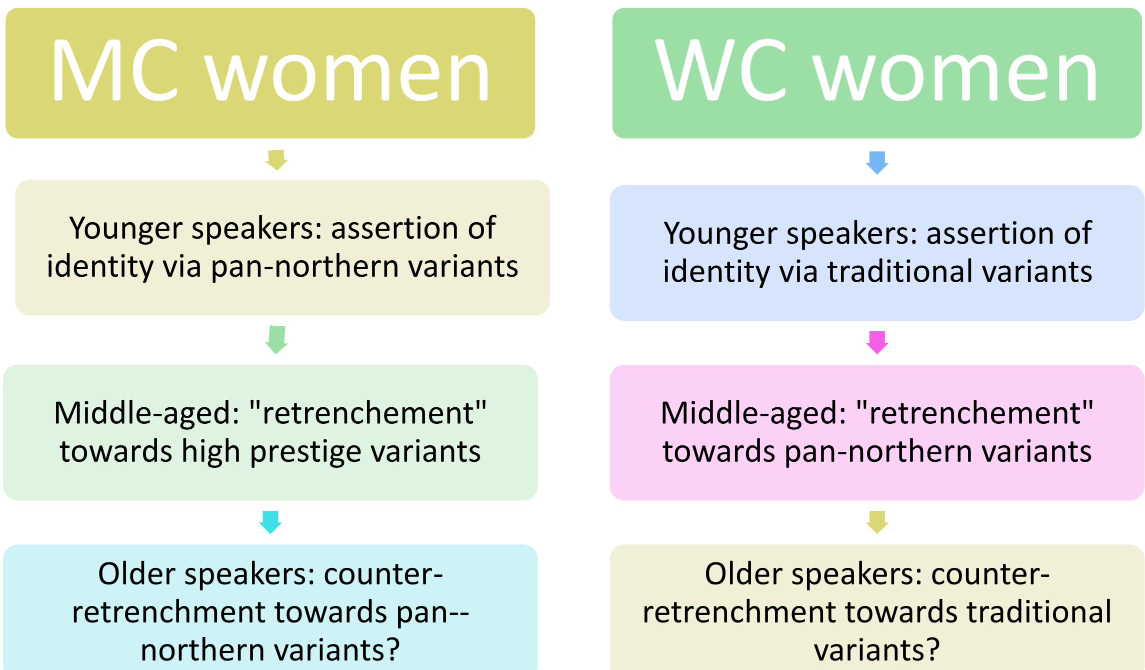
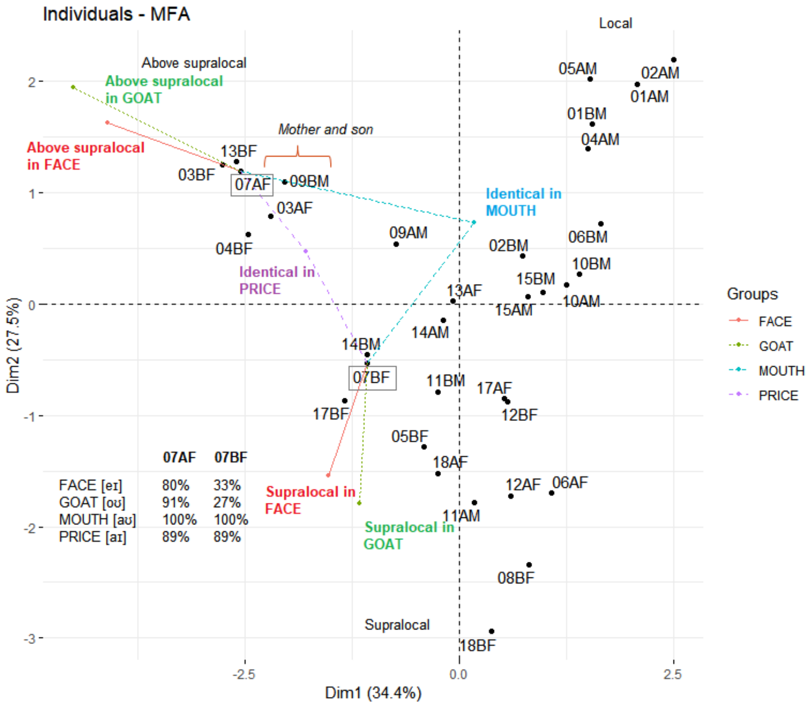


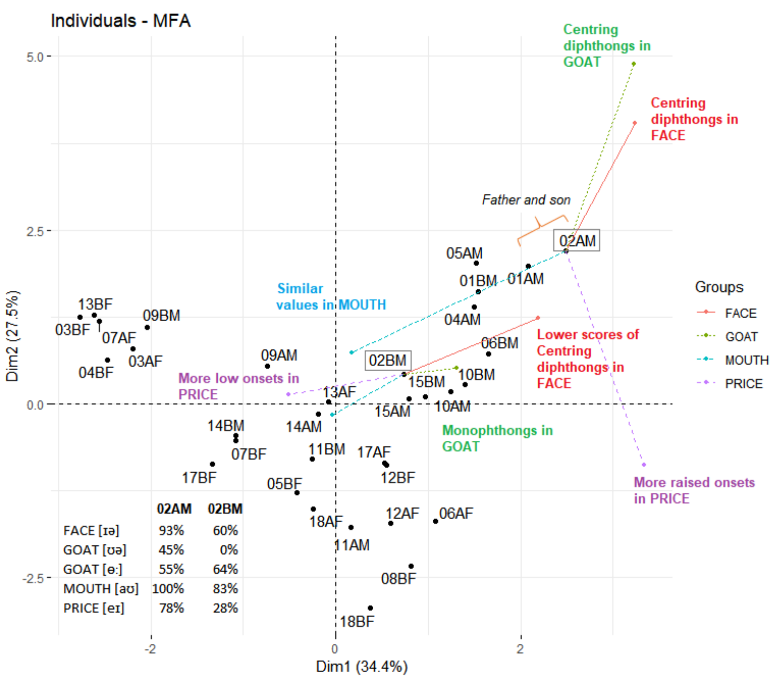
Figure 7-84 Suggested age-graded patterns in TE: middle-class and working-class women.



"**[07AF]** aged fifty-five years was born in Newcastle and lived off the West Road near the General Hospital. She attended Rutherford High School, left at sixteen and completed a year's course at a commercial college. She did secretarial work until the birth of her son [09BM] (tape 7) and returned to it on a part-time basis six years ago. She and her husband bought their house at Chapelhouse when they married. She has an older brother ..." (Oxley 1994, p.20)

"**[07BF]** is fifty-five years old and also lived off the West Road as a child. Her father was a chiropodist and she has an older sister and a younger brother ([11AM] tape 11). She met [07AF] at primary school and has been a close friend ever since attending the same high school, commercial college and first job. **[07BF]** later made a career in banking from which she has recently retired. She lives near [07AF] on Chapelhouse estate and is unmarried." (Oxley 1994, p.20)

Figure 7-85 Dyad 07 middle-aged MC women: different clusters.



"**[02AM]** aged sixty-two is employed as the manager of supervisors and youth trainees at a Youth Training establishment (painting and decorating). He is a time-served painter and decorator and has worked previously for Newcastle Breweries and as a military policeman. He was born in central Newcastle but has lived on the Newbiggin Hall estate for twenty five years. [01AM] (tape 1) is [02AM]'s youngest son." (Oxley 1994, p.8)

"**[02BM]** aged fifty-four years is a neighbour, friend and also godfather to [01AM]. He was born in central Newcastle moved out to Cowgate and then Newbiggin Hall where he has lived for twenty years. He has been forced into early retirement from Newcastle Breweries where he worked as a plumber due to arthritis in the hands." (Oxley 1994, p.8)

Contextual notes:

"As long standing friends the speakers were relaxed in conversation. **[02BM]** tended to include me in their conversation by making eye contact, so I took up a role as participant with minimum verbal input but plenty of non-verbal feedback. After completing the word list **[02AM]** remarked that he had used his 'best' English." (Oxley 1994, p.8)

Figure 7-86 Dyad 02, old & middle-aged WC men: different clusters.

02AM and 02BM (Figure 7-86) are two WC men aged 62 and 54 respectively. The former is a painter but also worked as a military policeman whilst the latter is a retired plumber (Oxley 1994, p. 8). Their variation patterns are similar in all respects: they both favour traditional variants but with lower scores for 02BM. It is possible that the more formal style implied by the wordlist reading task and his constant awareness of the presence of the female fieldworker, Penny Oxley (cf. contextual note in Figure 7-86), is probably what drove him to style-shift to a greater extent than his friend 02AM. He showed his awareness of the social stigma associated with the traditional FACE, GOAT and PRICE by avoiding them and by adopting supralocal equivalents in their stead. His scores range from a reasonably low 60% of centring diphthongs to zero in GOAT and FACE respectively, with raised onsets in PRICE being brought down to 28%. However, 02AM did not go as far as alternating between a velar and an alveolar -*ing* form in the sentences "he's booking separate tables" and "he's putting it off" like most supralocal speakers do. Such awareness of prestige forms vs. traditional ones on the part of 02AM is mentioned by Oxley's fieldwork report, saying that 02AM had been using his 'best' English while reading the wordlist. Without such detailed metadata, variation within the dyad would have been difficult to account since their social profiles are somewhat similar.

7.13.1.3 Mixed sex dyads

Out of the three mixed sex dyads (04, 05 & 06), none of the dyadic partners were placed in the same cluster, hence the primacy of gender difference over accommodation to a speaker even in mixed-sex conversation. Dyads 04 and 05 are older couples, while 06 involves the interaction between two youths, a sister and her brother. They are all very distant from each other on the factor map (Figure 7-87). I chose to comment on one dyad from each age group: husband and wife 04AM & 04BF and on the two siblings 06AF & 06BM. The choice of the former dyad was motivated by the fact that the two partners were placed at either ends of the above-supralocal / local continuum, the wife using a very high number of prestige variants in the wordlist and her husband, for traditional features.

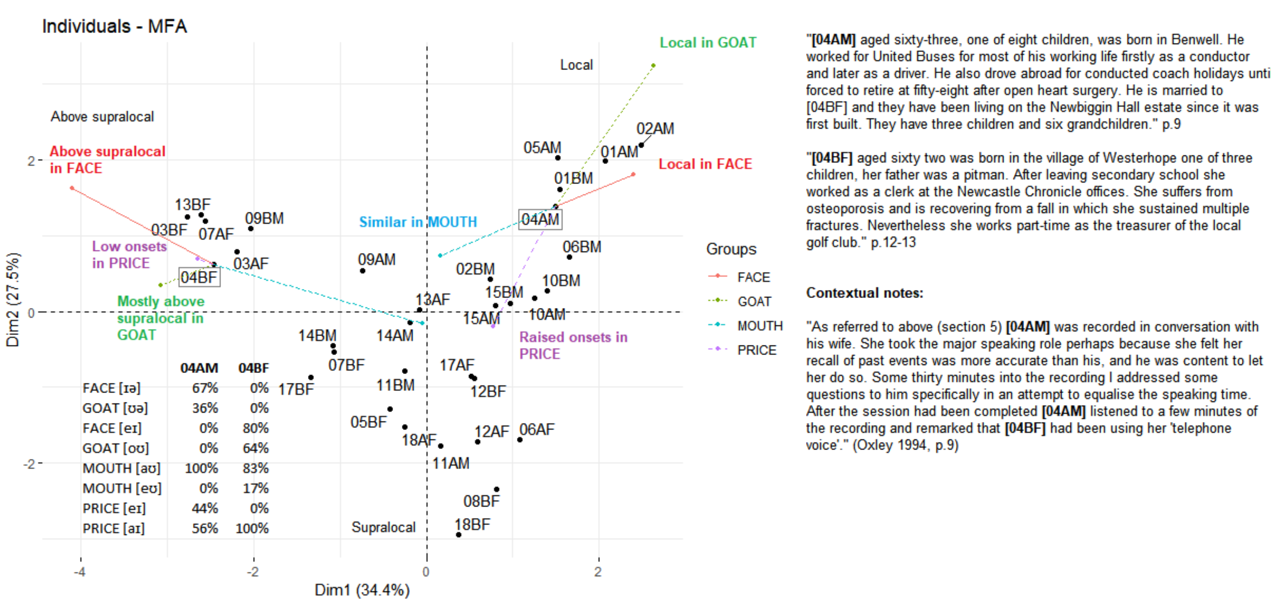


Figure 7-87 Dyad 04, old & middle-aged WC men: different clusters.

04AM & 04BF both share the same working-class background but the former uses traditional centring diphthongs in FACE (67%) and in GOAT (36%) and 44% of raised onsets in PRICE. Contrarily to the first one, the second speaker favours high prestige variants (80% in FACE and 64% in GOAT). 4BF has also used a few raised onsets in MOUTH (17%).

The difference between the two is striking and so is their social profile if one delves into the metadata more deeply. 04AM is a former bus driver and remained in a working-class environment. 04BF is from a working-class background but did a few office jobs. We can hypothesise that she is able to style-shift to a greater extent than her husband when reading the wordlist because of the type of jobs she had in her life (Coupland 1980). Watt (1998, p. 219) remarked that she adopted hypercorrected forms of the FOOT-STRUT set in the wordlist material. This was also the case for GOAT words (Watt 1998, p. 241). She also belongs to the group of middle-age working-class women that style-shifted the most when switching from a conversation to the reading of the list. Watt suggests that she was not the only one:

> [a]mong the WC speakers, style shifting is really only apparent in the speech of the OWC females; this is exactly what one might expect of middle-aged women such as [05BF], [04BF], [18AF] and [18BF], since notions of 'correctness' and 'talking nicely' are probably most strongly observed among this social group (Watt 1998, p. 241).

Watt's observation may explain why 4BF's husband remarked that she had been using her 'telephone voice' during the recording, namely, favouring more high prestige variants than in their day to day conversations (Oxley, 1994, p. 9). 5BF's husband had similar but more subtle comments while her wife was starting to read the wordlist: (5AM) "they want us to s[eː] it the w[eː]… we would normally s[eː] it" to which she replied (5BF) "well as you [a]m just speaking the w[eː] [a] normally s[eː] it!". The gap between speakers within a dyad is the largest of the PVC Newcastle data and highlights the importance of taking into account occupation and interaction at work when observing variation even though no quantitative analyses can easily be made with this kind of information given the sample size.

This section presented the sociolinguistic profiles of the PVC speakers based on the wordlist material. After several verifications on the conversational material, the degree of style-shifting from the conversation to the wordlist was deemed minor except among middle-aged MC women. Hence, in the MFA analysis, this category of speakers is slightly overrated as above supralocal speakers whereas, had the analysis been based on the conversational material, they would have been placed in the cluster of supralocal speakers. As in the TLS, the MFA analysis on the PVC material initially revealed three main types of speakers: above-supralocal, supralocal and traditional. A deeper analysis indicated that there are at least two types of supralocal speakers, those with and those without a raised onset in PRICE. There are also traditional speakers in FACE only, and others, in both FACE and GOAT. This seems to imply that although FACE and GOAT tend to operate in lockstep among traditional speakers (Watt 1998), **FACE is more resistant to levelling towards supralocal forms than GOAT is**. A comparison of variation by cluster is now carried out across the TLS and the PVC.

Comparing variation across the TLS & PVC auditory data

7.14 From TLS to PVC: main determinants of TE speech

The results reported in this section are the proportions within each of the 3 main clusters provided by the default parameters of the MFA/cluster analyses in both corpus: above supralocal, supralocal and traditional. The PVC & TLS clusters were more comparable with default parameters than clusters which would have resulted from different parameters.

The figures for the clusters of traditional speakers are aggregated and charted in Figure 7-88. They represent main determinants of speech from MFA 4b (TLS) and from MFA 6 (Table 7-24). Interestingly, the values for the traditional variants are much lower in the TLS than in the PVC but traditional variants for MOUTH are completely absent in the PVC. This can be ascribed to the rare number of words belonging to the set in the PVC wordlist. The centring diphthong in GOAT is almost absent in the TLS sample of Gateshead traditional men but is reported in the speech of two Newcastle male speakers and accounts for only 7% of all GOAT variants. It is difficult to know whether older forms like the centring diphthong were re-gaining prestige in the 1990s, thus leading to the increasing re-emergence of older forms compared to the 1970s.

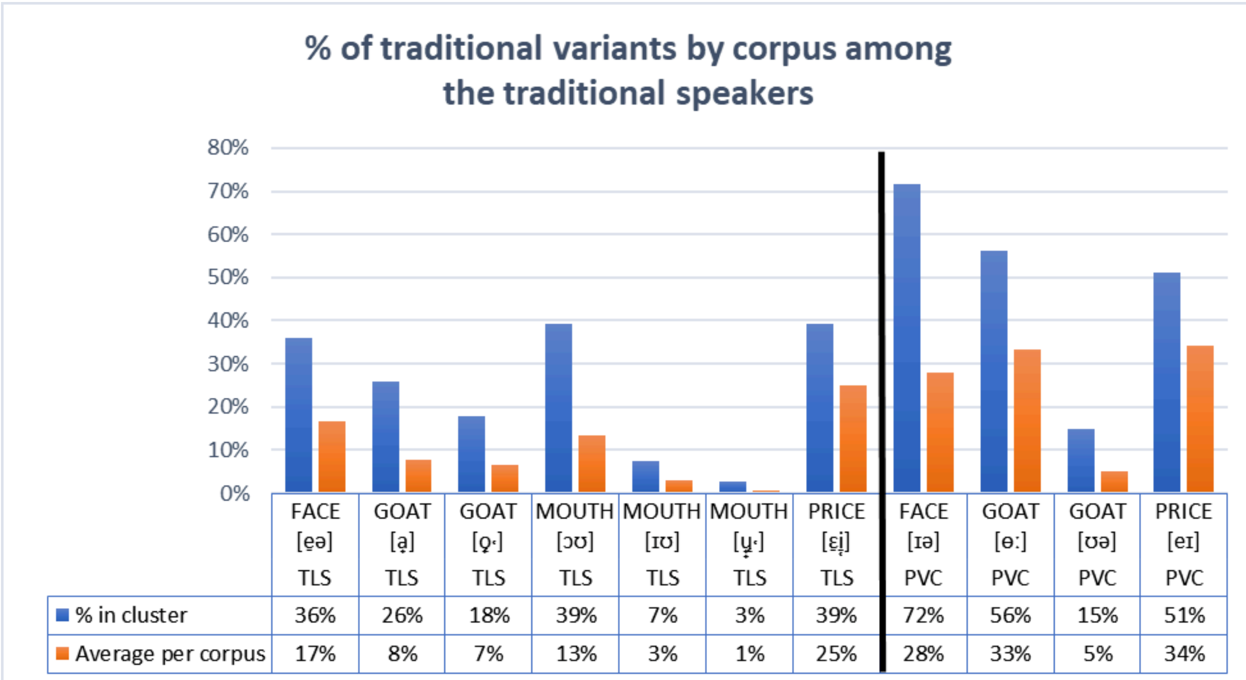
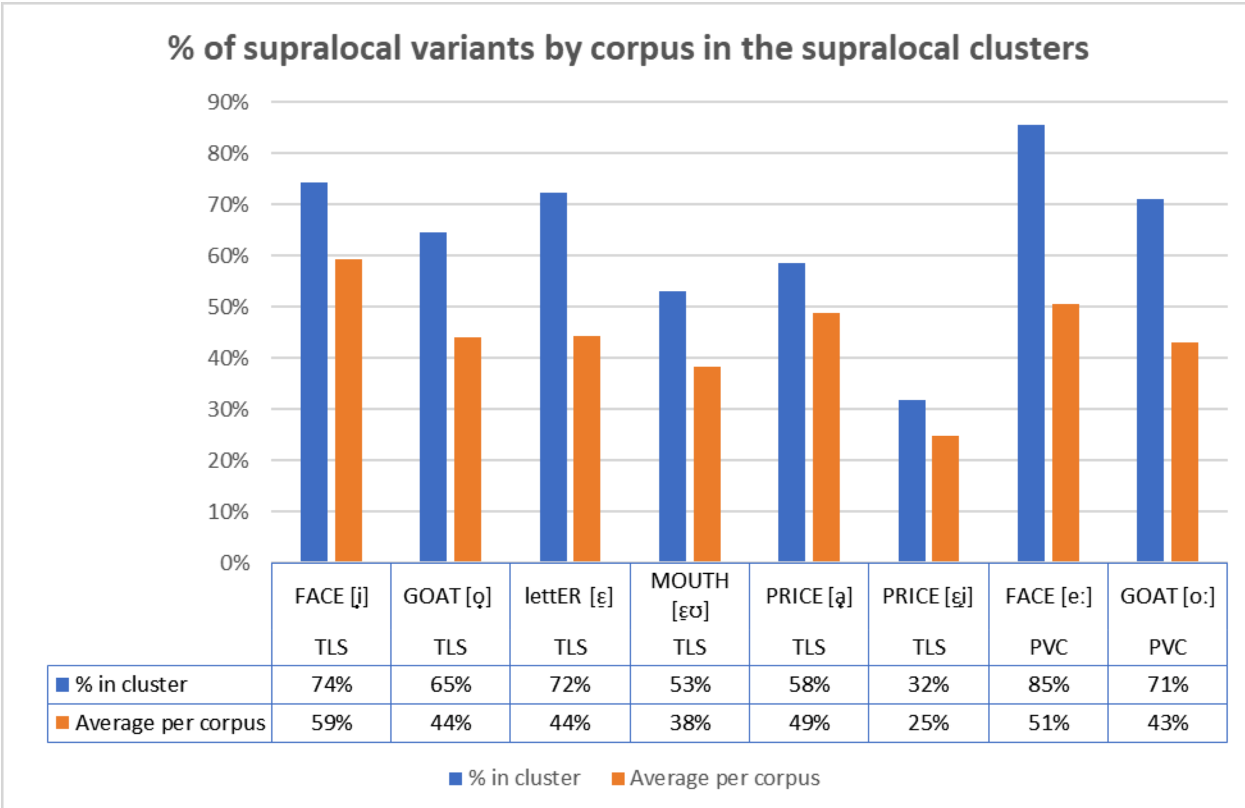


Figure 7-88 Percentages of traditional variants in the traditional clusters of the TLS & PVC.

PRICE values for the raised onsets are rather low in the TLS because the personal pronoun *I*, often realised as a monophthong probably accounts for at least half of the PRICE words in the interview material, which lowers the scores for all the other PRICE variants.



	FACE [ị] TLS	GOAT [ọ] TLS	lettER [ɛ̞] TLS	MOUTH [ɛ̞ʊ] TLS	PRICE [ạ] TLS	PRICE [ɛ̞i] TLS	FACE [eː] PVC	GOAT [oː] PVC
% in cluster	74%	65%	72%	53%	58%	32%	85%	71%
Average per corpus	59%	44%	44%	38%	49%	25%	51%	43%

Figure 7-89 Percentages of supralocal variants in the supralocal clusters of the TLS & PVC.

Average scores for the supralocal variants do not change so much across the decades 1970s and 1990s despite the inclusion of a higher number of middle-class speakers in the PVC (Figure 7-89). The PVC speakers who style-shift the most between the WL and the conversational material are either in the above supralocal or traditional clusters (Figure 7-61), so variation in this group mirrors the conversational style (FC), thereby making it even more comparable to the TLS. This said, average FACE values would probably have been higher in the PVC, had we used the FC data instead of the WL. But the robustness of these variants across the decades and corpus styles demonstrates that their adoption has remained constant, thus indicating that this **language change has stabilised for FACE and GOAT**. Higher percentages of raised onsets in PRICE indicate that it was a main determinant of TE supralocal

WC speech in the 1970s but less so in the 1990s. This may be due to the fact that there are more MC speakers in the PVC supralocal clusters and that the raised onset is more characteristically WC. Other supralocal variants like the raised lettER & and raised onset in MOUTH are an effect of gender as revealed by a Fisher test for lettER *(p* < .0001). Since the number of observations is rather small a Fischer test was more adapted than a chi-square test, which requires at least 5 observations per category. A logistic regression showed an interaction of gender and class with WC women favouring the raised onset to a greater extent than men *(p* < . 0001).[139] In the TLS (MC & LMC), the supralocal speakers are essentially women, whereas in the PVC, it is of mixed genders. This would suggest that **men and women are converging towards the supralocal variants**, with **the markers of WC women disappearing (raised onset in MOUTH)** instead of being adopted by supralocal men. A more detailed analysis of levelling in MOUTH is dealt with in the next section.

[139] The dependant variable was the presence of a raised onset or not. The other predictors included age and an interaction of gender and class.

7.15 Levelling in MOUTH

MOUTH is the vowel that has undergone levelling the most. The vestigial [u] and [ɪʊ], who were still heard in the TLS interview and WL data are now absent from the PVC WL. Unlike PRICE, the raised onset is on the verge of disappearing (Figure 7-91). In the TLS interview material, a conditional inference tree (Hothorn, Hornik, & Zeileis, 2006)[140] reveals that is it found among younger WC women and much less so among LMC women of the same generation (Figure 7-90). In the PVC, MOUTH is occasionally realised with a raised onset (ca. 20%) by only half of the WC women. In the TLS, frequent adopters of raised onsets, i.e. those who use it more than 50%, represent four fifth of the WC women. Interestingly, a majority of these speakers favour a raised onset in PRICE to a similar degree of proportions. It is difficult to know whether the younger female speakers from the PVC, who have retained a few raised onsets, are preservers of traditional female forms or innovators. But akin to their male counterparts, who have reinterpreted the traditional GOAT variant [ɵː] as more prestigious (Watt, p. 243), young WC women may very well be starting to reinterpret the local female variant [ɛʊ] as locally prestigious form. This would allow young women to express their affiliation to Tyneside by "reviving" their own marker of identity.[141] Further studies on more recent recordings of the DECTE will help confirm or reject this hypothesis.

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[140] Conditional inference trees test the effect of a number of independent variables upon a dependant variable (scores of MOUTH variants across speakers). Whenever an effect is significant a branch appears and separates the speakers into two groups (M vs. F). Sub-groups can appear whenever another effect is found (age and/or class).

[141] Future studies on NECTE2 with more recent recordings of TE will either help confirm or infirm this hypothesis.

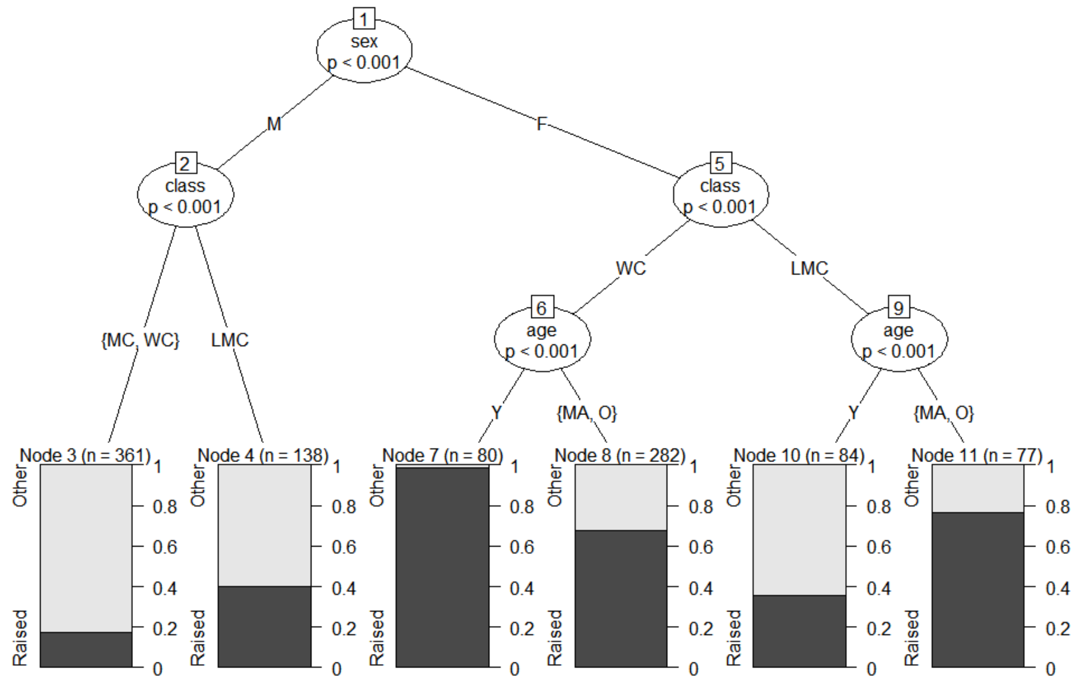


Figure 7-90 Conditional inference tree with percentages of MOUTH raised onsets (black)vs. other forms (grey) in the TLS split by the significant effect: sex, class and age.

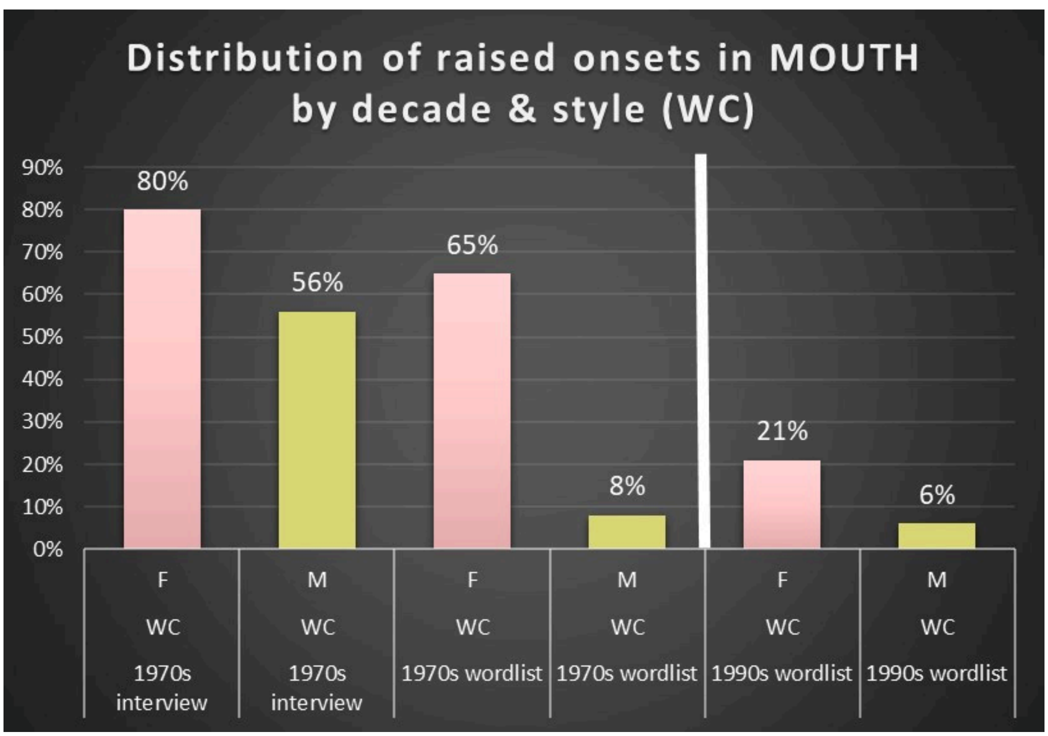


Figure 7-91 Distribution of MOUTH raised onsets by decade and style (WC).

7.16 Concluding remarks on variational changes between the TLS & the PVC

This section showed how the traditional and the supralocal clusters of MFA analyses on the TLS and the PVC reveal that proportions of traditional variants in FACE and GOAT increase in the PVC, but that their supralocal counterparts remain stable. Raised onsets in PRICE were significantly associated with the supralocal and the traditional speakers in the TLS. In the PVC, only a minority of supralocal speakers have retained the variant which is now more strongly associated with traditional speakers. Raised onsets in MOUTH is no longer a main determinant of WC female speech as they tend to converge towards a non-localised low onset. What now remains to be done before ending this chapter is a real-time study of TE. In the MFA & cluster analyses gender & class effects were brought to the forth but age did not appear as a significant effect when performing an aggregate analysis. However, it is possible that certain lexical sets are more affected by age or age *and* class *and* gender than other set, as depicted by the conditional inference tree in Figure 7-90. The main focus of the next study is to look at levelling from the angle of a real-time study, i.e. by looking at evolution of TE markers of indexicality as the speakers' birth year increases.

Real-time study of levelling towards pan-northern variants

7.17 Introductory remarks

In this section, a real-time study of TE is carried out based on the PVC & TLS sub-corpora of the DECTE corpus. The aim is to provide inferences regarding the degree of levelling towards pan-northern variants from the 1970s to the 1990s. Since real-time approaches are known to complement an apparent-time construct (Tillery & Bailey, 2003), a real-time study based on a restricted selection of variant appeared as the most pertinent next step to draw the two corpora together after having dealt with separate analyses of the TLS and the PVC.

7.18 Methodological issues

In this section I chose to complement the studies above and to adopt a real-time approach to this sociolinguistic data as in Trudgill (1972) or Buchstaller (2016). Choosing the pan-northern values proved to be a good way to measure levelling towards supralocal linguistic norms over time among in the PVC and the TLS. I then wanted to raise the following questions: if levelling is indeed occurring, does the levelling pace evolve differently depending on gender and class and does the recording style in the TLS and PVC play a role too?

One of the greatest challenges when separately analysing two sub-corpora that were built with different protocols is that it becomes harder and harder to find comparable aspects. I therefore chose linguistic variants that were frequent enough in both the TLS coding and the PVC wordlist and that were used by anyone from any social group. This was clearly the case of the supralocal values of FACE and GOAT. I took the most frequent sates in the TLS coding since they explain variation the most as showed by the MFA analysis on the TLS interview data. I kept the percentage values of the variants within their respective lexical sets (TLS) so that values could be reasonably comparable with those of the PVC. Choosing the supralocal value also allows to include variational information for most speakers and measure if, over time, the supralocal norm becomes more widespread, regardless of the other variants chosen by the speakers (above supralocal or local). Using the traditional value for GOAT would have given us nearly no information for one half of the sample (women) since it is barely used by them, contrarily to the supralocal variants.

Table 7-30 Variables retained for the real-time analysis (TLS and PVC).

	TLS (McNeany 1972)	**PVC (Watt 1998)**
FACE	[i̝̜] (state: 01123)	[eː]
GOAT	[o̟̜] (state: 01181)	[oː]
PRICE	[ɛ̠i̠̜] (state: 01341)	[eɪ]

Another initial challenge was to decide what to do with the age of the speakers since in traditional real-time studies, the speaker's birth year is used to form a time continuum. Penny Oxley's report provides the exact age of the speakers (1994), while the TLS uses an age decade. Adam Mearns did a meticulous job in retrieving more metadata from the TLS speakers than had ever been done before. He then found out the exact age for many speakers using the recordings themselves along with additional archive material (A. Mearns et al., 2016). For those whose exact age was missing, I chose a middle value within the decade itself so as not to skew the results any further. For instance, for a speaker in the decade 21-30 years old, I allotted the speaker the age of 25. Another problem was to retrieve the birth year. Since most TLS recordings were made in the 1970s, I decided to subtract the age of the speaker from the year 1970. It is possible that not all recordings were carried out that very year but so far, I have been unable to access more information on the matter. It is therefore important to note that the age is only an **approximation** of the age of some TLS speakers. For the PVC, I used the date 1994 provided in Oxley's report (1994) to compute the informants' age. To compare the two corpora, I chose to present my results based on the exact decade of birth of the PVC speakers and the approximate decade of birth of the TLS informants. Using either the approximate age or the approximate age decade did not affect the results presented below. The graphs below were made using a GAM smoothing (Wood 2017), which is used to estimate trends or curves instead of points.

With these results, we have to remain careful when interpreting the graphs, since pronunciations are known to evolve throughout one's life (Buchstaller et al., 2017). Younger speakers recorded below 30 usually adopt standard values to a lesser extent while middle-aged informants tend to use the standard variants much more (Trudgill, 1972; Wagner, 2008, 2012). Since speakers were not recorded at the same stage in their lives, the apparent time study should be used as a necessary and complementary approach to this real-time study.

7.19 Results & discussion

7.19.1 General trends in the levelling of FACE, GOAT and PRICE.

Overall, Figure 7-92 illustrates quite clearly that adoptions of the supralocal variant of FACE is spear-headed among women (+25%) with the levelling pace being more progressive for GOAT (+10%). While men appear to follow women to a smaller degree for the latter, men seem to march resolutely away from the variant [eː] in FACE. The youngest male speakers have an average score below 30%, while older speakers born before 1925 have scores above 50%. As to the PRICE raised onset, we notice that women are adopting it increasingly until reaching similar proportions of the local variant. It is possible that the raised onset is becoming a new prestige variant in the area. Hence creating a reversal of prestige norms in PRICE. However, we know that the PVC included an equal share of speakers from the middle-class while the TLS only had a few informants from the LMC. Results may be skewed by the change in cohort types from one corpus to the next. It is therefore necessary to separate each levelling trend by class, corpus and sex in the next sub-section.

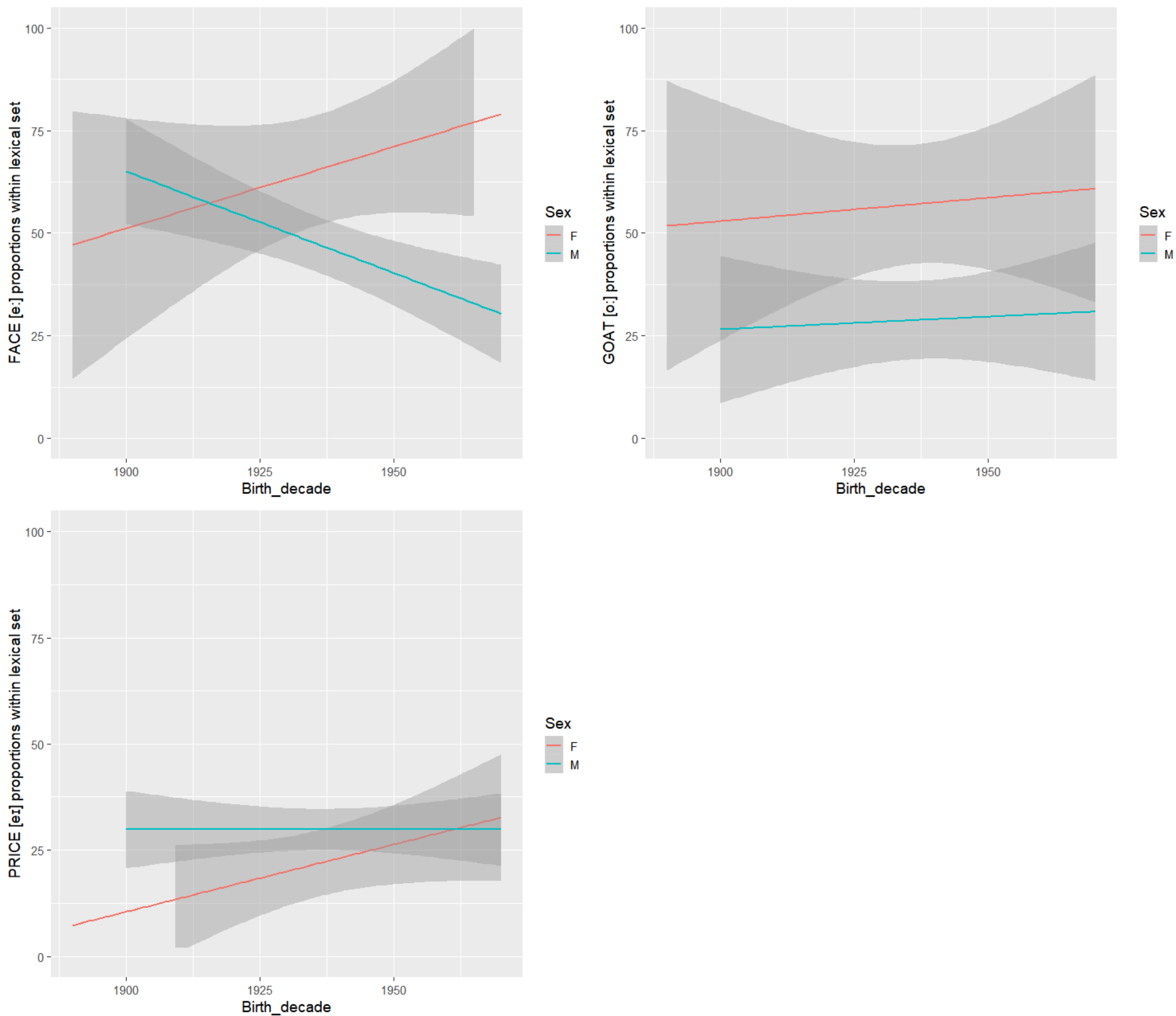


Figure 7-92 Real-time study of supralocal realisations of the supralocal FACE and GOAT values (resp. [eː] & [oː]) and of the PRICE local variant [eɪ].

7.19.1.1 Levelling by corpus, class and sex: gender-driven opposing prestige norms in FACE and GOAT.

As shown by the MFA analysis, variation patterns differ greatly depending on gender and class so I decided to split the trends based on these criteria to prevent false generalisations. As Figure 7-93 demonstrates, the younger generations of women in both corpora have changed over to employing the supralocal [e:]. This suggests that the gender gap in variation patterns seems to be widening, with women favouring supralocal levelling (even among MC speakers) and men adopting other variation norms. Indeed, only the younger working-class men in the PVC corpus adopt the pan-northern variant slightly more than the older speakers in the same category.

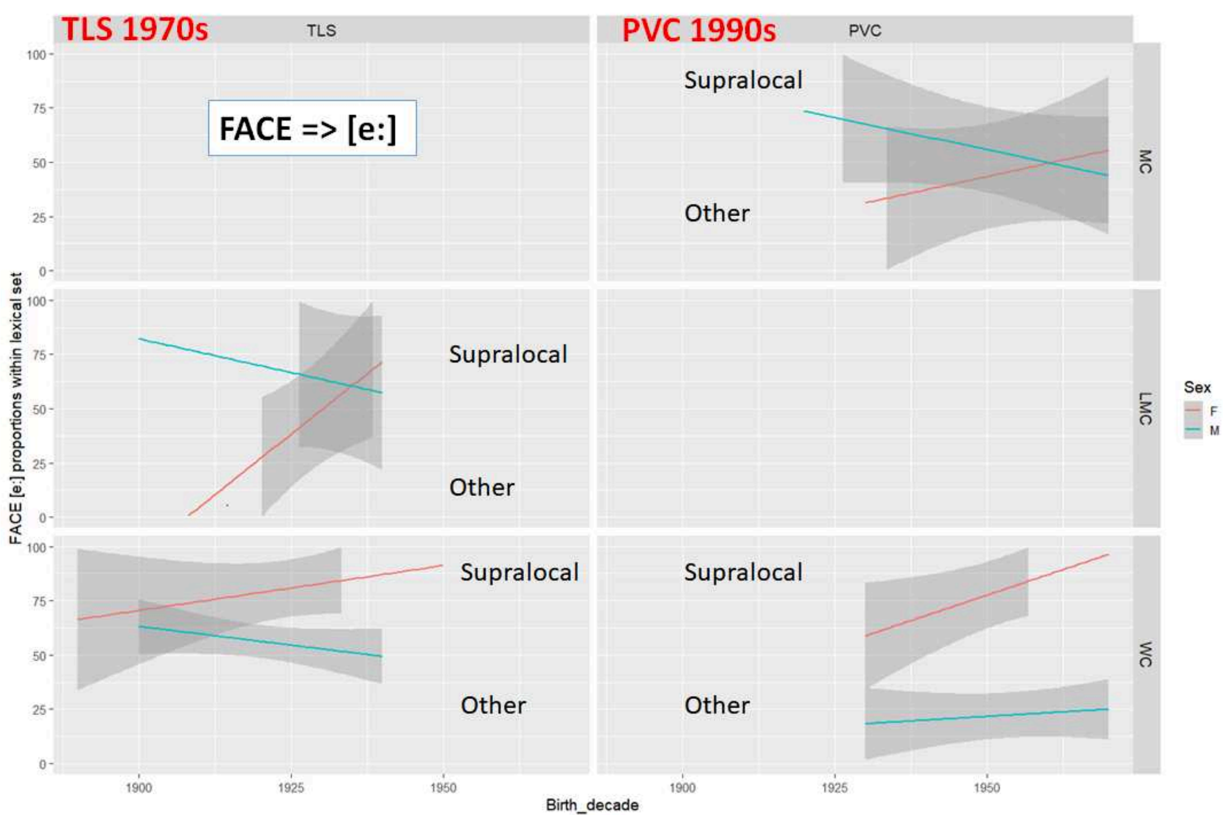


Figure 7-93 Real-time study of FACE levelling by corpus, sex and class.

Since the MFA analysis demonstrated the strong association of men with the local/supralocal variants except for one man in the TLS and two men in the PVC adopting above supralocal variants, it is clear that men are initiating counter-levelling in FACE, with the exception of the younger WC men in the PVC. Similarly to women, they follow the levelling trend albeit less sharply than their female counterparts.

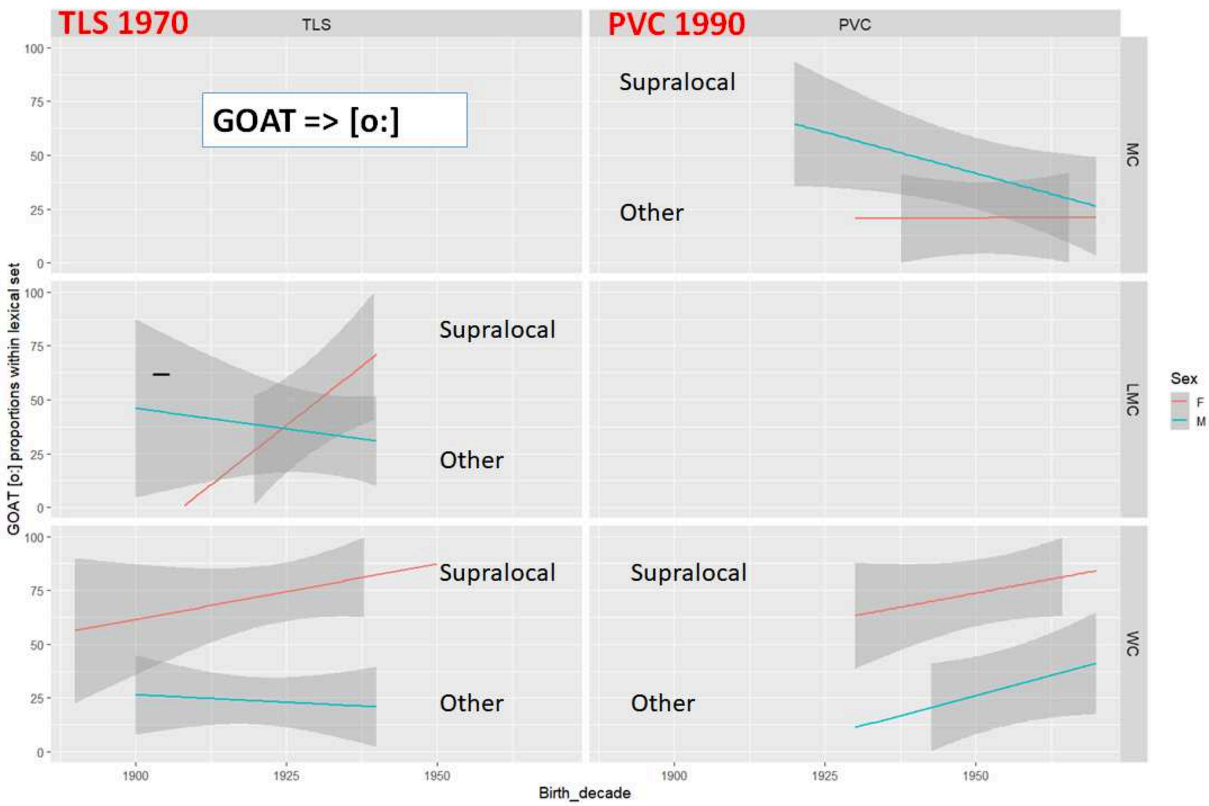


Figure 7-94 Real-time study of GOAT levelling by corpus, sex and class.

Proportions of the supralocal GOAT variant reveal similar levelling trends to those in FACE. Women are leaders of change towards pan-northern levelling in all groups except among middle-class speakers who favour the above supralocal variant [oʊ]. Stagnation in the trend can probably be ascribed to the fact that measurement for the PVC speakers stem from the world list reading task and not an interview like the TLS. In a future study I intend to use the spontaneous speech data of the PVC dyads instead.

Men adopt more local variants, with MC speakers using the WC variants as a new prestige norm pertaining to men only. **We therefore cannot disregard the fact that in Tyneside English, there are two parallel, gender-driven prestige norms**. The first one, is a female-driven norm which confers prestige on the middle-class pattern, but as was also found by Labov in his study of New York City (Labov, 1966a), men look up to an "equal and opposing prestige for informal working-class speech – a covert prestige enforcing this speech pattern" (Trudgill 1972, p. 183).

7.19.1.2 Counter-levelling of PRICE by corpus, class and sex: a new prestige-norm regardless of gender?

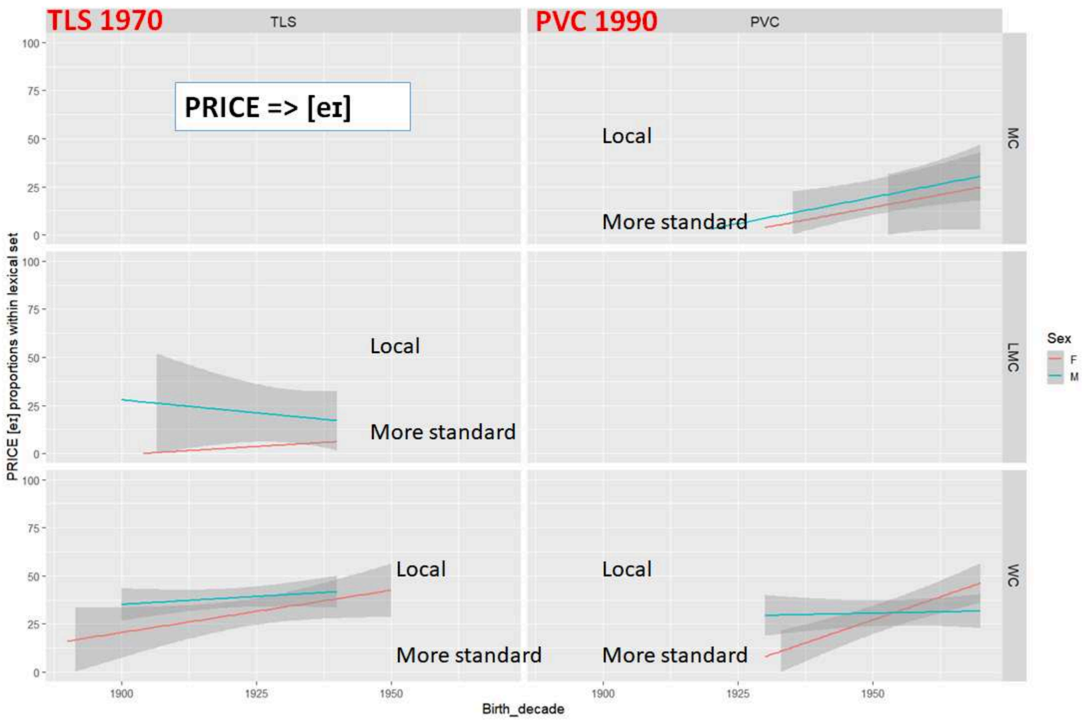


Figure 7-95 Real-time study of PRICE variant [eɪ] by corpus, sex and class.

In Figure 7-95 percentages of raised onsets in PRICE are expected to be low due to internal constraints. TE partially follows the Scottish Vowel Length Rule, so lower and raised onsets are bound to appear in a loose complementary distribution (Milroy, 1996). Although it is difficult to determine the total amount of words that are more likely to be pronounced with a raised onset and those with a lower onset, we can say with confidence that 50% is already a fairly high score.

Among women, raised onsets are on the rise reaching the scores for men and even outscoring working-class men in the PVC – proportions of LMC speakers are not enough to draw conclusions about these speakers but it is probable that the raised onset is gaining prestige among women of all classes.[142] Eckert and McConnell-Ginet remark that women and girls are "less constrained about crossing gender boundaries than boys and men". They develop this idea saying that "although the vernacular might seem to be masculine linguistic terrain, there are fewer constraints against a working-class woman stepping boldly onto that terrain, leaving girls and women freer to make full use of all linguistic resources, while boys and men stay carefully within conservative bounds" (2003, pp. 302-303). Hence the adoption of new prestige norms is likely to be facilitated in TE because women feel freer to adopt masculine norms and make them theirs. This said, the liberty with which the young middle-class speakers re-interpreted the traditional form [ɵː] as a "modern" and "prestigious" form in the PVC (Watt 1998), demonstrates that men are also able to play with conservative forms and turn them into markers of local modernity.

[142] As a frequent visitor of Tyneside, I remember hearing the variant more often among working class women in places like *Greggs* and *Mark Toney* who would tell me the bill using raised onsets: "two pounds n[eɪ]nty n[eɪ]n". *Greggs* is a bakery shop founded in Newcastle serving quick take away meal deals and breakfast "bacon rolls". It now has shops all over Britain. *Mark Toney* is a local ice-cream coffee shop and very popular among the locals.

7.20 Concluding remarks on levelling in TE

Across all ages, women appear to be leading the supralocal levelling process be it among the middle class or the working class (FACE and GOAT). A clear and widening gender gap is found among working-class speakers in both corpora. Men use the supralocal variant to a lesser extent except for PVC WC male speakers. However, this phenomenon observed in the PVC is partially due to the way young participants were sampled. Penny Oxley reports that in the 1990s it was still rare for WC boys to stay on for A-levels in the Tyneside area, which suggests that they were atypical for their class (Oxley 1994). Despite of this, PVC MC boys are clearly converging towards male working-class patterns.

The localised variant of PRICE is increasingly used by women who reach and even outscore men in the WC cohorts. This time, the variational gender gap is dwindling. Since women are known to be leaders of linguistic change in many cases, we can infer that they prioritise the class-based local norms over the class-less supralocal ones. As Milroy puts it "the localized [ei] in items of the type *right* and *wide* is in no danger of dying out" (1996, p. 221).

MOUTH is the vowel that has undergone levelling the most. The vestigial [u] and [ɪʊ], have disappeared from the PVC wordlist material but are still heard in the conversational data, especially in dyad 02. In the 1970 corpus, the raised onset is mostly heard among working-class women *(p* $< .001$), the highest scores being among younger WC women. In the WL material, scores tend to drop, which can be ascribed to the fact that the two MOUTH words from the list do not have a phonetic environment that typically favour raised or central onsets in Canadian raising (*sea houses* & *down*).

PART III

Acoustic analysis

CHAPTER 8 Acoustic analysis of FACE, GOAT and PRICE.

Summary of CHAPTER 8

In this chapter, a dynamic acoustic analysis of FACE, GOAT and PRICE in the TLS and PVC corpora (wordlist material) is carried out. Speech dynamics has recently gained prominence in sociophonetics and language variation (Cardoso, 2015; De Decker & Nycz, 2006; Sóskuthy, Stuart-Smith, Macdonald, Lennon, & Alam, 2017) because more statistical tools have been introduced in the field such as smoothing spline ANOVA (Gu, 2013) or generalized additive mixed effects models, also known as GAMMs, (S. Wood, 2017). Contrarily to linear mixed effects models, they can modelize time series, tongue shapes, pitch contours or formant trajectories, which are rarely linear. But akin to the more traditional mixed models, GAMMs can also address the issue of fixed effects like gender and social characteristics or random effects (subject and word) that may influence the shape of these curves. The present study addresses the issue of vowel variation within groups and individuals from a dynamic, and a static point of view (PRICE only). Formant trajectories of the vowels FACE and GOAT were first extracted and then hand-corrected in the TLS and PVC data. I then fit a GAMM model to the data with gender/age/class as linear fixed effects and time-normalised vowel measurements/duration as fixed effects smooths. The speakers and the word uttered are included in the model as random smooths. Results show interaction effects of gender and class with regard to both FACE, GOAT and PRICE. Spectrographic analyses of PRICE Revealed the importance not solely of onset height to determine a sociolinguistic variant but also of the formant trajectories themselves. While EI variants have their F2 soar towards F3 at the very beginning of the vowel, AI variants tend to have their F2 plateau at the onset of the vowel before merging with F3. A mixed effect model and a factor analysis including duration, F1 and F2 as variables rank F2 as the most important variable in distinguishing the low onset variant from the high onset variant in PRICE. In both the TLS and the PVC, duration in PRICE words follow the Scottish Vowel Length Rule more systematically than when inspecting the words from a variant point of view.

8.1 Introduction

The present study aims at verifying the coherence between the auditory/spectrographic data used in PART III of the thesis and acoustic analyses of FACE and GOAT in the PVC and TLS wordlists. The analysis for each lexical set is based on more than 3 000 measurements and presents a dynamic analysis of vowel trajectories using generalised additive mixed models (GAMMs; Wood, 2006) which is a non-linear model that analyses both fixed and random effects. Similarly to mixed effects linear models, they can also take into account random effects to limit the effect of individual variation and that of the word in which the measured vowel is. Another advantage of GAMMs is that the "type of non-linearity does not have to be specified in advance but is determined automatically . . . in a way that prevents overfitting" (Ko, Wieling, Ernst, Nerbonne, & Krijnen, 2014, p. 31). As Sóskuthy and colleagues point out "GAMMs are well suited to the analysis of time-varying speech data, as they can capture variation not only in trajectory height but also in trajectory shape" (Sóskuthy, Foulkes, Hughes, & Haddican, 2018, p. 8). Furthermore, Wieling remarks that "potentially interesting patterns in the dynamic data may be left undiscovered" (Wieling, 2018, p. 86) if one opts for a static approach of diphthongs only – also known as the *target approach* (Van der Harst & Van de Velde, 2014).

For the present study, GAMMs are useful in the sense that they can help determine the effect of external factors such as age, gender and class on the shape of formant trajectories and where in the trajectory the shape differ. I shall also use GAMMs to determine if the ratings correspond to significantly different formant trajectories and whether the shapes correspond to what is expected for a closing / centring diphthong or a monophthong. This said, GAMMs should not replace *target analyses* of phonetic data altogether. They should be paired up with other approaches. In a sense, GAMMs may over-complicate a model, especially if the focus of the analysis is the onset of a vowel only. Therefore a static analysis of PRICE vowels will also carried out in the present section so as to show how **both methods complement each other**.

8.2 Data & methodology

8.2.1 Data processing

Each vowel from the TLS and PVC wordlist was carefully aligned by hand using Praat (Boersma & Weenink, 2018) to ensure better results than forced-alignment despite great advancements in this field (Bigi, 2012; Sella, 2018). Then, a formant editor developed by Emmanuel Ferragne (Ferragne, 2019) was used to extract and hand correct F1, F2 and F3 trajectories. Namely, the spectrogram of the segmented vowels appear on individual windows and one can correct the formant estimation either by clicking on or, with a touch screen, drawing over the formant trajectories that are visible on the spectrogram. Each vowel was measured at a time step of 5 milliseconds, then time-normalised. In this chapter, I chose to use the time-normalised values. In the dataset, were added the auditory/spectrographic judgements both by Watt (1998) and mine. Watt's annotations pertained to FACE and GOAT vowels only. Watt's annotations and mine agreed on 81% of tokens (Cohen's Kappa =0.638). The hand-corrections of the formant trajectories with Ferragne's editor did not include the ratings so as to prevent any influence on the correction of the formant tracking. Moreover, the ratings were made at a much earlier stage than the formant corrections. It would have been nearly impossible to remember the chosen label for each item.

8.2.2 Measures of model fit and model selection

The GAMM analysis was computed using an extension of the `mgcv` package (S. N. Wood, 2009), called `mgcViz` (Fasiolo et al., 2018). It provides more modelling and visual possibilities than the base package. Since the data sets contained more than 60 000 observations, a model with random effects was computationally expensive so we opted for the *bamV* function in Rstudio, which speeds up the computation process. It is similar to the *bam* function used by Ko and colleagues in their work on dialectometry (Ko et al., 2014).

For the estimation of the non-linear and the random effects, the parameter ML (maximum likelihood estimation) was used to compare models differing in the fixed and random effects and to prevent overfitting using other parameters like GCV (generalised cross validation (S. Wood, 2011). The comparison of the model was based on the Akaike Information Criterion, henceforth AIC (Akaike, 1974; Sakamoto, Ishiguro, & G, 1986). A lower AIC value for one model against another indicates a relative better goodness of fit. A model with fixed effects only was compared to a model with random effects.

8.3 Results: PVC wordlist

8.3.1 Auditory/spectrographic ratings vs. acoustic trajectories

This preliminary step aims at analysing the correspondence between the auditory/spectrographic rating by the two analysts and the formant trajectory. The outcome variable for the following GAMM models is first **F1,** then **F2**. The following predictors are: **age** (young/old), **gender**, **class** (MC/WC), the **rating** (reference level: M for monophthong, CED: centring diphthong, CLD: closing diphthong and an extra central monophthong for GOAT, MC) along with the **following phoneme** (#: nothing, /p/, /t/, /s/, /d/ & /b/). The model includes height and shape effects on F1 or F2 for **age**, **gender** and **class**, and all their interactions. Models were first computed without random effects (GAM) and compared to a model where the **speaker** and the **word** were controlled for (GAMM) based on AIC, Akaike Information Criterion, (Sakamoto et al., 1986). It checks and penalises bad model fits and unnecessarily complex models. Models including random effects gave better fits with a lower AIC each time as shown in Table 8-1.

Table 8-1 Model comparison of a GAM vs. GAMM (y: F1 in FACE, re: speaker & word).

Mod.	Random effects	Score	Edf	Difference	Df	p.value	Sig.	Df	AIC
1	Without	-2958.091	26					42.65642	186748.8
2	with	-4307.960	46	1349.868	20.00	< 2e-16	***	80.89550	183312.5

Based on these values, the model with random smooths is a clear winner. Despite being more complex the fit is considerably improved. I found similar results for F2 in FACE and F1 & F2 in GOAT. Therefore, each model used in the sections below were made with random smooths where **speaker** and **word** are controlled for. This is important since without including **speaker** as a random smooth, for instance, the effects of the social and rating predictors will be based on the assumption that each vowel trajectory is an independent data point. Models with F2 in FACE showed much higher scores of explained deviance than those with F1 as a dependent variable (FACE: 40.6% for F1 vs. 80% for F2). Conversely, explained deviance was much lower for both models in GOAT (46.3 % for F1 vs. 53.7% for F2) since trajectories are expected to vary less from the onset to the target and a fourth level is used in the rating, i.e. the central monophthong [ɵː] coded MC.

8.3.1.1 The FACE vowel

Overall difference in F1

The first model using F1 as an outcome variable indicates that the formant trajectories for vowels rated as diphthongs by the rater (Amand) significantly differ in either shape or height from the vowels labelled as monophthongs ($p < .01$ for the centring diphthong and $p < .0001$ for the closing diphthong, cf. frame A in Figure 8-1). I chose to keep the R output results as such in Figure 8-1 to prevent confusion arising from a transfer of results into another format and display all the details needed to interpret the GAMM models.

Differences in curviness in F1

Then, in the rubric "smooth terms", we can check whether the shape of the three FACE variants corresponds to a straight formant trajectory or a curve (square B in Figure 8-1). A p-value below 0.05 only suggests that the shape of the trajectory significantly differs from a straight line. The column "edf" (frame B), which stands for estimated degrees of freedom, provides an index of the degree of straightness vs. curviness. A high number suggests a more curvy/wiggly line and a value close to 1 indicates a straight line. The vowels rated as monophthongs have an overall formant trajectory that is close to a straight line (edf = 1.069), while those labelled as diphthongs have a similar degree of curviness (CED edf = 5.735, CLD edf = 5.175). In the model, the monophthongs are still considered as significantly different from a straight line, yet the p-value is much higher than that for both diphthongs (M $p < .01$ vs. CLD/CED $p < .0001$). This may be due to formant transitions slightly affecting the trajectory of the monophthongs. However, such results suggest the reliability of the auditory/spectrographic analysis. But this is yet to be confirmed.

```
Family: Gamma
Link function: log

Formula:
F1 ~ annotation_AMAND + s(timePerc) + s(timePerc, by = annotation_AMAND) +
    s(timePerc, by = vowelInd, bs = "fs", m = 1) + class *
    sex * age2

Parametric coefficients:
                         Estimate Std. Error  t value Pr(>|t|)
(Intercept)              6.116803   0.005727 1067.987  < 2e-16 ***
annotation_AMANDCED     -0.001835   0.004980   -0.368    0.713        A
annotation_AMANDCLD      0.115602   0.004807   24.049  < 2e-16 ***
classWC                 -0.128495   0.006277  -20.469  < 2e-16 ***
sexM                    -0.087330   0.006733  -12.971  < 2e-16 ***
age2Young                0.037794   0.007209    5.242 1.61e-07 ***
classWC:sexM             0.047770   0.009310    5.131 2.91e-07 ***
classWC:age2Young        0.072918   0.009344    7.804 6.36e-15 ***
sexM:age2Young          -0.086658   0.009948   -8.711  < 2e-16 ***
classWC:sexM:age2Young   0.067039   0.012984    5.163 2.46e-07 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
                                  edf Ref.df      F  p-value
s(timePerc)                     6.410  7.369  3.641 0.000539 ***
s(timePerc):annotation_AMANDCED 5.787  6.897 25.745  < 2e-16 ***
s(timePerc):annotation_AMANDCLD 6.203  7.319 42.988  < 2e-16 ***   B
s(timePerc):vowelInd            6.205  7.561  4.568 2.47e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R-sq.(adj) =  0.197   Deviance explained = 25.9%
-ML =  93438  Scale est. = 0.040697  n = 16342
```

Figure 8-1 Summary output of model 1 (FACE, F1 as output variable)

We may now have a general idea of the curviness of all three variants but we still do not know whether the target in F1 is higher than the onset for the CED and lower for the CLD, nor do we know if the straight line for M is horizontal or not. Figure 8-2 can help us answer those questions. "Since GAMMs cannot be interpreted solely using model summaries, the plots are **not** purely illustrative: they play a central role in the discussion" (Sóskuthy et al., 2018, p. 8) [emphasis mine]. Let us then observe the plots. The first plot was computed based on a GAM regression and the second plot using local regression fitting (LOESS) since it reflects the shape of the trajectory better. Figure 8-2 and Figure 8-3 show that the monophthongal variant of FACE is indeed a fairly horizontal line, while both closing and centring diphthongs have falling and rising trajectories respectively. There may be a few formant visible transitions in the last 20% of the vowel as better displayed in Figure 8-3, but overall, the acoustic results for F1 confirm the reliability of the auditory / spectrographic analysis. I now turn to an analysis of F2 in FACE.

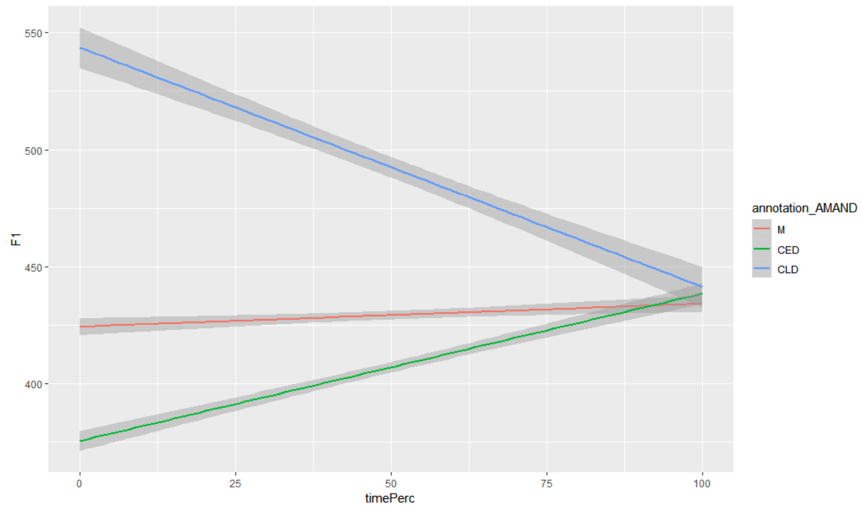


Figure 8-2 Prediction plot of F1 trajectory in FACE by rating using GAM (M: monophthong, CED: centring diphthong, CLD: closing diphthong).

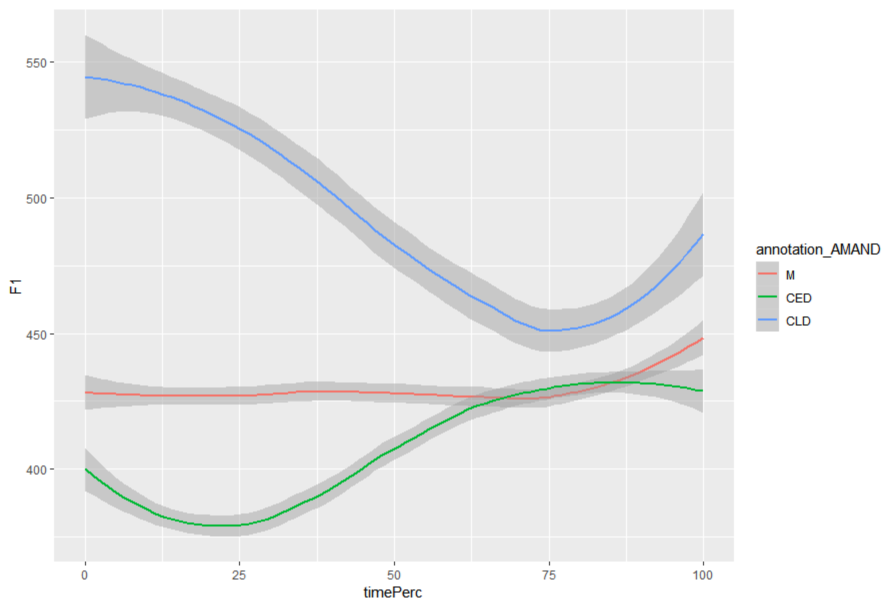


Figure 8-3 Prediction plot of F1 trajectory in FACE by rating using LOESS (M: monophthong, CED: centring diphthong, CLD: closing diphthong).

Overall difference in F2

The first model using F2 as an outcome variable indicates that the formant trajectories for vowels rated as diphthongs significantly differ in either shape or height from the vowels labelled as monophthongs (*p* < .001 for both the centring diphthong the closing diphthong, cf. square A in Figure 8-4).

Differences in curviness in F2

In the “smooth terms” section in Figure 8-4, we can see that F2 trajectories in M and CED are close to a straight line (*p* > .05, cf. square B in Figure 8-4), despite a curviness index of 5 and 3.9 respectively. Only CLD was deemed curvy enough. Trajectory plots in Figure 8-5 and Figure 8-6 reveal that the trajectories do correspond to what is expected for each vowel variant – a rather horizontal line for M, a rising F2 in CLD and decreasing F2 for CED.

```
Family: Gamma
Link function: log

Formula:
F2 ~ annotation_AMAND + s(timePerc) + s(timePerc, by = annotation_AMAND) +
    s(timePerc, vowelInd, bs = "fs", m = 1) + class * sex *
    age2

Parametric coefficients:
                       Estimate Std. Error  t value Pr(>|t|)
(Intercept)            7.860832   0.001933 4067.035  < 2e-16 ***
annotation_AMANDCED   -0.039604   0.001894  -20.907  < 2e-16 ***      A
annotation_AMANDCLD   -0.006587   0.001799   -3.661 0.000252 ***
classWC               -0.015359   0.002325   -6.607 4.04e-11 ***
sexM                  -0.189824   0.002495  -76.091  < 2e-16 ***
age2Young             -0.072856   0.002669  -27.300  < 2e-16 ***
classWC:sexM           0.001749   0.003458    0.506 0.612946
classWC:age2Young      0.110400   0.003458   31.929  < 2e-16 ***
sexM:age2Young         0.019881   0.003684    5.396 6.91e-08 ***
classWC:sexM:age2Young -0.039101  0.004808   -8.132 4.51e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
                                 edf Ref.df      F  p-value
s(timePerc)                    1.000  1.001  12.66 0.000373 ***
s(timePerc):annotation_AMANDCED  5.046  6.203 140.83  < 2e-16 ***      B
s(timePerc):annotation_AMANDCLD  4.721  5.831  90.15  < 2e-16 ***
s(timePerc,vowelInd)          27.051 27.923 107.79  < 2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R-sq.(adj) =  0.721   Deviance explained = 71.7%
-ML = 1.0732e+05  Scale est. = 0.0055627   n = 16342
```

Figure 8-4 Summary output of model 1b (FACE, F2 as output variable).

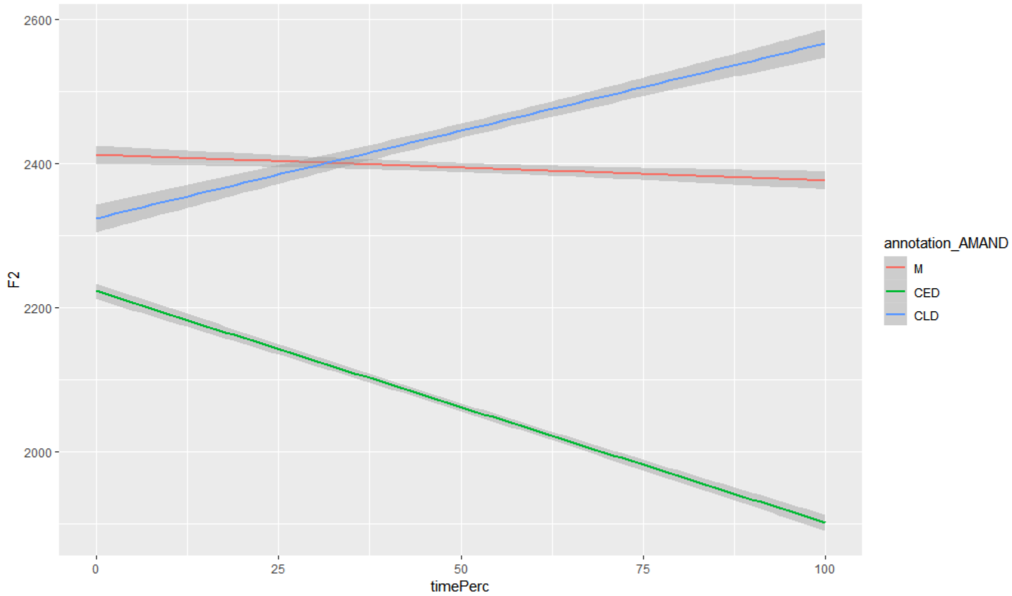


Figure 8-5 Prediction plot of F2 trajectory in FACE by rating using GAM (M: monophthong, CED: centring diphthong, CLD: closing diphthong).

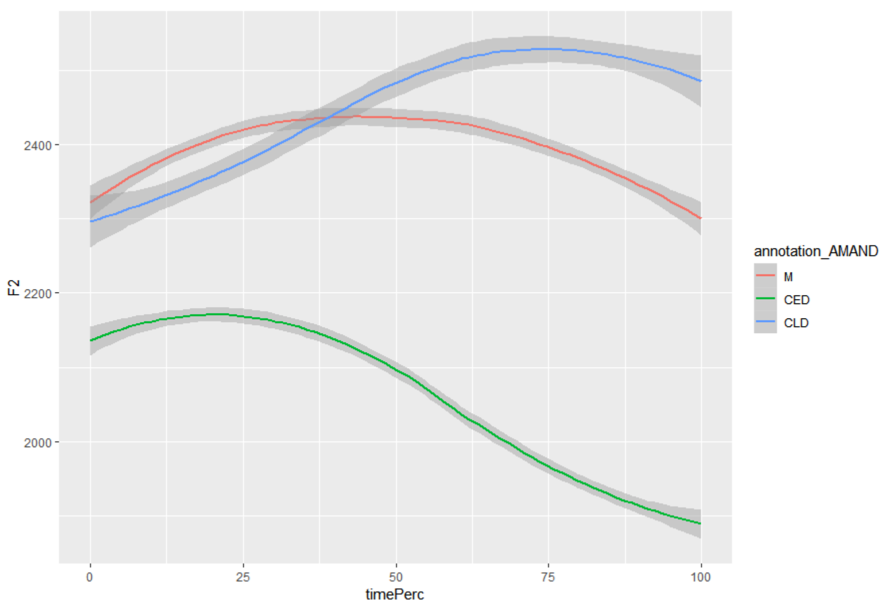


Figure 8-6 Prediction plot of F2 trajectory in FACE by rating using LOESS (M: monophthong, CED: centring diphthong, CLD: closing diphthong).

Shape differences in F1 and F2 trajectories (FACE)

GAMs can tell us in which section curves differ significantly. It is particularly useful if one wishes to check whether diphthongs differ in terms of offset/onset height or in terms of overall shape. Figure 8-7 depicts the differences in trajectory shape for F1 (top) and F2 (bottom) between each possible pair of variants (first variant minus the second variant). Here, the variants of FACE have very distinct realisations. All the pairs of curves differ in shape and height. In the middle section of the trajectory, where the lines cross, differences equate to zero. Since the acoustic analysis supports the auditory/spectrographic analysis, we can now turn to a sociolinguistic analysis of each variant.

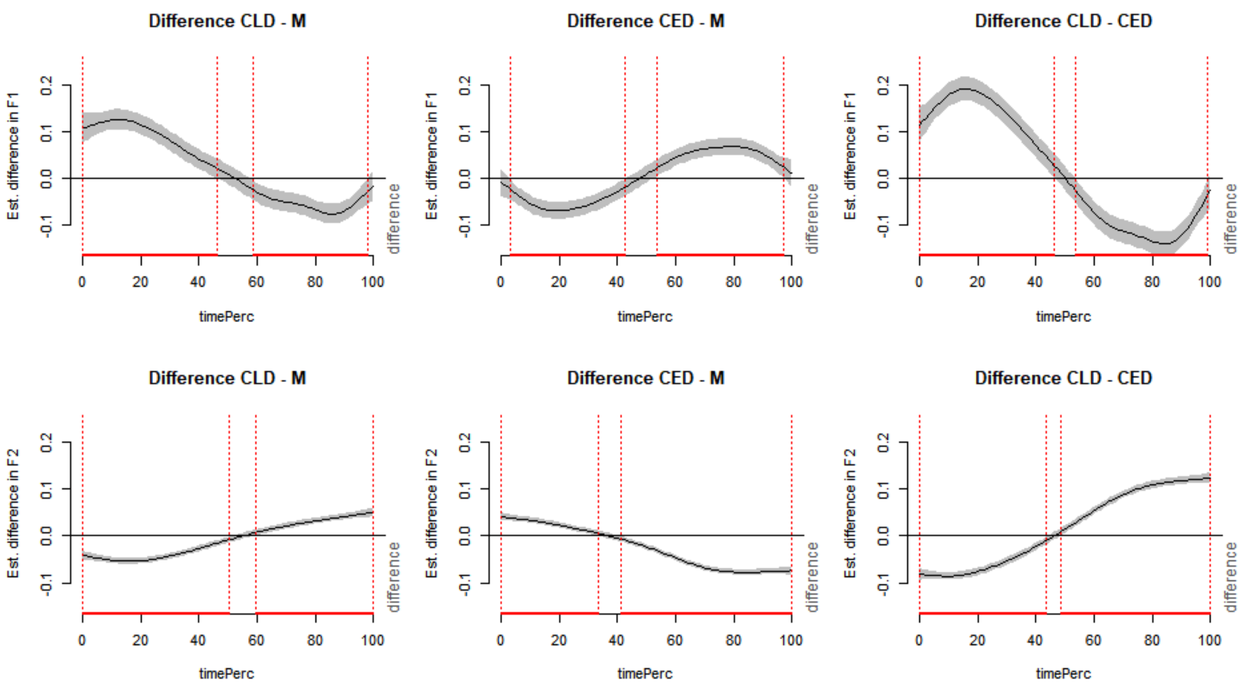


Figure 8-7 Differences in trajectory in F1 and F2 for the FACE set (M: monophthong, CED: centring diphthong, CLD: closing diphthong).

8.3.2 External factors of variation in FACE

Social factors affecting F1

Since neither F1 nor F2 were normalised, we clearly notice a difference in overall height between male and female formant trajectories as summarised by the effect plot of the GAMM analysis in Figure 8-8. Overall, frequencies are lower for men compared to women, which may give us an overly simplistic view of the effect of gender on formant trajectory heights. Hence, what we have to focus on is the shape of these curves and whether some variants are absent in a particular cohort. Therefore, a LOESS regression was used to depict estimated formant trajectories by gender, variant, class and age (Figure 8-9). Three main points arise from the interpretation of these graphs: (1) Only the older women used a closing diphthong in the WC cohort, whereas it is present in all MC ones. (2) CED patterns are not very distinguishable from M among women while men make a clearer distinction between the two variants. Older men of both social classes make CED and M more distinct from each other in the latter half of the vowel, having a higher F1 **target** for CED. Hence, the strategies among men for differentiating M from CED seems to be age and class related. (3) Younger MC female speakers have the steepest drop in F1.

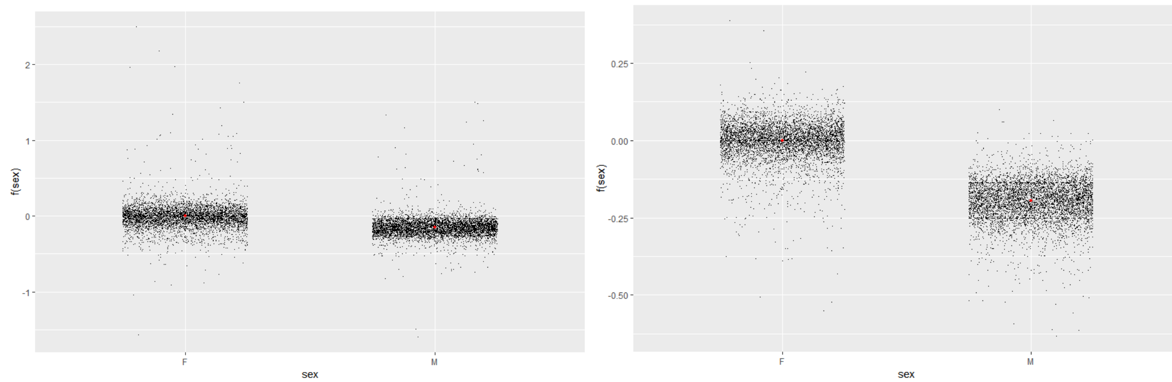


Figure 8-8 Plot of the effect of the parametric term *gender* in a GAMM analysis (F: female, M: man, left: F1, right: F2).

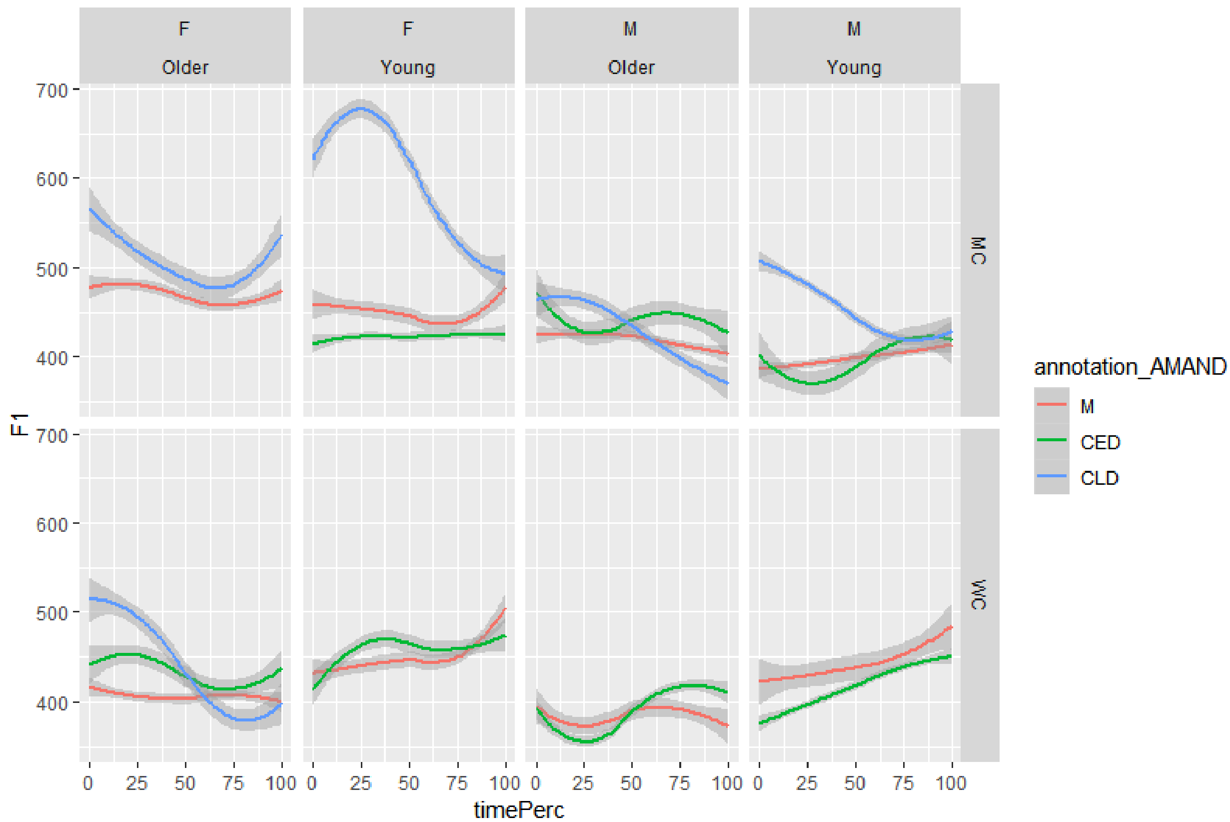


Figure 8-9 Prediction plot of F1 trajectory in FACE by rating using LOESS by class, gender and age cohort (M: monophthong, CED: centring diphthong, CLD: closing diphthong).

We now know that women make a very clear distinction between CLD and the other two variants M and CLD and that older men have a distinct target in M and CED. We then need to examine F2 trajectories to see if the patterns by cohort correspond to what is expected for each variant. Namely, a rather steady F2 for M, a rise for CLD and dip for CED.

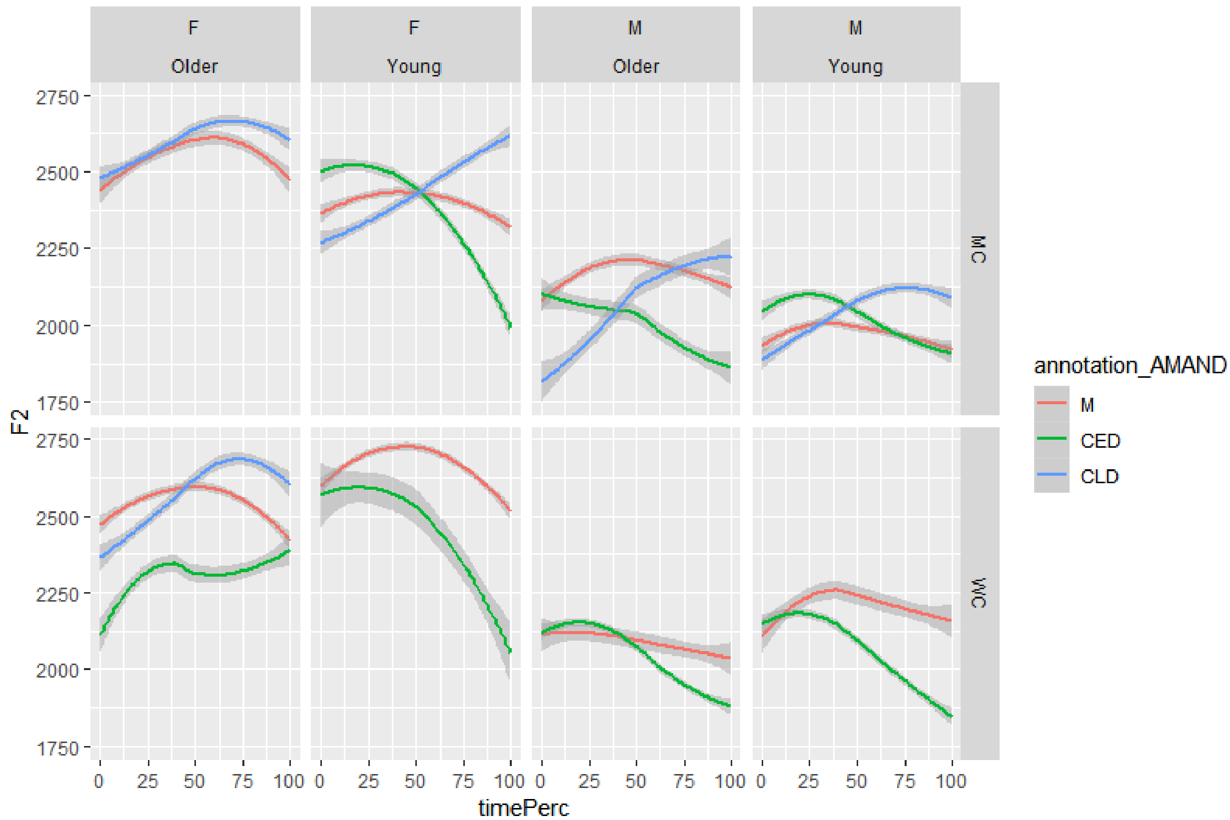
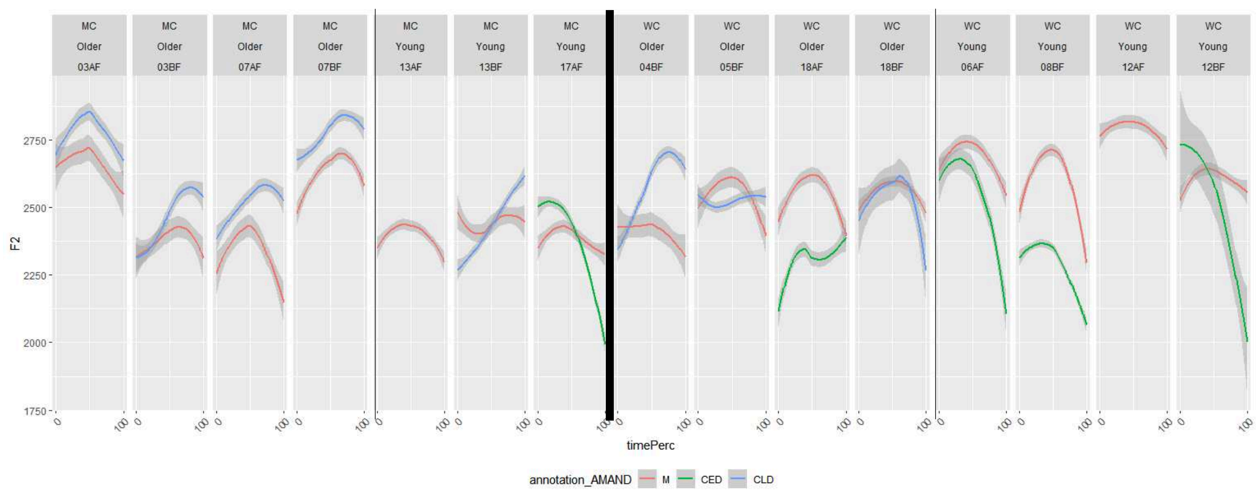


Figure 8-10 Prediction plot of F2 trajectory in FACE by rating using LOESS by class, gender and age cohort (M: monophthong, CED: centring diphthong, CLD: closing diphthong).

Figure 8-10 displays the F2 trajectories by age, class and gender cohort. Young MC men make the smallest distinction between M and CED, which is in line with what they did for F1 with both variants converging towards the last third of the vowel. The older and young WC men clearly have a lower target in CED than in M realisations of FACE. Older MC men make a distinction between the two variants at the very onset, while WC men make CED diverge from M at around 50% of the vowel. Once again, young women have the steepest curves, especially in CED, which suggests that the local variant CED is clearly audible among young women. Among MC women however, there is only one in three young female speakers using the local variant contrarily to WC women (3/4 use the CED,

Figure 8-11). Rating for 05BF and 18BF may not have been very accurate, for the distinction between CLD and M is somewhat unclear.

Figure 8-11 Prediction plot of female F2 trajectory in FACE by rating using LOESS by class, gender and speaker (M: monophthong, CED: centring diphthong, CLD: closing diphthong).



The F2 plot with individual female productions (Figure 8-11) highlights that the centring diphthong is rarely heard among young women only (17AF, 18AF, 06AF, 08BF and 12BF). Certain dyads have similar patterns like dyad 03, 07 or 06/08 since they use the same pair of variants and their F2 trajectories do not differ greatly. As for dyads 13, 18 and 12, the paired speakers exhibit diverging variant preferences:

- 13AF uses the monophthong exclusively while 13BF, who plans to attend a more prestigious university (Oxley 1994, p. 18), is the only young participant opting for the prestigious closing diphthong. Apart from academic ambitions, the social profiles given by the fieldworker Penny Oxley highlight only minute differences between the two girls.[143]

- 18AF and 18BF (middle-aged) were rated by Watt (1998) as producing monophthongs only and I rated one vowel as centring diphthong (*fatal*) for 18AF and one closing diphthong (*eighty*) for 18BF. Their profile in FACE is nearly identical while reading the wordlist.[144]
- 12BF might have realised only two centring diphthongs in *table* and *hate* (Amand rating), contrarily to 12AF. This may not be due to chance since Oxley reports 12AF as being "extremely aware linguistically". She "admits to modifying her speech and clearly sees this as necessary for her future ambitions" since she has already experienced negative comments about her northern accent. (Oxley 1994, p. 11).

Men across all generations use a distinct CED, except for 14AM, 09AM & BM (Figure 8-12). At first sight, 14AM & 14BM are in their late 60s, early 70s and live in the same estate. They both owned a business, post office and carpet trade, which makes their profile rather

---

[143] "[13AF] aged eighteen years is [10BM]'s girlfriend (tape 10) and lives on Chapelhouse estate. She has just completed 'A' levels in English, Mathematics and History at Walbottle High School and hopes to go to **Salford University** to read English and History. Her parents are both teachers and her sister, a third year medical student at Leeds. She does some evening work as an office cleaner and is planning a holiday in Spain with Alison and two other girlfriends" (Oxley 1994, p.18). "[13BF] is also eighteen and has known [13AF] since they were small children. She has completed 'A' levels in English, German and History at Walbottle High School and hopes to go to the **College of St John at Ripon** to read English. Her father is an accountant at Newcastle General Hospital where her mother works as a clerk. She is an only child, lives on Chapel park estate and has a Saturday / evening job as a waitress." (Oxley 1994, p. 18).

[144] While listening to the recordings, I noticed that one speaker used more glottal stops than the others so they differ in their production of other phonetic features. The differences may be allotted to the fact that, before becoming school cooks, the former speaker worked in a factory while the other worked for the gas board offices.

similar. Yet, 14BM joined the RAF before owning a business in Newcastle and it is very likely that the dialect contact he must have experienced while in the military has enhanced his ability to style-shift. 09AM & 09BM are also atypical for they use a CLD too. I tried to figure out why 09BM used a CED in some words, while 09AM did not. They are both in the same high school doing A-levels and a GNVQ respectively. They have the same age. However, the occupation of 09AM's father may suggest a slightly more prestigious role in society than that of 09BM – "self-employed and carrying out interior design for commercial properties" vs. "manufacturer's agent" – but more information is needed to account for the use of a centring diphthong in dyad 09.[145] The young MC men 10AM and 10BM do not clearly distinguish CED from M, both being flatter than in other men. This may suggest that they favour monophthongal realisations of FACE thereby following women who are the actors of change towards supralocal levelling.

[145] I also noticed that 09AM, who disfavours the local variant had first lived in an area where houses currently sell at a lower price (West Road) than in Chapelhouse estate (https://www.rightmove.co.uk/house-prices/NE15/West-Road.html, accessed 30th January 2019). At first sight, attending GNVQ classes seemed less prestigious than studying for A-levels in English, French and History (09BM), yet 09AM uses more prestigious terms than his friend. More detailed metadata might be needed such as the parent's mobility, whether the grandparents are also from the North East etc.

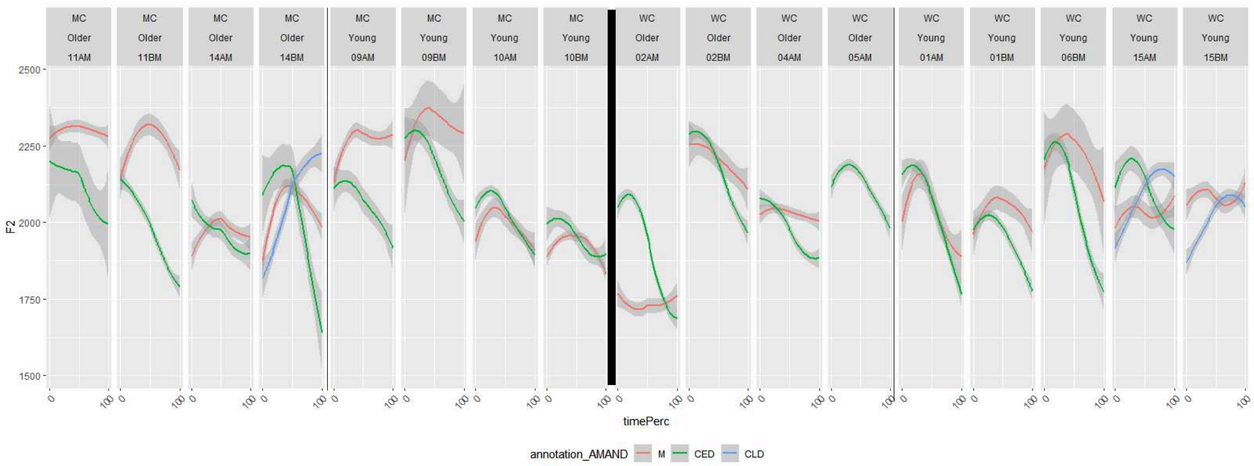


Figure 8-12 Prediction plot of male F2 trajectory in FACE by rating using LOESS by class, gender and speaker (M: monophthong, CED: centring diphthong, CLD: closing diphthong).

8.3.3 Dynamic analysis of GOAT vowels with GAMMs

Overall difference in F1

The first model using F1 as an outcome variable indicates that the formant trajectories for vowels rated as diphthongs by the rater (Amand) significantly differ in either shape or height from the vowels labelled as monophthong (M, reference level) *(p* < .05 for the centring diphthong CED and *p* < .0001 for the closing diphthong CLD, and *p* < .001 for the central monophthong MC, cf. square A, Figure 8-13). It is not surprising to observe a very small difference between M and CED since, usually, only a tiny rise of F1 is visible at the very offset of the diphthong. CLD values are generally lower and for M since the offset of the diphthong is a low vowel close to /u/.

Differences in curviness in F1

All the vowel variants significantly differ from a straight line. Surprisingly, the monophthong M is curvier than MC. As expected, CED is considered a straight line (edf = 0.03, *p* = 0.977) since the inglide is probably considered as noise. To test the robustness of the variant as a straight line in the model, more weight can be allotted towards the end of the vowel. The interval between the knots that contribute to the creation of a smooth function was narrowed down towards the end of the vowel, thus increasing the number of knots towards the end and thereby increasing the weight at the offset (model 3). In the summary results of model 3 (Figure 8-14), CED is considered curvier and is now significantly different from a straight line *(p* < .00001). Such model parameters should be tested especially when offsets in diphthongs are known to be subtly different from the onset. Changing these parameters did not affect the score for the explained deviance, nor did it impact the fixed effects. Model 3 will be used only when focusing on CED in GOAT.

```
Family: Gamma
Link function: log

Formula:
F1 ~ annotation_AMAND + s(timePerc) + s(timePerc, by = annotation_AMAND) +
    s(timePerc, by = vowelInd, bs = "fs", m = 1) + class *
    sex * age2 + s(speaker, bs = "re") + s(word, bs = "re") +
    folowingPhon

Parametric coefficients:
                         Estimate Std. Error t value Pr(>|t|)
(Intercept)              6.240679   0.074254  84.045  < 2e-16 ***
annotation_AMANDCED      0.029822   0.011754   2.537   0.0112 *
annotation_AMANDCLD     -0.139205   0.007438 -18.714  < 2e-16 ***      A
annotation_AMANDMC       0.024474   0.005733   4.269 1.98e-05 ***
classWC                 -0.172595   0.088550  -1.949   0.0513 .
sexM                    -0.243898   0.088559  -2.754   0.0059 **
age2Young                0.042975   0.096083   0.447   0.6547
folowingPhond           -0.044728   0.035016  -1.277   0.2015
folowingPhonl            0.087599   0.036131   2.424   0.0153 *
folowingPhonn           -0.072811   0.043488  -1.674   0.0941 .
folowingPhont           -0.015299   0.027804  -0.550   0.5822
classWC:sexM             0.123846   0.125233   0.989   0.3227
classWC:age2Young       -0.033422   0.130596  -0.256   0.7980
sexM:age2Young          -0.012983   0.130610  -0.099   0.9208
classWC:sexM:age2Young   0.108945   0.178707   0.610   0.5421
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
                                    edf    Ref.df       F  p-value
s(timePerc)                    1.000040  1.000066  68.183  < 2e-16 ***
s(timePerc):annotation_AMANDM  4.048922  4.925774  14.790 3.73e-14 ***
s(timePerc):annotation_AMANDCED 0.001285 0.002552   0.336    0.977        B
s(timePerc):annotation_AMANDCLD 4.794654 5.829851  33.231  < 2e-16 ***
s(timePerc):annotation_AMANDMC 1.000023  1.000041  47.641 5.44e-12 ***
s(timePerc):vowelInd           6.315704  7.767432   4.395 3.47e-05 ***
s(speaker)                    23.836157 24.000000 226.708  < 2e-16 ***
s(word)                        2.931933  3.000000 172.332  < 2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Rank: 109/110
R-sq.(adj) =  0.492   Deviance explained = 46.3%
-ML = -4155.1  Scale est. = 0.023618   n = 9404
```

Figure 8-13 Summary output of model 2 (GOAT, F1 as output variable). M: monophthong, CED: centring diphthong, CLD: closing diphthong, MC: central/open vowel.

```
Family: Gamma
Link function: log

Formula:
F1 ~ annotation_AMAND + s(timePerc) + s(timePerc, by = annotation_AMAND) +
    s(timePerc, by = vowelInd, bs = "fs", m = 1) + class *
    sex * age2 + s(speaker, bs = "re") + s(word, bs = "re") +
    folowingPhon

Parametric coefficients:
                        Estimate Std. Error t value Pr(>|t|)
(Intercept)             6.240678   0.074253  84.046  < 2e-16 ***
annotation_AMANDCED     0.029823   0.011754   2.537   0.0112 *
annotation_AMANDCLD    -0.139204   0.007438 -18.714  < 2e-16 ***
annotation_AMANDMC      0.024474   0.005733   4.269 1.98e-05 ***
classWC                -0.172594   0.088550  -1.949   0.0513 .
sexM                   -0.243897   0.088559  -2.754   0.0059 **
age2Young               0.042976   0.096082   0.447   0.6547
folowingPhond          -0.044728   0.035015  -1.277   0.2015
folowingPhonl           0.087599   0.036131   2.425   0.0153 *
folowingPhonn          -0.072810   0.043488  -1.674   0.0941 .
folowingPhont          -0.015299   0.027804  -0.550   0.5822
classWC:sexM            0.123845   0.125233   0.989   0.3227
classWC:age2Young      -0.033422   0.130595  -0.256   0.7980
sexM:age2Young         -0.012984   0.130610  -0.099   0.9208
classWC:sexM:age2Young  0.108945   0.178706   0.610   0.5421
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
                                  edf    Ref.df       F  p-value
s(timePerc)                   1.263e-04 2.123e-04   0.018 0.998437
s(timePerc):annotation_AMANDM   4.051e+00 4.928e+00  10.721 4.23e-10 ***
s(timePerc):annotation_AMANDCED 1.001e+00 1.003e+00  68.251  < 2e-16 ***
s(timePerc):annotation_AMANDCLD 4.793e+00 5.828e+00  13.057 3.22e-14 ***
s(timePerc):annotation_AMANDMC  1.000e+00 1.000e+00  14.675 0.000128 ***
s(timePerc):vowelInd          6.314e+00 7.767e+00   4.392 3.51e-05 ***
s(speaker)                    2.384e+01 2.400e+01 226.664  < 2e-16 ***
s(word)                       2.932e+00 3.000e+00 176.543  < 2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Rank: 109/110
R-sq.(adj) =  0.492   Deviance explained = 46.3%
-ML =  -4155  Scale est. = 0.023619  n = 9404
```

C

Figure 8-14 Summary output of model 3 (GOAT, F1 as output variable, knots at 20, 40, 60, 70, 80, 85, 90 and 95% of the vowel). M: monophthong, CED: centring diphthong, CLD: closing diphthong, MC: central/open vowel.

Figure 8-15 to Figure 8-18 depict formant trajectories for F1 and F2 in GOAT (all 32 speakers). Apart from a convex curve in F2 for M, formant trajectories form coherent curvatures. Contrarily to what has been found for FACE, it is primarily the onset in F1 that differentiate both CED and CLD from the back monophthong. Despite a more unobtrusive difference between MC and M in their F1 trajectory, F2 is much higher in the central monophthong MC as shown in the difference plots “Difference M-MC” in Figure 8-19.

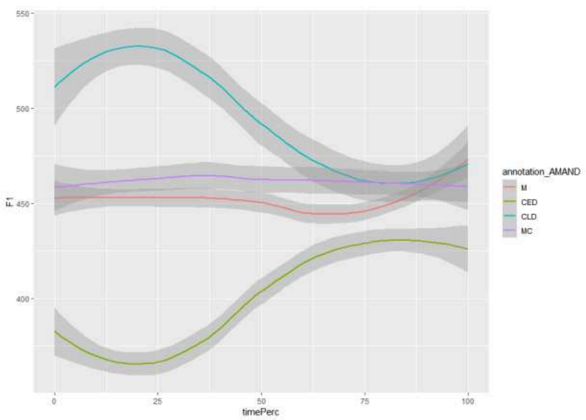


Figure 8-15 Prediction plot of F1 trajectory in GOAT by rating using LOESS (M: monophthong, CED: centring diphthong, CLD: closing diphthong)

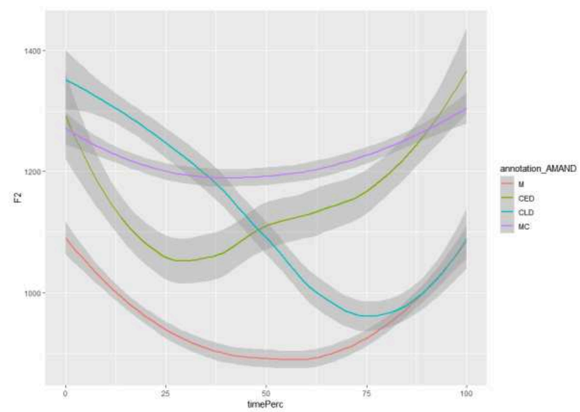


Figure 8-16 Prediction plot of F2 trajectory in GOAT by rating using LOESS (M: monophthong, CED: centring diphthong, CLD: closing diphthong)

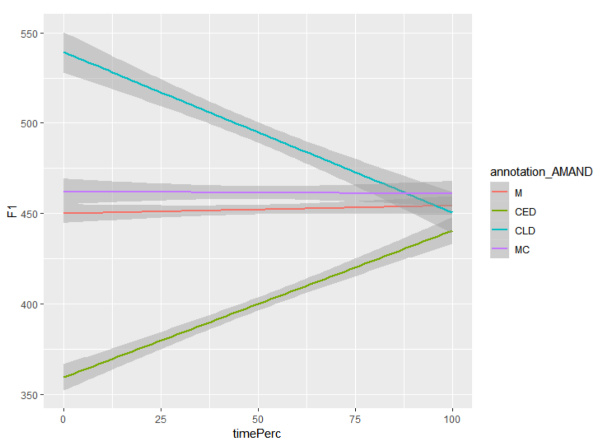


Figure 8-17 Prediction plot of F1 trajectory in GOAT by rating using GAM (M: monophthong, CED: centring diphthong, CLD: closing diphthong)

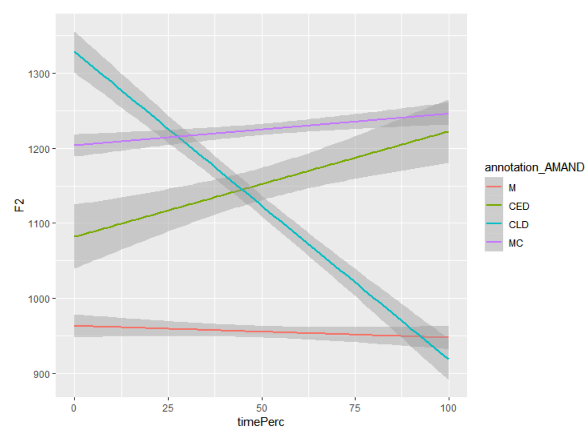


Figure 8-18 Prediction plot of F2 trajectory in GOAT by rating using GAM (M: monophthong, CED: centring diphthong, CLD: closing diphthong)

Model 2 reports more differences in height between CED and M in F1. Namely, between 0 and 20% of the vowel duration and above 40% onwards (Figure 8-19). Model 3, which includes more weight towards the last 20% of the trajectory, reports a difference in F1 only in the first half of the vowel (Figure 8-20). Differences in F2 are not dissimilar from model 2 to model 3. Since the reliability of the ratings has been tested, let us now tackle the issue of external factors that influence variation in GOAT.

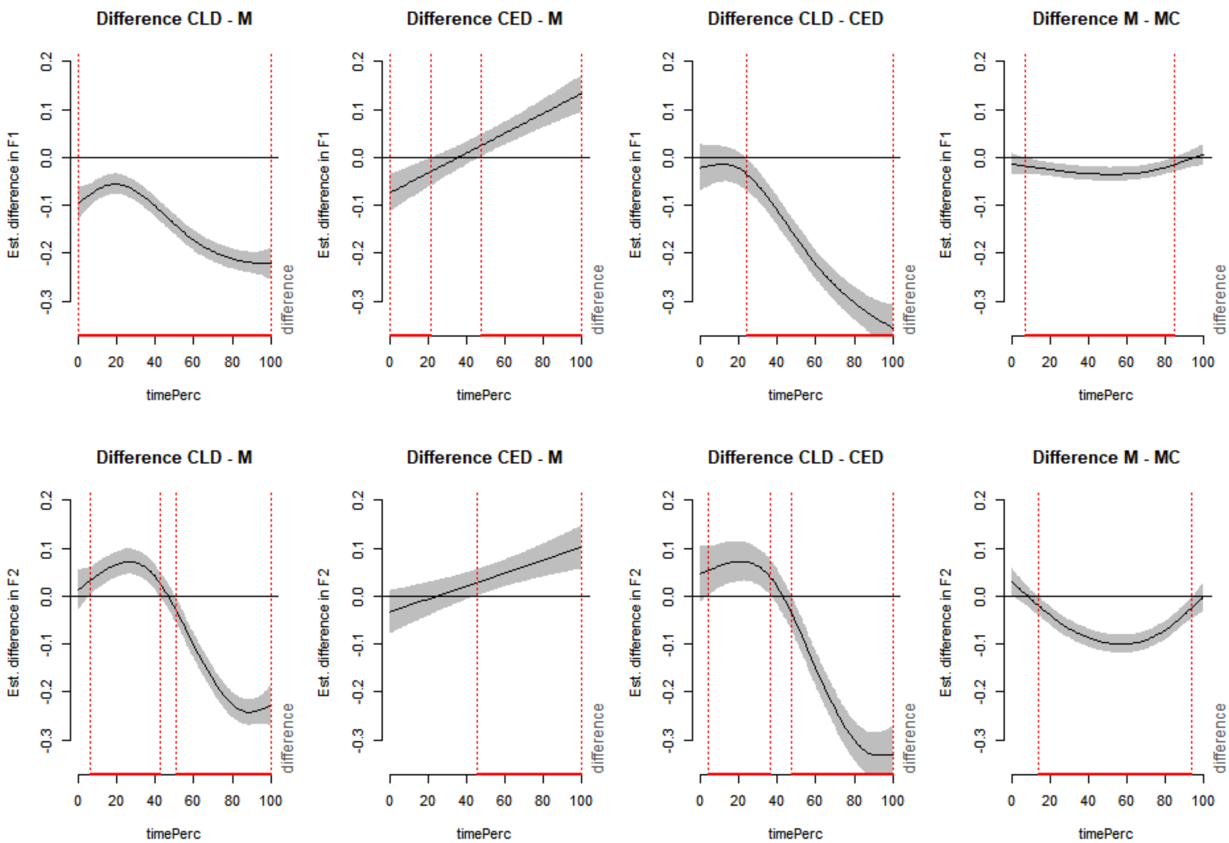


Figure 8-19 Differences in trajectory in F1 (top) & F2 (bottom) for the GOAT set using model 2 (M: monophthong, CED: centring diphthong, CLD: closing diphthong).

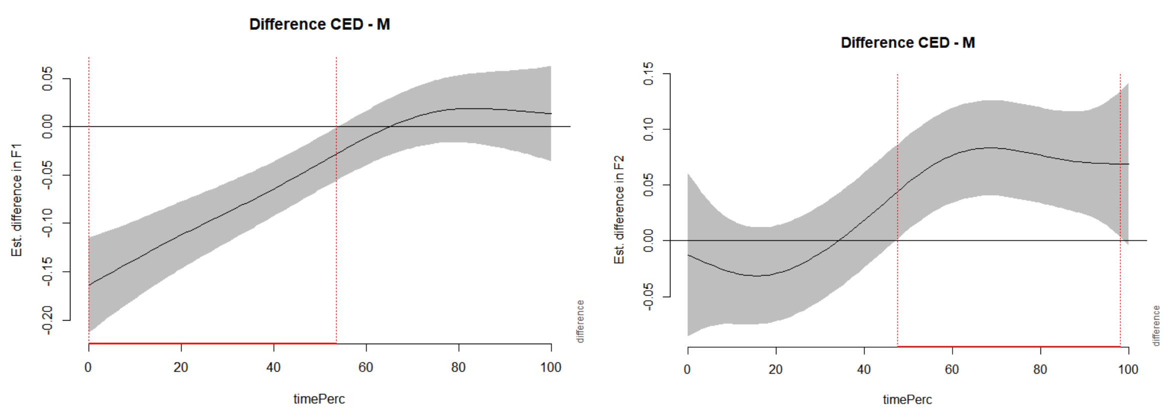


Figure 8-20 Differences in trajectory in F1 (left) and F2 (right) for the GOAT set using model 3 (M: monophthong, CED: centring diphthong, CLD: closing diphthong).

8.3.1 External factors of variation in GOAT in F1 & F2

Figure 8-21 displays formant trajectories by sex, age and class. Each curve represents a variant (Amand rating). Only WC men used CED in GOAT, while in FACE, it was slightly more frequent across gender, age and class. Young WC women only produced monophthongs. M is generally flat except among younger middle-class women, who also have the steepest curve for their closing diphthong. As opposed to older WC older women the former use the onset to make a difference between CLD and M. The distinction between each variant among WC older men is much less obvious than among their MC counterparts.

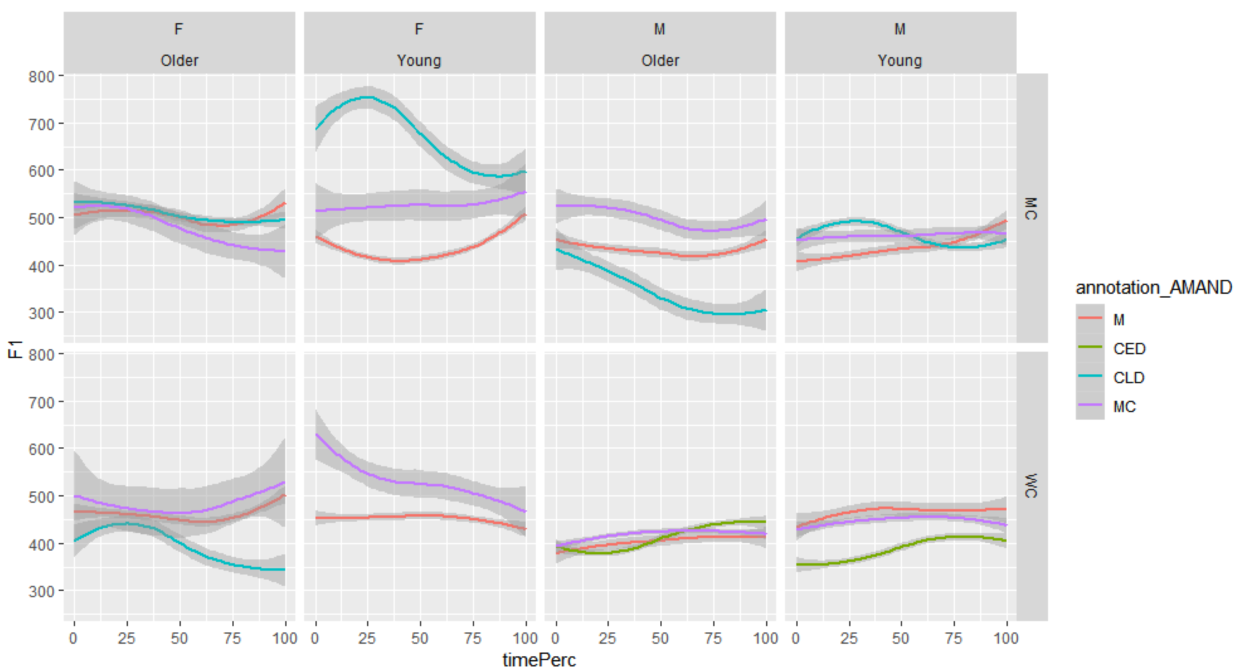


Figure 8-21 Prediction plot of F1 trajectory in GOAT by rating using LOESS by class, gender and age cohort (M: monophthong, CED: centring diphthong, CLD: closing diphthong).

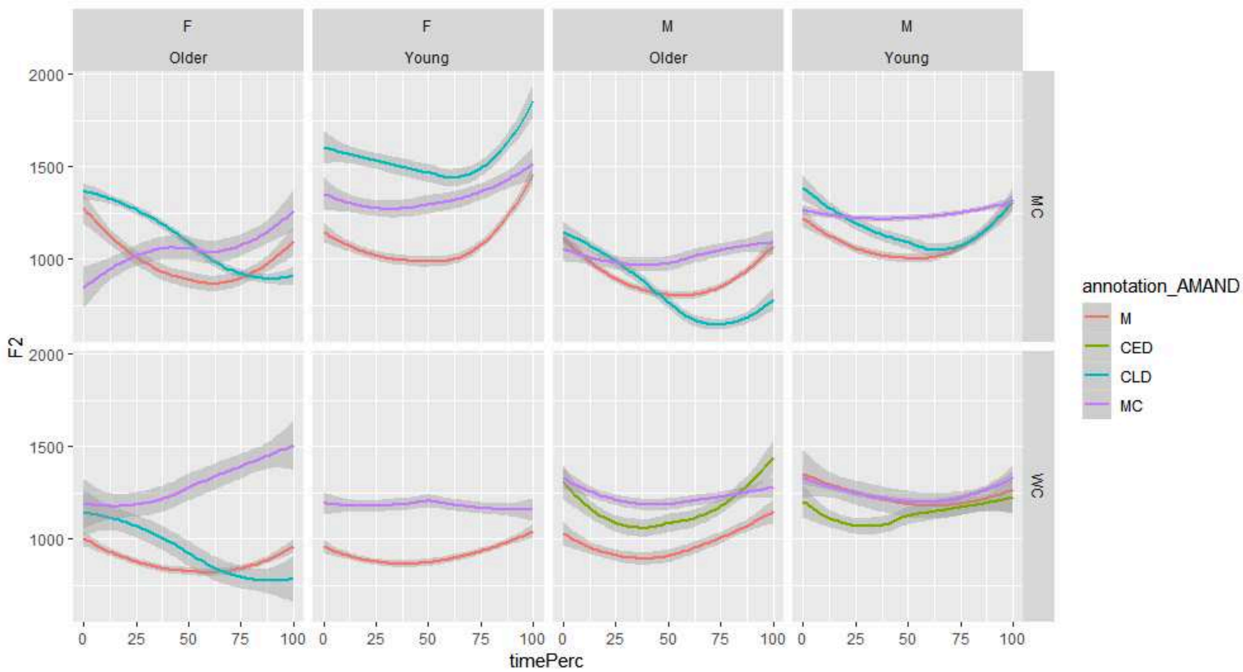


Figure 8-22 Prediction plot of F2 trajectory in GOAT by rating using LOESS by class, gender and age cohort (M: monophthong, CED: centring diphthong, CLD: closing diphthong).

F2 curves for M are more convex than for F1, which suggests greater formant movement (Figure 8-22). Except among older women, MC is relatively flat. Younger MC men do not seem to create a clear distinction between M and CLD. Interestingly, younger WC men have higher F2 values for M than do their female counterparts. Plus, their F1 is on average as high as the latter. It is possible that the back supralocal monophthong is undergoing fronting. This is in line with Watt's transcription of these GOAT words in MC younger men (Watt, 1998). Out of 49 measured vowels in this cohort, 33 were either a variant of a more open back vowel or a central vowel (Table 8-2). Only one speaker (01AM) had a back/high variant of GOAT, two speakers had more frequent central realisations (01BM & 06BM) and one, 15BM, favoured a lower variant [ɔː]. This may account for the overall higher values in F1 and F2. As for younger WC women, most vowels are either realised as [oː] or [ɔː] in Watt's transcription (1998). I also transcribed unstressed GOAT vowels as in *tomorrow*, *micro*, *metro*, *go* and *won't* and rated as MC – Watt transcribed some infrequent realisations of the unstressed vowels in these words but it is likely that they only served as extra indicators of variation in speakers.

Table 8-2 Watt's IPA transcription of GOAT vowels, WC younger speakers (top: men, bottom: women).

		Watt's transcription (1998), Y WC males													
Subj	**mainly**	**ɔ:**	**ɔ̝:**	**ɔ̞:**	**o:**	**˔o:**	**o̝:**	**ə**	**ə:**	**ɵ:**	**ø̝:**	**ʊ:**	**ʊə**	**ʊᵊ**	**TOTAL**
01AM	back/higher					1				1		4	4	1	11
01BM	central	1							3	3	4				11
06BM	central	3	1					1		6					11
15AM	back/mid	2			4		2								8
15BM	back/lower	7		1											8
TOTAL		**13**	**1**	**1**	**4**	**1**	**2**	**1**	**3**	**10**	**4**	**4**	**4**	**1**	**49**

		Watt's transcription (1998), Y WC females					
Subj	**mainly**	**ɔ:**	**ɔ̞:**	**o:**	**o̞:**	**o̝:**	**oʊ**	**TOTAL**
06AF	back/mid			10	1			11
08BF	back/lower	5	3					8
12AF	diverse	1	3	2		1	1	8
12BF	back/mid	5	2	1				8
TOTAL		**11**	**8**	**13**	**1**	**1**	**1**	**35**

Table 8-3 Amand's rating of GOAT vowels, Y WC women.

Subj & word	GOAT vowels rated as MC
06AF	**1**
won't	1
08BF	**1**
tomorrOW	1
12AF	**1**
won't	1
12BF	**4**
go	1
metro	1
tomorrOW	1
won't	1
TOTAL	**7**

When rating certain GOAT vowels, it was difficult to decide whether to add a third monophthongal variant to the list but some realisations were neither as back as the supralocal [oː], nor were they as central as those by a speaker like 6BM, where both Watt and I agreed on the variant type. I therefore opted for the label MC except in the word *polka* which had a pronunciation of its own (rated MO and often transcribed as [ɒ]) and is not presented in the results.[146] Although the choice did not seem ideal, it appears that the MC vowels among these women were significantly different in both F1 and F2 (Figure 8-21 & Figure 8-22, confidence intervals do not overlap except at the very end of F1 trajectories). A wider inspection of Watt's transcriptions also indicates that [oː] is by far the most frequent variant among women (40%, 77 out of 173), while men's score is about twice as less (23%, 41 out of 180). Hence within the supralocal variant, there is a clear gender gap among the supralocal variant itself, with men choosing fronter or higher GOAT exponents than women. A future analysis will measure the distance between the vowels rated as monophthongs using normalised F1 and F2 values and measure the extent of the gap. The next section provides a dynamic analysis of PRICE coupled with a static analysis of the onset only.

[146] Watt (1998, p. 244) made similar remarks: "the exclusion of polka from the overall figures for this variable. . . is necessitated by the fact that speakers assign it variably to GOAT and LOT".

8.4 Dynamic analysis of PRICE vowels with GAMMs

8.4.1 Inspection of the correlation between the annotations and their corresponding formant values.

Before describing the formant trajectories of PRICE by variant, it is necessary to check whether the annotations associated with each curve are coherent with regard to their frequency in F1 and F2. I first used a GAMM model with the annotations as a binary dependent variable (low versus raised onset: AI vs. EI). F1, F2, gender, age and class were considered as independent variables and the vowel ID as a random slope. The aim was to verify whether the curves in AI and EI varied significantly in height at least at the onset of the vowel for both F1 and F2. A GAM model, i.e. without random effects, with *word* as an additional fixed effect was performed and compared with a GAMM model with speaker and word as random effects.[147] A comparison of AIC between both models indicates a lower AIC in favour of the GAMM model (AIC: 8,598 vs. 13,073 for GAM). Adding interaction terms for the fixed effects did not improve the model significantly. They were therefore removed.

[147] Adding *word* as an additional fixed effect did not seem to make the GAMM model converge.

Table 8-4 Summary of the final GAMM model with the annotation (AI/EI) as dependant variable. The column 'edf' indicates the estimated degrees of freedom for each smooth function. Y: younger speakers, M: men, WC: working-class.[148]

```
Family: binomial
Link function: logit

Formula:
annotation_AMAND ~ F1 + F2 + s(timePerc) + s(timePerc, by = vowelInd) +
    age2 + class + sex + s(speaker, bs = "re") + s(word,
    bs = "re")

Parametric coefficients:
              Estimate Std. Error z value Pr(>|z|)
(Intercept) -9.1222401  3.0575764  -2.983  0.00285 **
F1          -0.0020590  0.0002864  -7.188 6.56e-13 ***
F2           0.0026515  0.0001380  19.220  < 2e-16 ***
Age_Young    1.2628871  0.5903661   2.139  0.03242 *
Class_WC     1.6580688  0.5911543   2.805  0.00503 **
Sex_M        0.9627583  0.5918197   1.627  0.10378
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
                        edf Ref.df    Chi.sq p-value
s(timePerc)           3.454  4.251     88.34  <2e-16 ***
s(timePerc):vowelInd  4.680  5.523     15.46  0.0126 *
s(speaker)           26.955 28.000  74805.48  <2e-16 ***
s(word)              14.993 16.000 491072.19  <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R-sq.(adj) =  0.719   Deviance explained = 69.4%
-ML = 4412.9  Scale est. = 1         n = 2513
```

The GAMM analysis reveals an overall significant difference in height between AI and EI. The final model output is displayed in Table 8-4. In the model, contrasts were set such that AI has a negative direction (-0.5) and EI, a positive one (0.5) – instead of the default 0 for AI and 1 for EI. This thereby gave us an indication of the bias via the intercept (in Table 8-4), i.e. whether one variant is more generally used than the other. Here the intercept is negative, which means that overall, speakers use more low onsets in PRICE than the raised onset. Here, the intercept (-9.12) is reliably different from zero (which would be equal odds) in the

[148] The model output was deliberatly left as such for the sake of transparency. Only the levels for the fixed effects were renamed slightly to become more explicit.

direction of 'AI' responses. This tells us that participants in this task default to using the lower variant in PRICE. F1 values for EI compared to AI are significantly different with EI having lower curves overall. This is the reverse for F2. Both results are in line with our expectations. Differences in overall heights of formant trajectories between men and women were not deemed significantly different. The positive values in the estimate for the WC indicates a strong preference for the raised onset compared to MC speakers. Younger speakers tend to favour the raised onset slightly more than the older speakers overall. Since the annotations made by the rater and the acoustic values tend to form coherent patterns, I shall now proceed to an analysis of the curves by variant type and by socioeconomic background.

8.4.2 External factors influencing formant trajectories in PRICE.

Dynamic analyses of PRICE vowels by variant (Figure 8 23) indicate a clear preference among MC speakers for a low onset (AI curve in coral), with the exception of young MC men whose datapoints for the raised onset are more numerous than in the other MC groups. In the WC cohort, raised onsets are more numerous overall. The distinction between both onsets is the most evident among younger women across both classes. Despite a few outliers in the formant trajectories, the acoustic results are in line with the auditory analysis in chapter 7.

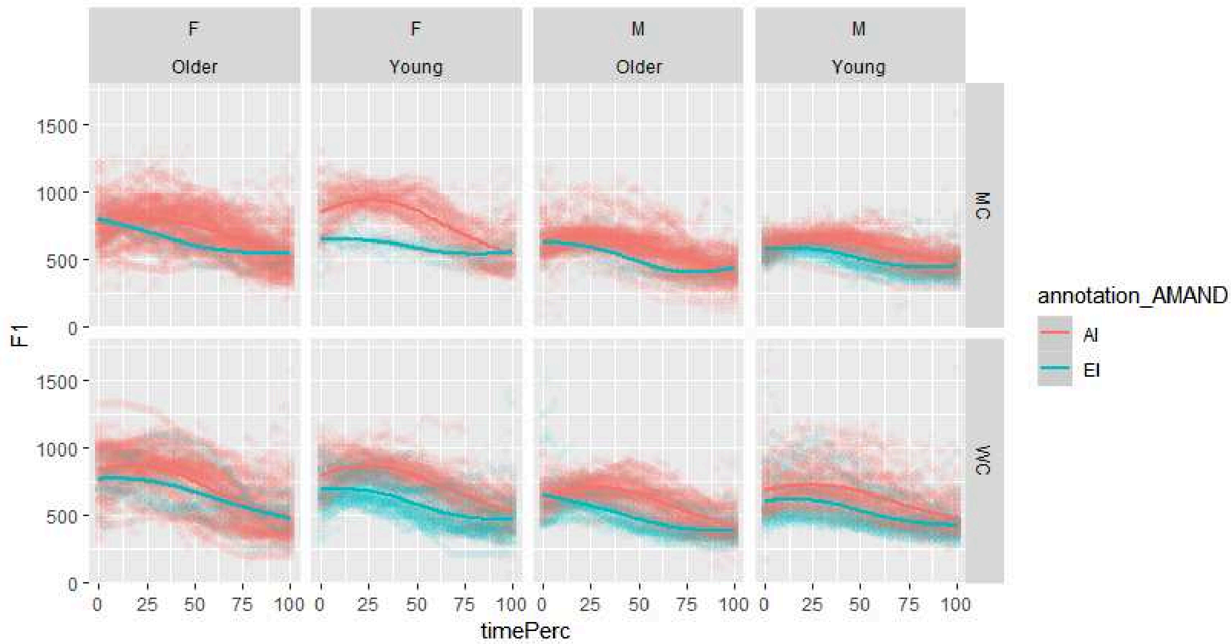


Figure 8-23 Locally weighted regression analyses of F1 by class, age and gender in PRICE. AI: low onset, EI: raised onset (PVC data, 33 speakers).

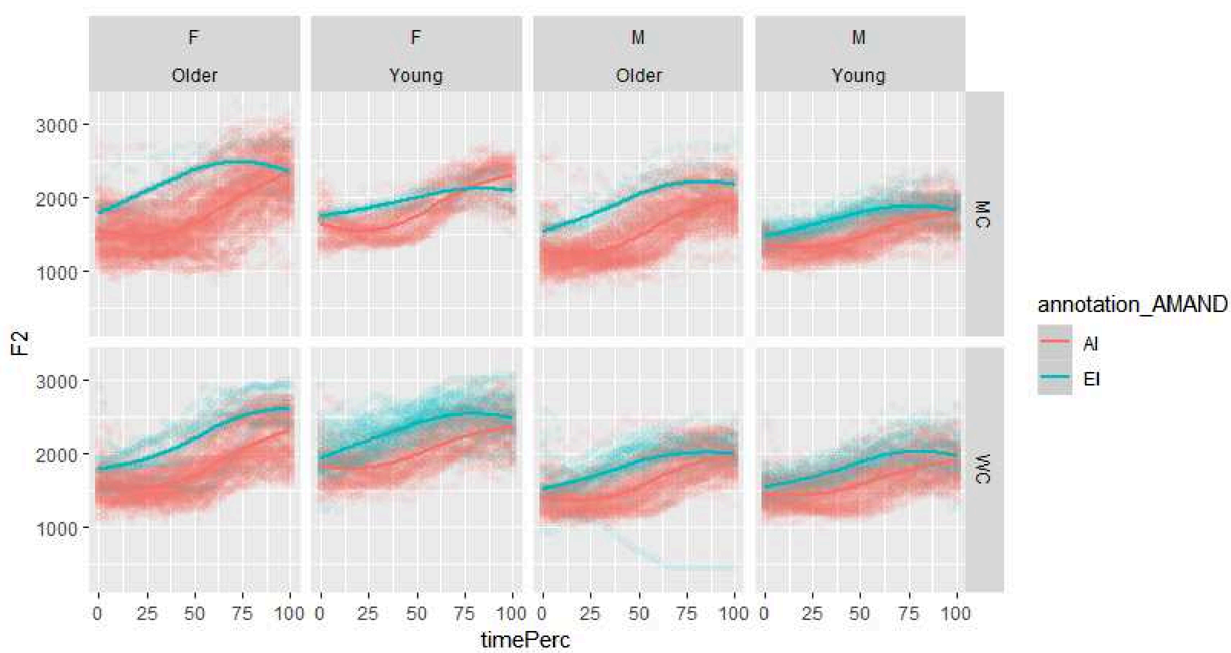
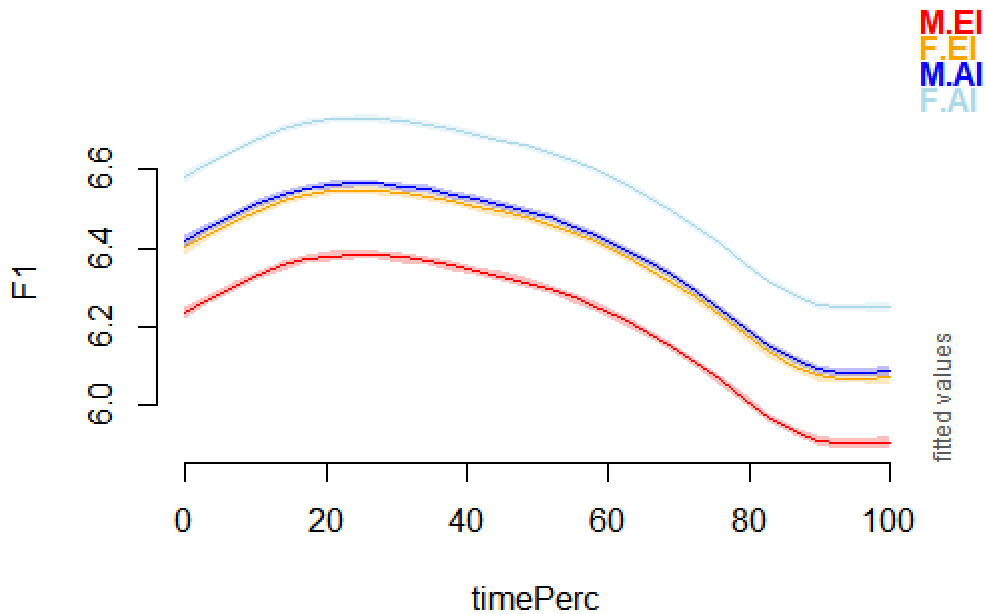


Figure 8-24 Locally weighted regression analyses of F2 by class, age and gender in PRICE. AI: low onset, EI: raised onset (PVC data, 33 speakers).

F2 trajectories tend to be visibly higher for women than F1 trajectories (Figure 8-24), which is to be expected because variation in F2 is generally higher than in F1 (Vaissière, 2015). A clear outlier is visible among older WC men, but overall, trajectories for both onsets correspond to the initial expectations of having trajectories labelled as EI higher than those labelled AI. Trajectories by gender show that while trajectories for both variants tend to be higher for women, the average AI trajectories of the women elbow the average EI curves for the men, which reveals the obvious gender effect with regards to formant frequencies (Vaissière, 2015). However, gender may not be the only affect in F1/F2 trajectories for PRICE. I shall now inspect other effects such as class, age and word.



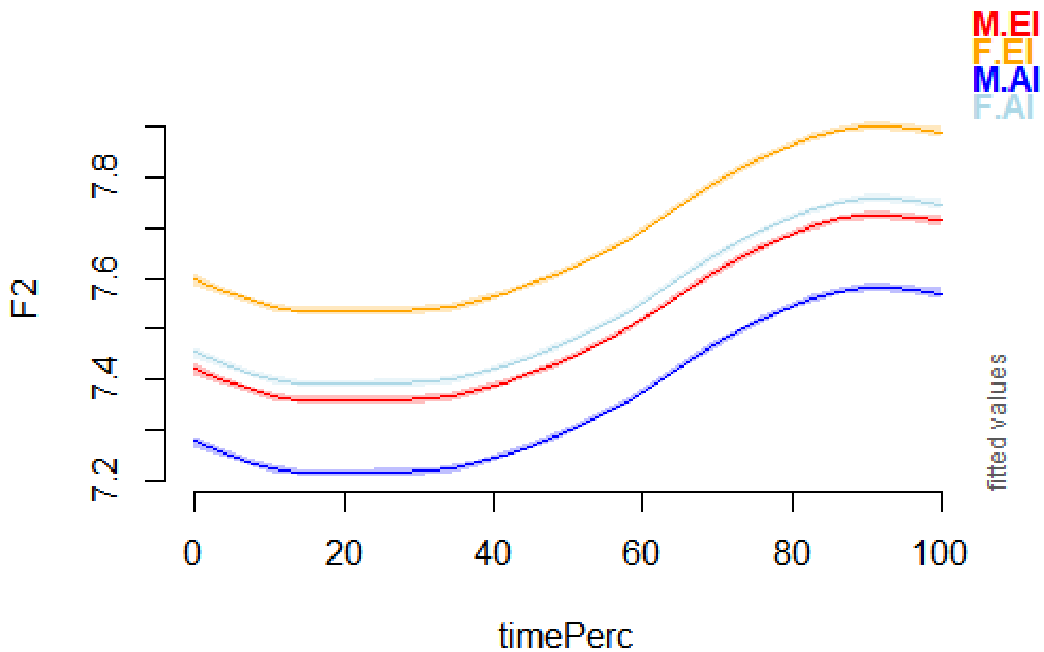


Figure 8-25 Formant trajectories by gender and PRICE variant (fitted values of the GAMM regression, top: F1, bottom: F2).

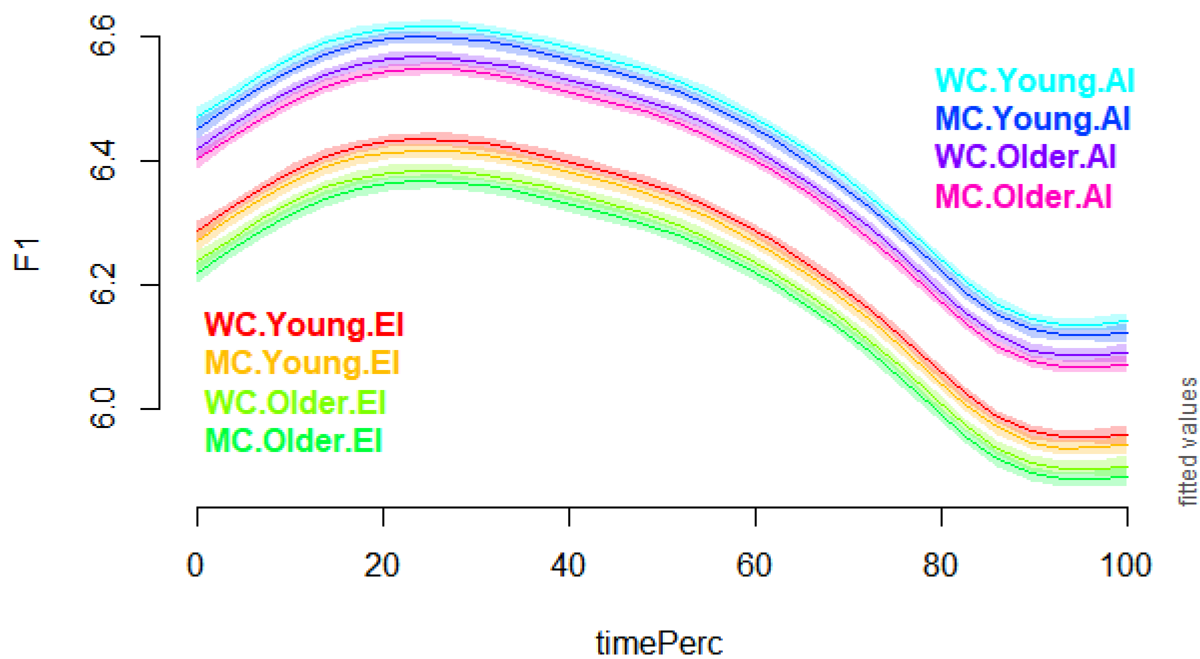


Figure 8-26 Fitted values of F1 trajectories by class and age per PRICE variant.

Figure 8-26 displays variation in F1 trajectories by age and class cohort. Overall, younger speakers tend to have higher frequencies than older speakers.

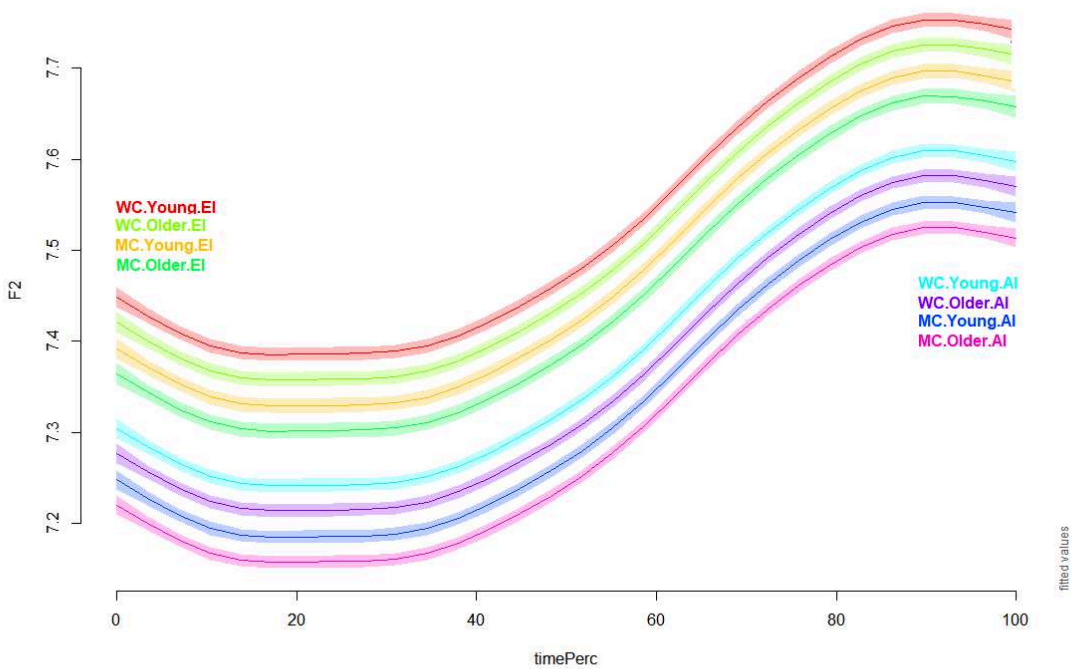


Figure 8-27 Fitted values of F2 trajectories by class and age per PRICE variant.

Interestingly, for F2 (Figure 8-27), class appears as more important than age with working-class speakers of both generations having more similar trajectories. Indeed, the differences in effects are made more explicit when plotting the effects of the GAMM analysis (Figure 8-28).

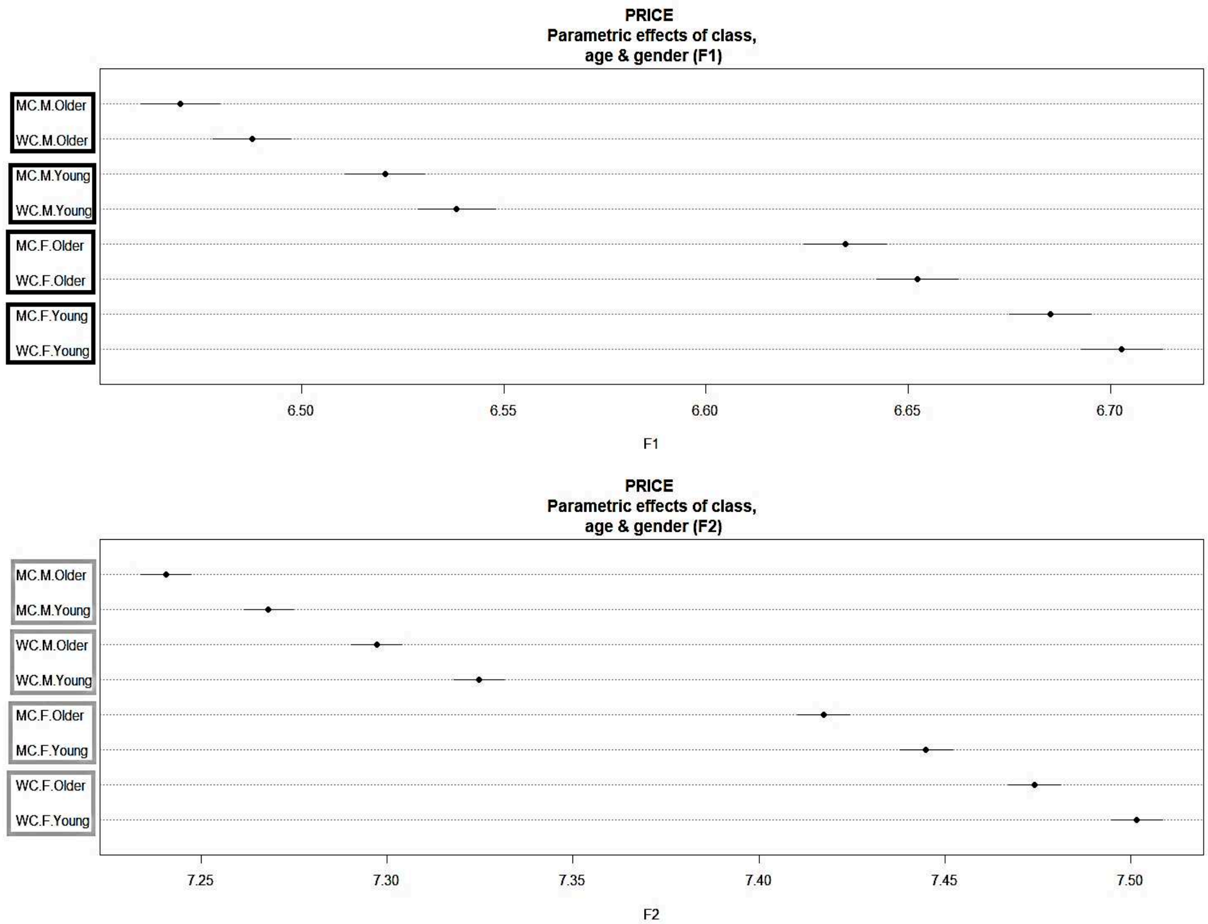


Figure 8-28 Parametric effects of class age and gender F1 (top) & F2 (below).

The plot summarising the parametric effects of age, gender and class confirms the major gender gap in both F1 and F2. In F1, the second most important effect is age group, and then class. This is the reverse for F2. Although the class effect is rather important and consistent across cohorts for F2, this may simply be the result of individual differences within the sample.

The GAMM analysis, showed a **general difference in formant trajectories** throughout the vowel **for AI and EI**. Since the **main focus** of the analysis is the **onset of the vowel**, medians for the first 25% of the vowel duration were computed. I will first use simple descriptive statistics to inspect the first quarter of the PRICE vowels in the PVC wordlist material. The data will then be modelised with a mixed effects model to account for potential external and word affects.

8.5 Acoustic distinctions in AI/EI medians for the 1st 25% of the vowel: f-patterns and duration.

First of all, let us examine the differences in height of the AI/EI medians in F1 and F2 that are displayed in Figure 8-29 (F1) and Figure 8-30 (F2). Overall, the AI/EI formant heights correspond to what is expected of a low and high variant. AI generally has higher F1 values and lower F2. EI patterns in a reverse manner. Differences in AI/EI are found to be greater among women than among men, which may be due to the former's tendency to have a larger vowel space than men – see for instance (Fant, 1966), (Gahl & Baayen, 2019) and (A. P. Simpson, 2001) on acoustic differences between either gender. As Simpson remarks, "[i]t has long been recognized that it is not possible to derive the formant values of male vowels from their female equivalents (or vice versa) by using a single scale factor based on an average female-male vocal tract length difference of 20%" (A. P. Simpson, 2001, p. 2153).

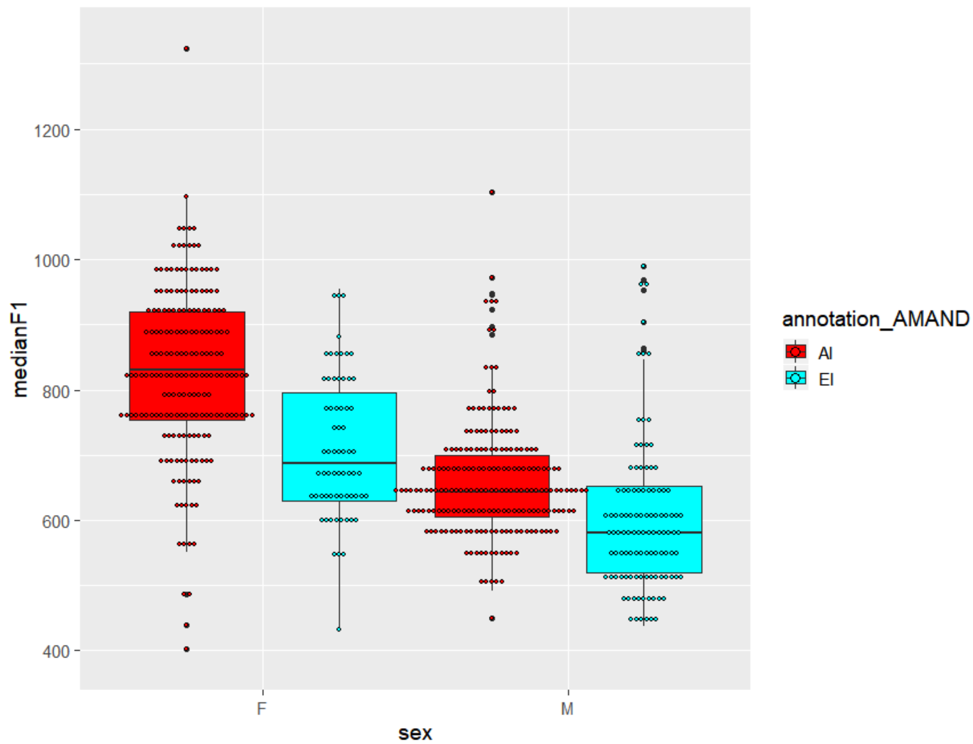


Figure 8-29 Boxplot of medians in F1 by gender and AI/EI variant (first 25% of vowel), PVC WL.

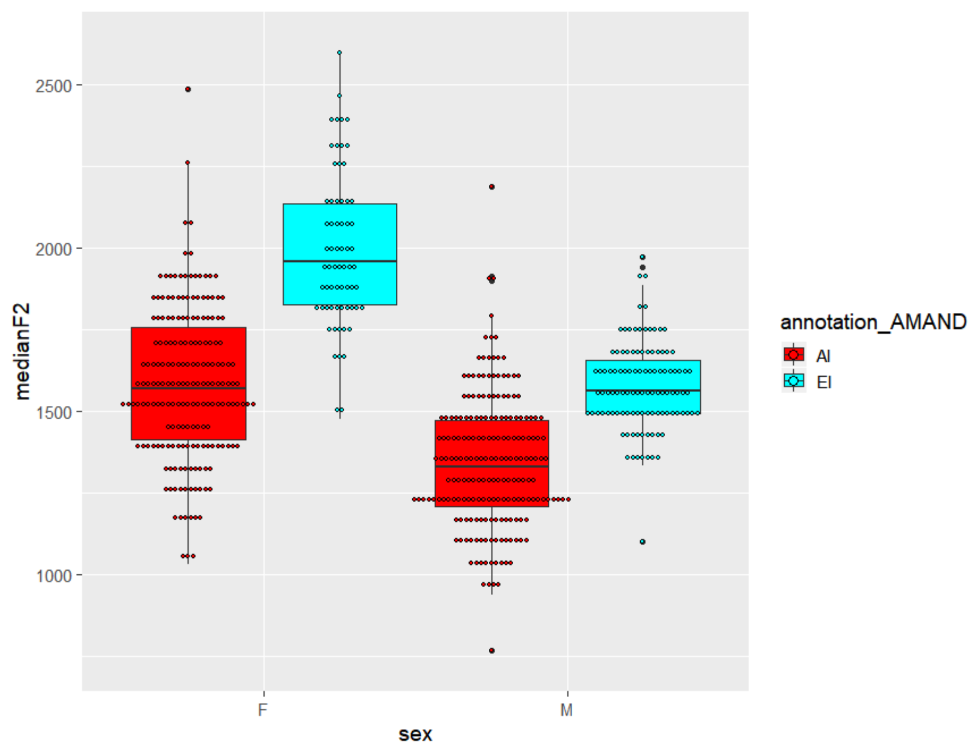


Figure 8-30 Boxplot of medians in F2 by gender and AI/EI variant (first 25% of vowel), PVC WL.

Although there are ways to find out **where** in the trajectory the differences in curves are the most striking, the basic model summary of GAMMs just indicates whether, at *some* point(s) in the trajectory, the curves are of different heights. Moreover, adding the entire curve provides unnecessary information and noise when only the analysis of the onset is at stakes. My main concern now is whether onsets in PRICE differ enough in F1 and F2 based on my annotations. A logistic regression including the random effects of words and speaker was used to test whether differences in the annotated AI/EI trajectories for the first 25% of the vowel duration were significant enough. The model used the binary AI/EI as a dependent variable and medians of F1 and F2 per word read per speaker (1st 25% of the vowel only). Separate models were built for men and women since the former's EI trajectories tend to overlap with the latter's AI values (see GAMM fitted values by gender in Figure 8-25). Duration was also included as a fixed effect. In this section I first analyse the overall affect of PRICE variants over f-patterns and duration. Then, duration is briefly mentioned before looking at f-patterns in more detail.

Results indicate that rated AI/EI differ significantly in both F1 & F2 be it amongst men and women (see tables in APPENDIX XIII for a full report of the models by formant and gender). As the effects of the mixed models illustrate (Figure 8-31 for F1 & Figure 8-32 for F2), men have lower f-values, but for both gender, the probability of a PRICE vowel being rated as EI decreases as F1 increase (Figure 8-31). The pattern is the reverse for F2, which meets the initial expectations.

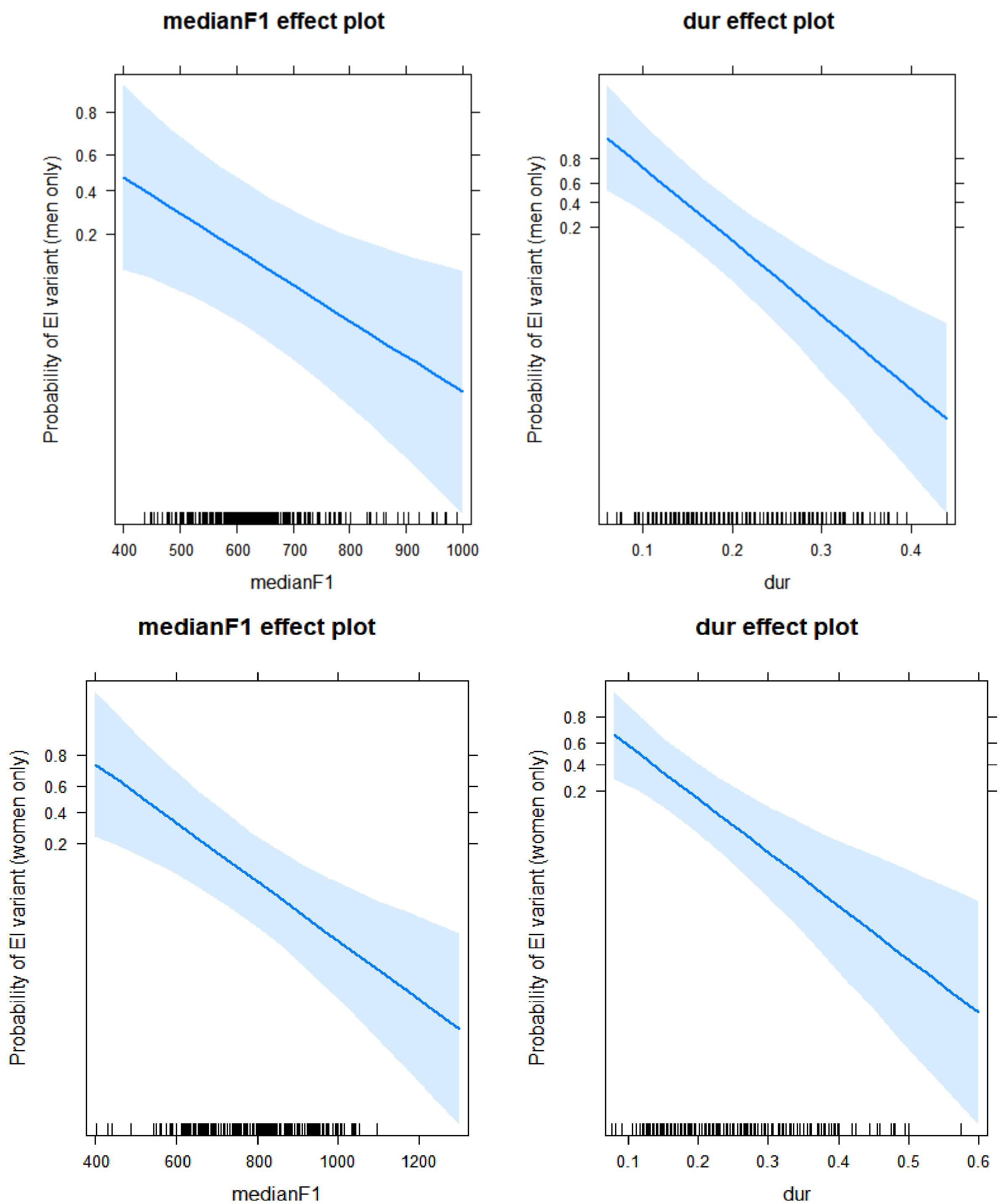


Figure 8-31 Effect plots: probability of EI variant as a function of median F1 (scaled) & duration (s). Top: men, bottom: women.

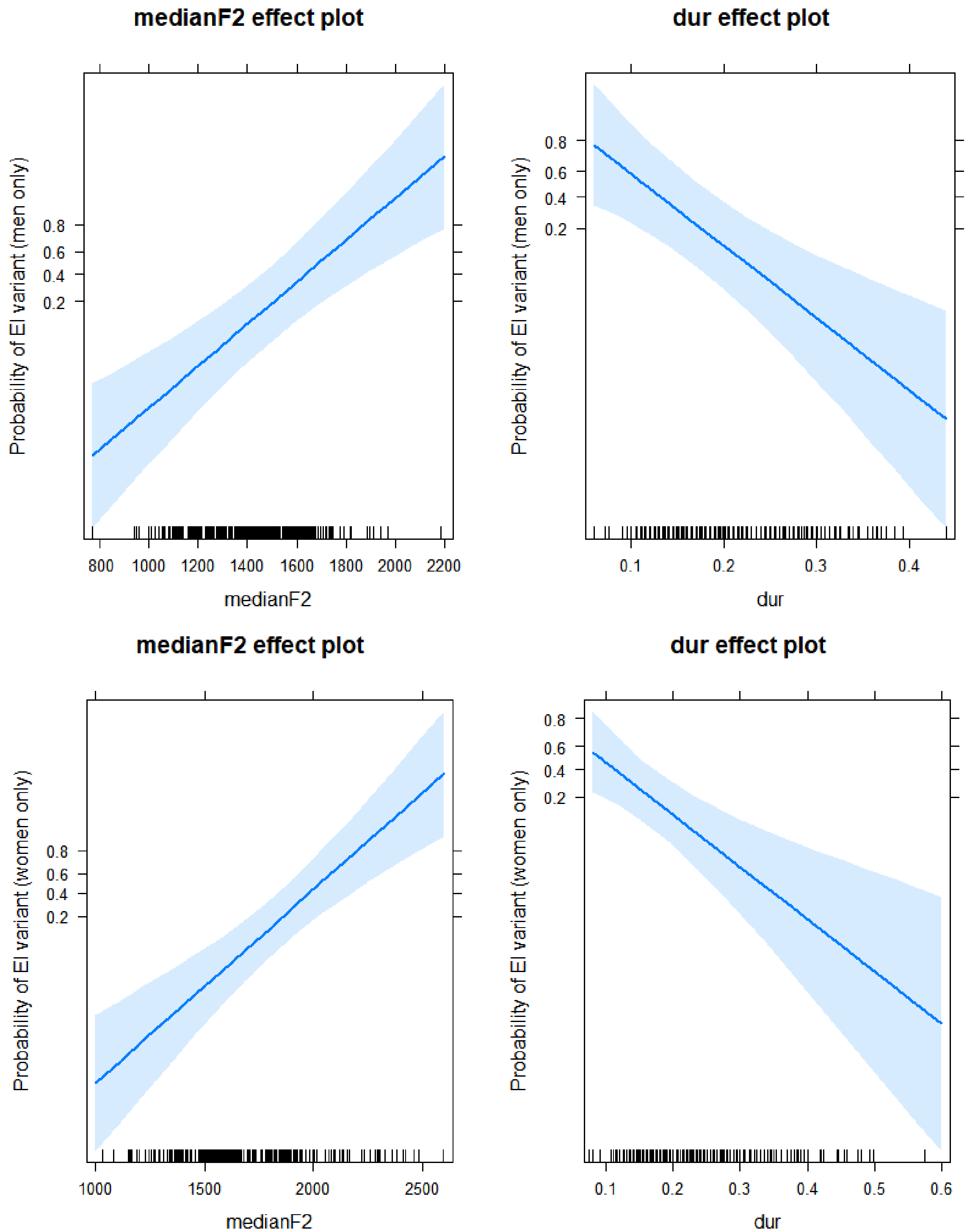


Figure 8-32 Effect plots: probability of EI variant as a function of median F2 (scaled) & duration (s). Top: men, bottom: women.

8.5.1.1 Duration

Despite the standard error for duration being rather high in both models for men and women (see APPENDIX XIII too for SE in duration), duration patterns are not devoid of interest. Boxplots by PRICE variant, age and gender indicate that younger speakers tend to have shorter values for EI variant (Figure 8-33).

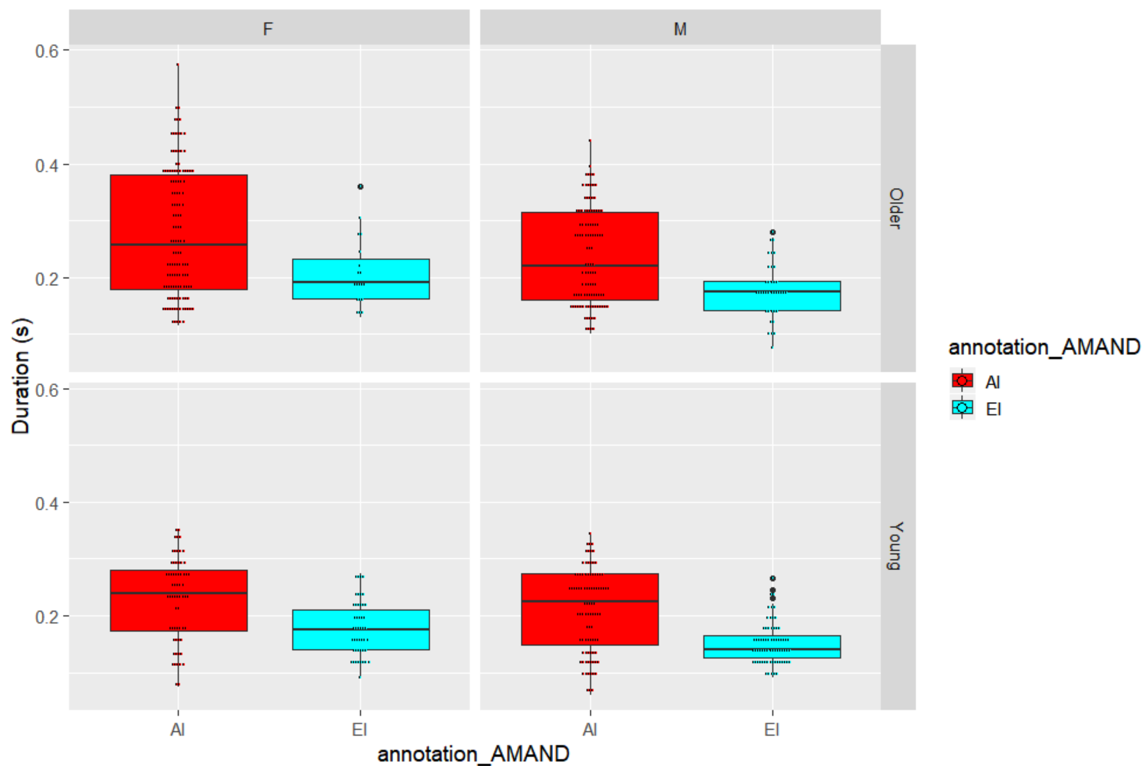


Figure 8-33 Boxplots of vowel duration (s) per PRICE variant by gender and age.

Since observations of duration are dispersed in both AI and EI, I thought it best to use a decision tree (Figure 8-34) to check for potential affects concerning the word itself as well as the variant type the speakers used. Such representations tend to a synthetic and clear vision of how a variable containing a lot of levels like *word* may affect duration in PRICE words, and whether the variant type has more influence on duration than the word itself.

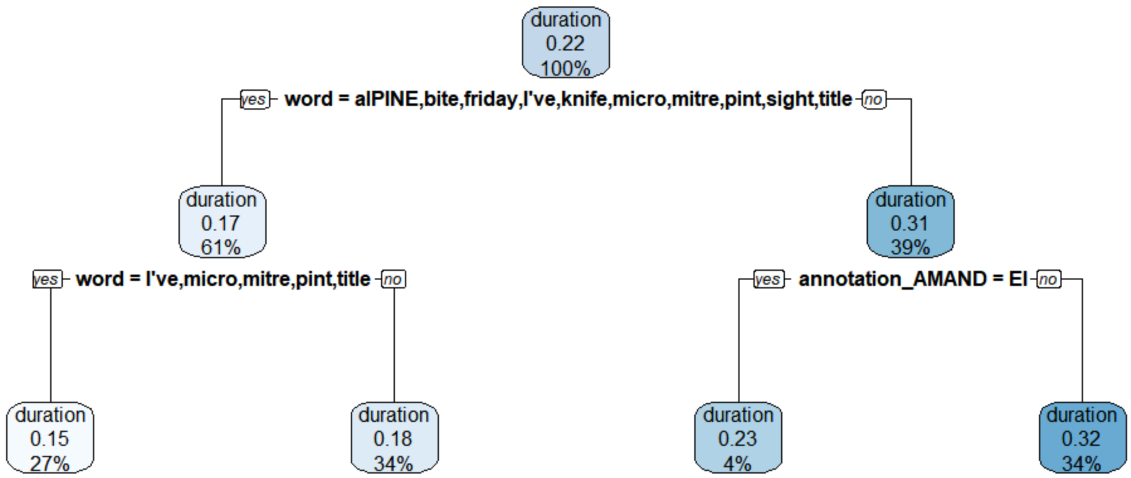


Figure 8-34 Decision tree: duration (s) as a function of word and PRICE variant.

The decision tree in Figure 8-34 indicates that a certain category of words read by the PVC speakers have shorter durations than average (0.17s vs. 0.22s for all observations), with words like *micro*, *mitre*, *pint* and *title* being even shorter (0.15s). Most words from the first list at the top of the tree are followed by a voiceless coronal or a nasal coronal. Time and space precludes a more precise study on the impact of place of articulation on duration in TE PRICE words, but this will be included in the list for future work. Words that do not belong to the list at the top of the graph, i.e. *dive, five, knives, sigh, sighed, side* and *size*, are split into two groups: those with a raised onset are shorter (EI: 0.23s) than those with a low onset (AI: 0.32s). **This suggests that the phonetic environment generally matters more than the variant used**. However, when adding the social data into the model for the decision tree, the type of variant was completely overshadowed by age, and gender affects Figure 8-35. Within the shorter category of words (*alpine, bite, Friday, knife and sight*), women tend to have slightly longer realisations than men, no matter the age category. As for longer words (*dive, five, knives, sigh, sighed, side* and *size*), age seems to matter first with younger speakers having shorter realisations than older ones. Within the category of older speakers, women have, once again longer realisations than men.

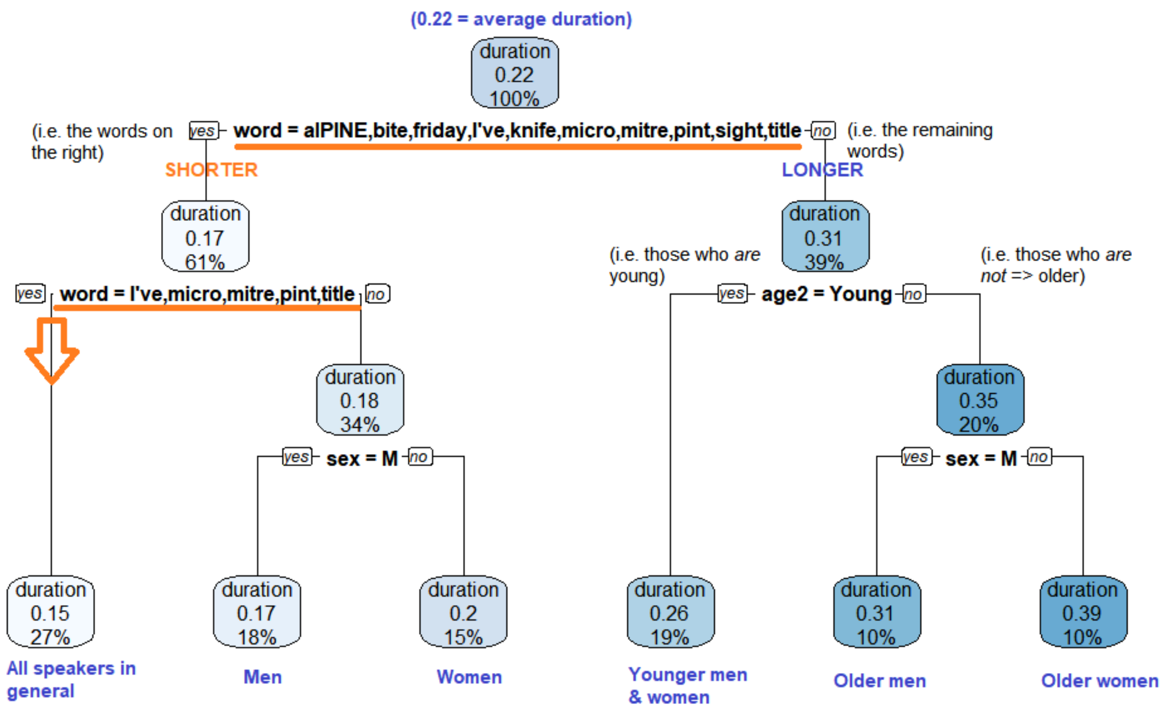


Figure 8-35 Decision tree: duration (s) as a function of word, PRICE variant (*NS*), age and gender. Longer words not shown from the list at the top right of the graph: *dive, five, knives, sigh, sighed, side* and *size*.

A more systematic study should be carried out but it is striking to see that when the importance of the AI/EI variant is no longer the main focus of the analysis, the Scottish Vowel Length Rule (SVLR) applies more systematically than expected for a sample of TE (J. Milroy, 1996). I would like to suggest that these decision trees allow us to reanalyse lexical diffusion phenomena and apply lexical-based analyses to Aitken's law. Regarding duration at least, some prototypical words like *I've* and *pint* are distinguished by the decision tree and this method could be used to pinpoint *lexical* leaders of phonetic change. The added benefit of our representation is that we can also factor in social variables like age and gender, as well as phonetic environment. According to Aitken long environments are: a following voiced fricative (/v/, /ð/, /z/, /ʒ/), which is the case for *dive*, *five*, and *size*, in final position (*sigh*)or a morpheme-boundary as in *sighed* (Aitken, 1981). Short environments include "voiced stops, nasals and the lateral as well as voiceless stops, voiceless fricatives and the voiceless affricate" (Aitken, 1981). In Figure 8-36 are aggregated the normalised medians (top) and means (bottom) of each individual PRICE word in the sample, including the pronoun *I*.

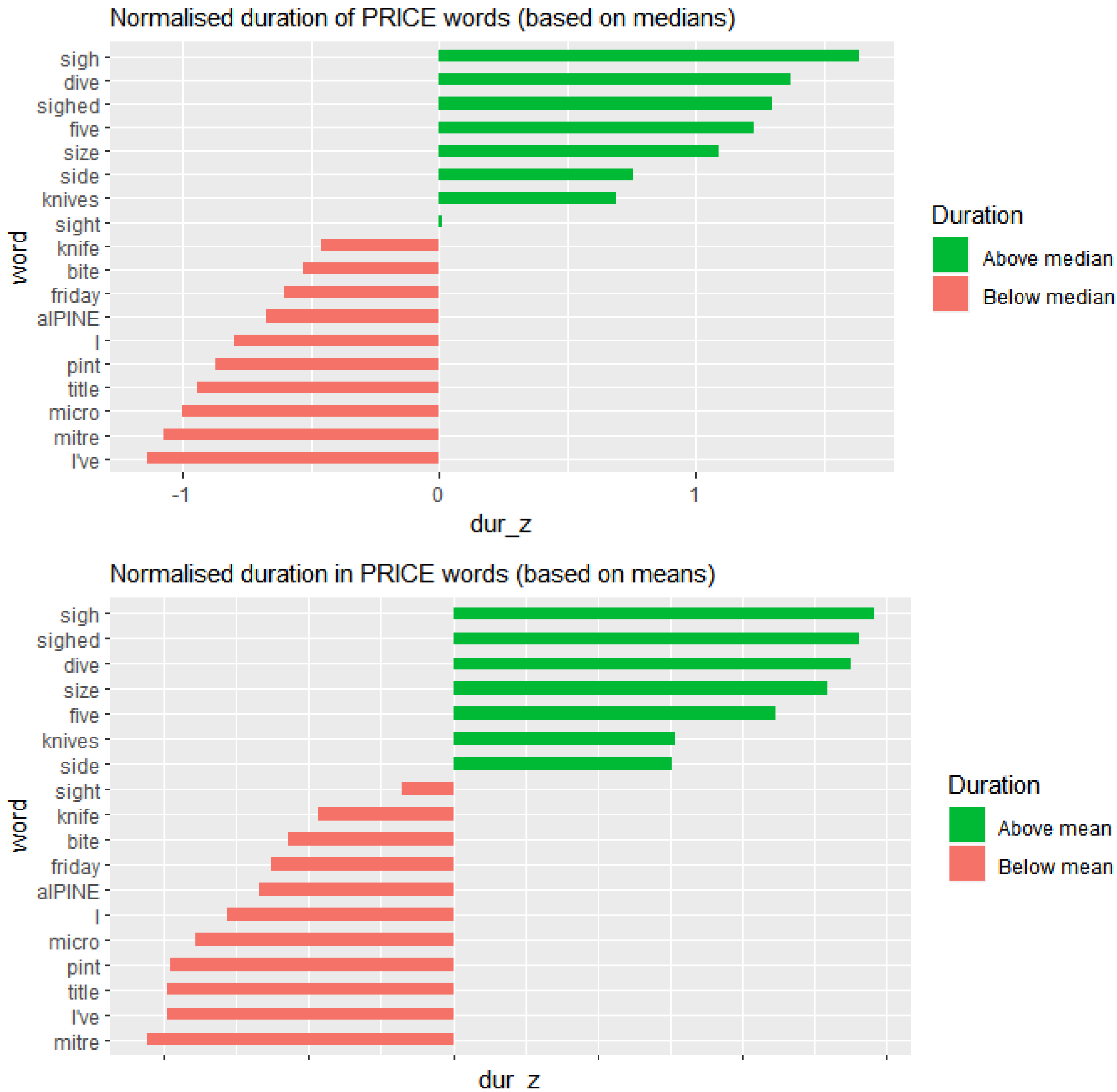


Figure 8-36 Normalised duration by word (medians vs. means), PVC WL.

Showing both the mean and the median appears useful when a word like *sight* operates as a tilting point between the longer words and the shorter words (top graph, median). But when computing the mean of this word, one sees that it falls back into the category of shorter words, thereby abiding to the SVLR. I believe that the length of these words, some of which were grouped together in the reading list may also be partly influenced by their position within the list. One word seems to fall outside the SVLR: *side*. Phonemically, it forms a minimal pair with the *sight*. However, differences in duration may well be the result of *pre-fortis clipping* (Wells, 1990). Wells explains that, when followed by an unvoiced consonant, a tense vowel will tend to be "*clipped*" or shortened. Looking at the phenomenon from another angle, it is possible that the frequent unrelease of stops in these two frequent words may lead to a lengthening of the vowel in *side* to compensate for the absence of voicing in the plosive, which would otherwise have been a major cue in distinguishing *side* from *sight*. Since duration is affected both by internal and external factors, it is probable that this is also the case for f-patterns. I now turn to an analysis of F1/F2 in PRICE onsets.

8.5.1.2 F-patterns

Since the model confirmed the reliability of the AI/EI ratings in terms of formant frequency, I will now analyse the interplay of external factors and variant type on F1 and F2. The multiple histograms in Figure 8-37 compare F1 heights in AI and EI (scaled medians in F1, horizontal axis) and the number of observations found for each bin of F1 frequency. Formant values were scaled to ensure better comparability between the groups. Distributions in EI variants tend to be lower than for AI (reverse for F2, see Figure 8-38). As expected, AI is clearly predominant across most cohorts excepts among younger working-class speakers, who have more counts in EI variants than average. Older women, regardless of class favour the less localised variant AI, so do middle-class speakers in general – with the exception of the younger MC men.

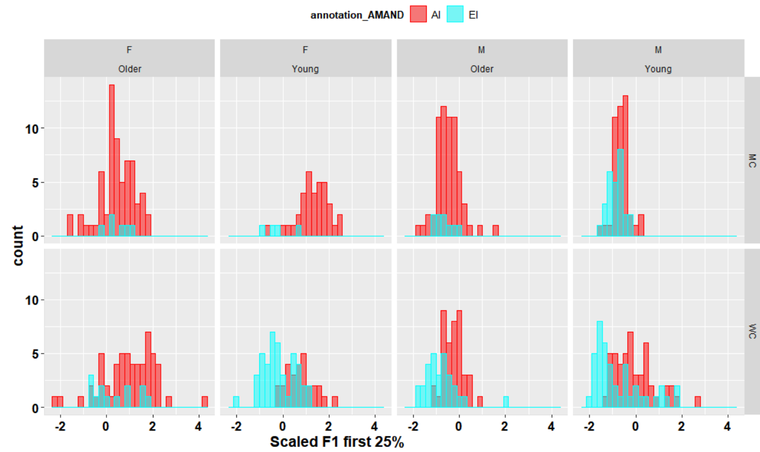


Figure 8-37 Histograms comparing F1 heights between variant type, by gender, age and class (average values in each group correspond to 0 on the horizontal axis).

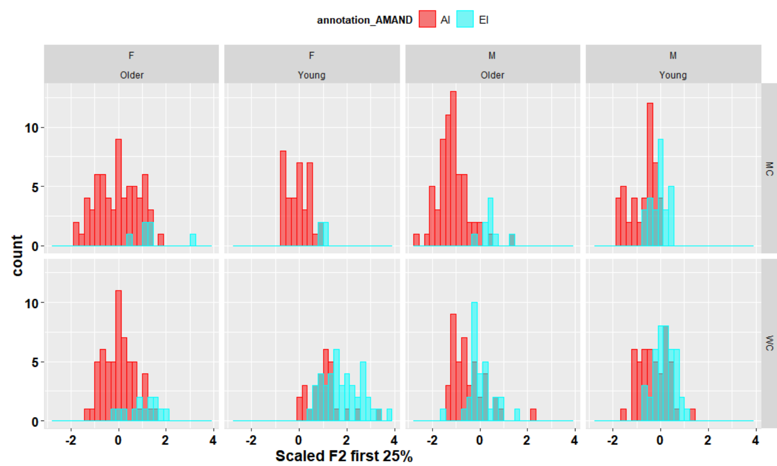


Figure 8-38 Histograms comparing F2 heights between variant type, by gender, age and class (average values in each group correspond to 0 on the horizontal axis).

Now that variant preference by cohort and f-patterns has been described, it is important to see how F1 and F2 pattern on a traditional vowel space. Since men and women tend to have distinct vowel spaces, they were kept separate in the vowel plots exhibited in Figure 8-39. Despite an overlap, both AI and EI centroids are separate.

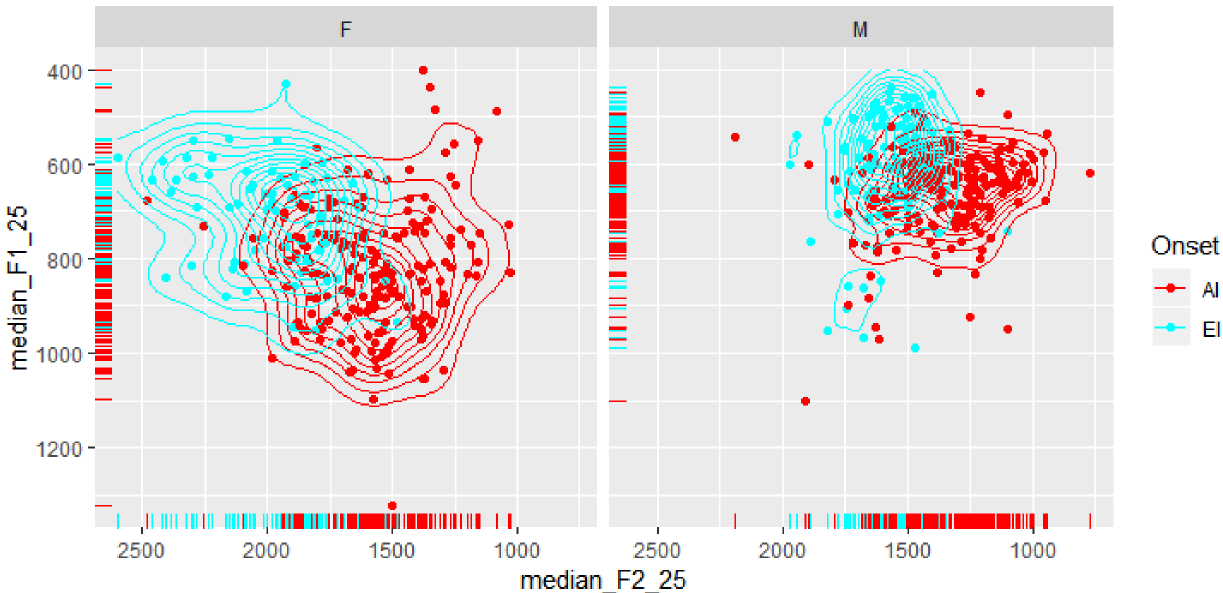


Figure 8-39 F1/F2 space by gender and PRICE variant.

Since there is a fair amount of overlap, I wanted to test whether distances between AI and EI were robust enough, by using several statistical analyses. On top of the mixed effect model, Pillai scores of a MANOVA, with F1 and F2 as the two dependent variables, were computed and compared with Wilcoxon tests as recommended by Nycz & Hall-Lew in their best practices for analysing mergers (Nycz & Hall-Lew, 2013).

Both the Pillai and Wilcoxon tests report a significant difference between AI and EI f-patterns (*Pillai: 0.248, F(2, 4514)=746.53, p <.2.2e-16*). Results for the Wilcoxon tests are listed in Table 8-5. P-values for F2 are lower than those in F1 among men and women alike, which suggests that, overall, F2 may be a better reference guide than F1 in distinguishing the local variant (EI) from the supralocal one.

Table 8-5 Results of Wilcoxon significance testing on medians of F1 & F2 (first 25%) by gender.

	MEN		WOMEN	
F1 (AI / EI)	W=15173	p = 2.458e-10	W=9533	p = 9.043e-11
F2 (AI / EI)	W=15271	p = 2.2e-16	W=1268	p = 2.2e-16

8.5.1.3 Individual F1/F2 plots

Speakers were also inspected individually. Their F1/F2 plots are provided in Figure 8-40. For reasons that remain hitherto unknown, certain vowel for some speakers could not be provided by the formant tracking correcting programme. This explains why fewer datapoints are plotted on the individual graphs. Some speakers like 03BF or dyads 13 and 14 have categorical use of AI. In general, AI/EI are clearly distinct but in speaker 5AM and 18BF, centroids overlap and bimodal distributions are visible. This suggests that some variants rated as AI may be closer to EI in term of f-patterns. It is therefore important to compare the auditory analysis (chapter 7) with the corresponding acoustic data.

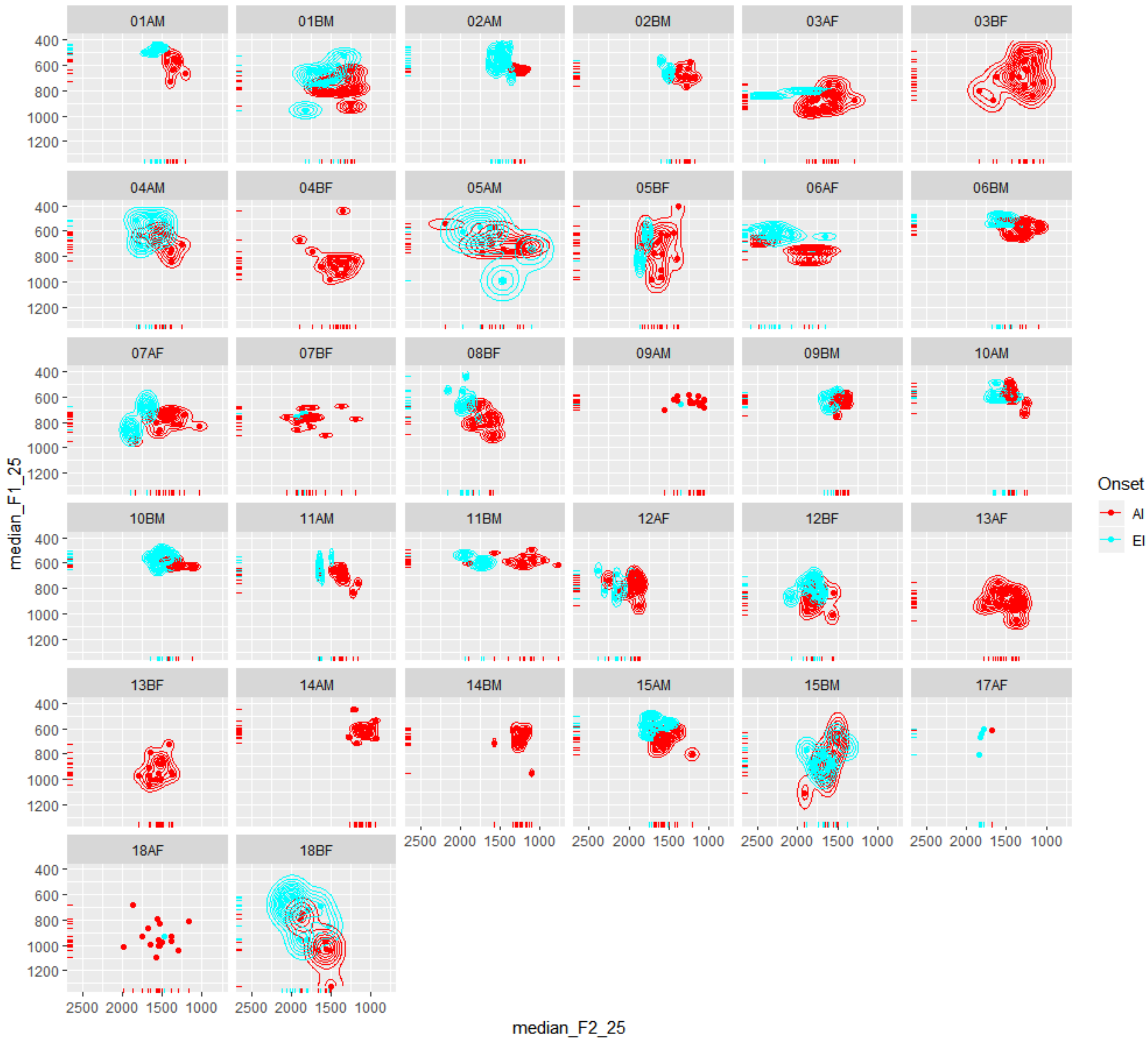


Figure 8-40 F1/F2 density plots by PVC speaker (medians of the first 25% of each PRICE vowel).

8.5.1.4 Mixed models vs. Factor Analysis of Mixed data to account for intricate variation patterns

Initial attempts to use a mixed effect model to analyse F1/F2 variation based on the social characteristics of the speakers provided little extra information if one uses F1 or F2 as a dependant variable social data as fixed effects (RE=fixed). Since most speakers use both variants, the model will be based on the mean values for all PRICE variants, regardless of whether they are realised as EI or AI. However, the corollary of having more EI values in a cohort is an increase in F2 and a decrease in F1. As Figure 8-41 illustrates, differences in median F2 by gender are obvious. Working-class and youngers speakers in general use EI a lot more than MC and older female speakers, which increases the average height in F2. But the fact that medians of AI and EI are grouped together blurs the overall picture.

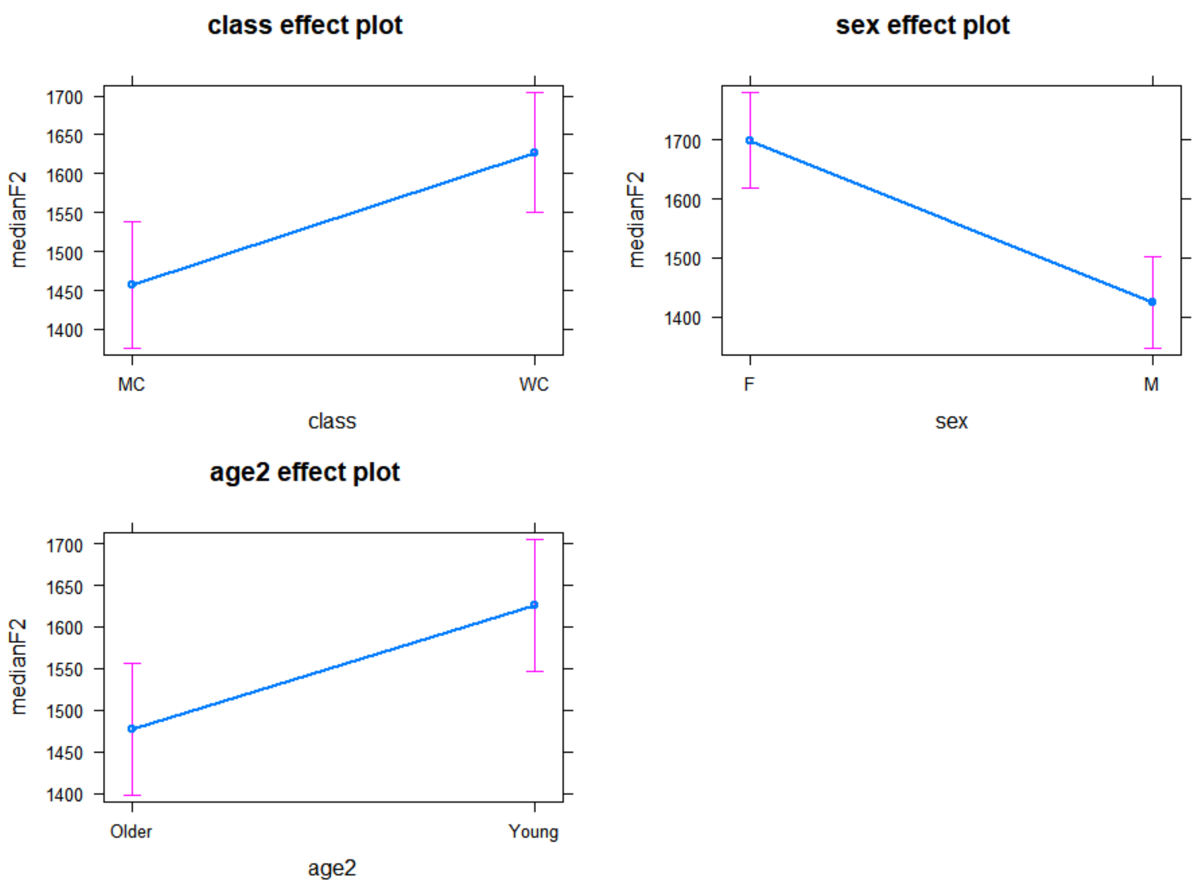


Figure 8-41 Effect plot by external factor (median F2, first 25%).

I therefore decided to use a variant of MFA, which analyses variation across both numeric and categorical variables, without taking into account any particular grouping of variables or hierarchy. The numeric variables comprised F2 & F1 medians for the first 25% of the vowel, the total duration of the vowel, while the categorical variables comprised gender, age and variant type (AI/EI). The approach is called *Factor Analysis of Mixed Data* (Husson et al., 2011).

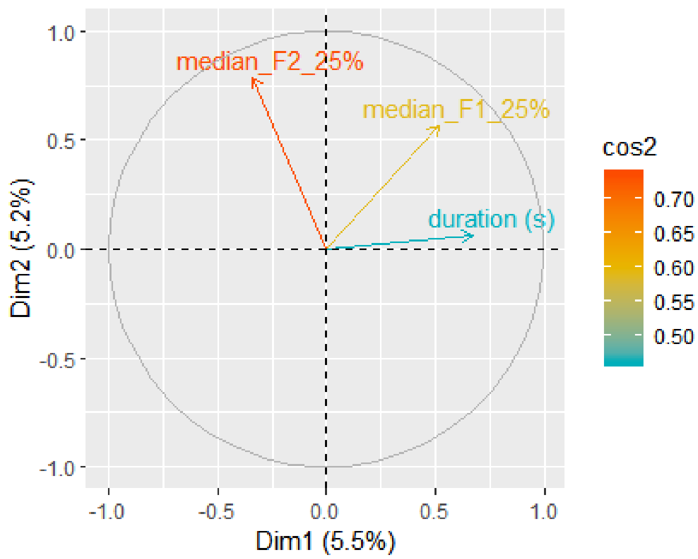


Figure 8-42 FAMD correlation circle: duration, medians of F1 & F2, first 25% of the vowel (PVC WL).

The FAMD model suggests that F2 best accounts for variation among speakers as indicated by the correlation circle in Figure 8-42 – the longer and redder the arrow, the better the variables accounts for variation. F1 comes next and duration is less of an important factor in dimensions 1 & 2. The proportion of variation explained is much lower than the results of the auditory analysis, i.e. below 11%. This can be ascribed to the complexity of word *and* individual speaker variation in terms of F1 & F2. But these results reflects the fact that F2 tended to be my first guide when rating each variant based on spectrographic representations of the vowels (see spectrograms in Chapter 1, for instance).

Individuals, words and categorical variables are examined via the factor map in Figure 8-43. 4 main cardinal points are visible here: men vs. women and the AI+older+MC vs. EI+young+WC. Speakers at the periphery tend to be more extreme in these cardinal points. Namely, 03BF, who has categorical use of AI is on the right hand side. Her position at the far right is due to her having a much higher vowel duration score than the rest of the sample (0.34s vs. mean: 0.20s, median:0.22s). By contrast, 6BM has the lower duration average (0.15s) and 01AM is not far behind (0.17s). Other speakers are defined by more intricate patterns but one sees that speakers on the left favour the EI variants (top left: women, bottom left: men). They tend to be either from the working-class or young. Speakers on the right tend to be middle-class or older.

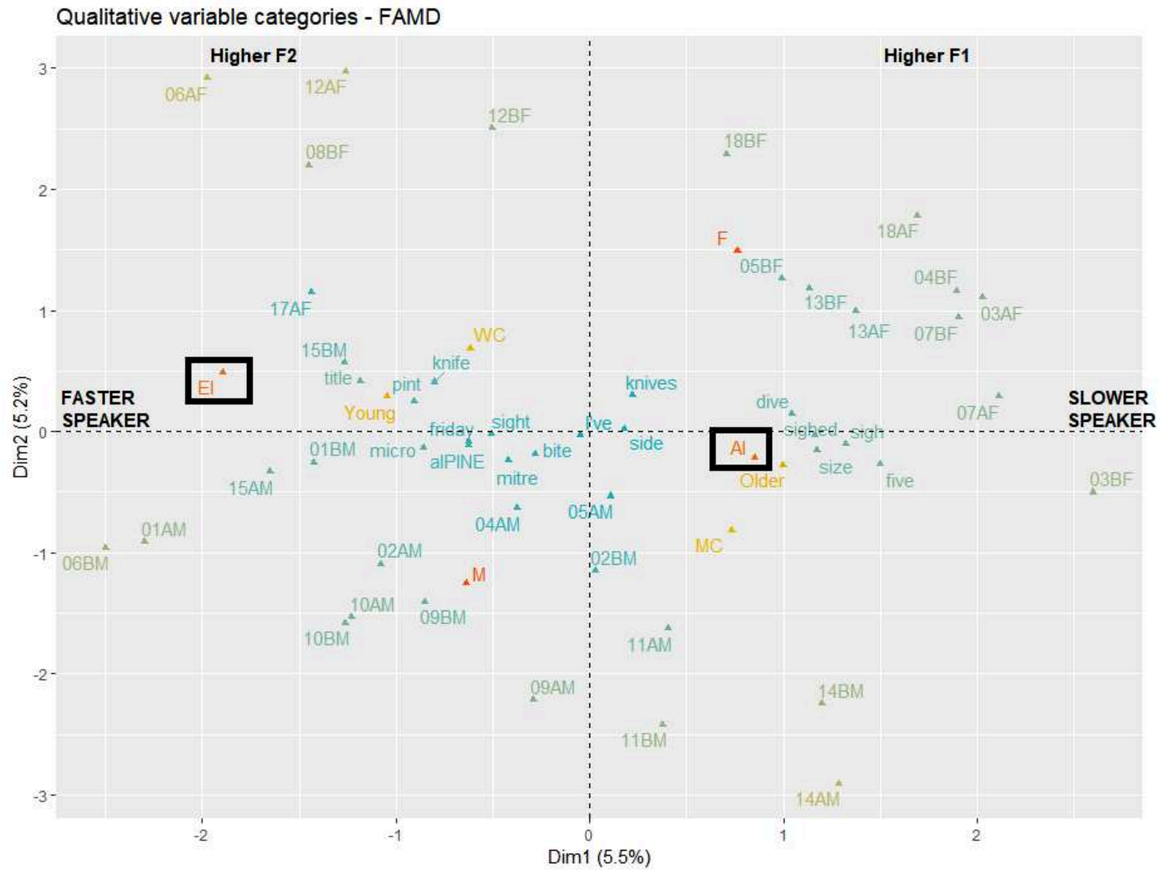


Figure 8-43 FAMD factor map of speakers with PRICE variant, word and social data (PVC WL).

The graph also presents the advantage of showing which words are more generally AI words, and which more generally trigger a raised onset among the speakers who favour EI more often than average. Words at the right hand-side of the label AI are realised as AI almost categorically (e.g. *five*). The position of the other words depends on the proportion for each variant, with title having the highest ratio of EI variants (EI=22 against AI=10). If you draw a line joining the AI/EI centroids you will find that *Friday* and *alpine* are more or less in the middle of the cline and have balanced proportions of AI/EI.

Our next section replicate the methodology for the TLS wordlist, with the exception of the decision tree, since there were less examples to be analysed.

Results: TLS wordlist

8.6 Acoustic analysis of PRICE vowels

8.6.1 Spectrographic representations of PRICE words in the TLS corpus

The present section provides spectrographic representations of PRICE vowels in the TLS wordlist from three different speakers so as to have an idea of how trajectories look like before being modelised.

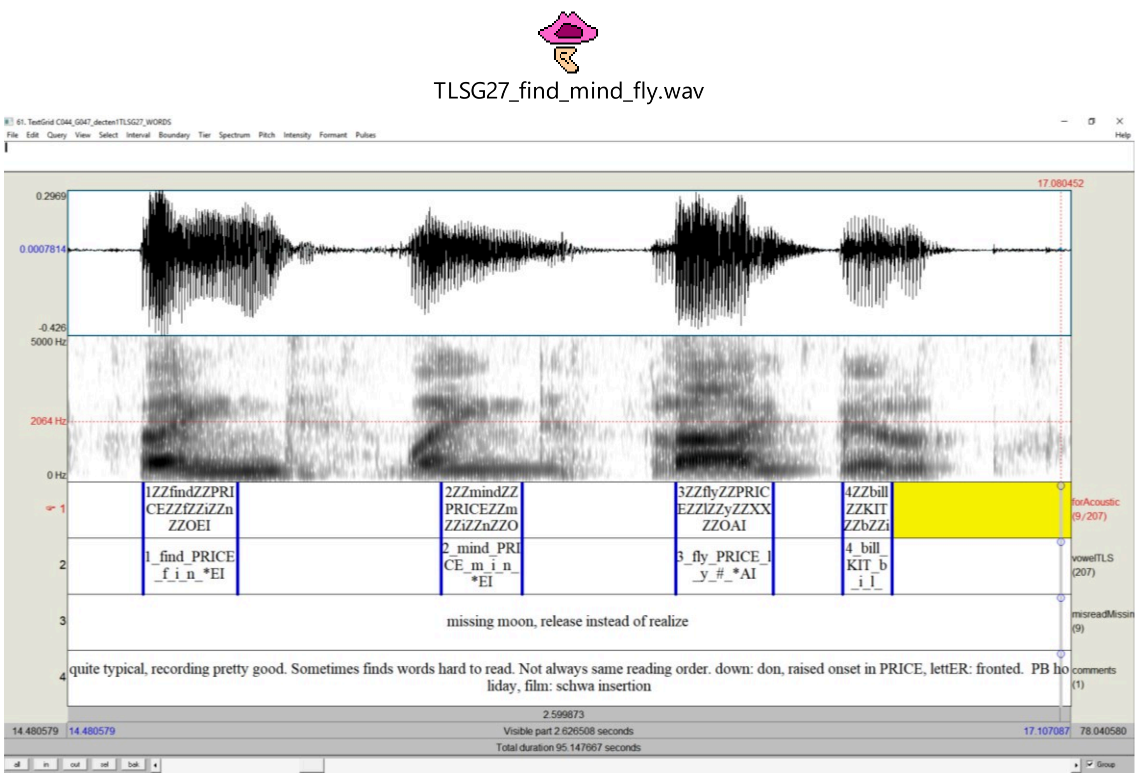


Figure 8-44 Spectrographic example of PRICE formant trajectories of *find*, *mind*[149] and *fly* (TLS, speaker G27M).

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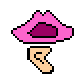
[149] *Mind* was misread as *wind* [weɪnd].

The spectrogram in Figure 8-44 illustrates formant trajectories in *find*, *mind* (actually misread as [weɪnd] and *fly*. At the onset of *find*, F2 shifts much more rapidly and shoots up to reach the offset. In *fly*, F2 remains stable for the most part of the vowel, and towards the last third, rises to reach F3 only at the end of the vowel – unlike *find* and [weɪnd] whose F2 merges with F3 at from the second half of the vowel onwards.



TLSG02_find_mind_fly.wav

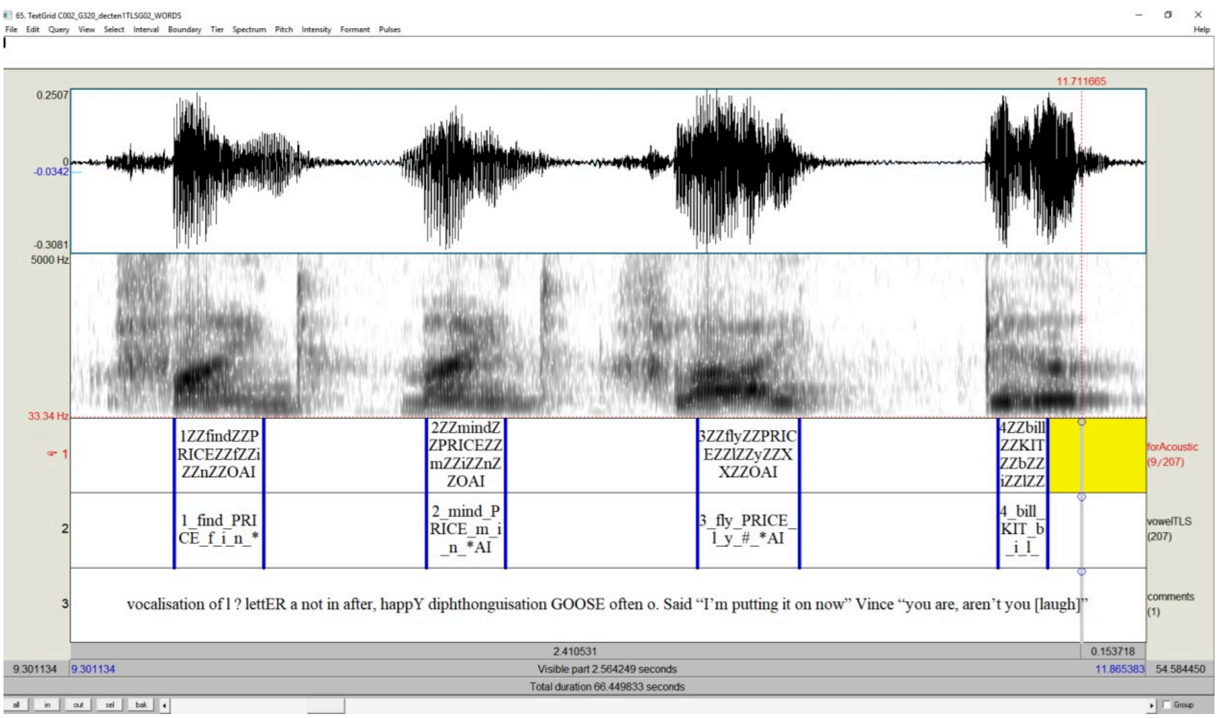


Figure 8-45 Spectrographic example of PRICE formant trajectories of *find*, *mind* and *fly* (TLS, speaker G02M).

The next speaker (G02M), whose PRICE words are illustrated in Figure 8-45, clearly has a lower onset but the F2 trajectory in *find* and *mind* is similar to that in speaker G27M as it shoots up to reach F3. A major difference, however, lies in the fact that in all three vowels, F2 merges with F3 only at the very offset.

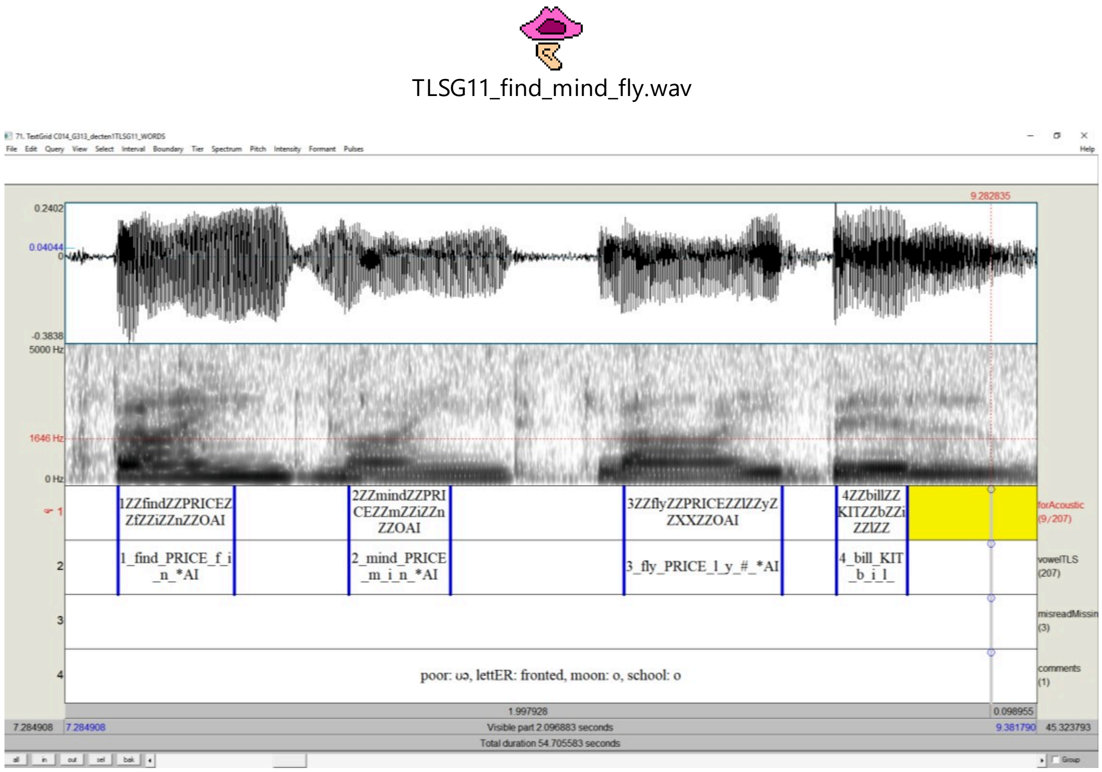


Figure 8-46 Spectrographic example of PRICE formant trajectories of *find*, *mind* and *fly* (TLS, speaker G11F).

The female speaker in Figure 8-46 also has its F2 offsets converging with F3 and an onset *plateau* throughout most of the vowel. She also has *plateaus*, albeit shorter ones, in *find* and *mind*. It is probable that external and internal factors simultaneously affect the duration of the onset plateau.

This section served as an illustration of the diversity of formant trajectories, whose modelling can but be improved by a dynamic approach. While changes in F1 are much more unobtrusive, F2 plays a major role in distinguishing the two types of onsets. While trajectories in some speakers directly shoot up towards F3, others have their onset plateau before rising abruptly towards the end of the vowel. The next section investigates differences in duration, formant trajectories and F1/F2 onset heights amongst the PRICE vowels read in the TLS wordlist.

8.6.2 Formant trajectories in PRICE (AI vs. EI)

F1 trajectories in AI/EI tend to start at similar heights during the first 10% of the vowel (Figure 8-47). The two curves then part after the first 10%. AI trajectories tend to plateau until the first 50%, then drop to reach a higher offset than EI trajectories. The latter tend to plunge so rapidly that at 50% of the vowel, F1 has already reached the average offset height of the AI trajectories. It then drops even further.

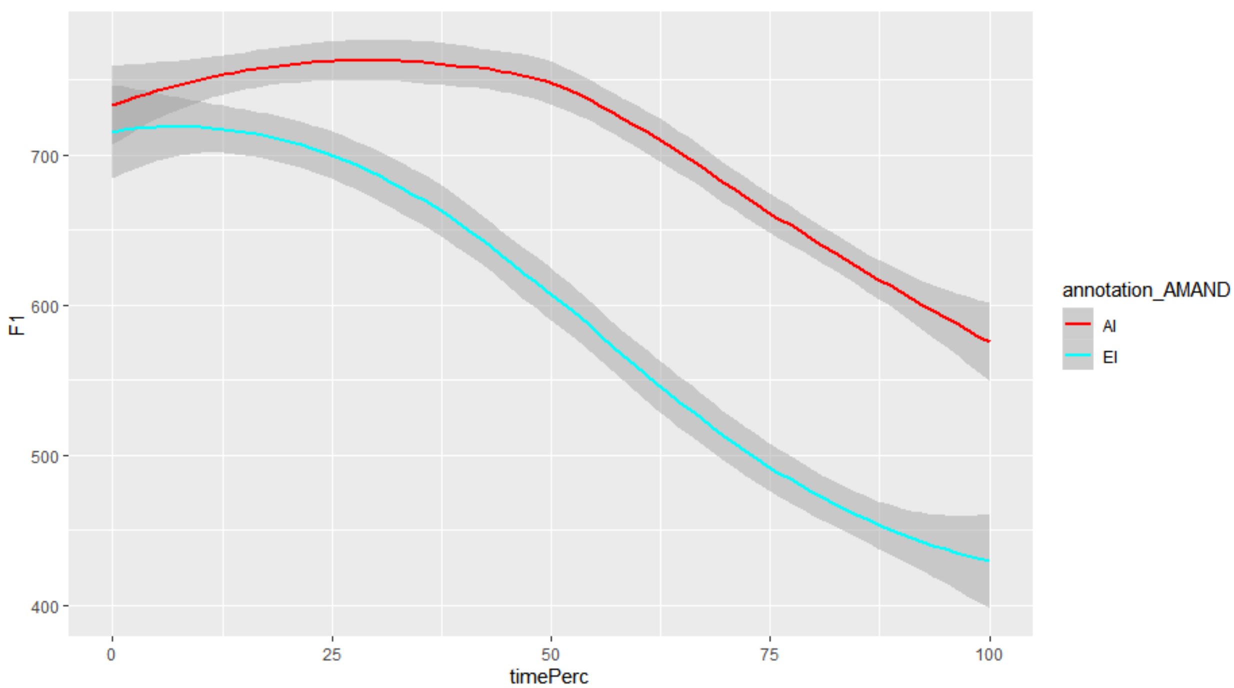


Figure 8-47 F1 trajectory by PRICE variant, LOESS regression (TLS WL).

In Figure 8-48, F2 trajectories in AI and EI clearly start at different heights, with EI values being higher than in AI. During the first 60% of the vowel, the slope in EI is slightly steeper in EI. It then levels off across the last quarter of the vowel. Offsets are just as further apart in F1 and F2. AI offsets in F2 therefore correspond to a [e], which is in line with

Ferragne's findings in other varieties like East Anglian English in the frame *hVd* (Ferragne & Pellegrino, 2010).

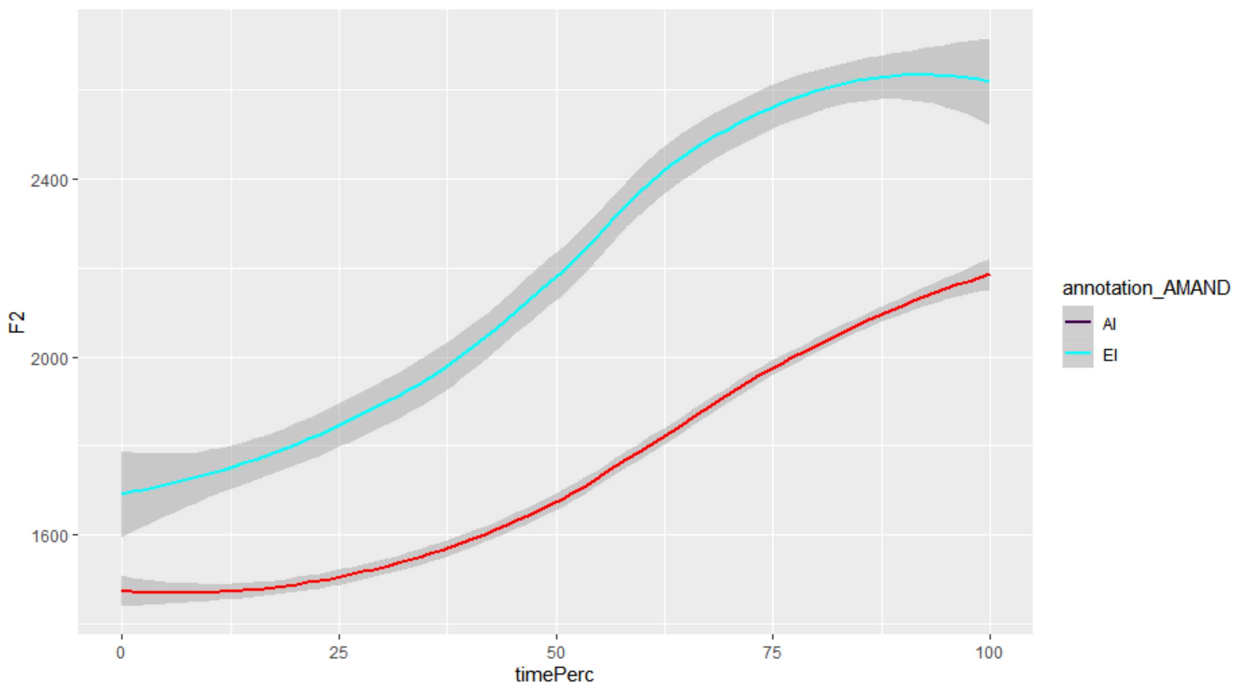


Figure 8-48 F2 trajectories by PRICE variant, LOESS regression (TLS WL).

Such differences in offsets may be ascribed to the fact that what matters in a diphthong is that the onset and offsets are clearly distinguishable. Although this should be backed by various experiments, I hypothesize that in AI, a contrast between [a] and [e] is audible enough to identify a PRICE vowel, but if the onset is already close to an [e] as in the EI variants, it might be necessary to raise the offset to a [j] to recreate this onset/offset contrast. Such differences in F1 targets between AI and EI variants are clearly visible in Ferragne and Pellegrino's study of vowels across the British Isles (2010). Let us take two examples from their analysis reproduced in Figure 8-49. East Anglian English is known for lower onsets in PRICE, while Glasgow English speakers favoured the variant [ɛj] in hVd. Differences in both F1 & F2 are striking. While 0 is the F1 onset value for *hide* in Glasgow English (*gla*), it is the offset value in East Anglian English (*ean*). It is then obvious that the offset in *gla* will have to be higher (here, -1.5).

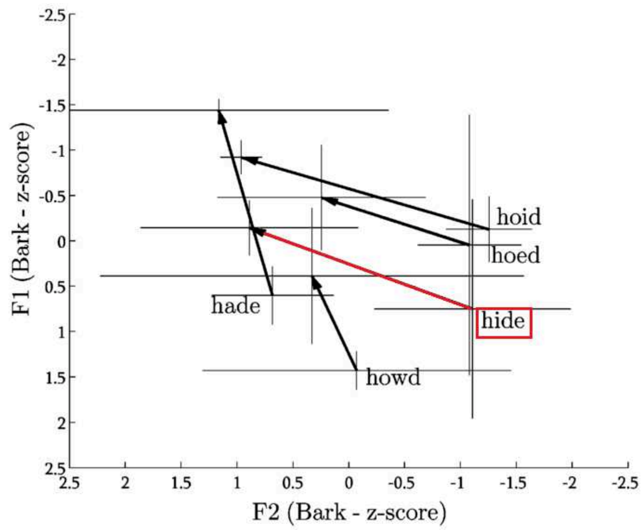


Figure 17 Median starting and end point for the five closing diphthongs produced by five male speakers of *ean*.

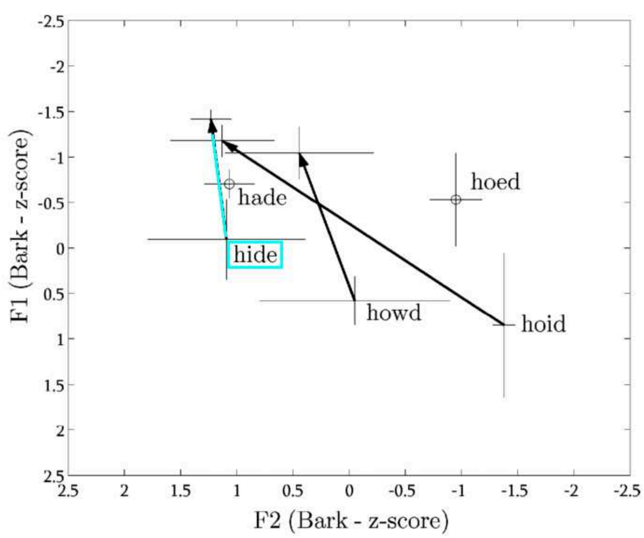


Figure 22 Median starting and end point for the five closing diphthongs produced by seven male speakers of *gla*.

Figure 8-49 Normalised onset/target formant values of East Anglian English (top) and Glasgow English (bottom). Adapted from Ferragne & Pellegrino (2010, pp. 15 & 17).

A similar phenomenon is probably at stake among the variants AI/EI in Tyneside English. Although the analysis by Ferragne and Pellegrino (2010) provides important insights on this variety, it is possible that the restriction to the frame hVd among 2 male speakers only may not have revealed the plurality of PRICE variants in TE as only low onset values are shown. Nonetheless, Ferragne & Pellegrino's examples of Newcastle English vowels clearly reveal the anteriority of the onset in *hide* compared to East Anglian English. Diphthongal onsets and offsets of a less traditional male speaker from Newcastle are reproduced in Figure 8-50.

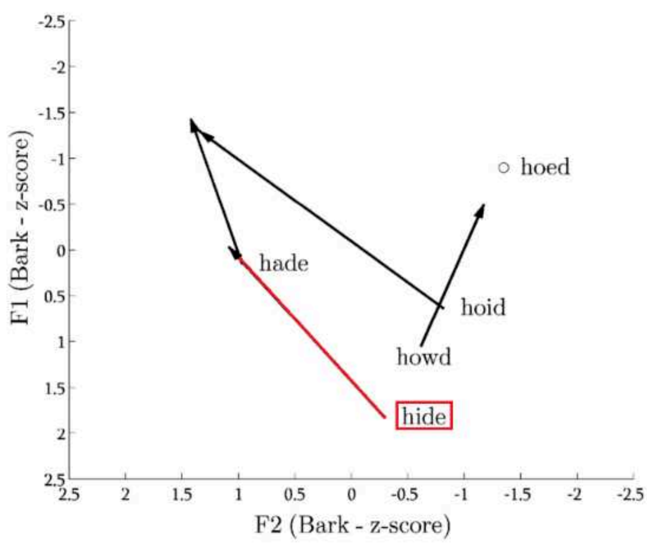


Figure 32 Median starting and end point for the five closing diphthongs produced by speaker GGC of *ncl.*

Figure 8-50 Normalised onset/target formant values of Newcastle English. Adapted from Ferragne & Pellegrino (2010, p. 22).

While the F1/F2 values of the speaker's target in hide are almost identical to the average values of the East Anglian speakers (Figure 8-49, top), the F2 onset of the Newcastle speaker is inferior to -0.5 (vs. superior to -1 in for *ean*). It is also worth noting that Newcastle F1/F2 onset values in hide are very similar to those of had in the Newcastle and Glasgow varieties, i.e. a slightly lower and retracted vowel than the values for Standard Southern British English [æ].

Now that differences in AI and EI trajectories have been identified, let us analyse how f-patterns and durations in the two variants differ by gender.

8.6.3 F-patterns at the onset only and duration

8.6.3.1 Distinction of AI/EI variant in formant height by gender

This section focuses on the onsets of the vowel, namely, the first 25% of the vowel duration in PRICE. The median values of the first quarter of the vowel were preferred over means so as to prevent outliers from skewing the results (see for instance Ferragne & Pellegrino 2010). The boxplots in Figure 8-51 clearly show that distances in F1 between AI and EI are visible, with EI having lower values. However, none of the differences were deemed significant enough. It is possible that only certain speakers make a clear-cut distinction between the two variants, but overall, these results are coherent with the trajectory analysis. The first 10% of AI and EI trajectories tend to overlap before parting (see Figure 8-47). As opposed to F1, medians of F2 at the onset of PRICE vowels are clearly distinct in AI and EI, especially among men (Figure 8-52).

What now remains to be investigated upon, is whether duration varies not only as a function of PRICE variant but also according to the phonological environment on either side of the vowel.

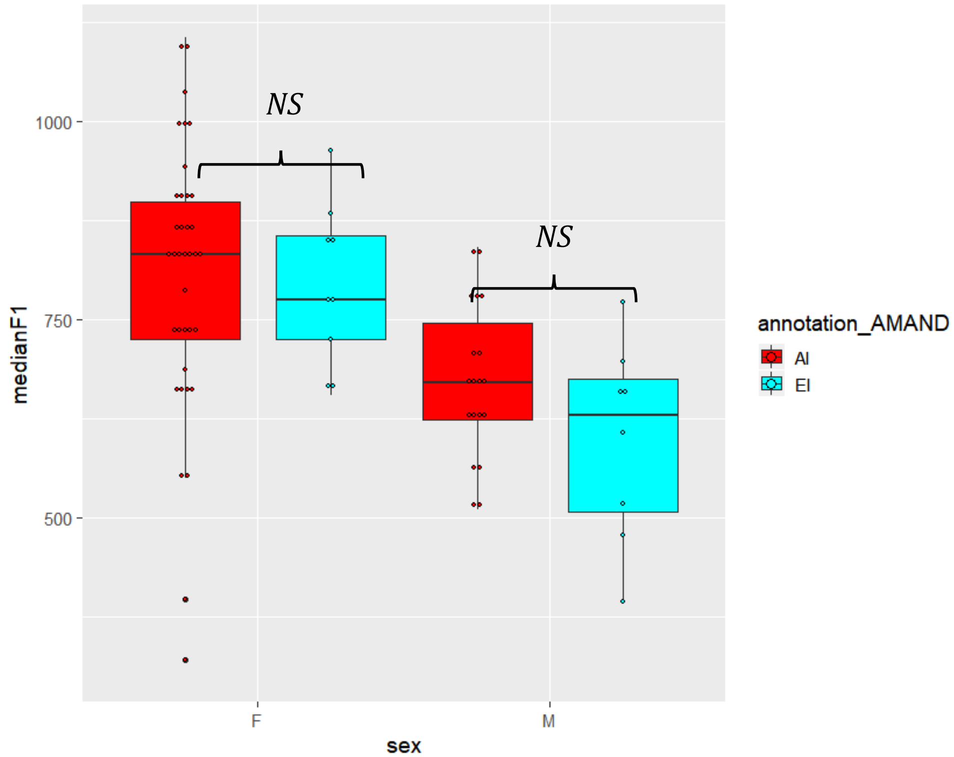


Figure 8-51 Boxplot of F1 heights (Hz) by gender and PRICE variant (TLS WL).

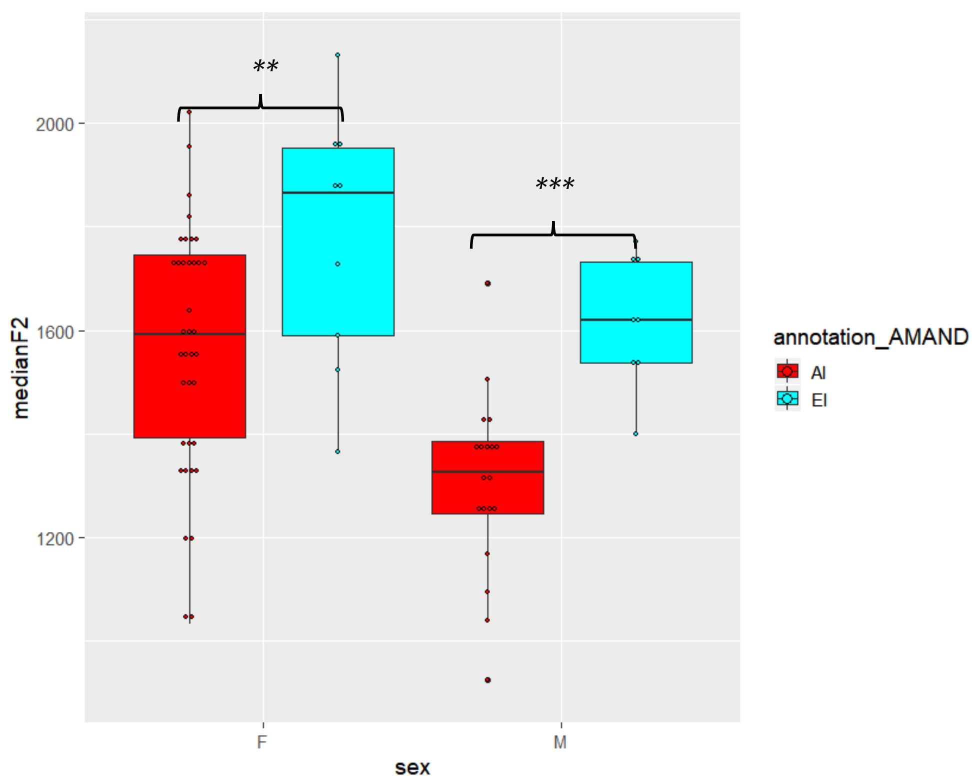


Figure 8-52 Boxplot of F2 heights (Hz) by gender and PRICE variant (TLS WL).

8.6.3.2 Duration by word in PRICE

The PRICE sample for the TLS is small and the wordlist was probably considered as experimental (*find, mind, fly* & *realize*, read only once). However, all four words pattern according to the SVLR in terms of duration, which is in line with the PVC data. As Figure 8-53 illustrates, raised onsets are avoided completely in longer contexts, i.e. in final position (*fly*) and when followed by the voiced fricative /z/ in *realize*. Duration values for the word *find* are much more spread out. The dots on the boxplot for EI means that half of the speakers who chose this variant tend to have equivalent duration values than those who used AI in the same word. Interestingly, the differences in AI/EI in *mind* tend to be more distinct despite 2 speakers having an EI duration above the median duration in AI. A non-parametric test (Wilcoxon test) was used to assess the difference in duration by PRICE variant – which is, itself, partly conditioned by the phonetic environment. Results indicate that EI tend to have shorter realisations than AI (*W = 86214, p.< 2.2e-16*). Linear models with and without a random effect for speaker were performed as well. Duration was coded as the independent variable and the AI/EI rating, as the dependent variable. While differences in duration for AI & EI remained significant, the AIC for the model with random effects was much lower (*lm*: df= 3, AIC=9993.776 vs. *lmer*: df=4, AIC: 9367.557). The estimated difference in length between AI/EI was the lowest for the model with random effects: EI variants (*find* & *mind*) being generally 36ms shorter than AI words (*fly* & *realize* + *find* and *mind* rated as AI). Another model with interaction terms between AI/EI and word indicates that *fly* is the word that is the most distinct from the others (*estimate= 79.03, sdt. error = 5.995, t=13.182*). When *mind* is coded as EI, it is generally shorter than when it is coded AI (*estimate= 19.01, sdt error*

=8.218, t=-3.13). However, more data in a controlled environment with speech rate taken into account should be collected.

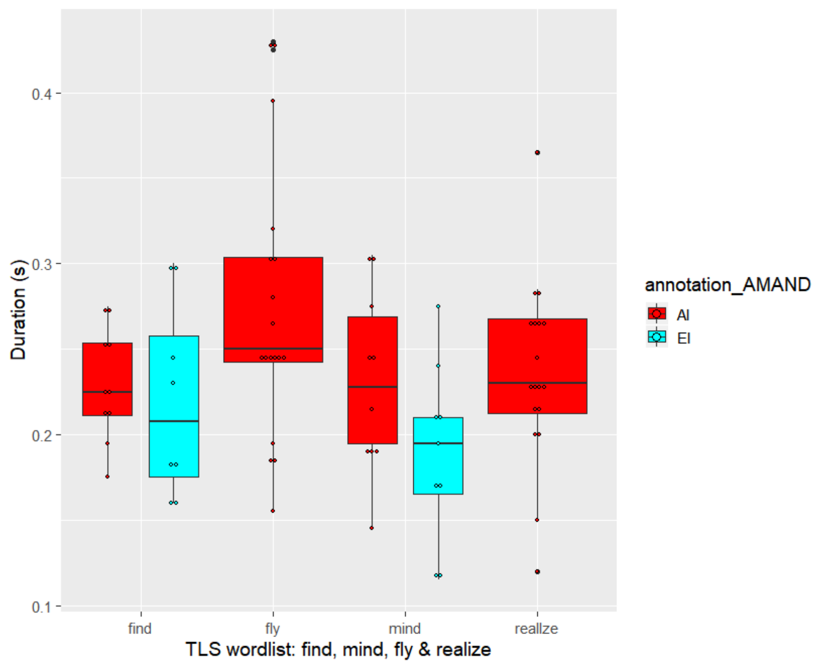


Figure 8-53 Duration by word and PRICE variant (TLS WL).

A normalisation of duration means and medians per word (Figure 8-54) indicated that *fly* tends to be much longer than other words, while *mind* was at the opposite end. This may be due to the fact that the word is read in between *find* (first word of the list) and *fly*. *Realize* has a much higher median than a mean and belongs to the longer words, which is probably the sign of high variability among speakers.

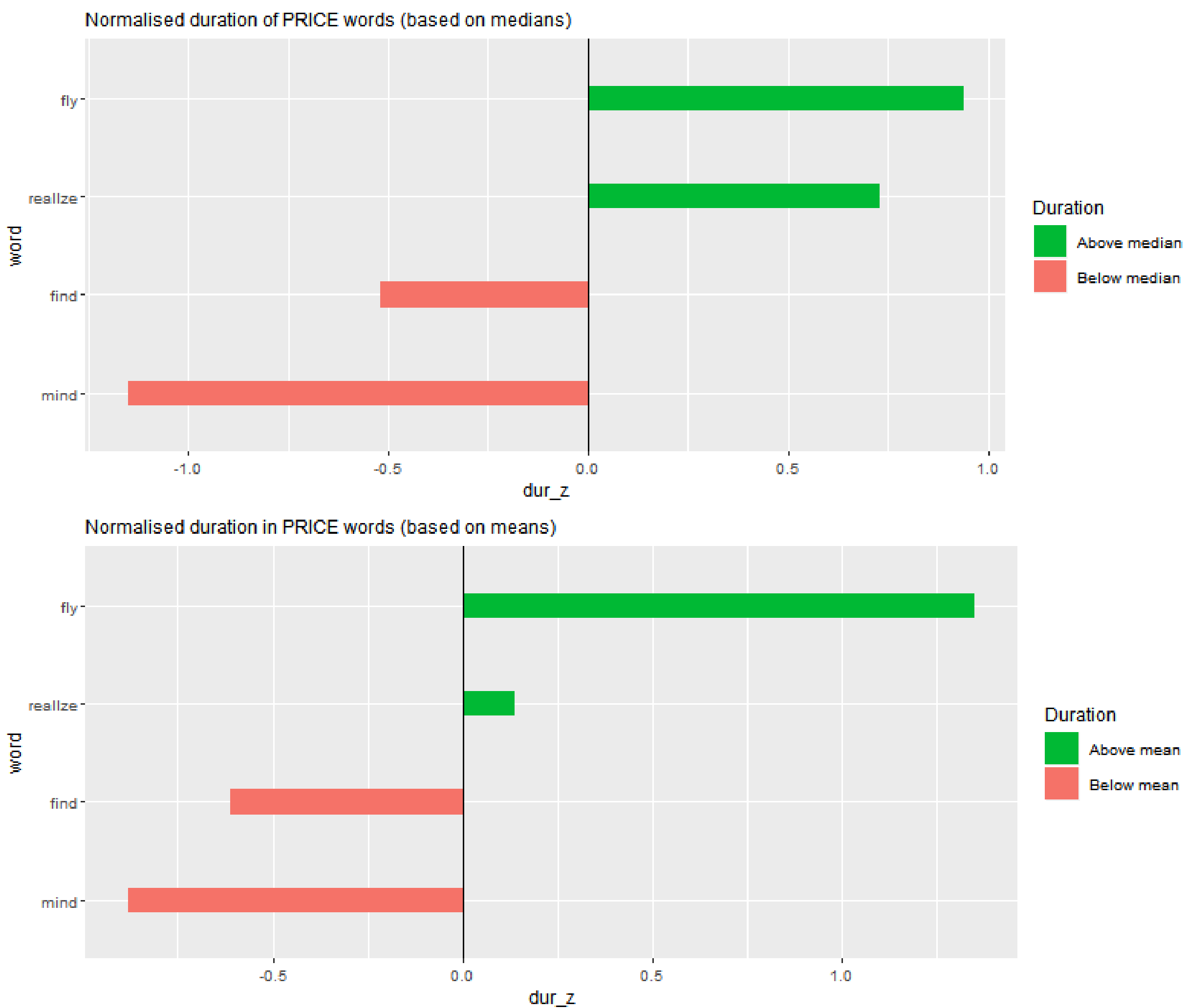


Figure 8-54 Normalised duration by word: medians vs. means (TLS WL).

8.6.3.3 F1/F2 plots by word and PRICE variant

The F1/F2 plots in Figure 8-55 describe the differences in F1/F2 by word and PRICE variant. While the centroids for EI do not overlap with AI in *find*, a few data points in Frequencies for individual vowels are much more spread out in realize. The overlap in *mind* may simply due to variation in vowel space among men and women. The next plot explores this obvious possibility.

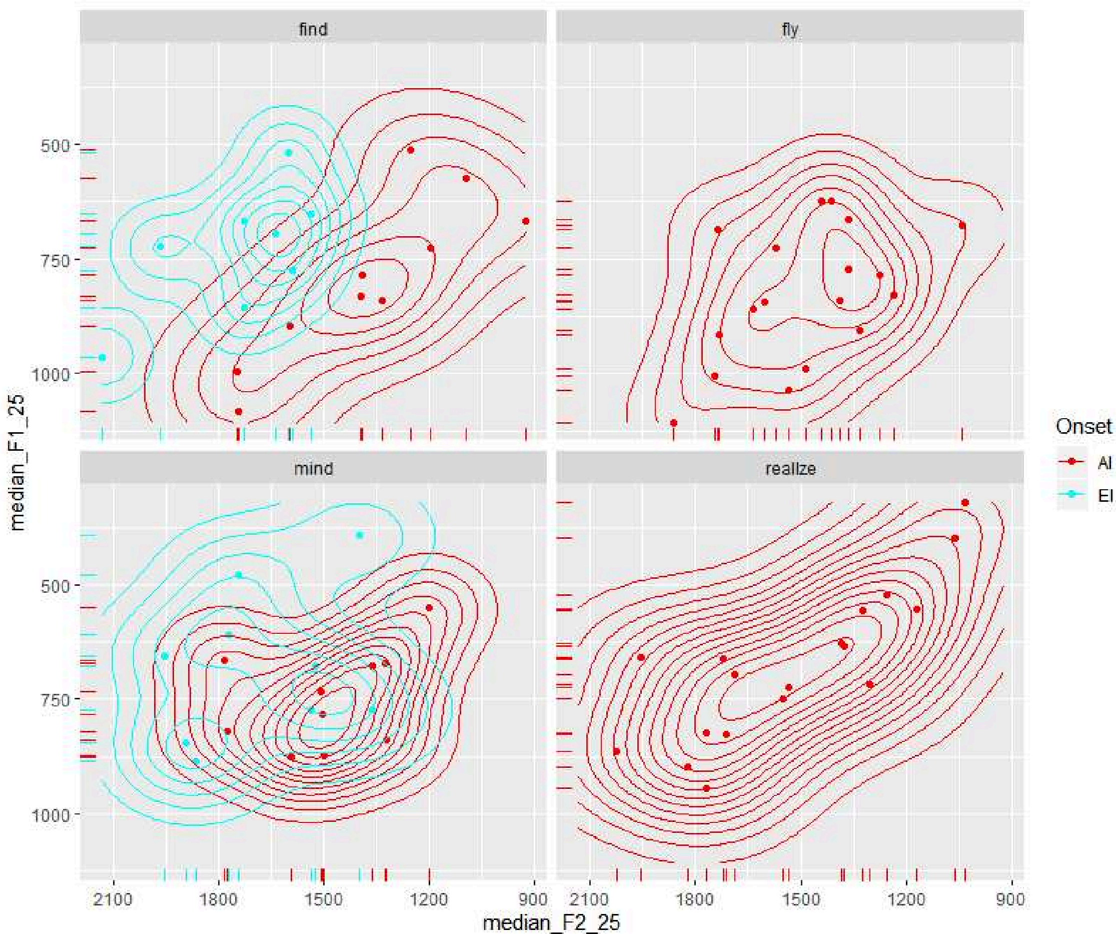


Figure 8-55 F1/F2 plot by word and PRICE variant (TLS WL).

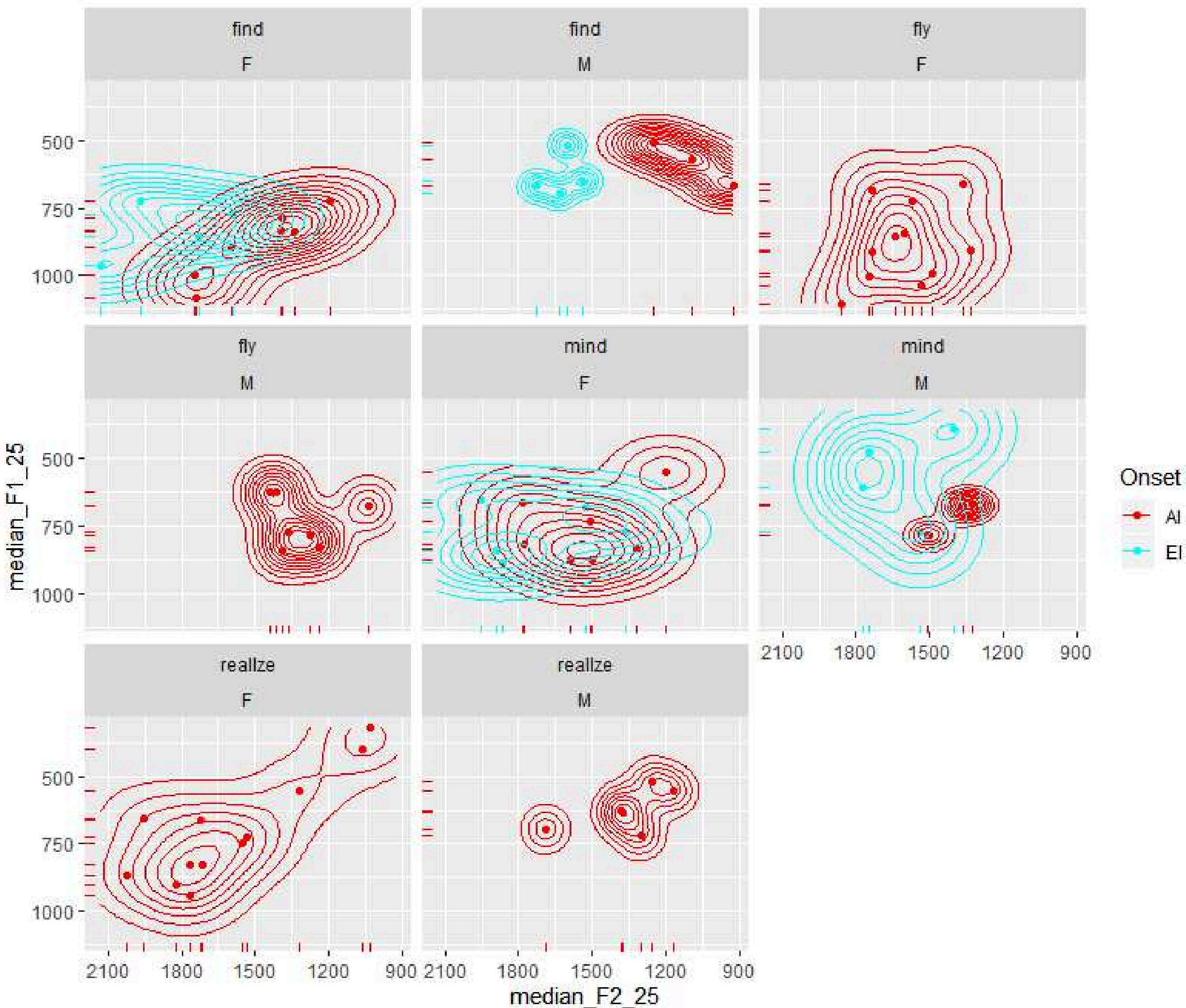


Figure 8-56 F1/F2 plot by gender, word and PRICE variant (TLS WL).

Figure 8-56 shows F1/F2 plots of individual vowels aggregated by word and gender. Men appear to distinguish AI from EI more distinctly than women. The vowel space among women is more spread out than among men.

8.6.4 Factor Analysis of Mixed Data: acoustic, internal & external factors

The same factorial analysis was applied to the TLS wordlist (FAMD). The correlation circle in Figure 8-57 confirms the crucial role of F2 (onset, median of the first 25%) in discriminating speakers and variant type.

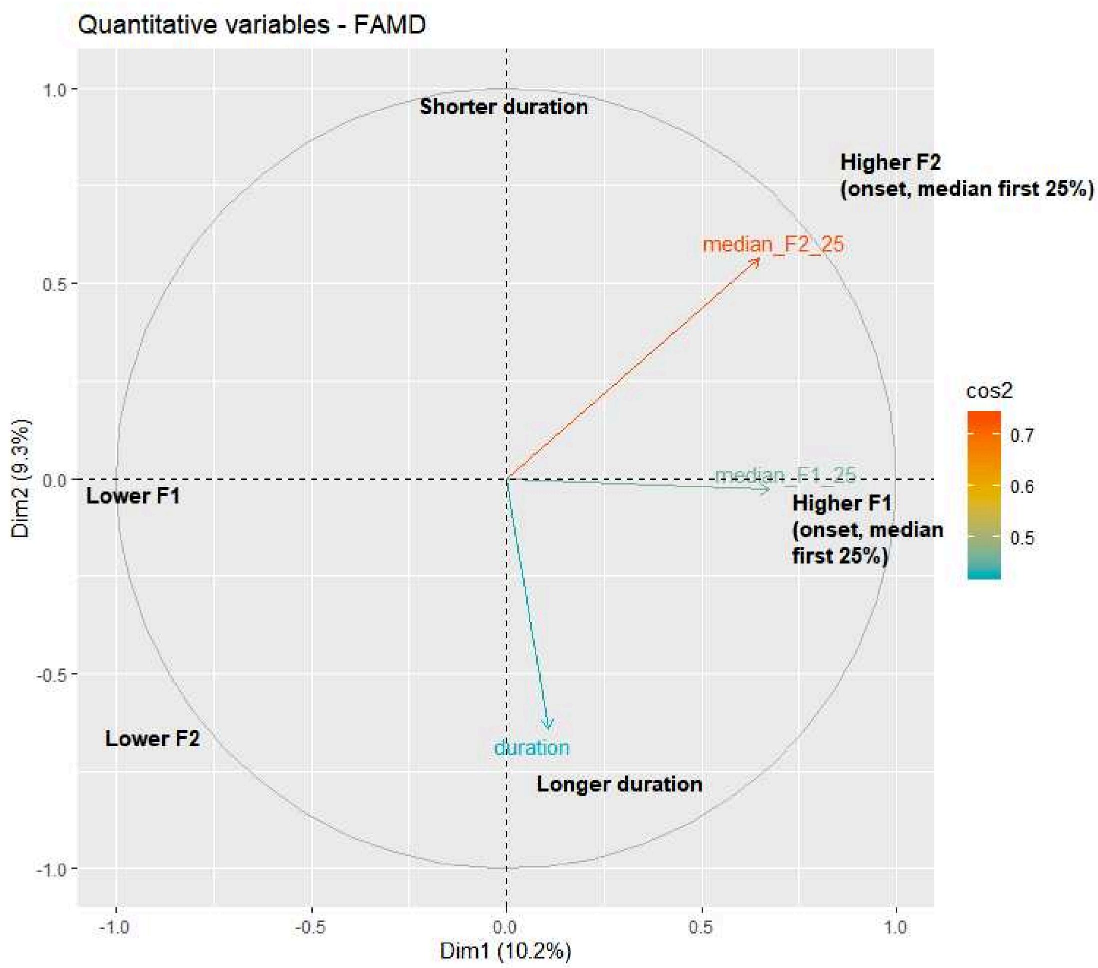


Figure 8-57 FAMD correlation circle: duration, medians of F1 & F2, first 25% of the vowel (TLS WL).

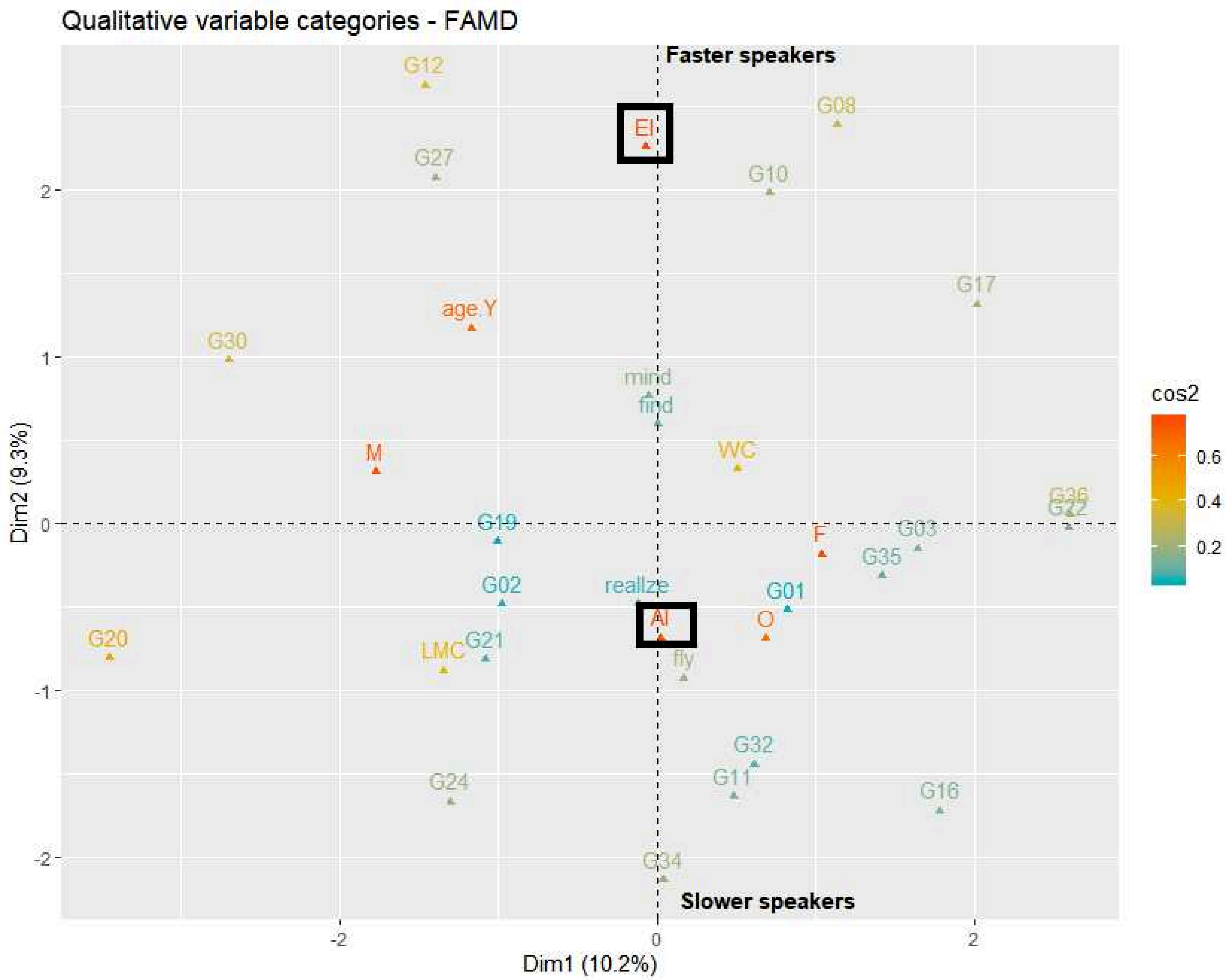


Figure 8-58 FAMD factor map of speakers with PRICE variant, word and social data (TLS WL).

The factor map in Figure 8-58 depicts variation in PRICE, based on F1/F2, duration, word, gender and age. Speakers at the top of the horizontal dashed line have shorter durations for PRICE words (G12, G08).

8.7 Discussion & conclusion: acoustic analysis (PVC & TLS)

It is probable that acoustic analyses are less well adapted to aggregate analyses than frequency scores when vowels and consonants are combines or when vowels include a mix of diphthongs and monophthongs. For this reason, each lexical set was treated individually in each section, thereby allowing an analysis that took into account the specificities of each feature. The GAMM analysis and generalised mixed effects models performed on the acoustic data helped confirm the reliability of the original transcriptions of the TLS along with that of the more recent ones by Amand and Watt. While both F1 and F2 were important clues in separating AI from EI PRICE variants in the PVC, only F2 showed to be significantly different in the TLS wordlist. Steeper rises in F2 were found among PRICE words pronounced with an EI, while AI words tended to have their onset plateau and then rise to merge with F3. More studies should be pursued in the relationship between F2 & F3 in variational analyses of PRICE words. In addition, duration measures in PRICE appeared more in line with the Scottish Vowel length Rule than variant scores, although more testing should be carried out. Eventually, a more detailed use of decision trees to classify words based on internal/external factors and variant scores, may help us analyse through which words, linguistic changes operate and how the change spreads to other words over time. To conclude, I believe that only both the auditory & acoustic analyses of the data, together with an alternation of aggregate (limited or exhaustive) and single-feature approaches provided a complementary and comprehensive view of variation in FACE, GOAT, and PRICE in the TLS and the PVC.

CONCLUSION

This aggregate analysis investigated coherence across FACE, GOAT, PRICE and MOUTH, which tend to level at various pace. In the TLS interview material, the original transcriptions show that speakers predominantly use supralocal forms. The traditional and above-supralocal forms have similar scores. An MFA/cluster analysis revealed a major gap between Newcastle & Gateshead speakers. Among the Gateshead speakers, the gender gap is also highly visible with two shades of accentedness within either gender. As expected, the working-class male speakers use the traditional forms the most, while educated lower-middle-class women (school secretary etc.) have high scores of above-supralocal forms. FACE, GOAT, PRICE and MOUTH stand out as major determinants of speech but they are not the only ones and future studies should explore the other features highlighted by the MFA. Monophthonguisation in FACE and GOAT is already predominant in the TLS and mirrors proportions found in the PVC. However, while monophthongs in FACE were already associated with traditional TE speech in the 19th century (in words like great, semi-phonetically transcribed as *greet*, Heslop 1892), evolution in the traditional GOAT vowel appears to have been much more radical as it changed from a front opening diphthong ([ɪe], Heslop 1892) to a centring diphthong with a retracted onset [ʊə] or simply a central monophthong [ɵː]. Based on the results of the MFA analysis, monophthonguisation of MOUTH in the TLS still characterises the traditional speakers and even more so than GOAT or FACE. In fact, a very low and retracted reflex of lettER showed up as the first characteristic feature of this cohort, with speakers from other TE-lects avoiding it. Interestingly, while the centring diphthong in GOAT is highly recessive, a similar variant of lettER was observed amongst younger speakers of the PVC, which corroborates Llamas and colleagues' study on the lexical set on more recent TE data (Llamas et al., 2017). This suggests that some traditional features are now extending to other social groups and more particularly young and mobile TE speakers.

The apparent-time study revealed interesting patterns in the MOUTH vowel. The raised onset was more popular among women of both classes. Older and middle-aged women of both classes had similar score but a lack of symmetry was found among younger female speakers. The young working-class women had much higher scores of raised onsets than older and middle-aged ones, which was the reverse for the lower middle-class younger women. Results from the PVC suggest that it is recessive in more formal styles such as the reading of a wordlist but they confirm the fact that the raised onset is a marker of indexicality for a local and generally younger woman. Lower middle-class speakers appear to have a less gender polarised use of the MOUTH vowel than traditional men, since LMC male speakers from the TLS sample were also reported to use the raised onset reaching similar aggregate proportions to the LMC younger women.

Both the TLS and the PVC results tend to sub-divide the supralocal speakers into two categories: those who raise their onset in PRICE more often and those who do not. PVC results from the wordlist showed that some words almost categorically triggered a low onset in the vowel (V# or following a voiced fricative). Younger speakers of both classes *and* gender are taking the lead on preserving the raised onset, alongside with the older WC men.

While FACE and GOAT operate in near symmetry, raised onsets in PRICE and MOUTH have a rather distinct coherence pattern: the former is more age related, and the latter, gender related. The monophthong in PRICE is found across speakers of both gender and is generally restricted to the pronoun *I* while a monophthong in MOUTH is a much stronger marker of indexicality, pointing at traditional working-class men. More investigations should be carried out on MOUTH and PRICE but it seems likely that the raised onset in the former will recede and women will converge with lower onsets favoured by men. On the contrary, a raised onset in certain PRICE words, which will remain a strong marker of the working class but adopted by adolescents of both classes before receding among middle-class speakers depending on their occupation or network.

The acoustic analysis helped confirm the reliability of the various coding made on the TLS & PVC. PRICE trajectories between EI and AI do not vary only in terms of onset heights but also in term of shape and this cannot be ascribed solely to duration. F2 in AI words tend to plateau close to F1 and then join F3 at the onset. F2 trajectories in EI words tend to have a different shape. They rise steeply towards F3 right at the start of the vowel and then plateau until the offset, with F2 almost merged with F3. GAMMs may not be enough to account for relationships between F1, F3 and F3 trajectories, but they highlighted more subtle patterns than would a static analysis of the onset only, which serves other purposes. I believe that the development of some kind of functional MFA may provide us with interesting tools for analysing and representing the complex sociolinguistic patterns that formant trajectories entail.

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APPENDIX I List of publications of the Song of Solomon by L.-L. Bonaparte in 1860 (Cercle de la Librairie, 1860)

ENREGISTREMENTS ET DÉPOTS DES OUVRAGES PUBLIÉS A L'ÉTRANGER.

(Plusieurs conventions internationales dispensent de l'obligation de l'enregistrement et du dépôt.)

ANGLETERRE.

LIVRES.

Biblia edo Testamentu zar eta Berria eta fray José Antonio de Uriartec, latiñezco vulgatatic lembicico aldiz Guipuscoaco Euscarara Itzulia. Luis Luciano Bonaparte principeac eta don José Antonio de Azpiazu Guipuzcoatorrac Lagunduric. Grand in-8° à 2 colonnes, 127 p. Londres......... [121

Cantique des cantiques de Salomon (le), traduit en basque labourdin, par M. le capitaine Duvoisin. In-16, 19 p. Londres, imp. George Barclay.. [122
Edition tirée à 250 exemplaires dont un seul sur papier épais.

Das hohe Lied Salomos in Siebenburgischsächsischer Sprache von J. Seibert. Aus dem « Ngrischen Magasin. » In-16, 28 p. Londres, imp. G. Barclay. [123
Edition tirée à 250 exemplaires, dont un seul sur papier épais.

Song of Solomon (the) in the Newcastle Dialect. From the authorised English Version, by Joseph Philip Robson. In-16, 20 p. Londres, imprimerie G. Barclay................................ [124
Edition tirée à 250 exemplaires, dont un seul sur papier épais.

Song of Solomon (the) in the Dialect of Central Cumberland. From the authorised English Version, by William Dickinson. In-16, 20 p. Londres, impr. G. Barclay.............................. [125
Edition tirée à 250 exemplaires, dont un seul sur papier épais.

Song of Solomon (the) in the Durham Dialect, as spoken at St. John's Chapel, Weardale, by Thomas Moore. In-16, 20 p. Londres, impr. George Barclay.................................. [126
Edition tirée à 250 exemplaires, dont un seul sur papier épais.

Song of Solomon (the) in the Dialect of Craven in the riding of Yorkshire. From the authorised English Version, by Henry Anthony Littledale. In-16, 20 p. Londres, impr. G. Barclay............... [127
Edition tirée à 250 exemplaires, dont un seul sur papier épais.

Song of Solomon (the) in the Sheffield Dialect. From the authorised English Version, by Abel Bywater. In-16, 20 p. Londres, impr. G. Barclay... [128
Edition tirée à 250 exemplaires, dont un seul sur papier épais.

Song of Solomon (the) in the Lancashire Dialect, as spoken at Bolton. From the authorised English Version, by James Taylor Staton. In-16, 20 p. Londres, imp. G. Barclay........................ [129
Edition tirée à 250 exemplaires, dont un seul sur papier épais.

Song of Solomon (the) in the Dorset Dialect. From the authorised English Version, by Rev. William Barnes. In-16, 20 p. Londres, impr. G. Barclay..... [130
Edition tirée à 250 exemplaires, dont un seul sur papier épais.

Song of Solomon (the) in the Living Cornish Dialect. From the authorised English Version. In-16, 20 p. Londres, impr. George Barclay............ [131
Edition tirée à 250 exemplaires, dont un seul sur papier épais.

Song of Solomon (the) in the Northumberland Dialect. From the authorised English Version, by Joseph Philip Robson. In-16, 20 p. Londres, impr. G. Barclay.................................. [132
Edition tirée à 250 exemplaires, dont un seul sur papier épais.

Song of Solomon (the) in the Devonshire Dialect. From the authorised English Version, by Henry Baird. In-16, 20 p. Londres, impr. G. Barclay. [133
Edition tirée à 250 exemplaires, dont un seul sur papier épais.

Vangelo di S. Matteo (il), volgarizzato in dialetto veneziano, dal sig. Gianjacopo Fontana. In-16, 129 p. Londres, impr. G. Barclay............... [134
Edition tirée à 250 exemplaires, dont un seul sur papier épais.

Vangelo di S. Matteo (il), volgarizzato in dialetto milanese, dal sig. Antonio Picozzi. In-16, v-124 p. Londres, impr. G. Barclay.............. [135
Edition tirée à 250 exemplaires, dont un seul sur papier épais.
Ces 15 ouvrages sont édités par le prince Louis-Lucien Bonaparte.

BELGIQUE.

LIVRES.

LÉVY. — Etude philosophique sur l'architecture; par Edmond Lévy, de Rouen, architecte, etc. Mémoire en réponse à la question suivante : Rechercher l'enchaînement des diverses architectures de tous les âges et les rapports qui peuvent exister entre les monuments et les tendances religieuses, politiques et sociales des peuples. In-8°, 80 p. Bruxelles, impr. Hayez; libr. Tircher; Paris, libr. Didron, Morel et C°; Rouen, libr. Lebrument. (1859.).. [136

APPENDIX II Ellis's Northern boundary (A. J. Ellis, 1889, pp. 495-496)

D 30 = EN. = East Northern.

Boundary. Beginning at Middlesborough, Yo., at the mouth of the Tees, proceed along the border of Yo. and Du. as far as Croft (14 sw.Middlesborough). Then go sw. from Croft to Middleham (8 s-by-w.Richmond), passing e. of Richmond and Leyburn. Turn s. and enter the West Riding just e. of Middlesmoor (13 w-by-n.Ripon), when turn slightly se. and go direct to Burley (7 n.Bradford), about where strike the s. *hoose line* 6 (p. 19). Follow this line, passing along the Wharfe by Otley, to about Arthington (17 s-by-w. Ripon), when quit the Wharfe, but pursue the s. *hoose* line to the s. of Tadcaster (9 sw. York), w. of Selby and Snaith, (passing 8 w.Goole) across Hatfield Chase, se. to the n. part of Nt., and then by the b. of Li. to the Humber, at the mouth of the Trent, and crossing the Ouse opposite Blacktoft (6 e.Goole), go by the Humber and coast round to the Tees mouth and Middlesborough again.

It must be understood that this line from Croft to Burley, separating EN. = D 30 from WN. = D 31, is merely approximative. The upper part of Swaledale, Wensleydale, and Nidderdale belong certainly to D 31, which, as we shall see, differs distinctly in character from D 30, but whether the boundary lies slightly e. or w. of that assigned has not been ascertained. Probably no definite line could be drawn. The one proposed is very nearly the w. b. of the great plain of

[1927]

Yo., and while it satisfies JGG., my authority for the adjacent part of D 31, does not interfere with any of CCR.'s indications.

Area. This district comprises the greater part of the North Riding, omitting the nw. horn of Yo., all the East Riding and a small portion of the West Riding, a very large extent of country, which has not been completely explored, although there can be but little doubt of the general character of the parts from which no information has been received.

This large area I have found it convenient to divide into four main varieties, which are themselves divided into subvarieties as follows:

VAR. i. *The Great Plain of York.*
(*a*) Mid Yo., (*b*) York Ainsty, (*c*) North Mid Yo., (*d*) New Malton, (*e*) Pateley Bridge and Lower Nidderdale, (*f*) Washburn River.

VAR. ii. *The North East Moors.*
(*a*) South Cleveland, North Cleveland being spoiled for dialect by the iron works, (*b*) North East Coast and Whitby.

VAR. iii. *The Wolds and South East Coast.*
(*a*) Market Weighton, (*b*) Holderness.

VAR. iv. *The Marshes.*
Goole, and Marshland.

Authorities. See Alphabetical County Lists for Yo. under the following names, where * indicates vv. per AJE., † per TH., ‖ in so., principally CCR.'s Glossic, ° in io.

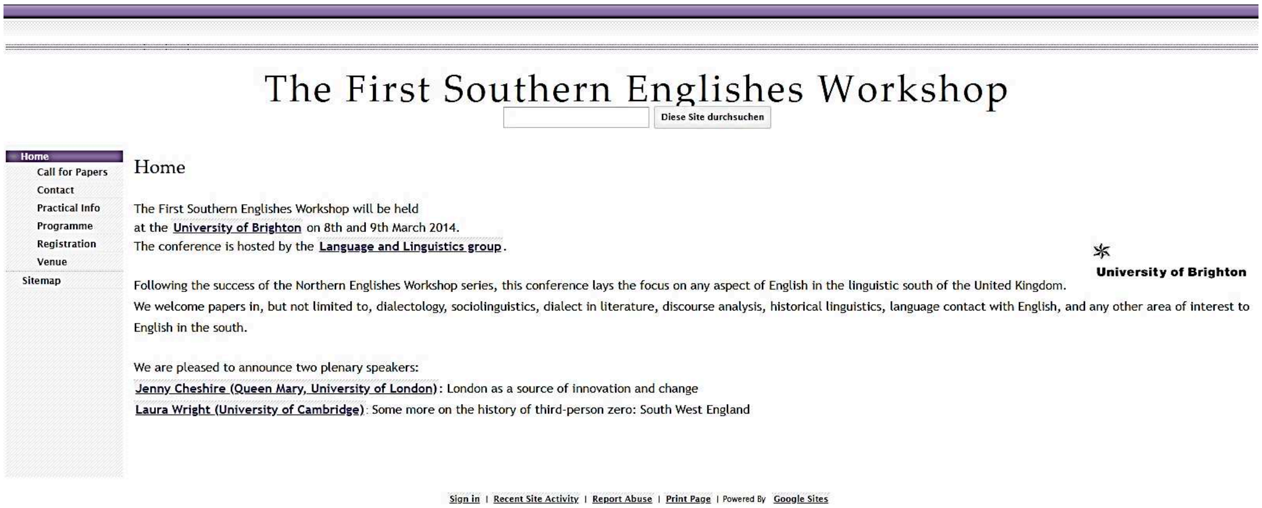
Var. i. (*a*) ‖Mid Yo., °Ripon to Thirsk. (*b*) ‖York Ainsty, ‖York city. (*c*) ‖North Mid Yo., °Thirsk. (*d*) ‖New Malton. (*e*) ‖Pateley Bridge. (*f*) ‖Washburn River.

Var. ii. (*a*) ‖Stokesley for South Cleveland, °Skelton, °Danby-in-Cleveland. (*b*) ‖North East Coast, °Hackness, °Whitby.

Var. iii. (*a*) *°Market Weighton, °Pocklington. (*b*) *†°Holderness, †Burton Constable, †Hornsea, †°Hull, †Leven, °Skeffling, ‖Sutton, †Swine, °Waghen.

Var. iv. °Drax, °East Haddlesley, *Goole, °Hatfield, °Selby, °Snaith.

APPENDIX III Southern Englishes workshop in 2014: following the footsteps of the Northern Englishes workshop



Since websites for conferences do not always remain online for a very long time, here is a screenshot of the first Southern Englishes Workshop acknowledging the legacy of the Northern Englishes workshops which were launched in 2006. (Retrieved 30/07/2019 from https://sites.google.com/site/sewbrighton/).

APPENDIX IV Heslop table of Northumbrian vowel variation in the late 19th century

The following comparative tables will show the range and variations of the foregoing sounds in the subdivision of the dialect :—

South Northumberland ..	*salt*	*malt*	*falt* (fault)	a as in German salz.
Tyneside	*salt*	*malt*	*falt*	
North Northumberland ..	*saat* / *sat* / *salt*	*mat* / *malt*	*faat* / *fat* / *falt*	
West-Tyne	*soat*	*moat*	*foat*	*oa* as heard in the *o* in sol*o*.

S. ..	*waa* [l] (wall)	*blaa* (blow)	*snaa* (snow	long a.
T. ..	*waa* [l]	*blaa*	*snaa*	
N. ..	*waa* [l]	*blaa* / *blaw*	*snaa* / *snaw*	*aw* as in awe.
W.-T. ..	*woa*	*blo*	*sno*	*o* as in sol*o*.

S. ..	*bowld* (bold)	*rowl* (roll)	*cowld* and *caad* (cold)	*howld* and *had* (hold)
T. ..	*bowld*	*rowl*	*cowld* and *caad*	*howld* and *had*
N. ..	*bold* / *bowld*	*row* [l]	*caad* / *cowld*	*had* / *howld*
W.-T. ..	*bowld*	*rowl*	*coad*	*hoad*

S. ..	*breest* (breast)	*seet* (sight)	*leet* (light)	*neet* (night)
T. ..	*breest*	*seet*	*leet*	*neet*
N. ..	*breest*	*sight*	*light*	*night*
W.-T. ..	*breest*	*seet*	*leet*	*neet*

S. ..	*forst* (first)	*porse* (purse)	*horl* (hurl)
T. ..	*forst*	*porse*	*horl*
N. ..	*furst* / *forst*	*purse* / *porse*	*hurl* / *horl*
W.-T. ..	*forst*	*porse*	*horl*

S. ..	*stee-yen* (stone)	*bee-yen* (bone)	*hee-yem* (home)	*hee-yel* (whole)
T. ..	*styen*	*byen*	*hyem*	*hyel*
N. ..	*styen*	*byen*	*hyem*	*hyel*
W.-T. ..	*steen*	*been*	*heem*	*heel*

Figure 8-59 Heslop's chart on vowel variation in Northumbrian English (1892, pp. xix-xx)

APPENDIX V Transcription of a song in TE by Daniel Jones (D. Jones, 1911)

— 184 —

iŋgliʃ

*tainsaid daiəlekt (*nɔːθʌmbələnd)

kom *dʒɔːdi haːd[1]) ðə beən[2])
ɑs ʃuːəʀ ɑ winiət[3]) bi læŋ
ɑd tjɛk[4]) ðə dʒuːl miˈsɛl[5])
bot ʀiːəli ɑːz[6]) nət stʀæŋ.
ðɔːz fluːwəʀ[7]) ənd koːulz tə gɛt
ðə huːs-tɔːnz[8]) ðɔː nɔt djon[9]),
sou haːd ðə beən fə feəz[10]),
jəv ɔftən djond[11]) fə fon.

siː[12]) *dʒɔːdi hɛld ðə beən
ðou seəʀ[13]) əgjɛn[14]) hiz wil.
ðə puːə bit θiŋ wæz gud
bət *dʒɔːdi hæd niː[15]) skil.
hiː hædnt its moðəz weːiz,
hiː sæt bjɛθ[16]) stif ən nom;
əfɔː faiv minits wæz paːst
hiː wiʃt its moðə wæd[17]) kom.

teikn daun bai D. J. frəm ðə dikteiʃn
əv Mr. S. G. Horsley.

dɔytʃ

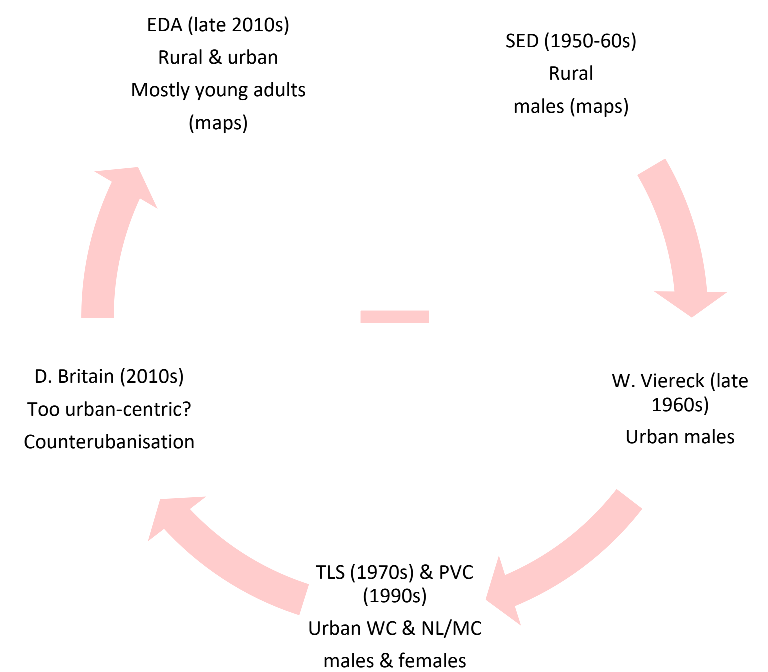
ausʃpraːxə dər gəbildətən fɔn Frankfurt a. M.

di ˈjuŋə ˈʃvalbə

„vɑs ˈmɑxt ˀiˑɐ dɑ?“ ˈfrɑːxtə ˀainə ˈʃvalbə diˑ gəˈʃɛftijn ˈˀɑːmaizn. „viˑɐ saməln ˈfoɐrɑːt ˀauf dn ˈvintɐ“, vɑːɐ diˑ gəˈʃvində ˈˀantvɔrt. „dɑs ˀis(t) ˈkluːx“, ˈsɑːxtə di ˈʃvalbə; „dɑs vil ˀiç ˈˀaux tuːn“. ˀunt sɔˈglaiç fiŋ siˑ ˈˀɑn, ˀainə ˈmeŋə ˈtoːtə ˈʃpinən ˀunt ˈfliːjn ˀin ˀiˑɐ ˈnɛst tsuˑ trɑːgn. „ˀɑːbɐ voːˈtsuː ˈsɔl dɑs?“ ˈfrɑːxtə ˈˀɛntliç diˑ ˈmutɐ. „voːˈtsuː? ˈfoɐrɑːt ˀauf dn bøːzn ˈvintə; ˈliːbə ˈmutɐ, ˈsamlə dɔx ˈˀaux! di ˈˀɑːmaizn hɑːbn miç diːzə ˈfoəsiçt gəˈləːrt“. „ˈoː, lɑs dən ˈˀirdiʃn ˈˀɑːmaizn diːzə ˈklainə ˈkluːxhait!“ fɐˈsɛtstə diˑ ˈˀaltə; „vɑs siç fyˑɐ ˈsiː ʃikt, ʃikt siç ˈniçt fyˑɐ ˈbɛsrə

1) hould. 2) tʃaild. 3) wil nɔt. 4) teik. 5) maiˈself. 6) aim. 7) ðɛəz flauər. 8) hauswəːk. 9) dʌn. 10) siəriəsli. 11) dʌn it. 12) sou. 13) sɔː (*sore*). 14) əgeinst. 15) nou. 16) bouθ. 17) wud.

APPENDIX VI Schematic evolution of dialectology with regards to fieldwork and participants (1950s-2010s)



SED: Survey of English Dialects

TLS: Tyneside Linguistic Survey

PVC: Phonetic Variation of Contemporary English

WC: working-class

NL: non-localised speech

MC: middle-class

EDA: English Dialect App

APPENDIX VII TLS: application for a grant in 1970 by Barbara Strang

SSRC001

Application for a Research Grant for the Tyneside Linguistic Survey

Contents

1. General Statement of Purpose

The Tyneside Linguistic Survey (T.L.S.) sets out, as a latitudinal survey, to discover the varieties of English used side by side in the urban area under investigation, and to establish the social distribution of these varieties; also, as a longitudinal survey to trace the changes in varieties and there social distribution through time. It is not, therefore, merely concerned with dialect, but is equally interested in the varieties of non-localised speech current in the community. At present work is centred on the City of Newcastle, but it should expand to cover the whole conurbation. While the study is academic in conception it has practical implications. People's lives and destinies are affected by their use of one kind of English rather than another, and by other people's assumptions about the social meanings of different varieties. In education much expenditure of time and effort depends on assumptions about the social meaning of different kinds of speech and about how education can modify the individual speech. In the teaching of English as a Foreign Language similar assumptions have far reaching effects. There is actually very little precise information about any of these subjects.

While one cannot assume that all urban areas are alike,it is necessary to start investigating in a single area of such a size as to be capable of producing meaningful evidence from a randomly chosen sample of manageable size. For this purpose Newcastle, with its surrounding urban areas, is ideally fitted. It is, however, a concern of the Survey to establish a method of investigation which could be applied in any city to elicit evidence of a kind strictly comparable with our own.

2. The subject related to wider academic considerations

Language is used by human individuals associated in groups. In addition to its role in shaping personality it functions in the definition of groups, acting internally as a bond between group-members and externally as a means of distinguishing group from group. In this respect it plays an immense part in determining a person's image of himself and the nature and range of his relationships throughout life.

Throughout human history three types of factor have determined the linguistic group-affiliations open to individuals. The one operative from the beginning is spatio temporal; a child, in acquiring a language variety, is limited to experience of the speech of other people existing contemporaneously and within spatial reach of him; the only kind of speech he can acquire is the indigenous variety characteristic of his group - family, village, tribe, etc. The second type of factor comes into operation with the evolution of major towns drawing their population from an area wider than the immediate environment. A child in an urban community is exposed to different types of speech co-existing in one place. As soon as this happens, speakers tend to sort the varieties they recognize on a social scale, since obviously a geographical differentiation is not relevant; and as language is a way of associating oneself with one group and dissociating oneself from others, speakers begin to change their usage in ways not previously found. The distribution and history of speech varieties is therefore different in pre-urbanised and urbanised speech communities. Urbanised speech commonly exists in some parts of a country alongised pre-urbanised speech in other (more rural) areas. A third type of factor may be briefly labelled technological. During the past century technological innovations have exposed speakers to varieties of speech used in places remote from them, and social considerations have often led speakers to make deliberate changes in their speech under these remote influences from films, broadcasting, records, etc. Not only language, but also linguistic history, changes in these three sets of conditions. The nature and pace of change are of a different order in the twentieth century from that prevailing throughout all earlier history. The study of varieties of speech under such characteristically modern pressures is of a high interest, including, but additionally differing in kind from, the interest of dialect surveys. It is a kind of study peculiarly appropriate to our time, and nothing quite like it is at present being undertaken anywhere in the English speaking world, though the various studies of Labov in the United States are the nearest in orientation.

3. The structure of the proposed investigation

(i) A first statement of plan was delivered as a paper to the International Congress of Dialectology in 1965, and subsequently published in Zeitschrift für Mundartforschung (xerox copy attached).

(ii) The latitudinal survey has already got under way without special funding. Work began in 1965 with a feasibility study of 60 speakers, using a brief and simple questionnaire. From the evidence of this study it was possible (a) to identify the main speech variables which a fuller questionnaire would have to elicit; (b) to design a questionnaire to carry out this purpose; (c) to determine which varieties and distributions could best be investigated by random sampling and which kind of sampling would be most appropriate (to wit, multi-staging with probability proportional to size); (d) to determine how far the evidence obtained according to (c) would need supplementation by other methods of sampling, including the use of hand-picked informants who spoke the rarer (but socially marked) varieties of English (such as different kinds of received pronunciation).

(iii) Since 1967 the rest of the latitudinal survey has been almost completed, and the work should be written up by the summer of 1970. It has involved the following tasks:

(a) The selection of a random sample of 150 speakers (.05°/o) whose recorded responses in an interview formed the basis for classification.

(b) The design of an interview embodying 250 analytically independent criteria (linguistic features of different kinds) in varied tasks, and seeking specific social and atitudinal information.

(c) Computing a similarity coefficient between all pairs of speakers, who are then clustered on the basis of their linguistic similarities (by means of an agglomerative non-overlapping technique). When the criterion values invariant over the whole sample have been partialled out, a list of diagnostic criterion values emerges. Speakers are also clustered on the basis of social similarities, and the social specificity for all linguistic diagnostics can be examined. Statistical inferences can be drawn as to the representation of varieties in the relevant population.

(d) Testing the stability of this first classification by (1) adding speakers from other samples, (2) changing the number and nature of the criteria, (3) changing the definition of the coefficient used, (4) changing the clustering method, (5) by permutations of 1 - 4.

This is the extent of the work at present in hand. It should be added that a by-product of the work is the organisation of an invitational conference on Language in Society on behalf of the Schools Council for September 1970 (statement of plan attached). In the same month a report on the work is to be presented to the British Association for the Advancement of Science at its meeting in Durham.

Funding is now sought for the extension of the Survey as follows:

(a) Extension of the sampling to five urban areas continuous with but outside the City of Newcastle. This will further test both the adequacy of the empirically defined criteria and the representativeness of the findings already made.

(b) For the same purpose, the use of further sub-samples within the City of Newcastle. One sub-sample would be an exact replica methodologically of the present sample, and the other would use a different sample method building in social stratification.

This part of the work would occupy one research worker at the equivalent of a lecturer's salary for the years 1970-72, plus a small allowance for secretarial help, and should be estimated at a cost of £4,000 over the two years.

(c) A longitudinal follow-up study of the first sets of areas investigated occupying the years 1972-4, at a cost of a further £4,000.

These studies would not exhaust the survey's interests, but the evidence of the past 4 years is that the Survey would attract research students with their own funding who would undertake further related investigations (sub-topics). The central topic so far studied has been worked on by the holder of a University Studentship reading for the degree of M.Litt., and of a Major State Studentship reading for the degree of Ph.D. Two M.A. students have examined the mode of interference from received pronunciation upon the diagnostic localised pronunciations; part-time research students are looking at the interaction of localised and non-localised speech among school children of certain ages. We feel confident of continuing to

- 4 -

attract such researchers for our remaining fields of interest, such as:

(a) Further follow-up studies at more remote dates.

(b) Study of children at ages not yet investigated by Survey workers.

(c) Varieties of English used throughout the hierarchy of a large industrial or commercial organisation.

(d) Varieties of English used by immigrants of various social groups.

The full meaning of these subsidiary investigations will only be clear against the background of the information provided by the central investigation, and it is this that we cannot complete without staff appointed for the purpose. We therefore apply for a grant of £8,000 in all for staff over the period October 1970 - September 1974, as specified above. We believe that it would be appropriate to ask for an additional £500 for expenses in equipment and tape during the same period. We have at present the expectation that the services of the University Computing Laboratory will be made available to us without cost.

No estimate of publication costs has been included as we are negotiating with a publisher and with the University Book Sponsorship Fund on this subject. We hope the position will be clarified by the time this application is considered, and we shall send supplementary information on this point as it becomes available.

APPENDIX VIII Interview with John Pellowe (undated): transcript

Interviewer: It's been my, sorry, it has occasionally been suggested that I, as a Londoner, have no right to <unclear> lightly on this essentially Northern programme. To these critics I merely say that what you've <unclear> own grounds of racial discrimination. More interesting that is whether Southern speech has any effect on the speaking habits of the indigenous population, namely your actual Geordies or associated Northerners, or whether living among them is having an effect on my way of speaking of t[**a**ː]king, like. This sort of thing's a subject of a survey being done by the English department of Newcastle University. They go around interviewing Tyneside families, trying to find out how the dialect's changing, if at all. And the <unclear> of outsiders like myself and vice versa. Jay Kelly's been talking to John Pellowe, an Essex man who does the actual tape recording of the way people speak. And he put it to one interviewer to another, didn't he find that faced with a tape recorder, people started putting on an accent not really natural.

Pellowe: When I first started interviewing, especially if the person has a local variety, I find myself quite unconsciously, I only find out afterwards, I find myself using *my* version of a local variety and at the same time it is not noticeable when I hear the tape afterwards that the person I'm talking to is using a *less* local variety now we might want to call it, I think it's it's it's the right sort of phrase, a form of social courtesy but the interesting thing is when the interview is really underway, and both people are er fully engaged in the conversation and not thinking about the machine or anything else, I myself so to say go back to my normal er urban Essex er type of variety, and that the person I'm talking to goes back to their own variety so their words, there is a relaxed norm in everybody's, in a certain situation using a certain variety there is a relaxed ordinary state

Interviewer: Mm Do you find that any interviewees are ashamed of the Geordie accent?

Pellowe: Er very rarely, but sometimes yes they are. I it's difficult to to work out why this should be so, I think, it might reflect some sort of social insecurity.

Interviewer: Have you come across anybody who for instance has been brought up in a in a a a very definite working-class background say Scotswood road and the moves, and because of his job or his eh his house and then moves into the middle class, do you find the he tries to alter his accent?

Pellowe: In the past this question has always received a definite and perhaps over dogmatic answer: "yes he does, he always tries to adapt his speech er towards a non-local variety". In my experience, this is certainly not the case, especially on Tyneside, but the thing is this that this is also one of the central concerns of the Tyneside survey: what clues in speech are there to various forms of social meaning? We are interested in considering whether there might be a possible practical er result of the survey whereby we could predict certain people who are about to be rehoused would tolerate certain forms of rehousing, and whether there are indications that certain speech varieties non local as well as local are an indication of a sort of group loyalty. Er this is a very important concept I think because it shows that these things are very much more unconscious than we usually believe. People just can't change the whole of their speech because they want to. They do it because of some external pressures or some feeling of insecurity as I've already said if a person is rehoused from a traditional terraced street, he may well find if he moves into a block of flats that he feels very insecure or even aggressive towards local authorities about this form of rehousing if

Interviewer: He then becomes even more local?

Pellowe: He becomes even more local in certain certain circumstances if if he really feels aggressive about this, and I think that we could perhaps develop an index of of local speech or even upon local speech which would indicate before rehousing that this is likely to occur.

Interviewer: How do people come in from outside take on the local dialect or try to take on the local dialect?

Pellowe: Er I would say a fair number and especially in if you like the younger age groups.

<u>Interviewer:</u> I guess you haven't and you must have done a lot of interviews with the local people but there's no trace of the Geordie in your voice is this because you're putting it on for this microphone or what?

<u>Pellowe:</u> Well I I wanted to do a distinction here between mimicking which I c can sometimes do but not I'm sure I would be disapproved of by true local speakers but I also a as I said earlier in interviews I find myself I find that I have done this in in in the interview with without being conscious of the change, and I think that the Tyneside Survey is not so much interested in conscious mimicking which is just a question perhaps of er having a musical ear and so on but is very much *more* interested in the unconscious adaptation because this is something that has a very important social meaning.

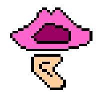
<u>Main transcription conventions:</u>

Estimated punctuation marks were added to enhance readability. Repetitions, false starts and fillers are also transcribed.

[**aː**]: realisation of dialect feature in IPA.

More: emphasised words by the speaker.

APPENDIX IX FACE breaking in Ulster Scots



ANT_FACE-VowelBreaking_ULSTER.mp3

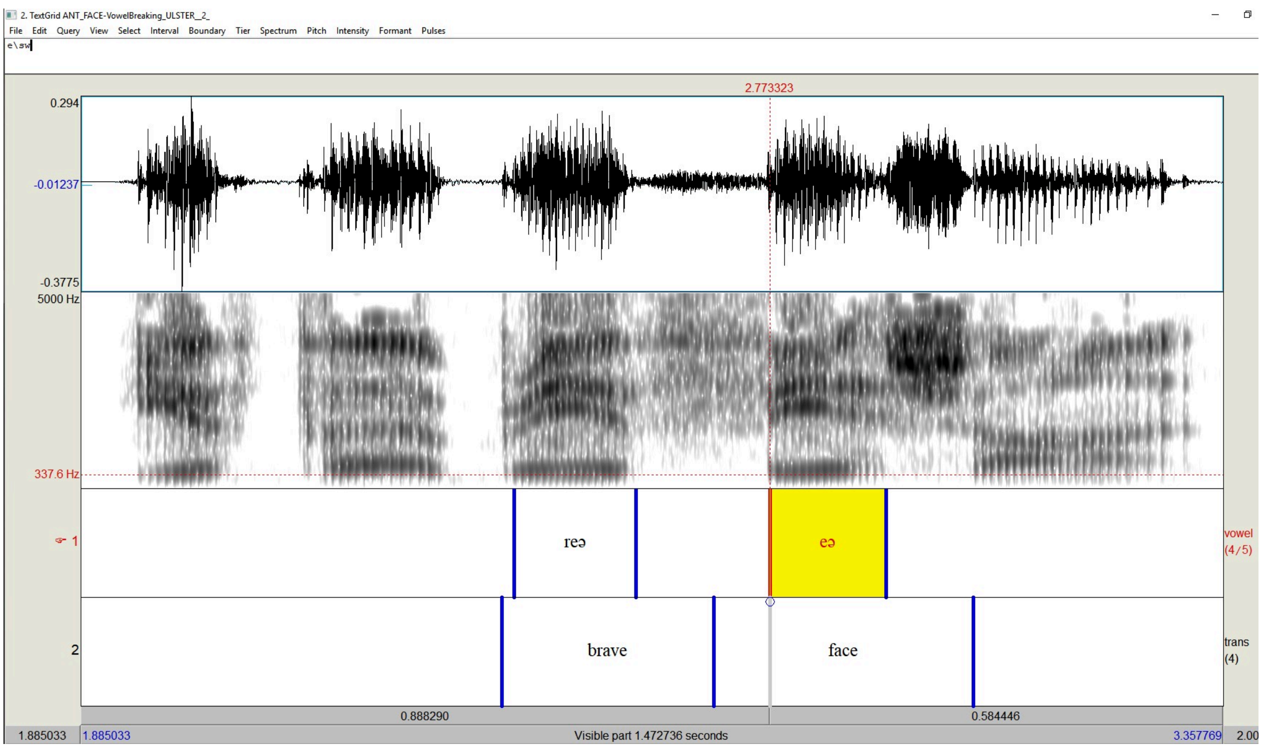


Figure 8-60 Spectrographic illustration of FACE breaking in Ulster English, traditional Uster Scots speaker (from sound retrieved at https://www.uni-due.de/VCDE/VCDE_Ulster_English.htm. Acessed 23 March 2019).

APPENDIX X The TLS coding scheme for FACE, GOAT, PRICE, and MOUTH

The entire coding scheme is available on the DECTE website and can be retrieved here:
https://research.ncl.ac.uk/decte/transscheme.htm

	OU	PDV	(code)	states	lexical examples
FACE	11 eI	eI	0104	eɪ eɪ ɛɪ ɛ̈ɪ	eight, great
		ɛ	0106	ɛ e ɛ ɛ	take, make
		eɪə	0108	ɛiə ɛɨə	shape, railway
		a	0110	a a a ɛ ɛ	take, halfpenny
		i	0112	i i i œ	great, brains
		iə	1120	iə eə iä iä	great, brains
		ɛɪ	0114	ɛɪ ɛɪ	eight, straight
		ə	1140	ə ɪ	Monday, holiday
GOAT	12 əʊ NL	əʊ	0116	əʊ aö ɛʊ oʊ əʊ	so, phone, nose
		əɪ	1160	əɪ ɪi i:	so, no
		ɔ:	0118	o ɔ ɔ ɔ	so, smoke
		u:	0120	u u u o o	go, nose
		ɑ:	0122	a a a a	old, know, no, cold
		ɪə	0124	jɛ jɛ jɛ ɪə iə iə	stone, home
		ɛʊ	0126	ɛʊ ɛʊ aʊ aʊ	bolt, hope
		ə	1260	ə ɪ	pillow, yellow
PRICE	13 aI NL	aI	0128	aɛ ai aɪ aɪ aɪ	I, side, china
		ɑ:	0130	a a a a	I, five
		i:	0132	i i i ɪ	blind, right
		eɪ	0134	ɛi eɨ ei	knife, mine

	OU	PDV	(code)	states	lexical example
MOUTH	15 aʊ NL	aʊ	0142	a:ʊ aʊ ɛʊ aʊ aʊ	house, now
		ɛʊ	0144	eʊ ɛʊ ɛʊ	house, crowd
		ɪʊ	1440	ɪʊ ɪʊ	now, cow
		u:	0146	ʊ u u u	mouse, round
		ɔʊ	1460	ɔʊ ʌʊ	loud, down
		ɑʊə	0148	ɛʊə aʊə aʊə	flower, our
		ɑ:	0150	ä a aə aə	our, tower
		ɛʊə	1500	ɛʊə ɛʊɛ ɛʊɐ ɛʊa	our

APPENDIX XI MFA: with vs. without social data bias

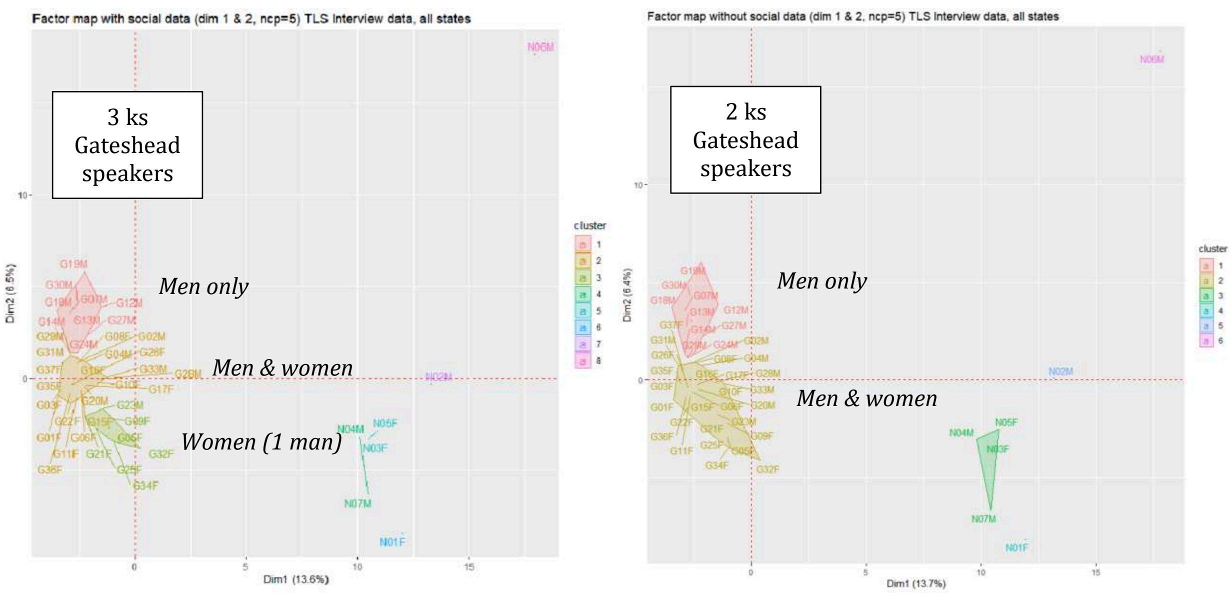


Figure Factor maps of MFA 0 vs. MFA 1: with (left) vs. without social data bias (right)

APPENDIX XII Watt's analysis of GOAT & FACE vowels: frequency tables of the variants (PVC)

FC: free conversation, WL: wordlist

GOAT (adapted from Watt (1998) p. 233 FC, p. 239 WL)

FC counts

Class	**Age**	**Sex**	GOAT_oː	GOAT_ʊə	GOAT_oʊ	GOAT_ɵː	TOTAL
Middle class	Older	Men	127	21	0	27	175
Middle class	Younger	Men	76	5	30	59	170
Middle class	Older	Women	176	0	18	2	196
Middle class	Younger	Women	126	5	34	6	171
Working class	Older	Men	55	63	3	53	174
Working class	Younger	Men	113	23	2	53	191
Working class	Older	Women	188	1	0	1	190
Working class	Younger	Women	196	0	0	1	197

FC %

Class	**Age**	**Sex**	GOAT_oː	GOAT_ʊə	GOAT_oʊ	GOAT_ɵː	TOTAL
Middle class	Older	Men	73	12	0	15	100
Middle class	Younger	Men	45	3	18	35	100
Middle class	Older	Women	90	0	9	1	100
Middle class	Younger	Women	74	3	20	4	100
Working class	Older	Men	32	36	2	30	100
Working class	Younger	Men	59	12	1	28	100
Working class	Older	Women	99	1	0	1	100
Working class	Younger	Women	99	0	0	1	100

WL counts

Class	**Age**	**Sex**	GOAT_oː	GOAT_ʊə	GOAT_oʊ	GOAT_ɵː	TOTAL
Middle class	Older	Men	29	0	3	0	32
Middle class	Younger	Men	12	0	11	10	33
Middle class	Older	Women	14	0	18	0	32
Middle class	Younger	Women	23	0	9	0	32
Working class	Older	Men	1	21	0	10	32
Working class	Younger	Men	19	2	0	20	41
Working class	Older	Women	25	0	6	0	31
Working class	Younger	Women	31	0	1	0	32

WL %

Class	Age	Sex	GOAT_oː	GOAT_ʊə	GOAT_oʊ	GOAT_ɵː	TOTAL
Middle class	Older	Men	91	0	9	0	100
Middle class	Younger	Men	36	0	33	30	100
Middle class	Older	Women	44	0	56	0	100
Middle class	Younger	Women	72	0	28	0	100
Working class	Older	Men	3	66	0	31	100
Working class	Younger	Men	46	5	0	49	100
Working class	Older	Women	81	0	19	0	100
Working class	Younger	Women	97	0	3	0	100

FC & WL %

Class	Age	Sex	WL_oː	FC_oː	WL_ʊə	FC_ʊə	WL_oʊ	FC_oʊ	WL_ɵː	FC_ɵː
Middle class	Older	Men	91	73	0	12	9	0	0	15
Middle class	Younger	Men	36	54	0	4	33	18	43	42
Middle class	Older	Women	44	90	0	0	56	9	0	1
Middle class	Younger	Women	72	74	0	3	28	20	0	4
Working class	Older	Men	3	32	95	36	0	2	45	30
Working class	Younger	Men	46	59	10	12	0	1	95	28
Working class	Older	Women	81	99	0	1	19	0	0	1
Working class	Younger	Women	97	99	0	0	3	0	0	1

FACE (adapted from p. 223 FC, p. 228 WL)

FC counts

Class	Age	Sex	FACE eː	FACE ɪə	FACE eɪ	TOTAL
Middle class	Older	Men	112	31	0	143
Middle class	Younger	Men	106	21	18	145
Middle class	Older	Women	139	4	10	153
Middle class	Younger	Women	132	4	30	166
Working class	Older	Men	63	110	1	174
Working class	Younger	Men	118	69	5	192
Working class	Older	Women	112	9	0	121
Working class	Younger	Women	147	4	0	151

FC %

Class	Age	Sex	FACE eː	FACE ɪə	FACE eɪ	TOTAL
Middle class	Older	Men	78.32	21.68	0.00	100
Middle class	Younger	Men	73.10	14.48	12.41	100
Middle class	Older	Women	90.85	2.61	6.54	100
Middle class	Younger	Women	79.52	2.41	18.07	100
Working class	Older	Men	36.21	63.22	0.57	100
Working class	Younger	Men	61.46	35.94	2.60	100

Working class	Older	Women	92.56	7.44	0.00	100
Working class	Younger	Women	97.35	2.65	0.00	100

WL counts

Class	**Age**	**Sex**	FACE eː	FACE ɪə	FACE eɪ	TOTAL
Middle class	Older	Men	44	0	8.0	52
Middle class	Younger	Men	27	5	20.0	52
Middle class	Older	Women	14	0	38.0	52
Middle class	Younger	Women	39	0	14.0	53
Working class	Older	Men	14	39	0.0	53
Working class	Younger	Men	26	40	0.0	66
Working class	Older	Women	37	0	14.0	51
Working class	Younger	Women	53	0	1.0	54

WL %

Class	**Age**	**Sex**	FACE eː	FACE ɪə	FACE eɪ
Middle class	Older	Men	84.6	0.0	15.4
Middle class	Younger	Men	51.9	9.6	39.5
Middle class	Older	Women	26.9	0.0	73.1
Middle class	Younger	Women	73.6	0.0	26.4
Working class	Older	Men	26.4	73.6	0.0
Working class	Younger	Men	40.1	59.9	0.0
Working class	Older	Women	72.5	0.0	27.5
Working class	Younger	Women	98.1	0.0	1.9

FC & WL %

Class	**Age**	**Sex**	WL eː	FC eː	WL ɪə	FC ɪə	WL eɪ	FC eɪ
Middle class	Older	Men	85	78	0	22	15	0
Middle class	Younger	Men	52	73	10	14	40	12
Middle class	Older	Women	27	91	0	3	73	7
Middle class	Younger	Women	74	80	0	2	26	18
Working class	Older	Men	26	36	74	63	0	1
Working class	Younger	Men	40	61	60	36	0	3
Working class	Older	Women	73	93	0	7	28	0
Working class	Younger	Women	98	97	0	3	2	0

APPENDIX XIII Summary of AI/EI mixed effects model by gender (PVC WL)

Table 8-6 Mixed-effects logistic regression testing duration and median F1 (scaled) of the first 25% of the vowel on the realisation of AI/EI PRICE variants. Men only

Fixed effects							***Random effects***			
	Estimate	*SE*	*z*	*p*	CI				Variance	*SD*
Intercept	3.450	1.414	2.440	0.015	*0.701, 6.411*		**Speaker**	Intercept	4.145	2.036
Median F1 (*scaled*)	-1.154	0.430	-2.686	<.01	*-2.043, -0.334*		**Word**	Intercept	4.805	2.192
Duration	-30.107	6.740	-4.467	<.0001	*-44.679, -17.808*					

Table 8-7 Mixed-effects logistic regression testing duration and median F1 (scaled) of the first 25% of the vowel on the realisation of AI/EI PRICE variants. Women only.

Fixed effects							***Random effects***			
	Estimate	*SE*	*z*	*p*	CI				Variance	*SD*
Intercept	3.0842	1.150	2.680	0.01	*0.832, 5.600*		**Speaker**	Intercept	0.3459	0.3459
Median F1 (*scaled*)	-1.305	0.356	-3.661	<.001	*-2.049, -0.623*		**Word**	Intercept	4.302	2.074
Duration	-20.031	4.909	-4.081	<.0001	*-31.343, -11.463*					

Table 8-8 Mixed-effects logistic regression testing duration and median F2 (scaled) of the first 25% of the vowel on the realisation of AI/EI PRICE variants. Men only.

Fixed effects							***Random effects***			
	Estimate	*SE*	*z*	*p*	CI				Variance	*SD*
Intercept	2.622	1.269	2.066	0.038	*0.091, 5.285*		**Speaker**	Intercept	2.759	1.661
Median F1 (*scaled*)	1.591	0.335	-4.749	<.00001	*0.974, 2.300*		**Word**	Intercept	3.039	1.743
Duration	-22.840	6.110	-3.738	<.001	*-36.162, -11.553*					

Table 8-9 Mixed-effects logistic regression testing duration and median F2 (scaled) of the first 25% of the vowel on the realisation of AI/EI PRICE variants. Women only.

Fixed effects							***Random effects***			
	Estimate	*SE*	*z*	*p*	CI				Variance	*SD*
Intercept	1.685	1.060	1.591	0.11	*-0.342, 4.133*		**Speaker**	Intercept	0.250	0.500
Median F1 (*scaled*)	2.377	0.460	5.164	<.00001	*1.553, 3.394*		**Word**	Intercept	2.242	1.497
Duration	-18.481	5.218	-3.542	<.0001	*31.102, -9.749*					

APPENDIX XIV Praat script 1. Create textgrids

text grid maker.praat

Originally created by the excellent Katherine Crosswhite

Script modified by Mark Antoniou

Modified by Eric Doty

What does it do?

This script opens all files in a directory. It creates a TextGrid for each of sound file, then opens the sound file and the TextGrid into the editor so you can add boundaries and labels.

Leaving the "Word" field blank will open all sound files in a directory. By specifying a Word, you can open only those files that begin with a particular sequence of characters. For example, only tokens whose filenames begin with ba.

The script will skip over any files in the directory that already have an associated .TextGrid file

The following four lines will create a dialog box, asking for the directory location you want to use. The two variables, "Directory" and "Word" will be used later in the script, where they are referred to as "directory$" and "word$", the dollar sign indicating that they are both string variables.

```
form Enter directory and search string
# Be sure not to forget the slash (Windows: backslash, OSX: forward slash) at the end of the directory name.
	sentence Directory C:\Users\Eric\Documents\School\Penn1\LING 520\Lab 1\test\
	sentence Word Lab1_
	sentence Filetype wav
endform

clearinfo

# Make a list of all sound files in the directory.
Create Strings as file list... file-list 'directory$''word$'*.'filetype$'

# Loop for all files.
number_of_files = Get number of strings
for x from 1 to number_of_files

# Now we will set up a string variable called "current_file$" and use it to store the first filename from the list.
	select Strings file-list
```

```
current_file$ = Get string... x
```

Now that we have the filename, we read in that file:

```
Read from file... 'directory$''current_file$'
```

A variable called "object_name$" will have the name of the sound object. This is equivalent to the filename minus the extension. This will be useful for referring to the sound object later.

```
object_name$ = selected$ ("Sound")
```

Check if TextGrid exists for the file

```
textgrid_filename$ = directory$ + object_name$ + ".TextGrid"
if not fileReadable (textgrid_filename$)
```

Now create a TextGrid for the current sound file. It will have only one tier named "segments". You can have multiple tiers, each with its own name. For example, I could've made three tiers by saying To TextGrid... "utterances words segments".

```
To TextGrid... "segments"
```

Since we have just created a TextGrid, it is automatically selected. We need both the TextGrid and the sound object to be selected together, so we must add the sound object to the selection.

```
plus Sound 'object_name$'
```

We want to open those two selected objects (Sound object and Textgrid object) in the editor.

```
Edit
```

The script will pause, allowing the user to enter the appropriate marks using the mouse and keyboard. Note that the user does not need to save the textgrid. They will click on "continue" to move to the next sound.

```
pause  Mark your segments.
```

We will save the TextGrid object, so that the user doesn't have to do it for each file. First, deselect the sound object, leaving only the TextGrid selected.

```
minus Sound 'object_name$'
```

Save the textgrid, giving it the same filename as the sound file, and the extension ".TextGrid".

```
Save as text file... 'directory$''object_name$'.TextGrid
endif
```

```
#    End the loop, and go on to the next file. To conserve memory, first remove the objects that we are through with. I like to do this by selecting all the objects in the list, then deselecting any we will still be using, such as the list of filenames.

        select all

        minus Strings file-list

        Remove


# This specifies the end of the loop.

endfor


# Clean up the Praat objects window.

select Strings file-list

Remove


# Display a message letting you know that you've reached the end of the list.

printline TextGrids have been created for 'word$'.'filetype$' files in

printline 'directory$'
```

Retrieved from: https://www.ling.upenn.edu/courses/Fall_2013/ling520/TextGridMaker.Praat

APPENDIX XV Praat script 2. Label empty boundaries

```
#Labels portions in the textgrid with label x with a replacement label y. If you wish to replace an empty interval with text, use "" for the empty interval.

#Copyright Christian DiCanio, Haskins Laboratories, October 2011.


form Extract Time Indices from Textgrids
  sentence Directory_name: /Forced_Alignment/FA_Penn/CTB501Lista001/foo/
  sentence Original_label *
  sentence Replacement_label SIL
  positive Labeled_tier_number 1
endform

Create Strings as file list... list 'directory_name$'/*.TextGrid
num = Get number of strings

for ifile to num
	select Strings list
	fileName$ = Get string... ifile
	Read from file... 'directory_name$'/'fileName$'
	Replace interval text... 'labeled_tier_number' 0 0 'original_label$' 'replacement_label$' Literals
	Save as text file... 'directory_name$'/'fileName$'
endfor
```

Retrieved from: https://www.acsu.buffalo.edu/~cdicanio/scripts/Replace_labels.praat

APPENDIX XVI Praat script 3. Label boundaries from an item list

```
# This script reads lines from a text file (called labels.txt and saved in the home directory)
# and adds them line by line as labels for intervals in a selected TextTier in the selected TextGrid
object.
#
# You should check that the boundaries are correct before running the script.
# The script will jump over intervals labeled as "xxx". Use this marking if there are intervals that
# you will remove later.
# Hint: This tool is useful if you use the mark_pauses script before it! It is easy to check that the
# pause boundaries are in correct places, if you know what kind of content should be in the sound
# segments - e.g., read sentences.
#
# This script is distributed under the GNU General Public License.
# Mietta Lennes 25.1.2002
#
soundname$ = selected$ ("TextGrid", 1)
select TextGrid 'soundname$'
stringlength = 0
filelength = 0
firstnewline = 0
oldlabel$ = ""
newlabel$ = ""
form Label intervals in an IntervalTier from text file
comment Give the path of the text file containing the label lines:
sentence Filename /home/lennes/labels.txt
comment Which IntervalTier in the selected TextGrid do you want to label?
integer Tier_(index) 1 (= the first IntervalTier)
comment Which interval do we start labeling from?
integer Starting_interval_(index) 1 (= the first interval)
comment Do you want to overwrite old labels?
comment (Intervals previously marked with 'xxx' will be skipped despite this!)
boolean Overwrite 1
endform
```

```
if fileReadable (filename$)
numberOfIntervals = Get number of intervals... tier
if starting_interval > numberOfIntervals
exit There are not that many intervals in the IntervalTier!
endif
leftoverlength = 0
# Read the text file and put it to the string file$
file$ < 'filename$'
if file$ = ""
	exit The text file is empty.
endif
filelength = length (file$)
leftover$ = file$
# Loop through intervals from the selected interval on:
for interval from starting_interval to numberOfIntervals
oldlabel$ = Get label of interval... tier interval
if oldlabel$ <> "xxx"
# Here we read a line from the text file and put it to newlabel$:
firstnewline = index (leftover$, newline$)
newlabel$ = left$ (leftover$, (firstnewline - 1))
leftoverlength = length (leftover$)
leftover$ = right$ (leftover$, (leftoverlength - firstnewline))
# Then we check if the interval label is empty. If it is or if we decided to overwrite,
# we add the new label we collected from the text file:
   if overwrite = 1
				Set interval text... tier interval 'newlabel$'
				elsif oldlabel$ = ""
			Set interval text... tier interval 'newlabel$'
				else
						exit Stopped labeling, will not overwrite old labels!
  endif
endif
endfor
else
```

```
        exit The label text file 'filename$' does not exist where it should!
    endif
```

Retrieved from: http://phonetics.linguistics.ucla.edu/facilities/acoustic/label_from_text_file.txt

APPENDIX XVII Main R packages used in this thesis

Clustering tendency measures	{clustertend} (Luo & Zeng, 2015)
Conditional inference tree	{party} (Hothorn et al., 2006).
Partition tree	{rpart} (Therneau & Atkinson, 2018), {partykit} (Hothorn & Zeileis, 2015), {rpart.plot} (Milborrow, 2019). {clustertend} (Luo & Zeng, 2015)
Mixed-effects models	{lmer4} (Bates, Maechler, Bolker, & Walker, 2015).
GAMMs	{mgcv} (Pedersen, Miller, Simpson, & Ross, 2018; S. N. Wood, 2009), {mgcViz} (Fasiolo et al., 2018), {qgam} (Fasiolo, Goude, Nedellec, & Wood, 2017).
Factor analysis (PCA, MFA, FAMD)	{FactoMineR} (Lê et al., 2008), {factoextra} (Alboukadel Kassambara & Mundt, 2017).
Plots	{ggplot2} (H Wickham, 2016), {ggpubr} (Alboukadel Kassambara, 2018), {easyGgplot2} (Alboukadel Kassambara, 2014), {ggrepel} (Slowikowski, 2018).
Effect plots	{effects} (Fox, 2003).
Packages for phonetic data	{phonR} (McCloy, 2016), {phonTools} (Barreda, 2015), {vowels} (T. Kendall & Thomas, 2018).
Reading phonetic fonts	{readr} (Hadley Wickham, Hester, & Francois, 2018).