A Sociophonetic Analysis of Jamaican Vowels

by

Alicia Beckford Wassink

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
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Doctoral Committee:

Associate Professor Patrice Speeter Beddor, Co-chair
Professor A. Lesley Milroy, Co-chair
Professor Richard W. Bailey
Professor Peter L. Patrick

ABSTRACT

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Co-chairs: Patrice Speeter Beddor, A. Lesley Milroy

This thesis provides an acoustic examination of the vowel systems of eleven Jamaican Creole-dominant (St. Thomas parish) and nine Jamaican English-dominant (Kingston) speakers and seeks to link results with sociolinguistic factors. This research was motivated by an interest in two enduring questions in creole linguistics: the possibility of contrastive vowel duration in Jamaican language varieties, and the magnitude of vowel quality differences between Jamaican English and Jamaican Creole.

Data were collected in rural and urban Jamaica using word list, casual conversation, and picture description tasks. Although fourteen orthographic vowel categories were investigated, of particular interest were the relative roles of spectral (quality) and temporal (quantity) characteristics in contrasts between vowels traditionally described as belonging to long:short oppositions (high front /iː, ɪ/, mid front /eː, ɛ/, low /ɑː, a/, and high back /uː, ʊ/). Spectral overlap was assessed using a formula based on a representation of vowel distributions as ellipses in acoustic space. Temporal overlap was assessed using duration ratios of long:short vowel pairs.

Variation in vowel quality and quantity was correlated with both extralinguistic and phonetic factors. St. Thomas and Kingston speakers displayed spectral differences between vowel quality oppositions, but for some contrasts temporal differences were of greater magnitude for St. Thomas speakers than for Kingston speakers. Additionally, females in both groups showed larger temporal differences within long: short pairs than

males. Manner of articulation and voicing of a following consonant primarily affected vowel duration.

A social network strength index, based on degree of orientation into a close-knit rural community, was adapted for use in Jamaica. However, with one exception, network strength was not a reliable predictor of acoustic features: males in Kingston with low network scores tended to show a high degree of r-lessness.

In an informal study of metalinguistic awareness, a listening task was used to elicit speakers' comments concerning what constitutes and distinguishes Jamaican Creole and English speech. Speakers related age, social class, and region of residence with differences in Jamaican speech and described a small number of stylistic, morphosyntactic, and phonological features which they ascribed to Jamaican English, Jamaican Creole, or American English.

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in loving memory of my father,
John Henry Beckford,
and adopted grandfather, Rev. Ernest L. Wilson
who brought with them to America their love of learning and
of the West Indies

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There is a Jamaican proverb that says, "Brick tap a brick mek house." Its meaning is roughly captured in the English saying, "Every little bit counts." The largest project is successfully accomplished by the efforts of many hands. This thesis is one such project because it has been completed through the contributions of many people. The first bricklayers to whom I extend thanks are Pam Beddor and Lesley Milroy. Both have been excellent, and very accessible, teachers. I am very grateful that they saw promise in bringing together the linguistic subfields of experimental phonetics and sociolinguistics. Pam's discipline and uncompromising pursuit of excellence in research have made this work better, ever better, than it would otherwise have been. It has been rewarding to work with her as a teacher, as editor of *Journal of Phonetics*, and as a friend. Lesley has taught me to "see" language where it resides in the community, in restaurants, airports, department stores, and the other places where I've been privileged to be in her company. Wherever she goes, she displays an uncanny ability to discover the life and language of a community, while enjoying life herself. Working with her has made my years at the University of Michigan a joyous apprenticeship. Peter Patrick is the next bricklayer I wish to thank. He was the first linguist with whom I ever "talked shop" and *imagine-- im dida study Patois*! His research into mesolectal Jamaican Creole has been an inspiration because it has embraced the variation inherent to the Creole rather than being daunted by it. I knew of Richard Bailey's books before I knew him. Thanks go to him for broadening my understanding of the worldwide development of the English language.

Linda Bailey, Venetia "Tulla" Barnes, Ansonette Palmer, Debbie Harris, and Claudette Reid assisted with fieldwork or transcription of the data. Their long hours and careful work contributed to the building of the dataset and prepared it for instrumental analysis. Others in Jamaica and in the United States provided invaluable support and connections--in Jamaica: Mervyn Alleyne, Lawrence Carrington, Winston Davis, Hubert Devonish, Silvia Kouwenberg, Velma Pollard, and the staff at the Language Laboratory and the Linguistics office at the University of the West Indies; in the States: Michelle Harris-Reid, John Rickford, and Kathy Welch. Claudine Reid and Ellen Veronica Noad opened their homes to myself and assistants during the fieldwork period. At the University of Michigan, I worked alongside some very talented students. Thanks go to all for friendhip and cameraderie, but particularly to Peggy Goetz, Matt Gordon, Jimmy Harnsberger, Jasmeet Judge, Mi-Ryoung Kim, and Denise Thompson-Cooper.

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This house has been built by many strong hands. All mistakes in the design and all structural flaws are my own.

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CHAPTER 1

INTRODUCTION

The aim of this dissertation is to provide an acoustic characterization of the vowel inventory(ies) and dimensions of contrast operating for speakers in two "regions" of the theoretical continuum of language spoken in Jamaica. This study investigates speech production in the tradition of experimental phonetics, examining the spectral and temporal features of the vowel system with the intention of describing features relevant for phonological contrast. At the same time, this study is concerned with the social countenance of synchronic variation, investigating the sociocultural setting in which language is used, where it varies, and how it both takes on and conveys social meaning for its speakers. An important goal of this thesis, then, is to make relevant observations concerning the manner in which language in Jamaica varies internally, while also reflecting the external forces which have an impact on linguistic variation and change. The goal of describing aspects of the internal structure and external influences on Jamaican language puts this thesis at the crossroads of creole studies, experimental phonetics and sociolinguistics.

In my view, one challenge that faces the linguist is to keep in mind the fact that language is a vehicle for conveying social meaning. At the same time, it is the responsibility of the linguist to study the internal structures of language and seek to understand languages as systems. It is difficult to work with a focus on *both* language internal and external mechanisms, and so these tasks have often been divided among the linguistic subfields with some focusing on one type of mechanism, and some on the other. Research examining creole languages has tended to emphasize the study of these varieties as sociocultural, language contact phenomena, rather than as objects for structural study. Jamaican Creole in particular is perhaps the best-studied of the anglophone creole languages, and yet progress toward understanding its internal linguistic structure has begun relatively recently, beginning with Bailey's *Jamaican Creole Syntax* in 1966.

For creole studies, this research helps to fill a void. Creole systems have gone largely unexamined by linguists conducting laboratory research, in part due to the social complexity of the distribution of use of and variation within the Creole, difficulties in data collection associated with lack of equipment, the challenges of collecting language data in naturalistic settings, and an historic tendency to focus on "standard languages." Because of these limitations, the phonetic and phonological studies in the literature at the writing of this thesis contain descriptions of the vowel inventory of Jamaican Creole accomplished via the auditory impressions of a handful of researchers on speaker samples which were often poorly defined. As a result, the accounts are disparate, and the phonetic nature of operating contrastive dimensions, such as vowel length, height and front-backness, unclear. This study will provide, to the best of my knowledge, the first detailed instrumental acoustic analysis of phonemic and phonetic distinctions between the vowel sounds produced by speakers from distinct regions of the Jamaican language spectrum.

It is perhaps wise to clarify here two terms used frequently in this thesis, Jamaican Creole and Jamaican English. The term "Jamaican Creole" has often been used broadly to describe the entire range of forms used by Jamaican speakers, whether acrolectal, mesolectal, or basilectal. This diverse range of forms has thus long been (perhaps misleadingly) considered to be a single dialect of English, by Jamaicans and non-Jamaicans alike. However, it has been repeatedly noted that some forms of the Creole are not intelligible to British or American speakers of English, and further, that schoolchildren from some Creole-speaking homes seem to have difficulty grasping English grammar and pronunciation in language arts classes. This suggests that there are significant differences between basilectal and acrolectal Jamaican Creole which render its classification as a dialect of English an oversimplification. LePage (1960), Wells (1973), Alleyne (1984) and other researchers have typically designated two basic functional categories of Jamaican speech, referred to in this thesis as *Jamaican Creole* and *Jamaican English,* which differ in at least the putative fact that Jamaican Creole, but not Jamaican English, has contrastive vowel length. Based on the findings presented in Chapter 4, even this basis for distinction is not entirely correct nor complete. Hereafter, the term *Jamaican Creole* will be used to describe only basilect-dominant forms of Jamaican language, while *Jamaican English* will refer only to acrolect-dominant speech. It should be emphasized that these language varieties are not discrete but may be said to exist on what researchers beginning with DeCamp (1961) have conventionally described as a linguistic post-creole continuum amidst a great deal of linguistic variation. Most Jamaican speakers will incorporate aspects of both Jamaican Creole and Jamaican English forms in their usage, some exhibiting a predominance of forms in one or the other end of this continuum.

For phonetics, this thesis represents an approach which combines laboratory elicitation and analysis with field-based data collection, and which explores the use of pictures for collecting controlled data. This thesis presents acoustic data which test the distinctness of vowels produced by Jamaican Creole-dominant and Jamaican English-dominant speakers. The data describe spectral and temporal similarities and differences as well as the interactions between spectral and temporal vowel features. Acoustic trajectories and "targets" have been explored for both simple (monophthongal) and complex (diphthongal) vowels. The purpose of the acoustic study was to better understand whether Jamaican Creole-dominant (i.e., basilect-dominant) speakers exploit a vowel system with systematic and robust differences from that of Jamaican English-dominant speakers.

A central theoretical assumption at the root of this work is that language (and language variation) is a community-situated phenomenon. That is, language is a unique endowment of the human species, observable in the individual speaker, but crucially, it is in an abstract sense "located" in the community, where it is employed for human interaction. Certain important aspects of language, such as how and why it undergoes or resists change, will be poorly understood if language is studied without attention to the social context in which it operates. The fullest early articulation of this idea was by Weinreich, Labov, and Herzog (1968), who formulated a methodology for investigating language change which called for an understanding of the "social matrix" in which language is embedded. Later research, such as is associated with Blom and Gumperz (1972) within the discipline of the ethnography of language and with L. Milroy (1980) within the framework of social network theory, has stimulated an even more qualitative ethnographic approach to community-based studies. The present work is influenced strongly by both approaches. In the case of a language such as Jamaican Creole, which has existed for centuries in a relationship of low prestige with British English (and presently American English, as some would argue), language variation and language maintenance take on interesting dimensions within the scope of social change.

For sociolinguistics, then, this study combines rigorous laboratory phonetic analysis with data gathering methods informed by key concepts emerging from social network theory, and it provides a significant exploration of a stigmatized language variety. The speaker sample for this study was chosen to control as far as possible for a number of relevant social variables, including age, gender, and a speaker's isolatedness within their social network. Social variables (such as gender, education, a speaker's network of social interactions, social class, age) are taken into account in interpreting the distribution of phonetic data. This study examined the vowel inventories of a limited sample of speakers, with the intention of making relevant observations about their particular systems based on a sizeable quantity of data per speaker.

The main advantage of having taken a "sociophonetic" approach in this study is that by controlling for key social factors which characterize Jamaican Creole-dominant and Jamaican English-dominant speakers, we are able to characterize speakers' vowel systems in a way which makes sense given the social conditions relevant to linguistic variation.

Organization of the present work

This thesis is organized into seven chapters. This first chapter has introduced the main goals of the thesis, and described its basic theoretical and methodological orientation.

Chapter 2 furnishes background for the present study in five areas. The first three subsections establish the knowledge base on which this dissertation draws, reviewing relevant literature from the linguistic subfields of creole studies, sociolinguistics, and phonetics. First, background concerning the sociocultural history of Jamaica and its situation of language use is provided in order to explore the way in which Jamaican Creole emerged out of cultural and linguistic contact during British colonization. This sociocultural setting necessarily impacts the study of Jamaican language, specifically with respect to how the language varies among Jamaican speakers, how speakers perceive the language, and how their perceptions influence the elicitation of Jamaican speech for the purposes of linguistic study. Second, general background on the linguistic structure of Jamaican Creole is provided. The literature reviewed in these two background subsections comes primarily from creole linguistics. Third, sociolinguistic literature concerning the study of linguistic variation is described. Fourth is presented a description of the phonetics literature concerning the study of vowels and vowel systems. Studies investigating the phonological and phonetic systems of creole languages are subsequently surveyed. Finally, the fifth subsection of this chapter describes the methodological background for this study, including a pilot study conducted prior to the main investigation, and the decisions concerning the regions of study, elicitation tasks, fieldwork methods, and study design that it influenced.

Chapter 3 describes the methodology for the acoustic investigation of Jamaican vowels. Data were collected in three tasks: casual conversation, word list readings, and picture list elicitation. In addition to these three tasks, Chapter 3 describes speaker selection, recording procedures, the spectral and temporal measures, and vowel coding for phonetic and sociolinguistic features.

Chapter 4 presents the results of the acoustic study, focusing on the spectral and temporal features of vowels produced by acrolect-dominant and basilect-dominant speakers, and how vowels differ from their neighbors in acoustic space. The global distribution of Jamaican vowels in acoustic space was observed to be largely "v"-shaped and symmetrical, with vowels tending toward the periphery of the space. Both sets of speakers were observed to exhibit significant temporal distinctions between vowels, while basilect-dominant speakers tended to show less spectral distinction between some pairs of vowels than acrolect dominant speakers. Basilect-dominant speakers tended to exhibit palatalization and downgliding with postvocalic-"r" and somewhat greater "r"-lessness.

Chapters 5 and 6 present the sociolinguistic analysis. In Chapter 5, a social network index developed for use in Jamaica is described. The sociodemographic composition of the speaker sample is explored, and links between the phonological variation described in Chapter 4 and speaker variables such as sex, social network, and orientation toward urban or rural life are suggested.

Chapter 6 presents the results of an informal study of the metalinguistic awareness of the speakers who participated in the production study. A description is given of speakers' impressions about Jamaican Creole, Jamaican English, and American English that might inform our understanding of the level at which speakers perceive differences between these varieties. It considers, for example, how Creole-dominant speakers label speech they hear and vary their own speech in order to imitate English.

Chapter 7 concludes the thesis with a summary of the findings of this research and its implications for understanding language variation in the Jamaican Creole continuum.

CHAPTER 2

LANGUAGE USE AND VARIATION IN JAMAICA

This chapter describes the landscape of language use in Jamaica and the body of literature that has explored it. Such issues are perhaps best understood after the language situation in Jamaica has been discussed. Therefore, the literature review follows a brief treatment of the linguistic heritage of Jamaica in §2.1. General discussion of linguistic research which bears on the Jamaican situation are presented and then applied in §2.2-2.3. Finally, the motivation for choice of the particular speech materials collected for this study is given in §2.4, along with the reasons for selecting the speakers whose speech data comprise the resulting dataset.

The review of the literature is presented in three parts. Topics relevant to this thesis have been studied within several of the subdisciplines of linguistics, including creole or contact linguistics, sociolinguistics, and phonetics. This study has drawn from these three bodies of inquiry in its sample design, data collection, and analysis. The concepts of the (post-) creole continuum and diglossia have emerged within the discipline of creole and contact linguistics, and they are described first, as they are the dominant conceptualizations of the language situation in Jamaica.[1] Following is a discussion of the geographical and social factors contributing to variation within Jamaican varieties. Within mainstream sociolinguistics, several areas of inquiry are particularly relevant to this discussion. These include sociolinguistic work on language variation (particularly the concepts of the speech community, and the variable use of phonological forms as correlated to gender and social class), social networks, study of non-standard language varieties, language attitudes and language choice, and standardization. In §2.3, a description of selected aspects of the phonetics literature dealing with acoustic descriptions of simple (monophthongal) and complex (diphthongal) vowels is presented. Studies focussing on the phonetic features of vowels in creole languages are also discussed. Finally, §2.4 describes the pilot study and preliminary methodological considerations that preceded the study of Jamaican vowels reported in later chapters of this thesis.

2.1 Linguistic Variation in Jamaica

2.1.1 The Linguistic Heritage of Jamaica

Language is dynamic and its trajectory of change is influenced by the same forces that impact the developing socio-political history of a group of people. For this reason, something about the catalytic conditions which brought about Jamaican Creole may be learned by looking at Jamaica's history. We may also learn something of the conditions under which this language continues to change. Jamaican history has been viewed as progressing through four phases: Amer-Indian residence (pre-1494); Spanish colonization (1494-1655); British colonization and the plantation economy (1655-1838); and the post-emancipation period (1838-present). Prior to Spanish colonization, the island was inhabited by an agricultural people to whom scholars refer as the Arawaks or Amer-Indians, who gave the island the name Xaymaca. The Spanish took the island in 1494, interested in the pursuit of gold and other mineral resources. By 1550, the native population had all but disappeared due to new diseases and harsh labor laws which the colonizers introduced. With the disappearance of the Arawaks, the Spanish needed laborers to undertake their work, and began transporting African slaves to the island. However, their hopes of finding gold on the island were frustrated, and following an attack in 1655, the Spanish gave Jamaica over to the British. Today, only a few linguistic artifacts remain from the Arawakan period, found in the name of the island and several native foodstuffs and agricultural implements. Mostly place names, such as Ocho Rios, Savanna-La-Mar and the island's former capitol city of Spanish Town, remain as reminders of Spanish occupation. The British held the island for more than 300 years afterward, and have had arguably the most lasting influence on this island and on its creole language. The British discovered that the production of sugarcane and coffee along with the sale of their by-products was immensely lucrative, and began to transport slaves to the island to maintain high levels of production on their system of estates or plantations. The British removed slaves primarily from trading ports in Ghana (the "Gold Coast") and Nigeria ("the Slave Coast"). Some came directly from the western part of the African continent, some from other British settlements in Barbados and elsewhere in the Caribbean. These slaves were primarily first speakers of languages belonging to the Kwa branch of the Niger-Congo family (LePage, 1960; Alleyne, 1984; Holm, 1988). Unlike the plantations of the United States south, Africans on the Jamaican plantations from 1655-1808 always greatly outnumbered Europeans.[2] Consequently, the slaves were always together in higher concentrations, with a greater likelihood of communicating in their native tongues, and less opportunity to learn English than in places where there was a greater presence of Europeans. Scholars recognize the existence of West African retentions in Jamaican culture and language, particularly in religious customs practiced in the oldest settlements on the island (Bilby, 1983; Alleyne, 1984). Suggested linguistic retentions have included the predominance of CVCV syllable structure, syllable-timing, serial verb constructions, adjective reduplication, non-differentiation of gender in third person singular nominative and possessive pronoun forms, and a tense-mood-aspect verb paradigm. Retentions at the phonetic level are as yet poorly understood (see §2.3). The bulk of lexical forms are derived from English. Many morphological forms with English phonological shape nevertheless show African derivation, such as calques like *eye water* ('tear'), which is similar to Mandinka *nye ji* (eye + water), and adjectives such as *mouth sweet*, from Twi *no ano yɛdɛ* (his mouth sweet), meaning 'he is a flatterer" (Roberts, 1988). Following independence from Britain when Jamaica became a nation within the British commonwealth, close ties with the former imperial power were maintained. Opportunities arose for children in wealthier families to obtain post-secondary education at British universities, which was viewed as very prestigious, contributing to the social status of the Jamaican who returned fluent in "polite British speech" (see discussion of attitudes toward Jamaican Creole, below). Jamaica currently has an established bipartisan political system under its own prime minister and parliament, and still retains close economic ties to Britian. The Jamaican economy also depends a great deal for revenue on tourism and export of goods to the United States. At the writing of this thesis, it was easier for a Jamaican to gain a visa to work in the United States than in some of the other Caribbean basin countries. Section 2.1.3 below goes into greater detail concerning the exchange of labor and culture between these countries.

The preceding discussion is intended to show that the conditions of formation of the Creole meant that the emergent language would be likely to contain both West African and English forms. Section 2.3 considers the phonological and phonetic features argued to have been inherited from these two sources. Attributing linguistic forms to one or the other of the source languages, or to the natural process of linguistic innovation is a difficult matter, and has received ostensibly less attention than the question of dealing with the lack of homogeneity among varieties within the spectrum of Jamaican language. The next section discusses this variation, and how it has been conceptualized in the lingusitic literature.

2.1.2 Two Conceptualizations of Jamaican Language: the post-creole continuum and diglossia

DeCamp (1971) introduced the concept of the post-creole continuum. This became the most widely-used, even if somewhat controversial, descriptor employed by linguists for the situation of language use and variation in Jamaica (Carrington, 1992). Indeed, Jamaican Creole is perhaps the best-known and most extensively studied example of a post-creole continuum. Language in Jamaica ranges from what is essentially a regional dialect of English spoken in the metropolitan areas, the *acrolect*, to a mutually unintelligible variety spoken mostly in rural areas, the *basilect* (DeCamp, 1961, 1971). Intermediate forms referred to collectively as the *mesolect* display a great deal of linguistic variation, involving linguistic alternation and code mixing. For example, a single idea may take several different morpho-syntactic and phono-lexical shapes, ranging from basilectal forms (or *creole base*, as Alleyne (1994) calls it), to those of the acrolect (or Standard Jamaican English):

(1)

basilect:	Ø	maka	jook	fi-mi	ʔan.
	det	"prickle"	*1sg. past* "stuck"	*1sg genitive*	"hand".
mesolect1:	Wan	prickle	jook	Ø + mi	han.
	det	"prickle"	*1sg. past* "stuck"	*1sg genitive*	"hand".
mesolect2:	A	prickle	stick	Ø + mi	han.
	det	"prickle"	*1sg. past*	*1sg genitive*	"hand".
acrolect:	A prickle stuck my hand.				

(2)

basilect:	Di	trii + dem	kot
	det	"tree" + *plural*	"cut" pred. adj.
mesolect:	Di	triiz	kot
	det	"tree" + *plural (-s)*	"cut" pred. adj.
acrolect:	The	trees	have been cut.

The example given above in (2) shows three possible realizations of the passive, the first two of which illustrate Creole syntax which uses a predicate adjective with no supporting auxiliary verb[3]. The concept of a creole continuum was later elaborated into a model by Bickerton (1972, 1975) and others to explore the spectra of language varieties in Hawaiian and Guyana.

While it *is* possible to identify Creole forms per se, it is not possible to identify discrete lects as basilect, mesolect, or acrolect, distinguished by invariant grammatical or lexical forms. In the same way, it has also proven problematic to attempt to position speakers at discrete points along the continuum. This is because a speaker's linguistic competence and productive ability tend to span what is more akin to a region of the continuum, such that many speakers are best characterized as exploiting a variable grammar (Patrick, 1996b). The use of implicational scales to classify speakers who vary in their use of forms has been useful but inevitably breaks down. (See Holm, 1988:57 for a description of the application of implicational scaling to Creole situations.) For this reason, creolists in the last few years have generally opted to refer to speakers as being *dominant* in a particular lect, i.e., basilect-dominant, or acrolect-dominant, even though this continues to imply that such lects may somehow be precisely located.[4] At present, however, this system seems the best available for describing variation in Jamaican language, and will be used in this study. Researchers and writers differ in their terms of reference, some calling the entire spectrum "Jamaican Creole" (LePage 1960), others simply "Jamaican" (Cooper, 1993). As Roberts (1988:9) points out, this broad range of forms challenges the definition of a "language", in that it "calls into question the extent to which two speech varieties in a society can differ and still be treated as belonging to the same language". Furthermore, socio-political links between Britain and its former colony in Jamaica have brought about a highlighting of the genetic link between

Jamaican Creole and British English. Jamaica has thus been viewed as one small part of the worldwide English-speaking community.

The situation in Jamaica has also at times been classed with those languages that exist in so-called *diglossic* relationships. The term diglossia was first used by Ferguson (1959) to describe situations in which two languages are used in a single speech community, each fulfilling distinct and complementary social roles. One of the languages, usually referred to by sociolinguists as the H (or 'high') variety is used for formal settings such as education, religious services, or government, while the other, the L ('low') variety is used for informal settings such as exchanges in the marketplace, casual interactions in the home, and the like. This relationship was shown to hold for languages such as Colloquial and Classical Arabic, but also for creole languages such as Haitian Creole and French in Haiti, and later for Indian-based Bhojpuri (a dying language being replaced by English-based Guyanese Creole) and Hindi in Guyana (Gambhir, 1983). Winford (1985) explored its application to Caribbean creoles in general. Beckford Wassink (1999) found that, when directly presented with the question given in Table 2.1, Jamaican Creole speakers assigned English and Jamaican Creole the same functions as traditionally assigned to H and L varieties, as shown in Table 2.1.

Interestingly, however, the Jamaican language situation differs strikingly in several respects from the prototypical diglossic situations described by Ferguson. The differences lie in the autonomy and standardization (codification) of, and with speaker loyalty to, the language. Haitian Creole, unlike Jamaican Creole, is an autonomous language. It is viewed by its speakers and by the French as being distinct from French. Though its orthography was standardized fairly recently (within the last 15 years),

Table 2.1. Responses of Jamaican Creole (mesolectal and acrolectal) speakers to the question, "Are there any places/times where you would _____ use Patois?" [from Beckford Wassink (1999)].

likely	never	exclusively
mentioned by 3 or more people:		
home	*school*	*rural areas*
telling a joke	*church*	*dramatic presentations*
		folktales/children's stories
		anytime that people don't understand English
		when angry
		market
mentioned by 2 people:		
		dancehall
mentioned by 1 person:		
courtroom	*government*	*street*
construction site	*places of business*	*bus*
school		*ghetto*
urban areas		*bars*
reporting news testimony		*shops*
playing sports/games		

Haitian Creole (Ferguson's first case of study) has official status and grammars and dictionaries for its instruction. Socially, use of Haitian Creole is normative in settings which exist in complementary distribution to those designated for use of French. Finally, the national, official recognition of Haitian Creole has received wide public support; Haitian Creole enjoys public loyalty. These official, social, and social psychological aspects similarly hold for standard(ized) languages (Alleyne, 1994). By contrast, Jamaican Creole is not yet standardized. It enjoys some degree of loyalty from most Jamaicans, although in select settings and in practice more than in word. However, it is stigmatized even in settings in which an L variety might be openly deemed appropriate. Alleyne (1994) and Winford (1994) suggest that the difference between Jamaican Creole and other creoles such as those spoken in Haiti, St. Lucia, and Dominica, which makes the latter situations but not the former ones of diglossia, is the presence in Jamaican Creole of intermediate varieties between the Creole and the standard. Creole continuum situations, such as the Jamaican one, typically show no standardization, no implementation in education, nor any language planning efforts. The presence of mesolectal varieties makes it difficult to view the two extremes as separate languages, even if substantive linguistic differences are readily demonstrable.

Patrick (1992) characterized the difficulty of treating linguistic variation within the Creole continuum as "the problem of pure grammars and mixed speech". Historically, linguists concerned with experimental investigations into language use have viewed linguistic variation as something to be avoided because noisy data obscures the emergence of systematic patterns of language use. At the same time, it is well understood that inter-speaker and even intra-speaker variation in linguistic behavior are normal, even within so-called "standard" varieties of a language. Chomsky's Generative Grammar, for example, took for its model an idealized monolingual speaker-listener with a single grammar (1965). The theory did not address the question of language processing for the bi- or multi-lingual language user, nor was it clear how Generative Grammar might accommodate code-switching behavior, nor did it contain modules for varying language use according to register. It was about the same time that Labov, within sociolinguistics, faced head-on the study of linguistic variation within the speech community and developed principles for both understanding and quantifying variation and "variable rules" for language use.

Inasmuch as linguists must recognize that variation exists within standard languages, the creole linguist must be all the more at home with the notion that variation resides within creole varieties. As Patrick (1992:6) cautioned, the researcher errs who would "impute invariance to a creole, or even to represent a creole variety as capable of adequate description with only categorical rules."

The continuum conceptualization thus focusses on the linguistic features of the creole, while the diglossic conceptualization focusses on social function. The spectrum of variation presents difficulties to both conceptualizations, making neither a fully satisfying solution to describing the language situation in Jamaica. DeCamp himself, who first applied the concept of the continuum to Jamaican language, stated that the continuum concept is an oversimplification for the very reason that it assumes all Jamaica to be a single speech community. If defined in terms of significant linguistic differences, differences which might exist concommittantly with differences in speech perception, for example, then it will be necessary to recognize this linguistic difference (e.g., in how children receive language arts instruction). Winford (1988) suggested, and I agree, that it may be more useful to somehow synthesize the concepts of diglossia and the post-creole continuum, rather than to use either alone. Although the theories themselves seem quite incompatible, it might be possible to bring the functional focus of the diglossia conceptualization together with the structural focus suggested by the continuum framework. Part of the reason for this is that even though the range of varieties within Jamaican language makes it difficult to demarcate *a* Jamaican Creole and *an* English, there does intuitively seem to be some kind of division of labor between Creole and English which all Jamaicans recognize and realize within the range of the continuum which they command (e.g., particularly with respect to the use of [more strongly-] Creole in informal settings among familiars). The use of Jamaican Creole and Jamaican English in certain predictable settings is built-into the structure of Jamaican life, and in this sense, all Jamaica is a community. As Hymes put it, "the culturally-based organization of linguistic means...is the only genuine basis for defining the speech community" (1974:115).

Variation between Jamaican varieties, however complicated, is patterned. Systematicity may be shown at the level of geographical and social variables operating at the level of the speech community. Such phenomena have generally been explored in the sociolinguistics literature. It is to these topics that I now turn, looking first at the larger body of sociolinguistic research on the speech community.

2.1.3 Sociolinguistic Studies of the "Speech Community"

Sociolinguistic studies have pointed out the importance of understanding that language is a socially-situated phenomenon which may be studied at the level of the group or the individual. Speakers within all language varieties vary systematically in their language use according to social variables such as level of education, socioeconomic status, social network ties or peer group membership, gender, social class, and age (Labov, 1966, 1972; Chambers, 1992; Milroy and Milroy, 1992). Several studies have explored language variation by classifying the features of a marked social or regional dialect such as African-American Vernacular English (AAVE) (Wolfram, 1969) or Canadian raising (Trudgill, 1983). Others have looked at a particular (set of) linguistic variable(s) within different gender, age, or social class groups, such as gender variation in reflexes of /a/ in three working-class Belfast neighborhoods (Milroy and Milroy, 1978), or the distribution of /ʌ/ and its reflexes among adolescent groups like Eckert's "jocks" and "burnouts" (1989). The use of certain linguistic forms or variables (such as post-vocalic /r/ in American, British, or Jamaican, dialects of English) often carries social significance within a community. At the level of the individual, the researcher may study how the differential use of the phonetic variants of a phonological variable by particular individuals indicates the direction or innovation of a sound change (Milroy and Milroy, 1985). At the group level, use of a particular phonetic variant of a phonological form may signal that a speaker resides in a particular speech community which has a particular way of speaking (Lippi-Green, 1989). Social network approaches examine the nature, strength, and direction of social interactions or ties between speakers and those within their matrix of social contacts (Milroy, 1982).

Because the present study focussed on two groups of speakers with particular types of social characteristics and matrices of social contacts, more background needs to be provided regarding the theory, methodology and findings of social network studies in sociolinguistics. This is the topic to which I turn in the following section.

2.1.3.1 Social Network Studies

A number of studies have identified the social network as an important level at which linguistic differentiation operates. The social network, as it has been conceptualized and researched in sociolinguistic studies, is any social cluster (a neighborhood, parish, community organization, institution, etc.) whose members may be shown to be mutually acquainted and who may share values or norms of behavior. One key finding of network studies has been that tightly-knit networks tend to exert a conserving force on local or vernacular language norms. Tightly-knit social networks of various types have been studied, in both rural and urban settings (e.g., Lippi-Green, 1989; and Bortoni-Ricardo, 1985, respectively). Two conditions have been shown to be crucial predictors of language use and conservation of local or vernacular forms in both the rural and urban studies, and to network studies in general: loyalty and proximity. Loyalty relates to the presence of an "ethos" of solidarity among speakers. Proximity relates to the relative power of a network as a norm-enforcement mechanism. That is, because it is an ostensibly local entity(e.g., a neighborhood) the social network is much closer to the individual, and its structures more tangible than those of the individual's social class (Chambers, 1995).

Loyalty to a community or group essentially means loyalty to the community's collective values. Such expressions of solidarity may be indicated by types of employment pursued, marriage patterns, etc., as will be discussed below, with respect to a particular *region*. Solidarity may come in the form of conformity to norms of dress, or patterns of social behavior. Conversely, the network may be smaller: a neighborhood, clan, gang, or group (Labov's (1972) study of New York gangs is one early example). Cheshire (1982) identified carrying of weapons, clothing styles, job aspirations, minor criminal tendencies, skill in fighting and swearing to be correlated to membership in the Orts Road group in Reading. Network membership, regardless of the scale of the network, can be signalled by linguistic conformity to local norms (the outworkings of which may be correlated to other sociolinguistic variables such as gender or age). Sociolinguists have generally measured speaker affiliation using some kind of index of a speaker's integration into that community. Indices quantify the quantity or number ("density") and quality or interconnectedness ("multiplexity") of a speaker's contacts (see below). Chambers pointed out that, "The conditions that enrich network ties are the same everywhere: kinship, proximity (neighborhood), occupation (workplace), and friendship (voluntary association)" (1995:75). However, the specific outworkings for a particular community differ. The indices developed must, then, be designed for the community in which they are used.

Lippi-Green (1989) examined integration of speakers into the rural alpine community of Grossdorf. Using a detailed index, she conducted a communication network analysis (her term) of 42 residents, assigning to each point values if particular features were identified in the speaker's kinship, occupation, residence, and voluntary association. These points were tallied into a network strength score, with a maximum possible of 17 points for married individuals and 16 for unmarried ones. Higher scores indicated greater integration into the local community.

Kinship was taken to be a primary indicator of network *density*, the number of community people (and places) known to the individual. Kinship was examined in terms of membership (of the speaker or his or her spouse) in one of the town's core families, and participation of family members (including the speaker's mother, father, maternal and paternal grandparents) in local activities. The second indicator of network density was workplace. Employment within the local community contributed positively to a speaker's integration score. Further points were assigned if the speaker held a traditional occupation, such as farming, and had always worked in the locale.

Multiplexity, the condition that obtains when a speaker knows other community members in multiple capacities, was assessed in terms of voluntary association and proximity. Voluntary association signifies speaker choice to informally associate with townmembers. Points were assigned if a speaker's co-workers were from Grossdorf, if any of these co-workers were relatives, for membership in local clubs or organizations, and informal association with local coworkers outside the place of employment.

Thus, the network of a maximally integrated speaker would be both dense and multiplex. There would be clear involvement in two active core clans, indicating that the speaker was subject to the rights and responsibilities associated with family membership; a choice to remain nearby to the local structures and effective strengthening of them by marrying into another established family; pursuit of solely traditional forms of employment; active interest in local social life. Lippi-Green found that integration into the community was highly correlated to use of local linguistic forms, but that the predictors operated differently for men and women. For men, use of local (conservative) forms seemed most closely tied to voluntary association. For women, education and age interacted with integration into the local community.

Bortoni-Ricardo's (1985) study of rural migrants to Brazlândia, examined the effects of communication or social network within an urban setting. Her concern was the process by which geographically-based rural dialects, specifically the Caipira dialect of Brazil, become transformed into urban social class-based ones. While the inhabitants of the community under investigation could all have been assigned the designation of urban lower-class individuals with rural background, correlations between patterns in a speaker's network of informal social contacts and his or her linguistic patterns led Bortoni-Ricardo to believe that a social network analysis would permit the disclosure of more subtle differences among these speakers which a social class designation might overlook. Her tools were two indices, labelled the "integration index" and the "urbanization index." The integration index enabled measurement of a speaker's maintenance of behaviors while in the city which would have been normative in the rural area; the urbanization index enabled measurement of re-orientation toward urban norms, respectively. Like Lippi-Green (1989), Bortoni-Ricardo gathered information concerning kinship, occupational history, and voluntary association. She further gathered information concerning age of migration, lengths of residence in the different regions, education, consumer behavior, job aspirations, and geographical mobility (discussed below). Bortoni-Ricardo found that a migrant's use of rural linguistic variants was related to both connection to the home region and integration into community centers in the new urban habitat that were populated by others from the speaker's home district. Speakers who used fewer non-standard Caipira forms tended to also show less voluntary association with the urban enclave wherein Caipira culture was actively maintained, particularly regarding two organizations within this enclave, a dance club and a philanthropic para-church organization called the Society of St. Vincent de Paul. Additionally, Bortoni-Ricardo found that dialect diffuseness (see below) developed in different ways for males and females, related to interactional patterns in the public versus the private (i.e., the home) spheres, respectively.

In her description of the linguistic behavior of the subject pool, Bortoni-Ricardo implemented LePage's (1980) notions of 'focussing' and 'diffuseness', as further explicated by Milroy (1982). The quality of "dialect diffuseness" (resulting from the process of dialect diffusion) characterizes those language patterns "of geographically or socially mobile persons, which cannot be said to be characteristic of any particular nameable accent, but rather [are] a mixture of various social and regional accents" (Milroy, 1982:141). A focussed dialect is typically identified by speakers as a distinct entity, and contains a predominance of nonstandard, local linguistic forms. The term "dialect diffuseness" refers to the situation (obtaining particularly in urbanizing nations) in which speakers of differing regional backgrounds and varying degrees of exposure to a trans-regional standard language come into contact with one another (Bortoni-Ricardo, 1985:105). To the extent that these speakers retain connections, to varying degrees, with the rural homeland and simultaneously cultivate connections with other urban-dwellers, their network of social contacts may also be characterized as being diffuse. (It is in this sense, i.e., as it relates to a relatively geographically and socially expansive network composition, that I use the term in Chapter 5.) Mobility is a crucial factor in dialect diffuseness. Not only did geographical mobility suggest contact with speakers from other than the speaker's own home region for the Brazlândia speakers, but it also implied occupational mobility, as well as a "search for change" in the economic basis of the individual's lifestyle, e.g., from an economy in the countryside of subsistence to one of accumulation (Bortoni-Ricardo, 1985:106). Thus, geographical mobility was seen to be related to social mobility.

In summary, I have described two studies of tightly-knit communities, one in an urban setting, the other in an isolated rural one, which exemplify the key findings of network studies in sociolinguistics: first, that tightly-knit communities (whether isolated or set within other, sometimes overlapping communities) frequently serve as mechanisms which promote the conservation of local, nonstandard, or vernacular linguistic norms. The influences of the community develop actively, as the individual chooses to participate in the community, and/or passively as the individual exists near to or within, it. Both contribute to speaker integration into the community. Second, systematic variation in linguistic behavior which may be missed by broad differentiation into social classes may be picked up by a more sensitive tool which permits examination of social network-type information. Third, sociolinguistic (including both demographic and network type) variables such as age, gender, voluntary association, and class frequently have an interactive effect. Both of the speech communities examined in Lippi-Green and Bortoni-Ricardo's studies were linked to a geographical region, and a regional dialect. However, it may be pointed out that in the case of Bortoni-Ricardo, retention of vernacular forms had more to do with social norms and cultural affiliations than geographical residence, per se.

2.1.3.2 Defining the "Speech Community"

Although the notion of the speech community has been central in sociolinguistics over the last three decades (Ferguson, 1959; Labov, 1966:125; Hymes, 1974: 53-55; Milroy, 1982), precise definition of the term has proved problematic. This difficulty results from the many levels at which variation within a single "speech community" might suggest redefinition of the boundaries or parameters by which the community is defined (Fasold 1990:40-41). An early formulation associated with Ferguson (1959) captures some general intuitions: all those within the borders of some country who speak the same language form a speech community. Later definitions refined the basic idea expressed here to deal with situations in which groups at more micro levels within such a community, such as those discussed above (gender, class, network type, etc.) share linguistic or stylistic (ethnographic) features, such as rules of turn-taking, which distinguished them from others (Hymes, 1972). Additionally, more recent definitions have shown that it is possible for individuals to simultaneously belong to, and on occassion move between, "overlapping" speech communities (Saville-Troike, 1982). This refinement facilitates coherent accounts of communities where code-switching is common. The difficulty has lain in circumscribing the relevant variety or set of shared norms or behaviors, and determining the extent of what is shared. But shared norms do not prefigure shared behavior. Labov's work, particularly in the 1960-70s (1963, 1966, 1972) illustrates the conceptualization of a speech community as a group of people who speak *differently*, yet share a *common* evaluation of the significance of social norms. That is, social stratification reflects differential adherence to a common set of norms.

2.1.3.3 The Notion of Speech Community in Jamaica

The issue of determining a set of shared sociolinguistic norms is relevant to applying the idea of a speech community to creole language situations in general, and to Jamaica in particular. The difference here is that rather than shared norms being associated with social dialects distinguished by primarily phonological variants, the social dialects in this case are distinguished in some cases by phonological differences and in other cases by grammatical, phonological and lexical differences which render them mutually unintelligible. An understanding of the significance of the physical geography of the island is crucial to understanding patterns of variation within Jamaican language. Socioeconomic status (including education) is another key influence, and has arguably received the most attention in recent years. Rural or urban orientation, i.e., integration into rural or urban networks, is a third. I briefly describe each of these factors in turn, below. I return to the idea of shared norms in Chapter 5.

Geographical variation

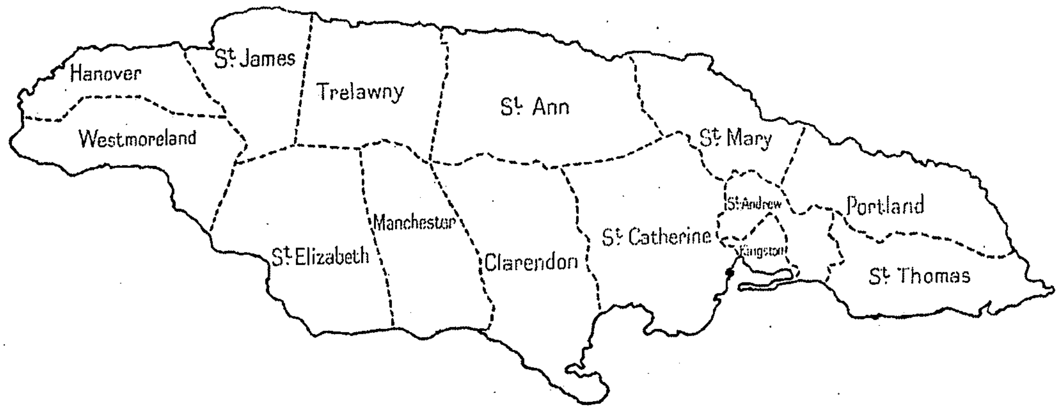


Figure 2.1. The country of Jamaica, divided into its 14 electoral parishes. (Reproduced and adapted from DeCamp, 1961).

Figure 2.1 provides a map of the island of Jamaica, showing the fourteen parishes into which it is organized. The most salient physical feature of the island, the mountain ridge, including the Blue Mountain range, which rises to heights of about 7,402 feet above sea-level, extends continuously across the center of the island from St. Thomas to Westmoreland. The mountains have played a prominent role in the unfolding history of the island. There are yet uninhabited areas along the main ridge because travel through the mountains is a difficult enterprise, serving to limit movement between communities on the island. The subsidiary branches extending from the main ridge divide the country into the compartments that were the foundation for its system of parishes. Isolation in the mountains has been both an obstacle and an aid to freedom. In 1655, on the eve of the British invasion, a group of Spanish settlers and their slaves escaped to some of the most inaccessible regions of the mountain range. Shortly after, all the fugitives but a group of about 250 of the former slaves were evacuated to Cuba. These slaves formed the first group of what have become known as the "Maroons". Over the years of British occupation, including periods encompassing two wars fought with the Maroons, several settlements arose in the eastern and western regions of the Blue

Mountains, and with additional escapes from the British plantations, the number of Maroons increased to 1,200 by emancipation in 1838 (Bilby, 1983; Holm, 1989). A map of the major Maroon settlements is provided in Figure 2.2. Some rural areas, then, particularly at the higher, rockier elevations of St. Elizabeth and St. Thomas, contain settlements which have remained isolated for generations. In these settlements, earlier Creole forms, along with several West African cultural traditions (see Alleyne, 1980) were preserved to an extent unmatched in any other creole-speaking population in the Caribbean. At emancipation, freed slaves largely moved off the plantations to become independent small-landholding farmers, but on the whole, few moved very far from the plantations on which they had worked as slaves (DeCamp, 1961). Thus, the most archaic forms of Jamaican Creole have been maintained in the historically isolated mountains communities.

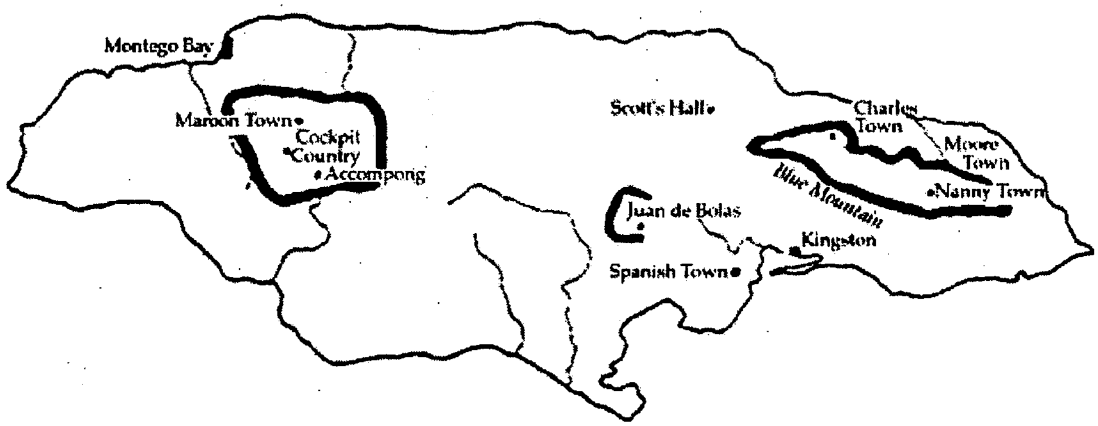


Figure 2.2. Map of the Maroon settlements of Jamaica. Accompong, St. Elizabeth, and Nanny Town, St. Thomas are the locations of the two oldest. (Reproduced and adapted from Agorsah, 1994)

A related geographical influence on language was described by DeCamp (1961). The highest elevations of the Blue Mountain range are to be found in the east along the border between the parishes of Portland and St. Thomas, and in the north of St. Elizabeth to the west. The presence of isogloss boundaries along these major land boundaries (with archaic forms in use along these western and eastern areas) suggests that there are some regionalisms associated with the westernmost parishes and the easternmost parishes, as well as the central part of the island (including Kingston).

The third important respect in which geography impacts language use in Jamaica concerns roads to and from its commercial and cultural center, Kingston. Up to the present day, there have been only two major roads which permit the passage of automotive traffic across the island from the north to the south coast. These roads are heavily travelled and have served to transport not only goods, but also Kingston culture along Jamaica's main thoroughfares. Thus, proximity or accessibility to Kingston influences access to urban speech forms. The major metropolitan area of Kingston/St. Andrew has been the center of economic activity, as well as the intellectual center. Since the 1940s it has been the home of the main campus of the University of the West Indies and other academic and cultural institutions. A major wave of immigration brought a remarkable increase to the population of the parish near the close of the 19th century: from 30,000 in the early 1900s to 62,700 by 1921. At the time of the 1943 census, the population totalled 109,000 (Clarke, 1975). During this period, Jamaicans from the mountainous rural parishes of the interior flooded the so-called "Corporate Area" (Kingston and its suburbs located in the adjacent parish of St. Andrew) in search of work. However, as Patrick (1992) pointed out, this urban migration did not mean a uni-directional re-orienting of a person's personal and working relationships from the rural home district to the city. A pattern developed which is very common on the island today of work-seekers moving to the Corporate Area (referred to as "town") while maintaining close first-order network ties in the rural home district ("country"). That is, geographical mobility became a key factor in the maintainance of existing social networks. The urban-working individual then served as the conduit whereby goods and new technology could reach those back home. Those with an automobile or able to afford bus fare travelled "to country" on weekends or for vacations. Quite frequently, this had (and continues to have) the effect of temporarily separating family members when husband, wife or a family member of working age left, sometimes for years, to work in the city. Thus, while living in an urban area, this person retained a rural orientation. The urban factor in this urban-rural equation is not limited to metropolitan Jamaica (Patrick, 1992). Many Jamaicans today leave both Jamaica's rural and urban areas to seek work or education in the urban areas of other countries, sending funds for children and/or spouse to join them after a time, or returning home themselves after building up their savings over a period of months or years.

The final important influence on patterns of variation to be discussed here is tourism. This may be described as a geographical rather than a socioeconomic influence since contact with foreign tourists cuts across social class lines, and operates geographically. Montego Bay and the resort areas of the north coast, Negril and Kingston in the west and south receive the greatest number of tourists each year. North American, British, and more recently Australian tourists interact with Jamaicans at all levels of society from lower-working class street vendors selling souvenirs and food, to middle-class tourist board officials who arrange outings for foreign visitors, to upper class business people and government officials who themselves dine and spend leisure time at the popular resort locations. Certainly, this contact makes available to the Jamaican ear some features of American and British speech. Such contact is arguably different in kind from that of American or British television or radio programming, since it is interactional. The influences of both are likely to be important, though little is known of the magnitude of their impact.

Because of their contributions to a person's experience of linguistic variation, location of residence, geographical mobility around and outside the island, and interactions with tourists have been included in the sociolinguistic analysis of speaker variables for this study (see §3.4, and Appendix A).

Socioeconomic variation

Social class has been shown to be significantly correlated with variation in language use in a host of sociolinguistic studies. The classic example is Labov's 1966 study of postvocalic /r/ in New York City, in which middle-class speakers were shown to use this prestige variant more frequently than the highest socioeconomic class, who were r-less a greater proportion of the time. In sociolinguistic studies of post-colonial societies, such as Jamaica, there has also been shown to be a correlation between class and language use. Use of Jamaican English has been associated with upper-middle and upper class speakers, Jamaican Creole with lower-middle or working class speakers (Akers, 1981; Wells, 1982). Wells referred to these Jamaican varieties as "Jamaican Educated" and "Jamaican Creole", respectively. While some sort of bilingualism may be the norm in Jamaica, monolingual basilect speakers may be found in the lowest social classes, and monolingual acrolect speakers in the highest (Alleyne, 1976)[5]. A few researchers have investigated linguistic variation within just the upper social classes of Jamaican society. Miller studied acrolectal Jamaican English, finding correlations within just the upper classes between high-income/occupation, post-secondary education, gender, and use of certain phonological forms of Jamaican English (Miller, 1987). Expanding on Miller's study, Irvine (1994) studied variation among the upper classes in Kingston and Upper St. Andrew, finding variation between speakers of what she termed "Educated Jamaican English" (EJE) and "Variety A", the latter popularly referred to as the "Upper St. Andrew drawl". Variety A was associated with the highest-wage earners, and was characterized by such features as overall nasality of voice and absence of postvocalic /r/ in comparison to the rhotic Jamaican English, among other features (Irvine, 1994:72). Variety A was associated with the self-employed/business owners, Jamaican English with business managers and professionals (Irvine, 1995).

The use of social class as a predictor of linguistic variation has proven problematic, however, in post-colonial societies. Rickford (1986) criticized sociolinguistic studies, such as that of Akers (1981) which provided quantitative data on the distribution of linguistic features of "Upper", "Middle", and "Lower" class respondents without motivating his use of these classifications. In fact, the Jamaica Census bureau uses the classifications "Working", "Middle" and "Upper" class with many occupationally-designated substrata to each level. I would further suggest that even after grouping speakers into social strata, we will still have failed to tap the indicators which are the most telling with respect to what comprises social stratification in Jamaican society. For example, in the preceding section the point was made that geographical mobility and urban vs. rural orientation of a speaker's networks need to be accounted for. What is needed is a measure which is richer in ethnographic information. Income and occupation do not capture sufficient information to reflect what contributes to an individual's standard of living.

It may be profitable to have a model which additionally looks at a speaker's network of informal social interactions (Milroy, 1980), integration into community life (Lippi-Green, 1989), household applicances and media influences. For example, goods such as washing machines and satellite dishes may be acquired from savvy family members who have worked for a time overseas and brought goods or currency into Jamaica having discovered means of avoiding duty payments (which is extremely common). This was the case with one family I interviewed in the pilot phase of this study (§2.4.1). Their annual income placed them in the working-class income bracket.

However, because of acquisitions made for them overseas by a family member who went to the United States for work, they were able to live well above the level of their income. In the mountainous areas, it is not unusual for several families to share a telephone, but for each to have its own television and video tape recorder. Certainly, as has been noted above, regular access to North American and British radio and television programming makes it possible for current linguistic trends from "foreign" (Jamaican for "abroad") to easily find their way into otherwise isolated homes. In the same way, it would seem crucial to ascertain a speaker's contacts with Creole- relative to English-speaking acquaintances. As has been suggested, contacts with English speakers can be made regardless of social class (via tourism), but the nature and frequency of these contacts is likely to make a difference.

Because of the potentially significant effects of socioeconomic variables on speech, a questionnaire was designed for this study to allow quantification of such variables, to gather data concerning both social class and social network, and some attitude information (Beckford Wassink, 1999; §3.4 regarding sociolinguistic coding, and Appendix A).

The separate treatment of geographical and social factors in the preceding sections is not intended to suggest that these various influences (whether the latter is cast in terms of employment or education) do not interact. The interrelatedness of such variables as social class, gender, education, and network has been shown in several studies (Nichols, 1983; Rickford, 1986). But furthermore, it is known for the specific case of Jamaican Creole that linguistic features which at one time were characteristic of one geographical area, or more broadly associated with urban or rural settings, have now become associated with social class. DeCamp noted that "many localisms are already caste-marks of age, poverty and illiteracy...yet the geographical factor cannot be ignored, for some districts are more isolated than others and abound more in poverty and illiteracy" (DeCamp, 1961:80). Thus, what exists in present-day Jamaica is linguistic variation resulting from the intertwined effects of language contact, historical and geographical isolation vs. modern metropolitanism, educational and socioeconomic disadvantage vs. advantage.

2.2 Issues in Data Collection

The above discussion of the socioeconomic variables correlated with usage of Jamaican Creole and Jamaican English alludes to the stigmatization of the Creole. DeCamp suggested that many localisms are caste-markers for poverty, illiteracy, etc. Many of these localisms are in fact archaic creole forms, such as the anterior tense preverbal marker *(b)en,* which is found in the older districts of St. Elizabeth. More recent sociolinguistic work has shown (Labov, 1972) that it is difficult for an observer outside the peer group to observe in the natural vernacular forms which are stigmatized. This section explores the issues related to elicitation of a stigmatized, non-standard language, and the multi-valued nature of attitudes toward Jamaican Creole that makes it challenging, but not impossible, to sample in controlled settings.

2.2.1 Accessing the Vernacular: attitudes to language

The social meanings attached to variation in language use have been studied in research on language attitudes and language choice. Speakers, reflecting an awareness of social norms (i.e., socially-constructed expectations about what is required, appropriate, inappropriate, meaningful social behavior), often exhibit different perceptions about varieties which linguists call "standard" and "non-standard", their attitudes toward these language varieties more generally reflecting attitudes toward the people who use them (Fasold, 1984; Giles and Coupland, 1991). Those who speak standard and non-standard varieties themselves often exhibit perceptions in line with social norms when asked to evaluate their own language use. A number of studies have shown that negative self-ratings of one's native speech variety are regularly reported from respondents who judge themselves to be speakers of non-standard varieties (see, e.g., Labov, 1966 and Preston, 1989). The picture of attitudes toward language, however, is much more complex than speakers having negative attitudes toward non-standard varieties and positive attitudes toward standard ones. Looking at several studies reported in the literature, Ryan (1979) investigated the persistence of language varieties which have lower social prestige than so-called standard varieties. (For discussions of the concept of linguistic prestige, see Lambert, 1967 and Gambhir, 1983, for a discussion of attitudes toward Bhojpuri and Hindi in a diglossic creole setting in Guyana). Ryan found that speakers of non-standard varieties often operate with multivalued systems, valuing both the standard and non-standard varieties, but for differing reasons. While speakers often associate use of the standard with educational accomplishment, sophistication, and socioeconomic status, the non-standard variety or vernacular is valued because it connotes trustworthiness, honesty, and friendship. (See also Giles, 1977, cited in Fasold, 1984, and for a creole case, see Rickford, 1983)

Only a handful of studies have looked at language attitudes in creole settings, where use of a standard often occurs in complementary distribution with use of a creole. Much of the literature available focusses on the attitudes of teachers toward creole varieties (see, e.g., Winford, 1976; Morgan, 1983). For speakers in the former British colonies of the West Indies, attitudes toward English and Creole have traditionally reflected the general direction of social prestige prior to the abolition of the African slave trade and national independence. Here, the social values and culture, systems of commerce and government, as well as the language, of the English-speaking dominant classes have historically been regarded as more sophisticated than those of the laboring classes, who have tended to be creole-dominant. These attitudes persist. It is very common to hear creole-dominant speakers describing the language of the dominant classes as more well-formed, expressive, or proper than those of the lower class (Beckford Wassink, 1999). Speakers of Jamaican Creole will generally indicate when directly questioned that it is best to use "the proper English" in most if not all settings, and will demonstrate that they would prefer to hear Jamaican Creole spoken than use it themselves. This espoused preference for English will emerge even more markedly if the speaker perceives the interviewer to be a speaker of "standard" English. However, Rickford and Traugott (1985) pointed out an interesting paradox in how creoles tend to be viewed by their speakers. Creoles are often viewed as illegitimate languages (e.g., as "mangled" versions of the standard), and serve as symbols of social, moral, and political degradation. However, they persist because speakers find in their vernacular an allegiance along solidarity lines (Ryan, 1979; Labov, 1984; Rickford and Traugott, 1985). Speakers operate with a system of attitudes which is best understood as being multi-valued. Attitudes are more complex than "Creole is bad, English is good." Such a conceptualization would predict that the Creole is likely to die out. It is important to note that there has actually been recent *expansion* of the roles Creole is permitted to take (Christie, 1995; Shields-Brodber, 1995; Beckford Wassink, 1999). Rickford (1983) found for non-estate (roughly lower-middle) and estate (roughly working) class speakers in the Guyanese continuum, that members of both groups tended to judge a speaker as a potential friend when that speaker's speech was most like their own, but all tended to judge the mesolectal and acrolectal speakers as most likely to succeed in society and receive high-paying jobs. Christie (1995) found that attitudes toward Jamaican Creole are becoming more positive due to the influences of increasing nationalism, regard for traditional folk heritage, and the cultural phenomenon called Dancehall that had its origins within the working classes. Beckford Wassink (1999) found additionally that attitudes toward Jamaican Creole are gender-graded, so that males of all ages tend to be more favorably predisposed to Creole than females, with young adult males most favorably predisposed overall. Furthermore, there is in Jamaica a speech-style termed Speaky-spoky characterized by a Jamaican Creole speaker's hypercorrected use of English features. Research into this style has shown that although speakers may believe their use of English forms to be status-enhancing, such behavior is frequently criticized by others as being pretentious insofar as the speaker is departing from their normal speech behavior (cf. Patrick and McElhinny, 1993, also Chapter 6, below).

Roberts (1988) made another relevant observation concerning folk perceptions. When classifying the postcreole continuum forms used in the West Indies, lay people frequently talk about "English and 'the rest'" subsuming mesolectal and basilectal varieties. Perhaps this is in part understandable because folk perceptions indicate that the moment one introduces creole forms into English speech, i.e., mixing English and creole, the result is corrupted English. Jamaicans often demonstrate an idealized conception of a homogenous, invariant English (a form spoken, presumably, in America or the United Kingdom, which they feel should be mastered by Jamaicans but isn't). One speaker cited in Beckford Wassink (1999) used these words: "English is so structured that there is something in it that is to be desired." Certainly, there is evidence that this idealization of English followed the path of colonization to the many countries in which English was transplanted. The historic record provides a wealth of examples, primarily expressed by Europeans living in the remote colonies, that people felt horror that terrible things were happening to English as European children born or raised in the colonies (the original "creoles") or European women living on the estates spoke a mixed form of the language with slaves and slave children (Bailey, 1991).

Sociolinguistic research on social networks has also helped us to understand why non-standard varieties persist. In contrast to social class-based approaches to understanding language variation, which are status-based and tend to be oriented toward differences between social groups, a social network approach focusses on language use as solidary, within-group behavior (Milroy, 1980; Milroy and Milroy, 1992). Dense, tightly-knit social networks, such as exist in many rural communities, are often environments in which localized norms of behavior are retained, whereas the development and spread of a standard language involves the spread of non-local norms of language behavior. Use of a vernacular, non-standard, or local variety, then, constitutes the local norm for language behavior, and endures because it signals membership in the local community. A number of studies have examined language choice and perceptions about local varieties and their potential to mark speakers with respect to allegiance with a local community or in-group. Blom and Gumperz (1972) showed that bidialectal speakers of two varieties of Norwegian, Ranamål (a local dialect) and Bokmål (the standard variety in Northern Norway) kept use of the two varieties separate in the following fashion: in gatherings of friends and relatives, the speech variety chosen was Ranamål, regardless of whether participants discussed local, national, or official business, whereas whenever "local and nonlocal relationships were relevant to the same situation, topical variation [elicited] code switching" (1972:428). This means that the activation of preexisting social relationships and obligations between participants constrained them to respond to each other in light of those roles, minimally affected by the presence of strangers. In so doing, speakers showed themselves to be "team members", aligning themselves with the local community in which use of Ranamål was normative. Use of Bokmål in such a situation resulted in speaker judgments that the speaker was using "artificial" speech or pretense. As was noted in §2.1.3.1, Lippi-Green's (1989) network strength index measured integration into the local community using several indicators of network density (number of connections between different individuals), multiplexity (number of connections between the same individuals), and voluntary association. The greater the integration of the speaker into the local community, the greater their use of local or vernacular forms.

These ideas, that 1.) language use is socially situated, 2.) that social networks often function as forces which conserve local norms, and 3.) that language attitudes toward and choice between standard and local forms are to a large extent situationally defined and audience-directed, are of critical importance to this study, affecting issues of both data collection and analysis. The language choice decisions Jamaican Creole speakers make and the social norms that constrain them affect where and when Creole speech may be elicited, which requires an awareness of the kinds of settings in which Jamaican Creole may be judged appropriate for use. Jamaican Creole speech data for vernacular conversation are best elicited from a group of speakers who are known to each other and have informal social ties that, once activated, will be likely to move them to select Creole as the medium of conversation. My own observation of such settings suggests to me that Blom and Gumperz' findings for the Norwegian speakers holds for Jamaican Creole speakers as well. My perceived status as an insider or outsider to the group and visibility/participation in conversation also affected speakers' choice of Standard Jamaican English (or a hypercorrected form of Creole, e.g. see discussion of "Speaky-Spoky in Chapter 6) or Jamaican Creole in my presence.

Because the presence of an English-speaking outsider might suppress the emergence of Creole speech, I engaged a basilect-speaking fieldwork assistant; one who had insider status in the community in which I collected my Creole data. As I am a mesolectal speaker of Jamaican Creole, a basilect-dominant speaker's initial conversation with me predictably occurs in a fairly formal register, which is the protocol for greeting a stranger. Indeed, if no rapport is achieved, conversation is expected to occur at this more formal level. A basilect-speaking fieldwork assistant was invaluable in activating the norms which may allow Creole speech to emerge.

2.2.2 Literacy and the Status of the Standardization of Jamaican Creole

It has been shown that popular perceptions of Jamaican Creole that conceptually align the creole with English make it difficult to garner sufficient public support to promote standardization of the Creole. In the mid 1980's the approach in all but a few Jamaican schools which were progressive in their language arts instruction, was to ignore Jamaican Creole or prohibit its use altogether (Morgan, 1983). The net results have been that teachers become frustrated with students' lack of proficiency in English. Some writers have expressed frustration that what endures in Jamaica is a situation characterized by, as Carrington (1988:39) put it:

> the production of populations uneducated by their schooling, having limited competence in the official language and with no confidence in the usefulness of the language that they do control.

In 1987, literacy among Jamaicans was 82 per cent (Miller, 1987; see also Lawton, 1982 for a discussion of literacy in Jamaica). In general, across all social classes and ethnicities, males tend to have higher rates of illiteracy than females. Among the lighter-skinned classes, illiteracy is less than 3 percent. Among the darkest classes, illiteracy rises to around 30 percent, not much different from figures given in the 1943 census presented by Miller (1987:102, more recent figures from the National Institute of Jamaica 1984 Census). At the writing of this thesis, the NIJ was undertaking a subsequent enumeration. Of course, it may be the case that the new figures would report a higher literacy rate. Nonetheless, the consequence of limited competence in English for this study is that a written data elicitation task might prove difficult for certain speakers.

The fact that Jamaican Creole has no standard orthography as yet also poses a challenge for its elicitation. Because of its low status, Jamaicans are not taught in school to read Jamaican Creole but rather are taught to read the spelling system of English. Those who write informally in Creole (e.g., for personal correspondence) have largely devised their own spelling systems. Journalists who write in Creole (usually either to provide captions for cartoons or caricature work, or to relate dialogue in reporting a news story) frequently use spellings regularized or approved for a particular periodical. Journalist Carolyn Cooper, also a lecturer at the University of the West Indies, presents her Creole-language column "Uman Tung" (Woman's Tongue) in two forms each week in the *Jamaica Observer*, once in Jamaican Creole, using a spelling system devised by linguist F. G. Cassidy in the *Dictionary of Jamaican English* (Cassidy and LePage, 1967, hereafter abbreviated *DJE*), and once in an orthography of her own which uses a mixture of English orthography and a broad phonetic rendering. She calls this *chaka-chaka* (Jamaican for "disorderly") spelling (Cooper, 1997). Writers such as Lorna Goodison (e.g., Goodison 1992:103) and Louise Bennett Coverly have used systems of their own in writing Creole. Bennett included a glossary at the end of her book of poetry entitled *Jamaica Labrish* to list alternative spellings the reader may have encountered for a word she uses.

The historical controversy of whether Jamaican Creole is *worth* writing has contributed a circular aspect to the problem. Jamaicans point to the wealth of lexical items and technical terms available in English as confirmation that Jamaican Creole is impoverished. Most are unaware that the English language itself was once regarded as lacking scholarly value relative to Latin, and that it was the focus of heated debate regarding its dialectal variation and one-time unregularized spelling system (Crystal, 1987:214).[6] Certainly, there are some Jamaicans who read columns written in Jamaican Creole. However, even these Jamaicans are unlikely to be able to read Creole spelling with ease. This was borne in mind in designing the word list and elicitation procedures for this study.

This thesis, then, is concerned with characterizing one aspect of the sound systems of acrolect- and basilect-dominant Jamaicans: the relative inventories of vowels. The previous sections in this chapter have explored some of the social issues related to the study of linguistic variation in Jamaica, including where these forms of speech might be located, and how they may best be elicited. Having considered these issues, I now turn to a review of the literature into the acoustic properties of vowel systems, including research into Jamaican vowels.

2.3 The Linguistic System of Jamaican Creole

2.3.1 Vowel Studies of Jamaican Creole

Within the field of linguistic phonetics, individual language and typological surveys using observational and experimental acoustic, articulatory and perceptual descriptions of vowel phonemes have been useful for corroborating languages' vowel inventories (e.g., Ladefoged, 1993; Ladefoged and Maddieson, 1996; MacEachern and Ladefoged, 1997). The present study provides an acoustic description of the vowels used by speakers of acrolect-dominant and basilect-dominant Jamaican Creole speech. There are several reasons for conducting this analysis. First, the existing literature investigating the vowel system of Jamaican Creole comprises almost exclusively auditory impressions of vowel productions (LePage, 1960; Lawton, 1963; Akers, 1981; Wells, 1982; Lalla and D'Costa, 1990; Sebba, 1993. Veatch, 1991 is the exception). The literature is often unclear as to whether the vowel system under description is that of

Creole speakers or speakers of mesolectal or acrolectal varieties. Moreover, descriptions are often based on data from a single speaker. Perhaps as a direct result of this, the auditory accounts are discrepant as to what the basic phonemes of Jamaican Creole are. These accounts are given below; horizontal lines divide the monophthongs (upper section) from the diphthongs (lower section) posited by each author:

Table 2.2. LePage's (1960)11-member inventory with 2 long vowels and 4 diphthongs for 1 male basilect speaker. o/ʌ indicates alternation between two phonetic qualities for words such as "bud". Cassidy (1961) and Cassidy and LePage (1967), however, posit /aː/ instead of /a/ vacillating somewhat on the question of length (xxxviii-liv, *DJE* 1980 ed.):

iː		uː
i		u
e		o/ʌ
	a	
ie		uo
ai		ou

Table 2.3. Lawton's (1963:45ff) 9-member inventory with no long vowels whatsoever and 4 diphthongs. (from 5 male speakers):

i		u
e		o
	a	
ie		uo
ai		ou

Table 2.4. Akers' (1981:25) inventory for Jamaican Creole based on data acquired for a pooled sample of 66 speakers (both acrolectal, mesolectal, and basilectal) comprised of three perfectly symmetrical subsystems--5 short and 5 long monophthongs, 5 diphthongs--with a total of 15 members:

i		u
e		o
	a	
i:		u:
e:		o:
	a:	
ie		uo
ei		ou
		ai

Table 2.5. Wells' (1973; and Sebba, 1993 follows) inventories for 'Jamaican Educated' (JE) and 'Jamaican Creole' (JC). 12 vowels are posited for JC, 16 for JE , based on data from a sample of 12 speakers in each of the two groups:

JC

i		u
e		o
	a	
i:		u:
ie		uo
	a:	
ai		ou

JE

i		u
e		o
a		ɔ
i:		u:
e:	ə:	o:
a:		ɔ:
		ɔu
ai		ɔi

Table 2.6. Mead's (1996) 12-member inventory with 3 long vowels and 4 diphthongs, following that of Cassidy (1961). In that study, he does not analyze data for any speaker sample:

i:	u:
i	ʊ
e	o
a	ɑ:
ie	uo
ai	ou

Table 2.7. Lalla and D'Costa's (1990) 10-phoneme inventory with 5 short, 1 long and 4 diphthongal vowels for reconstructed "Early Jamaican Creole". /aː/ appears in their vowel list (1990:62) but is absent from the associated chart several pages later (1990:67):

i	u
e	o
a	(aː)
ie	uo
ai	ou

As may be seen in the inventories above, some researchers have identified two vowels of Jamaican Creole, /ie, uo/, as monophthongs (Wells, 1973; Veatch, 1991), while others maintain that these are diphthongs just like /ai, ɔi, aʊ/ in American English (LePage, 1960; Lawton, 1963; Akers, 1981; Mead, 1996). Presumably, the distinction the former authors are making is that /ie, uo/ are phonologically monophthongs, which may have a dipthongal realization. In general, the authors disagree regarding the presence of long and short vowels. For example, while Wells posited long and short /aː, a/ for Jamaican Creole (and two additional low vowels for Jamaican English, namely /ɔː, ɔ/), LePage, and Lawton posited only short /a/.

In part, these discrepancies probably reflect the absence of instrumental analysis of the distinctions maintained between vowels of different groups of Jamaican speakers. But it is also likely that they reflect the beliefs a particular author held about the history and phonology of Jamaican vowels. Lawton, for example, believed a long-short contrast to be of lesser importance than a difference in tone which carried the phonetic consequence of vowel lengthening. He therefore posited no long vowels for Jamaican Creole. It seems likely that Lawton's belief followed from an understanding that some West African languages employ contrastive tone, and a conviction that tone serves as the basis of contrast for a small number of minimal pairs in Jamaican Creole (Lawton 1963, 1968:257).

What is known concerning the inputs of the source languages to Jamaican Creole? Alleyne (1980) stated that early Jamaican Creole could distinguish pairs such as 'beat' and 'bit', but could not distinguish others where categories apparently merged early on in the formation of the Creole such as /u/ and /ʊ/ in 'luke' and 'look'. (see Wells, 1982 for a full discussion of the so-called "pool~pull" merger in English dialects.) Some British dialectology literature suggests that quality and quantity operated differently in different 15th and 16th century British dialects such as Scots and those in the south of the country (Milroy and Milroy, 1992), and currently in Scots and English, as Wells (1982) makes clear.

Little is known about the phonological structures of the vowel systems of the African languages which form the substrate of Jamaican Creole. Carter suggests, although this may be an oversimplification becasue of the complex interactions sometimes found between vowel duration and supersegmental features such as tone, that there are four different categories into which African languages fall (Carter, 1993; but see Ladefoged, 1964). These are summarized in Table 2.8 Notably, Twi, which formed part of the Jamaican substrate, contrasted single and double vowels.

Table 2.8. Vowel length in the African substrate

vowel system:	example language:
(1) phonemic long/short contrast	Arabic
(2) phonetic, but not phonemic length	Swahili
(3) single/double vowels	Twi
(4) short only	no substrate West African language is known to fall into this category, but several African-substrate pidgin and creole languages do)

Alleyne (1980) characterized the earliest ancestor of Jamaican Creole and of other creoles which arose in the Caribbean during British colonization, as a reconstructed, four-tiered variety called Afro-American (Fig. 2.3). Based on evidence from 2 current-day creoles, Saramaccan and Ndjuka, both of which contain short vowels alone, he argued that Afro-American had neither vowel length nor a productive tense/lax distinction. Alleyne asserted that long vowels in Middle English "were interpreted as nuclei of neutral length" (1980:39), meaning that Afro-American had no means of distinguishing English long/short pairs such as 'beat' and 'bit'; or 'fool' and 'full'. However, Carter (1993) argued that the presence of diphthongs in early examples of Jamaican Creole provides compelling evidence that Jamaican Creole did inherit distinctions of quality. Insofar as this holds for the range of creole varieties present in the Creole since its earliest days (note evidence of a *range* of varieties in Jamaican Creole given by Alleyne, 1976:45-49), variability in the super and substrate languages should predict that Jamaican varieties are **as likely** to maintain distinctions of quality as of quantity.

At present, the literature lacks a detailed, large-scale instrumental acoustic characterization of the vowel inventories operating within the different regions of the Jamaican continuum. Crucially, Akers and Lawton suggested that phonemic contrasts in all dimensions obtain from vowel length or tone alone, and not from differences in quality (Lawton, 1963,1982). Characterization of the relative roles of vowel quality and quantity is one task of this study.

i u

e o

ɛ ɔ

a

Figure 2.3. Reconstructed, four-tiered system of Afro-American (Alleyne, 1980).

2.3.2 Acoustic Analysis of Vowels

An acoustic approach can help to show the overall distribution of vowel phonemes in a system, the traditional approach being to plot vowels in F1/F2 acoustic space. The relative closeness/distance of vowel "steady states" or targets and overlap of their acoustic categories may be quantified, and the status of vowels as monophthongs or diphthongs may be assessed through acoustic measurements taken over time. An acoustic analysis of Jamaican Creole would facilitate comparison with other languages whose vowel inventories have been documented, for example those in Maddieson's UPSID database (Maddieson, 1984, used, for example, by researchers such as Schwartz, Boë, Vallé and Abry, 1997, for the development of models which help describe universals in vowel inventories). Most other kinds of phonetic analyses, e.g., articulatory ones, are not as easily conducted in rural areas as equipment and expense may be prohibitive, and the procedures may seem very strange to potential subjects. On the other hand, it is often easier and less expensive to record speech which may subsequently be analyzed in the laboratory.

Acoustic analysis of monophthongs is relatively straightforward. It has been well-established that important information about vowel quality and cues for vowel identification are carried in vowel formant frequencies (Fant, 1963, 1970a, 1970b, 1973; Liljencrants and Lindblom, 1972), although these are subject to variation due to contextual coarticulation, rate of speech effects, and speaker sex (Peterson and Barney, 1952; Strange, Verbrugge, Shankweiler, and Edman, 1976; Gay, 1978). Information about location of tongue body constriction, tongue height and degree of jaw opening, among other properties, are carried in the first (F1) and second (F2) formants; information about lip rounding in the second and third formants (F3) (Fant, 1963; Ladefoged, 1993). The distances between F2 and F1, as well as F3 and F2, are also believed to be important correlates of these articulatory properties (Ladefoged, 1993). By measuring vowel duration, we can corroborate reports that a language makes contrastive use of vowel length and observe durational ranges pertaining to a long/short distinction. By examining the changes in F1 and F2 over time across the vowel, we can describe the trajectories of monophthongal and of diphthongal vowels (Ren, 1986).

The description and classification of diphthongs, sometimes referred to as complex vowels, have proven to be a complex business (Lehiste and Peterson, 1961; Ren, 1986; Gottfried, Miller and Meyer, 1993). Some researchers have characterized diphthongs as single vocalic events, i.e., initial steady-state+glide+final steady-state sequences in which there is believed to be one vowel nucleus with two targets (e.g., Lehiste and Peterson, 1961). Other researchers have characterized diphthongs as sequences of two vowels or of one vowel and one semivowel (e.g., Pike 1971). Several studies have shown that looking at diphthongs as sequences of two monophthongs is an oversimplification (see, e.g., Holbrook and Fairbanks, 1962; Lehiste, 1964; and, Wise, 1965, all reported in Gottfried, Miller, and Meyer, 1993. See also Ren, 1986). For example, diphthong durations are generally shorter than the sum of the durations that their monophthongal components would exhibit if produced in isolation, and further, it is usually the case that neither the initial nor the final nucleus component of a diphthong reaches its target formant frequencies (Gottfried, Miller, and Meyer, 1993). Reflecting this fact, Bladon (1985) and Miller and Chang (1989) have proposed a "dual target" hypothesis which holds that the diphthongs of American English are distinguished in terms of initial and final "targets" which need not coincide with any particular monophthong. Diphthongal patterns in English appear to be specifiable by F2 trajectory. That is, F1 may change minimally across the course of a diphthong relative to the dynamic nature of F2, which serves to provide the crucial cue for English diphthong identity (Ren, 1986:12, but also see Gottfried, Miller, and Meyer, 1993).

Acoustic descriptions of diphthongs may be organized into two types of approaches: spectral descriptions and temporal descriptions. Gottfried et al. (1993) summarized and evaluated three hypotheses proposed in the phonetics literature for the classification of English diphthongs which make use of both temporal and spectral information by examining a corpus of six American English diphthongs produced in two consonantal contexts (/b_d/, /h_d/) at two tempos in differing stress conditions in log F1 x log F2 space and an "auditory perceptual space". Their study asked which combination of acoustic parameters may be considered the most effective in classifying diphthongs, evaluating three hypotheses. The "onset + offset" hypothesis posits that F1 and F2 spectral patterns at diphthong onset and offset adequately characterize the information relevant to diphthong perception. Second, the "onset + slope" hypothesis holds that it is by considering the combination of rate of spectral change (primarily in F2) in Hz/ms (i.e., Hertz over milliseconds) and the F1/F2 pattern at diphthong onset that one arrives at an accurate characterization of a diphthong. Third, the "onset + direction" hypothesis emphasizes the contribution of the course of formant movement from onset to offset. Gottfried *et al.* concluded that all three alternative hypotheses permitted correct classification of English diphthongs, at better than 90%. They noted that spectral specification of diphthong onset is a key element in all the approaches, and that increased tempo or lack of stress will tend to cause the onsets of American English diphthongs /aʊ, aɪ, oʊ, ɔɪ/ (but not /eɪ/ and /ju/) to centralize in the acoustic vowel space. Diphthongs have been shown to have distinctive rates of spectral change in F2 for English and other languages (cf. Gay, 1978; Manrique, 1979; and Jha, 1985), the highest slopes obtained for /aɪ/, /ɔɪ/. F2 rate of transition is thus held to be an effective parameter for the classification of diphthongs. It remains to be seen which parameters are relevant for Jamaican diphthongs.

2.3.3 Previous Acoustic Studies of Creole Vowel Systems

Sabino (1996) conducted the most recent of the few existing instrumental studies of the full vowel system of a creole language, looking at the now-extinct Dutch-based creole, Negerhollands. The account she provided is for its last speaker, a Virgin Islands English Creole (VIEC)~Negerhollands bilingual, who died in 1987. F1/F2 plots are given for 118 Negerhollands and 166 VIEC stressed vowels collected in conversational settings and in a recording session at a television station. The vowel systems are mapped in F1/F2 space using the means and variances of the vowel tokens, and then mean formant values for the two varieties are tested for statistical significance using a method developed by Veatch (1991). Although Negerhollands was reported by other researchers to have a phonemic length distinction among its mid and low vowels, Sabino found that her consultant was losing that distinction. She reported that length distinctions among Caribbean creoles are rare and supplemented by quality differences which may work to enhance the length contrast, but could be found in four languages--Guayanese, Jamaican, Negerhollands, and VIEC.

Veatch (1991) examined the acoustic characteristics of the vowels produced by two male speakers of mesolectal Jamaican Creole in an effort to provide a "phonetic grammar" (Veatch's term) for surface forms of vowels in four dialects of English, of which Jamaican was one. He posits the following 17 phonetic qualities for (mesolectal) Jamaican Creole, including 6 short, 8 long or diphthongal, and 3 r-colored vowels:

Table 2.9. Jamaican Creole vowel inventory posited by Veatch (1991:115)

	V		V:		Vr		Vi		Vu	
high	i	u	ii	uu	ir	ur	..	..	..	..
mid	e	o	ie/e:	uo/o:	..	..	..	..	..	ou
low	a	ɔ	aa[7]	ɔ:	ar	..	ai/ɔi:		..	.. ..

Veatch concluded from his study that Jamaican vowels are distributed in acoustic space in a triangular or v-shape, with "maximum density of tokens -- that is, the mode of the distribution -- ...closer to the bottom corner of the triangle". The long vowels (high and mid) are raised and shifted to the periphery of acoustic vowel space relative to their short counterparts (for a discussion of peripherality, see Labov, 1984; Schwartz *et al.*, 1997), which allows them to function as a subsystem in sound change separately from the more centralized short counterparts (Labov, 1994). Veatch's approach to characterizing Jamaican vowels was to posit lexical sets derived from British English and show how exemplars of these sets are phonetically realized in Jamaican words. Although diachronically motivated, one difficulty with this approach is its derivativeness. While the individual measurement of all datapoints makes it possible to independently assess the distribution of vowels, use of an English-based taxonomy for their classification must be viewed with caution because it yields a perspective strongly colored by the sociohistorical relationships between sounds in just one of the source languages (the superstrate English) and its offspring (the Creole), and biased toward only those historical processes such as mergers, etc. which occured in that source. Undeniably, however, until more is known concerning the phonological and phonetic features of the relevant 16-17th century West African inputs to Jamaican Creole, there will remain an imbalance in the background information available to researchers. A second limitation of this study is that it did not look into the variation within the Creole continuum, but rather considered one variety of the Creole (as produced by two speakers) as a reference for the whole creole. The present study examines two points on the continuum, basilect- and acrolect-dominant speech, bringing to light differences and similarities between varieties internal to the Creole phonological system.

2.3.3.2 (KYA) and Jamaican low vowels

In examining the spectral features of Jamaican vowels, particular attention was paid to a particular region of acoustic vowel space. Previously studied by F. Miller (1987), this phenomenon was identified as phonolexical and referred to as (KYA) by Patrick (1992). (KYA) functions as a sociolinguistic variable and affects the phonetic realization of certain stop consonants preceding low vowels. Patrick traces its history back as far as the 17th century and locates its origins in British inputs to Jamaican Creole. (KYA) involves the variable palatalization of velar stops (/k, g/ become /ç, ʝ/) and the occurrence of a palatal glide preceding low vowels [k^j, g^j] before stressed vowels, e.g., [k^ja(ɹ)] "car", [g^jal], "gal". Patrick notes that the velar stop plus glide sequence occurs in disyllabic words where the vowel receives primary stress, with a few exceptions which suggest that (KYA) is spreading by lexical diffusion, e.g., *New<u>cas</u>tle*, *<u>cam</u>paign* where (KYA) occurs in syllables receiving secondary stress. Two facts are crucial regarding the sociolinguistic distribution of this variable: first, (KYA) use is associated with two groups of speakers, whom Patrick calls "prestige" and "traditional". "Prestige" (KYA)-users are generally urban-oriented middle-class and relatively highly-educated, while "traditional" users are rural-oriented working class, with less formal education. Second, palatalization occurs only before those vowels which were low and front in the relevant 17th century British varieties. The front/back vowel quality distinction has been lost for many speakers of Jamaican Creole, such that "traditional" speakers are more likely to display no spectral distinction between the vowels in words such as *cot* and *cat*. Nevertheless, (KYA) only appears in their speech with those vowels which were low and front in 17th century British dialects. Thus, for these speakers, it serves to distinguish minimal pairs. However, (KYA) is similarly distributed in the speech of those who display no merger. The realization of (KYA) was examined in the present study for the current sample of urban- and rural-oriented speakers. Of interest were two questions; first, whether there were identifiable spectral differences between the low vowels of the two groups of speakers, and additionally, whether there were intra-speaker differences between the historically-distinct vowels.

2.3.4 Meeting at the Crossroads between Phonetics and Sociolinguistics: sociophonetic studies

In the field of sociolinguistics, there is a long tradition of examining phonological variables, and some of these studies have investigated the phonetic quality of the variables under study. For example, early studies such as Labov's (1963) pioneering research in Martha's Vineyard, Massachusetts examined the phonetic quality of phonological variants. However, sociolinguistic studies have varied in amount of phonetic detail. Much research has found impressionistic auditory analysis sufficient for establishing differences in vowel quality which relate to social variation. For example, much of the research into the phenomenon of the so-called Northern Cities Chain Shift is based primarily upon auditory assessment of raising, backing, lowering, etc. of vowel quality with acoustic analysis used as a check of auditory perception. Sometimes, in studies for which acoustic measurements did serve as the primary basis for analysis, the words subjected to comparison have frequently not been of similar phonetic environments and do not occur in sufficient number (of individual repetitions) to satisfy the standards of experimental phonetics, although this is inevitable to some extent when the intended object of speech is naturally-occuring conversation (Labov, Yaeger, and Steiner, 1972).

Some of the research which has entailed finer-grained phonetic analysis has been referred to as "sociophonetics", a designation explicitly invoking an intersection between the fields of sociolinguistics and phonetics. These studies have looked at how language-general and language-specific phonetic processes impact sociolinguistic issues such as linguistic variation and sound change. Several sociophonetic studies have examined the operation of low-level phonetic features within the larger realm of linguistic variation and change, and found phonetic differences that aid in explicating phonological phenomena. DiPaolo and Faber (1990) studied what happens at the phonetic level in one case of "apparent merger" in American English. The lexical categories /i/ and /ɪ/ (as in "feel"and "fill") have been described by sociolinguists as being merged in this dialect, that is, all distinctions of quality and quantity were said to be lost. DiPaolo and Faber showed that residual phonation differences were being systematically retained which enabled listeners to distinguish these vowels. All other dimensions of potential contrast, e.g., F1, F2, and duration showed no apparent difference. Indeed, the research on so-called mergers is possibly the most notable body of research to "cross" between phonetics (where it has entered into discussions concerning "incomplete neutralization") and sociolinguistics (Port, Mitleb, and O'Dell, 1981; DiPaolo and Faber, 1990; Manaster Ramer, 1996; Port, 1996).

Other sociophonetic research has been concerned with critiquing the methods sociolinguists use to collect, analyze and interpret their data. Kerswill and Wright (1990) showed (on the basis of electropalatographic data) that there are psychoacoustic factors that influence how researchers transcribe speech sounds. This affects the validity of their transcription (auditory transcriptions often make up the "data" on which analyses are based rather than the physical data themselves). A transcriber may be inconsistent in how they transcribe a given sound, and inter-transcriber differences may also be considerable. Instrumental studies such as these have elucidated low-level phonetic differences between phonological forms which show social (dialectal) variation. They have also sounded a warning against over-reliance on impressionistic auditory descriptions.[8]

The present study seeks to extend the body of literature containing studies of phonological variation which are conducted using detailed phonetic and sociolinguistic information. It is hoped that a fine-grained phonetic analysis might help to highlight phonetic differences in Jamaican vowel systems. The methodology was designed with an awareness of the cautions raised by some of the studies mentioned above--particularly, to be sensitive to the limitations of auditory analysis, and to attempt to address potential inter-transcriber differences.

2.4 Field Methods and Methodological Preliminaries

The language variety studied in this thesis has been characterized as a stigmatized, post-creole continuum variety. Additionally, it has been noted that some of the variation internal to the language spectrum in Jamaica is associated with the interacting variables of region and socioeconomics or social network. These factors, along with the results of a pilot study of Jamaican vowel productions, described below, influenced methodological decisions for the current study, particularly considerations for selecting speakers, choice of region for study, selection of residents from the regions chosen who might serve as fieldwork assistants, and design/data collection procedures. That is, data collection procedures and an overall design were required which would enable both instrumental analysis and comparisons of data from literate and illiterate speakers. This section describes the pilot study, followed by the decisions that the pilot, in conjunction with the background described in the preceding sections, helped to influence concerning fieldwork and methodology for the current study.

2.4.1 The Pilot Study

In order to establish the parameters of the present study, I conducted a preliminary study in February 1995, which examined the vowel productions of three Jamaican speakers, in conjunction with a larger study of folk attitudes toward Jamaican Creole. The sample comprised three mesolectal speakers of Jamaican Creole, two female and one male, from a semi-rural community outside of Kingston. The purpose of this small-scale production study was fourfold: first, to test whether speakers might reliably produce Creole in a formal test setting involving a word list reading task; second, to test an orthographic system for representing Jamaican Creole words; third, to assess potential difficulty of the word list items with a group of speakers who had had a sixth-form (high school) education, or higher; and finally, to ascertain the type of equipment necessary to record, in a fieldwork situation, data of suitable quality for acoustic analysis. Pilot study speakers read two randomizations of a word list containing 169 real-word Jamaican Creole and English CV(C) mono- and di-syllables in the Jamaican Creole carrier frame, Im a rait __ pon di paper, "He/she is writing __ on the paper." Test words contained monophthongal, diphthongal, and r-colored vowels preceded by one of /p,b,t,d,k,g/ and followed by one of /t,d/, and other words of potential interest, including vowel- and h-initial minimal pairs, vowel-final words, and words with initial and final fricatives. Recordings were made in quiet rooms in speakers' homes for one male and one female, in a quiet room at a local school for the second female. Data were recorded, digitized and analyzed with equipment and in a manner similar to that described for the acoustic study reported in Chapter 4, except that interval measures were taken for all vowels, both monophthongs, diphthongs and r-colored vowels.

The first purpose for the pilot study, as mentioned above, was to test whether speakers might reliably produce Creole forms in a formal word list setting. One noted tendency was for speakers in the pilot study to alter their speech from more to less formal styles in the course of reading the long list of words. A decision was made for the main study to emphasize to the speaker, in the instructions preceding the word list reading, that it was not important to correctly pronounce the words, as much as to speak as she or he normally would. It was decided, secondly, that if the speaker's casual code was known to be Creole, I would give the instructions in Creole to reinforce the idea that it was the vernacular in which I was interested. Finally, a conversational task was introduced into the main study to check speaker pronunciations on the word list.

A second purpose of the pilot was to assess the orthographic system chosen (see §2.2.2, for a discussion of the lack of standardization of an orthography for Jamaican Creole). The orthographic system employed for the carrier frame followed Cassidy (1961), a roughly phonetic one-sound-one-symbol method of spelling, with English orthography for the target word. The expected advantages of this method, given the objective of eliciting Creole speech, included general avoidance of English spellings (to discourage an "English mode") and ease of reading the target word. Creole orthographies are unfamiliar to most speakers. Therefore, rather than presenting both the sentence frame and target words in Creole orthography, it was decided that carrier material (held constant from sentence to sentence) be presented in a non-English spelling while the target word (i.e., the new material) occurred in English orthography, which would likely be more familiar to the reader. This system was *chaka-chaka* (mixed), like that of Cooper (1997), but it had fairly successful results. No speakers reported difficulty in reading associated with the mixing of English and Jamaican Creole spellings. Although speakers initially tended to read the first word in the carrier frame "Im" incorrectly, each asked for clarification and had no further difficulty with the carrier sentence. Therefore, a similar approach was used to present the word list in the main study. The *chaka-chaka* presentation was retained, except the carrier sentence was modified to omit ambiguous *Im*, and shortened.

A third purpose for the pilot study was to test speaker difficulty with the words in the list. Here, I was interested not in speaker difficulty with reading the Patois spellings, described above, but in the difficulty of the token words themselves, which were presented in English orthography (see "Data Types and Study Design", below). There were in fact difficulties with reading four of the 169 target words, among them "though" (pronounced as [tʌf, tɹu]), "putt" (as [pʊt]). These, as well as several words with potentially ambiguous spellings were omitted from the word list in the main study (but also see Chapter 4, acoustic study results). Because representation of each vowel in the system (set in a real-word token) was possible with monosyllables alone, disyllabic words were removed from the final list. The number of initial consonantal contexts was reduced; however, the palette of final consonants was also expanded in order to cover all places, as well as all manners (voiced, voiceless, fricative, and nasal) of articulation in order to better study phonetic effects associated with consonantal context. Each possible place of articulation utilized in Jamaican varieties was represented in initial and following contexts; bilabial, alveolar (or alveo-palatal) and velar. See §3.2 for a more complete description of the word list task design for the main study.

The fourth purpose of the pilot speech production study was to test the suitability of the recording rendered by the cassette recorder and lapel microphone for acoustic analysis. Although the quality of recording was suitable for auditory analysis, it was determined that a DAT recording would be more suitable for acoustic analysis. Additionally, I surmised that the higher resolution possible from a digital recording might make it easier to distinguish frequencies present in the signal originating from the desired source from those attributable to background noise at certain frequencies, which would inevitably be an issue in a field situation.

Several of the questions included in the *attitude* study mentioned above also provided useful information in the design of the current study of Jamaican English and Creole vowel production. I investigated laypeople's intuitions concerning where the "deepest Patois" might be spoken as an aid to chosing a location in which to find basilect-dominant speakers for the current study. Respondents in the attitude study most frequently mentioned the parishes of St. Elizabeth and St. Thomas (in concurrence with DeCamp's report, mentioned on page 13).

2.4.2 Demographic Information

Because many Jamaicans maintain simultaneous and active connections between urban and rural life, an attempt was made to locate speakers who had a definite dominant orientation to one area or the other. Network and demographic information were collected for each speaker which made it possible to assess their history of residence in the area, and that of their families going back three generations; friendship networks; their geographic mobility; the presence or absence of both local and foreign audio and televised media into their home; their occupation and interactions with local or non-local workmates and, very importantly, foreign tourists, as well as their educational background. (The demographic questionnaire, with sample responses, is given in Appendix A.) The decision as to whether a speaker was basilect-dominant or acrolect-dominant was made using three sources of information: first, the social network and demographic information just described; second, my own and my field assistants' observations of their behavior in casual conversation with peers (including use of acrolectal and basilectal phonological, lexical and grammatical features); and third, self-reported information about what variety, "Patois" or "English" they felt they used most frequently and how comfortable they were with both (see demographic questionnaire). Respondents were presented a set of questions investigating settings where they might opt to use English or Jamaican Creole, and their attitudes towards these varieties. They were also asked about other languages to which they'd been exposed, such as in school.

2.4.3 Regions of Study

The choice of regions from which to collect speech was based on three pieces of information: respondent opinions provided in the pilot phase of the study concerning the regions in which it is likely to find acrolect- and basilect- dominant speakers, background reading, and my own impressions, given my familiarity with the island. Kingston/Upper St. Andrew was the most obvious locale in which to seek acrolect-dominant speakers. Respondents in the pilot study suggested the old Maroon settlements of Accompong in St. Elizabeth and Nanny Town, St. Thomas as regions where speakers of the deepest basilect might be found. Selection of study locations was based on availability of appropriate fieldwork assistants for gaining access to speakers (see below) and transportation.

2.4.4 Fieldwork Assistants and Transcribers

Two fieldwork assistants were hired who were familiar with several rural districts in St. Thomas and who might mitigate my effects on the recording session as an outsider to those areas. These fieldwork assistants assisted in making connections and eliciting basilectal speech. One had some training in linguistics; the other, experience in interviewing methods and connections to the Golden Grove Banana Farm, where several interviews were subsequently conducted.[9] Both were from St. Thomas; not from Nanny Town, but about five and four miles south of it, respectively. Additionally, these two women had acquaintances in the desired areas of the Kingston/Upper St. Andrew area who then, along with my own contacts, comprised the acrolectal sample. Certainly the fact that my university-educated fieldwork assistants were friends of some of the St. Thomas speakers means that these speakers' networks were not exclusively rural-oriented. However, we did the best we could to find speakers fitting the desired criteria for rural-orientation. Data for this study were collected with the aid of these fieldwork assistants.

In addition to the two fieldwork assistants, I had the assistance of two Jamaican transcribers, one in Jamaica, and a second upon my return to the States. Transcribers were selected for combined skills of competence in basilectal Jamaican Creole and also in linguistic transcription. Using Cassidy's orthographic system (described in §2.2.2), the transcribers typed and timestamped the conversational recordings (see Data Types and Study Design, below). I double-checked all transcriptions against their respective tape recordings. Timestamping entailed providing a time index on the transcript at two-minute intervals of time elapsed on the tape. To check inter-transcriber consistency, transcribers completed one transcription in common, and I then checked their work. Inter-transcriber consistency was estimated to be around 90 % (involving mostly differences in spelling words for which Cassidy allows multiple spellings, e.g., *hafi/afi, truu/tru "through")*. Each transcribed 5 of the 9 conversational sessions across which the 28 Kingston and St. Thomas speakers recorded for the word list task were distributed (see Chapter 4, Appendix D). When one of the fieldwork assistants described above was unable to attend two of the St. Thomas word list sessions, the transcriber who worked on location in Jamaica was trained to take her place. This transcriber was also present for the basilectal conversational sessions, so that it might be easier for her to transcribe later.

2.4.5 Data Types and Study Design

I wanted to collect data that would capture the maximum number of contrasts between vowels, be potentially comparable across both literate and illiterate speakers, and of a quality suitable for instrumental analysis. To this end, I decided to gather data from three tasks or types of settings: word list, conversational, and picture.

Traditionally, word list data are the type most frequently analyzed acoustically. Target words are elicited in sentence positions where phonological and phonetic factors such as sentence stress may be controlled. Such considerations were important for this research, because vowel duration was a desired object of study. Patterns should emerge most consistently in these and other features of the vowel when several repetitions of a the same set of sequences are collected. In addition to these linguistic considerations, the experimental setting in an acoustic study is carefully controlled to block out or avoid ambient noise, so that recorded materials will be of sufficient quality for instrumental analysis. For these reasons, a word list task was designed to be the primary source of data for this study.

However, while word list data potentially allow for the most detailed instrumental analysis of vowel data, the experimental setting in which they are collected is one in which speakers will most closely monitor their speech. Jamaican speakers may judge English, rather than Creole, most appropriate for this setting, making it difficult to elicit Creole speech. This potential problem was addressed in two ways. The first concerns the design of the word list task, the second concerns introduction of a second task, described below. Creole use was encouraged in the word list task by setting target words into a Jamaican Creole carrier phrase, *Unu rait __ pon it* "You (pl.) wrote __ on it". The fieldwork assistant took an active role in the word list session, particularly in sessions with basilect-dominant speakers. If the speaker was basilect-dominant, the fieldwork assistant provided instructions for the word list task in Jamaican Creole.

During the word list reading, the fieldworker also assisted the speaker if he or she had difficulty with any words. This assistance took the form of providing clues or synonyms for target words. Speakers were instructed to speak in the session as they normally do in everyday conversation. For consistency, acrolect-dominant speakers also read words set in the Jamaican Creole carrier phrase.

The second step taken to increase the possibility of collecting casual speech was to additionally record each speaker in casual (potentially less-monitored) conversation. Thus, a conversational session constituted a second "task" in which speech data were collected. The field assistants' role in the conversational task was to help conversation to proceed more smoothly, facilitating introduction of topics and interacting normally with those in the group who were their familiars, thereby serving as insiders to the group. This made it possible for the researcher (myself) to participate minimally in conversation, to avoid a situation where speakers might converse more formally. (Blom and Gumperz, 1972). Generally, the fieldwork assistant initially set up conversational sessions with the aid of a "key person" in each conversational group, who recruited several friends for the session, and then helped the fieldwork assistant to keep conversation flowing. This made it additionally possible for me to background myself from the conversation.

Because it was likely that at least some basilect-dominant speakers would have difficulty reading the word list, a picture task was included for the St. Thomas speakers (and available for any of the Kingston sample had they showed similar difficulty). Speakers were asked to describe in a sentence what they saw, using a common carrier frame suggested by the fieldwork assistant (see §3.2.3). This task, though somewhat structured, was more casual than the word list task, because it allowed some creativity on the part of the speakers. However, it was hoped that speakers might place the target word in the same carrier settings to make the target words suitable for acoustic comparison.

Conversational data were collected in the first of two sessions that were held with each speaker, word list and picture data in the second. This ordering afforded speakers an opportunity to interact more informally with the interviewer(s) in the first meeting, without the heightened attention to speech and potential ideas concerning the focus of the study that beginning with the word list might have introduced.

Notes to Chapter 2

[1] In fact, the discipline of "creole linguistics", "creole studies" or "creolistics" has itself often been classified under the heading of sociolinguistics, a classification away from which many researchers would like to move because of its inherent suggestion that the objective of study is the historical development of, and variation within, a creole, rather than study of other features (syntax, phonetics/phonology, etc.) in which respect a creole happens to be interesting. Rather than talking about the relevant creole literature in the section on sociolinguistics, I will describe it within the sections on sociolinguistics and phonetics, where relevant.

[2] For example, in 1768, Europeans numbered 18,000, while Africans numbered more than 160,000. In total, 747,500 slaves were transported to Jamaica, more than 65% from ports on the Gold and Slave Coasts (LePage, 1961). Note, however, that port of embarkation information does not reliably indicate what people groups these slaves came from. The best available evidence, primarily captains' logs, suggest that these were Kwa-speaking people.

[3] The parallel active construction in Jamaican Creole for this passive would be *Dem kot di trii-dem* "They cut the trees", where there is an expressed agent "Dem".

[4] Carrington (1992) has questioned the concept of the post-creole continuum. He argues that, although better-motivated than the binary image of "a" Creole and "a" Jamaican English, the unidimensionality and linearity the continuum model suggests makes it more of a liability than a helpful illustrative device. Jamaican Creole, he argues, is a multidimensional construct, with "upper, middle, and lower levels" which variably penetrate each other. The implicational scaling which the continuum model implies is not possible. Rickford (1987) on the other hand, argued that unidimensionality and linearity are not integral to the continuum concept.

[5] It may be worth noting that ethnicity is correlated with social class in Jamaica. The highest classes tend to contain so-called "Jamaica whites" (those of European heritage), and those of East Indian, Syrian and Chinese ancestry. This group comprises 10-12% of Jamaican society. Jamaica "brownings" (those of mixed racial heritage) are usually upper-middle class. Blacks fall into the lower strata. There has been very little blurring of this color-line since Jamaican Independence (E. Miller, 1986). Perhaps the most notable exception is P.J. Patterson, Jamaica's current prime minister, who is black.

[6] Note, however, that in my study of Jamaicans' attitudes toward Jamaican Creole and English, 76% of respondents interviewed said that one can say anything in Jamaican Creole that can be said in English, and 43%, when asked to make a choice between the members of the pair of descriptive words "expressive~limited", said that the word "expressive" better described how they felt about Jamaican Creole than did the word "limited".

[7] It is unclear why Veatch uses both geminated vowels such as [aa] and the lengthening diacritic [ɔ:] in his transcriptions.

[8] This is not to say that auditory descriptions are never appropriate. There are clear cases where auditory analysis is entirely suitable, such as binary judgements as to

whether a sound is palatalized or not, for example. Acoustic analysis is not required for all studies of linguistic variation or sound change. Moreover, taking acoustic measures does not ensure the accuracy of one's findings. Appropriate measures must be taken in sufficient quantity from a well-designed sample, and must be well-interpreted.

[9] Data were also collected Quickstep, St. Elizabeth, a village near to Accompong in Cockpit Country. These data are not reported here, as they were not comparable to those collected for the Kingston and St. Thomas speakers.

CHAPTER 3

METHODS FOR THE ACOUSTIC STUDY

As noted in Chapter 1, two studies, one acoustic and the other sociolinguistic, were conducted in this thesis project. It is the acoustic study with which we are concerned in this chapter, and in Chapter 4. The acoustic study examines similarities and differences in the vowel production of acrolect-dominant and basilect-dominant Jamaican speakers. This chapter sets out the procedures involved in collection of data for the acoustic study. Sections 3.1 - 3.6 describe the procedures used in the acoustic study for sampling, elicitation, acoustic and auditory analysis, and sociolinguistic coding, of vowel data. Data were collected in three tasks which are described here--word list, conversation, and picture. Field methods are described in detail in §2.4, Field Methods and Methodological Preliminaries. Acoustic study results are discussed in Chapter 4.

3.1 Sampling Issues & Procedures

In its methodology and analysis, this study brings together the two linguistic subfields of phonetics and sociolinguistics. Researchers in these disciplines have tended to sample speaker populations according to different criteria, being driven by different research concerns. Acoustic phonetic studies, particularly cross-language studies, use sampling criteria such as native language (and dialect) of speaker, gender, exposure to non-native languages, etc. in order to examine variation in production or perception of phonemic or phonetic contrasts. Sociolinguists generally study phonological variation within speech communities referring more systematically to sociodemographic criteria such as age, gender, social network, social class, or neighborhood or community of residence, etc., all of which potentially affect phonetic realizations of specific phonological variables. As was discussed in §2.2, studying variation within the Jamaican continuum essentially entails study of a language variety with a range of regionally and socially determined forms which differ widely from each other. A combined approach was taken in order to enable comparison of phonetic features which may vary among speakers according to sociolinguistic factors. The Jamaican case is a sensitive one because of the stigmatization of Jamaican Creole, which always poses a challenge for its elicitation (see §2.2.1). To address this issue, methods were employed that were informed by sociolinguistic research concerned with elicitation of a stigmatized variety.

The sample was balanced according to gender and age. Variation in the sample according to these factors potentially contributes to phonetic variation in vowel production in terms of (at least) fundamental and vowel formant frequencies. From a sociolinguistic perspective, both gender and age are key variables correlated with variation in production of creole forms; i.e., in terms of language choice (Nichols, 1983; Rickford, 1991; Beckford Wassink, 1999). The effects of these variables operate differently for different creole varieties. First, with respect to gender, Nichols (1983) reported that males tended to use more Gullah forms than females, while Rickford (1991) and Escure (1991) reported that females use as much, if not more creole than their male counterparts. One study within the Jamaican continuum reported that males' attitudes toward use of Jamaican Creole were more favorable overall than females', but that age and gender showed a cumulative effect such that younger males were likely to be most positively predisposed to the Creole overall (Beckford Wassink, 1999). Gender, therefore, is an important extralinguistic factor to examine.

Second, selected speakers were between the ages of 20 and 45, to control for differences in vowel production which might result from differential Jamaican Creole usage associated with larger age differences, or from different attitudes toward Jamaican Creole linked to older or younger speakers. A negative predisposition toward Creole might make elicitation more difficult, particularly in an experimental setting, and would also be likely to reduce the opportunity to study language changes in progress (see §2.2.1). In addition, restricting age allowed for control of possibly age-related physiologically-based differences in vowel production.

Third, speakers were targeted who were embedded in certain types of social networks and displayed certain social profiles. Desired network types were either rural-oriented (for those who were basilect-dominant) or urban-oriented (for those who were acrolect-dominant), with the bulk of informal social contacts in the resident area. Basilect-dominant speakers were required to have grown up, attended school (if any), been employed (if applicable), and remained in the district of birth. Information was gathered concerning types of media programming to which a speaker was exposed, and the kinds of appliances contained in their household. An overall measure, called the network strength score, of their integration into their local community was used. This measure is discussed in Chapter 5. Degree of contact with tourists was noted for all speakers. The nature of the network of informal and formal social ties a speaker maintains has been shown to strongly influence his or her linguistic repertoire (Milroy and Milroy, 1992). Other sociolinguistic variables were taken into consideration in sampling, as well. Basilect-dominant speakers were lower-working class, and acrolect-dominant ones were either middle or upper-middle-class, according to the criteria of the Jamaican Census Bureau, which takes into account occupational type and level of education.[1] The study described here investigated the speech of Jamaicans with different network types, or orientations--rural or urban. The sample was small in terms of representativeness of the wider community of "rural" or "urban" speakers, but was large in size for detailed quantitative phonetic analysis, in which many tokens per speaker are required for analysis.

3.2 Tasks and Materials

Data for the acoustic study were collected in three tasks: conversational, word list, and (for the St. Thomas speakers) picture. These tasks made it possible for data to be collected in settings distinguished by their potential for encouraging more or less careful attention to speech, and for roughly comparable data to be collected for both literate and illiterate speakers. Field methods associated with these tasks are described in detail in §2.4.5, Data Types and Study Design.

3.2.1 Conversational Task

Conversational data were collected so that a sample of a speaker's relatively casual speech might be compared against his or her word list productions. Eight conversational sessions, each 60 to 90 minutes in length and comprised of two to four speakers, were recorded and transcribed using the equipment described below in §3.3. All speakers who read the word list were also recorded in casual conversation. Small groups were attended by myself plus one fieldwork assistant and/or transcriber. Recording proceeded until about 25 minutes of speech had been contributed by each speaker. Conversational sessions proceeded around topics chosen by the members of the group, with the fieldworker (or transcriber) directing questions to maintain the flow of conversation, encourage participation, and open the floor when a single speaker seemed to be dominating. Each group had a "key person", usually the speaker who had invited the others in the group to participate, hosted the gathering, and had been the original contact for setting up the meeting(see §2.4). The presence of this person also proved helpful on occasion in encouraging other group members to speak, presumably because this person felt some responsibility for the success of the conversation, given that they had assisted in recruiting the others. Conversational sessions were transcribed and digitized following the procedures described below in §3.5. Transcripts were examined for CV(:)(r)C monosyllables matching target words in the word list task. These words were flagged on the transcript, located in the digitized sound file (using a time index) and saved to an individual sound file for acoustic analysis.

The vowels in cliticized, or otherwise reduced forms of word list tokens were not selected for acoustic analysis. Clitics are grammatical operators which are functionally dependent upon neighboring syntactic phrasal structure. Vowels in such words are typically unstressed and generally have an acoustic structure (both spectral and temporal) which varies greatly from non-reduced forms. Often, no measurable vowel portion is present. Affected (and hence omitted) words in the Jamaican conversations included the conjunction "cause" (the derivative of "because"), which tends to reduce to [ka:] in all Jamaican varieties in casual speech, and "could" which tends to reduce to [k(i)d], with a greatly reduced or undistinguishable vowel segment. On the other hand, the auxiliary verb "can", which reduces in varieties of American and British English to [kn̩] tended not to be reduced, and was included in the acoustic analysis.

A tally of the number of tokens extracted from conversational data for each speaker is provided in Appendix E. (Speaker groups for the conversational sessions are described below, and a sample conversation transcript provided in Appendix D).

3.2.2 Word List Task

Word list data were collected because they are most appropriate for a detailed instrumental analysis of vowel data. The word list contained 226 real-word Jamaican Creole and English CV(:)(r)C monosyllables in the Jamaican Creole carrier frame, *Unu rait* ______ *pon it*, "You (pl.) wrote _____ on it".[2] Target words contained a monophthongal, diphthongal, or r-colored vowel preceded by one of /b, d, k/ and followed by one of /p, b, t, d, k, g, s, z, n/. The word list is given in Appendix B; the breakdown according to vowels is given in Table 3.1. This table presents the number of possible occurences of each vowel across the real-word items in the wordlist. Vowels were classified according to orthographic category. By this, it is meant that words were classified together with other words of similar spelling. Speakers read four randomizations of the list, for a total of 904 sentences per speaker. CV(:)(r)C monosyllables were chosen because they allowed collection of the largest number of real-word items that varied only in identity of the vowel, across different consonant contexts. Particular initial and final consonants were chosen to allow examination of effects related to place of articulation (bilabial, alveolar, and velar) on vowel production. A voiceless, rather than voiced velar, /k/, was chosen because this consonant is known to be palatalized before /a/ for some speakers. This variation is socially determined, and of interest in this study (see §2.3.2 and also, Patrick, 1992 for a discussion of the sociolinguistic variable (KYA)). CV(:)C, but not CV(:)r(C), target words were digitized and subjected to acoustic analysis; r-words were included as a check of speaker use of postvocalic r, but were not subjected to acoustic analysis. The total number of possible words analyzed instrumentally for a given speaker, then, equalled 748. A tally of the number of tokens extracted from word list data for each speaker is provided in Appendix E.

Table 3.1. Distribution of vowels among tokens in the word list and picture elicitation tasks. Vowels were classified according to orthographic category. Word list counts are calculated over 4 repetitions of the 226-item list, picture counts over 1 repetition of the 59-item list.

Orthographic Category	Short Vowels				Long Vowels				Diphthongs				Vr				*total*
Word List Task:	ɪ	72	ʊ	12	iː	68	uː	76			oː	64					
	ɛ	68	ʌ	88					eː	56	aʊ	28	eːɹ	32	ɚɹ	48	
	a	68	ɔ	76			ɑː	16	aɪ	48	ɔɪ	4	aɹ	48	ɔɹ	32	
total:		208		176		68		92		104		96		80		80	904
Picture Task:	ɪ	4	ʊ	2	iː	7	uː	3			oː	6					
	ɛ	2	ʌ	4					eː	4	aʊ	2	eːɹ	1	ɚɹ	3	
	a	7	ɔ	2			ɑː	2	aɪ	4	ɔɪ	2	aɹ	3	ɔɹ	1	
total:		13		8		7		5		8		10		4		4	59

Speakers were instructed to read at a normal pace and consistent inflection, without pausing within the sentence. Each was told that we were not interested in "proper" pronunciation, but in the way they ordinarily spoke, our focus being how individuals in different regions of Jamaica speak. Because the spelling of the Jamaican Creole carrier frame *Unu rait _____ pon it* was possibly unfamiliar (see §2.2.2), I or the fieldworker ensured that each reader understood what the carrier meant before beginning the task. To further facilitate understanding of the task, two sets of instructions were prepared, one in English, another in Jamaican Creole. Instructions were delivered by myself, or by the fieldwork assistant if known to the speaker.

Mispronounced words were presented again at the end of a randomized set. In some cases, a reader had considerable difficulty with the task. When this occurred, he or she was given the option to finish the first set and was subsequently given the picture task rather than asked to begin the second set. This was the case for three male speakers in the St. Thomas sample, and one female in the Kingston sample.[3]

3.2.3 Picture Task

For as many of the word list items as possible, pictures were collected from magazines, newspapers, or drawn. This made it possible to collect data that were roughly comparable to the word list forms (i.e., words in a constant carrier frame read with similar focus and inflection) for less literate speakers. These were presented to the St. Thomas speakers following the word list task. Speakers were asked to provide a sentence describing what they saw, using a carrier, *Mi sii a* __ "I see a __", suggested by the fieldworker. To avoid ambiguity, the intended (target) word was printed on the card with its picture. This cue seemed to aid speakers with even the most rudimentary reading skills. A set of 59 pictures was compiled, with each potential vowel type represented at least once. (Table 3.1 gives the breakdown of vowels occurring in the picture task.) In the sentences speakers provided, the target word generally appeared in focused, stressed position. Picture words were generally read only once, although some speakers uttered the target word in isolation before setting it in a sentence. In such cases, both instantiations were digitized, and sentence frames noted, so that consonant contexts could be compared. Picture task words are reproduced in Appendix F, and a tally of resulting vowel tokens analyzed for each (St. Thomas) speaker is provided in Appendix E.

This task was one which speakers seemed to enjoy a great deal, suggesting that they felt free to use their vernacular. Two speakers did occasionally volunteer English sentences. When this occurred, I inquired, *A Patois dat?* "Is that Patois?", at which they generally smiled, and switched to Patois.

3.3 Recording Procedures and Conditions

The three tasks described in the previous section were collected across two separate recorded sessions. First, speakers participated in one informal conversational session. Conversational sessions were conducted in a home or accustomed meeting place of the speakers in that group. Later that day, or within several days, speakers came into a sound-attenuated recording studio at the language laboratory of the University of the West Indies (Kingston speakers) or to a quiet room (St. Thomas speakers) for a second session to record the word list and picture data. This second session generally lasted from 50 to 120 minutes (the longer times occurred for speakers who completed the picture task in addition to the word list, particularly when they had difficulty reading).

Recordings were made using a Sony DAT Walkman TCD-D8 and AIWA JS215 stereo lapel microphone, with two exceptions. Two conversations, B and C (see Table 3.2), were recorded using an Azden WLX-PRO wireless remote microphone with a transmitter and remote receiver located in a separate room with the DAT recorder. This system was subsequently abandoned because the output was not as high-quality as that obtained with the stereo microphone, and the voices of those sitting next to the speaker were not always reliably picked up. The stereo microphone provided appropriate range and directional control so that normal ambient noise did not substantially interfere with the desired signal. For transcription purposes, digital tape recordings containing conversational data were dubbed to analog audio cassette and transcribed by the transcribers using a Panasonic Standard Cassette Transcriber RR-830.

Regardless of how closely an experimenter endeavors to control recording conditions, collecting data in naturalistic settings often brings unforeseen eventualities. During the rural phase of the fieldwork period, Jamaica was hit by a tropical storm which brought five days of flood rains and extensive damage to particularly the southern parishes of the island. These conditions made it impossible to record speakers on days when they had been given time off to participate in the study. To avoid missing other potential speakers, I ventured out at the first sign of a lull in the downpour. I was able to record four speakers I otherwise would have missed. However, the rains returned while I was recording the first speaker, and heavy rain is audible in the background on portions of these speakers' tapes. Special filtering procedures were used to make analysis of these data possible (see §3.5, below).

3.4 Speakers

Data for 20 speakers are analyzed in this study, the sample fairly balanced between acrolect- and basilect-dominant, male and female, speakers. Eleven were from rural districts in the parish of St. Thomas (six males and five females); and 9 from the metropolitan Kingston area (five males and four females). Speakers were between the ages of 20 and 39, and had no known speech or hearing difficulties. Speakers were paid $J350 ($US10) for their participation.

Table 3.2 presents details of the speaker sample. Speakers are listed by initial, prefixed by K if recorded in Kingston, or T if in St. Thomas. Gender, age, conversational session index (representing the group of speakers who participated in a session) and field assistant (or transcriber) present for their conversational and word list session are also given. Where there is no fieldworker or transcriber listed, this means that I alone was present for both the relevant conversational and word list sessions. Only one of the St. Thomas-born fieldworkers, FW1, attended the recording sessions. The transcriber, T1, was present for the conversational sessions conducted in basilectal Creole (see §2.4.4-5).

Speakers participating in the conversational settings together were required to be familiars (i.e., those with whom a speaker had informal social ties; see §2.4) so that these sessions could be conducted with individuals likely to use their most casual speech style with the others in the group. Speakers who participated in conversational sessions were also recorded reading the word list.

Location of residence and sex have already been mentioned as speaker-dependent demographic factors which will be examined in this study. Further

Table 3.2. Speaker sample for the acoustic study.[4]

Speaker	Gender	Age	Conversational Setting Index	Fieldworker Present
KR	male	21	B	FW1
KT	female	22	B	FW1
KD	female	24	B	FW1
KM	male	37	C	
KC	female	32	C	
KF	female	33	C	
KE	male	24	J	
KW	male	23	K	
KU	male	20	K	
total number of Kingston speakers = 9				
TT	female	32	E	T1
TL	female	29	E	T1
TB	male	24	F	FW1, T1
TE	male	31	F	FW1, T1
TI	male	24	F	FW1, T1
TA	male	35	G	FW1, T1
TH	male	22	G	FW1, T1
TX	male	24	G	FW1, T1
TM	female	33	H	FW1, T1
TJ	female	25	H	FW1, T1
TV	female	39	H	FW1, T1
total number of St. Thomas speakers = 11				

demographic and network information was collected for each speaker, and was used to code each vowel. In the final dataset, each vowel was coded with sociolinguistic information associating it with a particular speaker, as well as with phonetic information about the word in which it was produced. This coding structure facilitated comparison between the vowel productions according to the factors listed in Table 3.3.

Table 3.3 Coding scheme for phonetic and sociolinguistic analysis.

Example: below is the coding for the vowel /ɪ/ from the second occurrence of the word "kid" extracted from the conversational speech of speaker X from St. Thomas:

table key:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
code:	t	x	m	8	h	c	w	a	v	a	1	s	2	v	kid	s	hf

sociolinguistic factors	phonetic factors
1. location of residence (kingston, st. thomas) 2. speaker (initial) 3. sex (male, female) 4. network strength score (#) (See §5.1) 5. education (primary or less, high school, university) 6. employment category[5] (unemployed, student, common laborer, public-sector employee, private-sector employee/self-employed professional, owner/director of business) 7. social class (middle, working)	8. vowel 9. place of articulation of preceding consonant (labial, alveolar, velar) 10. place of articulation of following consonant (labial, alveolar, velar) 11. voicing of following consonant (0:[-voi],1:[+voi]) 12. manner of articulation of following consonant (stop, fricative, nasal) 13. repetition (1-4) 14. session (wordlist, conversation, picture) 15. word 16. vowel length category (long, short) 17. vowel quality category (HighFront, HighBack, Mid, Low)

3.5 Acoustic Analysis

Target words were digitized at a sampling rate of 11 kHz and low-pass filtered at 5.5 kHz. These words were subsequently analyzed using Soundscope analysis software by GW Instruments. Appendix E provides the number of vowel tokens comprising the datasets for each speaker, for each of the three tasks: conversational, word list, and picture (for St. Thomas speakers). On average, 650 of the word list tokens collected per speaker, and 40 of the conversational tokens (and 40 of the picture tokens for St. Thomas speakers) were of sufficient quality for acoustic analysis, and were thus included in the final dataset for that speaker. Target words extracted from the conversational and picture sessions for each speaker were digitized and measured using the same procedures as for word list data. However, because stress conditions and surrounding phonetic contexts, among other factors, were not identical to those of the word list data, results for word list data were not pooled together with conversational and picture data for the analysis.

Temporal and spectral measures were taken from the acoustic signal for each vowel occurring in a CV(:)C word. The two sections which follow (§3.5.1 and §3.5.2) describe the two types of acoustic measures separately. Section 3.5.3 describes the methods used for normalizing spectral data. Section 3.5.4 describes measures that were based on a combination of spectral and temporal information.

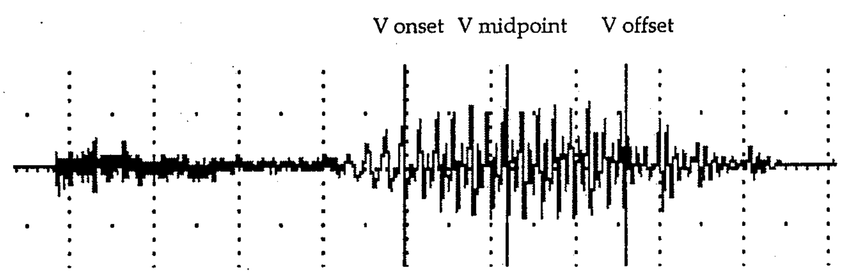


Figure 3.1. Placement of markers for vowel onset, midpoint, and offset.

3.5.1 Temporal Locations and Measures

Vowel onset, midpoint, and offset constituted the basic temporal locations on which temporal and spectral measures were based. Midpoint consisted of the true midpoint for monophthongal vowels, and the midpoint of the nucleus portion of a diphthong for diphthongal vowels (described below). Figure 3.1 provides an example of manual placement of markers for these three positions. Vowel onset was determined from the waveform as the first regular pitch pulse following release of closure of a preceding consonant. Offset was defined as the last regular pitch pulse in the periodic signal where the following consonant was an obstruent. Where the following consonant was a nasal, offset was defined as the point in the waveform at which the complex wave smoothed (i.e., appeared to have fewer components), which was generally accompanied by a decrease in the amplitude of the signal. This location was checked on the spectrogram for the presence of a nasal consonant (murmur). Portions of the signal were auditorily inspected and compared, where necessary, to aid in cursor placement.

Locations for vowel midpoint and interval positions (described below) were determined using an automatic procedure. Vowel duration was automatically calculated from vowel onset to offset locations (T_{off}-T_{on}). Midpoint for monophthongs was automatically calculated as the point halfway between these two points (T_{on} + 1/2 Vdur). For diphthongs, a "nucleus midpoint" location was calculated, intended particularly to allow comparison of downgliding vs. upgliding or monophthongal realizations of /eː, ie, oː, uo/. The midpoint of the diphthong nucleus was taken to be the interval measure (described in §3.5.2, below) closest to a point 1/3 of the distance into the vowel (Figure 3.2). This location was selected on the idea that it represented a point in the vowel after the effects of the preceding consonant would likely be reduced, and possibly in sufficient time for an articulatory target for the diphthong to be reached.[6] Other researchers have made use of this general region to define the nucleus of a diphthong. For example, Jenkins, Strange, and Edman (1983) made use of the 1/3 distance calculation for the construction of nucleus-attenuated silent-center stimuli for a test of perception of American English vowels.

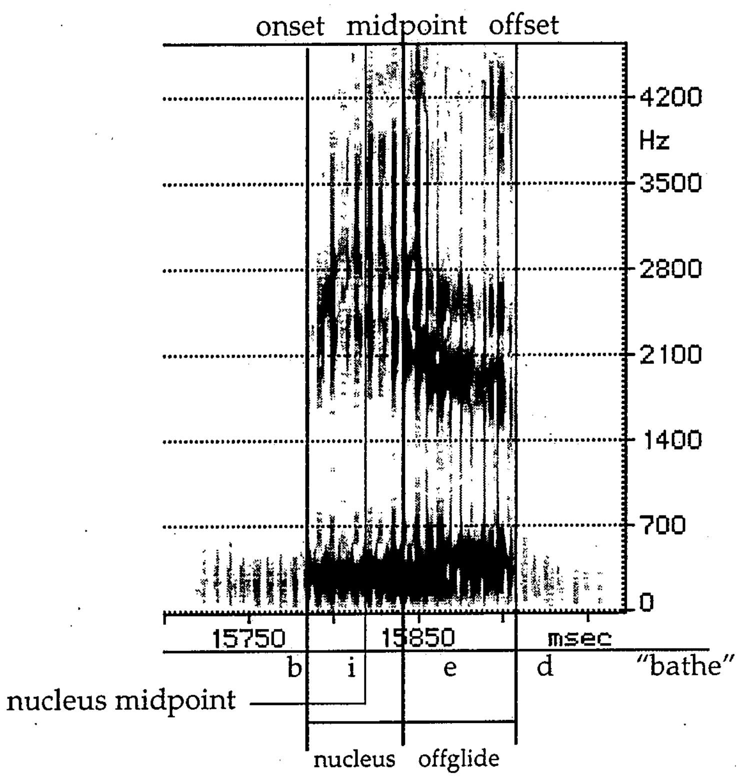


Figure 3.2. Spectrogram illustrating the partitioning of a diphthong into nucleus and offglide, and designation of nucleus midpoint.

3.5.2 Spectral Measures

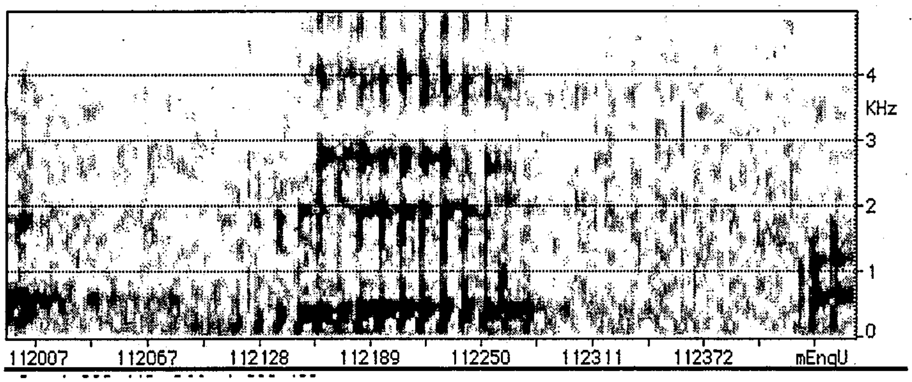
Spectral measures included a base set of measures (at onset, midpoint, offset) taken for all vowels, with an additional set of interval measures for /ie, eː, uo, oː, aʊ, aɪ, ɔɪ/ only. For the base set of measures, formants F1 and F2 were taken at vowel onset, midpoint, and offset, yielding a minimum of six spectral values for each vowel. If the vowel was a member of the set /ie, eː, uo, oː, aʊ, aɪ, ɔɪ/ an additional set of formant measures was taken at 12.5 ms intervals across the duration of the vowel.[7] On average, eight intervals (yielding an additional 16 values beyond the base set of 6, for a total of 22 measures) were taken for vowels in this set.

f0 and F3 were measured, but were not reliably calculated by the analysis software (additionally, F3 was frequently too faint to visually detect), and therefore were not used further for this study. Also, in the final analysis of data for the study, spectral measures at vowel onset and offset were not examined. Measures for vowel onset and offset were included only in calculating Grand Means for F1 and F2 as part of the procedures of data normalization for each speaker (see §3.5, below). Only spectral measures for vowel midpoint (monophthongs) and for 1/3 intervals (for diphthongs) were compared and summarized in Chapter 4. A decision was made to omit onset and offset from comparisons to achieve a dataset of manageable size for this study. Choice of vowel midpoint (for monophthongs) and 1/3 interval (for diphthongs) positions as the basis of comparison for vowel data was made because the effects of flanking consonants are generally believed to be smallest toward vowel midpoint, and because these positions were taken as the most likely targets positions for the vowel.

Formant measures were based on superimposed FFT and LPC spectra using a 25.6 msec window. FFT analyses used a 59 Hz filter; LPC spectra used 14 predictor coefficients. In an initial pass, formant measures were taken using an automatic peak-picking routine based on the LPC spectra. Then, all automatically-measured formant values were checked visually in the combined FFT/LPC display, and where questionable, corrected or confirmed by examining the combined FFT/LPC spectra and a narrowband spectrogram of the vowel. Usually, there was relatively little discrepancy between FFT and LPC spectra, but in cases of greater discrepancy, the LPC display was relied upon more heavily. This included, for example, situations in which the fundamental frequency of a speaker was quite high, resulting in a frequency structure where harmonics were spaced widely apart, rendering FFT less reliable (particularly for vowels where the formants would be closely positioned, such as F1 and F2 for high back vowels, or F2 for high front ones). Where the signal was additionally of low amplitude, F2 tended to be difficult for the software to discern automatically. In these cases, both the FFT and LPC were sometimes unreliable, and manual correction was necessary.

Signals with substantial amounts of low-amplitude aperiodic energy resulting from rain distortion (see §3.3) were further filtered to enable visual detection of formant structure. For the spectrographic displays of these tokens only, energy below 25 dB was filtered out; however, final formant measures were still based on the unfiltered LPC/FFT spectra. If it was possible to measure a rainy token without resetting the parameters of the spectrographic display, this was preferred. Figure 3.3 shows a sample "rainy" token before and after filtering. Rain did not interfere with any of the conversational recordings, but did interfere with the word list and picture task recordings for TX, TM, TJ, and TV as described in Table 3.4. For TM and TX, this meant loss of one of the four repetitions of the wordlist, while the other three repetitions remained.

(a)



(b)

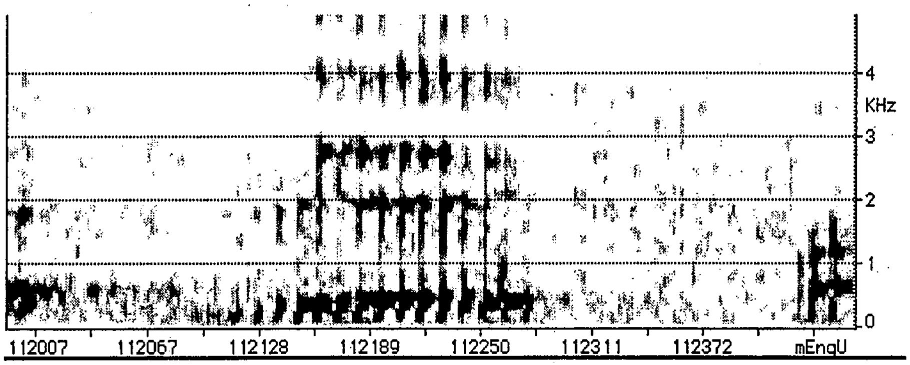


Figure 3.3. Rain-distorted token of the word "bake" for Speaker TX (male, St. Thomas). Panel (a) shows the unfiltered vowel spectrogram, (b) Spectrogram after parameters were reset to filter out energy below 25db.

Table 3.4. Rain-distorted data

Speaker		Filtered data	Lost data
TJ--	wordlist:	88	-
	picture:	14	-
TM--	wordlist:	-	226
	picture:	5	-
TV--	wordlist:	341	-
	picture:	-	-
TX--	wordlist:	315	227
	picture:	56	1

3.5.3 Normalization Techniques

All tokens subjected to acoustic analysis (in wordlist, conversational, and picture tasks) were normalized in order to allow for comparison of data between speakers, and to display vowel data in a manner reflecting some aspects of the sensitivity of the auditory system. Direct comparison of acoustic data in Hertz from different speakers is not feasible because the distribution of vowels in acoustic space is significantly affected by sex- and age-related factors (Hindle, 1978). The normalization technique followed was the scaling algorithm introduced by Nearey which uses log-mean transformed difference values (1977; see also Disner, 1980).

The normalization procedure entailed two steps. In the first step, Hertz values for vowel formants were log-transformed. The logarithmic scale reflects more accurately than a linear (Hertz) scale the sensitivity of the human ear to changes in frequency (Moore, 1989; Nearey, 1989). As the first step in the normalization process, Hertz values for each formant were log-transformed to approximate an auditory scaling. (I follow the convention wherein F2 is plotted on the abscissa in reverse order and F1 on the ordinate, also in reverse order.)

The second step was designed to suppress the effects of inter-speaker variation due to, e.g., sex-related differences. For example, males tend on average to have lower fundamental and lower formant frequencies than females, and their vowel space tends to be more compact overall than that of females, as shown in the examples of non-normalized data for a male and a female speaker in Figure 3.4. For each speaker, the log-transformed frequency of a particular formant (F1 or F2), (G), occurring in a given word (j) for a particular speaker (k) was converted to a difference score (F_{ijk} norm): the difference of that value from the mean of all values for that speaker for that formant. The overall mean ($\overline{G}$) (i.e., the F1 or F2 Grand Mean) was calculated over all realizations (at vowel onset, midpoint, and offset) of that formant for that speaker. The formula for calculation of the log mean-transformed frequency of a formant is provided below in (1). Thus, both F1 and F2, the "coordinates" by which a vowel is located in acoustic space, were plotted as differences from their respective grand means.

(1)

$$F_{ijk}\,\text{norm} = G_{ijk} - \overline{G}$$

(2) expresses this calculation in a way which shows more clearly the uniform scaling property of this algorithm,

(2)

$$F_{ijk}\,\text{norm} = g(F_{ijk}) + b_{ik}$$

where g is a function of frequency for formant F_i, and b is a speaker dependent constant which is essentially added to the raw data for that speaker in log-transformed space. In this method, the mean of all vowels for a given speaker is used as a correction factor, with the center of acoustic space for all speakers being equivalent (i.e., where the center of acoustic space would have the coordinates F2=0, F1=0). Relative distances from a central point are preferred over system-specific values (in raw Hertz) which cannot be compared across speakers. Put simply, this technique makes it possible for vowels produced by different speakers to be effectively mapped onto the same space.

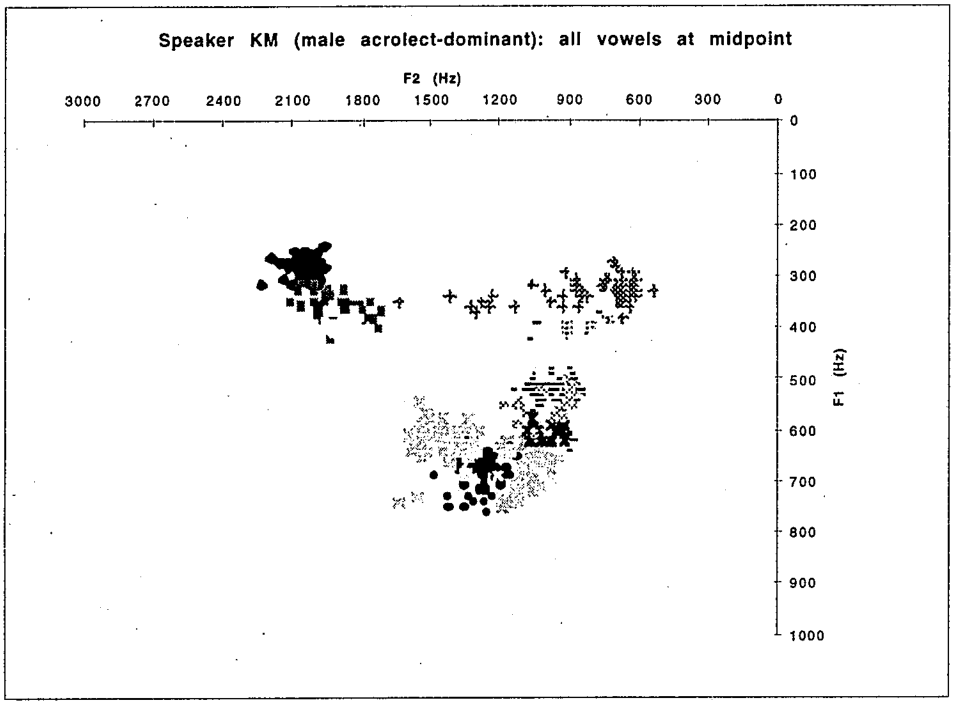
3.6 Auditory Analysis

Acoustic analysis was the first step in analysis of the Jamaican vowel data. In a second step, auditory analysis was conducted on the three types of data (word list, conversation, and picture). Auditory analysis was primarily used to allow flagging of notable features in a talker's speech, and to determine whether a speaker generally spoke the same in the experimental (word list) and casual (conversation) sessions. Soundfiles were listened to for notable features of speaker pronunciation which might be of interest to this study, such as palatalization of the consonant preceding /a/, the realization of r-colored vowels, rising and falling diphthongs, place assimilation of an alveolar obstruent to a following velarized approximant /ɫ/ (e.g., [kʲangɫ] "candle"), and the presence or absence of initial and final consonant clusters. Presence or absence of these features was noted in the database for each speaker, alongside the acoustic measurements. For the conversational data analysis, words showing interesting features were additionally flagged on the transcript, and these patterns are reported in Chapter 4 as a means of supplementing the picture of vowel production provided by the word list and picture data.

3.7 Summary

This chapter has described the procedures used in measuring and analyzing the vowel data of two groups of Jamaican speakers, the first acrolect-dominant and urban-oriented, the second basilect-dominant and rural-oriented. Two types of data were collected for all speakers, from a formal setting (word list), and a casual setting

(a)



(b)

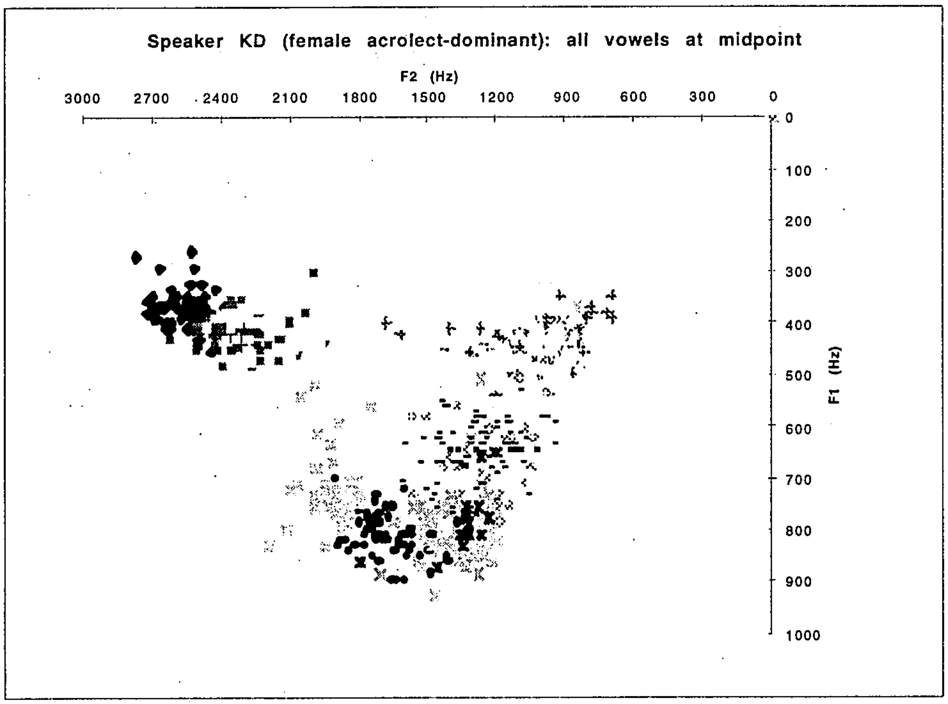


Figure 3.4. Non-normalized F1 x F2 data (in Hertz) for one male speaker (KM), panel (a), and one female speaker (KD), panel (b).

(conversational). The second of these was essentially intended as a check of the features of the first. A third type of data (picture) was collected for speakers who might have difficulty reading, to ensure that some data matching that of the word list and of controlled stress and consonant context would be collected for these speakers. Procedures were described for a two-step acoustic and auditory analysis. Prior to acoustic analysis, however, vowel data were normalized to allow comparison between speakers, and to transform data to a more nearly auditory scale. The acoustic analysis entailed taking a base set of six measures for all vowels, and additionally at regular intervals for diphthongs. A nucleus midpoint measure was calculated and used in place of the true midpoint measure for diphthongal vowels. Spectral and temporal information were used for comparison of the trajectory of change in diphthongal vowels over time. While similar measures were taken for vowel onset, midpoint, and offset (and additionally for nucleus midpoint and 12.5 ms intervals for dipthongs), vowel onsets and offsets were used only as time markers for calculating duration, for normalization calculations, and to locate the beginning and end of the trajectory of a diphthong, (see Fig. 4.4a,b). Thus, in the presentation of results in Chapter 4, three main vowel positions will be used for description and comparison of the data: 1.) vowel midpoint (monophthongs), 2.) nucleus midpoint (for diphthongs), and 3.) interval positions (for characterizing the trajectory of a diphthong). Auditory analysis was accomplished to provide a "bigger picture" view of a speaker's vowel productions. Auditory analysis entailed description of such features as palatalization, rhoticity, and gliding, which supplemented the profile provided by the acoustic data. The next chapter sets out the results of the acoustic and auditory analyses which constituted the acoustic study.

Notes to Chapter 3

[1] Acrolect-dominant speakers were chosen who did not show the marked upper-class dialect described by Irvine (1994) as the "Upper St. Andrew Drawl" (see Chapter 2.3 for a discussion of some of the features associated with this social dialect). Note also that choice of acrolect-dominant and basilect-dominant speakers for this study distinguishes it from those of Veatch (1991) and Patrick (1992), both of whom looked only at mesolectal speakers. Some care must be taken, then, in comparing results from this work with those of the aforementioned studies.

[2] r-colored vowels were included to investigate the presence or absence of rhoticity in these varieties. Jamaican Creole and certain varieties of Jamaican English are described as being non-rhotic.

[3] For two of the male St. Thomas speakers, as it became apparent that they were experiencing difficulty reading, they were asked if they wished to discontinue the task. However, indicating that they would not, they struggled through the remainder of the first set, each taking in excess of 1 1/2 hours to do so. The fieldwork assistant and I developed a system wherein we described the target word or a rhyming word (which the assistant would provide, rather than myself so my pronunciation would not have an adverse affect), giving the speaker an opportunity to yet "discover" the word. This method was highly successful, and made it possible for one complete randomization of the wordslist to be obtained for these two speakers. This method was also successfully employed for other speakers who were requested to correct mispronounced words.

[4] Speakers are identified by an initial, prefixed by K if recorded in Kingston or T, if in St. Thomas. Gender, age, conversational setting index, and initials for the fieldworker or transcriber present in a speaker's word list, picture task and conversational sessions are also given. For example, speaker KT, a female Kingston resident, participated in a conversational session (indexed B) with three other speakers, myself, and fieldworker FW1. T1 indicates the sessions wherein Transcriber 1 served as fieldworker (see §2.4.4).

[5] The Jamaican Ministry of Labour uses three income-based "occupation" categories as indicators of social class, namely: public-sector work (e.g., high ranking civil servants, public administrators); private-sector (e.g., management, self-employed professionals); and, owners/directors of businesses (Irvine, 1994). Rickford (1986), Patrick (1992) and Beckford Wassink(1999) have discussed the difficulty of operationalizing social class indicators such as income for use in non-industrialized societies such as Jamaica.

[6] A subset of 311 vowels (from the data of TB, TJ, TM, TX, KD, and KU) were treated differently from what has been described. This subset included those words with lexical diphthongs which were produced as monophthongs (see following footnote). In the earliest stages of analysis, the rate of change in F2 criterion was used to determine which vowels would receive interval measures in addition to the base set of onset, midpoint, and offset measures. Diphthongs measured during this initial stage of analysis were also subjected to this criterion. If they exhibited little or no change in F2 across their overall duration, no intervals were measured. For these vowels, there was generally little difference in F1 and F2 at onset, midpoint, or offset, and vowel midpoint was taken as the provisional measure of nucleus midpoint. After the rate of change in F2 criterion was discarded, however, these vowels were reconsidered. Ideally, they should receive comparable treatment to the rest of the dataset. However, because they exhibited little

change in F2, and because of time constraints, the decision was made not to remeasure them. Instead, for each, the distance between the vowel midpoint position (which had been taken) and the nucleus midpoint (which would have been taken had intervals been measured), was calculated to indicate where a measure would have been taken to make them comparable to the rest of the set. The vowels of six speakers were affected. In each case, the midpoint measure was between 0.2 and 24 ms (i.e., within slightly less than two intervals) away from the point 1/3 of the distance into the vowel which would have been used to select the closest interval.

[7] Essentially, the set of vowels for which interval measures were taken constitutes the set of possible diphthongs for a Jamaican English or Creole speaker. However, the set of vowels for which interval measures were taken was not initially restricted to diphthongs. Because this study had as its primary goal the thorough acoustic description of Jamaican vowels, and because gliding (as in consonants palatalized before /a/ the sociolinguistic variable(KYA)) is known to occur for certain monophthongs, it was deemed important to examine change in the time course of any vowel for which change over time might potentially be significant. This would include such change as accompanies palatalization before monophthongs, or in- or downgliding for diphthongs. Thus, a methodology was initially implemented, following Gottfried, Miller, and Meyer (1993) of taking interval measures for any vowel which changed more than 3 Hz per millisecond (the rate of change in F2 described in §3.5.3). Any vowel which did not show this magnitude of change received the basic set of ten spectral measures. However, this criterion was eventually discarded for two reasons. First, it was not sensitive enough to exclude monophthongal vowels for which rate of change in F2 was not substantial, i.e., vowels which were *not* gliding or palatalized, such as *dud, bus, but, done, cuss*, but rather showed significant rate of change in F2 because they tend to have short durations, and because the excursion of F2 from a frequency associated with an alveolar place of articulation (typically a high F2, e.g., between 1400 and 1800 Hz), to a frequency associated with articulation of a back vowel such as /ʌ/ (which is typically associated with a low F2, e.g., between 850 and 1100 Hz) deceptively suggested a significant rate of change. This rate of change was often quite similar to that of the rate of change in F2 for a palatalized consonant preceding a monophthong, or an in- or downgliding diphthong. Second, not all diphthongal vowels showed a high rate of change in F2. In the first case, two diphthongs /aɪ, ɔɪ/, such as in *bide, coin,* tended to have extremely long durations but very short excursions in F2 due to short distances between F2 for /a/ and /ɛ/ which was frequently the offglide or final position for F2. *Bide*, for example, was frequently pronounced as [baɛd]. In the second case, particularly the Kingston speakers pronounced the long-/e/ class of vowels as a long monophthong, [eː], with no offglide, resulting in little or no overall change in F2 in many cases. Thus, the 3 Hz/ms criterion was at the same time too sensitive and not sensitive enough.

CHAPTER 4

ACOUSTIC STUDY RESULTS

This chapter constitutes the heart of the present study: the acoustic analysis of the vowel inventories of the Kingston-dwelling acrolect-dominant and St. Thomas-dwelling basilect-dominant speakers. Its primary goal is to present the results of the experimental study, the methods for which were described in Chapter 3.

The presentation is organized as follows: first, following a description in §4.1 of the dataset upon which results are based, the methods used for describing the vowel system, including statistical test design and methods for quantifying spectral and temporal similarities and differences (i.e., degree of overlap) between vowels, are presented in §4.2-3. For presentational purposes, the overall vowel space was partitioned into five vowel quality subsystems: high front, mid front, low, high back, and mid back (i.e., the sets of vowels which neighbor each other in acoustic space; including phonologically long:short pairs). The discussion of results begins with a description of basic temporal and spectral patterns in the overall set of vowel data. This analysis is guided by the results of initial descriptive and inferential statistics conducted over a subset of the data in all subsystems. The results of a by-subsystem analysis are given in §4.4, paying particular attention to the relative roles of spectral and temporal features in achieving phonemic contrast and their possible interactions. Results for the subsystem analyses are presented using a two-tiered approach. Following a general description of patterns in the data for that subsystem, statistical comparisons are reported for a subset of data for which statistical tests could be conducted, in order to more rigorously test the temporal and spectral patterns which emerged in the data. This two-tiered approach, in which all data were incorporated in the first tier of general description, followed by statistical comparison of a subset of data in the second, was necessitated by the methodological design for this study, which stipulated, first, that only real words be used as test stimuli, and second, that only data in phonetically comparable contexts be statistically tested (see §4.3). The proportion of all data which could be included in statistical tests was low, about 31%. Thus, it was deemed necessary to base the analysis for this study on both descriptive and statistical comparison. Following the subsystem analysis, interactions between subsystems and general observations regarding the global distribution of Jamaican vowels in acoustic space are described in §4.7. This discussion addresses the basic shape, symmetry, and features of the system. Section 4.8 contains a more general discussion of other phonological phenomena in the Jamaican system, including phonetic effects, rhoticity, and vowel merger. §4.9 concludes with a discussion of the main findings of the chapter.

4.1 Dataset for the Acoustic Study

The experimental study reported in this chapter uses as its primary source the data collected in the word list task, described in Chapter 3. Picture and conversational data (St. Thomas sample) and conversational data (Kingston sample) were also elicited; however, statistical analysis and comparisons presented in this chapter are based only on the word list data. This is because word list data occurred in a range of consonantal contexts, were the most comparable between speakers, were collected in large quantity, and provided for the fullest representation of the vowel and consonant paradigm. Picture and conversational data were analyzed as a check of word list productions. These supplemental data are described in the vowel quality subsystem analyses below as to whether or not, and how, they differed from word list productions.

Data were analyzed for 20 speakers, of which 19 had complete word list materials, making them suitable for inclusion in the analysis. The restriction of comparisons to word list data meant excluding the data of one speaker, TI (male, St. Thomas), who had exceptional difficulty reading and completed only the conversation and picture tasks. However, his data were not excluded altogether, particularly because they could prove to be a valuable sampling of basilect-dominant speech. It may be recalled from Chapter 2 that basilect-monolingualism is associated with uneducated speakers, so exclusion of illiterate speakers increases the likelihood of omitting basilect-dominant (and certainly basilect monolingual) speech from any sample of Jamaican speakers. Data for speaker TI are presented separately in an excursus following the body of this chapter.

The present dataset contains acoustic analyses for 12,669 words drawn from roughly 24 hours of word list and picture task recordings, and 9 hours of conversational recordings. An additional 3928 r-colored vowels were subjected to auditory, but not acoustic, analysis. Tallies of data collected in each task for each speaker are provided in Appendix E. The following section sets out the procedures used for quantifying the data. These procedures concern the spectral and temporal comparison of the data subjected to acoustic analysis.

4.2 Defining Spectral and Temporal Overlap

The relationship of vowel duration to segmental and suprasegmental linguistic features has been studied extensively. Languages differ in the role which vowel duration plays in the vowel system. In some languages, the quantity difference is the basis for phonological contrast, as in Czech and Serbo-Croatian (Lehiste, 1970).

Sometimes, when quantity is primary, it is enhanced by other kinds of suprasegmental phenomena, such as pitch accent (Ladefoged, 1964). In other languages, quantity enhances segmental distinctions. For example, the tense-lax distinction in English is understood to frequently entail a distinction in vowel quality (height or backness) enhanced by a quantity (length) distinction (Ladefoged, 1993; Ladefoged and Maddieson, 1996). English is claimed to utilize primary quality rather than quantity, partly because of the magnitude of phonetic effects on vowel length in English. Lehiste (1970) identified a number of phonetic factors which may affect vowel length, including the intrinsic duration of the vowel (high vowels tend to be shorter than low vowels); segmental conditioning (e.g., voicing of flanking consonants); and suprasegmental conditioning factors which co-occur with length (e.g., stress). For example, English vowels are longer before voiced than before voiceless consonants (e.g., Kluender, Diehl, and Wright, 1988), a feature that is found cross-linguistically, although it does not operate uniformly for all languages.

The interaction of vowel duration with other features has resulted in some confusion in the literature with respect to cases in which duration is contrastive, versus those in which it is not (Hubbard, 1998). There has been much discussion over how much of a temporal difference constitutes a primary difference in the presence of various types of spectral overlap. Crothers (1978) studied 85 languages reported to have contrastive vowel length, and classified them into those which exhibited (1) secondary quantity--showing zero or partial spectral overlap where the magnitude of temporal difference between vowels was high; and (2) primary quantity--where vowels showed complete spectral overlap accompanied by high magnitude of temporal difference. In addition, some languages showed (3) a "subset relation" in which long~short oppositions obtained for part of the system (usually peripheral /iː~ɪ, ɑː~a, uː~ʊ/), but not another (/ɛː, ɔː/). An overall ratio of 1.6:1 has been generally accepted as the minimal ratio for a language showing primary quantity where there is also partial or complete overlap in spectral quality (Crothers, 1978).

4.2.1 Temporal Overlap

Crothers' three-way classification was adapted for the present study of Jamaican vowels by quantifying the notions of no-, partial-, and complete temporal overlap. Phonologically long:short vowel pairs were classified using calculations based on the arithmetic means and standard deviations of measured vowel durations. The quantification procedure was as follows. First, duration ratios were calculated for phonologically long:short pairs within the system of each speaker. For example, an /iː/ with a duration of 142 ms and an /ɪ/ with a duration of 83 ms had the ratio 1.7:1 (i.e., the long vowel was 71% longer than the short). Then, an overall long:short ratio was calculated for each vowel pair for each group of speakers (i.e., Kingston or St. Thomas). Finally, an overall long:short ratio was calculated for each group, averaged across the long:short ratios of all vowel pairs for that group.

Complete temporal overlap: Mean duration of the shorter vowel in the pair was 80% or more of the duration of the longer member. Expressed another way, mean durations of the vowels showed a ratio of less than about 1.2:1. (Usually, the deviations brought the mean durations of the members of the pair within 10 ms of each other.)

Partial temporal overlap: Mean duration of the shorter vowel in the pair was between 60-80% of the duration of the longer member. That is, mean durations of the vowels showed a ratio of between 1.2:1 and 1.6:1. (Usually, mean durations of the members of the pair were within 10-20 ms of each other.)

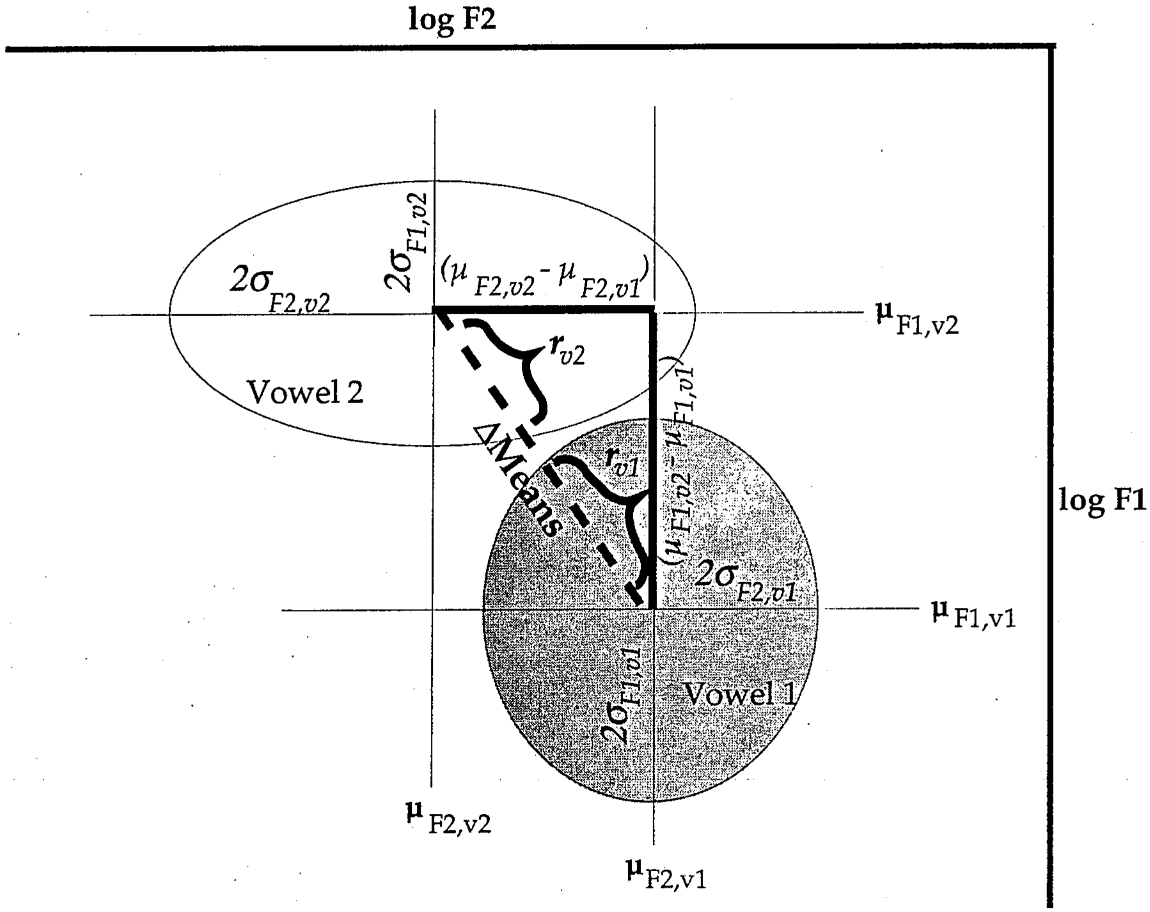


Figure 4.1. Illustration showing vowel distributions as ellipses defined by the means ($\mu_{F1,vi}$, $\mu_{F2,vi}$) and deviations ($\sigma_{F1,vi}$,$\sigma_{F2,vi}$) of the first two formants for each vowel in two-dimensional space. The deviations of both distributions and the slope of the line connecting the means of the two distributions are used to calculate overlap.

No temporal overlap: Mean duration of the shorter vowel in the pair was less than 60% of the duration of the longer member. That is, mean durations of the vowels show a ratio of greater than 1.6:1. (Usually, mean durations of the members of the pair were separated by 20 ms or more.)

4.2.2 Spectral Overlap

To achieve the spectral part of the classification, a method was devised for quantifying degree of spectral overlap or distinction, using the means and standard deviations of the normalized vowel formant data for each speaker. This method is illustrated in Figure 4.1. The distribution of data (i.e., the scatter) for a given vowel, v_i, is represented by an ellipse with the mean of the distribution locating the center, and the values representing twice the standard deviations of F1 and F2 forming the major and minor axes, i.e., the bounds of the ellipse in the F1 and F2 directions in acoustic space. The distribution of data for the neighboring vowel in acoustic space is represented by a second ellipse in the same fashion. Relative overlap of the ellipses is calculated using formulae based on the geometry of an ellipse. First, the distance between the centers of the two ellipses (i.e., the means of both distributions), *ΔMeans*, is calculated using the two lines that connect the mean F1 and F2 values (μ) of each vowel (v_i), as is shown in equation (1).

$$\Delta Means = \sqrt{\left(\mu_{F1,V2} - \mu_{F1,V1}\right)^2 + \left(\mu_{F2,V2} - \mu_{F2,V1}\right)^2} \tag{1}$$

Second, a direction-adjusted standard deviation, σ_{vi} *, based on the standard deviation in F1 and F2 for each distribution is calculated for each ellipse along a line connecting the two centers, using the formulae in (2) and (3). The ellipse radius along this same line (i.e., the line connecting the centers of each vowel distribution in the pair), referred to as r_{vi}*, is calculated as twice the value of σ_{vi} *, as given in equation (4). The slope of the line between the centers of the two vowel distributions of interest, expressed as variable *k*, is an important parameter in the calculation. The slope of the lines connecting the centers (based on means in F1 and F2) between vowel v_1 and vowel v_2 is given by

$$k = \frac{\mu F1_{v2} - \mu F1_{v1}}{\mu F2_{v2} - \mu F2_{v1}} \qquad \text{(for a given vowel pair) (2)}$$

$$\sigma_{vi}* = \sigma_{F1}\sigma_{F2}\sqrt{\frac{k^2+1}{\sigma_{F1}^{\ 2}+\sigma_{F2}^{\ 2}k^2}}$$ (for a particular vowel) (3)

$$r_{vi}* = 2\ \sigma_{vi}*$$ (for a particular vowel)(4)

Next, two geometrical conditions were devised for testing overlap between the ellipses representing the vowel distributions. The first condition tests for the presence of any overlap; the second condition tests whether the overlap is partial or complete. Based on a visual assessment of plotted vowel data, it was decided that cases in which one vowel distribution essentially contained a second, the pair could be considered to completely overlap. If the two distributions were roughly the same size, the two would be considered to completely overlap only if neither vowel distribution protruded more than "a moderate amount" outside the borders of the other. For this study, "a moderate amount" was assigned the value of 20% of the diameter (40% of the radius) of the vowel distribution serving as the basis for comparison. Because either vowel distribution might be contained in the other, this second condition was applied twice, with the first and second vowel exchanging roles in the two applications. These two applications are referred to as Conditions 2a and 2b. Sample calculations yielding the three overlap decisions described below are provided in Appendix C.

Condition 1: Compare the distance between the means in acoustic vowel space (ΔMeans) to the sum of the radii ($r*_{v1} + r*_{v2}$). If *ΔMeans* is larger than ($r*_{v1} + r*_{v2}$), then there is no overlap between the ellipses, and the vowel pair is described as showing *no spectral overlap*.

Condition 2a: Compare the two distributions to see if the elliptical distribution associated with v_2 protrudes beyond the elliptical borders of distribution v_1 by more than 40% of the radius (20% of the diameter) of v_1 at its furthest extent. If it does not, the vowel pair is said to exhibit *complete spectral overlap.*

Condition 2b: Compare the two distributions to see if the elliptical distribution associated with v_1 protrudes beyond the elliptical borders of distribution v_2 by more than 40% of the radius (20% of the diameter) of v_2 at its furthest extent. If it does not, the vowel pair is said to exhibit *complete spectral overlap.*

If Condition 1 indicates the existence of some spectral overlap, but complete spectral overlap is not indicated by either Condition 2a or Condition 2b, then the vowel pair is said to exhibit *partial spectral overlap.*

The main benefit of this formula for quantifying spectral overlap is that it enables evaluation of two-dimensional data. In other words, it is not necessary to assess overlap separately for F1 and F2 and then estimate their combined contribution to spectral overlap. F1 and F2 values are treated simultaneously, and the calculated ellipse radii, r^*_{vi} (in the direction of the line connecting the centers of the two ellipses) accounts for the shapes of both ellipses, whether round or oblong in the F1 or F2 direction.[1]

4.3 Statistical Testing and Overall Test Results

Descriptive and inferential statistics were used to highlight possible patterns in the data, helping to guide the description that follows. This section presents the results for two Grand ANOVAs conducted over a subset of the data across all vowel quality subsystems. The following section, §4.4, provides the results of statistical tests run over a subset of data within the various vowel quality subsystems. The inputs and design for the statistical tests will be described in the paragraphs which follow.

Normalized word list data constituted the basis for the quantitative description and the inputs to statistical models. Statistical tests were of two kinds: (1) *repeated measures mixed-model ANOVA*, and (2) *logistic regression*, which are appropriate for data which satisfy the conditions of independence and normality of distribution (Woods, Fletcher and Hughes, 1991). The word list data satisfied both conditions. Random effects were included in the models to allow for potential variability resulting from word- and speaker-related factors. The mixed model ANOVA makes possible the comparison of data with an unbalanced number of observations between cells. This was necessary for comparisons between /uː, ʊ/, for example, because /uː/ is highly productive lexically (appearing in numerous real-word items in many consonant environments) while /ʊ/ is not.

Three possibilities were evaluated regarding the composition of the set of values used for conducting the statistical comparisons: (1) include in the model *all observations* of a particular variable of interest, such as F1; (2) for a particular variable of interest, calculate a *vowel mean* for each speaker over all repetitions of all words instantiating a given vowel; and (3) for a particular variable of interest, calculate a *word mean* for each word, over all words instantiating a particular vowel for a given speaker. The third method was chosen for two reasons. Method (2) weighs equally all observations of a vowel which contribute to the resulting mean regardless of the relative numbers or effects of potentially unequally contributing factors. For example, if most real-word items instantiating the vowel /ɛ/ have an initial alveolar consonant, but very few have a velar consonant, the effects of the alveolar place of articulation on the resulting vowel articulation are greater in proportion, but this difference in proportion would be lost once the mean was calculated, which is undesirable. Calculating the mean over all repetitions of a word retains the variability associated with word-related differences or consonant context effects, which may then be statistically modeled. On the other hand, conducting the analysis over all observations of a given vowel, as in method (1) results in retention of potential outliers which may skew the distribution (although with a sufficiently large number of observations, this would not likely cause excessive skewing).

For the reasons described above, a repeated measures model, using word mean values, was employed. It was necessary to ensure that a given word not skew the data by appearing twice. Such would be the case with homophones, such as "debt" and "death," which are both pronounced [dɛt] in most Jamaican varieties. Where such pairs occurred, one member was deleted from the statistics dataset but retained for general description. Other homophone pairs for which this procedure was followed included:

doth ~ dot	[dat]	been ~ bean	[biːn]
both ~ boat	[b(u)oːt]		

A second group of words was excluded from statistical analysis because the vowels were produced inconsistently by a number of speakers, ostensibly because of confusion concerning the identity of the word. This set included the words "kook" (often pronounced [kʊk] "cook"), "bok" as in "bok choi," a commonly-eaten vegetable in Jamaica (frequently pronounced [bʊk] "book"), "bows (noun)," and "bows (verb)," which were sometimes confused with each other, and sometimes lengthened as the speaker made sure they were producing the correct word. Finally, several words were excluded which had been included in the word list to assess the Creole feature of consonant cluster reduction. These words constituted CVC items for basilect-dominant speakers, but CCVC or CVCC items for acrolect-dominant speakers, which might affect primarily vowel duration comparisons. These words included "cost," "kept," "kind," "scope," and "skip". Thirteen words were excluded from the database for the reasons described in this and the preceding paragraphs. Thus, a possible total of 744 words were analyzed acoustically per speaker, of which 692 could be submitted for statistical testing.

Statistical models included, wherever possible, both phonetic and sociolinguistic factors to maximize examination of all variables which might have had an effect on a particular variable of interest (F1, F2, duration at vowel midpoint). Each vowel token analyzed was coded for a number of factors which could be examined for their effect on the realization of the vowel. The coding scheme was described in the methods for this study (§3.4). Phonetic and sociolinguistic factors included in some or all of the statistical comparisons included:

Sociolinguistic Factors

(1) Group: based on location of residence (2 levels: Kingston, St. Thomas)

(2) Gender (2 levels: male, female)

Phonetic Factors:

(3) Vowel (14 levels, representing the orthographic categories: /iː, ɪ, eː, ɛ, ɑː, a, ɔ, ʌ, ʊ, uː, oː, aɪ, ɔɪ, aʊ/)

(4) Place of articulation of preceding consonant (3 levels: alveolar, bilabial, velar)

(5) Place of articulation of following consonant (3 levels: alveolar, bilabial, velar)

(6) Voicing of following consonant (2 levels: 1 = [+voice], 0 = [-voice])[2]

(7) Vowel length (two levels: long, short)

(8) Vowel quality (four levels: high front, high back, mid front, low) for pairs of monophthongs that neighbor each other in acoustic space. The mid back quality was not included because it did not include a monophthong pair.

Restrictions to the statistical dataset

All data were coded for several additional factors that were not treated as independent variables, but rather were used to restrict the set of vowels whose data were included in these tests, as explained below.

Position within the vowel (onset, midpoint, offset) -- Statistical comparisons were restricted to spectral and temporal values measured at true or nucleus midpoint (as described in §3.5, and in §4.4, below) in order to reduce the dataset to manageable size for this study.

Manner of articulation--Statistical tests were restricted to vowels occurring in stop consonant environments in order to avoid comparing vowels which vary in duration because of the manner of articulation of the following consonant.

Repetition--Data were coded as occurring in one of the four repetitions of a word, however subsequent tests were conducted over word means averaged across all repetitions of a word (as explained above), so that one set of representative values per word was entered into analyses for each speaker.

Session--words were coded as occurring in word list, conversation, and picture sessions; however, statistical comparisons were restricted to word list data.

Random Effects

Repeated measures were included for two factors, speaker and word.

Separate (inferential) statistical analyses were conducted for each of the following acoustic measures: normalized values for F1 and F2 at vowel midpoint (using measures described in §3.5), and vowel duration (in milliseconds). Presence or absence of downgliding and palatalization was examined in an additional set of tests using summary (descriptive) statistics. For palatalization, all words in the /a/ category were coded (two levels: 0 = [- palatalized]; 1 = [+ palatalized]) according to my auditory assessment of their palatalization. A word was coded [1] if either the initial palatal consonant [ç] or the velar + glide sequence [k^j] was detected. With respect to downgliding, all words in the categories /eː, oː/ were coded for the presence or absence of downgliding (according to two levels: 0 = monophthongal or upgliding; 1 = downgliding or centering).

Only three sociolinguistic factors (group, speaker, gender) of the original set of seven given in §3.5 were encoded in the analyses. This is because preliminary examination of the distribution of the resulting dataset showed some redundancy in the sociolinguistic factors. Group, employment, education, class and network strength score contributed quantitatively to the variation in the data in similar ways (and this was in part designed into the definition of the two speaker groups), although they encode, in quality, different kinds and amounts of detail about speaker characteristics. Therefore, they were not included as factors in the analysis, but will be described in the discussion in Chapter 5 for the various perspectives they afford.

Thus, all vowels were coded to permit potential examination of the effects of various phonetic and extralinguistic factors. Ideally, each factor which might affect the realization of a vowel (i.e., account for some of the variation between productions in a systematic way) would be included in the ANOVA model. However, such a model was not feasible given design limitations. Because the word list was composed of real-word items, certain preceding and following consonant environments were not possible for certain vowels. In particular, /ʊ, ɑː/ appeared in few contexts. Consequently, a model including all vowels would have to be limited to consonant environments in which /ʊ, ɑː/ occurred. In fact, these environments did not overlap. To address this, two main sets of ANOVAs were run, each different in one respect (inclusion of /ɑː/ or /ʊ/) from the other so as to include these two vowel subsystems in comparisons with all other possible subsystems. The first main ANOVA contained the high front, mid front and low (for /ɑː/) subsystems; the second included the high front, mid front and high back (for /ʊ/) subsystems. Preceding and following consonant environments and other factors were then restricted as necessary to possible comparisons for the relevant vowel quality subsystems. For the first set of ANOVAs, consonant environment was restricted to preceding bilabial with following alveolar; for the second, preceding bilabial with following velar. The factors included in each of the ANOVA sets included vowel quality (3 levels: high front, mid front, and low or high back), vowel length (long, short), following voicing (voiced, voiceless), group (Kingston, St. Thomas), and gender (male, female) with all of their possible interactions. For the Grand ANOVAs, the low vowel quality subsystem was restricted to the phonological long:short pair /ɑː, a/ for comparability with other qualities, all of which contained one pair of vowels. Repeated measures were included for the factors speaker and word. Each Grand ANOVA set contained three tests--one for F1, one for F2, and a third for vowel duration. For the duration ANOVAs only, voicing of following consonants was restricted so that voiced and voiceless consonants would not be crossed in the comparison. For the same reason, manner of articulation was restricted to obstruent consonants for all comparisons (F1, F2, and duration). The results of the Grand ANOVAs are presented in Tables 4.1 and 4.2. Only the statistically significant effects ($p < 0.05$) are reported. (Interested readers will find a useful introduction to the statistical concepts used below in Milroy 1987a, chapter 5, and Woods, Fletcher, and Hughes 1991, particularly chapter 12.) Table 4.3 provides summary mean formant frequency and vowel duration data, first for the overall sample, and then broken down by group (Kingston or St. Thomas). These means were obtained for the dataset prior to running the Grand ANOVAs and will be referred to in the interpretation of the Grand ANOVAs, below.

Consider first the results of the tests on the front and low vowels (Table 4.1). The first group of effects relates to F1, which is generally correlated with vowel height. As expected, the ANOVA shows a significant effect of vowel quality on F1. The means

Table 4.1. Grand ANOVA Set #1. Vowel quality subsystems include: high front, mid front, low. Consonant environments: preceding bilabial, following alveolar. Repeated measures for speaker and word. Values submitted consist of word means for each speaker.

Dependent Variable **Significant Factors**	df	F	*p*-value
F1			
vowel quality	(2, 164)	1421.73	<0.01
vowel length	(1,164)	327.90	<0.01
vowel quality * vowel length * gender	(2,164)	3.13	<0.05
vowel quality * group * gender	(2,164)	5.27	<0.01
F2			
vowel quality	(2,164)	1992.06	<0.01
vowel quality * vowel length	(2,164)	178.91	<0.01
vowel quality * vowel length * group	(2,164)	6.69	<0.01
vowel quality * gender	(2,164)	4.16	<0.02
vowel quality * vowel length * gender	(2,164)	5.45	<0.01
vowel quality * group * gender	(2,164)	9.11	<0.01
vowel length * group * gender	(1,164)	4.33	<0.04
vowel quality * vowel length * group * gender	(2,164)	4.38	<0.02
Duration			
vowel quality	(2,164)	240.35	<0.01
vowel length	(1,164)	1336.68	<0.01
following voicing	(1,164)	80.92	<0.01
vowel quality * vowel length	(2,164)	5.60	<0.01
vowel length * group	(1,164)	8.89	<0.01
vowel length* gender	(1,164)	32.85	<0.01
vowel length * group * gender	(1,164)	7.08	<0.01
vowel length * following voicing	(1,164)	7.17	<0.01
group * following voicing	(1,164)	5.80	<0.02
group * gender * following voicing	(1,164)	5.54	<0.02

Table 4.2. Grand ANOVA Set #2. Vowel quality subsystems include high front, mid front, high back. Consonant environments: preceding bilabial, following velar. Repeated measures for speaker and word. Values submitted consist of word means for each speaker.

Dependent Variable **Significant Factors**	df	F	*p*-value
F1			
vowel quality	(2,110)	189.02	<0.01
vowel length	(1,110)	157.60	<0.01
vowel quality * vowel length	(2,110)	11.30	<0.01
vowel quality * gender	(2,110)	3.01	0.05
F2			
vowel quality	(2,110)	2277.08	<0.01
vowel quality * vowel length	(2,110)	10.69	<0.01
vowel length * gender	(1,110)	4.94	0.03
vowel quality * group * gender	(2,110)	9.76	<0.01
Duration (Following voicing restricted)			
vowel quality	(1,45)	7.14	0.01
vowel length	(1,45)	52.88	<0.01
vowel length * group	(1,45)	6.68	0.01

table (Table 4.3) reveals the nature of this difference: the low vowel quality has the highest mean F1 (indicating lower position in the articulatory space), with lower means for the mid front, and then the high front, qualities, respectively. Interestingly, the ANOVA also showed a significant effect of vowel length. Table 4.3 indicates that for all three vowel qualities, the long vowels tend to have a lower F1 (indicating higher position) than the short vowels.

Two significant interactions also emerged: vowel quality-by-vowel length-by-gender, and vowel quality-by-group-by-gender. In post hoc tests with vowel quality and vowel length or gender held constant in turn while the levels within the remaining factor were compared, we found that males and females show very similar F1 means for all vowels qualities and lengths except for the short, high front vowel /ɪ/. (See Table 4.3). For this vowel, the difference between males' and females' mean F1 was greater than in the other vowel qualities, such that males have a lower mean F1 for /ɪ/, indicating a higher vowel (highfront+long[3]: $F(1,164)=0.51$, $p=0.47$; highfront+short: $F(1,164)=2.93$, $p=0.08$; low+long: $F(1,164)=0.23$, $p=0.63$; low+short: $F(1,164)=1.37$, $p=0.24$; mid+long: $F(1,164)=0.33$, $p=0.57$; mid+short: $F(1,164)=2.33$, $p=0.13$). It may be observed from the means table that, for the long vowels in the high and mid front vowel qualities, St. Thomas speakers have lower F1 means than Kingston speakers (higher vowels).

The vowel quality-by-group-by-gender interaction indicates that depending on the vowel quality and group designations of a particular observed F1 value, gender has a different effect on F1. Post-hoc tests investigating this interaction suggest group and gender-related differences. As shown in Table 4.3, Kingston males have lower mean F1 values than Kingston females for the high front vowels /iː, ɪ/ (higher vowels). At the same time, St. Thomas males show a lower mean F1 for low vowels /ɑː, a/than do St.

Thomas females (higher vowels). Furthermore, females in the two groups differed in mean F1 of their high front vowels, such that St. Thomas females display lower mean F1 values (higher vowels). [highfront+Kingston: F(1,164)=3.40, p=0.07; highfront+St. Thomas: F(1,164)=0.93, p=0.34; low+Kingston: F(1,164)=1.28, p=0.26; low+St. Thomas: F(1,164)=3.56, p=0.06; mid+Kingston: F(1,164)=1.43, p=0.23; mid+St. Thomas: F(1,164)=0.10, p=0.75; highfront+female: F(1,164)=3.49, p=0.06; highfront+male: F(1,164)=0.88, p=0.35).] Mean F1 differences by group and gender are described in detail in §4.4.

Table 4.3. Mean formant frequency and vowel duration data for the overall sample. Values for formants are given in Hz, and duration values in ms.

	Overall			Kingston			St. Thomas		
Subsystem	F1	F2	Duration	F1	F2	Duration	F1	F2	Duration
High Front									
ɪ	377	2248	73	380	2216	72	374	2279	75
iː	303	2454	134	302	2458	128	304	2449	140
Mid Front									
ɛ	525	2002	99	549	1966	99	503	2038	99
eː	405	2259	147	403	2257	141	406	2262	152
Low									
a	742	1512	118	760	1541	118	726	1486	118
ɑː	690	1211	184	691	1190	181	688	1232	187
ɔ	714	1282	116	726	1268	114	703	1296	118
ʌ	570	1132	101	583	1151	99	557	1114	103
High Back									
ʊ	403	889	64	410	936	59	397	846	69
uː	351	880	142	342	925	132	361	833	151

Results for the ANOVA examining F2 are provided in the second panel of Table 4.1. For F2, associated with the front-back dimension, there is, as expected, a main effect of vowel quality, indicating that the vowel quality groupings differ in terms of their front-back situation in acoustic space. The means table shows that the high front vowels are highest in F2 (therefore, situated furthest front in articulatory space), and the low vowels are lowest, with the mid front vowels in between. A vowel quality-by-vowel length interaction suggests that particular vowel quality and vowel length combinations exert a different effect on F2. Specifically, as may be observed from the means table, the long front vowels /iː, eː/ have a higher mean F2 than their short counterparts /ɪ, ɛ/. However, low /ɑː/ has a lower mean F2 than/a/. In fact, vowel quality and vowel length participate in a four-way interaction with group, and gender. The Kingston genders show extremely similar F2 means for all vowel quality and vowel length levels. However, the St. Thomas genders differed widely in mean F2 for their long vowels, particularly in the low vowel quality subsystem. An examination of the means shows the nature of this difference. St. Thomas females display a higher mean F2 (further front in articulatory space) in their high front and mid front vowels than St. Thomas males, but lower F2 (further back) for low vowels. Thus, the variation in F2 in the observed values may be best understood when all the factors--group, gender, vowel quality, and vowel length--are taken together. The patterns to which this larger test alludes will be elucidated as the vowel quality groups are examined in greater depth, below.

The ANOVA conducted for the third dependent variable, vowel duration, included following voicing as a factor because of the known possibility, described above, that voicing of the following consonant may affect vowel duration. Main effects of vowel quality, vowel length, and following voicing are observed. The vowel quality effect is consistent with intrinsic length differences, the means for the high front, mid front, and low vowels being 107 ms, 124 ms, and 149 ms, respectively. Note that vowel quality shows no interactions with sociolinguistic factors. The expected main effect of phonological vowel length on duration indicates that the phonological long:short pairs do indeed differ in their duration, such that /iː, eː, ɑː/ are longer than /ɪ, ɛ, a/ (Table 4.1). The effect of following voicing on vowel duration is consistent with segmental conditioning, wherein voiced and voiceless consonants exert a different effect on vowel duration. Vowels exhibit a longer duration when followed by a voiced consonant. The vowel quality-by-vowel length interaction further indicates that the vowel length specification (long or short) of the vowel differs in its effect on duration depending on the vowel quality subsystem of the vowel. Interestingly, the phonologically long vowel in a pair was always approximately 45-60 ms longer than the phonologically short member, but both members of each pair were shorter than the vowel quality exceeding them in F1 (long with vowel quality varied: $F(2,164)=145.71$, $p<0.01$; short with vowel quality varied: $F(2,164)=100.18$, $p<0.01$). That is, mean durations for /iː, ɪ/ are 134 and 73 ms, respectively, both about 15-20 ms shorter than their long and short counterparts in the mid front quality, /eː, ɛ/, which were 147 and 99 ms, respectively. Next, /eː, ɛ/ are observed to be 30 ms shorter than their counterparts in the low vowel quality subsystem, /ɑː, a/, which were 184 and 118 ms in duration, respectively. Vowel length additionally interacts with group and gender. Post-hoc comparisons show that St. Thomas females exhibit longer long vowels than both Kingston females and St. Thomas males (long+Kingston: $F(1,164)=0.66$, $p=0.42$; long+St. Thomas: $F(1,164)=7.87$, $p<0.01$; short+Kingston: $F(1,164)=0.15$, $p=0.7$; short+St. Thomas: $F(1,164)=0.45$, $p=0.5$; long+female: $F(1,164)=6.00$, $p<0.05$; long+male: $F(1,164)=0.42$, $p=0.52$; short+female: $F(1,164)=0.06$, $p=0.81$; short+male: $F(1,164)=0.27$, $p=0.61$).

The remaining interactions relate to following voicing, which influences vowel duration in a patterned way along with other factors. First, the vowel length-by-following voicing interaction suggests that the effect of a following voiced or voiceless consonant differs depending on the length specification of the vowel. Post-hoc tests in which the vowel length level is held constant and the effects of voicing are examined indicate that although the durations of both long and short vowels are significantly affected by the voicing of the following consonant, the effect is greater for short vowels (long: $F(1,164)=19.85$, $p<0.01$; short: $F(1,164)=68.50$, $p<0.01$). That is, a short vowel before a voiced consonant is longer than a short vowel before a voiceless consonant relative to the difference in durations between long vowels before voiced and voiceless consonants. Second, following voicing interacts with group, such that the Kingston speakers show a greater following voicing effect than St. Thomas speakers. The two-way group-by-following voicing interaction is only part of the picture, however, because there is also a three-way group-by-gender-by-following voicing interaction. When group and gender levels are held consonant, and the effect of following voicing is examined, the effect of following voicing on duration is greater for the Kingston males than other speakers (Kingston+female: $F(1,164)=18.28$, $p<0.01$; Kingston+male: $F(1,164)=49.08$, $p<0.01$; St. Thomas+female: $F(1,164)=22.31$, $p<0.01$; St. Thomas+male: $F(1,164)=4.25$, $p<0.05$). That is, Kingston males show the largest difference between the durations of vowels followed by voiced and voiceless consonants. As will be shown in the subsystem analyses below in §4.4, this picture is somewhat complicated, because in general, St. Thomas females show the greatest tendency to exploit vowel length differences; that is, they show larger differences between phonologically long and short vowels. However, their own vowels do not show as great an effect of following voicing.

The second set of ANOVAs, given in Table 4.2, included the high back vowel subsystem (containing /ʊ/) with the high front and mid front subsystems, and were conducted for vowels in the preceding bilabial with following velar context. Not surprisingly, some of the effects found here match those of the first set of ANOVAs described, so the discussion of this set of tests will be briefer.

F1 values showed main effects of vowel quality and vowel length. Analysis of the means of each grouping showed the expected pattern as did the groupings in the first set of Grand ANOVAs. As may be seen in Table 4.3, high front vowels have the lowest F1 means, followed by high back vowels and mid front vowels, respectively. Also, as in the first Grand ANOVA, long vowels differed in F1 from short vowels. The means table (Table 4.3) shows that long vowels in the three qualities exhibit a lower mean F1. Next, two interactions emerged. In the first, vowel quality and vowel length interacted such that the long and short vowels within the vowel qualities all differed significantly in mean F1, but the difference was largest for the high front and mid front vowels (post-hoc tests of effects: highback: $F(110,1)=9.77$, $p=0.002$; highfront: $F(110,1)=71.15$, $p<0.001$; midfront: $F(110,1)=120.19$, $p<0.001$). In the second interaction, vowel quality and gender interacted, such that males and females differed most in mean F1 of mid front vowels. Means indicate that males' F1 values for /eː/ are higher than females'.

The expected vowel quality main effect emerged in the second ANOVA test on F2 as it had in the first ANOVA. High back vowels are lowest in F2, followed by mid front vowels and high front vowels, as may be observed in the mean values in Table 4.3. The second ANOVA also showed a vowel quality-by-vowel length interaction, such that the vowel qualities differed in the front-back situation of the members of the phonological long:short pair. The means show a lower F2 for /uː/ (meaning that it is situated further back) than /ʊ/, but a higher F2 for /iː/ and /eː/ than /ɪ/ and /ɛ/, respectively. There were two other interactions in this set of tests: vowel quality-by-group-by gender, and vowel length-by-gender. The three-way interaction between vowel quality, group and gender suggests that the St. Thomas genders differ in the F2 of all three vowel qualities, while the Kingston genders do not (highback+Kingston: $F(110,1)=2.47$, $p=0.12$; highback+St. Thomas: $F(110,1)=6.75$, $p=0.01$; highfront+Kingston: $F(110,1)=0.01$, $p=0.92$; highfront+St. Thomas: $F(110,1)=5.93$, $p=0.02$; midfront+Kingston: $F(110,1)=0.07$, $p=0.80$; midfront+St. Thomas: $F(110,1)=5.65$, $p<0.02$). Furthermore, the females of the two groups differ in mean F2 of their high back and mid vowels (highback+female: $F(110,1)=8.50$, $p<0.01$; highback+male: $F(110,1)=1.46$, $p=0.23$; highfront+female: $F(110,1)=3.33$, $p>0.05$; highfront+male: $F(110,1)=0.36$, $p=0.55$; mid+female: $F(110,1)=4.79$, $p<0.05$; mid+male: $F(110,1)=0.11$, $p=0.74$). The fourth interaction in this set of tests involved vowel length and gender, such that females' phonologically long and short vowels tended to vary more in F2 than did males' (female: $F(110,1)=6.92$, $p<0.01$; male: $F(110,1)=0.00$, $p=0.98$). The first set of ANOVAs had also suggested that the effect of vowel length specification on F2 differed depending on gender of the speaker, but further suggested that this interaction could be part of a more complex interaction with group and vowel quality (i.e., as indicated by the four-way vowel quality-by-vowel length-by-group-by-gender interaction described above).

The second ANOVA on duration, as did the first, showed main effects of vowel quality (high vowels are shorter than non-high vowels; high front: mean 98 ms, high back: mean 103 ms, and mid front: mean 118 ms) and length (phonologically long vowels are longer than phonologically short ones). The vowel length-by-group interaction was due to St. Thomas speakers showing longer durations for the phonologically long vowels than Kingston speakers, consistent with the results of the first grand ANOVA (long: $F(1,110)=4.94$, $p=0.03$; short: $F(1,110)=0.20$, $p=0.66$). Following voicing could not be investigated in this set of tests because there was no minimal pair to contrast the high back vowels.

In summary, the Grand ANOVAs showed two main effects (vowel quality and vowel length) and one interaction (vowel quality-by-vowel length) in common for F1. The first Grand ANOVA did not show two-way interactions for vowel quality-by-vowel length or vowel quality-by-gender. However, it did show a three-way interaction between all three variables. The second Grand ANOVA did not show an interaction of vowel quality-by-group-by gender. In F2, the two tests show main effects of vowel quality, and interactions between vowel quality-by-vowel length and vowel quality-by-group-by-gender. They differ in that the first ANOVA alone additionally shows interactions of vowel quality-by-vowel-length-by-group, vowel quality-by-gender, and vowel quality-by-vowel length-by-gender. It seems likely that the differences between the ANOVAs may be mainly attributable to the fact that they tested different combinations of the vowel quality subsystems. For example, both sets included both phonologically long and short vowels. However, all the vowel systems included in the second set were non-low, while they were high, mid and low in the first, which means that differences in F1 were very likely to emerge. Also, a number of interactions emerged only in the first Grand ANOVA, most of which were related to group. As will be seen below in §4.4.2, the low vowel quality subsystem, which was included in this set of tests but not in the second, shows large between-group spectral and temporal differences. These differences may be partly responsible for the appearance of so many interactions.

In general, however, the patterns that emerged with respect to phonologically long and short vowels seem to hold for both: e.g., phonologically long vowels being more peripheral in the acoustic space than short ones, and durations for non-low vowels being shorter than for low. With respect to group-related differences, these initial tests suggest that St. Thomas speakers tend to have longer durations (particularly for long vowels, and particularly if female), than do the Kingston speakers. Results consistent with intrinsic duration and segmental conditioning were indicated in the first ANOVA, where following voicing was able to be included as an independent variable.

In terms of the extralinguistic variables, then, interactions involving gender emerged from both sets of tests for F1 and F2, and for duration in the first Grand ANOVA. Interactions involving group emerged for F1, F2, and duration from the first test, and for F2 and duration in the second. This suggests that both play a role in variation in spectral and temporal aspects of vowel production.

The statistically significant effects emerging from this overall view (vowel quality, vowel length, group, gender, and following voicing) were used to guide the general discussion which begins below in §4.4.2 and were further investigated in a set of ANOVAs in which vowels were compared within their vowel quality subsystems. Because of the differences in distribution of vowels with respect to possible consonant environments, the vowel quality subsystem analyses were conducted over those environments possible for both members in the comparison. In some cases, the environments specified for the different vowel quality subsystem tests were similar, and in some cases they differed. In the subsystem analyses below, the phonetic factors included in the relevant tests will be specified. Group and gender were, once again, the two sociolinguistic factors included in all the vowel quality subsystem analyses. Random effects for word with repeated measures for speaker were also included in all ANOVAs. These apply for all of the subsystem analyses which will be reported below. Only the significant main effects and interactions will be provided in the accompanying tables.

4.4 Jamaican Vowels: A vowel quality subsystem analysis

4.4.1 Organization of Vowel Quality Subsystem Descriptions

This section presents an analysis of Jamaican vowels grouped by vowel quality "subsystem," that is, a set of vowels which are neighbors in acoustic space. The subsystem groupings are intended merely to provide a principle for organizing the presentation of data. The discussion below will begin with the high front vowel quality subsystem, moving to the mid front, low, mid back, and finally, the high back subsystems.

The subsystem analysis has two parts: the first, contained in §4.4.2-4.4.6, is a description of each subsystem. The results for each subsystem will be presented using a two-tiered approach. Description of general spectral and temporal features constitutes the first tier, and statistical tests the second. In the first tier, true (for monophthongs) or nucleus midpoint (for diphthongs) values for all the data collected for each of the subsystems (all places of articulation, all following manners of articulation) will be described and compared in terms of general spectral and temporal patterns. Monophthong pairs are classed according to the "overlap" categorizations described above. All data are described in terms of means and variances for each vowel category, using both normalized and raw Hertz data, but comparisons will be based on the normalized data. Trajectories for diphthongs are described using vowel onset, 12.5 ms intervals, and vowel offset. In the second tier, statistical analyses will be presented in each subsystem for a subset of data which occurred in comparable stop consonant contexts.

The subsystem descriptions will proceed in the following order: discussion of the basic and allophonic realizations of vowel phonemes; spectral and temporal features and overlap based upon mean and deviation data; statistical comparisons; and finally, variation between word list, conversational, and picture productions. The range of allophonic realizations of each vowel are provided in a close phonetic transcription which was achieved by auditory analysis of vowels in the word list, conversational and picture sessions. Plots of F1 x F2 (log-mean normalized) formant data for the word list productions of each speaker are included in Appendix G. (Tallies of all data for each speaker are presented in Appendix E.)

Early in each subsystem analysis, a table is provided which presents the means and deviations for F1 and F2 (both raw and normalized values), and for duration for each vowel pair, along with the results of the formula for quantifying spectral overlap of the distributions in two-dimensional space. The final column of the table presents the overall decision made concerning type of spectral overlap (none, partial, or complete) for each vowel pair, by speaker. This overall decision followed directly from the spectral overlap conditions described in §4.4 (Conditions 1, 2a, and 2b), therefore, only the overall decision is included in the tables in this section. To review, Condition 1 tested for no overlap. That is, if Condition 1 was met, the vowels showed no overlap (i.e., the difference between their means was greater than the sum of their deviations in two-dimensional space). Conditions 2 a and 2b tested whether overlap was complete or less than complete (i.e., partial). If Condition 2a or 2b (or both) was met, this meant that the distributions showed complete overlap. If Conditions 2a and 2b both returned values of 0, this meant that there was some overlap, but at less than 80% (i.e., protrusion was less than 20%), which I have taken as the cutoff below which distributions are described as showing only partial overlap. While Conditions 2a and 2b could simultaneously return values of 1, Condition 1 would not be met simultaneously with Conditions 2a or 2b.

Each subsystem description also contains additional charts and tables to exemplify selected spectral and temporal patterns in the data. Spectral patterns are illustrated in F1 x F2 formant charts which show the major patterns found in the data for each vowel pair across the sample of speakers. Each illustration shows data extracted from the vowel plot for one speaker whose pattern was taken to be typical of the overlap pattern specified. An attempt is made to represent visually, in the text of this chapter, a sampling of the data of as many speakers as possible. In all charts, "no spectral overlap" is referred to as Pattern 1, "complete overlap" as Pattern 2, and "partial overlap" as

Pattern 3. Temporal patterns are presented in tables which provide the duration ratio for each vowel pair for each speaker.

Following the subsystem analyses, the vowel quality subsystems are compared in §4.5, and their implications for the phonological contrast of Jamaican vowels are discussed.

4.4.2 High Front Subsystem /iː, ɪ/

The vowel quality category containing the vowels /iː, ɪ/ is considered first. The primary phonetic realizations for these vowels included: for /iː/, [i, ɪⁱ]; for /ɪ/, [ɪ, ɪː]. Table 4.4 presents the means (with *k* representing the slope of the line, *ΔMeans*, connecting these means), deviations (σ^*_{vi}), and overlap decisions for this vowel pair. In this table, "K" represents Kingston speakers and "T," St. Thomas speakers. General patterns emerging from the means and deviations calculated for all data (for all places of articulation and all following manners of articulation) at vowel midpoint are described first.

4.4.2.1 Overview of /iː, ɪ/ based on all data

The means presented in Table 4.4 show that in general, /iː/ has a lower F1 and higher F2 than /ɪ/ for all speakers, indicating that /iː/ is higher and more forward in articulatory vowel space than /ɪ/. Not surprisingly, the variances in F1 are smaller than for F2 in Hertz. (The deviations for the normalized data (in log Hz) for F1 and F2 look more similar due to transformation of the data to a logarithmic scale.)

Table 4.4. Means and standard deviations for F1 and F2 (both raw Hz and normalized data), and duration for /iː,ɪ/ for all speakers. For each pair, values representing the distance between the means of each distribution (ΔMeans), each distribution's standard deviation (σv_1, σv_2), and the test conditions for determining overlap, are given. Values are from vowel midpoint.

Vowel Pair	Speaker	n	F1		F1 (log Hz)		F2		F2 (log Hz)		duration (sec)		$\sigma^* v_1$	$\sigma^* v_2$	k	ΔMeans	Overlap Decision
ɪ	KC.f	*17*	395	*23*	-0.08	*0.03*	2256	*95*	0.20	*0.02*	0.063	*0.014*	0.024	0.018	-0.968	0.063	partial
iː	KC.f	*18*	357	*28*	-0.12	*0.03*	2504	*82*	0.24	*0.01*	0.108	*0.022*					
ɪ	KD.f	*63*	418	*33*	-0.10	*0.04*	2270	*129*	0.15	*0.06*	0.077	*0.025*	0.042	0.022	-1.082	0.078	partial
iː	KD.f	*60*	368	*37*	-0.16	*0.05*	2548	*93*	0.20	*0.02*	0.132	*0.031*					
ɪ	KE.m	*64*	359	*35*	-0.10	*0.04*	2175	*83*	0.16	*0.02*	0.069	*0.024*	0.034	0.036	-3.125	0.096	partial
iː	KE.m	*60*	291	*32*	-0.19	*0.05*	2327	*87*	0.19	*0.02*	0.126	*0.030*					
ɪ	KF.f	*64*	443	*70*	-0.07	*0.07*	2368	*124*	0.17	*0.02*	0.065	*0.016*	0.054	0.028	-3.601	0.196	none
iː	KF.f	*60*	284	*19*	-0.26	*0.03*	2674	*61*	0.22	*0.03*	0.125	*0.031*					
ɪ	KM.m	*64*	367	*24*	-0.09	*0.03*	1893	*81*	0.16	*0.02*	0.066	*0.019*	0.027	0.024	-3.418	0.130	none
iː	KM.m	*60*	276	*18*	-0.21	*0.03*	2058	*53*	0.20	*0.01*	0.124	*0.034*					
ɪ	KR.m	*64*	318	*38*	-0.13	*0.05*	2167	*108*	0.18	*0.02*	0.066	*0.021*	0.039	0.029	-2.461	0.100	partial
iː	KR.m	*60*	256	*26*	-0.22	*0.04*	2362	*79*	0.22	*0.01*	0.140	*0.027*					
ɪ	KT.f	*63*	414	*39*	-0.09	*0.04*	2277	*152*	0.14	*0.05*	0.085	*0.022*	0.046	0.036	-1.471	0.126	partial
iː	KT.f	*60*	326	*43*	-0.19	*0.06*	2668	*146*	0.21	*0.02*	0.141	*0.023*					
ɪ	KU.m	*63*	374	*34*	-0.10	*0.04*	2328	*142*	0.18	*0.03*	0.087	*0.024*	0.037	0.037	-2.602	0.132	partial
iː	KU.m	*60*	282	*31*	-0.23	*0.05*	2595	*124*	0.23	*0.02*	0.138	*0.028*					
ɪ	KW.m	*62*	344	*40*	-0.12	*0.05*	2241	*76*	0.19	*0.01*	0.062	*0.016*	0.020	0.029	-1.015	0.053	partial
iː	KW.m	*55*	315	*41*	-0.16	*0.05*	2446	*66*	0.23	*0.02*	0.102	*0.022*					
ɪ	TA.m	*55*	285	*57*	-0.14	*0.08*	2275	*118*	0.22	*0.02*	0.074	*0.029*	0.069	0.041	-6.195	0.076	complete
iː	TA.m	*48*	237	*21*	-0.22	*0.04*	2340	*132*	0.23	*0.03*	0.150	*0.046*					
ɪ	TB.m	*55*	365	*36*	-0.11	*0.05*	2167	*138*	0.17	*0.03*	0.083	*0.022*	0.046	0.049	-9.802	0.096	partial
iː	TB.m	*54*	293	*33*	-0.20	*0.05*	2217	*158*	0.18	*0.03*	0.136	*0.023*					
ɪ	TE.m	*64*	364	*57*	-0.10	*0.07*	2169	*139*	0.16	*0.03*	0.083	*0.019*	0.056	0.052	-3.414	0.117	partial
iː	TE.m	*60*	281	*40*	-0.22	*0.06*	2339	*129*	0.20	*0.02*	0.135	*0.025*					
ɪ	TH.m	*42*	324	*36*	-0.10	*0.05*	2162	*132*	0.16	*0.03*	0.069	*0.018*	0.042	0.043	-2.469	0.080	partial
iː	TH.m	*40*	274	*37*	-0.17	*0.06*	2315	*120*	0.19	*0.02*	0.122	*0.025*					
ɪ	TJ.f	*49*	488	*43*	-0.06	*0.04*	2579	*107*	0.22	*0.02*	0.080	*0.018*	0.039	0.044	-6.681	0.210	none
iː	TJ.f	*45*	303	*37*	-0.26	*0.05*	2770	*84*	0.26	*0.01*	0.168	*0.034*					
ɪ	TL.f	*64*	353	*24*	-0.12	*0.03*	2275	*94*	0.19	*0.02*	0.066	*0.022*	0.020	0.025	-0.644	0.065	partial
iː	TL.f	*58*	343	*81*	-0.15	*0.02*	2589	*97*	0.24	*0.04*	0.127	*0.022*					
ɪ	TM.f	*48*	399	*46*	-0.10	*0.05*	2559	*116*	0.22	*0.02*	0.056	*0.022*	0.041	0.040	-2.912	0.144	partial
iː	TM.f	*43*	292	*42*	-0.24	*0.06*	2850	*107*	0.27	*0.02*	0.145	*0.025*					
ɪ	TT.f	*64*	367	*32*	-0.09	*0.04*	2170	*176*	0.16	*0.04*	0.074	*0.022*	0.039	0.027	-1.407	0.082	partial
iː	TT.f	*59*	314	*19*	-0.15	*0.03*	2417	*168*	0.21	*0.03*	0.161	*0.038*					
ɪ	TV.f	*63*	435	*46*	-0.08	*0.05*	2420	*79*	0.18	*0.01*	0.076	*0.019*	0.033	0.038	-2.912	0.095	partial
iː	TV.f	*60*	357	*66*	-0.17	*0.07*	2599	*84*	0.21	*0.01*	0.123	*0.021*					
ɪ	TX.m	*46*	363	*34*	-0.12	*0.04*	2030	*82*	0.16	*0.02*	0.081	*0.023*	0.031	0.038	-2.351	0.046	partial
iː	TX.m	*44*	330	*37*	-0.16	*0.05*	2118	*113*	0.18	*0.02*	0.132	*0.025*					

When the amount of overlap of the distributions for /iː, ɪ/ is assessed for each speaker using the decision conditions described above in §4.2, all speakers except KF.f, KM.m, TJ.f, and TA.m were evaluated as showing a pattern of partial spectral overlap in the relative spectral positioning of /iː, ɪ/. KF.f, KM.m, and TJ.f showed no spectral overlap, and speaker TA.m showed complete spectral overlap. Figure 4.2 (a-c) illustrates these three patterns in plots of /iː, ɪ/ for speakers TA.m (complete overlap), KF.f (no overlap), and TB.m (partial overlap), with TB.m exemplifying the typical pattern. It may be recalled that in quantifying overlap, I use a formula that constructs an ellipse representing the mean of the vowel distribution plus two standard deviations. By so doing, the decision for overlap is not based on values representing the entire range of observed values for F1 or F2, which may include outliers, but on the range of values into which roughly 95% of the distribution falls.

Thus, it may be seen in Figure 4.2b that the distributions of both vowels are nearly identical for TA.m. The difference in F1 between his vowel means is 47 Hz, and the difference in F2 is 65 Hz. One standard deviation in either dimension (F1 or F2) closes the distance between the means entirely. The means for speaker TX.m are also very close, with a difference between F1 means of 34 Hz and 88 Hz in F2.[4] For most speakers, /ɪ/ is lower and further back in the vowel space than /iː/, with a difference in F1 of around 50 Hz or more (approximately 0.06 log Hz or more), or a difference in F2 of 200 Hz or more. The means in Table 4.4 further suggest that females tend to have higher values for F2 for /iː/ and larger differences in F2 for the pair than do males, indicating that /iː, ɪ/ are further apart for them, on average, with /iː/ further front in the vowel system. This pattern is clearly shown by the data in Hertz, but is present in the normalized data, as well. Females tend to show a difference of 0.04 log Hz or more, the males less than this. This pattern is further supported by the statistical results reported below.

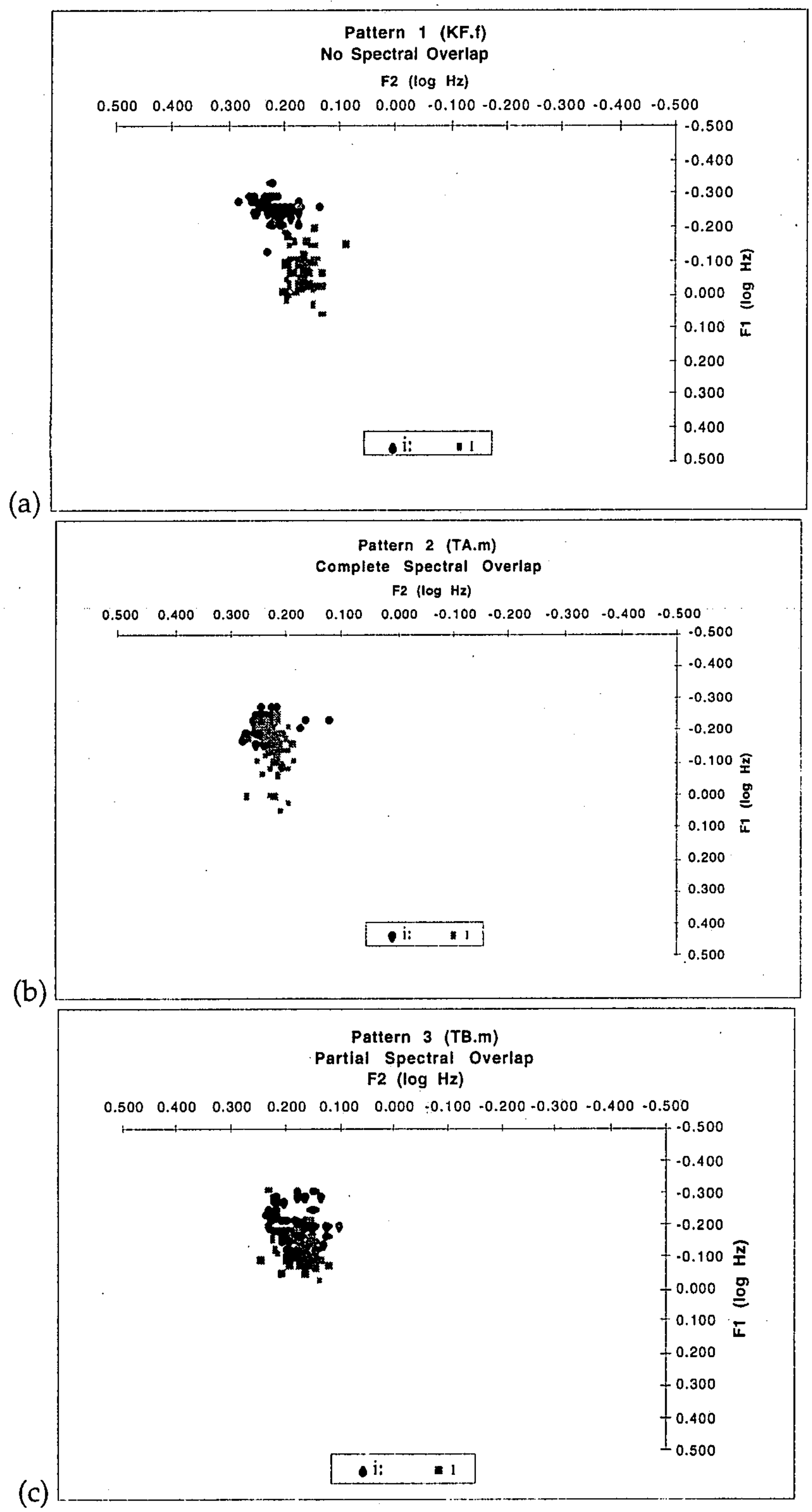


Figure 4.2 a,b,c. Spectral patterns associated with /i:, ɪ/

The overall means for F1 and F2 showed no consistent pattern with respect to possible effects of manner of articulation of the following consonant. For Kingston females, /iː/ had the lowest mean F1 when followed by an oral stop (-0.197 log Hz), and mean F1 values for vowels followed by nasals and fricatives were about equal (-0.189 and -0.190 log Hz, respectively). For Kingston males, /iː/ had a lower mean F1 when followed by fricatives (-0.208 log Hz) than by oral stops (-0.203 log Hz) and nasals (-0.190 log Hz), respectively. St. Thomas males showed a pattern similar to the Kingston males, except that the means for F1 of /iː/when followed by fricatives and oral stops were equal (-0.204 log Hz; with following nasal, -0.161 log Hz). For St. Thomas females, /iː/ had a lower mean F1 when followed by oral stops (-0.195 log Hz) than by nasals (-0.179 log Hz) and fricatives (-0.176 log Hz), respectively. Similarly, four different patterns emerged for F2. For /ɪ/, two patterns emerged with respect to F1. For Kingston males and all St. Thomas speakers, F1 was nearly equivalent for vowels followed by oral stops and fricatives, and slightly higher for those followed by nasals (e.g., St. Thomas females: -0.093, -.0.90, -0.068 log Hz before fricatives, oral stops, and nasals, respectively). For Kingston females, F1 of /ɪ/ was lowest before nasals, then stops and fricatives (-0.093, -0.083, and -.076 log Hz, respectively). F2 was highest (/ɪ/ furthest front) before stops, followed by nasals and fricatives for Kingston females and all St. Thomas speakers (e.g., for Kingston females: 0.161, 0.152, 0.125 log Hz, respectively). For Kingston males, the direction of difference (from highest to lowest F2) was nasals, stops, fricatives (0.188, 0.179, 0.171 log Hz, respectively). These values, however, were all taken to be low-level differences, not necessarily reflecting consistent within- or between-group patterns.

The means for F1 and F2 in the word list productions shown in Table 4.4 above did not appear to be very different for speakers from the picture, and conversational productions (not shown) except in the fact that the variances tended to be larger. The greatest differences in means were for speaker TA.m, who showed mean values of 358

Hz and 2199 Hz for F1 and F2, respectively, for /ɪ/ (over 7 observations) in his picture data, and 296 Hz and 2056 Hz (over 6 observations) in his conversational data. Across all sessions, his standard deviations for F1 ranged between 36-70 Hz in F1 and 115-131 in F2.

Table 4.5 provides the duration ratios for the /iː, ɪ/ vowel pair for all speakers. In all cases except KU.m, durations ratios are greater than 1.6:1. Given the criteria set out in §4.2, this means that the vowels show no temporal overlap for males and females, Kingston and St. Thomas speakers alike, although the St. Thomas speakers, particularly the St. Thomas females, show a greater tendency for /iː/ to be more than twice the length of /ɪ/. It is interesting to note that one of the speakers described above, TA.m, whose spectral values were shown to be completely overlapping for /iː, ɪ/ shows one of the larger (2.0:1) ratios (see Table 4.5). This is not surprising if spectral difference is insufficient basis for phonemic contrast for this speaker.

In contrast to the wide variation in orderings of mean F1 and F2 values of vowels followed by consonants of differing manners of articulation (discussed above), duration values showed a clearer, expected pattern (see §4.6). For all speakers, /iː/ was shorter before an oral stop than a nasal or fricative. For example, Kingston males' /iː/ was shortest before an oral stop (126 ms), 8 ms longer before a nasal, and 18 ms longer before a fricative. Likewise, all speakers showed a common pattern for /ɪ/: shortest before fricatives, longer before oral stops and nasals (e.g., Kingston females: 56, 74, and 88 ms preceding fricatives, oral stops and nasals, respectively). The results for /ɪ/ are unexpected, because vowels generally tend to be longer before nasals and fricatives than oral stops (Lehiste, 1970). However, this finding also emerges below for /ɛ/ and /ɑː/. A possible explanation for this unexpected pattern is offered in §4.5.

Table 4.5. Mean long: short duration ratios for /iː, ɪ/ (means given in ms). The value given in the /iː, ɪ/ ratio row represents the length of /iː/relative to /ɪ/.

	Female Speakers					*Male Speakers*					
	KC.f	KD.f	KF.f	KT.f		KE.m	KM.m	KR.m	KU.m	KW.m	Kingston average
iː	108	132	125	141		126	124	140	138	132	129
ɪ	63	77	65	85		69	66	66	87	62	71
iː:ɪ ratio	1.719	1.717	1.907	1.661		1.836	1.883	2.134	1.584	2.122	1.840
	TJ.f	TL.f	TM.f	TT.f	TV.f	TA.m	TB.m	TE.m	TH.m	TX.m	St. Thomas average
iː	168	127	145	161	123	150	135	135	122	132	140
ɪ	80	66	56	74	76	75	84	83	69	81	74
iː:ɪ ratio	2.111	1.911	2.573	2.179	1.623	2.013	1.614	1.623	1.776	1.623	1.905

4.4.2.2 Statistical results for /iː, ɪ/ based on a subset of the data

Table 4.6 gives the results of the statistical tests that were conducted on word means for a subset of the /iː, ɪ/ data. ANOVA tests used log-mean normalized values for F1 and F2 at vowel midpoint, included word list data only, and were conducted over the following initial and final stop consonant environments: initial bilabial with following bilabial, initial bilabial with following alveolar, initial alveolar with following bilabial, initial alveolar with following alveolar (representing 50% of all words in this vowel quality subsystem). These tests are described separately below.

Statistical tests on F1 showed two main effects, vowel and gender. The vowel effect indicates that F1 is significantly higher for /iː/ than for /ɪ/. The gender effect is due to the fact that males of both groups have a lower F1 on average for /iː/ and /ɪ/ than females (see Table 4.4). This means that this vowel tends to be higher for males than females.

Vowel also exhibited a main effect in the statistical test on F2 with F2 of /iː/ being higher than that of /ɪ/. Vowel interacted with gender: F2 of /iː/ for females was

Table 4.6. ANOVA results for the high front vowel quality subsystem. Consonant environments for F1,F2 tests: preceding bilabial with following bilabial, preceding bilabial with following alveolar, preceding alveolar with following bilabial, and preceding alveolar with following alveolar. Consonant environment for Duration test: preceding bilabial with following alveolar. Factors for F1, F2 tests include Vowel, Preceding Place, following place, group, gender. Factors for Duration test include: Vowel, following voicing, group, gender. Repeated measures for speaker and word. Values submitted consist of word means for each speaker.

Dependent Variable **Significant Factors**	**df**	**F**	***p*-value**
F1			
vowel	(2,157)	348.10	<0.01
gender	(1,157)	6.23	0.01
F2			
vowel	(2,157)	597.06	<0.01
vowel * group	(1,157)	31.12	<0.01
vowel * gender	(1,157)	47.10	<0.01
Duration			
vowel	(1,45)	23.16	0.01
group	(1,45)	4.77	0.03
vowel * gender	(1,45)	3.88	0.055

higher than males'. This confirms the observation made above that females' /iː/ is situated further front in their system than males'. There was also a vowel-by-group interaction, such that St. Thomas speakers' F2 for /ɪ/ tended to be higher than that of Kingston speakers. This means that St. Thomas speakers tended in general to have a more fronted production of /ɪ/.

Statistical tests on duration values were conducted over the initial bilabial with following alveolar category, where voicing of the following consonant could be held constant. Vowel was significant, with /iː/ longer than /ɪ/. There was a trend toward a vowel-by-gender interaction which was just below the level of significance ($F(1, 45)=3.88$, $p=0.055$) indicating a tendency for females to have greater differences in mean duration for /iː, ɪ/. The vowel-by-group interaction was due to the fact that St. Thomas speakers showed longer durations for /iː/ than Kingston speakers (see Table 4.5).

In summary, /iː, ɪ/ in the high front vowel quality subsystem most frequently showed either partial or no spectral overlap, with no temporal overlap for individual speakers. Complete spectral overlap with no temporal overlap was attributed to the data of one speaker from St. Thomas, TA.m, although means were very close for another, TX.m. Interestingly, when the duration means over all vowels to come in the following subsystem analyses are examined, it will be seen that /iː, ɪ/ are the vowel pair with the largest duration ratios (1.840:1, and 1.905:1 for Kingston and St. Thomas, respectively). However, though the duration difference is remarkable, it must be borne in mind that the preceding discussion suggests that spectral quality also differentiates the two vowels for most St. Thomas speakers as it does for the Kingston speakers.

4.4.3 Mid Front Subsystem /eː, ɛ/

The range of realizations for /eː/ included [eː, ie, iː, i̞ː, ɪː, eᵊ, iᵋ]; and for /ɛ/, [e, ɛ]. There was a great deal of variation in productions of the /eː/ class of words from downgliding diphthong, to mid monophthong, to a high monophthong. (Classification of a token as downgliding, monophthongal, etc. was achieved by auditory analysis and visual inspection of the vowel spectrogram.) The presence of a high monophthong in the vicinity of /iː/ for some speakers suggests that perhaps /eː/ overlaps spectrally with /iː/, thus raising issues about its phonemic classification. I return to this issue in §4.5.

4.4.3.1 Overview of /eː, ɛ/ based on all data

Table 4.7 presents the means, deviations, and overlap decisions for this vowel pair. The pair /eː, ɛ/ showed no- or partial spectral overlap for all speakers with the

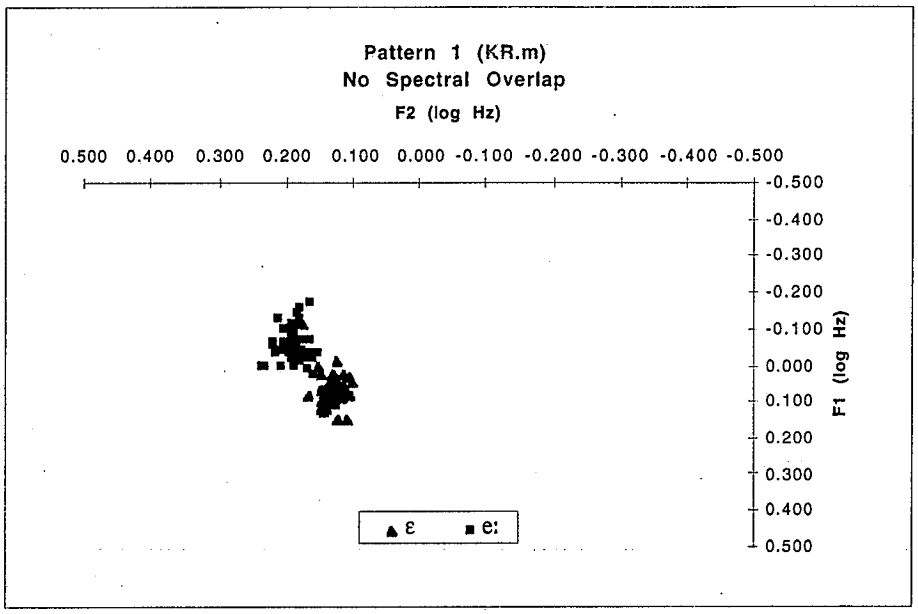
Table 4.7. Means and standard deviations for F1 and F2 (both raw Hz and normalized data), and duration for /eː,ɛ/ for all speakers. For each pair, values representing the distance between the means of each distribution (ΔMeans), each distribution's standard deviation (σv_1, σv_2), and the test conditions for determining overlap, are given. Values for monophthongs are for vowel midpoint; for diphthongs, nucleus midpoint.

Vowel Pair	Speaker	*n*	F1		F1 (log Hz)		F2		F2 (log Hz)		duration (sec)		$\sigma^* v_1$	$\sigma^* v_2$	k	ΔMeans	Overlap Decision
ɛ	KC.f	20	527	33	0.04	0.03	1973	103	0.14	0.02	0.093	0.012	0.026	0.035	-2.039	0.155	none
eː [ie]	KC.f	16	383	33	-0.09	0.04	2302	132	0.21	0.03	0.123	0.018					
ɛ	KD.f	64	596	78	0.05	0.05	2045	83	0.10	0.02	0.104	0.020	0.038	0.034	-2.757	0.156	none
eː [ie]	KD.f	56	423	34	-0.09	0.03	2316	156	0.16	0.03	0.151	0.033					
ɛ	KE.m	64	522	26	0.06	0.02	1936	92	0.11	0.02	0.096	0.022	0.022	0.022	-2.438	0.156	none
eː [ie]	KE.m	56	374	25	-0.08	0.03	2218	59	0.17	0.01	0.133	0.033					
ɛ	KF.f	64	627	70	0.08	0.05	2142	93	0.12	0.06	0.092	0.020	0.050	0.021	-1.688	0.132	partial
eː [ie]	KF.f	56	481	33	-0.03	0.03	2488	81	0.19	0.01	0.147	0.031					
ɛ	KM.m	60	523	47	0.06	0.04	1658	71	0.11	0.02	0.110	0.109	0.028	0.019	-1.877	0.114	none
eː [ie]	KM.m	56	414	28	-0.04	0.03	1876	49	0.16	0.01	0.142	0.028					
ɛ	KR.m	64	500	40	0.07	0.04	1913	62	0.13	0.01	0.097	0.014	0.026	0.031	-2.270	0.143	none
eː [ie]	KR.m	54	370	36	-0.06	0.04	2184	85	0.19	0.02	0.143	0.032					
ɛ	KT.f	60	529	43	0.01	0.09	1979	103	0.08	0.06	0.114	0.020	0.077	0.035	-1.392	0.127	complete
eː [ie]	KT.f	56	410	38	-0.09	0.04	2334	151	0.15	0.03	0.163	0.027					
ɛ	KU.m	64	578	48	0.09	0.04	2029	118	0.12	0.03	0.106	0.025	0.034	0.037	-2.497	0.169	none
eː [ie]	KU.m	54	404	50	-0.07	0.05	2343	104	0.18	0.02	0.138	0.032					
ɛ	KW.m	64	523	40	0.06	0.03	2001	101	0.14	0.02	0.088	0.012	0.032	0.038	-2.948	0.181	none
eː [ie]	KW.m	53	353	40	-0.11	0.05	2287	93	0.20	0.02	0.116	0.021					
ɛ	TA.m	50	407	53	0.01	0.06	2123	83	0.19	0.02	0.101	0.027	0.051	0.057	-5.238	0.173	partial
eː [ie]	TA.m	52	276	46	-0.16	0.07	2285	94	0.22	0.02	0.145	0.044					
ɛ	TB.m	55	505	26	0.04	0.02	1868	87	0.11	0.02	0.105	0.015	0.022	0.034	-1.834	0.069	partial
eː [ie]	TB.m	40	440	47	-0.02	0.04	2017	111	0.14	0.02	0.143	0.019					
ɛ	TE.m	64	501	31	0.04	0.03	1875	73	0.10	0.02	0.103	0.015	0.024	0.024	-2.264	0.082	partial
eː [ie]	TE.m	49	422	24	-0.04	0.02	2024	93	0.13	0.02	0.142	0.023					
ɛ	TH.m	47	444	25	0.04	0.02	1909	94	0.11	0.02	0.083	0.019	0.023	0.047	-1.573	0.100	partial
eː [ie]	TH.m	29	368	47	-0.05	0.06	2164	168	0.16	0.04	0.140	0.028					
ɛ	TJ.f	48	568	62	0.01	0.05	2247	187	0.16	0.04	0.112	0.020	0.043	0.018	-1.021	0.077	complete
eː [ie]	TJ.f	41	498	26	-0.05	0.02	2539	89	0.22	0.02	0.184	0.025					
ɛ	TL.f	64	495	44	0.03	0.04	2062	99	0.14	0.02	0.088	0.018	0.032	0.030	-2.146	0.129	none
eː [ie]	TL.f	55	378	33	-0.09	0.04	2337	97	0.20	0.02	0.143	0.028					
ɛ	TM.f	47	467	73	-0.03	0.06	2302	121	0.18	0.02	0.077	0.019	0.033	0.015	-1.131	0.074	partial
eː [ie]	TM.f	42	407	17	-0.09	0.02	2575	73	0.23	0.01	0.155	0.022					
ɛ	TT.f	64	509	52	0.05	0.05	2027	63	0.13	0.01	0.101	0.019	0.027	0.029	-2.076	0.130	none
eː [ie]	TT.f	56	388	31	-0.06	0.03	2309	106	0.19	0.02	0.176	0.027					
ɛ	TV.f	61	574	60	0.04	0.05	2202	151	0.14	0.04	0.103	0.021	0.044	0.032	-2.558	0.097	partial
eː [ie]	TV.f	53	467	45	-0.05	0.04	2382	88	0.18	0.02	0.148	0.031					
ɛ	TX.m	46	538	42	0.05	0.03	1791	72	0.10	0.02	0.115	0.017	0.031	0.033	-3.188	0.104	partial
eː [ie]	TX.m	43	428	36	-0.05	0.04	1925	91	0.14	0.02	0.139	0.026					

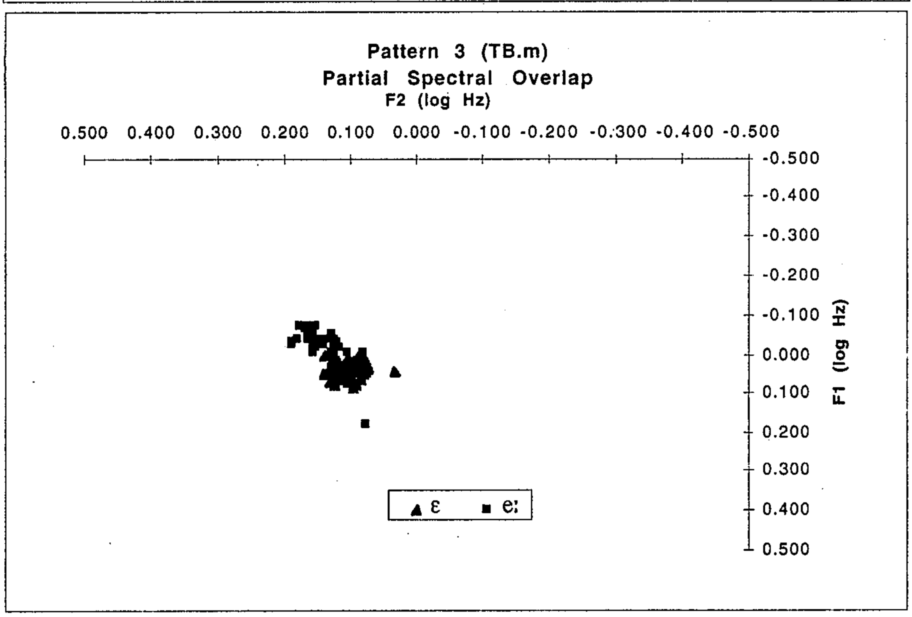
exception of speakers TJ.f and KT.f.[5] Figure 4.3 (a,b) shows vowel distributions for KR.m and TB.m, who were evaluated as showing no spectral overlap, and partial overlap, respectively. Their data were taken to be typical of the spectral patterns in the larger sample, whose vowel plots appear in Appendix G. Whether /eː/ was pronounced as a monophthong or a diphthong (the breakdown will be described below), its nucleus was higher than that of /ɛ/, on the order of 100 Hz (0.1 in log Hz), as may be seen in the F1 means for all speakers provided in Table 4.7. For all speakers, /ɛ/ showed lower F2 values than /eː/, on the order of 200 Hz, indicating that it is located further back in the vowel space. The deviations for F1 and F2 for the two vowels were low, suggesting that these vowels cluster fairly tightly, as did the other front vowels, /iː, ɪ/. The mean values for F1 and F2 presented earlier in Table 4.3 (mean formant values for all speakers, both groups) show a spread in F1 means of about 100 Hz for St. Thomas speakers, but about 50 Hz for Kingston speakers. It is clear from the mean data in Tables 4.4 and 4.8 that spectral values are separate for both groups. (The relevant statistical tests are presented below.)

Following manner showed no robust effects on F1 or F2. For Kingston females, /eː/ had a lower mean F1 (i.e., /eː/was higher) when followed by fricatives and oral stops than by nasals (-0.076, -0.073, and -0.067 log Hz, respectively), with the differences between manners being small. Kingston males and St. Thomas females showed a similar pattern. For St. Thomas males, /eː/ had a lower mean F1 when followed by oral stops (-0.068 log Hz) than by fricatives (-0.065 log Hz) and nasals (-0.046 log Hz), respectively. For F2, however, four different patterns emerged, as was the case for /iː/. Likewise, for /ɛ/, four different patterns emerged for F1 and three for F2.

As with the high front vowels, St. Thomas speakers showed larger duration ratios than Kingston speakers, the ratio for /eː/:/ɛ/=1.56:1; for Kingston, 1.42:1. Table



(a)



(b)

Figure 4.3 a,b. Main spectral patterns associated with /eː, ɛ/.

4.8 provides the duration ratios for this vowel pair averaged across both monophthongal and diphthongal realizations (all place and manner contexts, word list session); Table 4.9 provides means for monophthongal (n=826) and diphthongal (n= 238) productions separately for both groups (all place and manner contexts, word list session). Table 4.8 shows that both /eː, ɛ/ are longer for St. Thomas speakers, on average. (Speakers in both groups produced downgliding [ie] but in different proportions, as is discussed below in §4.4.3.3.) The mean duration data in this table also suggest that females tend to have longer /eː/ than males, across both Kingston and St. Thomas groups.

The effects of a following nasal on vowel duration differed slightly from those reported for the high front vowels. Findings for /ɛ/ matched those for /ɪ/, with vowels shorter before fricatives and oral stops than nasals (e.g., St. Thomas males: 100 ms, 100 ms, and 109 ms, respectively). For /eː/, following oral stops resulted in the shortest durations, followed by fricatives and nasals for Kingston speakers and St. Thomas males (e.g., for Kingston females: 138 ms, 167, and 176 ms, respectively). For St. Thomas females, the ordering of fricatives and nasals was reversed (152, 168, and 174 ms for vowels following stops, nasals, and fricatives, respectively).

Table 4.8. Mean duration ratios for /eː, ɛ/, [ie] included (means given in ms)

	Female Speakers					*Male Speakers*					
	KC.f	KD.f	KF.f	KT.f		KE.m	KM.m	KR.m	KU.m	KW.m	Kingston average
eː	122	150	147	163		133	142	143	138	116	139
ɛ	93	104	92	114		95	95	97	106	88	98
eː:ɛ ratio	1.312	1.442	1.598	1.430		1.400	1.495	1.474	1.302	1.318	1.419
	TJ.f	TL.f	TM.f	TT.f	TV.f	TA.m	TB.m	TE.m	TH.m	TX.m	St. Thomas average
eː	182	143	155	176	148	146	146	142	140	139	152
ɛ	112	88	77	101	103	101	105	103	83	115	99
eː:ɛ ratio	1.625	1.625	2.013	1.743	1.437	1.446	1.390	1.379	1.687	1.209	1.555

Table 4.9. Mean durations for [eː] and [ie] (in ms) across all place and manner contexts for the word list session (Kingston: n=504; St. Thomas: n=560)

[eː]	N (%)	Mean Dur	Std Dev	Minimum	Maximum
Kingston	392 (78)	114	27	68	175
St. Thomas	434 (77)	122	31	68	199
Total:	826 (77)				

[ie]	N (%)	Mean Dur	Std Dev	Minimum	Maximum
Kingston	112 (22)	127	13	115	149
St. Thomas	126 (23)	140	8	133	151
Total:	238 (22)				

4.4.3.2 Statistical results for /eː, ɛ/ based on a subset of the data

The ANOVA design and output for the mid front subsystem is provided in Table 4.10 (a,b). Two sets of ANOVAs were run in order to include as many contexts as possible for this vowel pair. In these tests, only monophthongal variants of /eː/ were included in comparisons with /ɛ/. This is because the tests were intended to highlight spectral and temporal similarity and difference, and diphthongal [ie] is already distinct in its spectral trajectory from monophthongal [ɛ]. Consonant environments included in the statistical tests for the mid front vowel quality category were initial bilabial with final alveolar or velar (set 1) and initial alveolar with final alveolar (set 2). These contexts accounted for 53% of words with mid front vowels. Following place of articulation was therefore a factor in the analyses with initial bilabials, in addition to vowel, group, and gender. In describing the two sets of ANOVAs, I will first discuss F1 for both tests, then F2 for both, and finally duration for the one test in which it was compared.

Table 4.10a. ANOVA results for the mid front vowel quality subsystem (first set). Consonant environments for F1, F2, and Duration tests: preceding bilabial with following alveolar or velar. Factors for F1, F2 , and Duration tests include vowel, following place, group, gender. Following voicing restricted to voiceless consonants for Duration test. Repeated measures for speaker and word. Values submitted consist of word means for each speaker.

Dependent Variable **Significant Factors**	**df**	**F**	***p*-value**
F1			
vowel	(1,81)	323.65	<0.01
vowel * group	(1,81)	23.56	<0.01
F2			
vowel	(1,81)	88.36	<0.01
vowel * group	(1,81)	7.91	<0.01
Duration			
vowel	(1,33)	40.99	<0.01
group	(1,33)	5.30	<0.03
vowel * group	(1,33)	5.45	<0.03
vowel * gender	(1,33)	8.04	<0.01

Table 4.10b. ANOVA results for the mid front vowel quality subsystem (second set). Consonant environments for F1,F2 tests: preceding alveolar with following alveolar. Factors for F1, F2 tests include vowel, group, gender. No test of duration was possible for this consonant environment. Repeated measures for speaker and word. Values submitted consist of word means for each speaker.

Dependent Variable **Significant Factors**	**df**	**F**	***p*-value**
F1			
vowel	(1,8)	12.32	<0.01
vowel * group	(1,8)	19.11	<0.01
F2			
vowel	(1,8)	102.94	<0.01
vowel * group	(1,8)	4.94	<0.06

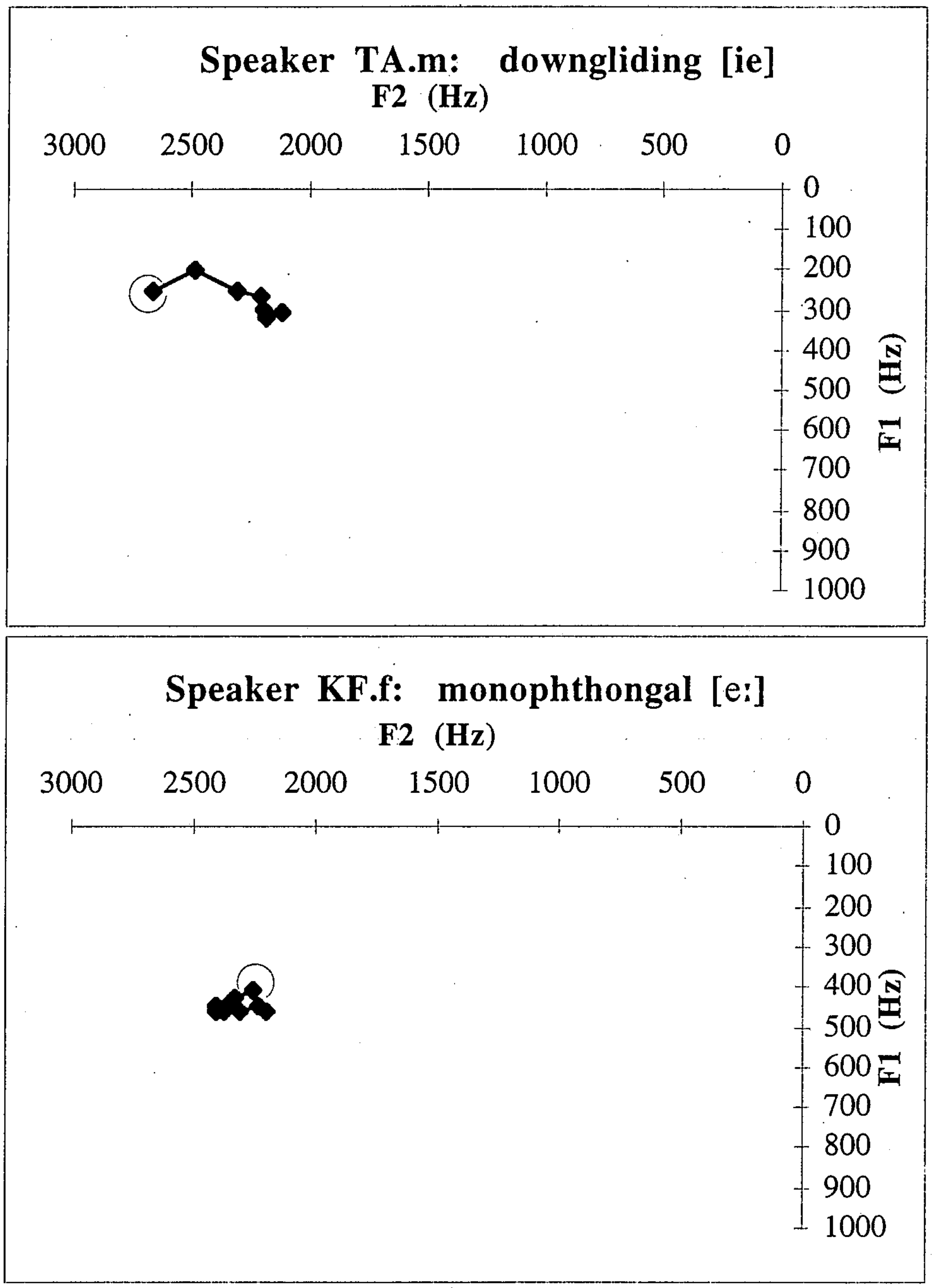
For F1, both analyses showed a main effect of vowel, and a vowel-by-group interaction. St. Thomas speakers' /eː, ɛ/, though distinct, were closer in F1 than those produced by the Kingston speakers: i.e., Kingston speakers' [eː] was higher than St. Thomas speakers' [eː], while Kingston speakers' [ɛ] was lower than the St. Thomas group's. This provides statistical support for the difference in the spread of F1 noted above in the discussion of the overall /eː, ɛ/ results.

F2 values showed the same results, except that the vowel-by-group interaction falls just short of statistical significance for the initial alveolar context (Table 4.10b). F2 values for /eː/ were higher (i.e., /eː/ was more front), but similar to the case of F1 above, St. Thomas speakers' /eː, ɛ/ were closer together in F2 than those produced by the Kingston speakers (see means in Table 4.3).

The duration comparison was restricted to the initial bilabial with following alveolar and bilabial with following velar contexts where voicing of the following consonant could be held constant (see Table 4.10a). Monophthongal /eː/ is longer than /ɛ/ (accounting for the main effect of vowel), and St. Thomas speakers' /eː/ is longer than Kingston speakers' (accounting for the main effect of vowel). The vowel-by-group interaction is due to a larger difference between /eː/ than /ɛ/ for the two groups (St. Thomas speakers' /eː/ being longer), but in addition, females' /eː/-- but not /ɛ/-- is longer than males' (accounting for the vowel-by-gender interaction).

4.4.3.3 Monophthongal vs. Diphthongal Productions of /eː/

Figure 4.4 (a,b) compares a downgliding diphthong [ie] for speaker TA.m against a monophthongal [eː] for speaker KF.f. The points plotted on each graph represent the positions of the first and second formants at each of the 12.5 ms interval measures taken for each diphthong from vowel onset to offset, the line showing the ordering of intervals and the direction of change in acoustic space. Spectral coordinates at vowel onset are



(a)
(b)

Figure 4.4 a,b. Plot of successive spectral measurements for: (a) downgliding [ie] produced by basilect-dominant speaker TA.m, in the word "babe", and (b) monophthongal [e:] for speaker KF.f, also in "babe". Plotted points represent successive 12.5 ms interval measures from diphthong onset to offset; onset position is circled.

indicated by a circle. Typically, the downgliding diphthong (Fig. 4.4a) displays rather slight movement down the peripheral track of the left system boundary combined with movement toward the center of acoustic space. A second variant, the centering diphthong [e^{ə}] (not shown), on the other hand, shows movement from the periphery toward the center of acoustic space, showing a similar magnitude of change in F2 to the downgliding diphthong, but changing very little in F1 . Monophthongal [e:] shows little movement in either F1 or F2 (Fig. 4.4b). In terms of duration, diphthongal productions of [ie] were longer on average than monophthongal [e:], on the order of 15-25%, as shown in Table 4.9.

Table 4.11 Occurrences of downgliding [ie] in the word list data, expressed as a raw number (top row) and as a proportion of all /e:/ words for each speaker (bottom row) across all place and manner contexts.

	Female Speakers					*Male Speakers*				
	KC.f	KD.f	KF.f	KT.f		KE.m	KM.m	KR.m	KU.m	KW.m
#downgliding	15	0	0	0		7	0	30	8	52
%	*30*	*0*	*0*	*0*		*13*	*0*	*56*	*14*	*93*
	TJ.f	TL.f	TM.f	TT.f	TV.f	TA.m	TB.m	TE.m	TH.m	TX.m
#downgliding	4	29	1	1	2	36	8	10	3	32
%	*7*	*52*	*2*	*2*	*4*	*69*	*19*	*20*	*10*	*76*

The distribution of downgliding realizations is particularly interesting. Logistic regression with random effects for word and subject (speaker) repeated was used to test the proportion of downgliding productions in all sessions for the initial bilabial with final velar context. The St. Thomas speakers downglided more frequently in the word list session (St. Thomas: 57%, Kingston: 44%), but this trend was *not* statistically significant ($F(1,470)=0.65$, n.s). Further, males in both the Kingston and St. Thomas groups downglided more frequently than their female counterparts, but again, this effect did not reach significance (Kingston--males: 53%, females: 23%; St. Thomas--males: 59%, females: 32%; F(1, 470)=0.03, n.s.). In order to take a closer look at the data, the number of words coded as downgliding for each speaker was tallied for the word list session, as shown in Table 4.11. This table suggests that the results did not reach statistical significance because the within-group variation was great. Three of four Kingston females showed no downgliding whatsoever in the word list, but the fourth, KC.f, showed more downgliding than three out of five of her male counterparts. Among Kingston males, occurrence of [ie] ranged from 0-93% in the word list session. No St. Thomas speaker produced exclusively monophthongal variants. However, the ranges for females and males in this group were quite broad.

Table 4.12 compares production across sessions, making it possible to check whether speakers suppressed downgliding in the word list sessions (mean formant values for vowels recorded in the different sessions are provided in Appendix E). St. Thomas females exhibited more of a tendency than their male counterparts to use monophthongal [eː] in their word list productions, but exhibited downgliding [ie] in their picture and conversation sessions. St. Thomas males tended more to have both gliding and monophthongal productions in their word list sessions. Four Kingston males produced both downgliding and monophthongal productions in their word list sessions, but only Kingston female KC.f showed any downgliding in the word list. What is interesting is that downgliding productions, which have traditionally been discouraged in formal settings as rural, uneducated pronunciation, did emerge in the word list. However, it seems clear that there was a trend toward using monophthongal productions in the word list, but downgliding ones in the less formal picture and conversation settings.

In summary, when the vowels in the mid front subsystem were examined, and monophthongal variants of /eː/ compared with /ɛ/, it was found that speakers in both

Table 4.12 Monophthongal vs. downgliding/centering productions of /e:/, by session.

	Downgliding or Centering [ie]		Monophthongal [e:]	
Speaker	word list	picture/conversation	word list	picture/conversation
St. Thomas males				
TA	X	X		
TB	x	x	x	x
TE		X	X	
TH	x	X	X	
TX	X	X		
St. Thomas females				
TJ	x	X	X	
TL	X	X	x	
TM		X	X	
TT		X	X	
TV		X	X	x
Kingston males				
KE	x		X	X
KM		x	X	x
KR	X	X	x	
KU	x	nd	X	nd
KW	X		x	X
Kingston females				
KC	X	nd		nd
KD		x	X	x
KF		nd	X	nd
KT		nd	X	nd

KEY: Capital (X) indicates that the predominance of a speaker's productions fell into the category specified; lower case (x) indicates that less than 5% of realizations fell into the categor(ies) specified. (nd) indicates that a speaker had "no data," i.e., no /e:/ productions in a particular session.

the Kingston and St. Thomas groups tended to show the same spectral patterns--no or only partial spectral overlap between /e:, ɛ/. This is similar to what was found for the high front subsystem. The St. Thomas speakers showed a tendency for the vowels to be closer together in both F1 and F2, although the means, variances, and statistical results suggested that these vowels had different distributions. On the other hand, St. Thomas speakers also showed a larger difference in duration between these vowels in addition to this spectral difference. Vowel quantity was shown to be used by females differently from males, females achieving a greater temporal spread between /eː, ɛ/ than males in both groups by lengthening /eː/. When the mid front subsystem is compared with the high front subsystem the two sets of vowels show a degree of overlap for some speakers.

4.4.4 Low Subsystem /a, ɑː, ɔ, ʌ, aɪ, ɔɪ/

The range of realizations for /a/ included [aː, ɑ, a̹]. The range for /ɑː/ included [ɑː, ɑːː, ɒː, ɒ̹, ɑ̹, ɔː]. /ɔ/ was realized as [ɔ, ɔː, ɑ], and /ʌ/ was realized as [ʌ, ɔ]. This vowel quality subsystem contained one canonical long:short opposition /ɑː, a/, and the vowels that are their neighbors in acoustic space. /ʌ/ was included in this subsystem because several accounts of the vowel inventory of Jamaican Creole in the literature have suggested that /ʌ/ is often pronounced [ɔ] or [o] in basilectal speech (LePage, 1960; Roberts, 1988). Other accounts leave out /ʌ/ entirely (e.g., Akers, 1981; Wells, 1982). There was some spectral variation in /a/ due to the effects of the preceding consonant, i.e., the palatal consonant or velar consonant plus glide [kʲ]. These patterns will be described below in a brief consideration of the spectral effects of palatalization.

Vowels /aɪ/ and /ɔɪ/ were included in this subsystem because their nuclei occurred near to that of /a/ for most speakers. Spectral and temporal features of these vowels are described following the subsections treating /ɔ, a, ɑː, ʌ/ and palatalization preceding /a/.

4.4.4.1 Overview of /ɑː, a, ɔ, ʌ/ **based on all data**

Table 4.13 (a-c) presents the means, deviations, and overlap decisions for the monophthongal vowels in the low subsystem. For these charts, since there are numerous two-way comparisons, vowel pairs and their overlap decisions are listed in

Table 4.13 a-c. Means and standard deviations for F1 and F2 (both raw Hz and normalized data), and duration for /a, ɑ:, ɔ, ʌ/ for all speakers. For each pair, values representing the distance between the means of each distribution (ΔMeans), each distribution's standard deviation (σv_1, σv_2), and the test conditions for determining overlap, are given. Values presented are from vowel midpoint.

(a)

Vowel	Speaker	*n*	F1		F1 (log Hz)		F2		F2 (log Hz)		duration (sec)		Vowel Pair	σ*v₁	σ*v₂	k	ΔMeans	Overlap Decision
a	KC.f	20	694	38	0.16	0.02	1413	162	-0.01	0.05	0.110	0.023	a/ɑ:	0.040	0.028	0.406	0.060	partial
ɑ:	KC.f	5	658	25	0.14	0.02	1240	93	-0.06	0.03	0.158	0.009	a/ɔ	0.045	0.021	0.169	0.061	complete
ɔ	KC.f	18	678	34	0.15	0.02	1226	59	-0.07	0.02	0.101	0.022	ɔ/ɑ:	0.022	0.017	-2.703	0.013	complete
ʌ	KC.f	25	563	25	0.07	0.02	1074	105	-0.13	0.04	0.094	0.016	ɔ/ʌ	0.023	0.022	1.373	0.100	none
													ʌ/ɑ:	0.020	0.025	1.078	0.093	none
a	KD.f	64	802	45	0.18	0.03	1689	122	0.02	0.03	0.120	0.025	a/ɑ:	0.031	0.039	0.120	0.101	partial
ɑ:	KD.f	16	782	61	0.17	0.04	1344	135	-0.08	0.04	0.183	0.019	a/ɔ	0.032	0.038	0.037	0.087	partial
ɔ	KD.f	67	796	43	0.18	0.02	1385	123	-0.07	0.04	0.122	0.041	ɔ/ɑ:	0.031	0.038	0.669	0.016	complete
ʌ	KD.f	88	641	57	0.09	0.04	1276	153	-0.10	0.05	0.101	0.026	ɔ/ʌ	0.039	0.025	2.566	0.102	partial
													ʌ/ɑ:	0.036	0.039	3.603	0.090	partial
a	KE.m	64	719	40	0.20	0.02	1448	99	-0.01	0.03	0.115	0.030	a/ɑ:	0.028	0.021	0.679	0.161	none
ɑ:	KE.m	16	583	25	0.11	0.02	1064	56	-0.15	0.02	0.175	0.020	a/ɔ	0.029	0.034	0.422	0.094	partial
ɔ	KE.m	68	661	46	0.16	0.03	1187	97	-0.10	0.03	0.110	0.040	ɔ/ɑ:	0.031	0.020	1.156	0.071	partial
ʌ	KE.m	87	564	37	0.10	0.03	1170	117	-0.11	0.04	0.098	0.031	ɔ/ʌ	0.028	0.029	9.936	0.069	partial
													ʌ/ɑ:	0.022	0.040	-0.366	0.042	complete
a	KF.f	64	873	52	0.23	0.03	1719	152	0.03	0.04	0.110	0.025	a/ɑ:	0.033	0.032	0.697	0.199	none
ɑ:	KF.f	16	673	56	0.12	0.04	1179	84	-0.14	0.03	0.185	0.023	a/ɔ	0.036	0.028	0.369	0.120	partial
ɔ	KF.f	67	794	59	0.19	0.03	1324	85	-0.08	0.03	0.110	0.035	ɔ/ɑ:	0.031	0.034	1.425	0.088	partial
ʌ	KF.f	88	613	65	0.07	0.05	1192	112	-0.13	0.04	0.099	0.030	ɔ/ʌ	0.051	0.032	2.439	0.124	partial
													ʌ/ɑ:	0.036	0.053	-11.645	0.042	complete
a	KM.m	64	676	35	0.18	0.02	1311	75	0.00	0.02	0.114	0.025	a/ɑ:	0.024	0.015	0.445	0.129	none
ɑ:	KM.m	16	598	17	0.12	0.01	1000	59	-0.11	0.02	0.180	0.024	a/ɔ	0.025	0.025	0.155	0.078	partial
ɔ	KM.m	68	657	32	0.16	0.02	1097	62	-0.07	0.02	0.109	0.026	ɔ/ɑ:	0.022	0.014	1.001	0.057	partial
ʌ	KM.m	88	518	45	0.06	0.03	963	81	-0.13	0.03	0.094	0.029	ɔ/ʌ	0.029	0.022	1.814	0.119	none
													ʌ/ɑ:	0.012	0.029	3.719	0.066	partial
a	KR.m	61	719	47	0.23	0.03	1476	134	0.02	0.04	0.123	0.022	a/ɑ:	0.039	0.030	0.170	0.108	partial
ɑ:	KR.m	16	690	49	0.21	0.03	1154	76	-0.09	0.03	0.194	0.014	a/ɔ	0.039	0.062	0.178	0.072	complete
ɔ	KR.m	67	699	51	0.22	0.03	1265	233	-0.05	0.06	0.116	0.040	ɔ/ɑ:	0.062	0.030	0.152	0.036	complete
ʌ	KR.m	87	528	51	0.09	0.04	1032	137	-0.14	0.06	0.095	0.025	ɔ/ʌ	0.047	0.037	1.417	0.151	partial
													ʌ/ɑ:	0.031	0.045	2.286	0.128	partial
a	KT.f	64	823	60	0.21	0.03	1697	95	0.01	0.02	0.136	0.025	a/ɑ:	0.025	0.026	0.107	0.108	none
ɑ:	KT.f	16	803	72	0.20	0.04	1325	80	-0.09	0.03	0.199	0.024	a/ɔ	0.025	0.029	0.066	0.074	partial
ɔ	KT.f	68	815	62	0.21	0.04	1435	127	-0.06	0.03	0.129	0.034	ɔ/ɑ:	0.030	0.027	0.197	0.034	partial
ʌ	KT.f	87	632	89	0.09	0.06	1352	177	-0.09	0.04	0.111	0.024	ɔ/ʌ	0.057	0.035	4.044	0.116	partial
													ʌ/ɑ:	0.042	0.059	-18.989	0.107	partial

(b)

Vowel	Speaker	*n*	F1		F1 (log Hz)		F2		F2 (log Hz)		duration (sec)		Vowel Pair	σ*v₁	σ*v₂	k	ΔMeans	Overlap Decision
a	KU.m	*64*	784	*69*	0.22	*0.04*	1603	*121*	0.02	*0.03*	0.120	*0.030*	a/ɑ:	0.033	0.026	0.225	0.145	none
ɑ:	KU.m	*16*	728	*57*	0.19	*0.03*	1156	*67*	-0.12	*0.03*	0.180	*0.020*	a/ɔ	0.033	0.037	0.328	0.119	partial
ɔ	KU.m	*68*	719	*53*	0.18	*0.03*	1238	*108*	-0.09	*0.04*	0.118	*0.037*	ɔ/ɑ:	0.038	0.026	-0.181	0.029	complete
ʌ	KU.m	*88*	625	*44*	0.12	*0.03*	1166	*116*	-0.12	*0.04*	0.109	*0.031*	ɔ/ʌ	0.033	0.033	2.313	0.066	partial
													ʌ/ɑ:	0.033	0.031	-27.046	0.066	partial
a	KW.m	*62*	700	*57*	0.19	*0.03*	1418	*136*	-0.01	*0.04*	0.106	*0.020*	a/ɑ:	0.040	0.025	0.149	0.069	partial
ɑ:	KW.m	*15*	682	*32*	0.18	*0.02*	1208	*68*	-0.07	*0.02*	0.154	*0.014*	a/ɔ	0.039	0.031	0.221	0.063	partial
ɔ	KW.m	*63*	678	*46*	0.17	*0.03*	1228	*87*	-0.07	*0.03*	0.098	*0.024*	ɔ/ɑ:	0.031	0.024	-0.527	0.007	complete
ʌ	KW.m	*84*	553	*33*	0.09	*0.03*	1079	*87*	-0.12	*0.04*	0.089	*0.019*	ɔ/ʌ	0.028	0.031	1.555	0.104	partial
													ʌ/ɑ:	0.021	0.027	1.831	0.104	none
a	TA.m	*62*	658	*72*	0.22	*0.04*	1308	*191*	-0.02	*0.06*	0.124	*0.034*	a/ɑ:	0.058	0.038	0.313	0.052	complete
ɑ:	TA.m	*12*	636	*83*	0.21	*0.05*	1160	*99*	-0.07	*0.04*	0.193	*0.047*	a/ɔ	0.060	0.040	0.064	0.036	complete
ɔ	TA.m	*56*	655	*71*	0.22	*0.05*	1198	*107*	-0.06	*0.04*	0.111	*0.046*	ɔ/ɑ:	0.044	0.043	0.964	0.019	complete
ʌ	TA.m	*81*	473	*57*	0.08	*0.05*	910	*100*	-0.18	*0.05*	0.102	*0.030*	ɔ/ʌ	0.048	0.045	1.179	0.186	none
													ʌ/ɑ:	0.045	0.048	1.207	0.167	partial
a	TB.m	*55*	694	*45*	0.17	*0.03*	1466	*150*	0.00	*0.05*	0.124	*0.020*	a/ɑ:	0.045	0.042	0.112	0.040	complete
ɑ:	TB.m	*13*	686	*33*	0.17	*0.02*	1337	*127*	-0.04	*0.04*	0.171	*0.019*	a/ɔ	0.044	0.047	0.205	0.034	complete
ɔ	TB.m	*65*	683	*53*	0.17	*0.03*	1360	*148*	-0.03	*0.05*	0.126	*0.035*	ɔ/ɑ:	0.045	0.037	-0.345	0.007	complete
ʌ	TB.m	*78*	538	*42*	0.06	*0.03*	1152	*184*	-0.11	*0.07*	0.113	*0.026*	ɔ/ʌ	0.038	0.037	1.396	0.128	partial
													ʌ/ɑ:	0.024	0.037	1.566	0.126	none
a	TE.m	*64*	702	*48*	0.18	*0.03*	1474	*147*	-0.01	*0.04*	0.120	*0.019*	a/ɑ:	0.044	0.040	-0.014	0.024	complete
ɑ:	TE.m	*16*	702	*32*	0.18	*0.02*	1393	*129*	-0.03	*0.04*	0.174	*0.018*	a/ɔ	0.041	0.050	0.326	0.032	complete
ɔ	TE.m	*68*	688	*71*	0.17	*0.05*	1376	*157*	-0.04	*0.05*	0.123	*0.033*	ɔ/ɑ:	0.048	0.023	1.551	0.012	complete
ʌ	TE.m	*85*	546	*55*	0.07	*0.04*	1171	*192*	-0.11	*0.07*	0.109	*0.026*	ɔ/ʌ	0.047	0.048	1.378	0.124	partial
													ʌ/ɑ:	0.024	0.047	1.393	0.136	partial
a	TH.m	*45*	562	*61*	0.14	*0.05*	1438	*218*	-0.02	*0.07*	0.103	*0.028*	a/ɑ:	0.066	0.053	0.297	0.108	partial
ɑ:	TH.m	*11*	525	*71*	0.11	*0.06*	1127	*137*	-0.12	*0.05*	0.155	*0.034*	a/ɔ	0.065	0.054	0.334	0.097	partial
ɔ	TH.m	*36*	524	*61*	0.11	*0.05*	1160	*150*	-0.11	*0.05*	0.118	*0.045*	ɔ/ɑ:	0.054	0.052	0.009	0.012	complete
ʌ	TH.m	*61*	473	*29*	0.07	*0.03*	1105	*153*	-0.13	*0.06*	0.091	*0.028*	ɔ/ʌ	0.027	0.061	4.478	0.043	complete
													ʌ/ɑ:	0.061	0.027	4.478	0.043	complete
a	TJ.f	*50*	873	*106*	0.20	*0.06*	1564	*264*	0.00	*0.08*	0.134	*0.031*	a/ɑ:	0.074	0.064	0.376	0.144	partial
ɑ:	TJ.f	*13*	775	*89*	0.14	*0.05*	1142	*187*	-0.13	*0.07*	0.237	*0.027*	a/ɔ	0.076	0.072	0.293	0.102	partial
ɔ	TJ.f	*53*	817	*109*	0.17	*0.06*	1245	*208*	-0.10	*0.07*	0.132	*0.041*	ɔ/ɑ:	0.068	0.060	0.598	0.043	complete
ʌ	TJ.f	*67*	659	*75*	0.07	*0.05*	1074	*175*	-0.16	*0.07*	0.112	*0.026*	ɔ/ʌ	0.054	0.061	1.461	0.112	partial
													ʌ/ɑ:	0.049	0.052	2.647	0.076	partial

(c)

Vowel	Speaker	*n*	F1		F1 (log Hz)		F2		F2 (log Hz)		duration (sec)		Vowel Pair	σ^*v_1	σ^*v_2	k	ΔMeans	Overlap Decision
a	TL.f	*64*	721	*71*	0.19	*0.05*	1522	*146*	0.01	*0.04*	0.103	*0.023*	a/ɑ:	0.041	0.076	0.216	0.112	complete
ɑ:	TL.f	*15*	683	*71*	0.17	*0.05*	1195	*199*	-0.10	*0.08*	0.169	*0.026*	a/ɔ	0.041	0.046	-0.146	0.053	partial
ɔ	TL.f	*67*	731	*39*	0.20	*0.02*	1349	*146*	-0.04	*0.05*	0.100	*0.032*	ɔ/ɑ:	0.036	0.066	0.554	0.065	complete
ʌ	TL.f	*84*	564	*58*	0.08	*0.04*	1126	*241*	-0.13	*0.09*	0.088	*0.021*	ɔ/ʌ	0.052	0.027	1.340	0.143	partial
													ʌ/ɑ:	0.049	0.047	2.896	0.088	partial
a	TM.f	*49*	864	*87*	0.24	*0.04*	1418	*162*	-0.04	*0.05*	0.097	*0.026*	a/ɑ:	0.045	0.063	0.566	0.095	partial
ɑ:	TM.f	*13*	784	*119*	0.19	*0.08*	1175	*144*	-0.12	*0.06*	0.184	*0.032*	a/ɔ	0.045	0.046	0.740	0.058	partial
ɔ	TM.f	*54*	804	*132*	0.20	*0.07*	1271	*112*	-0.08	*0.04*	0.095	*0.035*	ɔ/ɑ:	0.042	0.061	0.338	0.038	complete
ʌ	TM.f	*65*	573	*109*	0.05	*0.08*	1111	*114*	-0.14	*0.04*	0.088	*0.026*	ɔ/ʌ	0.069	0.062	2.535	0.160	partial
													ʌ/ɑ:	0.083	0.076	5.900	0.139	partial
a	TT.f	*64*	723	*75*	0.21	*0.05*	1676	*190*	0.05	*0.06*	0.121	*0.029*	a/ɑ:	0.056	0.044	0.293	0.166	partial
ɑ:	TT.f	*16*	647	*44*	0.16	*0.03*	1158	*119*	-0.11	*0.05*	0.222	*0.029*	a/ɔ	0.055	0.039	0.396	0.130	partial
ɔ	TT.f	*68*	648	*70*	0.16	*0.05*	1264	*112*	-0.07	*0.04*	0.124	*0.041*	ɔ/ɑ:	0.038	0.046	-0.028	0.039	complete
ʌ	TT.f	*86*	535	*49*	0.08	*0.04*	1150	*155*	-0.12	*0.06*	0.103	*0.025*	ɔ/ʌ	0.043	0.046	1.905	0.093	partial
													ʌ/ɑ:	0.030	0.041	18.136	0.084	partial
a	TV.f	*64*	807	*74*	0.19	*0.04*	1538	*152*	-0.02	*0.04*	0.127	*0.025*	a/ɑ:	0.041	0.035	0.363	0.076	partial
ɑ:	TV.f	*15*	759	*51*	0.16	*0.03*	1304	*107*	-0.09	*0.04*	0.184	*0.016*	a/ɔ	0.041	0.044	0.329	0.068	partial
ɔ	TV.f	*68*	768	*67*	0.17	*0.04*	1325	*122*	-0.08	*0.05*	0.121	*0.034*	ɔ/ɑ:	0.042	0.034	0.714	0.008	complete
ʌ	TV.f	*83*	642	*50*	0.09	*0.03*	1212	*123*	-0.12	*0.04*	0.106	*0.024*	ɔ/ʌ	0.036	0.038	2.000	0.087	partial
													ʌ/ɑ:	0.030	0.036	2.248	0.080	partial
a	TX.m	*48*	645	*31*	0.13	*0.02*	1413	*128*	0.00	*0.04*	0.122	*0.021*	a/ɑ:	0.039	0.037	-0.111	0.043	partial
ɑ:	TX.m	*12*	652	*33*	0.13	*0.02*	1281	*109*	-0.04	*0.04*	0.171	*0.013*	a/ɔ	0.039	0.027	-0.065	0.035	complete
ɔ	TX.m	*52*	648	*32*	0.13	*0.02*	1300	*81*	-0.03	*0.03*	0.121	*0.025*	ɔ/ɑ:	0.026	0.034	-0.346	0.007	complete
ʌ	TX.m	*69*	568	*35*	0.07	*0.03*	1130	*89*	-0.10	*0.03*	0.113	*0.022*	ɔ/ʌ	0.031	0.024	0.941	0.084	partial
													ʌ/ɑ:	0.026	0.031	1.105	0.081	partial

columns 7-13 of the table. Pairwise comparisons are given for those vowels which show either partial or complete spectral overlap in the data of most speakers. For example, /a, ɑː, ɔ/ show overlap for some speakers, so these vowels are compared in pairs for all 19 speakers (see formant charts in Appendix G). /ɑː, ɔ, ʌ/ also overlap in some manner for most speakers, so they are likewise compared. /a, ʌ/ did not overlap for any of the Kingston speakers, nor for most of the St. Thomas speakers (with the exception of TJ.f). /a, ʌ/ are not included in pairwise comparisons, but will be generally discussed below.

The main patterns associated with /ɑː, a/ are illustrated in Figure 4.5 (a-c): no overlap (Pattern 1), data of KE.m; complete overlap (Pattern 2), data of TE.m; partial overlap (Pattern 3), data of KD.f. Table 4.13 (a-c) shows that for Kingston speakers, the vowels /ɑː, a/ exhibit either no or partial spectral overlap. No Kingston speaker was assessed as showing complete spectral overlap. For most, /ɑː/ is backed and raised relative to /a/, and the two do not overlap at all. This may be seen in both Figs. 4.5 (a) and (c), and in the overlap decisions in Table 4.13 (a-c). For some Kingston speakers, including KE.m, KF.f, KM.m, KU.m, /ɑː/ is backed and raised nearly to [ɔː] (as may be seen in the Appendix G plot for Pattern 1 speaker KE.m). For others, it is backed only, [ɒː] (see Appendix G, plot for Pattern 3 speaker, KD.f). For St. Thomas speakers, on the other hand, /ɑː, a/ show either partial or complete overlap (as is illustrated in Fig. 4.5b, Pattern 2, TE.m). /ɔ, a/ were partially or completely spectrally overlapping for most speakers. The list of speakers showing partial or complete overlap for /ɑː, a/ and for /ɔ, a/ (therefore, for all three vowels /ɑː, a, ɔ/), includes all the St. Thomas speakers and four Kingston ones (KC.f, KD.f, KR.m, KW.m). This may be seen in the means presented in Table 4.13a-c. Interestingly, the table also shows that for all speakers in both groups, /a/ typically has a large deviation in F2; however, /ɔ, ɑː/ show larger deviations in F2 (on the order of those for /a/) for the St. Thomas speakers than for the

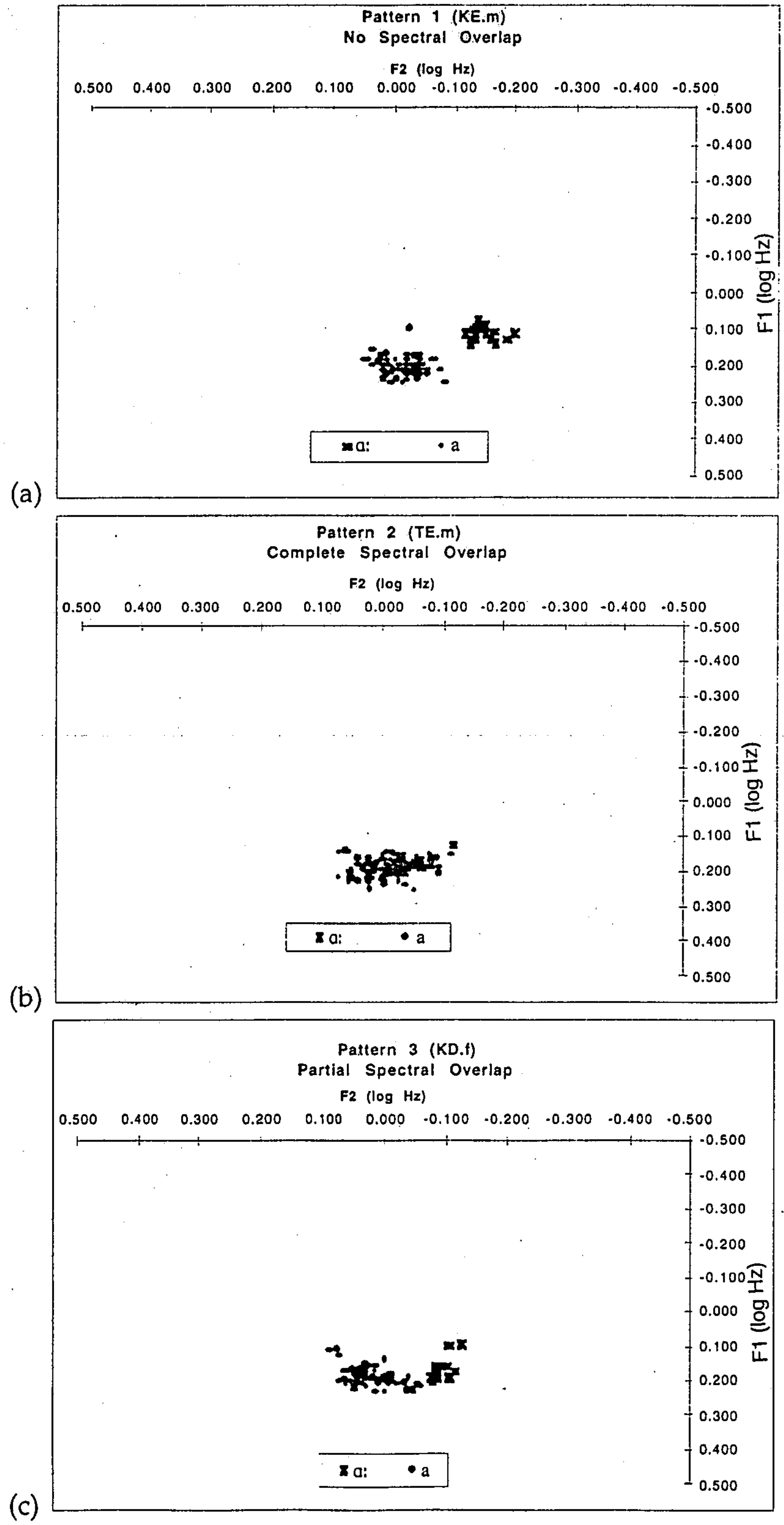


Figure 4.5 a-c. Three main spectral patterns associated with /ɑ:, a/.

Kingston speakers. This suggests that the categories are kept spectrally separate to a greater extent for the Kingston speakers. Examination of the temporal properties of these vowels is therefore in order. First, however, I will describe the spectral properties found for /ʌ/ and report results related to the effects of following manner on /ɑː, a, ɔ, ʌ/.

Means in Table 4.13 a-c suggest that speakers in both groups produced /ʌ/ higher than any other vowel in this subsystem. Its most frequent realizations included /ʌ, ɔ/. The formant charts provided in Appendix G show that for most speakers, /ʌ/ never reaches the height of mid back /oː/. Visual inspection of these charts suggests that the speakers with the highest productions of /ʌ/ relative to other vowels in the back vowel region of their own systems, are TA.m, TH.m, TM.f, and TV.f. These four speakers consistently produced the [ɔ] variant. For all speakers, except KC.f, KW.m, and TB.m, /ʌ/ shows some spectral overlap with /ɑː/. As above, following manner showed no clear effects on F1.

Table 4.14 presents the mean durations and duration ratios for vowel pairs in the low vowel quality subsystem. It may be seen in panel (c) of the table that /a, ɔ/ show the smallest duration ratios (1.045:1 for Kingston speakers and 1.002:1 for St. Thomas speakers.) This is the only case in which Kingston speakers show a larger duration ratio, although it is a minute difference, than do the St. Thomas speakers. /ɔ, a/ show partial or complete spectral overlap for all speakers, but for speakers TB.m, TE.m, TX.m, and KR.m, there is both complete spectral and temporal overlap. Panels (d)-(f) of Table 4.14 show that /ʌ/ is shortest for all speakers, relative to /a, ɔ, ɑː/, averaging around 100 Hz across all speakers. For both groups, duration ratios for both /ɑː, ɔ/ and /ɑː, a/ are larger than 1.5 on average, with females in the St. Thomas group showing longer

Table 4.14a. Mean duration ratios for /ɑː, a, ɔ, ʌ/ (means given in ms).

		Female Speakers					*Male Speakers*					
(a)		KC.f	KD.f	KF.f	KT.f		KE.m	KM.m	KR.m	KU.m	KW.m	Kingston average
	ɑː	158	183	185	199		175	180	194	180	154	179
	a	113	120	110	136		115	114	123	120	106	117
	ɑː:a ratio	1.398	1.525	1.682	1.463		1.522	1.579	1.577	1.500	1.453	1.522
		TJ.f	TL.f	TM.f	TT.f	TV.f	TA.m	TB.m	TE.m	TH.m	TX.m	St. Thomas average
	ɑː	237	169	184	222	184	192	171	174	155	171	186
	a	133	103	97	121	127	124	124	120	103	122	117
	ɑː:a ratio	1.782	1.641	1.897	1.835	1.449	1.548	1.379	1.450	1.505	1.402	1.589
(b)		KC.f	KD.f	KF.f	KT.f		KE.m	KM.m	KR.m	KU.m	KW.m	Kingston average
	ɑː	158	183	185	199		175	180	194	180	154	179
	ɔ	101	122	110	129		110	109	116	118	98	113
	ɑː:ɔ ratio	1.564	1.500	1.682	1.543		1.591	1.651	1.672	1.525	1.571	1.589
		TJ.f	TL.f	TM.f	TT.f	TV.f	TA.m	TB.m	TE.m	TH.m	TX.m	St. Thomas average
	ɑː	237	169	184	222	184	192	171	174	155	171	186
	ɔ	131	100	95	124	121	114	126	123	118	121	117
	ɑː:ɔ ratio	1.809	1.690	1.937	1.790	1.521	1.684	1.357	1.415	1.314	1.413	1.593
(c)		KC.f	KD.f	KF.f	KT.f		KE.m	KM.m	KR.m	KU.m	KW.m	Kingston average
	a	113	120	110	136		115	114	123	120	106	117
	ɔ	101	122	110	129		110	109	116	118	98	113
	a:ɔ ratio	1.119	0.984	1.000	1.054		1.045	1.046	1.060	1.017	1.082	1.045
		TJ.f	TL.f	TM.f	TT.f	TV.f	TA.m	TB.m	TE.m	TH.m	TX.m	St. Thomas average
	a	133	103	97	121	127	124	124	120	103	122	117
	ɔ	131	100	95	124	121	114	126	123	118	121	117
	a:ɔ ratio	1.015	1.030	1.021	0.976	1.050	1.088	0.984	0.976	0.873	1.008	1.002

durations for /ɑː/ on average than all others: 158-199 ms for Kingston females, 154-194 ms for Kingston males; 169-237 ms for St. Thomas females, 155-192 ms for St. Thomas males.

Taken together, the means suggest that with the exception of /ɑː, a/, Kingston and St. Thomas speakers show similar duration ratios. /a, ɔ/ overlap spectrally with /ɑː/ for several St. Thomas speakers; however, the pair which constitute the conventional long:short opposition, /ɑː, a/ are kept temporally distinct. The temporal distinction of /ɑː, a/ has been noted widely in the literature on Jamaican Creole (Akers,

Table 4.14b. Mean duration ratios for /ɑː, a, ɔ, ʌ/ (means given in ms).

		Female Speakers					*Male Speakers*					
(d)		KC.f	KD.f	KF.f	KT.f		KE.m	KM.m	KR.m	KU.m	KW.m	Kingston average
	ɑː	158	183	185	199		175	180	194	180	154	179
	ʌ	93	100	98	110		98	94	95	109	89	98
	ɑː:ʌ ratio	1.699	1.830	1.888	1.809		1.786	1.915	2.042	1.651	1.730	1.817
		TJ.f	TL.f	TM.f	TT.f	TV.f	TA.m	TB.m	TE.m	TH.m	TX.m	St. Thomas average
	ɑː	237	169	184	222	184	192	171	174	155	171	186
	ʌ	112	88	89	103	106	102	113	109	91	113	103
	ɑː:ʌ ratio	2.116	1.920	2.077	2.155	1.736	1.882	1.513	1.596	1.703	1.513	1.821
(e)		KC.f	KD.f	KF.f	KT.f		KE.m	KM.m	KR.m	KU.m	KW.m	Kingston average
	ʌ	93	100	98	110		98	94	95	109	89	98
	ɔ	101	122	110	129		110	109	116	118	98	113
	ʌ:ɔ ratio	0.921	0.820	0.891	0.853		0.891	0.862	0.819	0.924	0.908	0.876
		TJ.f	TL.f	TM.f	TT.f	TV.f	TA.m	TB.m	TE.m	TH.m	TX.m	St. Thomas average
	ʌ	112	88	89	103	106	102	113	109	91	113	103
	ɔ	131	100	95	124	121	114	126	123	118	121	117
	ʌ:ɔ ratio	0.855	0.880	0.933	0.831	0.876	0.895	0.897	0.886	0.771	0.934	0.876
(f)		KC.f	KD.f	KF.f	KT.f		KE.m	KM.m	KR.m	KU.m	KW.m	Kingston average
	a	113	120	110	136		115	114	123	120	106	117
	ʌ	93	100	98	110		98	94	95	109	89	98
	a:ʌ ratio	1.215	1.200	1.122	1.236		1.173	1.213	1.295	1.101	1.191	1.194
		TJ.f	TL.f	TM.f	TT.f	TV.f	TA.m	TB.m	TE.m	TH.m	TX.m	St. Thomas average
	a	133	103	97	121	127	124	124	120	103	122	117
	ʌ	112	88	89	103	106	102	113	109	91	113	103
	a:ʌ ratio	1.188	1.170	1.095	1.175	1.198	1.216	1.097	1.101	1.132	1.080	1.145

1981; Wells, 1982, and others, see §2.3.1). The present data additionally show that the length distinction is particularly large for St. Thomas females, who show longer /ɑː/'s overall).

As with /iː/ above, /a/ (for all speakers) and /ɔ/ (St. Thomas speakers) were shorter before a following oral stop than before nasals or fricatives (e.g., St. Thomas females' /ɔ/: 105, 127, 157 ms, respectively). Kingston speakers' /ɔ/, and /ʌ/ for all speakers, were likewise shortest before oral stops, but vowels preceding fricatives were shorter than those preceding nasals (e.g., Kingston females' /ɔ/: 114, 123, and 136 ms, preceding oral stops, fricatives, and nasals, respectively).

4.4.4.2 Statistical results for /ɑː, a, ɔ, ʌ/ based on a subset of the data

Statistical comparisons were carried out for the consonantal environments of preceding bilabial with following alveolar (set 1), and preceding velar with following alveolar (set 2). The statistical results are given in Table 4.15a-b for the two subsets. These analyses included only 29% of data collected for this subsystem, as was mentioned earlier in this chapter. This is because there were few monosyllabic real-word items in which /ɑː/ occurred. As there were four monophthongal vowels in this subsystem, i.e., /a, ɑː, ɔ, ʌ/, pairwise comparisons were necessary. Sufficient voicing contrasts were possible to allow following voicing to be included as a phonetic factor in the analysis.

Vowel showed the only main effect on F1 for both consonant environments. Tukey-Kramer pairwise comparisons for set 1 elucidate the direction of difference for a subset of the vowels: /a/ and /ɔ/ showed no significant difference in F1, while /ʌ/ was significantly different from /ɔ/, and even more from /a/ (/a/x/ɔ/: t(75)=0.11, n.s.; /a/x/ʌ/: t(75)=15.65, p<0.01; /ɔ/x/ʌ/: t(75)=15.54, p<0.01). The second set of pairwise tests showed /ɑː, a, ʌ/ to be significantly different from each other, the result for /a, ʌ/ being in line with the set 1 result for this pair (/ɑː/x/a/: t(74)=-7.70, p<0.01; /ɑː/x/ʌ/: t(74)=14.19, p<0.01; /a/x/ʌ/: t(74)=-7.70, p<0.01). There were no significant F1 differences due to the extralinguistic variables group or gender, or the phonetic factor of following voicing. Preceding and following place could not be included in the model, but comparison of the means for the two environments suggests that vowels after an initial velar were slightly higher (i.e., F1 was lower) than those with an initial bilabial. F2 values also showed a significant main effect of vowel, such that, from most front to most back, respectively, the vowels were positioned as follows: /a, ɔ, ʌ, ɑ/. Tukey-Kramer pairwise comparisons for set 1 suggest that /a, ʌ/ are most different in

Table 4.15a. ANOVA results for the low vowel quality subsystem subset /a,ɔ,ʌ/ (first set). Consonant environments for F1, F2, and Duration tests: preceding velar with following alveolar. Factors for F1, F2 , and Duration tests include vowel, following voicing, group, gender. Repeated measures for speaker and word. Values submitted consist of word means for each speaker.

Dependent Variable **Significant Factors**	**df**	**F**	***p*-value**
F1			
vowel	(2,75)	162.11	<0.01
F2			
vowel	(2,75)	182.20	<0.01
vowel * following voicing	(2,75)	6.31	<0.01
Duration			
vowel	(2,75)	43.78	<0.01
following voicing	(1,75)	85.44	<0.01

Table 4.15b. ANOVA results for the low vowel quality subsystem subset /a,ɑː,ʌ/ (second set). Consonant environments for F1,F2 tests: preceding bilabial with following alveolar. Factors for F1, F2 tests include vowel, following voicing, group, gender. Repeated measures for speaker and word. Values submitted consist of word means for each speaker.

Dependent Variable **Significant Factors**	**df**	**F**	***p*-value**
F1			
vowel	(2,74)	244.59	<0.01
F2			
vowel	(2,74)	162.88	<0.01
following voicing	(1,74)	6.58	0.01
vowel * group	(2,74)	4.68	0.01
vowel * gender	(2,74)	4.39	0.02
vowel * group * gender	(2,74)	5.47	<0.01
Duration			
vowel	(2,74)	572.95	<0.01
following voicing	(1,74)	60.40	<0.01
vowel * following voicing	(2,74)	6.73	<0.01
vowel * group	(2,74)	3.78	0.03
vowel * gender	(2,74)	16.79	<0.01

F2, followed by /a, ɔ/, then /ɔ, ʌ/ (/a/x/ʌ/: t(75)=18.97, $p<0.01$; /a/x/ɔ/: t(75)=11.30, $p<0.01$; /ɔ/x/ʌ/: t(75)=7.68, $p<0.01$). The second set of pairwise tests likewise showed /ɑː, a, ʌ/ to be significantly different from each other, the result for /a, ʌ/ being in line with the set 1 result for this pair (/ɑː/x/a/: t(74)=-13.92, $p<0.01$; /ɑː/x/ʌ/: t(74)=3.08, $p<0.01$; /a/x/ʌ/: t(74)=16.88, $p<0.01$). The vowel-by-group-by-gender interaction in the initial bilabial environment occurred because F2 of /ɑː/ was generally lower for Kingston than St. Thomas speakers, with Kingston females showing the lowest values overall (i.e., indicating the most backed productions, [ɑː, ɒː]). /a, ɑː/ were produced closest together by St. Thomas speakers, with St. Thomas males showing productions in closest proximity. In this subsystem, it seems that the Kingston females pattern more like the St. Thomas males than the St. Thomas females do. The following voicing main effect in set 2 (the initial bilabial context) indicates that productions of /ɑː/, /a/, or /ʌ/ before a voiced consonant were higher in F2. The vowel-by-following voicing interaction in set 1 (the initial velar context) similarly indicates that productions of /a/ before a voiced consonant are highest in F2 relative to those with a following voiceless consonant (/a/: $F(1, 75)=12.93$, $p<0.01$; /ɔ/: $F(1, 75)=0.01$, n.s.; /ʌ/: $F(1, 75)=1.41$, n.s.).

With respect to duration, both sets of tests showed main effects of vowel (with /ɑː/ longest and /ʌ/ shortest, as may be expected) and following voicing, indicating that the vowels were longest when following a voiced consonant. (Set 1--/a/x/ʌ/: $t(75)=9.34$, $p<0.01$; /a/x/ɔ/: $t(75)=4.14$, $p<0.01$; /ɔ/x/ʌ/: $t(75)=5.20$ $p<0.01$; Set 2--/ɑː/x/a/: $t(74)=26.17$, $p<0.01$; /ɑː/x/ʌ/: $t(74)=31.62$, $p<0.01$; /a/x/ʌ/: $t(74)=5.68$, $p<0.01$.) The vowel-by-following voicing interaction in set 2 is due to the fact that /a/ and /ʌ/ show large effects of lengthening before a voiced consonant (/a/: $F(1,74)=46.27$, $p<0.01$; /ɑː/: $F(1,74)=2.87$, *n.s.*; /ʌ/: $F(1,74)=24.58$, $p<0.01$). In addition, a vowel-by-group interaction was found, such that /ɑː/ was longer for St. Thomas than for Kingston speakers ($F(2,75)=3.78$, $p=0.03$). Mean duration values for /a, ɑː/were more spread for St. Thomas speakers, as well. That is, /a/ tended to be shorter, and /ɑː/, longer. Durations for /a, ʌ/ and /ɔ, ʌ/ were not significantly different between Kingston and St. Thomas speakers in either set of tests. The vowel-by-gender interaction that emerged in set 2 occurred because females in both groups tended to have an extra long /ɑː/ (i.e., [ɑːː, ɒː]); with St. Thomas females' /ɑː/ longest overall ($F(2,75)=16.79$, $p<0.01$).

4.4.4.3 Palatalization before /a/

An examination of palatalization of consonants preceding /a/ was conducted using auditory and acoustic analyses together. In the auditory analysis, all realizations of /a/ (in all consonant environments) were coded with respect to the palatalization or non-palatalization of their preceding consonants. All consonant contexts were included because, as will be described below, palatalization was present in more than just the initial velar stop context associated with the phonolexical variable (KYA) described by Patrick (1992) (see §2.3.3.2 for a discussion of this variable). In part, I was interested in seeing whether palatalization of the preceding consonant showed any effect on the phonetic realization of /a/, and in part, I was interested in exploring the acoustic structure of [kʲa] and [ça] sequences.

Behavior of the Kingston and St. Thomas groups was quite different with respect to palatalization of the consonant preceding /a/. A logistic regression on the binomial distribution (values were binary: 1=palatalized, 0=not palatalized) revealed a main effect of group ($F(1,279)=9.46$, $p<0.01$), and a group-by-gender interaction ($F(1,279)=6.09$, $p<0.02$) for the word list data. Overall, the Kingston speakers palatalized 3% of all /a/ words; St. Thomas speakers, 10%. When we look within the groups, an interesting pattern emerges--Kingston *females* actually palatalized more frequently than their male counterparts: 7% as compared to Kingston males' 1%. The reverse pattern obtained within the St. Thomas group. St. Thomas males palatalized consonants preceding /a/ more frequently than St. Thomas females: 11%, compared to St. Thomas females' 8%. Thus, being male and basilect-dominant was most highly correlated with palatalization.

It is instructive to consider the set of words that speakers palatalized across all places, manners, and sessions. Palatalization has been described as occurring variably as an offglide following velar consonants /k, g/ (LePage, 1967; Patrick, 1992). In addition, the obstruent itself may have a palatal place of articulation, in which case, the offglide is absent (Wells, 1982). The set of all words that were palatalized in the present dataset, and their frequency of palatalized realizations are provided in Table 4.16. Both [k^ja] and [ça] realizations were counted as palatalized, the former being the most common case. Proportions are averaged over word means, so that a speaker's average amount of palatalization went into the overall calculation of the mean. No words with initial bilabial consonants showed palatalization. Two alveolar-initial words were palatalized, "dab" and "damn" (the latter occurring in one conversational session) realized as [d^jab] and [d^jam], respectively. Three words seemed to be "favorites" for palatalization: "cab," "cap," and "cat". There were two words, "cast" and "dab," which were palatalized by the St. Thomas speakers, but not by the Kingston speakers.

Table 4.16 (continued, next page). Palatalized words (all sessions).

Word	Group	Gender	% palatalized occurrences
cab	Kingston	female	46
		male	32
	St. Thomas	female	63
		male	95
cad	Kingston	female	7
		male	20
	St. Thomas	female	33
		male	14
can	Kingston	female	58
		male	26
	St. Thomas	female	68
		male	92
cap	Kingston	female	69
		male	35
	St. Thomas	female	73
		male	88

Table 4.16, continued. Palatalized words (all sessions).

Word	Group	Gender	% palatalized occurrences
cast	Kingston	female	0
		male	0
	St. Thomas	female	17
		male	15
cat	Kingston	female	77
		male	50
	St. Thomas	female	73
		male	83
dab	Kingston	female	0
		male	0
	St. Thomas	female	53
		male	63

Although the words most frequently palatalized contained an initial velar/palatal obstruent, it is difficult to say whether the proper assessment is that velar stops are the favored environment for palatalization, or whether this effect is lexical, related to a particular set of words. The palatalization of "dab" and "damn" by St. Thomas speakers is interesting because it deviates from the traditional pattern. This may be suggestive of a change in progress involving the extension of a phonolexical rule.

Figure 4.6 (a,b) shows spectrograms for two instantiations of "can"--one, with an initial palatalized consonant [ç] [panel (a)] and the other, an initial velar + glide, [k^j] [panel (b)]. The palatal consonant showed frication following release on the order of 60-70 ms for all speakers for whom it was observed. It was additionally observed that there is a slope in the F2 frequency during the consonantal (fricated) portion of the signal before the vowel begins. This seems to be typical of palatalized consonant [ç]. On the other hand, the velar obstruent + glide [k^j] showed no frication following closure of the consonant, and frequently shows a more rapid trajectory downward in F2. This realization is taken to be a secondary articulation for /k/. This study does not undertake to study the consonants associated with palatalization in enough detail to clearly ascertain whether [k^j] can confidently be described as such, however. A full investigation would ideally provide information related to relative strictures associated with palatalized and non-palatalized /k/ and timing relations of the stop and glide.

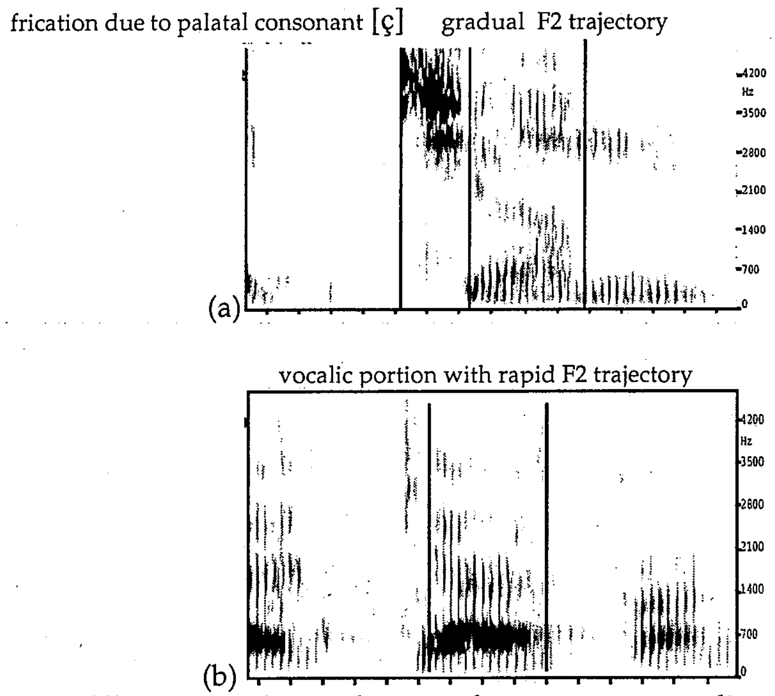


Figure 4.6. Differences in the production of consonants preceding /a/. Panel (a) Shows a spectrogram for "can" by speaker TA.m. The initial consonant is the palatal fricative [ç]. Panel (b) shows a velar stop + glide [k^jan] in "can" by speaker TX.m. Each tick on the horizontal axis is 43 ms.

The palatal consonant was observed for productions of several of the St. Thomas males and Kingston females, including TA.m, TX.m, KF.f; however, the velar obstruent + glide was more prevalent in the speaker sample, as was noted above. Production of [ç] resulted in a more fronted vowel than the velar obstruent + glide sequence. This is perhaps due to the more gradual slope in F2 associated with the palatal consonant, as

Fig. 4.6a illustrates; F2 is higher at midpoint than in the velar + obstruent sequence pictured below it in Fig. 4.6b.

4.4.4.4 Diphthongs with low nuclei

The diphthongs /aɪ, ɔɪ/ were examined separately and without statistical comparison because they are not monophthongal vowels potentially participating in a long:short opposition. The range of realizations of these diphthongs included, for /aɪ/, [aɪ, aᵋ, ɑⁱ, a]; for /ɔɪ/, [aɪ, a, aⁱ]. Interestingly, these vowels were frequently identical for both the Kingston and St. Thomas speakers, who usually realized them both as [aᵋ, aɪ]. Some /ɔɪ/ words, such as "boy," seemed to differ slightly from /aɪ/ in having a longer, sometimes more fronted, nucleus portion [bʷa̟ːɪ]. This lengthening is quite possibly associated with the labiovelar glide /w/. This "diphthong" was also interesting because it showed the least change in F2 of all diphthongs (and many monophthongs), as may be seen in Figure 4.7. The offglide portion of both diphthongs was at times very slight; so much so that the resulting vowel sounded nearly monophthongal.

In summary, several notable findings emerged from analysis of the low vowel quality subsystem. First, the phonological long:short pair /ɑː, a/ showed no or partial spectral overlap for Kingston speakers, while showing partial or complete overlap for St. Thomas speakers. Smaller deviations were interpreted as suggesting that Kingston speakers may be keeping these vowels spectrally distinct to a greater extent than St. Thomas speakers. The monophthong pair /a, ɔ/ showed partial or complete spectral overlap for all speakers, and it was the only pair to show complete temporal overlap, as was found in the cases of four male speakers. The vowel/a/ showed significant variation in F2, as a result of following a palatalized consonant (with a preceding [ç] causing the most fronting). In addition, /a/ was the vowel most affected by a following voiced consonant (in both F2 and duration). Finally, while downgliding of /eː/ was found to occur very little in Kingston females relative to the other groups (with one exception, KC.f), Kingston females exhibited more palatalization of consonants preceding /a/ than their male counterparts.

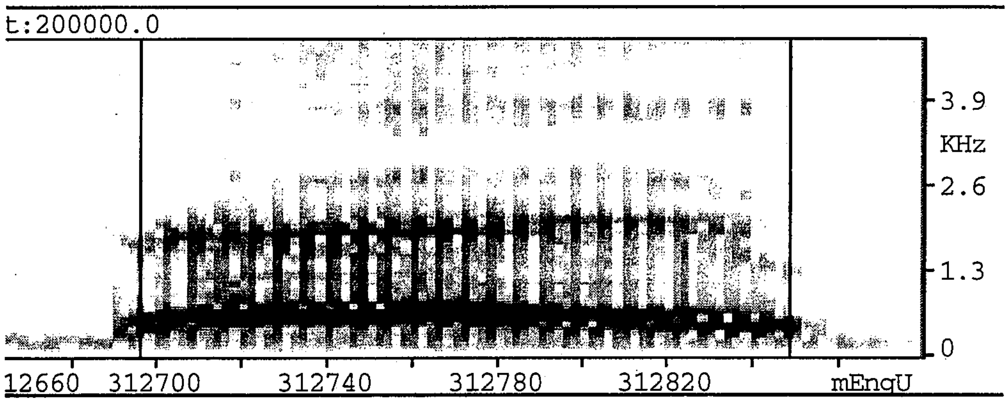


Figure 4.7. Spectrogram illustrating the extremely slight slope of F1 and F2 in /aɪ/. Token from KW.m "died".

4.4.5 Mid Back Subsystem /oː, aʊ/

The vowels considered in this section were adjacent in acoustic space, but were not monophthongs functioning in a phonological long:short opposition. For this reason they were not subjected to statistical analysis, but will be described here in terms of their general spectral and temporal characteristics.

Basic realizations of /oː/ in the present data included [oː, ʊo], with several different, less frequently occurring variants, including [$o^ʊ$, $o^ə$, ʊə, uo, $u^ə$], where superscripts represent offglides which were typically short (less than 30 ms, if able to be distinguished from the nuclear portion of the vowel), and vowel sequences represent diphthongs with a second portion that was sustained longer than 30 ms. Basic realizations for /aʊ/ included [oʊ, uo, ʊo, ʊə, o^u, o^o]. Jamaican /oː/ has been of interest to researchers because it is one of the vowels for which Jamaican Creole pronunciation clearly differs from Jamaican English. The Creole form is typically a centering or downgliding diphthong. Figure 4.8 (a,b) displays typical downgliding and monophthongal productions of /oː/, from the data of speakers TB.m and KM.m, respectively, similar to the presentation of data for /eː/ in Figure 4.4 (a,b). The downgliding variants [uo, ʊo] generally show a rise in F1 on the order of 100 Hz or more (lowering in vowel height) accompanied by a rise in F2 of similar or greater magnitude (centralization). The centralizing variant [ʊə] shows only the increase in F2. This pattern is similar to what was observed for /eː/ in §4.4.3. The monophthongal variant /oː/, as well as the variants with an upglide, i.e., [o^{ʊ}], typically exhibit very little change in F1.

Table 4.17 provides the means and standard deviations (at nucleus midpoint), and overlap decisions for this vowel pair. The nucleus portions of /aʊ, oː/ showed partial or complete spectral overlap for all speakers. Figure 4.9 (a,b) shows these two patterns, exemplified by the data of TH.m in panel (a) (Pattern 2, complete spectral overlap) and KU.m in panel (b) (Pattern 3, partial overlap). The means presented in Table 4.17 indicate that a few St. Thomas speakers, TA.m, TH.m, TJ.f, TM.f, TX.m showed complete overlap for these vowels, producing both /aʊ, oː/ as one of [ʊo, ʊə]. In the typical, partial overlap, pattern, the nucleus of /aʊ/ was higher in F1, and therefore lower in articulatory space, than the position of the nucleus of /oː/, while the F2 values for the pair differed by less than 100 Hz. /aʊ/ exhibited the greatest F1 dispersion of all vowels analyzed for several speakers, its nucleus midpoint values overlapping with two, and sometimes three other vowel categories, including /uː, ʊ,

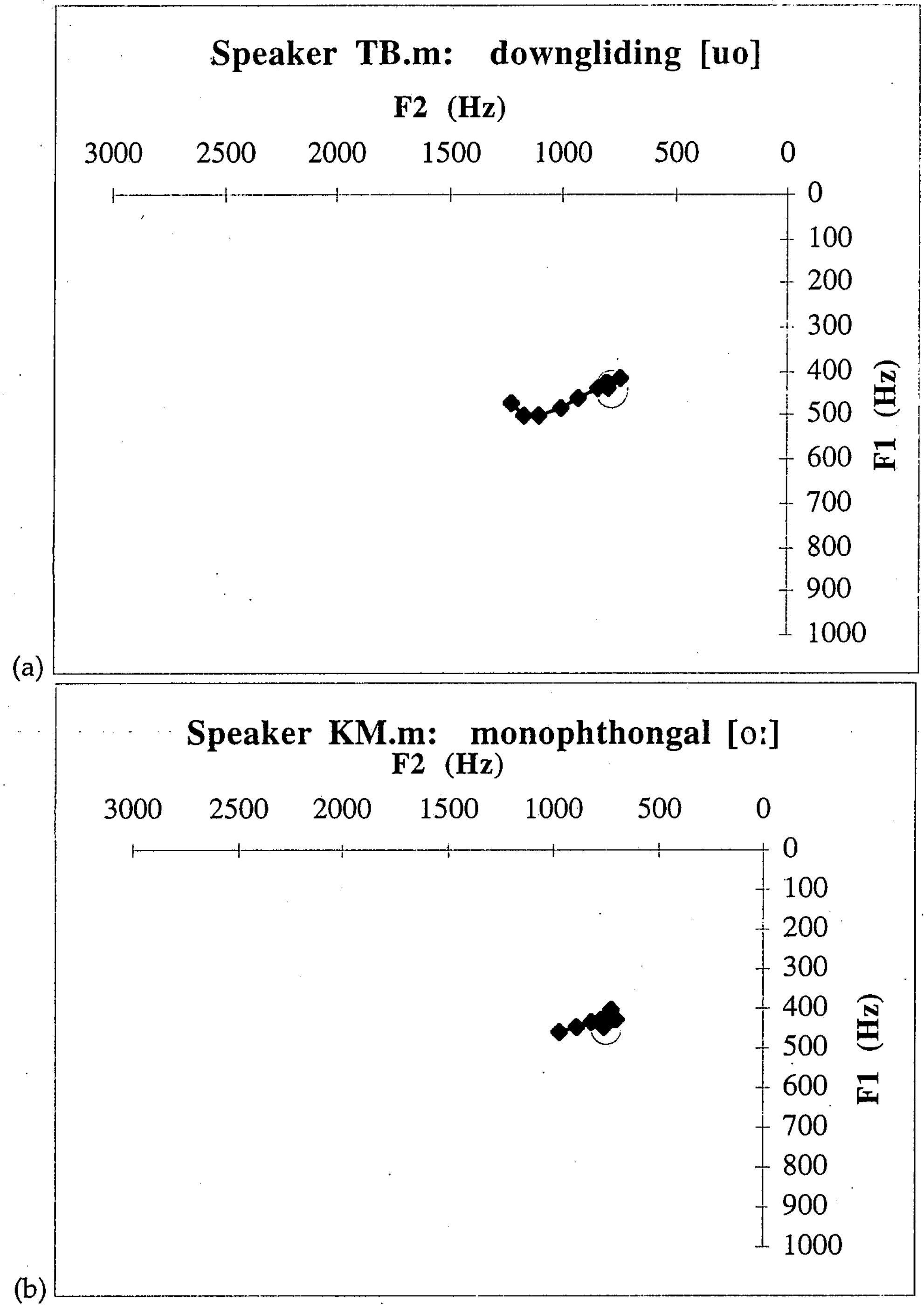


Figure 4.8 a,b. Plot of successive spectral measurements for: (a) downgliding [uo] produced by basilect-dominant speaker TB.m, in the word "boat," and (b) monophthongal [o:] for acrolect-dominant speaker KM.m, also in "boat". Plotted points represent successive 12.5 ms interval measures from vowel onset to offset; onset position is circled.

Table 4.17. Means and standard deviations for F1 and F2 (both raw Hz and normalized data), and duration for /aʊ, oː/ for all speakers. For each pair, values representing the distance between the means of each distribution (ΔMeans), each distribution's standard deviation (σv_1, σv_2), and the test conditions for determining overlap, are given. Values represent nucleus midpoint.

Vowel Pair	Speaker	n	F1		F1 (log Hz)		F2		F2 (log Hz)		duration (sec)		$\sigma^* v_1$	$\sigma^* v_2$	k	ΔMeans	Overlap Decision
oː [uo]	KC.f	15	424	46	-0.05	0.05	790	76	-0.26	0.04	0.122	0.017	0.045	0.023	1.015	0.126	partial
aʊ	KC.f	7	519	31	0.04	0.03	965	47	-0.17	0.02	0.139	0.023					
oː [uo]	KD.f	51	460	44	-0.06	0.04	1032	260	-0.20	0.07	0.154	0.035	0.041	0.065	4.128	0.139	partial
aʊ	KD.f	24	632	98	0.08	0.07	1101	123	-0.17	0.05	0.188	0.032					
oː [uo]	KE.m	52	433	50	-0.02	0.05	909	70	-0.22	0.03	0.135	0.029	0.042	0.039	1.667	0.116	partial
aʊ	KE.m	24	544	49	0.08	0.04	1044	88	-0.16	0.04	0.159	0.024					
oː [uo]	KF.f	50	491	73	-0.02	0.06	991	86	-0.21	0.04	0.149	0.039	0.050	0.049	1.534	0.089	partial
aʊ	KF.f	24	583	81	0.05	0.06	1109	94	-0.16	0.04	0.172	0.039					
oː [uo]	KM.m	52	441	28	-0.01	0.03	850	152	-0.19	0.06	0.142	0.025	0.028	0.033	2.499	0.080	partial
aʊ	KM.m	24	524	43	0.06	0.03	902	60	-0.16	0.03	0.169	0.021					
oː [uo]	KR.m	51	378	41	-0.05	0.05	787	91	-0.26	0.05	0.131	0.028	0.048	0.048	1.970	0.108	partial
aʊ	KR.m	24	471	51	0.04	0.05	881	99	-0.21	0.05	0.160	0.031					
oː [uo]	KT.f	52	436	49	-0.06	0.05	981	182	-0.23	0.07	0.162	0.028	0.051	0.086	1.578	0.207	partial
aʊ	KT.f	24	658	116	0.11	0.08	1303	535	-0.12	0.11	0.189	0.019					
oː [uo]	KU.m	52	457	72	-0.02	0.07	899	105	-0.23	0.05	0.150	0.037	0.063	0.050	1.582	0.132	partial
aʊ	KU.m	23	587	70	0.09	0.05	1055	106	-0.16	0.04	0.176	0.035					
oː [uo]	KW.m	49	407	50	-0.05	0.06	834	97	-0.24	0.05	0.115	0.019	0.054	0.031	1.622	0.116	partial
aʊ	KW.m	24	508	34	0.05	0.03	956	75	-0.18	0.03	0.138	0.019					
oː [uo]	TA.m	43	345	68	-0.07	0.10	724	84	-0.28	0.05	0.147	0.039	0.076	0.087	1.698	0.107	partial
aʊ	TA.m	23	427	104	0.03	0.11	823	114	-0.22	0.06	0.179	0.036					
oː [uo]	TB.m	46	448	45	-0.02	0.04	936	127	-0.20	0.06	0.146	0.018	0.049	0.044	1.060	0.097	partial
aʊ	TB.m	23	526	48	0.05	0.04	1088	128	-0.13	0.05	0.158	0.025					
oː [uo]	TE.m	50	445	53	-0.02	0.05	983	208	-0.19	0.08	0.144	0.015	0.057	0.035	1.335	0.103	partial
aʊ	TE.m	24	536	39	0.07	0.03	1119	136	-0.13	0.05	0.155	0.017					
oː [uo]	TH.m	29	414	31	0.01	0.03	832	123	-0.25	0.07	0.143	0.028	0.063	0.052	0.175	0.043	complete
aʊ	TH.m	14	422	36	0.01	0.04	913	112	-0.21	0.05	0.154	0.019					
oː [uo]	TJ.f	38	509	35	-0.04	0.03	869	231	-0.26	0.09	0.197	0.034	0.033	0.059	1.760	0.116	partial
aʊ	TJ.f	19	645	82	0.06	0.06	975	115	-0.20	0.05	0.203	0.018					
oː [uo]	TL.f	52	413	41	-0.05	0.04	778	61	-0.28	0.03	0.139	0.025	0.039	0.042	1.610	0.066	partial
aʊ	TL.f	24	471	59	0.01	0.05	843	58	-0.25	0.03	0.155	0.027					
oː [uo]	TM.f	39	415	26	-0.08	0.03	831	67	-0.27	0.03	0.161	0.027	0.028	0.098	1.981	0.168	complete
aʊ	TM.f	22	595	166	0.07	0.11	996	162	-0.19	0.07	0.159	0.039					
oː [uo]	TT.f	52	398	39	-0.05	0.04	790	92	-0.28	0.05	0.178	0.025	0.045	0.050	0.928	0.083	partial
aʊ	TT.f	23	457	75	0.00	0.07	907	84	-0.22	0.04	0.208	0.058					
oː [uo]	TV.f	49	516	60	-0.01	0.05	948	143	-0.23	0.06	0.150	0.027	0.055	0.052	1.371	0.097	partial
aʊ	TV.f	20	611	73	0.07	0.05	1070	143	-0.17	0.06	0.167	0.020					
oː [uo]	TX.m	36	512	38	0.03	0.03	975	81	-0.16	0.04	0.136	0.020	0.035	0.044	0.478	0.033	complete
aʊ	TX.m	20	531	59	0.04	0.05	1046	103	-0.13	0.04	0.156	0.025					

ʌ/(as may be seen in the vowel plots in Appendix G for speakers KR.m, KT.f, KU.m, KW.m, TA.m, TH.m, TM.f, and TV.f). For speaker TM.f, whose /ɔ/ is quite far back, and slightly raised, /aʊ/ shows some overlap with this category, as well.

Table 4.18 shows the distribution of monophthongal and diphthongal productions of /oː/ for all speakers, according to session. In contrast with the session-by-session evaluation provided in Table 4.12 for /eː/, speakers showed less variation between sessions for /oː/. The St. Thomas speakers, especially males, typically showed more downgliding than monophthongization in their word list and picture sessions (indicated by capital 'X''s), while the Kingston speakers showed a predominance of monophthongal productions. Most St. Thomas speakers showed at least some monophthongal productions in their word list.

Durations for /aʊ/ were consistently larger than for /oː/, for all speakers, on the order of 12-34 ms (with the exception of speakers TJ.f and TM.f, whose means were 6 and 2 ms apart, respectively). In terms of following manner, /oː/showed the typical pattern, with smaller duration values before following stops than nasals and fricatives although differences between means were sometimes small (e.g., Kingston males: 125, 145, and 149 ms, respectively).

In summary, a general overview of the mid back subsystem indicates that F1 values in this subsystem extend over a wider range than other subsystems, vowel nuclei falling in the regions of /uː/, /ʊ/ and /ʌ/. Durations for /oː, aʊ/ overlapped some with each other, but /aʊ/ was consistently longer. As with /eː/ in the mid front subsystem, mid back /oː/ was frequently realized as a downgliding or centering diphthong. Overall, St. Thomas speakers (males, in particular) displayed the greatest amount of downgliding. Kingston males, on the other hand, produced fewer downgliding variants of /oː/ (across all sessions) than they did for /eː/.

(a)
(b)

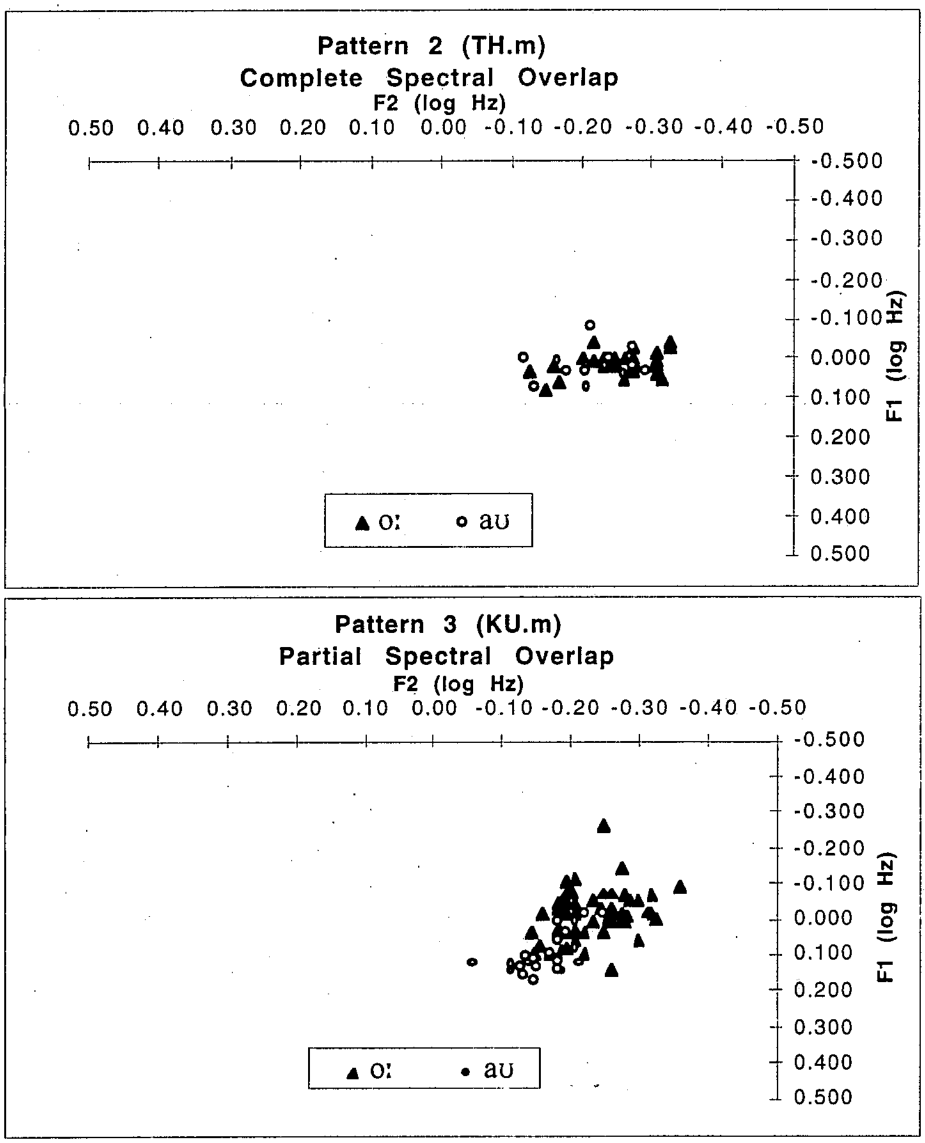


Figure 4.9 a,b. Two main spectral patterns associated with /aʊ, oː/.

Table 4.18. Monophthongal vs. downgliding/centering productions of /oː/, by session.

	Downgliding or Centering [uo]		**Monophthongal [oː]**	
Speaker	word list	picture/ conversation	word list	picture/ conversation
St. Thomas males				
TA	X		x	x
TB	X	X		
TE	x	X	X	
TH	x	x	x	x
TX	X	X	x	
St. Thomas females				
TJ	x	X	X	
TL	X	X	x	
TM	x	nd	x	nd
TT		x	X	x
TV		x	X	x
Kingston males				
KE		x	X	X
KM	x		x	X
KR			X	X
KU			X	X
KW			X	X
Kingston females				
KC	X			x
KD	x	x	x	X
KF		X	X	x
KT			X	X

<u>KEY:</u> Capital (X) indicates that the predominance of a speaker's productions fell into the category specified; lower case (x) indicates that less than 5% of realizations fell into the categor(ies) specified. (nd) indicates that a speaker had "no data" in a particular session.

4.4.6 High Back Subsystem /uː, ʊ/

The high back quality subsystem included the vowel pair/uː, ʊ /. Basic and allophonic realizations of these vowels were as follows. The range of realizations for /uː/ included [uːː, $\mathrm{u}^{ʊ}$, ʊː, uː]. The range of realizations for /ʊ/ included [u, ʊ].

Table 4.19. Means and standard deviations for F1 and F2 (both raw Hz and normalized data), and duration for /u:, ʊ/ for all speakers. For each pair, values representing the distance between the means of each distribution (ΔMeans), each distribution's standard deviation (σv_1, σv_2), and the test conditions for determining overlap, are given. Values represent vowel midpoint.

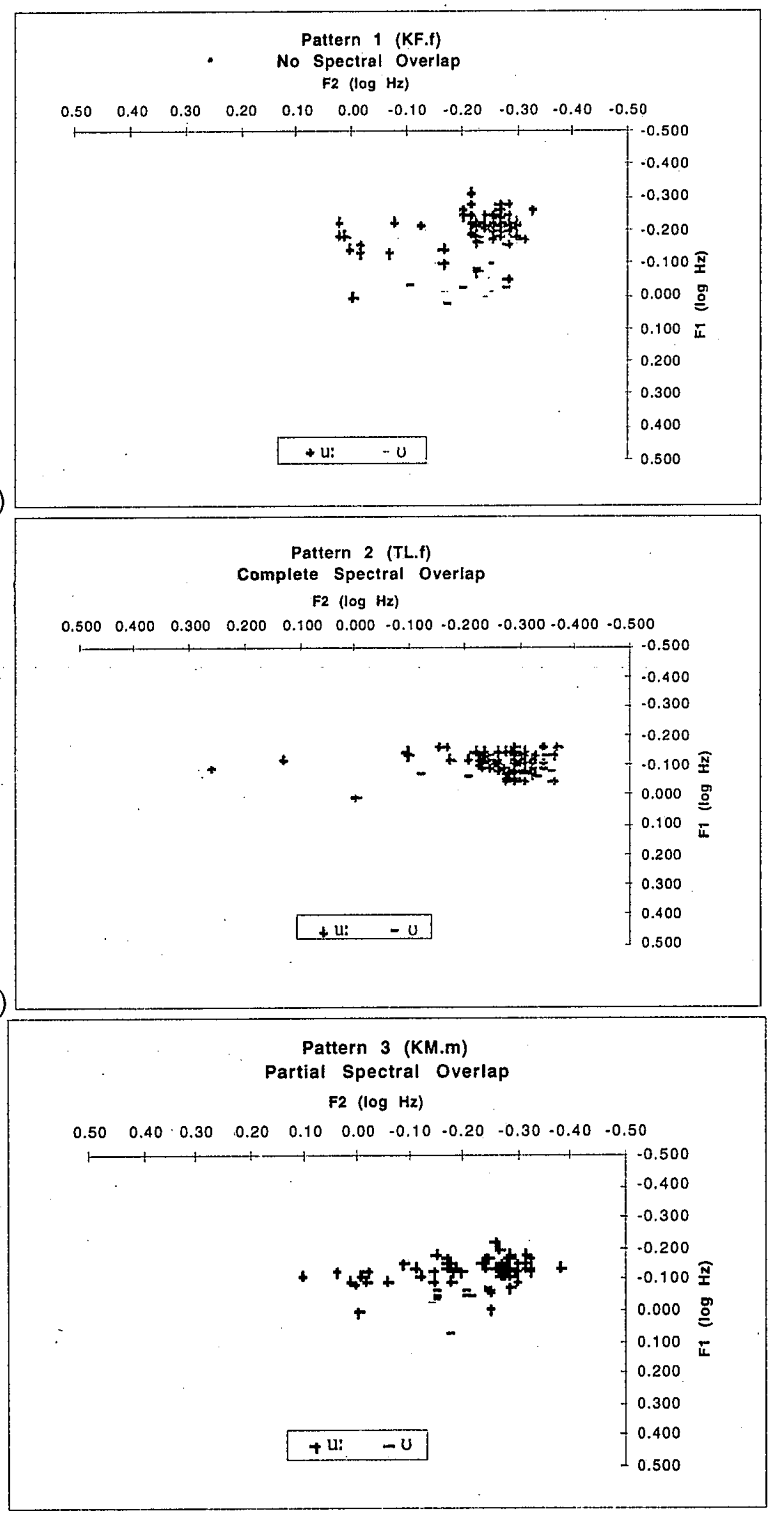
Vowel Pair	Speaker	*n*	F1		F1 (log Hz)		F2		F2 (log Hz)		duration (sec)		σ^*v_1	σ^*v_2	k	ΔMeans	Overlap Decision
ʊ	KC.f	*3*	394	*33*	-0.08	*0.04*	753	*101*	-0.28	*0.08*	0.051	*0.007*	0.039	0.047	-1.994	0.046	complete
u:	KC.f	*22*	360	*39*	-0.12	*0.04*	791	*145*	-0.26	*0.07*	0.116	*0.029*					
ʊ	KD.f	*12*	454	*37*	-0.06	*0.03*	1042	*103*	-0.20	*0.08*	0.062	*0.016*	0.042	0.042	1.196	0.041	partial
u:	KD.f	*71*	423	*34*	-0.09	*0.03*	978	*179*	-0.22	*0.07*	0.135	*0.032*					
ʊ	KE.m	*12*	408	*75*	-0.05	*0.07*	996	*92*	-0.18	*0.09*	0.049	*0.014*	0.075	0.076	2.591	0.087	partial
u:	KE.m	*72*	339	*66*	-0.13	*0.07*	931	*248*	-0.22	*0.10*	0.133	*0.032*					
ʊ	KF.f	*12*	479	*38*	-0.03	*0.03*	983	*114*	-0.22	*0.05*	0.057	*0.015*	0.035	0.046	15.672	0.179	none
u:	KF.f	*72*	319	*36*	-0.21	*0.05*	973	*228*	-0.23	*0.08*	0.130	*0.035*					
ʊ	KM.m	*12*	409	*41*	-0.04	*0.04*	823	*81*	-0.20	*0.04*	0.057	*0.019*	0.039	0.034	4.878	0.095	partial
u:	KM.m	*68*	330	*26*	-0.14	*0.03*	808	*224*	-0.22	*0.10*	0.133	*0.034*					
ʊ	KR.m	*12*	342	*47*	-0.10	*0.06*	800	*88*	-0.25	*0.05*	0.057	*0.013*	0.065	0.040	-18.591	0.076	complete
u:	KR.m	*72*	285	*27*	-0.17	*0.04*	874	*428*	-0.25	*0.17*	0.138	*0.035*					
ʊ	KT.f	*12*	427	*22*	-0.07	*0.02*	1094	*97*	-0.18	*0.07*	0.069	*0.019*	0.024	0.039	2.138	0.040	complete
u:	KT.f	*68*	394	*31*	-0.11	*0.04*	1065	*262*	-0.20	*0.10*	0.145	*0.037*					
ʊ	KU.m	*12*	398	*42*	-0.07	*0.05*	971	*95*	-0.21	*0.08*	0.070	*0.021*	0.047	0.060	5.275	0.110	partial
u:	KU.m	*72*	312	*45*	-0.18	*0.06*	959	*356*	-0.23	*0.13*	0.140	*0.032*					
ʊ	KW.m	*12*	364	*29*	-0.10	*0.03*	825	*84*	-0.24	*0.04*	0.051	*0.010*	0.035	0.045	5.099	0.043	complete
u:	KW.m	*71*	331	*35*	-0.14	*0.04*	824	*222*	-0.25	*0.08*	0.111	*0.030*					
ʊ	TA.m	*9*	331	*49*	-0.08	*0.07*	775	*101*	-0.25	*0.05*	0.086	*0.042*	0.065	0.078	1.690	0.092	complete
u:	TA.m	*53*	278	*59*	-0.15	*0.08*	700	*113*	-0.30	*0.07*	0.167	*0.042*					
ʊ	TB.m	*12*	335	*53*	-0.15	*0.07*	806	*98*	-0.26	*0.08*	0.083	*0.028*	0.076	0.066	1.064	0.091	partial
u:	TB.m	*60*	345	*43*	-0.21	*0.06*	875	*213*	-0.33	*0.09*	0.146	*0.023*					
ʊ	TE.m	*12*	336	*37*	-0.14	*0.05*	818	*120*	-0.26	*0.06*	0.084	*0.020*	0.062	0.106	0.153	0.042	complete
u:	TE.m	*67*	343	*50*	-0.13	*0.06*	921	*266*	-0.22	*0.11*	0.142	*0.018*					
ʊ	TH.m	*10*	380	*39*	-0.03	*0.05*	1067	*105*	-0.15	*0.11*	0.059	*0.011*	0.066	0.073	0.849	0.068	complete
u:	TH.m	*24*	345	*53*	-0.08	*0.06*	936	*188*	-0.21	*0.08*	0.136	*0.025*					
ʊ	TJ.f	*9*	472	*69*	-0.07	*0.07*	768	*87*	-0.30	*0.05*	0.069	*0.019*	0.069	0.071	-114.476	0.101	partial
u:	TJ.f	*54*	375	*62*	-0.17	*0.07*	788	*216*	-0.30	*0.10*	0.182	*0.038*					
ʊ	TL.f	*12*	384	*19*	-0.08	*0.02*	795	*96*	-0.28	*0.07*	0.057	*0.011*	0.023	0.034	-2.739	0.036	complete
u:	TL.f	*70*	355	*26*	-0.11	*0.03*	834	*289*	-0.26	*0.10*	0.135	*0.024*					
ʊ	TM.f	*10*	446	*49*	-0.05	*0.05*	824	*83*	-0.27	*0.04*	0.046	*0.015*	0.045	0.109	1.159	0.073	complete
u:	TM.f	*49*	398	*85*	-0.11	*0.08*	855	*171*	-0.32	*0.42*	0.150	*0.031*					
ʊ	TT.f	*12*	403	*21*	-0.05	*0.02*	841	*95*	-0.26	*0.08*	0.061	*0.015*	0.027	0.047	1.642	0.054	complete
u:	TT.f	*72*	364	*39*	-0.09	*0.04*	796	*217*	-0.28	*0.09*	0.799	*5.365*					
ʊ	TV.f	*12*	461	*41*	-0.06	*0.04*	894	*98*	-0.25	*0.07*	0.058	*0.015*	0.045	0.063	1.747	0.070	complete
u:	TV.f	*66*	404	*57*	-0.12	*0.06*	826	*141*	-0.29	*0.06*	0.144	*0.036*					
ʊ	TX.m	*9*	444	*28*	-0.03	*0.03*	875	*53*	-0.21	*0.03*	0.089	*0.013*	0.028	0.048	2.111	0.051	complete
u:	TX.m	*47*	401	*42*	-0.08	*0.04*	844	*170*	-0.23	*0.07*	0.134	*0.024*					

4.4.6.1 Overview of /uː, ʊ/ based on all the data

Figure 4.10 (a-c) shows the basic patterns associated with this vowel quality subsystem, using the data of KF.f (Pattern 1, no spectral overlap), TL.f (Pattern 2, complete spectral overlap), and KM.m (Pattern 3, partial spectral overlap). Pattern 1 was only shown by speaker KF.f.

Not many real-word items were available for /ʊ/, so it is less well-represented than /uː/, occurring between three (for speaker KC.f) and 12 (for most speakers) times per person. Therefore, the observations that will be made in this section should be interpreted with caution. For most speakers, the vowel pair differed in F1 by around 40 Hz, with deviations which indicated category overlap. The means provided in Table 4.19 suggest that /uː/ is very slightly further back than /ʊ/, on the order of 40-100 Hz in F2. Auditory inspection revealed that all speakers in both groups, with the exception of TA.m, TT.f, KC.f, and KW.m, tended to palatalize the alveolar consonant preceding/uː/ in "duke," "dune," "dude," and "dues." The effects of palatalization were still evident at vowel midpoint, resulting in a higher mean F2 and large standard deviations (although these words did not constitute a high enough proportion of the /uː/ class to skew the mean). As was the case in several preceding subsystems, the effects of following manner on F1 and F2 showed no consistent patterns.

Duration ratios for /uː, ʊ/ are provided in Table 4.20. Examination of the table shows that /ʊ/ is consistently shorter than /uː/ for all speakers, ranging from 46 -89 ms. This makes /ʊ/ the shortest vowel observed overall, surpassing /ʌ/ which was described in the low vowel quality subsystem. Duration ratios for this vowel pair were



(a) (b) (c)

Figure 4.10 a,b,c. Three spectral patterns associated with /uː, ʊ/.

very large for both speaker groups, averaging 2.27 for both. No differences in gender or group were apparent from the mean data. In contrast with the results for following manner reported above for F1 and F2, a single pattern emerged for duration. Consistent with results for /iː/ and /a/ above (for all speakers), and /ɔ/ (St. Thomas speakers), mean durations for /uː/ were shortest in the environment of a following stop, and longer before following nasals and fricatives (e.g., for Kingston males: 117, 138, and 155 ms, respectively).

Table 4.20. Mean duration ratios for /uː, ʊ/ (means given in ms).

	Female Speakers					*Male Speakers*					
	KC.f	KD.f	KF.f	KT.f		KE.m	KM.m	KR.m	KU.m	KW.m	Kingston average
uː	116	135	130	145		133	133	138	140	111	131
ʊ	51	62	57	69		49	57	57	70	52	58
uː:ʊ ratio	2.275	2.177	2.281	2.101		2.714	2.333	2.421	2.000	2.135	2.271
	TJ.f	TL.f	TM.f	TT.f	TV.f	TA.m	TB.m	TE.m	TH.m	TX.m	St. Thomas average
uː	182	135	151	167	144	167	145	142	136	134	150
ʊ	69	57	46	61	58	86	83	84	59	89	69
uː:ʊ ratio	2.638	2.368	3.283	2.738	2.483	1.942	1.747	1.690	2.305	1.506	2.270

4.4.6.2 Statistical results for /uː, ʊ/ based on a subset of the data

Table 4.21 (a,b) presents the ANOVA factors and output for the high back vowel quality subsystem. 30% of high back quality words were submitted to statistical testing. Analyses were conducted on the /uː, ʊ/ pair in two consonant environments: preceding bilabial with following velar (set 1; Table 4.21a), and preceding velar with following alveolar (set 2, Table 4.21b). In the initial bilabial with following velar environment, /uː/and /ʊ/differed neither in F1 (height) nor F2 (primarily backness). In the initial velar with following alveolar environment, F1 of /uː/ was significantly lower than that of /ʊ/. As was mentioned with respect to the overlap illustrations and mean data presented above, statistics must be interpreted with caution because it is possible that different patterns would emerge if the number of values entering into the comparison were larger.

For F2, the initial velar with following alveolar environment showed a main effect of group, such that Kingston speakers (of both genders) had higher values for F2 of /uː/ (i.e., further front in articulatory vowel space).

Only the initial velar with following alveolar environment permitted comparison of duration for the high back vowel quality subsystem. Main effects of vowel and group were found. As was predicted by the examination of mean data above, /uː/ was significantly longer than /ʊ/. The main effect for group indicated that mean vowel duration (for both /uː, ʊ/) was significantly different for the St. Thomas and Kingston groups, such that St. Thomas speakers' productions were longer than Kingston speakers'. No vowel-by-group interaction was found.

To summarize, in the high back subsystem, comparisons were limited because of the infrequent lexical occurrence of /ʊ/. The comparisons available suggest that /uː/ and /ʊ/ are partially or completely spectrally overlapping for most speakers. /uː/ has a slightly lower F2 (i.e., occurs slightly further back) than /ʊ/, but has a larger deviation due to the effects of palatalization of preceding alveolar consonants. The pair is perhaps only remarkable in that they show very large duration ratios, larger than any other monophthong pair, owing to the shortness of /ʊ/.

Table 4.21a. ANOVA results for the high back vowel quality subsystem (first set). Consonant environment for F1 and F2 tests: preceding bilabial with following velar. Factors for F1 and F2 tests include: vowel, group, gender. Repeated measures for speaker and word. No tests could be run on Duration. Values submitted consist of word means for each speaker.

Dependent Variable **Significant Factors**	**df**	**F**	***p*-value**
F1			
vowel	(1,14)	1.12	0.3 n.s.
F2			
vowel	(1,14)	0.64	0.4 n.s.

Table 4.21b. ANOVA results for the high back vowel quality subsystem (second set). Consonant environments for F1, F2, and Duration tests: preceding velar with following alveolar. Factors for F1, F2, and Duration tests include: vowel, group, and gender. Repeated measures for speaker and word. Following voicing restricted to voiced consonants for duration test. Values submitted consist of word means for each speaker.

Dependent Variable **Significant Factors**	**df**	**F**	***p*-value**
F1			
vowel	(1,49)	43.11	<0.01
F2			
group	(1,49)	6.66	<0.01
Duration			
vowel	(1,14)	112.12	<0.01
group	(1,14)	7.14	<0.02

4.5 Spectral and Temporal Relationships and Phonemic Merger

Spectral and temporal features have been examined for those vowels which neighbor each other in acoustic space. I was interested in examining whether and how these vowels are distinguished by the present sample of acrolect-dominant and basilect-dominant Jamaican speakers. In this section, I will step back from the subsystem analysis, and consider how speakers make use of spectral and temporal interactions in their larger vowel systems.

Table 4.22 summarizes the overlap patterns for the vowel quality subsystems for each speaker. The table was constructed using the overlap decisions presented in §4.4, based on the mean and deviation data for F1, F2 (by means of the overlap calculations), and duration for each speaker. Rows indicate *no*, *partial*, or *complete* overlap in spectral properties for a given vowel quality pair; columns indicate the same for temporal properties.

Perhaps most salient is the fact that all phonologically long:short pairs are temporally distinct for all speakers. Vowels in the front pairs /iː, ɪ/ and /eː, ɛ/ showed the greatest tendency to be kept both spectrally and temporally distinct by speakers in both groups. Beyond this, some group-specific patterning emerged. /eː, ɛ/ typically showed no or partial spectral and temporal overlap for both Kingston and St. Thomas speakers. However, Kingston speakers additionally tended to show some temporal overlap between the vowels. That /eː, ɛ/ showed partial temporal overlap in the presence of no spectral overlap for some Kingston speakers is perhaps an indication that spectral distinction provided sufficient phonemic contrast, allowing temporal distinctions to be relaxed. F2 values for Kingston speakers, as a group, in two subsystems, additionally pointed to another spectral pattern--slightly more centralized productions of /ɛ/ (more backed) and /uː/ (more fronted) than St. Thomas speakers. /ɑː, a/ were found to be kept more spectrally distinct by Kingston speakers, while the only speakers to maintain a temporal distinction alone for this pair fell within the St. Thomas group. Overall, Kingston speakers exhibit spectral distinctions (i.e., no or partial spectral overlap, as was shown for /iː, ɪ/, /eː, ɛ/, /a, ɔ/, /ɑː, a/) more frequently than they show complete spectral overlap (in the case of/uː, ʊ/) between vowel quality oppositions. St. Thomas speakers tend to show partial or complete spectral overlap with temporal distinction (as was shown for /uː, ʊ/, /ɑː, a/, /a, ɔ/) more frequently than they show spectral distinction (/iː, ɪ/, /eː, ɛ/). Conversely, Kingston speakers show some oppositions with partial temporal overlap, /eː, ɛ/, /a, ɔ/, whereas with the exception of /a, ɔ/, the St. Thomas speakers never do.

Table 4.22. Spectral and temporal overlap by vowel quality subsystem and speaker (low vowel combinations continued in second column).

Subsystem	Spectral Overlap	Temporal Overlap: no overlap	Temporal Overlap: partial overlap	Temporal Overlap: complete overlap
HIGH FRONT iː, ɪ	no overlap	TJ.f, KF.f, KM.m		
	partial overlap	TB.m, TE.m, TH.m, TL.f, TM.f, TT.f, TV.f, TX.m, KC.f, KD.f, KE.m, KR.m, KT.f, KU.m, KW.m		
	complete overlap	TA.m		
HIGH BACK uː, ʊ	no overlap	KF.f		
	partial overlap	TB.m, TJ.f, KD.f, KE.m, KM.m, KU.m		
	complete overlap	TA.m, TE.m, TH.m, TL.f, TM.f, TT.f, TV.f, TX.m, KC.f, KR.m, KT.f, KW.m		
MID FRONT eː, ɛ	no overlap	TL.f, TT.f, KM.m, KR.m	KC.f, KD.f, KE.m, KU.m, KW.m	
	partial overlap	TA.m, TB.m, TE.m, TH.m, TM.f, TV.f, TX.m, KF.f		
	complete overlap	TJ.f	KT.f	
LOW ɑː, a	no overlap	KE.m, KF.f, KM.m, KT.f, KU.m		
	partial overlap	TH.m, TJ.f, TM.f, TT.f, TV.f, TX.m, KC.f, KD.f, KR.m, KW.m		
	complete overlap	TA.m, TB.m, TE.m, TL.f		
LOW ɔ, a	no overlap			
	partial overlap		TH.m, TV.f, KM.m, KT.f	TJ.f, TL.f, TM.f, TT.f, KD.f, KE.m, KF.f, KU.m, KW.m
	complete overlap		TA.m, KC.f	TB.m, TE.m, TX.m, KR.m
LOW ɔ, ɑː	no overlap			
	partial overlap	KE.m, KF.f, KM.m, KT.f		
	complete overlap	TA.m, TB.m, TE.m, TH.m, TJ.f, TL.f, TM.f, TT.f, TV.f, TX.m, KC.f, KD.f, KR.m, KU.m, KW.m		
LOW ɔ, ʌ	no overlap		TA.m, KC.f, KM.m	
	partial overlap		TB.m, TE.m, TJ.f, TL.f, TM.f, TT.f, TV.f, TX.m, KD.f, KE.m, KF.f, KR.m, KT.f, KU.m, KW.m	
	complete overlap		TH.m	
LOW ɑː, ʌ	no overlap	KC.f, KW.m	TB.m	
	partial overlap	TA.m, TJ.f, TL.f, TM.f, TT.f, TV.f, KD.f, KM.m, KR.m, KT.f, KU.m	TE.m, TX.m	
	complete overlap	TH.m, KE.m, KF.f		

An interesting feature becomes apparent when we look at the system as a whole. For some speakers, there are some cases of overlap that do not occur within the vowel quality, or canonical long:short, oppositions. Examination of the front system (along the left boundary of v-shaped acoustic space), using the means and variances presented in this chapter along with the plots for normalized vowel data given in Appendix G, for speakers TA.m, TH.m, TJ.f, TL.f, TT.f, TV.f, KC.f, KD.f, KE.m, KR.m, KT.f, KU.m, KW.m, shows that the means and variances of some members of the high front and mid front subsystems overlap. What this points to for three speakers, rather than a true cross-subsystem spectral overlap between monophthongs, is the tendency for the nucleus of a downgliding diphthong to originate in the high front subsystem. For speakers TA.m, KC.f, and KW.m, the nucleus of downgliding diphthong [ie] overlaps with monophthong [iː]. These phonemes remain distinct in quality, however, due to the offglide of the diphthong. For the other speakers, the nuclei of the diphthong (which is realized as [ɪe]) and of their other, monophthongal productions of /eː/, are lower, partially overlapping with monophthongal /ɪ/. Where /eː/ is monophthongal, the distinction here becomes one based on length differences between [ɪ] and [eː]. That is, while spectral values overlap for [ɪ] and [eː] for speakers KD.f, KE.m, and KT.f, temporal values are large (e.g., for KD.f, [ɪ] averages 69 ms, and [eː], 133 ms).

Figure 4.11 presents graphically the duration means for all speakers, grouped by gender and group. This chart summarizes the general trends which have been observed for the groups and genders in the earlier discussion. Overall, the statistical tests suggest that St. Thomas speakers utilize vowel length (quantity) distinctions to a greater extent than Kingston speakers, and females (particularly in the case of /a, ɑː/) show a greater tendency to utilize length distinctions than males. Variation related to gender and group will be revisited in the discussion of individual speakers and the contributions of extralinguistic variables in Chapter 5.

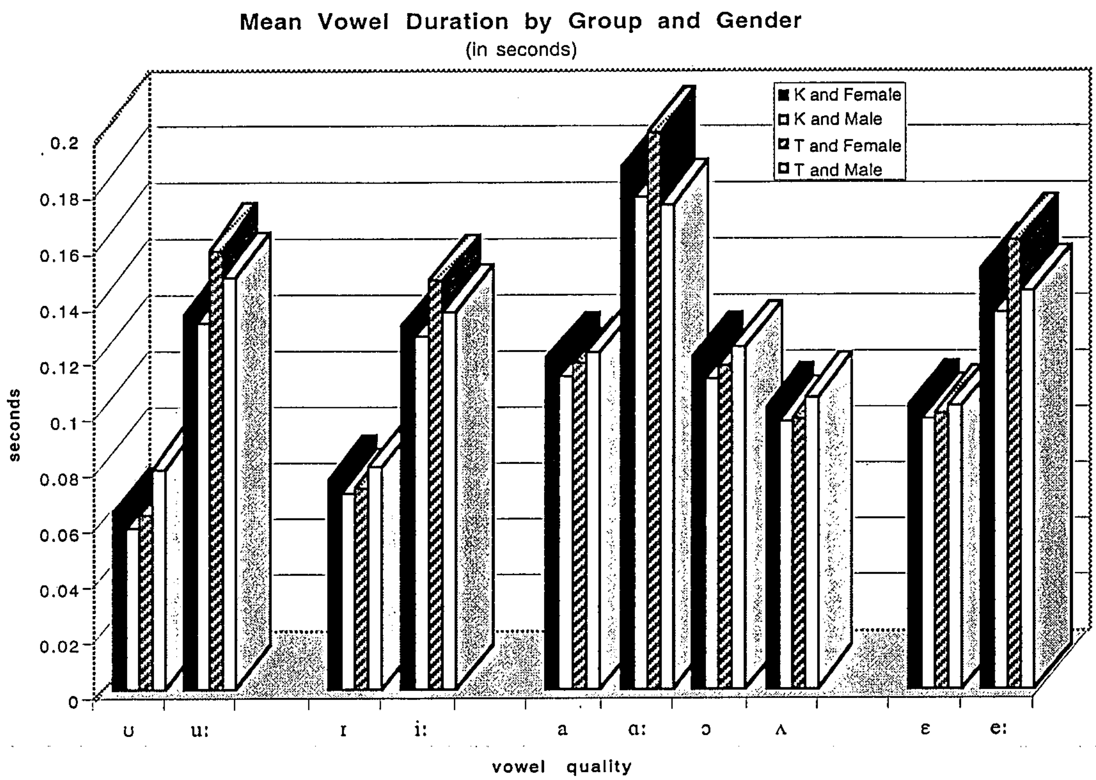


Figure 4.11. Mean vowel durations grouped according to group and gender.

Table 4.22 highlights a pattern which emerged in §4.4.4. The members of the monophthong pair /a, ɔ/ tend to have very similar duration, height (F1) and backness (F2) for some St. Thomas speakers. Not surprisingly, when inspected auditorily, these vowels also sound alike. In fact, for three St. Thomas speakers and one Kingston speaker, these categories completely overlapped. These vowels seem to fit the traditional definition of a phonemic merger, "the coming together (or convergence) of linguistic units which were originally distinguishable" (Crystal, 1991). While an assessment of at least near-merger seems well-justified, in the absence of information to check low-level phonetic effects such as phonation differences (cf. diPaolo and Faber, 1990), the pair cannot be confidently concluded to show complete merger. One pair of diphthongs, /aɪ, ɔɪ/, also overlapped both temporally and spectrally--notably, not just for St. Thomas speakers, but for all speakers. This finding (described in §4.4.4), is consistent with those for some varieties of English which show the LOIN/LINE near-merger (Wells, 1982). By contrast, the data presented above show that /uː, ʊ/ are maintained in conditions of both partial and complete spectral overlap for St. Thomas speakers, but that these vowels are temporally distinct. Scots English, one of the superstrate inputs to Jamaican Creole, exhibits a phonemic merger of these vowels (cf. Wells' [1982] discussion of the "pull/pool" merger). In this regard, Jamaican differs in merged vowel categories.

When long:short ratios for the speaker groups are compared, the St. Thomas speakers show an overall duration ratio (averaged across all vowel quality oppositions) of 1.66:1, with that of Kingston speakers around 1.56:1. These numbers are not very different, and it is difficult to attribute to them any kind of independent meaning. It is clear that duration must be viewed as one part of the picture of phonemic contrast. First, spectral proximity of the vowels participating in the opposition must be taken into account along with temporal properties. Because spectral differences tended to be smaller and sometimes nonexistent for the St. Thomas speakers, while temporal distinctions were kept large, we may say with some confidence that duration plays a larger role in phonemic contrast for the St. Thomas speakers studied than for the Kingston speakers. But even the 1.56:1 ratio for the Kingston speakers is relatively large compared to that associated with, for example, 1.2:1 for American English, given by Hubbard (1998).

4.6 Phonetic Effects

Two extralinguistic variables, group and gender, have been shown both in the Grand and subsystem ANOVAs to be important contributors to variation in the production of Jamaican vowels. Phonetic effects also play a role in shaping the system and in contributing to patterned variation. Thus, it is clear that phonetic and extralinguistic factors operate simultaneously to influence the realization of vowel sounds. The emergent phonetic effects are highlighted in the following paragraphs, and the extralinguistic effects are discussed at greater length in Chapter 5.

The least expected phonetic result in this study was related to the magnitude of spectral distinctness between vowel quality pairs. As was mentioned in §2.3, previous research on Jamaican phonology has reported that basilectal Jamaican Creole distinguishes vowels by duration. What has not been previously reported is the nature of vowel quality differences in the light of that purported duration difference. LePage (1960) and Wells (1982) provide phonetic transcriptions that allude to such differences, however, when they report their impressions of allophonic variants for Jamaican vowels. The present acoustic study has shown that spectral distinctions occur for a group of basilect-*dominant* speakers, although these differences are not equal for all pairs of vowels. It was shown, for example, that /iː, ɪ/ are more spectrally distinct (i.e., show larger F1 and F2 differences) than /ɑː, a/, although both pairs of vowels were classified as showing no temporal overlap. Thus, we see that the relative temporal properties of these vowels are important, but the nature of the relationship between spectral and temporal properties is (at least acoustically) different. Lehiste (1970:30) indicates that it is not unusual for languages that show primary quantity to also show distinctions of quality. Perceptual research might be helpful in shedding light on whether Jamaican listeners show particular sensitivity to temporal cues versus spectral cues, or make decisions concerning vowel identity or contrast using some combination of the two.

Three other phonetic effects emerged in this study. First, vowel quality subsystems were shown to be significantly different in duration (see discussion of intrinsic duration in §4.2, and Grand ANOVA results in §4.3), suggesting that in general, high and low vowels differ in length, perhaps due to articulatory factors. This is consistent with findings reported for other languages (Lehiste, 1970).

Second, in the duration comparisons presented for the low and high back qualities, and in the discussion of the Grand ANOVAs which compared the subsystems, the phonetic factor of following voicing was shown to be an important contributor to variation in vowel duration. This effect, referred to in §4.2 as "segmental conditioning," is related to the finding in the present study that vowels are consistently longer before voiced consonants than voiceless, and that this effect seemed to be larger for short vowels. In addition, the first set of Grand ANOVAs showed a larger effect of following voicing on duration for the Kingston males than for other speakers (see §4.3). This effect, however, did not emerge in the subsystem analyses.

Third, effects related to the manner of articulation of a following consonant were not examined statistically, but a general pattern related to vowel duration was noted across the first tier of the subsystem analyses. Vowels /iː/, /a/, /oː/, and /uː/ (all speakers) and /ɔ/ (St. Thomas speakers), were consistently shorter when followed by oral stop consonants than when followed by nasal stops and fricatives, respectively (i.e., stop < nasal < fricative). Vowels /eː/, /ʌ/ (all speakers), and /ɔ/ (Kingston speakers) were also shortest when preceding a stop; however, a vowel followed by a fricative was shorter than one followed by a nasal stop (i.e., stop < fricative < nasal). Vowels /ɪ/, /ɛ/, and /ɑː/ were shorter when followed by fricatives than stops. Lehiste (1970) and others have noted that vowels tend to be longer when followed by nasals and fricatives, consistent with the findings reported here for /iː/, /a/, /oː/, and /uː/ (and /ɔ/ for St. Thomas speakers). But what might account for the orderings in the second and third cases? Voicing of the following consonant was not balanced in these comparisons. The set of words with final stop consonants contained both [+voiced] and [-voiced] members for vowels /iː/, /uː/, and /a/ but only voiceless members for /ɪ/, /ɛ/, and /ɔ/. Given the effects of a following voiced consonant on vowel duration (described above), the absence of voiced word-final consonants in the fricative set may account for the shorter durations. For /ʌ/, the difference in mean duration for vowels followed by nasals vs. fricatives was quite small--less than 7 ms for both St. Thomas genders and Kingston females, so this result may not reflect a clear difference in the effects of following nasals and fricatives. It is not entirely clear why St. Thomas and Kingston speakers differed in the effects of following manner on duration of /ɔ/. One possibility is that this difference is in part due to the fact that for a few St. Thomas speakers (but only one Kingston speaker), /ɔ/ is spectrally and temporally very nearly identical to /a/, and thus, the vowels pattern together for these speakers.

4.7 The Global Occupation of Acoustic Space

This section presents general observations about the overall distribution of Jamaican vowels in acoustic space based on the data provided above in the subsystem analyses. In doing so, the concepts of vowel system shape, peripherality, symmetry, and interior occupation, are defined and discussed.

Conventional typological accounts of the configuration of vowel systems rely on the basic principle of phonological contrast. Typological descriptions of vowel inventory configurations and the theories surrounding the idea of what is relevant for phonological contrast continue to be refined (the first articulation of phonological contrast was by Trubetskoy [1939]). Schwartz, Boë, Vallée and Abry (1997) analyzed the vowel inventories of the 317 languages in the UPSID database (Maddieson, 1984), with a view to describing major trends in how the vowels belonging to the world's languages are organized. They argued that models of vowel systems concerned with the prediction of vowel system configurations must reflect factors known to be relevant to the patterning of real vowel inventories. They elicit the features pertaining to vowel systems using the following questions:

(1) What is the global occupation of acoustic space in terms of peripheral vs. non-peripheral vowels?

(2) How are the left and right "boundaries" of acoustic space occupied (front vs. back occupation of peripheral vowels, as well as front vs. back symmetry, gaps, or holes in the peripheral system)?

(3) How is the interior of acoustic space occupied (relation among series of non-peripheral vowels particularly front rounded, central rounded or unrounded, back unrounded; vertical organization of these series; status of schwa)? (Schwartz, *et al.*, 1997:235).

While this study is not concerned with modeling universal trends in vowel system inventories, it is useful to summarize the findings for Jamaican vowels in a manner which facilitates comparison with other, previously described vowel systems. In addition, the property of peripherality in particular has proven relevant to linguistic variation and change. Phonological rules governing the path of sound change have been argued to operate at precisely the level of peripheral or non-peripheral tracks of a vowel inventory for several modern English dialects (Labov, 1994). The overall character of the Jamaican system will be discussed below in terms of its peripherality, symmetry, and interior occupation of acoustic space.

4.7.1 Peripherality

The vowel distributions for all the Jamaican speakers analyzed, whether from Kingston or St. Thomas, were found to lie along the boundary lines of a v-shaped space with its apex at /a/, as is illustrated in the schematic diagram in Figure 4.12. The right and left representations are idealized composites of the vowel plots of acrolect-dominant speakers KF.f and KM.m, who showed the greatest number of spectrally-distinct monophthong pairs (left diagram) and basilect-dominant speakers TA.m and TM.f, who showed the most spectral overlap (right diagram). The composites were made by juxtaposing the plots of speakers with similar extreme patterns in clustering/distinctness and plotting the location of the center of each vowel category on the idealized diagram. These diagrams are intended to represent the range of configurations (both show positionings that were present in the plots of other speakers in their own, or the other, group). However, the v-shaping is common to all. Veatch (1991) first reported a v-shaped system for two mesolectal speakers, and refers to the apex as the "low corner" of Jamaican vowel space. Figure 4.13 is based on the means provided in Table 4.3 and presents the basic distribution associated with the vowels that were examined in §4.4. This v-shape is common to all speakers, although for some speakers, the vowels in the mid front category, as well as the nuclei for diphthongs /oː, aʊ/ overlap with those in the high front, and high back categories, respectively (as will be described in the discussion of symmetry which follows). Because the vowels all fall along the boundary line that connects the extrema of the system, i.e., point vowels /iː, a, uː/, the Jamaican system may be described as "peripheral". High front and mid front monophthongs /iː, ɪ, ɛ/ lie roughly along a single line along the left boundary of acoustic space, high back monophthongs /uː, ʊ/ along the right boundary. The nuclei for the mid front and mid back diphthongs /eː~ie, aʊ, oː~uo/ also lie along the lines of their respective left or right boundaries.

As was mentioned in §4.4.2, vowels in the high front subsystem tend to show greater clustering than do those in the back. This is likely to be in part an artifact of the logarithmic scaling used in the normalization procedure, which tends to spread out values slightly in the lower frequencies and to compress higher frequency ranges (below and above 1000 Hz , respectively). However, the same pattern appears to obtain when data are plotted in Hertz (Veatch, 1991:123). Clustering among the low vowels is greatest overall.

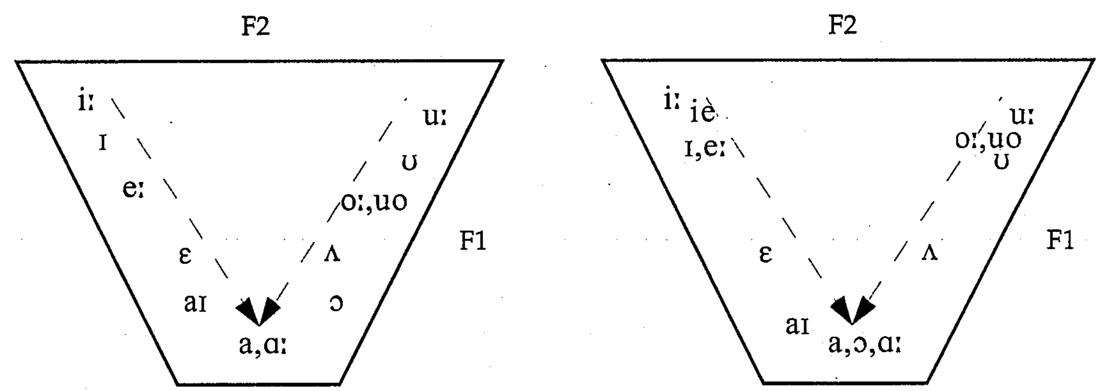


Figure 4.12. Schematic diagrams of the shape and distribution of idealized phoneme categories in Jamaican vowel space. Left: diagram of a system showing little spectral overlap. Right: diagram of a typical system in which nuclei of diphthongs in the mid front and back vowels overlap with high vowel subsystems (see text for explanation).

There is slight variation among speakers in the verticality of the boundary lines of the system. This may be seen, for example, in the vowel plots of speakers TL.f and KF.f in Appendix G. The angle formed where the right and left boundary lines come together at the apex of the system is obtuse for some speakers, such as TL, but acute for others, such as KF.[6]

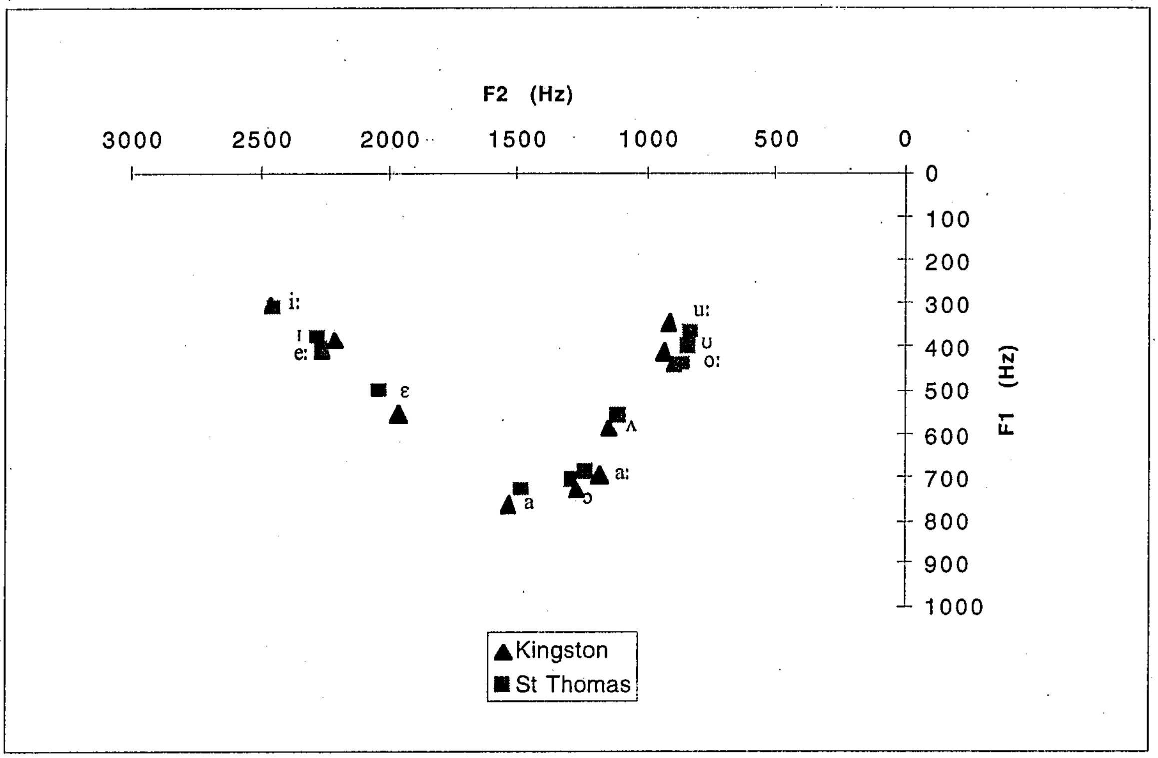


Figure 4.13. Mean vowel formant frequencies for monophthongal vowels at midpoint and diphthongs at nucleus midpoint, by group (in Hertz).

4.7.2 Symmetry

As defined here, symmetry concerns the relative spatial distribution and number of front and back vowels (both monophthongs and diphthongs), such that in a symmetrical structure, the numbers in both regions of the system are equal and located opposite each other. A structure is described as "right" or "left" if it contains a greater number of vowels in one region than the other. In the Jamaican data, it may be observed that the distribution of vowels tends to be symmetrical. Those speakers, described in §4.4, for whom the high front and mid front subsystems showed no overlap correspond to the system represented in the left diagram in Figure 4.12, with 5 vowels along each of the front and back boundary lines. Those speakers (such as TM.f , whose vowel plot has been reproduced in Figure 4.14, and TA.m, whose vowel plot is provided in Appendix

G) who showed spectral overlap primarily between the high and mid front subsystems correspond roughly to the diagram in the right of the figure. This latter group showed overlapping means and variances for /iː, ɪ, eː~ie/ in the high front region and /uː, ʊ, oː~uo/ along the high back. (Clustering here is described in terms of the means and variances rather than visual assessment of vowel plots because this allows the most precise estimation of the mean of the distribution.)

Clustering results in "gaps" between mid front /ɛ/ and low /aɪ/ for several speakers, mostly in the St. Thomas group (TA.m, TB.m, TJ.f, TL.f, TM.f, TV.f.) Figure 4.14 illustrates this for speaker TM.f. Vowels seem to be concentrated, particularly for the St. Thomas speakers, in the upper region of the left system (high front) vowels with means within a range of about 200 Hz of each other in F1, and around the apex of the system in the low corner (low vowels), with means that are within 300-500 Hz of each other in F2. (Veatch [1991] has also noted clustering in the low corner of Jamaican vowel space, referring to the system as "bottom heavy".) Kingston speakers tend to show greater vertical and horizontal spectral distribution among vowels in both the left and right systems, with monophthongal vowels generally non-overlapping (see particularly KM.m, KF.f). St. Thomas speakers also show greater overlapping (if not clear clustering) of vowels in the mid and high back region.

4.7.3 Interior Occupation

The individual speakers' vowel plots (Appendix G) show that as a rule, the acrolect- and basilect-dominant speakers' vowels were concentrated at the periphery, rather than the center, of acoustic space. Three exceptions to this were female speakers KT.f, TL.f, and TT.f who produced fairly centralized /ʌ/. Data for the present study come from vowels in stressed syllables only, so additional information about the quality

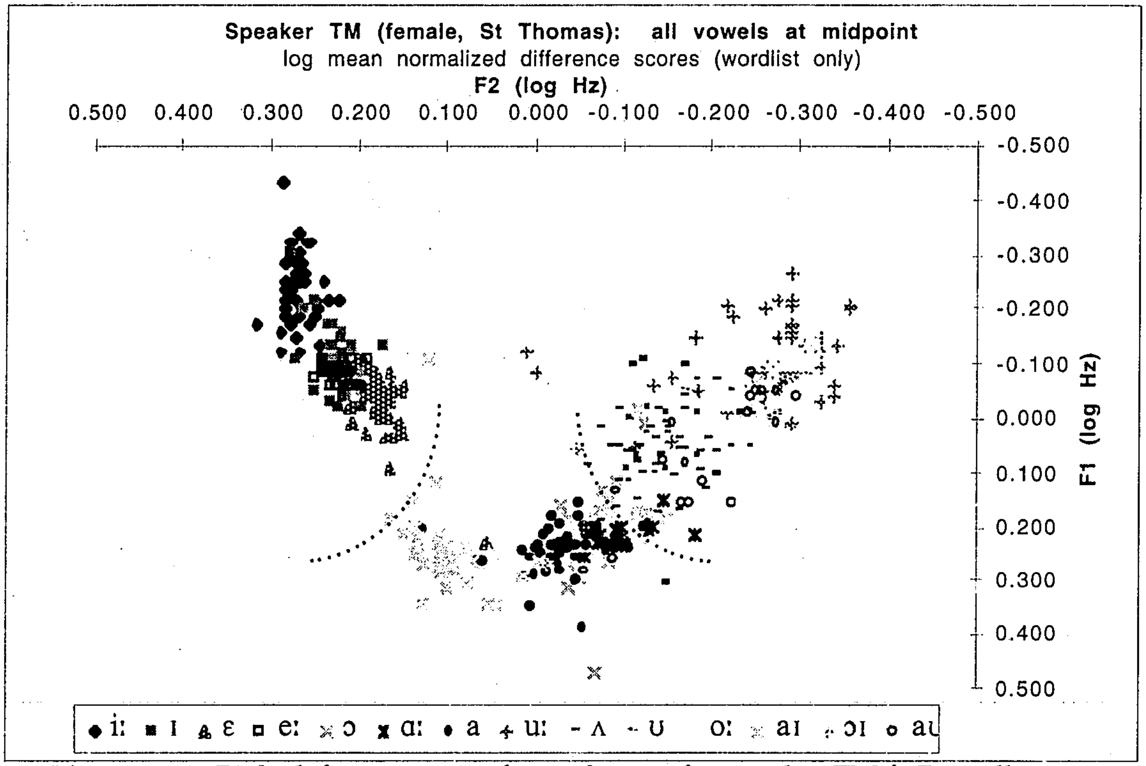


Figure 4.14. Right-left symmetry of vowel space for speaker TM.f. Data illustrate pattern where there is a gap in acoustic space between the mid and low, and high back and low subsystems. Phonetic symbols represent orthographic categories.

of vowels in unstressed syllables is needed to explore whether vowels may be centralized in unstressed syllables.

4.8 Rhoticity

Table 4.23 provides a breakdown of the realizations of postvocalic-r for the speakers included in the acoustic comparisons above. R-words occurring in the word list, conversational, and picture task sessions were subjected to auditory analysis, and both occurrences and non-occurrences of /ɹ/ were noted. The results presented were tallied together across the three sessions. Where r-less words occurred, the word and the session(s) in which it occurred are noted. The proportion of occurrences and non-occurrences is expressed for each vowel, and an overall percentage of r-less words averaged across all vowel types is given for each speaker.

A number of studies, such as Wells (1982), Irvine (1994), and Patrick (1992) have reported variability in the rhoticity of Jamaican speakers. Indeed, the present data show some variability both between and within the English-dominant Kingston and Creole-dominant St. Thomas groups. As a rule, all speakers show some use of postvocalic r. The proportion of use, however, varies. As a group, the St. Thomas males have the highest overall proportion of r-less words, between 19-27%, with the exception of speaker TB.m. Absence of postvocalic-r was primarily found after the vowels /a, ɑː, ɔ/. Speaker TB.m systematically produced postvocalic-r, except for one word "burn," which he pronounced several times in his conversational session as [bʌn]. As will be discussed further in Chapter 5, this finding is interesting, because this particular word is strongly associated with Creole--the vowel quality for this word is quite possibly lexicalized. Two other males, and one St. Thomas female, but no Kingston speakers, also used [bʌn].

Females in both the Kingston and St. Thomas groups showed a low incidence of r-less words. Where it did occur, absence of postvocalic-r was primarily associated, as in the case of the male speakers, with the vowels /a, ɑː, ɔ/.

Kingston males fell into two groups: those who were consistent in use of postvocalic-r, and those who showed no postvocalic-r in the presence of /a, ɑː, ɔ/. Absence of postvocalic-r has been widely purported to carry social meaning in Jamaica (cf. Roberts, 1988; Irvine, 1994), and this social significance is further considered in Chapter 5.

Table 4.23. Postvocalic-r occurrence by speaker and vowel. Lexical items produced with no postvocalic-r are listed for each speaker, with the session in which they occurred. Session codes: w=word list; v=conversation; p=picture.

	eːɹ		aɹ		əɹ		ɔɹ		%	
Speaker	pvr	no pvr	pvr	no pvr	pvr	no pvr	pvr	no pvr	r-less	r-less words (session)
St. Thomas males										
TA	32		22	24	31		14	1		corn,corp,cord,cars,cart,dark,
	100%		*48%*	*52%*	*100%*		*93%*	*7%*	*20%*	darn,dart (w)
TB	32		48		48	2	32			burn (v)
	100%		*100%*		*96%*	*4%*	*100%*		*1%*	
TE	19		20	27	50	2	14	9		burn (v), barb,bark,card,cart,
	100%		*43%*	*57%*	*96%*	*4%*	*61%*	*39%*	*27%*	dark,darn,dart,cord,corn, corp (w)
TH	32		30	6	48		6	26		bark,bart,card,carp,cart,cord,
	100%		*83%*	*17%*	*100%*		*19%*	*81%*	*22%*	corn,corp (w)
TX	6	2	10	5	24		10	5		dared,dares, corn, corp, cord,
	75%	*25%*	*67%*	*33%*	*100%*		*67%*	*33%*	*19%*	dork (w)
St. Thomas females										
TJ	7		13	2	17		10			dark, darn(w)
	100%		*87%*	*13%*	*100%*		*100%*		*4%*	
TL	19		42	1	46		35			dark (w)
	100%		*98%*	*2%*	*100%*		*100%*		*1%*	
TM	16		38		40		26	1		born (v)
	100%		*100%*		*100%*		*96%*	*4%*	*1%*	
TT	21		53		55		33			
	100%		*100%*		*100%*		*100%*		*0%*	
TV	20		53		57	1	40			burn (v)
	100%		*100%*		*98%*	*2%*	*100%*		*1%*	
Kingston males										
KE	17		13	19	3	17	25	5		barb,bard,bark,card,carp,cars,
	100%		*41%*	*59%*	*15%*	*85%*	*83%*	*17%*	*41%*	dark,dart,dork(w,v)
KM	36		16	26	35		35	8		barb,bark,bart,card,carp,cart,
	100%		*38%*	*62%*	*100%*		*81%*	*19%*	*22%*	dark,darn,dart,cord,corn(w,v)
KR	31		49	2	44		32			carp,dart
	100%		*96%*	*4%*	*100%*		*100%*		*1%*	
KU	32		44		48		33			
	100%		*100%*		*100%*		*100%*		*0%*	
KW	32		49		49		37			
	100%		*100%*		*100%*		*100%*		*0%*	
Kingston females										
KC	32		48		48		32			
	100%		*100%*		*100%*		*100%*		*0%*	
KD	33		52		49		32			
	100%		*100%*		*100%*		*100%*		*0%*	
KF	32		37	5	48		25	3		card,cart,carp,dark
	100%		*88%*	*12%*	*100%*		*89%*	*11%*	*5%*	
KT	32		41	2	36		32			card,cart
	100%		*95%*	*5%*	*100%*		*100%*		*1%*	

Several other features emerged in the auditory analysis of /ɹ/ which bear mentioning. Several St. Thomas speakers, most notably TV.f, tended to realize the vowels in the "curse" category as [ɔ], e.g., [kɔɹs] "curse," [kɔɹb] "curb". Words in the "berg" and "birth" orthographic categories were never realized as [ɔ], but consistently as [ɚ], or lowered [ɚ̞]. Second, palatalization and downgliding occurred along with postvocalic-r in the St. Thomas speakers' data. Words in the "dares" /eːɹ/ category were consistently produced [ieɹ], e.g. [kieɹz] "cares," [bieɹd] "bared". Words in the "car" category were pronounced [kʲaː]~[kʲaːɹ] "car". The initial consonant was sometimes palatal [ç] in the speech of St. Thomas speaker, e.g., TA.m, who produced [çaːz] "cars". This is in contrast to Kingston speakers' productions, which although r-less, were not usually palatalized, e.g., [kɑː] "car," with /a/ sometimes retracted to [ɑ, ɒ]. This difference in the realization of /a/ suggests that even though both the basilect-dominant and acrolect-dominant speakers show r-lessness, the resulting productions are still markedly different. Patrick (1992) has argued that "prestige" speakers often eliminate (KYA) before /aɹ/. The middle-class Kingston speakers in the present sample may fit into Patrick's category of "prestige" speakers, so that the result observed here is consistent with this argument.

4.9 Discussion

The key findings reported in this chapter relate to the interactions between temporal and spectral features for the Jamaican speakers. Across all speakers, a v-shaped system was observed, regardless of whether from St. Thomas or Kingston. Within that basic shape, acoustic (F1 x F2) space is occupied differently by speakers primarily according to group, and it is found repeatedly that group additionally shows a strong interaction with gender. In general, the St. Thomas speakers show a greater tendency than Kingston speakers toward spectral overlap between members of a vowel quality subsystem (as shown by the vowel-by-group interactions for many of the statistical analyses). Speakers in both groups do, however, maintain some distinctions in vowel quality. This is a more complex picture than found in accounts of the inventory of Jamaican Creole that assert that length alone forms the basis of phonemic distinction. The overall vowel duration ratio for the basilect-dominant speakers was found to be larger than 1.6:1, similar to those reported in the literature for languages which have distinctions of length (primary quantity), in contrast to languages for which differences in vowel length co-occur with distinctions of vowel quality (secondary quantity), e.g., to enhance a tense/lax distinction (Peterson Lehiste, 1960; Crothers, 1978; Maddieson, 1984; Hubbard, 1998). However, at 1.56:1, the Kingston speakers' overall ratio was not much below the cutoff.

Use of picture and conversational data enabled the evaluation of a speaker's variation between settings distinguished by formality. Spectral features of the vowels participating in the phonological long:short oppositions did not vary much across sessions, but production of the diphthongs /eː/ and /oː/ did (Tables 4.12, 4.18, Appendix E). This variation, along with the variation among realizations of /a/, is associated with sociolinguistic factors, and will be discussed in Chapter 5.

Spectral features associated with the palatal fricative [ç] were examined, showing this consonant to be quite distinct from [kʲ] which has been reported to be widespread in metropolitan Jamaican varieties. It was noted that the palatal consonant tends to bring about fronting of the /a/ vowel. Patrick (1992:137) discussed the phonolexical variable (KYA) relative to a low vowel merger, which others including Wells (1982) have also described, in metropolitan Jamaican varieties. Patrick presented the idea, suggested in previous research, that vowels /a/ and /ɑː/ are merged for Jamaican Creole speakers. (KYA) is found only before those vowels which were low and front in 17th century vernacular English. Therefore, it had been asserted that (KYA) serves to make these vowels distinct for these Jamaican speakers. Patrick, however, argued that these phenomena are distinct because (KYA) is used by speakers at all levels of Jamaican society, including those who do distinguish /a/ and /ɑː/. Indeed, this study has found [kʲ] pronunciation in speakers of both groups. In addition, we now have further information concerning its differential patterning between the genders. St. Thomas speakers showed greater use of palatalization, but within the Kingston group, females showed more of this feature than Kingston males. Data were also presented here, however, which provide evidence against a low vowel merger for basilect-dominant speakers whose data were studied here. While /a/ and /ɑː/ did frequently show spectral overlap, they were kept temporally distinct (as shown in Table 4.14a-c). This was particularly the case for St. Thomas females.

Excursus

SPEAKER TI.M

Chapter 4 has focused on the data of 19 basilect- and acrolect-dominant speakers of Jamaican Creole. This excursus presents the picture and conversational data of the twentieth speaker, TI.m, whose data could not be included in the preceding comparisons because word list data could not be collected from this speaker, who read disfluently. However, I did not wish to exclude potentially valuable data. Importantly, monolingual use of Jamaican Creole is associated with uneducated Jamaican speakers, and this study is interested in basilect-dominant speech, which might emerge most reliably in uneducated speakers. Speaker TI.m met the criteria for the study in all respects: he was a rural-oriented individual, native to a St. Thomas district, with a focussed, local communication network structure; participated in conversational and picture tasks; completed a demographic and social network profile questionnaire. The highest level of schooling attained for this speaker was primary school.

Picture and conversational task data for TI.m were analyzed according to the procedures for acoustic analysis set out in §3.5. However, normalization procedures were different due to the absence of word list data. Normalized data were calculated using onset, midpoint, and offset values for his picture and conversational data.

Picture words were consistently produced in the carrier frame *Mi si a* __. Consonantal context varied widely for the conversational words. Summary means and deviations for these data are presented in Appendix E; a vowel plot is provided on the following page. The number of datapoints for this speaker is small: 30 vowels from conversation, 28 from picture. There is greater variation in the vowels for this speaker, as a result of varying consonantal context in the conversational items. However, the following general observations may be made.

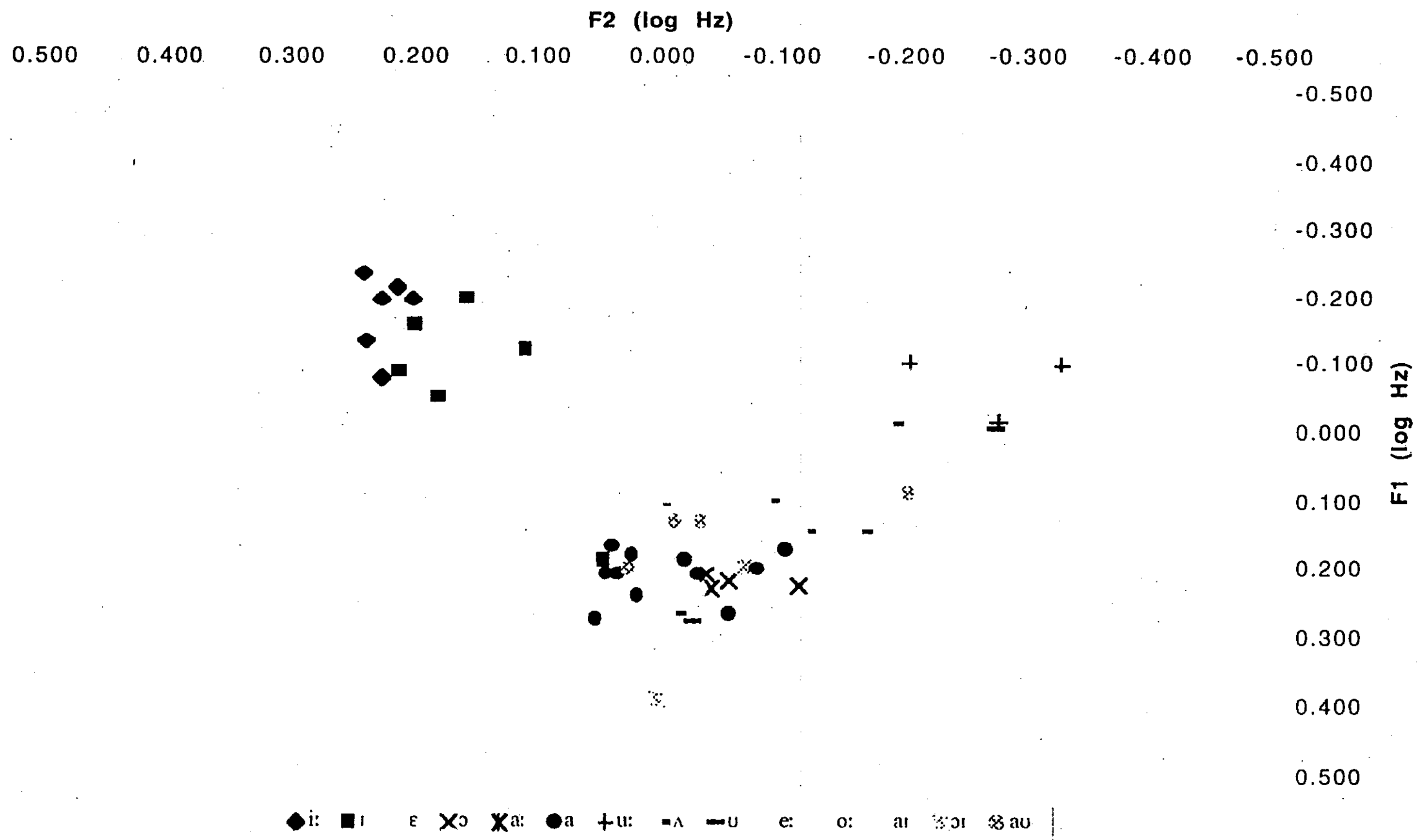
Speaker TI.m shows the v-shaped vowel space found for the other speakers. Along the front boundary, there is a clustering of high front neighboring vowels /iː, ɪ/. However, /iː, ɪ/ seem to be kept somewhat apart in F2. (We cannot arrive at a firm conclusion about this, however, because patterning of vowels may have been different had more tokens and additional consonant contexts been included.) Continuing down that boundary line, we find a gap between the high front and mid categories. /a, ɔ/ overlap, with /aɪ/ positioned furthest forward among the low vowels. /aɪ, ɔɪ/ do not appear to overlap spectrally. In fact, three tokens of /ɔɪ/ occur in the high back vowel region. This is because these three tokens were of the word "boy," and were produced as [bʷai]. The diphthong in this word tends to have a long nuclear portion spectrally similar to /u/ as a result of the labiovelar glide (this was discussed briefly in §4.4.4). Interestingly, the nucleus for the /aʊ/ diphthong (collected in four occurrences of two words, *down, cow*) appears to overlap with the low category. The nucleus of this vowel appears to be lower for TI.m than for the other speakers. TI.m consistently downglides both /oː/ and /eː/, producing [uo, ie], respectively.

Auditory analysis of picture and conversational data revealed additional features of the speech of TI.m. First, postvocalic-r was not used in any of the following picture task or conversational words: "burn" [bʌn], "farm" [faːm], "cord" [kaːd], "bird" [bʌd]. /ʌ/ tokens show partial overlap with /a, ɔ/ consistent with reports concerning basilectal production of this vowel by Wells (1973). In addition, TI.m shows assimilation of an alveolar obstruent to a following velarized approximant [ɫ] in words such as "middle" and "only" which he pronounces [migɫ̩] and [ɔŋgɫ̩], respectively. /oː/ is consistently realized as downgliding [uo], with a nucleus in the vicinity of [u, ʊ]. Two tokens of /u/

are higher than the single token available for /ʊ/, but it is not possible to compare the high back vowels in terms of spectral overlap.

Thus, the analysis of data for TI.m, though limited, reveals similar patterns to the data for the basilect-dominant speakers described in the preceding pages. His data seem to show a possible difference with respect to one item: a fronted nucleus for /aʊ/.

Speaker TI (male, St Thomas): all vowels at midpoint
log mean normalized difference scores (conversational and picture tasks)



Notes to Chapter 4

[1] The conditions for determining spectral overlap were developed to judge in a consistent way distinctions between cases of "no overlap," "partial overlap," and "complete overlap" for vowel pairs. The boundaries of these three categories were set somewhat arbitrarily to reflect my visual assessment of overlap for vowel pairs plotted in F1 x F2 space (Appendix F). The choice to define the ellipse axes as *twice* the standard deviation essentially fixes the boundary for the "no overlap" category, since approximately 95% of normally distributed data would be found within an ellipse of this size. The ellipse size could be defined differently to make it easier or more difficult for a vowel pair to fit into the "no overlap" category. The degree of "protrusion" of one ellipse with respect to another allowed in Condition 2 likewise sets the boundary of the "complete overlap" category. The limit value of protrusion could be changed from 40% of the radius to any other reasonable value. The most appropriate settings for these boundaries may change with the purpose for which this tool is used.

[2] Voicing of the preceding consonant was not included as a factor because it was predicted by place of articulation. Initial contexts included voiced bilabial /b/, and alveolar /d/, and voiceless velar /k/. Comparisons were constructed so as to avoid crossing of voicing levels where they might have an influence on vowel duration.

[3] In presenting the results of post-hoc tests, I give the variables held constant while the third was varied, e.g., "highfront+Kingston: $F(1,164)=3.40$, $p=0.07$" signifies that the vowel quality category was held constant at high front and the group held constant at Kingston while the differences between the two gender levels were tested for statistical significance.

[4] The fact that the overlap formula results in an assessment of "partial" rather than "complete" overlap for TA.m but not for TX.m indicates that the criteria for a "complete overlap" decision were rather stringent. TA.m shows larger variances for the /iː, ɪ/ vowel pair than does TX.m. This means that a proportion, larger than the overlap formula admits for a condition of complete overlap, of the area of one distribution falls outside the other.

[5] Speaker TH.m was evaluated as showing complete overlap because of a large deviation in F2 of /eː/, although his means were well within the ranges that obtained for other speakers. His vowel plot (provided in Appendix E) does not show complete overlap for these vowels. Therefore, he may be taken to show the same overall pattern as other speakers, despite the strict criteria of the decision rule.

[6] Veatch (1991:123) noted that there was some front-back asymmetry for his speakers, such that the right boundary line tended to be more vertical than the left, suggesting that this difference may disappear when the scale is transformed from Hertz, which he used, to Bark, mel, or log. Indeed, it was found that the right boundary for all the present speakers became less vertical after transformation to a more auditorily appropriate scale.

CHAPTER 5

THE SOCIOLINGUISTIC STUDY (PART 1): SPEAKER IDENTITY

This chapter explores the sociodemographic makeup of the pool of speakers whose vowel inventories were analyzed in Chapter 4. The vowel production study reported in that chapter showed variation in the data related to the two extralinguistic variables examined--gender and group. Kingston and St. Thomas groups differed with respect to spectral and temporal properties of vowel production, but there were also differences within the groups. This chapter has as its goal the description of the demographic characteristics of the speakers participating in this study, locating where they seem to emerge, non-linguistic factors that might underlie variation in vowel production. A demographic and network questionnaire, described below, was designed to reflect the culture and present situation of language use and variation in Jamaica. Speaker profile information provided in this chapter based on the questionnaire is intended to supplement the vowel production information given in Chapter 4. This chapter and the investigation of metalinguistic awareness that follows in Chapter 6 constitute the sociolinguistic part of this work.

The questionnaire was designed to elicit quantifiable information regarding traditional sociolinguistic speaker variables such as social class, occupation, and age. In addition to these, information about a speaker's network of informal social interactions was also obtained. The goal was not to conduct a full scale network study, to investigate a substantive issue such as, for example, retention of conservative dialect forms, but rather network information was used to facilitate design of a sample in which the speech of particular individuals could be compared (see §2.2-2.4). Network analysis is highly adaptable to different community situations, and has been used in previous studies to examine relationships between the structure of a speaker's informal orientation and integration into rural communities. Network analysis has also been applied to the study of patterns related to urban-orientation and rural association in dialect speakers and the effect of these patters on the conservation of dialect forms. (Rickford, 1982, argues, for example, that the notion of social class is difficult to apply to non-industrial settings).

Some of the speaker sample is for the most part rural-oriented and some, urban-oriented. In addition to possible links between urban or rural orientation and language variation, patterns are examined that are possibly associated with "in-between" speakers--i.e., urban-oriented speakers with connections to a rural district, and rural-oriented speakers with connections outside that district, as is widely found in Jamaica.

This chapter is organized as follows: §5.1 deals with speaker demographics, questionnaire design, and data collection procedures, §5.2 with demographic composition of the sample, §5.3 with possible correlations between demographics and phonetic features described in Chapter 4. As no statistically significant link between network strength and vowel production is observed, an evaluation of the questionnaire forms a significant part of the following discussion given in §5.4.

5.1 Demographic Characteristics of the Kingston and St. Thomas Speakers

The current study used a method of sampling sensitive to the influence of social network composition on both the language to which speakers are exposed and the usage patterns they develop as a result of this exposure. It is informed by methodology pioneered by Bortoni-Ricardo (1985) and Lippi-Green (1989) who developed tools for working with urban migrants from rural areas and rural-dwelling populations, respectively. Methods for both studies were first described in (Milroy, 1987b). These tools were revised and expanded in the present study to be applicable to rural and urban-oriented Jamaican speakers. This section describes the theoretical underpinnings of the design, and the adaptations I have made in seeking a suitable approach for the Jamaican situation.

In the social network literature, dense, multiplex network structures (discussed in §2.1.3) have been associated with the conservation of local, usually non-standard language forms in tightly-knit communities. The literature has explored this type of network structure more than those structures that operate for persons at the margins of such networks. These less-researched network types include those where "weak links" in the web of personal ties to a dense network, or diffuse network structures, allow for the introduction of innovations away from local norms, sometimes toward a standard variety (Milroy and Milroy, 1985). The network tool developed for this study was designed to probe into sites where non-local influences are likely to be introduced. Also, several of the concepts utilized in other network-type approaches did not seem to quite fit the Jamaican situation, or were not felt to be sensitive enough. These are the concepts of "kinship" and "voluntary association". I attempted to incorporate into the set of traditional network indicators questions more sensitive to family type (specifically, presence of a domestic helper or upbringing amongst dispersed caregivers) and preferences for spending social time engaged in both Jamaican and foreign activities or media. Also incorporated were questions investigating international contacts and travel abroad. The following paragraphs discuss my reasons for expanding the conceptions of kinship and voluntary association.

The concept of kinship as set out and quantified by Lippi-Green and others working primarily in European agricultural and industrial communities generally assumes a paternal nuclear family structure. One assumption implicit in the methodology of such a study, which is appropriate for that type of community, was that kinship ties to a geographical area (which determined core family status) extended down through paternal and maternal grandparents, through a speaker's parents, to the speaker. In Lippi-Green's Network Strength index, which measures integration into a local community, a speaker receives points for each parent and grandparent who was a community resident and an active participant in community life. No attempts were made to quantify links to the community through any other relative than grandparent, parent, or spouse. The researcher working in any of the post-slavery, post-colonial nations of the Caribbean quickly runs into difficulties trying to quantify family networks in this way. This is because in addition to the patriarchal and nuclear-type family structures assumed in the majority of extant network studies, we also other family patterns common to a post-slavery society. For example, Rubenstein (1980), cited by Barrow (1996), describes extra-residential unions between parents (e.g., father and mother are not legally married, but exist in a long-term union from different residences). Parenting patterns associated with these types of unions are described by Barrow:

> Parental responsibilities for children, including 'owning' (accepting paternity of), 'minding' (financially supporting) and 'caring' (rearing), are distributed and allocated not only to those identified as biological and social parents, but also to extended family and community members in order to ensure as adequate a performance as possible in the circumstances in which villagers live. The flexibility of conjugal unions, especially extra-residential unions, and of parental role behavior allows villagers to respond quickly to socio-economic constraints and also to incentives, for example, to labour and migratory opportunities. (1996:69)

It should be pointed out that under such a situation as this, children may move between caregivers in various locations before they become self-supporting. This phenomenon is referred to as "child-shifting" (Barrow, 1996). Oftentimes, where a male figure is absent, child-shifting proceeds through a strong network of female relatives.

The relevance of the structures of family life in the Caribbean to the design of a sociodemographic and network questionnaire is as follows. First, in measuring a speaker's integration into a particular community, we would want to know if the speaker had been raised (cared for) by an aunt, uncle, grandparent or close family friend in the community, while parents fulfilled a "minding" role from some other location. This speaker might still, then, be closely tied to the community although this important link would be missed if information were gathered only about parents. We would similarly want to know if a speaker lived at a distance from a parent, but maintained regular contact. Such a parental connection might provide a rural or urban link for the speaker, and thus to that parent's network of social interactions (i.e., a "weak link"). Third, if a speaker had been raised with parents present but was primarily in the daily care of a domestic helper, this helper might constitute a major role in the upbringing and linguistic exposure of the speaker, even to the extent of furnishing for that speaker what has been referred to in the developmental language acquisition literature as "motherese" (Clark and Clark, 1977). Thus, an appropriate demographic tool for the Jamaican situation would investigate information concerning caregivers, in the various forms these may take.

The second adaptation concerns the measurement of voluntary association. Network studies have generally been focused upon speaker integration into a particular community characterized by particular community centers and types of activities which signaled local allegiance. Often, except perhaps in the case of studies that examine the rural-urban transition of migrant populations, these studies focus on activities solely within the community, assigning points to a speaker for participating in local activities, but not addressing other associations a speaker keeps. Ostensibly, the logic is that local strong ties are maintained at the expense of looser, community-external ties. However, it does not necessarily follow that strong ties to a local community will necessarily exist in complementary distribution with external ties. For example, a respondent may spend all her leisure time with local friends, but correspond regularly with American penpals (a widespread custom in Jamaica). Or, she may be born and raised in a small town, such as Port Morant, which has a strong sense of local community and history (specifically, for example, its participation in the Morant Bay Rebellion which was an important battle in the fight for Jamaican Independence), but run the family-owned hotel which is frequented by foreign tourists. The point here is that a speaker may simultaneously be exposed to both local and external inputs. However, it is acknowledged that if a great deal of time and commitment is invested in outside ties, this will likely be at the expense of local ties. The challenge, then, for this study was to begin to quantify both these types of inputs and to interpret the resulting complex picture of potential influences on language behavior.

5.1.1 Questionnaire Design

The sociodemographic questionnaire designed for this study has two parts, the first collected sociodemographic information, the second social network information and media preferences. Part I elicited information regarding the traditional sociolinguistic variables of age, gender, education, occupation (speaker's as well as parent's), social class, birthplace, and place of residence (questions 1-8), followed by fairly detailed information about a speaker's linguistic background (questions 9-18), and information about speaker attitudes toward Jamaican Creole (question 19). Part II gathered detailed information concerning speaker's network of social interactions (questions 1-22) and media preference information (questions 23-25). Because the recording of information collected in Part I was very straightforward, only information regarding the coding of social class and occupation will be described below. The second part of the questionnaire was more complex and its contents and design will be described in detail in the paragraphs that follow. A sample sociodemographic questionnaire is provided in Appendix A.

Level of highest education attained was elicited from each speaker, along with names and locations of their primary schools and last school attended. Names and location of schools were obtained because this information can be useful in further judging the social class and urban vs. rural orientation of the speaker (see below).

Each speakers' social class was judged based upon the speaker's self-assessment of their class combined with education, occupation, and income information (where a speaker was willing to provide income figures). Students who were dependent children were asked about parents' social class and income. Occupation information included job title, and company name and location, where applicable. Speakers were classed into groupings used by the Jamaican Electoral office in stratification of voters for the voters list, where appropriate to their type of work and income (listed below in ascending order of earnings):

a.) unemployed

b.) skilled or common laborer

c.) public-sector employee (high-ranking civil servants, public administrators)

d.) private-sector employee (management, self-employed professional)

e.) owner/directors of businesses

Respondents were coded according to their occupation (u-unemployed, c-skilled/common laborer, p-public sector, r-private-sector, o-owner, s-student). Speakers were subsequently assigned an occupation code. Independent of other information, occupational categories a-c above correspond roughly to a working class designation, d-f to middle or upper class, depending upon income and managerial status (for d, e). Dependent students were accorded their parents' social class. Educational information was used to supplement occupation information in judging a speaker's social class. (For a discussion of the difficulties associated with applying the notion of social class to non-industrial societies, see §2.1.3, above).

Part II of the questionnaire was designed so that each response could be assigned a numerical score. Scores on individual questions were tallied into an overall network strength score. A high score indicated integration into a tightly-knit rural community, and a low score indicated a network type characterized by strong urban (Jamaican or both Jamaican *and* overseas) orientation. Two types of questions were used: indicators and contraindicators. Indicators were defined as features of a respondent network which pointed to connection to a rural community, and were assigned one positive point. Contraindicators were defined as features of a speaker's network of social interactions which pointed to urban orientation and received one negative point. Each of the three subsectors (Family Membership and Activity; Working Relationships; and, Voluntary Association and Local Culture) contained one or two contraindicator questions, appearing last in a block of questions, and related to the theme of that block. These subsectors and their scoring systems are described below.

The social network and media preference questions were grouped into three subsectors incorporating the ideas of Lippi-Green (1989) and Bortoni-Ricardo (1985, 1991) , with the addition of questions in the voluntary association subsector which I refer to as "local culture" preferences. The questionnaire was intended to measure respondent orientation to a close-knit rural community versus an orientation toward urban life characterized by no more than loose ties to a rural community (i.e., local vs. diffuse network structures). Lippi-Green's three subsector system of indicators was adopted, including: kinship, workplace (density indicators), and voluntary association (multiplexity indicator). Information regarding travel and mobility, and voluntary association in urban centers was collected, drawing on Bortoni-Ricardo's procedures for examining the network patterns of migrants to an urban center.

Subsector 1: Family Membership & Activity

Respondent upbringing in a family system which had been centered in the rural community was taken to be a primary indicator of network density. Family system here is taken to mean any and all caregivers (biological and non-biological/social) with whom the respondent lived for more than one year prior to age 12, as well as location of residence of biological and social family going back three generations. Respondents were assigned points for having lived their whole life in the local community. The contraindicator for close family connection to the rural community involved regular contacts with family in urban Kingston or overseas (this, of course, would be a given for a speaker who had grown up in Kingston). Information was collected regarding parents' / parents' families' present residence and length of time in the district. If the respondent had been child-shifted prior to age 12, they still received one point if this shifting took place within the local community, otherwise, they received no points. Questions 9a-c investigated a speaker's possible exposure to a local or non-local domestic helper (see earlier discussion in §5.1) and the dialect region of the helper.

1. How long have you lived in this neighborhood/district? (1 pt.)

2. Has your mother's/female guardian's family lived in this neighborhood/district for a long time? If yes, how many generations? (1 pt.)

3. Has your father's/male guardian's family lived in this neighborhood/district for a long time? If yes, how many generations? (1 pt.)

4. Is/was your mother/female guardian involved in many local activities? (1 pt.)

5. Is/was your father/male guardian involved in many local activities? (1 pt.)

6. Is/was either grandmother involved in many local activities? (.5 pt. for each grandmother)

7. Is/was either grandfather involved in many local activities? (.5 pt. for each grandfather)

8. Has your spouse's family lived in this parish a long time? (1 point for common law or legal spouse, or individual with whom respondent shared parental responsibilities).

9. Does your family have a domestic helper? If yes, please answer the following. If no, please go to number 10.

    a. Is your domestic helper from this neighborhood/district?

    b. Has your helper's family been in this neighborhood/district for a long time?

    c. How long has she been with you?

10. Do you have close relatives (visit or talk to regularly) living in other parishes? (Contraindicator: 1 pt. deducted if Kingston).

11. Do you have close relatives (visit or talk to regularly) living abroad/in foreign[1]? (Contraindicator: 1 pt. deducted if yes, 2 if they have visited several times).

<u>Subsector 2: Working Relationships</u>

The second area of network density was the nature of the respondent's work and relationships in the workplace. Of interest was whether the respondent held employment in a traditional field (farming, vending or domestic labor for women) which put them in regular contact with others with close ties to the rural community. Regular interaction with tourists constituted the contraindicatory network characteristic.

12. Do you work in this neighborhood/district? Occupation? (1 pt.)

13. Have you always worked in this neighborhood/district? (1 pt.)

14. Are any of your coworkers from this neighborhood/district? (1 pt.)

Some occupation questions, which revealed multiple capacities in which a respondent knew town members, constituted indicators of multiplexity.

15. Are any of your coworkers related to you? (1 pt.)

16. Do you spend time outside of work with any of your coworkers? (1 pt.)

17. Do you meet any tourists on your job or elsewhere? (Contraindicator: 1 pt. deducted)

Subsector 3: Voluntary Association and Local Culture

The next two blocks of questions, "voluntary association" and "local culture", examined those social inputs which, more than any others, are under the respondent's control, (i.e., voluntary allegiances) and were intended to bring out additional information about a respondent's orientation toward community activities and preferences.

Questions probed music and viewing preferences, leisure time locations and activities. With respect to musical preferences, a distinction was made between preferences for Jamaican DJ's and artists versus non-local or foreign ones. Christie (1995) asserted that recently, Jamaican popular culture is helping to increase the prestige of Jamaican Creole by widening the range of settings in which Creole is accepted. I was interested in examining speakers' participation in popular culture. No distinction was made here between professional Jamaican "Dancehall" recording artists and local community DJ's as it would have been difficult to ask respondents to make this distinction for all artists which they listed, and because Dancehall culture generally favors Jamaican Creole. This subsector also considers as media those inputs brought via computer technology (e.g., over the internet). Family car ownership was also taken into consideration, as this increases the possibility of respondent mobility, participation in life outside the local community, and potentially, socioeconomic status. Regular interaction with friends overseas was regarded as the contraindicator for the voluntary association subsector. Signs of a regular diet of foreign media programming and automobile ownership were the contraindicators for the Local Culture subsector.

Voluntary Association

18. Are you involved in any social activities in this neighborhood/district? (1 pt.)

19. Do your closest friends live in this neighborhood/district? (1 pt.)

20. Do you have close friends (visit or talk to regularly) in other parishes? (Contraindicator: 1 pt. deducted if Kingston)

21. Do you have close friends (visit or talk to regularly) abroad/in foreign? (Contraindicator: 1 pt. deducted, 2 if visited regularly)

Local Culture

22. Where do you spend your social time? (not scored)

23. Who are your favorite musical artists? (.5 pt for each Jamaican artist named, -.5 for each foreign one)

24. Do you/does your family own a car? (1 pt if no)

25. Does anyone in your home have any of the following(.5 pt. for each no response): washer, dryer, radio/stereo cassette player, compact disk player, television, video cassette recorder, cable television, computer, satellite dish, electronic mail/internet service.

26. What are your favorite radio/television programmes? (.5 pt for each Jamaican program named, -.5 for each foreign one)

It may be seen from this discussion that it would be possible for urban-oriented speakers to still have some rural ties, and conversely, for rural-oriented speakers to have some interactions with urban-oriented speakers and overseas culture. Thus, the questionnaire is capable of providing a fairly representative picture of a speaker's inputs, capturing something of the widespread nature of urban influences at work even in relatively isolated communities in current-day Jamaica. This is in line with the perspective that DeCamp challenged researchers of the Jamaican continuum to take in the 1960's, and was voiced more recently by Carrington (1992) and others, even though it would surely complicate methodological procedures. The goal was to avoid an oversimplified picture of a respondent's network which describes a speaker as solely urban or rural, as such speakers are quite rare in present-day Jamaica. It is for this reason, then, that speakers are described as rural- or urban-*oriented*.

5.1.2 Data Collection Procedures

Demographics questionnaires were completed for the 20 speakers whose vowel data were described in Chapter 4.[2] The questionnaire was administered after collection of all production data in the conversation, wordlist, and picture tasks. This previous acquaintance made it easier for the researcher to pose what might have been considered personal questions concerning occupation, education, acquisition of material goods, etc. All questionnaires were completed in the presence of either myself or a trained fieldwork assistant so that any questions a speaker had might be answered and any ambiguous responses they made could be clarified. The fieldwork assistants and I played either a direct or indirect role in assisting with questionnaire completion, depending on the level of literacy of the speaker. If able to read and write, the speaker completed the form while we sat alongside. If illiterate, the questions were posed orally to the speaker by myself or by the fieldworker, who filled in the form. The male St. Thomas speakers were all workers at Eastern Banana Estates, Ltd., and were granted time off from work to participate. Out of sensitivity to their time limitations, one of the fieldwork assistants administered the questionnaire to one speaker while another speaker completed the word list and picture tasks with myself and the other fieldwork assistant.

5.2 Demographic Composition of the Sample

This section examines the overall demographic composition of the speaker sample with respect to age, birthplace, language background, social class, education, occupation, and social network. Table 5.1 presents the breakdown of the sample according to these variables. Speaker TI.m, whose data were subjected to auditory, but not acoustic comparison with the larger dataset, will be included in these summaries.

Speakers ranging in age from 20 and 39 constitute the sample of 11 males and 9 females. Of these, nine are Kingston residents and 11 are St. Thomas residents. As shown in the data of Table 5.2, the Kingston/St. Thomas designation corresponds to the general urban/rural orientation of the speaker, the St. Thomas residents being oriented to rural life, and the Kingston ones to urban life (as may be checked against speakers' network strength scores, which are presented in Table 5.2, discussed below). This orientation was ascertained not entirely by their place of residence, but by the character of their social network, as will be illustrated in the discussion of network profiles below. The system by which points were assigned was designed to span a continuum rather than to make dichotomous classifications as urban or rural, thereby reflecting some of the natural variability which occurs in Jamaican society.

Table 5.1. Demographic composition of speaker sample for the vowel production study. Speakers are grouped by place of current residence as indicated by the first letter of speaker alias (K=Kingston, T=St. Thomas). Occupation codes represent: u=unemployed, c=skilled/common laborer, s=student; p=public sector, r=private-sector, o=owner.

Alias	Sex	Age	Class	Occ. Code	Occupation	Birthplace	Highest Level of Education Attained
KC	Female	32	MC	r	Information specialist	Kingston, Kingston parish	post-grad
KD	Female	24	MC	s	Student	Hopewell, Hanover	college
KE	Male	24	MC	s	Student	Kingston metro area, St. Andrew	college
KF	Female	33	MC	r	Audit Manager	Kingston, Kingston parish	post-grad
KM	Male	37	MC	o	Musician	Kingston, Kingston parish	college
KR	Male	21	MC	s	Student	May Pen, Clarendon	college
KT	Female	22	UC	s	Student	Kingston, Kingston parish	college
KU	Male	20	MC	p	Administrative Assistant; student	Lucea, Hanover	college
KW	Male	23	MC	s	Student	Braeton, St. Catherine	post-grad
TA	Male	35	WC	c	General worker	Duckenfield, St. Thomas	primary/prep
TB	Male	24	WC	c	Maintenance worker	Kingston metro area, St. Andrew	high school
TE	Male	31	WC	c	Mini backhoe operator	Morant Bay, St. Thomas	high school
TH	Male	22	WC	c	Maintenance #2	Stokes Hall, St. Thomas	high school
TI	Male	24	WC	c	Equipment sideman	Arcadia, St. Thomas	primary
TJ	Female	25	WC	u	Unemployed	Port Morant, St. Thomas	high school
TL	Female	29	WC	c	Vendor	Barkinglodge, St. Thomas	high school
TM	Female	33	WC	u	Unemployed	Port Morant, St. Thomas	high school
TT	Female	32	WC	c	Vendor	Hampton Court, St. Thomas	high school
TV	Female	39	WC	u	Unemployed	Port Morant, St. Thomas	high school
TX	Male	24	WC	c	General worker	Wheeler Field, St. Thomas	high school

The members of the Kingston sample were born in several parishes in addition to Kingston, including Clarendon, Hanover, and St. Catherine. Each indicated, however, that Kingston had been their place of primary residence or schooling. In selecting the speaker sample, care was taken to ensure that Kingston speakers were urbanized despite their various birthplaces, and if born in a western parish, showed no obvious, marked regional linguistic features. DeCamp (1961:63-64) used isoglosses to divide the island into more and less conservative regions (in terms of archaic and traditional creole forms). De Camp asserted that urban influences associated with Kingston had radiated from Kingston, through its suburbs, to prosperous districts in other parishes such as St. Catherine and Clarendon, with which Kingston is connected by major thoroughfares. Hopewell and Lucea, in Hanover are two such areas, and lie along the Class A highway extending west from the major resort city of Montego Bay. In the northern part of

Clarendon, and in the western parish of Hanover, DeCamp found that younger, well-educated speakers used forms characteristic of Kingston and its satellites, although Hanover was generally considered part of the western dialect area. St. Thomas speakers were all from districts in the eastern part of the parish. All were born and raised within miles of the district in which they currently reside. Speaker TB.m was born in a Kingston metro area hospital, but to a family in Bath, St. Thomas, where he currently resides.

All speakers had obtained some level of schooling. School codes given in Table 5.1 indicate highest level of schooling entered, whether or not that level was subsequently completed. Speaker TA.m dropped out of primary school due to lack of interest. To my knowledge, at least one of the speakers who entered secondary (high) school, TI.m, did not complete it. Three speakers, KC.f, KF.f, and KW.m, held masters' degrees. Speakers TL.f and TT.f had, following high school, completed training certifying them in the operation of a daycare center.

Respondents were asked what they felt to be their own fluency in English and in Jamaican Creole Patois. An interesting response from acrolect-dominant speaker KF.f was that she does not try to speak Patois. "When I try to speak Patois," she commented, "people laugh at me."

Travel overseas and interaction with tourists was taken to indicate exposure to varieties of (particularly American or British) English which might potentially influence production of Jamaican English. The speakers who reported traveling overseas several times (to the U.S.A., U.K., and/or Canada) were KC.f, KD.f, KF.f, KM.m, KR.m, all of whom had friends abroad with whom they regularly interacted. All the Kingston speakers indicated that they interacted with tourists at their place of employment, or elsewhere. TA.m, TB.m, TH.m, TI.m, TJ.f, TM.f, and TV.f, indicated that they spoke fairly regularly with friends in the U.S., but had never visited them.

The sample was comprised of both employed and unemployed individuals. Occupations held by the working-class St. Thomas speakers spanned a broad range, from operators of heavy machinery at Eastern Banana Estates who worked for an hourly wage, to those who packed bananas into boxes for piecework wages, to vendors (involving the sale of boxed juices and snacks from a shack outside the home). One of the currently unemployed speakers, TV.f, had at one time been employed as a domestic helper for a St. Thomas family. The middle-class Kingston speakers included an information analyst and an audit manager at Jam-Pro, an international corporation; a recording artist and technician; an administrative assistant; and several students, several of whom held administrative part-time positions.

The social network schedule elicited information on work-related ties. One important predictor of network multiplexity is the situation in which a speaker works with individuals with whom he or she also spends social time outside of work. In close-knit communities, this connection often means that there are additional levels at which speakers share social values. That is, multiplex network links suggest additional opportunity for shared norms to be reinforced. In an urban setting, multiplex links may be associated with work and social time both being spent in a particular neighborhood.

Each of the Kingston speakers indicated that the people they worked with, though they sometimes were known to live in the same neighborhood, were not people with whom they spent their social time. Several of the students who held part-time jobs indicated that they spent social time with others of their classmates, particularly (in the case of KR.m, KT.f, and KD.f) where those classmates came from the same home parish.

KT.f and KR.m attended primary and high school together in Clarendon, and then came together to the University of the West Indies to study. Neither, however, was actively involved in activities local to their home parish. Speaker KW.m, on the other hand, reported being fairly active in Braeton, St. Catherine, and not in Kingston. His parents were farmers, and he worked with them on weekends. Though he was a UWI student, he did not live on campus, but commuted (a 90-minute bus ride) on the days he had classes. In his questionnaire, he reported involvement in community center activities back home, and in local politics (political science was his concentration at the university). Table 5.2 shows his network score to reflect greater integration into a rural community than other speakers in the Kingston sample.

Table 5.2. Network strength scores, broken down by subsector, and ranked by overall points assigned to each speaker.

Speaker	kinship and family activity	occupation	voluntary association and local culture	**Composite Network Strength Score**
KM.m	-1.0	-1.0	-8.5	-10.5
KC.f	-1.0	-1.0	-8.0	-10.0
KD.f	-2.0	-1.0	-5.5	-8.5
KF.f	-2.0	-1.0	-4.0	-7.0
KE.m	-3.0	-1.0	-2.0	-6.0
KR.m	-1.0	-1.0	-2.0	-4.0
KU.m	-1.0	-1.0	-1.5	-3.5
KT.f	1.5	-1.0	-3.0	-2.5
KW.m	0.0	-1.0	2.5	1.5
TB.m	1.0	3.0	2.0	6.0
TI.m	2.5	4.0	0.5	7.0
TV.f	4.0	0.0	4.0	8.0
TJ.f	2.0	3.0	3.5	8.5
TA.m	3.0	3.0	2.5	8.5
TM.f	5.0	0.0	4.5	9.5
TT.f	5.0	5.0	0.0	10.0
TL.f	5.0	5.0	1.0	11.0
TE.m	2.0	4.0	7.0	13.0
TX.m	4.5	3.0	6.5	14.0
TH.m	4.5	3.0	6.5	14.0
n=	*20*		average NSS:	2.95

Speakers TJ.f, TM.f, and TV.f came from the village of Port Morant, where they had been born and raised, and raised their children. They had been best friends as long as they could remember, and lived in small zinc-roofed homes next door to one another. All were currently unemployed. They had worked as independent saleswomen (vending snacks on the street), and TV.f had worked for a time as a domestic helper in the larger nearby town of Morant Bay. At the time of the study, these women passed much of their days together, "taakin' tingz an'time" (shooting the breeze) and watching popular American television programming (particularly three soap operas, including "The Bold and the Beautiful", "Young and the Restless", and "Melrose Place"). Thus, in contrast to the Kingston females, all of whom were upwardly-mobile, geographically mobile, and highly educated, these women lived a fairly local life, except for the travel afforded them by their television set. This local orientation to St. Thomas was by choice. Each indicated that that she had considered going to Kingston to work, but preferred to remain where she could maintain friendship ties. This was also the case for speakers TT.f and TL.f, though their case is somewhat different. Following high school, both received training for certification to open and operate a local daycare center. They subsequently applied for funds from government organizations to pay staff and maintain their facilities, including laundry equipment and a kitchen for a hot lunch program. Unsuccessful in obtaining long-term support, they went out of business, and at the time of the study ran a small snack stand along the main crossroad in their district. Speaker TL.f was interested in being certified to teach primary school, but had not entered such a program at the time of her interview. She and TT.f voiced a strong desire to remain in their community in St. Thomas, and were not interested in going to Kingston to work.

It may be important that the television programs mentioned above were American soap operas. TJ.f, TM.f, and TV.f reported that they never missed an episode of these shows. They were up-to-date with what was happening in the "lives" of the characters, and very capably enacted the most interesting parts of the dialogue amongst themselves. Thus, they were exposed to American English dialogue daily. As was pointed out in Chapter 2, such exposure is unlikely to influence speech behavior, but does constitute language experience of a sort. Perhaps surprisingly, almost all of the St. Thomas speakers (including the males) but only a few of the Kingston ones, reported being regular viewers of American soap operas: KC.f, KF.f, TB.m, TI.m, TJ.f, TL.f, TM.f, TT.f, TV.f.

One question in the local culture section of the questionnaire elicited information on where speakers spent social time. The chief point of this question was to investigate whether social time was spent in community activities which would suggest integration into community life. TX.m, in addition to his employment on the banana estate, also farmed on his private property. His leisure time was spent in a traditional occupation, and he regularly helped other local farmers. Others of the St. Thomas males participated in a local sports club, where they played either cricket or football (soccer) together on a regular basis. Several of them, TB.m, TE.m, TI.m were additionally part of a football league sponsored by their workplace. These men also mentioned local "sound systems" (i.e., local dance clubs) as places where they spent some social time. Interestingly, in the question in which they were asked who were their favorite musical artists, the DJs working locally in these dance clubs were frequently named in addition to more widely-known national Dancehall recording artists.[3]

In their responses to the local culture questions, information was obtained which provided evidence that overall, Kingston speakers' networks were fairly diffuse. For example, most speakers (KC.f, KD.f, KE.f, KF.f, KM.m, KR.m, KT.f) indicated that they spent their social time at home, at private parties, or at the movies. Several respondents

(KD.f, KR.m) indicated that they additionally spent time at the Mall at Liguanea with their friends--an up-scale shopping district built on the model of an American in-door shopping mall, which is the only one of its kind in the region. It is known as a hot-spot where middle and upper-class Jamaicans can shop to keep up with upscale local and American trends. KR.m indicated that his social time was spent between Kingston, Liguanea, and his hometown in Clarendon. Several speakers, KM.f, and KC.f flew to Miami on occasion to go shopping and find entertainment.

The demographic and network information reported in this section has shed some light on speakers' rural or urban orientation. This information is relevant to some of the patterns that emerged in the acoustic study. The statistical models in Chapter 4 examined possible correlations between linguistic behavior and extra-linguistic factors Group and Gender. Group subsumed rural or urban orientation and had two levels, Kingston and St. Thomas. In the section that follows, I will summarize and offer an interpretation of the patterns that emerged from the acoustic study with respect to these extralinguistic variables, highlighting relevant points from the detailed ethnographic information just described.

5.3 Correlations between Demographic and Social Network Characteristics and Jamaican Speakers' Vowel Spaces

This section considers variation in the acoustic data presented in Chapter 4. In the first and second subsections, differences associated with the extralinguistic variables group and gender will be considered, based upon the statistical data and overlap quantifications provided in §4.4-5. In the third subsection, differences between individual speakers will be discussed in relation to their network characteristics.

5.3.1 Differences Related to Group (St. Thomas or Kingston)

Of the two extralinguistic variables investigated, group and gender, group-related differences emerged most clearly in the production study and the clearest of these was in the area of temporal vowel properties. First, for three of the four vowel quality groupings that were statistically compared, St. Thomas speakers showed larger duration ratios (§4.4). Table 5.3 presents the duration ratios provided in Tables 4.5, 4.8, 4.14, and 4.20 for these vowel quality subsystems, along with the level of statistical significance obtained for the differences between duration values tested in the ANOVAs for these subsystems (Tables 4.6, 4.10, 4.15, 4.20). A main effect of group emerged in tests on the high front, mid front, and high back subsystems. For two subsystems, mid front and low (/ɑː, a/), a vowel-by-group interaction was found, such that the St. Thomas speakers showed longer average durations for the longer member of each vowel pair.

Table 5.3. Mean duration ratios for Kingston and St. Thomas groups, by vowel quality subsystem

Vowel quality subsystem	Kingston ratio	St. Thomas ratio	level of significance (p-value)
High Front	1.84	1.91	0.03
Mid Front	1.42	1.56	0.03
Low (/ɑː, a/)	1.52	1.59	0.03
High Back	2.27	2.27	n.s.

Second, St. Thomas speakers additionally showed smaller spectral distinctions than did the Kingston speakers between certain long:short pairs. Table 5.4 presents, for both groups, the percentage of speakers who were evaluated as showing either no spectral overlap, partial spectral overlap, or complete spectral overlap for the five vowel quality subsystems (high front, mid front, low /a, ɑː/, mid back, and high back). Percentages given are drawn from Tables 4.4, 4.7, 4.13, 4.17, and 4.19 in the subsystem analyses in §4.4. In both of the front categories, Kingston and St. Thomas speakers both showed a predominant pattern of partial or no spectral overlap. In the /ɑː, a/ opposition, St. Thomas speakers showed partial and complete overlap patterns, while Kingston speakers showed no and partial spectral overlap. In the mid back category, containing diphthongs /oː, aʊ/, neither group kept the pair completely separate in F1/F2, showing particularly large deviances for /aʊ/, but only the St. Thomas speakers showed cases of complete spectral overlap. Finally, with respect to the high back category, speakers from both groups completely overlapped spectral features for /ʊ, uː/, but the St. Thomas speakers were again more likely to do so.

Table 5.4. Percentage of speakers in Kingston and St. Thomas groups showing no-, partial-, or complete spectral overlap, by vowel quality subsystem (Kingston n=9; St. Thomas n=10).

	No Spectral Overlap		Partial Spectral Overlap		Complete Spectral Overlap	
Vowel Quality Subsystem	Kingston %	St. Thomas %	Kingston %	St. Thomas %	Kingston %	St. Thomas %
High Front	22	10	78	80	-	10
Mid Front	78	20	11	70	11	10
Low /ɑː, a/	56	-	44	60	-	40
Mid Back	-	-	100	70	-	30
High Back	12	-	44	30	44	70

Third, r-coloring was subject to between-group differences, as was discussed in §4.8. As was illustrated in Table 4.23, absence of postvocalic-r, however, was additionally correlated with gender, such that males of both groups showed greater occurrence of r-lessness than females in their groups, but St. Thomas males showed the greatest absence of postvocalic-r. It was noted, though, that vowel quality differed when postvocalic [r] was absent. For example, in pronouncing the word "dark"

Kingston speakers tended to produce a retracted low back vowel ([dɒːk]) in contrast to the preference of St. Thomas speakers for a low front vowel ([daːk]).

A fourth group difference emerges as a tendency but is not statistically significant. The Kingston and St. Thomas groups were shown to use downgliding [uo, ie] in similar settings, in that the variant [uo] emerged more frequently in the word list productions of both groups than [ie] (Tables 4.12, 4.18), though not to a statistically significant level. Downgliding of the phonological categories /eː, oː/ has been noted as a feature of early Jamaican Creole (Lalla and D'Costa, 1990:64), who note that [ie] remained in 19th century Jamaican Creole when [ie] lowered to [eɪ] in British Received Pronunciation. The data presented in these sections suggest that [ie] is present to a greater degree in the speech of St. Thomas speakers. (There were four Kingston speakers who never produced [ie] in their word list session and produced [ie] less than 5% in their other sessions.) In addition, [ie] showed a tendency toward gender-grading (again, not statistically significant), such that males in both groups produced more downgliding variants in their word list productions (Kingston, males: 53%: females 23%, but due entirely to downgliding in speaker KC.f; St. Thomas, males 59%, females 32%). Anecdotally, I have heard Jamaican speakers, usually middle-class speakers encountered around the UWI campus, mention that people on the smaller islands are picking up the "Jamaican" feature of [ie], suggesting that it is becoming something of a pan-West Indian feature, particularly in Trinidad.

5.3.2 Differences Related to Gender

Gender-related differences emerged in the acoustic study which were statistically significant both in one of the main analyses of variance (i.e., Grand ANOVAs preceding the subsystem analyses), and in the vowel quality subsystem analyses themselves. Specifically, the first set of Grand ANOVAs pointed to a vowel quality-by-vowel length-by-gender interaction for vowel duration. ANOVAs conducted within the vowel quality subsystems showed that gender and vowel interacted for the high front, mid front, and low vowel qualities. For these vowels, females of both groups showed a longer "long" vowel, /iː, eː, ɑː/, than did males (this was additionally true if /eː/ was the produced as the downgliding variant [ie]). Figure 4.11, reproduced below as Figure 5.1, illustrates these patterns. Thus, females of both groups tend to use vowel length differently

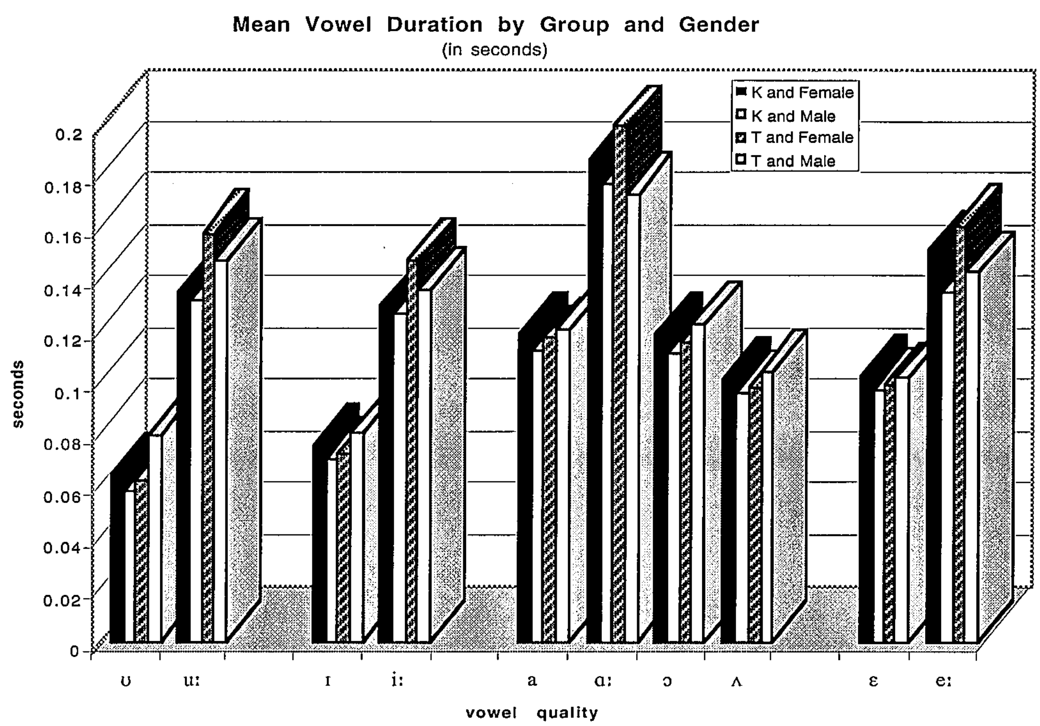


Figure 5.1 Mean vowel durations, by group and gender.

than males. Statistical results in §4.4 showed that St. Thomas speakers showed greater temporal contrasts between long and short vowels than Kingston speakers overall, with females of both groups showing larger duration ratios than do the males in their own groups.

Absence of postvocalic-r was not tested statistically, but appeared to pattern strongly according to gender (Table 4.23). Females of both groups showed 5% r-lessness or less (i.e., occurrence of postvocalic-r was high), while r-lessness was more pronounced among males. Interestingly, there may also be some patterning of postvocalic-r associated with social network (see §5.3.3, below).

With respect to palatalization of the velar consonant /k/ before /a/ (the phonolexical variable referred to as (KYA)), it was shown in §4.4.4 that Kingston females used palatalized variants more than Kingston males: Table 4.16 showed higher proportions of the [k^j] variants of "cab, can, cap, cat" for Kingston females. Research into certain changes in progress, such as the spread of glottal stop in Britain, has shown similar directions of difference to be consistent with "change from below" (Milroy, Milroy, Hartley, and Walshaw, 1994). It is not clear whether the present data reflect change in progress. Patrick (1992) described (KYA) as a centuries-old, near-categorical feature in working class speakers, his data showing higher frequencies of (KYA) than the middle class studies of Irvine (1994) and Miller (1987), although these latter authors do show fairly high levels of palatalization for middle-class speakers. The present data likewise show higher frequencies of [k^j] for St. Thomas than Kingston speakers (this result attaining statistical significance). The presence of [k^j] in the Kingston speakers' data may indicate synchronic variation associated with both rural and urban norms favoring this Creole feature (Christie, 1995; Beckford Wassink, 1999). Further investigation is needed to test these findings and establish what the present data reflect.

5.3.3 Social Network and Individual Differences

In §5.2, the demographic characteristics of the St. Thomas and Kingston speakers were described at some length. These were displayed in Table 5.1 and network characteristics in Table 5.2. In this section I assess whether any patterns emerged from the network information with respect to differences in individual speaker vowel production. I do not describe statistically significant correlations but examine patterns related to individual speakers, where network can give additional insights into inter-speaker variation.

Postvocalic-r showed the suggestion of a pattern related to social network and gender. It was noted above in §5.2 that females of both groups showed a high occurrence of postvocalic-r (95-100%). Males, however, show an interesting pattern. If males are ranked by Network Strength Score (NSS), and their percentage of r-productions compared, the result is Table 5.5. The pattern for St. Thomas males, as was mentioned in §4.8 was to show 19-27% r-lessness. TB.m was found to be anomalous. When his NSS is compared to the others, we see that he has the lowest score of all the St. Thomas speakers, and that his % r-lessness is closest to those of the Kingston speakers immediately below him in NSS. These Kingston speakers (KW.m, KU.m, and KR.m) have the NSS scores closest to zero among their group, reflecting network structures comprised of both rural and urban connections, or, in other words, not heavily metropolitan or rural. Speakers KM.m and KE.m showed the highest proportion of r-lessness among Kingston males and the highest NSS scores among males of both groups. Both were performers--KM.m a formally-trained musician (22% r-less), and KE.m a student of the theater arts at the University of the West Indies (41% r-less). While four of the St. Thomas males also showed r-lessness, it will be recalled that the bulk of St. Thomas speakers' r-less productions occurred before low vowels that were quite different in quality from those of the Kingston speakers.

Table 5.5 Per cent r-lessness for males of both groups, rank-ordered by Network Strength Score

Speaker	Composite Network Strength Score	% r-lessness
KM.m	-10.5	22
KE.m	-6.0	41
KR.m	-4.0	1
KU.m	-3.5	0
KW.m	1.5	0
TB.m	6.0	1
TA.m	8.5	20
TE.m	13.0	27
TX.m	14.0	19
TH.m	14.0	22

I will next examine patterns related to network strength by considering the extreme scores listed in the network strength table (Table 5.2). The speakers showing the lowest network strength scores were KM.m and KC.f, who were assigned -10.5 and -10.0 points, respectively. Both speakers displayed network structures which were urban-oriented with no rural, but several overseas, connections. As was described in §5.2, these two speakers reported frequent contacts and travel in the U.S. as well as contact with tourists in their work. Their voluntary association scores were the lowest of the sample, -8.5 for KM.m, and -8.0 for KC.f, respectively, and reflected mostly non-rural leisure-time (including media) preferences. Both speakers named favorite musical artists from England and America--David Bowie, Elvis Costello, and Miles Davis by KM.m, "Prince" by KC.f. Both speakers actively used electronic mail. KM.m was the only self-employed person in the sample, and KC.f held a job in the private sector (see Table 5.1).

In section §4.4, both speakers showed typical Kingston group patterns of partial or no spectral overlap for /iː, ɪ/, /eː, ɛ/, /ɑː, a/, /ɑː, ɔ/,/a, ɔ/, and /ɑː, ʌ/. Both showed partial spectral overlap for /aʊ, oː/. KC.f was the only Kingston female to downglide /eː/ to [ie] in the word list. In §4.4.3, KC.f and TA.m were the two speakers to show the highest nucleus midpoints for this vowel. KC.f showed palatalization of /k/ before /a/ as was noted for Kingston females, producing the velar + glide [kʲ] rather than palatal consonant [ç]. In her downgliding of [ie], and palatalization of [kʲ], KC.f shows patterns different from the other Kingston females, however she shows similar patterns in r-production.

Speaker KM.m was very similar to other Kingston males in his speech. He has been described in a preceding paragraph as showing typical patterns in terms of spectral overlap. In addition, he did not palatalize consonants preceding /a/. He does, however, exhibit greater r-lessness than three of the other four Kingston males, as was shown in Tables 4.23 and 5.4. This was the clearest feature in which he differed from others of the Kingston males.

Thus, for these two speakers, at the lowest end of the network strength scale, there seems to be no clear link between network and vowel production.

At the rural end of the network scale, TX.m and TH.m showed the highest scores, indicating substantial integration into rural life. TX.m stood out from the other St. Thomas speakers in several respects. TX.m was one of two St. Thomas speakers to show no monophthongal productions of /eː/ in their word list and picture sessions, exclusively producing downgliding [ie] (Table 4.11). In addition, he was found to produce the palatal consonant [ç] preceding [a] (see §4.4.4). TX.m showed partial spectral overlap for /eː, ɛ/ and /ɑː, a/, but complete spectral overlap for /ɑʊ, oː/, which was noted as being typical for St. Thomas speakers. Conversely, his proportion of r-less words, at 19%, was typical of St. Thomas males, and he did not produce the basilect-associated variant [ɔ], in the environment of a following postvocalic-r, as was observed for speakers TA.m and TV.f. Thus, overall, TX.m seems a good example of a typical basilect-dominant speaker with a clearly rural orientation.

TH.m was somewhat different in his speech than TX.m. He did not show complete spectral overlap for /iː, ɪ/ or /ɑː, a/, but the more typical partial overlap pattern. He did show complete spectral overlap for /uː, ʊ/ and /aʊ, oː/. TH.m was one of several speakers (from the St. Thomas group only) to produce the Creole form [bʌn] "burn" (see 4.6). In contrast to TX.m, TH.m showed mostly monophthongal productions of /eː/ in his word list session, although he did produce a few downgliding ones, and was mostly downgliding in his picture and conversational data (see Table 4.12). This may be related to a choice on his part to avoid a Creole-related feature in the more formal elicitation setting of the word list session.

For the St. Thomas speakers with the highest scores, then, there was not a clear uniformity in the production of forms which would suggest a link between vowel production and network strength. Rather, both speakers mostly showed features typical of their group. Other speakers, whose speech characteristics may be illuminated in terms of network patterns, are considered below.

TV.f was among those speakers who showed r-lessness in one particular word, "burn", which she pronounced [bʌn]. This word, in Jamaican folk discussion, is associated with Creole culture and speech. I am not aware of any discussions of [bʌn] in the literature, but know from my own background that it occurs in particular Creole phrases. "Bun-bun" is the name for a dish regarded as a treat, consisting of the rice remaining at the bottom of a pot of rice pilau which is typically overcooked or slightly burned, and considered to contain extra flavor. "Bun-up-gun" is a nickname, generally used for males, with the intention of teasing. "Bun" replaces "burn" in middle-class Jamaican speech when a speaker switches to Creole, particularly for stylistic impact. In this study, TV.f is among those speakers (with TE.m, and TH.m) who produce [bʌn] in their picture and conversational speech. Interestingly, this was the only word in her dataset which showed absence of postvocalic-r. This speaker was assigned an average network strength score among St. Thomas speakers, 8 points, notable only perhaps in because of a fairly high kinship subsector score (4.0).

Speakers TL.f and TT.f were assigned the highest network strength scores among St. Thomas females. Generally, however, their speech was not markedly different from the other St. Thomas speakers. Neither showed any spectral overlap for /eː, ɛ/, and both showed complete or partial spectral overlap for /ɑː, a/. TL.f was notable among St. Thomas females in that she displayed mostly downgliding productions of /eː/ in all sessions, while TT.f showed monophthongal productions in her word list and downgliding productions in her picture and conversational tasks. Both received high kinship and voluntary association subsector scores.

Overall, except for the possible pattern noted for postvocalic-r, it is not clear that a link between network scores and vowel production can be drawn from the range of speakers and tokens analyzed here. The lack of a clear link may indicate that social network influences vowel production weakly or that the network tool developed has left out or misrepresented one or more of the significant network factors which shape vowel production. The strengths and weaknesses of the demographic questionnaire and the usefulness of the network study as a whole are explored in the next section. In the absence of a larger sample of speakers, it is difficult to know what to make of the differences observed above for particular individuals. Analysis of a larger sample could illuminate more subtle spectral and temporal patterns associated here with St. Thomas versus Kingston speakers.

5.4 Discussion

5.4.1 Strengths and Weaknesses of the Demographics Questionnaire

The questionnaire used for this study was designed to enable exploration of two areas which are seldom examined in the still-developing field of social network research: the influence of non-nuclear family members in the network of a speaker, and the simultaneous presence of local community and external cultural inputs. A procedure was developed for characterizing a different family pathway structure, one different from both the nuclear, two-generation model generally assumed in network studies. The model developed here was appropriate for a common social pattern in Jamaica--the non-nuclear family, in which domestic helpers and extended family members and friends have on the beyond the influences of mother, father, grandmother, grandfather, who may or may not themselves be present, making it possible to explore roles other than the traditional parental roles.

In general, however, the network questionnaire was of limited utility as an analytical tool. While plausible hypotheses were developed, based on the network study, to explain behavior of a few speakers who differed from their larger groups, network strength did not predict patterns of variation in the overall sample. It elicited a great deal of information about topics which were difficult to relate directly to variation in linguistic behavior (i.e., media preferences). A more straightforward line of inquiry into personal contacts in rural and urban areas could have made the questionnaire a stronger tool for assessing urban and rural integration--i.e., less complex (omitting topics such as media preference and attitude information, for example) and more direct regarding personal contacts. The questionnaire may have been stronger if a speaker was simply asked about the number of contacts they had in the rural district and in Kingston.

5.4.2 Summary

In this chapter, the demographic and social network traits of the basilect-dominant and acrolect-dominant speakers were examined with a view to understanding their social characteristics. These characteristics were then explored in turn to gain insight into patterns of linguistic variation observed in Chapter 4. The extralinguistic variables tested statistically included group and gender, and both yielded significant results. Main effects of group were found in the statistical tests reported in Chapter 4--in both the Grand ANOVAs and the vowel quality subsystem analyses. In §5.3 (and earlier in §4.4), St. Thomas speakers were shown to maintain larger duration ratios, on average, than Kingston speakers for high front, mid front, and low vowels. Additionally, St. Thomas speakers were shown in these sections to have more cases of complete spectral overlap (in the high front, mid front, low, and mid back qualities).

Furthermore, gender emerged as an important effect in several interactions. Group was found to interact with gender particularly in vowel length for the high front, mid front, and low vowel quality subsystems. Females were shown in §5.3 (and earlier in §4.5), to exhibit longer vowels than males. In particular, females in both groups seemed to have longer long vowels /iː, eː, ɑː/than males, with St. Thomas females showing the largest duration ratios. Although not tested statistically, other gender-linked differences were found. Males in both the Kingston and St. Thomas groups were found to show more absence of postvocalic-r than females, and to downglide /eː/ more frequently. St. Thomas males were found to palatalize /k/ before /a/ more frequently than St. Thomas females. On the other hand, females in the Kingston group were shown to palatalize /k/ before /a/ more frequently than their male counterparts.

The effects of gender on linguistic variation in Creole settings have not been widely explored (but see Nichols' (1983) research into variation in Gullah speech between males and females). The present study suggests once again that gender-related differences may be an important part of the overall picture of linguistic variation in Creole situations.

Notes to Chapter 5

[1] "In foreign" is Jamaican Creole, meaning "overseas".

[2] Questionnaires were also completed for those speakers whose vowel data have not been reported. Since this chapter is concerned with relationships between linguistic variables and speaker demographics, only those speakers whose data were subjected to acoustic and auditory analysis will be considered.

[3] There is an interesting anecdote related to the mention of local DJs as favorite artists. One local St. Thomas DJ, "Sizzler" was mentioned very frequently by St. Thomas respondents. The transcriber who assisted with completion of the demographic questionnaires, a Kingston resident and music lover, was moved to ask, "who is this Sizzler?", thinking that this was a national figure in popular music whose name she didn't recognize. She was surprised to find that so many respondents mentioned a local name.

CHAPTER 6

THE SOCIOLINGUISTIC STUDY (PART 2): METALINGUISTIC AWARENESS

The aim of this chapter is to provide an informal folk linguistic study of metalinguistic commentary from the respondents to supplement to the more structured analyses presented earlier in this thesis. Chapter 4 reported an experimental study of production differences in the vowel systems of acrolect- and basilect-dominant speakers. Chapter 5 examined the speakers' social and network profiles as a means of shedding light on potential correspondences between speaker profile and production. The focus here is on attitudinal differences related to the level at which speakers of Creole and English conceive differences between these varieties. The following questions are addressed: What distinctions do speakers make between English and Creole? How do they label and imitate different varieties? Are there differences in how Creole and English speakers label the same stretch of speech, where that speech contains a range of morphological, stylistic and phonological forms spanning a range from Creole to English? What features are cued to their detection of regional or social class variation? Metalinguistic commentary from two sources are reported. Data were primarily elicited using a labeling task which will be described below. Additional commentary is discussed which emerged from the conversational sessions described in Chapters 3 and 4. The methods used here are intended not as a rigorous study of evaluative responses, but as a way of providing a general picture of respondent attitudes and distinctions between Creole and English. Section 6.1 describes the design of the labeling task; §6.2, its methodology; and §6.3, the results for the labeling task followed by a discussion of the conversational task commentary.

As mentioned in Chapter 2, when Jamaicans talk about language in Jamaica, they commonly carve up the spectrum into two broad categories--"English and 'the rest' Roberts" (1988: 9; cf. §2.2.1). This conflation of intermediate and basilectal varieties of the Creole is a consequence of a post-colonial perspective wherein the Creole is viewed as a broken variety of English at worst, or, where viewed more neutrally, as a dialect of a monolithic English language. There is more to lay distinctions, however, than the two-part classification just described. Just as there is a continuum of linguistic features, some related to geographical and socioeconomic difference (cf. Chapter 2), there are many ways in Jamaica of "talking about talking". These metalinguistic conceptions go far beyond a concern with the extent to which English is mixed with Creole. They indicate ideas about social stratification, regional difference and local allegiance across the island. We will examine below a few of these "ways of talking".

There is a research tradition within linguistics, often referred to as "folk linguistics", in which the metalinguistic awareness and conceptual categories which have meaning for laypeople are examined (Hoenigswald, 1966; Preston, 1993). Partly because it is difficult to access mental states of awareness and to rely on speakers' self-reported information (Agheyisi and Fishman, 1970), linguists often study speaker production without reference to intuitions concerning what constitute for the speaker linguistic correlates to social distinctions (i.e., linguistic variables which signal social status, or regional affiliation, in-group membership, etc.). However, speaker intuitions may help linguistic studies of creole languages, in particular, to move forward. Such research into Creole languages may have something to say about the applicability or lack thereof of extant models of code-mixing and code-switching to this type of language variety, and would almost certainly stand to gain from knowing whether systematic patterns may be found in where speakers make distinctions between Creole (phonetic, phonological, morphological, or syntactic) forms and forms of the lexifier language. The usefulness of speaker reports can also be argued from a language arts education perspective. That is, certain difficulties instructors face in teaching Creole speaking students the grammar and pronunciation of English might be served by research that explores how Creole speakers perceive features of the target language, and equally importantly, how they perceive the features of their own.

6.1 Labeling Task Design

A cassette recording was made of a casual, self-guided conversation between three Jamaican women who differed with respect to their age and dominant code. The chief topic of their conversation was Jamaican politics. The participants (S1, S2, and S3) were familiars, who consented to having an hour of their casual conversation tape-recorded. S1 was an upper-middle class, mesolect speaker in her early 50's; S2, a middle class, mesolect speaker in her early 30's, residing in an urban lower-middle/lower-class Kingston neighborhood; and S3, a working class, basilect-dominant speaker in her 70's, from a rural district about 15 miles outside of Kingston. S1, S2, and S3 were spending an afternoon in a beauty salon owned by S1, staffed and operated by S2. S3 , a friend and former domestic helper of S1, regularly visited the shop to bring S1 fresh fruit from trees that grew on her property and inquire about small tasks which she could complete for pay. S2 had moved to Kingston from a rural district in Portland a few years earlier to attend cosmetology school, and had subsequently been employed by S1. S2 had gone as far as secondary school in her education, while S1 had completed college, and S3 had gone only as far as primary school.

The conversation was extremely lively, with S2 dominating the discourse and S1 and S2 expressing clear party leanings and political opinions. S2 at times switched between English and Creole as she imitated the speech of prominent politicians.

Respondents were told that they would be listening to a two-minute excerpt from a tape-recorded conversation between three women. They were given no details concerning the age or regions of residence of the speakers on the recording. Respondents were asked to label or more generally describe what they heard on the tape, specifically:

(1.) Did they hear Patois? English? Spoken by whom?

(2.) Was there a difference in how the women spoke?

(3.) How would they identify or imitate the women's' speech patterns?

6.2 Labeling Task Data Collection Procedures

Respondents were the 20 speakers whose data were analyzed in the acoustic study described in Chapters 3 and 4. Listening sessions were conducted individually, with the stimulus excerpt delivered over earphones. A transcript of the excerpted conversation is provided in Appendix H. No respondent heard the commentary given by any other. The labeling task was conducted immediately following a respondent's word list task. The respondents' verbal comments were written down, as close to verbatim as possible, by the researcher (myself).

Statements respondents made about features they believed to identify a speaker's speech as English or Patois (or a type of Patois) were noted. Similarities and differences in the body of labeling task responses are discussed below.

6.3 Results

This section presents the metalinguistic statements collected from respondent commentary. Metalinguistic statements collected in the labeling task are presented first in §6.3.1, followed by metalinguistic discussion occurring in the conversational tasks in §6.3.2. Although the conversational sessions described in Chapters 3 and 4 were designed to provide production information to supplement the vowel study, metalinguistic discussion also occurred within several conversations which deserves treatment here, as well. In §6.3.1, labeling task data are presented individually first, and then summarized as they generally relate to the questions listed in §6.1, with particular attention to words respondents used to label the speech they heard. Then, in §6.3.2, I will present discursively the metalinguistic commentary which emerged from the conversational sessions.

6.3.1 Metalinguistic Statements in the Labeling Task

Following in Table 6.1 are the statements made by respondents in the labeling task regarding the excerpted conversation described in §6.1, reported as close to verbatim as possible. Interviewer questions are not included. Respondent aliases represent grouping (K=Kingston; T=St. Thomas), speaker ID, and sex. Labels volunteered by respondents are set in boldface.

Table 6.1. Labeling task responses

Speaker	Labeling Task Response
1. KC.f	I would say that all three are using Patois at some point, but that the first speaker [refers to S1, but means S2], the youngest I presume, has a tendenc to mix English into it, particularly when she is recalling what was said by Seaga and so forth.
2. KD.f	All were using Patois, but one woman [S2] is mixing her speech. The older woman [S3] uses the most Patois, but this is typical of older women.

3. KE.m The differences are because of age--the women are of three different age groups (20's, 50-60s, 70s). The youngest [S2] is from Kingston--has a Kingston voice. The middle woman [S1] sounds more rural. It's hard to tell...Age makes a difference in how they say the things they want to say. The eldest [here, I believe he actually means S1] is the most difficult. Sometimes she would use a standard way of speaking. The middle aged one [S1] sounds rural. Older [S3?] one has had lots of exposure. Oldest person [S3] still sounds rural, but has had English teacher exposure. Because of her age, she is trying to sound more formal. The youngest one [S2] has probably had the most modern exposure. Sounds more effort-filled...affected...the Middle aged one [S1?] is the least pretentious.

4. KF.f Everybody's talking Patois. Some talk it better than others, in the sense tha some Patois is more proper. The first lady [S2] is speaking Kingston Patois The other ladies, one [S1] is very clearly using Patois, and the other [S3] isn talking very much, but she's speaking Patois, too. The worst Patois I've heard is from St. Mary, Clarendon...they drop the 'h' there.

5. KM.m Changing into a form you don't normally speak is awkward. You make mistakes imitating a form you don't normally use. It gives away that you don't really speak this way. It's unnatural for [S2] to speak like "Mr. Seaga says"--it's too polished. Switch seemed too easy. [S1] sounds bilingual--she seemed perfectly bilingual. Sounded learned like an actress reading a script. Was she [names a radio personality]? Like me now--my profession puts me into circumstances a normal middle-class Jamaican, who speaks little Patois, wouldn't find himself in. I record in Allman Town, and use more Patois as a result, but it's not my normal mode. I would refer to this natural style as more of a **broken English**. Not actually like the Patois they speak in St. Elizabeth.

6. KR.m One woman [S2] sounded like Patois wasn't her natural mode, but...all were well-versed in Patois. The conversation sounded staged.

7. KT.f There was one woman using English [S2] --the one talking about Seaga's comments.

8. KU.m The leader of the conversation [S2] mixed a lot of English and Patois. The lady who butted in [S1] used **staunch Patois**. Generally, it was a mixture with more English words. Patois speech was like when she [S2] said "Mr. Sinting or Neda". There is an awkwardness when she's quoting the *Gleaner*--as if she's speaking German--She has difficulty with fluency in English. She always resorts to Patois because it's more comfortable for her

9. KW.m The youngest one [S2] is using English then switching back to Patois, especially when the content is becoming emotional. She is then speaking just like the other women. She uses English because she must give quotes of what KD [a politician] is saying.

10. TA.m Di younges' wan [S2] shi taak laik a wud se **stoosh**. But di older ladies [S1, S3] I wud se dem taak Patois...jus' di naamal Patois.

11. TB.m One usin English, two speakin the extra **raw-baan Patois.**

12. TE.m Some speech sound English, and some Patois. I don't really opinion a

	difference. Well, all three usin **broad Patois** same way...two- but two [S1, S3] using a different Patois , "gi dem a search, gi dem a search".
13. TH.m	I hear Patois first, then English, then English.
14. TI.m	Two ladies are speaking Patois. There is a time when someone's talking English. The first lady [S2] is speaking English when she she repeat something Mr. KD says, then she speak Patois. The other ladies speak Patois.
15. TJ.f	All a dem usin di **broad Patois**!
16. TL.f	One is using proper English but from time to time, she mix in Patois words Two are using **broad Patois**.
17. TM.f	I wud se all three a dem usin Patois, but laik two a dem, di older liedies [S1, S3] ar usin jus diffraan Patois. Laik di migl wan [S2] usin **Kingston Patois**, but the oldest liedi taak laik se shi fram country.
18. TT.f	One [S2] is using proper English. Two usin **broad Patois**
19. TV.f	Laad! Di three a dem gwaan laik se dem waan run fi Prime Minista! Di firs' one speakin [S2] **broad Patois**, an the oldest liedi [S3]. Laad Jesus! (laughs) The second one [S1] usin Patois, tuu. The firs' one [S2] shi mix up di English wit di Patois, laik how shi se "Mr. Sinting o' Neda".
20. TX.m	All three usin Patois like normal.

While some of the statements were unambiguous as to what the respondent made of the conversational excerpt, several of the statements were difficult to interpret. In a couple of cases, KE.m and KR., it was not clear whom the respondent was describing from time to time. KE.m differentiated the speakers primarily by age, but it seems that he confused the ages of speakers [S1, S3]. An attempt was made following a speaker's initial response to clarify to whom they were referring, but in some cases, such as this, not all ambiguity was resolved. Second, several speakers (KC.f, KF.f) referred to S2 as the "first speaker", while she was actually the second in order of occurrence on the excerpt. This may be for the following reason. Since the tape recorder was sitting closest to S2, her speech came through loudest on the recording. It is possible that although S1 spoke first, S1's initial turn was disregarded because it was more muffled, and respondents took the louder turn of S2 to mark the beginning of the excerpt. These limitations noted, I will attempt, in the brief discussion which follows, to draw together some of the ideas conveyed in the clearest responses.

The responses obtained are generally about the overall quality of the speech of the three women. Respondents basically labeled the varieties spoken as English or Patois, and then provided more or less detail about these designations. Interestingly, there is not uniformity of agreement in the labeling of the varieties the three speakers are using. While the majority of respondents indicate that the older of the three women, S1 and S3, use Patois (although perhaps different varieties of Patois) throughout the excerpt, the sample appears divided on the speech of S2. Most say that she is mixing her speech--notably, KC.f remarks that she is actually mixing English *into* her Creole, while TL.f says the opposite. Indeed, several respondents (KR.m, KM.m) seem to indicate that S2 is Creole-dominant, and is at some level disfluent or at least uncomfortable in using English. It is suggested that she is using English out of necessity in reporting the speech of an English-dominant Jamaican (as reported in an English-language newspaper). Others report that S2 uses Patois along with the other speakers. It is additionally interesting that nearly all of the Kingston speakers discuss S2's speech as a mixture of English and Patois, while only two of the St. Thomas speakers do. Three speakers indicate that all three are using Patois, and these speakers are all among the St. Thomas sample. Interestingly, two of the St. Thomas speakers make a distinction within Patois varieties, presumably distinguishing standard Patois, from what they labeled "broad" and "extra raw-baan" (extra raw-born), i.e., deeper Creole, often regarded as more aggressive-sounding Patois. One possible interpretation of these facts is that some of the English-dominant respondents have different criteria for identifying English forms than do the St. Thomas speakers. That is, Jamaican Creole by definition is a mixed variety. For three of the St. Thomas speakers, the speech of all three women counted as mixed (Creole) speech, notwithstanding S2's switches into English. It seems possible that these three respondents heard all three speakers as using Patois, and made (reported making) no distinctions concerning code-switching or differences between Patois and English (e.g., TE.m). Other speakers make a finer distinction between English and Creole, which allows them to report that one speaker is switching back and forth between English and Creole. Several St. Thomas speakers indicated that S2 is using "the proper English". This may indicate that within what is a Patois base or frame, they heard words, phrases or pronunciations which for them qualify as English. One English-dominant speaker, KF.f, seems to classify all Jamaican speech together as Patois, and makes a distinction (unusual among Jamaicans) between more and less "proper" Patois. However, these data should be interpreted with caution since the task can provide only a limited picture of a speaker's perceptions. Only the clearest patterns emerging from responses are presented here.

The most-frequently occurring metalinguistic descriptor used was "Broad Patois" mentioned by three respondents, all from the rural sample (TE.m, TT.f, and TL.f). From the examples and imitations they gave me, it seems that "broad Patois" for them is perhaps broadly conceived as a variety using Patois words and phrases which they associate with deep Creole. As examples, they gave words usually showing final consonant deletion "**Gi** dem a search" (literally, "Give them a search"), "Mr. Sinting o **Neda**" ("Mr. Something or Other"), or syntactic features of Creole such as serial verb constructions, e.g., "Him run come give me the ball". (Bold print indicates emphasis a respondent placed on the syllable when giving the example).

Another label which respondents frequently used to distinguish the women's speech was the notion of "Kingston Patois". This notion seems to be linked with what

KE.m refers to as "exposure". Usually cued by a nasal quality to the speech, respondents associated this pronunciation with S2, suggesting that it resulted from exposure to metropolitan Kingston life and modern influences (e.g. KW.m). TA.m refers to this as a "stoosh" way of talking, KW.m calls it "pretentious". Interestingly, although S1 was of the highest socioeconomic status, it was not her speech which was regarded as "stoosh" or "pretentious." "Stoshus" or more commonly, "stoosh" is a Jamaican term connoting mild disgust which denotes pretension. S1 did not switch into English at any point while speaking to the two other women.

Some respondents distinguished the speech of S1, S2 and S3 on the basis of assertions concerning the region they believed a speaker to be from, or whether they believed a speaker to be urban or rural-dominant. As was mentioned, respondents KE.m and KF.f identified S2 as being from Kingston, or using Kingston Patois. In fact, S2 is not originally from Kingston. She was born in a rural district in Portland, attended basic and primary school in rural St. Thomas, and moved to the working-class neighborhood of Vineyard Town in Kingston in her teens to work as a cosmetologist. She has assumed a fairly urban lifestyle, as attested by her clothing, hair, and makeup, and present dissociation from country life. Her strong efforts to participate actively in city life are rewarded here by respondent opinion that she has a Kingston way of speaking. S2 has great difficulty reading English. She was originally considered for inclusion in the Kingston sample, but was excluded when it became evident that she was unable to read the word list and consent form for the study. This made it unlikely that she was English-dominant. She is probably most accurately classified as a lower-middle class urban mesolect speaker. In identifying her as a Kingston speaker, respondents were making a statement that is just as much about urban orientation as it is about region.

Patrick (1992) discusses perceptions both rural and urban dwellers have of "Kingston" as an urban center with its finger on the pulse of the current cultural heartbeat, although having lost for some the uncomplicated innocence (if not the struggle) of country life. Christie (1995) describes the urban (Kingston) phenomenon called "Dancehall", which, with its emphasis on certain styles of music, dress and dance, has elevated the status of Jamaican Creole in popular attitudes. I would suggest that in addition to this, the emergence of Dancehall (and other forms figuring into popular culture such as reggae in the 1960s) has given Jamaican Creole an urban aspect which characterizes the urban mesolectal varieties. The "Kingston Patois" which S2 speaks appears be one such variety with identifiably urban features. Layfolk often point to slang usages of urban origin ("Mr. Sinting o' Neda" is one example, but see Beckford Wassink, 1999, for others) as being Creole forms. A few other statements were made about regional differences. The oldest woman was easily identified as a rural speaker, and basilect-dominant. Her age also seemed to corroborate respondent expectations that she speak basilectal Jamaican Creole: KE.m, and KD.f indicated that older speakers are more likely to use Patois. Concerning phoneme-level differences between the Creole and English, two speakers mention Creole features which they both ascribe, although they occur more widely than this, to the parish of Clarendon. KD.f mentions h-dropping, and in his conversational session, KE.m mentions "ringing" the final consonant (see §6.3.2, below). The phenomenon of "h-dropping" actually involves both h-deletion and hypercorrect insertion in stressed syllables, such as [ʔɛvɛn] "heaven", [ʔɛlp] "help", and conversely, [hais] "ice", and [hɛg], "egg". This phenomenon has been an important shibboleth in British English, associated with social class variation (Milroy and Milroy, 1985); and is also class-marked in Jamaican Creole, associated in particular with a hypercorrect speech style called Speaky-Spoky (Patrick, 1997; see §6.3.2.1, below).

Attempts at eliciting specific statements about potential phonemic differences between Creole and English, and at eliciting imitations of speaker style were largely unsuccessful. Sometimes, speakers indicated that it was difficult to describe differences in pronunciation. Others made general statements about pronunciation, such as that someone "sounded rural". In general, I have taken this to suggest two things: first, a lack of specificity in my line of questioning, and second, that such low-level differences are not as salient for speakers as other types of stylistic, morphological, or syntactic features. However, additional metalinguistic commentary emerged in the conversational sessions, and will be treated in the section that follows. While imitations of pronunciation differences did not emerge from the labeling responses, several did emerge from the conversational data.

6.3.2 Metalinguistic Statements in Conversational Material

In the course of the conversations conducted during the first phase of the study, metalinguistic statements emerged with fair frequency. As it turns out, some of this discussion elucidates comments made by respondents during the labeling task. A few of these statements concern phoneme-level differences between regional or social varieties. Some of the clearest statements are briefly presented and described below. These discussions concerned stylistic forms, referred to widely in Jamaica as "Speaky-Spoky", "Twangin'" and "Taakin' Broad". We will consider each of these in turn. Additionally, there was some discussion of pronunciation differences between regions in Jamaica in the conversation in which KW.m participated. In this conversation, he describes what he calls "ringin' consonants". His ideas will also be presented.

6.3.2.1 Speaky-Spoky: Speechin'

Perhaps the most lively conversation recorded was between speakers TJ.f, TM.f, and TV.f in Port Morant, St. Thomas. At the beginning of the conversation, when introductions were being made, the three women were informed that it was really Patois in which I was interested. This was their response:

INTERVIEWER (myself): Alright wi can choose a topic. I tell you one next thing, though. It's really Patois I'm interested in, so ==

TJ.F: ==don't speak no spoke!

ALL: <@@@>[1]

TJ.f: Dat is all wi speak roun here-so.

INTERVIEWER: Right.

TJ.f: No spoke ataal.

Patrick (1992, 1997; Patrick and McElhinny, 1993) describes Speaky-Spoky as a stylistic variant of Jamaican Creole which is linked to a particular kind of symbolic behavior. The term refers to the hyper-correct usage of English forms, with a clear implication that one is using "proper" forms (although sometimes incorrectly) as opposed to their customary way of speaking, making nouns and verbs agree, and so forth. Along with this comes the implication, however, that the Speaky-spoky utterance is high-faluting, performance language. In practice, Jamaicans "speak Spoke" when they substitute English forms in an utterance for Creole ones, e.g., to elevate themselves in the mind of their hearer, or occasionally, to facilitate the understanding of someone who has not comprehended the Creole. In addition to usage of lexical forms which do not occur in Jamaican Creole, Speaky-spoky is associated with the hypercorrect use of [ɔ] and [h] by working class Jamaican Creole speakers. Crucially, Speaky-spoky is a mode or style of discourse, and is distinct from code-switching. Because of the formality implied, long conversational turns in this style are commonly referred to as "Speechin", although any long turn on a serious topic may be referred to thus. For example, in one of the St. Thomas conversational sessions, speaker TA.m (Conversational session G), suddenly aware that he had been talking at length, exclaimed, *Mi spiich dem!*, roughly, "I gave them Speech!".

In the conversation above, TJ.f is quick to anticipate my desire that she and her co-participants speak in Patois. Indeed, she is acknowledging not only an understanding of what kind of speech I was interested in collecting, but also is asserting that their speech is not pretentious. Later in this conversation, she goes on to imitate the speech of a Jamaican putting on airs, trying to sound American. She modifies her speech to Speaky-Spoky, and uses phonetic forms associated with the widely-used term "twangin'". It is to this that we now turn.

6.3.2.2 Twangin'

Toward the end of the Port Morant conversation, in which the three women mentioned earlier (TJ.f, TM.f, and TV.f) participated, a second metalinguistic term arises. TV.f asks how they sounded on the recording, and, encouraged that they sounded wonderful, she asks jokingly if I can bring them back to the United States with me, introducing the topic of "goin' a faarin" (going abroad). This is a much-loved topic of conversation in rural Jamaica. Many articles and comedy routines have been dedicated to the caricature of the ill-fated, usually uneducated and rural-born, Jamaican who travels abroad only to forget friends and family back home, and what's worse, to take up odd habits of speaking and acting. Because of his or her assumed rise in status for reaching the "promised land", he or she begins to affect an American accent, referred to as "twangin' ", not realizing how comical the new guise sounds to other Jamaicans. TJ.f produces a number of utterances in her best American-English twang, in the style of Jamaican comedian Oliver Samuels, which give us a glimpse of her idea of how it sounds for a Jamaican to put on American English:

note: TJ.f is addressed in the excerpt below by her "pet" name (nickname), *Daata* "Daughter".

TV.F *Dat taim wen poor Daata riich ova so yu nuo man an di man a se*
Then, when poor Daata arrives there, you know, man, and they greet her

hi, hello. Howdie-du how are yu? Mi a go si we yu a go se
"Hi, hello. Howdie-du how are you?", I am going to see what you are going to

wen a caal tu yu an se hi Daata ar hi Ms. Jackie =
say when I call to you and say, "Hi Daata" or "Hi Ms. Jackie"

TJ.F *Mi noh se hi whosoeva!*
I don't say "Hi" to anyone!

ALL <@@@>

TV.F *An mi nuo, wen yu go yu noh bada stay ova deh tuu long yu nuo, cau yu is*
And I know, you had better not stay over there too long you know, because you

a uman we noh love write. Cau wen yu go ova deh an buck op on dem
are a woman who doesn't like to write. Because when you go over there and

pretty place deh an beach an aal dem sup'ing yu noh
run across all those pretty places there and beaches and all those things, you won't

memba nobody cross ya yu nuo.
remember anyone over here, you know!

TJ.F *A say, "Ohhh Valerie, I'm in Michigan you know!"*
I will say, "[ãoʷ vælɹi aːm ɪn mɪtʃɪgan jiuʷ nõʷ]"

ALL <@@@>

TV.F *Yu memba, piipl unu ear ya, Daata deh a Michigan!*
You remember, people, you hear it here. Daata is in Michigan!

ALL <@@@>

TV.F *Dat taim Pam a se, bot noh mumma voice dis, a uu voice dis yu nuo!*
Then, Pam [TJ.f's daughter] will say, "But this is not mama's voice. Who's voice is this?", you know!

TJ.F *Bot den ear mi nou, yu noh nuo ,"Ohhh. Is how yu taakin' like that?"*
But then listen to me now, you don't know, "Oh, how are you talking like that?"
[ãoʷ ɪz aʊ jiuʷ tɔːkɪn lajk˺ ðat]

ALL <@@@>

TV.F *Mi a tell unu se yu cyaa se Daata again yu nuo, yu*
I am telling you, you (all) can't say "Daata" anymore you know, you

afi se "Hi Jacqueline." Mi a go se, eh, yu go we from mi pickni,
have to say "Hi Jacqueline." I am going to tell you, hey, get away from me, kid--

a Daata yu niem. Yu come back come gwaan laik...
your name is Daata. You've returned (from abroad) acting like...

TJ.F *Ear mi nou, "What Valerie? I can't understand you!", <@@@>*
I'll say, "[wat˺ vælɹi aː kænt˺ andastan jiuː] <@@@>

TV.F *Den watch di Daata a taak!*
Then watch (get a load of) Daata talking!

ALL <@@@>

V *Den poor help mi nou, caal ova sed nou bot noh mi Daata mi waan*
Then help poor me now, I come to visit now and it's Daata I want

bot daughta deh a Michigan, Hmm= Mi big im op man, big im op,
but Daata is in Michigan. Hmm=I congratulate her, man, congratulate her.

Im nice an aalright. Mi wanda 'ow im get deh, mi uda laik
She's nice and alright. I wonder how she got there. I would like

fi go deh tuu. Ear afta, "yu ear dat bad mind uman deh"=
to go there, too. From then on [I say], "You hear that 'bad-mind' woman there?"=

ALL <@@@>

TV.F *Stop "taak" yu nuo, stop "Spiich". "Yu ear dat bad mind uman deh", im*
Stop "twangin'", you know, stop "Speechin'". You hear that bad-mind' woman there, she

stop taak dan 'ow im fi taak yu nuo= Lord have mercy pon wi. Lord
stopped talking, then how is she to talk, you know? =Lord have mercy on us. Lord

hav mercy!
have mercy!

TJ.F *Mi se "Valerie, I'm in Michigan you know and I'm sending for you*
I say, "[vælɹi a:m ɪn mɪtʃɪgan jiu^{w} n^{j}o^{w} an a:m sɛndɪn fɔ jiu:

next week"
nɛkst˺ wi:k]."

TV.F *Massa God, yu uda si how mi go buy it man, mi uda go buy it, mi*
Lord God, you would see how I would go and buy it [a travel ticket], man, I would go buy it, I

uda steal mi steal ar wa. Jump ova board an di man se, di man,di
would surely steal or something. Jump overboard and the man would say, the man, the

man se tu di uman se "wen yu go tell mi se mi get truu an mi gwaan!"
man said to the woman, "When you get there, tell me I've reached there, too, and I'll be ready to go!"

ALL <@@@>

Most notable in TJ.f's "American English" pronunciation is her extensive nasalization of non-high vowels /a, æ/ and use of gliding [jiu^{w}, n^{j}o^{w}]. Production of all four of these qualities involves lengthening of the vowel, as well. Overall, she speaks with an intonation which contains a more marked rise and fall pattern than her customary Creole utterances. She exchanges vowels which would be monophthongal or downgliding in Jamaican Creole, e.g. [ju, nuo] "know", for longer, upgliding productions [jiu^{w}, n^{j}o^{w}]. Sensitivity to contrasts in duration has also been expressed in Jamaican folkways. Louise Bennett, in her videotape entitled "Miss Lou and Friends" shows an awareness that Jamaican pronunciation of /u/ in [ju] "you" is shorter, compared to British Received Pronunciation.

In her first conversational turn, TV.f also uses some American English when she envisions how people "in foreign" will greet TJ.f. However, she does not alter her pronunciation in the same way as TJ.f Rather, she uses a lexical item "Howdie-du" which does not occur in Jamaican Creole, and carefully pronounces initial [h] in "hi", "hello", "howdie", and "how". TV.f does not produce initial [h] in general in her conversational speech, so it is possible that what we see in her "Hi, hello. Howdie-du how are you" is hypercorrect [h]-insertion associated with Speaky-spoky style.

6.3.2.3 Taakin' Broad

In their conversational session, TA.m, TX.m, and TH.m, discuss problems they have communicating with a new temporary supervisor, visiting from The Netherlands to teach them new techniques in the farming of bananas. They are aware that he does not understand Patois and gave the following as examples of Patois speech which the foreigner (although fluent in English) finds difficult to comprehend. They refer to this speech as talking "broad Patois," and give the following examples in their discourse:

(1) TA.M: *Mi an di bwai gwaa a riva an mi inna di wata, an di bwai fling wan stone afta mi an run we.*

The boy and I went to the river and I was in the water when the boy threw a stone at me and ran away.

(2) TA.M: *Cyari di baal come.*

Bring the ball.

(3) TA.M: *We mi bat deh?*

Where is my bat?

(4) TH.M: *Come go have a bite.*

Let's go eat.

(5) TH.M: *Come yah nuo. Come dig out i hole yah.*

Come here. Come dig out this hole.

(6) TA.M: *Come yah man.*

Come here, man.

(7) TX.M: *Go fi dat carry come.*

Go bring that here.

In these statements, the respondents refer to different kinds of linguistic structures. Two of these, statements (5) and (6), concern intonation. TH.m subsequently remarks that what he believes to be happening is that the foreigner is talking fast while all the while saying the same thing about them. TA.m suggests that it is the intonation of phrases such as (6) that the foreigner does not understand: that, spoken with a particular intonation, which he exemplifies by stressing the initial word "come", the statement is simultaneously appropriately polite and expressive of urgency when a worker needs assistance quickly. He goes on to say that the foreigner does not understand this and fails to use the statement properly when he wants the workers' assistance.

TA.m, TH.m, and TX.m all offer examples that concern one morpho-syntactic feature of Jamaican Creole, that is, the serial-verb construction, in (2), (4), and (7), respectively. Finally, the example given in (3) concerns the Creole use of locative "deh". It is interesting to consider how a structure like this might compare with one such as (1) which contains few syntactic or lexical features which would be unintelligible to English speakers, but rather is generally suggestive of Patois pronunciation and word usage.

So far, then, metalinguistic discussion has extended to a stylistic form, Speaky-spoky, which is associated with lexical and phonological features, and Taakin' Broad, which speakers seem to associate with Creole morphosyntax, and perhaps intonation. The third example concerns pronunciation feature believed to reflect regional variation.

6.3.2.4 Ringin' Consonants

The final metalinguistic topic to be mentioned in this chapter involves a description of a phonetic feature of urban lower-middle and working-class Jamaican Creole, rather than a constitutive label for a way of speaking. One topic used for directing conversation was 'regional variation among language varieties in Jamaica'. This topic yielded interesting discussion in the conversation in which speaker KE.m participated. He has had no training in linguistics, to my knowledge.

> KE.M: I don't know if it's socialization or what. But let us say ahm a woman from Kingston should say, "Im a com. She would say [im a kòm^ə]. An an she stresses the final consonant. Ahm or or she's saying "yard" and she says [ja:d^ə], with a harder 'd'. Y'know--ahm it it, it is something -- I've, I've, I've seen. Ahm I'm not sure. It can't be universal. Ahm but what is, what is, what is also obvious is that if she is coming from lower middle to lower class then then that normally tends to be the case. If she's coming from, from let's say middle-middle or upper middle to upper class then there's another kind of nasal ring that comes with it...that's basically the Upper St. Andrew speech.

KE.m is actually making two observations here. The first shows an awareness of the tendency for voiced oral and nasal stops in Jamaican Creole to be followed by a reduced schwa. Second, he shows an awareness of the nasal vocal quality in acrolectal

Jamaican speech which Irvine (1994) ascribes to an upper-class social dialect referred to as Variety A (mentioned previously in §2.1.3).

6.4 Discussion

By asking respondents questions that directed them to identify Patois and English features, I was able to obtain information concerning the level at which respondents differentiate these varieties. Indeed, they seem to make more micro distinctions than classifying all Jamaican speech into "English" or "Patois" (see §2.2.1 and also the introduction to this chapter), including regional differences, expectations of a correlation between age and Patois usage, and of course, social class features. In addition, respondents distinguished morpho-syntactic features of Jamaican Creole and English, and mentioned a few phoneme-level and intonational differences. Also, in both the labeling task and conversational discussion, speakers named ways of speaking such as Speaky-Spoky/Speechin' which have to do with speech style or usage of English, Taakin' Broad, which concerns varieties of Patois itself, and also "exposure" to urban life and linguistic forms. Very little of the commentary, however, was devoted to phoneme-level phenomena.

Completion of the labeling task was hindered by some of the same limitations faced by other studies involving direct questioning and self-reports. A central hope was to be able to collect from respondents statements about phoneme-level information to which they attend in distinguishing Jamaican English from Jamaican Creole. In the absence of very specific and well-directed questions, such responses did not easily emerge. The observations collected in this chapter could, however, could provide the basis for a more rigorous experimental study.

Two approaches could be taken to build on the current, informal study. First, data could be more systematically collected and checked. Rather than an open-ended request for comments regarding the three questions, it may be useful for a future study to first invite open-ended responses, and then ask respondents to list particular words or phrases that could be assigned the labels they used (from both the excerpt, and volunteered from their own thoughts). For example, "What words/phrases did you feel were broad Patois/twangin'/speechin'?". "Can you form Patois/twangin' speechin'"? ("Form" means to "put on", "pretend" or "imitate"). Another possibility, to be used independently or in conjunction with the suggestion just made, would be to use some form of subjective reaction test, with respondents labeling synthesized or excerpted samples which differed in a single phonetic respect. One task used by Akers (1981:114) was to provide a nonsense word in Patois phonology, and ask respondents to utter it back to him in English. Such a method might be tried here--respondents could be given words and asked to transform them into English (or pronounce them with a twang), broad Patois, etc.

Certain tests used in perceptual phonetics may be useful for devising a more rigorous experimental test of phonetic perception. That is, such a test would examine how speakers perceive the sounds of Jamaican Creole and English rather than what speakers can articulate about distinctions they make between the varieties. For example, if a speaker does not utilize a spectral distinction between vowel categories such as /ɑː, a, ɔ/ "dawn, dan, don" or /iː, ɪ/ "seat, sit" in their own productions, but achieves lexical distinction via durational contrast (or some kind of interacting relationship between temporal and spectral features), research questions might be: 1.) how will they identify one member of such a set?, and using what criteria?, 2.) how well will they discriminate the members of sets utilizing such spectral contrasts in the absence of the kind of durational distinctions they make vs. spectral distinctions made in conjunction with durational contrast? 3.) What criteria will they say they use for making distinctions? Speech perception research has been most centrally located in the disciplines of perceptual phonetics and psychology, where researchers use respondents' self reports in addition to experimental tests. Possible links between phonetic production and perception are very complex, the related issues having received active research attention and extensive argument (e.g., Fowler, 1981; Flege, 1988).

Notes to Chapter 6

[1] Throughout this thesis, the transcription conventions used are from DuBois (1991), who provides symbols for noting intonational and phonetic phenomena. Laughter is symbolized "<@@@>". The conventional symbol for latched turns is used, "==".

CHAPTER 7

GENERAL DISCUSSION AND CONCLUSIONS

7.1 The Vowel Systems of Jamaican Speakers

The study reported in this thesis was concerned primarily with characterizing the acoustic structure of the vowel systems of eleven basilect-dominant speakers from the rural parish of St. Thomas and nine acrolect-dominant speakers from urban Kingston in the country of Jamaica. Vowel data were investigated using an experimental phonetic approach. Of particular interest were the spectral and temporal features of the vowels, and the ways in which these features combine to enable phonemic contrast in vowel quality oppositions.

7.1.1 Spectral and Temporal Features

In an analysis based on normalized data, detailed comparisons of vowel pairs involved in the putative long:short opposition in Jamaican Creole were accomplished, and general observations were made concerning the overall distribution of Jamaican vowel space. With respect to the latter, the vowels of the present sample of speakers were found to be distributed in a v-shape towards the periphery of vowel space, with clustering in the high front and low regions of acoustic space. This larger distribution was divided into five subsystems, two along the front or left boundary line (including the high front and mid front subsystems), one in the low corner, and two along the back or right boundary line (including the mid back, and high back subsystems). Each subsystem contained one long:short (tense/lax) vowel opposition, allowing a detailed spectral and temporal comparison of the vowel pair. A formula developed for quantifying spectral overlap of vowel distributions using vowel means and standard deviations proved helpful for evaluating the relative positioning of pairs of vowels in acoustic space.

General patterns were noted concerning temporal and spectral properties and their interactions. For cases described as complete spectral overlap such as in the high front (for /iː,ɪ/), low (for /ɑː,a/), and high back (for /uː,ʊ/) vowel quality subsystems, it was observed that vowels would show a difference in mean F1 on the order of around 45 Hz or less, concomitant with a difference in mean F2 of around 90 Hz or less. Crucially, one standard deviation from the mean for either F1 or F2 would close the distance between the means almost entirely. For example, speaker TA.m showed complete overlap of /iː,ɪ/. The difference between F1 means for the vowel pair was 34 Hz, the difference between F2 means, 88 Hz. Deviations for F1 of /iː,ɪ/, respectively were 34 Hz and 37 Hz; and for F2, 82 Hz and 113 Hz. Vowel pairs which were evaluated as being spectrally non-overlapping typically showed differences in mean F1 of greater than 60 Hz in F1 and 200 Hz in F2. Relationships where relative spectral positioning fell in-between the two ranges just described were characterized as partial spectral overlap (i.e., where distributions overlapped, but by less than 85%), and such cases consistently occurred where there was no temporal overlap between vowel categories. One case, /a, ɔ/, was found to show complete spectral overlap with complete temporal overlap, and the interpretation was suggested that this might represent phonemic merger.

Two kinds of phonetic effects emerged from statistical tests conducted on a subset of the data. In an initial set of "Grand ANOVAs" run over all of the vowel quality subsystems, it was found that the vowel quality subsystems differed in duration such that high vowels were significantly shorter than low ones. Vowel quality was not found to interact with any other factor. This effect has been referred to as "intrinsic duration", and has been found for all of the languages in which it has been investigated (Lehiste, 1970). Second, the voicing of a following consonant was found to significantly effect the duration of a vowel, an effect known as "segmental conditioning". A vowel length-by-following voicing interaction was found, indicating that the duration of short vowels is affected to a greater extent than long vowels. A third phonetic effect, related to manner of articulation of a following consonant, was not examined statistically, but emerged from the general description of overall means for the entire dataset. Vowel durations for /iː/, /a/, /uː/, /oː/ (for all speakers) and /ɔ/ (St. Thomas speakers) were found to be shorter before oral stops than nasals and fricatives.

Statistical tests also elucidated the contribution of extralinguistic factors to variation in Jamaican vowel production. Both the Grand ANOVAs and post-hoc subsystem tests showed differences related to group and gender of the speaker. Three patterns were found. First, there were consistent differences between the Kingston and St. Thomas groups. Although both groups displayed spectral differences between vowel quality oppositions, St. Thomas speakers showed more contrasts wherein the temporal difference was of greater magnitude than the spectral one relative to their Kingston counterparts. Differences in spectral quality, for example for vowel pair /iː,ɪ/, in the vowels of the basilect-dominant speakers were greater than expected, given the focus in the literature on quantity distinctions in Jamaican Creole. It was concluded, however, that quantity is primary for the basilect-dominant speakers, who were shown in the quantification of spectral overlap to consistently display partial or complete spectral overlap for four of five vowel quality subsystems (as was discussed in §5.3.1), and described as exhibiting an overall ratio in the relative durations of long and short vowels, of around 1.66:1. Kingston speakers were found to have an overall long:short ratio of 1.56:1. These two ratios do not seem to be very different, and it is difficult to assess their meaning in phonological terms, but taken together with information about both groups' use of spectral overlap, inter-group differences begin to emerge. The long:short ratio is a useful point of comparison with other languages. The ratio for Jamaican vowels is significantly different from the ratio reported by Hubbard (1998) for American English, 1.2:1, more closely resembling ratios reported for languages for which difference in length is the basis for phonemic contrast, in the presence of less robust quality distinctions. In this respect, there is a clear difference between this English-based Creole, including the acrolect which is often spoken of as a regional dialect of English, and one of English's "standard" varieties. Further research needs to be done to corroborate the duration ratios found in this study for Jamaican speakers.

Second, a clear relationship was found between gender and lengthening of long vowels females showed larger vowel duration ratios than males. This effect was clearest in the high front, mid front, and low vowel quality subsystems for the pairs /iː,ɪ/, /eː,ɛ/ and /ɑː,a/, respectively. Kingston females were also shown to retract /ɑː/ to /ɒː/, which has been reported elsewhere (Irvine, 1994).

The third finding that emerged with respect to patterns identified for the present Jamaican vowel data, was that all speakers, in both the St. Thomas and Kingston samples, were found to have /ʌ/, clustering separately from the /ɔ/ orthographic class. One speaker in this study, TV.f, showed the lower F1 values typical of the higher vowel in the basilectal pattern, while keeping these vowels spectrally separate from the /ɔ/ class.

7.1.2 Palatalization and Rhoticity

Two aspects of Jamaican phonology, palatalization of velar consonants preceding /a/ and rhoticity, were discussed as they relate to the realization of vowels in the present data.

Palatalization of voiced and voiceless velar obstruents in Jamaican varieties has been attributed to the influence of 17th century English dialects, where the form was present in lower class speech as a polite form, but became a prestigious form in Jamaican Creole (Patrick, 1992). In the Creole, it has been reported as occurring sometimes with a palatal place of articulation (Wells, 1982). This palatal articulation, [ç], surfaced in the present study because of its effect on F2 of /a/. It was observed that when /a/ was preceded by the palatal consonant, it was more fronted as the result of a more gradual slope in the second formant, which began during the palatal consonant and was still evident at vowel midpoint. Acoustic analysis additionally enabled the characterization of the typical spectral pattern associated with the palatal consonant, [ç], specifically, a period of 60-70 ms of frication centered around 2000 Hz following consonant closure. The velar stop + glide sequence /k^j/ showed a more rapid F2 trajectory, so that F2 was typically lower at vowel midpoint, and the effect of the glide no longer apparent. A second observation was made with respect to palatalization. The initial velar/palatal obstruent context is the typical one associated with palatalization in Jamaican varieties, and these two variants occurred most frequently for the St. Thomas speakers. Interestingly, these speakers additionally showed a tendency to palatalize two alveolar-initial words.

Statistical tests on palatalization reported in the low vowel quality subsystem analysis indicated a surprising finding--that the Kingston females produced the palatalized variant with statistically significantly greater frequency than their male counterparts.

Rhoticity was investigated using auditory analysis in order to ascertain its place in the vowel inventory of the present Jamaican speakers. The finding that emerged was that rhoticity showed between-group differences, as was discussed in §4.8. As was illustrated in Table 4.23, absence of postvocalic-r, however, was additionally correlated with gender. While males of both groups showed more r-lessness than females in their groups, St. Thomas males were less likely to use postvocalic-r than their Kingston counterparts. Vowel quality differences between the vowels in r-less words also emerged in these non-rhotic realizations, such as retraction of [ɒː], e.g., in [dɒːk] "dark", for Kingston speakers versus [daːk] for St. Thomas speakers.

7.2 The Demographics of Language Variation

A second goal of the thesis was to explore several aspects of the social setting of language use in Jamaica--specifically, to investigate speakers' impressions concerning what constitutes English vs. Creole speech, focussing on their descriptions, imitations, and stylistic variation. This was explored in Chapter 6.

A demographic questionnaire was developed specifically for use in the Jamaican setting. Its questions focused on social aspects of an individual's interactional network which could potentially affect linguistic behavior, including kinship, occupation, voluntary association, and social and geographic mobility. These ideas were adapted from studies in two different kinds of communities--one rural, and tightly-knit, the other urban, with a sample of migrant speakers who showed differing degrees of association to the rural home district, and of integration into urban life. By synthesizing the principles and questionnaire design of both types of study, this study was able to examine some aspects of the urban-orientation and the rural-orientation patterns shown by speakers.

A social network approach was taken for this study because it is highly adaptable to different social situations, and because it allows a fairly fine-grained examination of social variables which might be correlated with language use and variation. The social network concept was used primarily as a sampling tool to structure a study of rural-oriented individuals with local networks, and urban-oriented individuals with diffuse network structures; it was not systematically employed as a framework for interpreting variation in the data. However, variation in vowel production was examined alongside the results of the network analysis for speakers in the present study, in an effort to explicate some of the linguistic variation that had emerged. However, very likely because of the small sample size of the groups in the study, no clear patterns emerged with respect to variation within St. Thomas or Kingston groups. There was some indication of a relationship between language variation and the network domains of voluntary association and kinship, which was helpful in examining the productions of a few speakers who noticeably diverged from others in their groups. The speakers discussed included TA.m, who was unique in showing complete spectral overlap of /iː,ɪ/, as well as downgliding /ie/ in all sessions, and palatal consonant /ç/ preceding /a/, and speaker KC.f, who showed downgliding /ie/ in her word list and palatalization of /a/.

The network tool developed for use in Jamaica was different from previous network studies with respect to questions in the kinship and voluntary association subsectors. Where network studies have focused on family structure, they have tended to assume patriarchal or patri-local communities with strong core or clan family structures because such structures operated for the particular community (e.g., Lippi-Green, 1989). Although this kind of family unit is to be found in Jamaica, the structure of the family in post-colonial, post-slavery societies such as this is often different. One example given was that of wealthier families, wherein the family unit often includes a domestic helper who sometimes has primary responsibility for child-care. It is important to account for the potential influence of this person on a speaker. The network information elicitation tool developed for the Jamaican setting was developed to be flexible enough to account for different types of family structure, and able to track the geographic mobility of the individual. It proved useful in elucidating information about the role of kinship in such kinds of network structure, and though it was not used extensively here, shows potential usefulness for other studies in which similar sorts of family structures need to be taken into account.

7.3 Metalinguistic Awareness and Stylistic Variation

In an informal study of the metalinguistic awareness of the speakers who participated in the production study, some of the views held by Jamaican speakers concerning what constitutes and distinguishes Jamaican Creole and English speech were examined. The investigation began with the notion that in Jamaica, there are many ways of "talking about talking". A labeling task using an excerpted portion of a conversation between three women of differing social class was used to elicit respondent commentary, with additional commentary extracted from conversational data collected as part of the experimental study described in Chapters 3 and 4. Speakers' labels ranged from "staunch Patois", "raw-baan" Patois, and "broad Patois", which they used to describe basilectal speech, to "Kingston Patois" for the speech of the middle-class women recorded on the labeling excerpt tape. Speakers gave examples, primarily exemplifying Jamaican Creole morpho-syntax and intonation to indicate aspects of Creole speech which made it clear that a speaker was not fluent in English, or which posed comprehension difficulties for a speaker not fluent in Jamaican Creole. In two conversational sessions, the stylistic forms referred to as "Speaky-spoky" (also referred to as, "Speechin' ") and "Twangin' " were mentioned. In one of these sessions, speaker TJ.f gave her impression of how an English twang sounds. Her imitation was characterized by nasalized, lengthened, upgliding diphthongs, such as [ao^{w}] for her customary /oː,uo/. In her imitations, speaker TV.f showed a pattern common in Speaky-spoky productions of hypercorrect h-insertion.

Patrick (1997:44) describes structural linguistic variation using an apt analogy which serves as a reminder that linguistic structure ultimately serves the pragmatic, stylistic, semiotic intentions of a speaker. He says, "structural variation is only a vehicle which speakers drive to their chosen destination, and variation studies may have erred in seeking to interpret the social meaning of each structural unit or linguistic variable." His point is that it is crucial that variation studies of linguistic structures not go so far afield as to make it difficult to return to an accounting of speaker identity and situational meaning. The study of metalinguistic awareness presented in Chapter 6 attempts to link a structural description of a linguistic system and its variation (Chapter 4) with speaker awareness and construction of identity. To extend Patrick's analogy, if linguistic structure is a vehicle, and the speaker the driver, we might also understand the following to be true. The driver operates the vehicle, choosing its direction and destination, and perhaps prior to its purchase, chooses some features of the vehicle (by analogy, such things as model, color, type of transmission). Conversely, there are structural mechanisms related to the vehicle of which an average owner is not aware or does not control (combustion, firing of pistons, etc.). These mechanisms are akin to low-level linguistic mechanisms which speakers do not voluntarily command. Linguistic variation may be generally likened to the vehicle which the operator selects and drives, but there is much about the structural operation of the vehicle (and some of the variation) which they do not command.

In the same way, there are features that the Jamaicans who participated in this study seemed to "drive", and others which they did not. Such variant and invariant features, of course, exist for speakers of all languages. The phonemic realizations that seemed to be driven were the ones for which speakers' productions showed variation between the word list, picture and conversational sessions. Three, in particular were noted: some speakers consistently produced monophthongal variants of /eː/ and /oː/ in their word list sessions, but downgliding [ie] and [uo], respectively, in their picture or conversational sessions. Such control of variation suggests the operation of Labov's (1972) notion of attention to speech as speakers selected the linguistic variants which they believed to be appropriate for the situation. However, speakers did not show similar variation in the lower-level features of spectral properties. That is, they did not show significant or systematic difference between their word list, picture and conversational sessions in the height or backness of their vowels. (Duration could not be considered in this respect because, while the effects on F1 and F2 were somewhat less variable, duration varied greatly in conversational speech for any given vowel.) An interesting question would be whether such features tend to be less accessible (as are the inward workings of an automobile to one untrained in auto mechanics) to the speaker for stylistic variation.

7.4 Implications of this Study and Considerations for Future Research

7.4.1 Bringing Together Phonetics and Sociolinguistics

By bringing field data into the laboratory, it was possible to identify phonetic patterns related to a sociolinguistic variable, (KYA) and characterize important aspects related to its production. Creole linguists have known that the initial consonant in the phonolexical variable (KYA) can be either a velar obstruent + glide or a palatal consonant, but the features of the two have not been defined and distinguished. In this study, I have been able to characterize the phonetic structure of the palatal consonant, and have found that this pattern was more prevalent in the speech of basilect-dominant speakers.

Traditionally, the field of acoustic phonetics has focused on examining the phonetic features of the speech signal--the properties of the vocal source and filter mechanisms--and acoustic evidence of differences between languages. Traditionally, sociolinguistic studies have focused on linguistic variation related to extralinguistic variables, with attention to phonetic environments which exert an effect on a phonological variable. It is intriguing to think about what it is that the phonetician examines under the laboratory "microscope". What I have learned is that the acoustic signal simultaneously encodes phonological variation linked to social differences and also effects related to phonetic factors. Variation in the spectral and temporal features of Jamaican vowel data has been shown to be related to both extralinguistic and phonetic variables.

7.4.2 Working with Picture Data

Illiteracy can prove to be a significant barrier to conducting an experimental study where data of a particular phonetic shape and context are required. The elicitation of speech using picture data returned very satisfactory results, and is believed to hold promise for instrumental studies requiring that words be uttered in a controlled consonant context or sentence frame. By suggesting a carrier frame to the speaker, I was able to achieve a constant consonant environment for desired words. If carefully done, so that a speaker is encouraged to progress with the desired, consistent tempo, it is possible to achieve (from literate and illiterate speakers), controlled data suitable for instrumental analysis. Second, by presenting pictures rather than a word list, particularly where the content of the pictures attracted interest by humor or oddity, speakers produced forms which did not emerge reliably in the word list; forms which were closer to their vernacular, conversational style without the reduction in phonetic forms which occurs in allegro tempo connected speech. This is of particular value when the researcher is attempting to elicit data for a stigmatized language variety, where the experimental setting may create a situational conflict for the speaker in terms of their beliefs concerning the appropriacy of their use of the stigmatized form. Third, picture data were also free of the speaker overlap which is present as a natural consequence of using naturalistic conversation between two or more speakers.

Of course, there are shortcomings associated with the use of pictures as a methodological procedure. It may not be possible to collect pictures for all the stimuli desired. The researcher would perhaps be limited to real-word items which were easily rendered as illustrations. Pictures themselves may be ambiguous as to the desired word.[1] Nevertheless, it is my feeling that this method holds rich and yet unexplored possibility for the elicitation of data appropriate for experimental study.

7.4.3 Jamaican Intonation

One of the most exciting possibilities for future research in Jamaican phonology is that of an instrumental study of Jamaican intonation. Lawton (1963, 1982) and Devonish and Seiler (1991) have described intonational patterns related to syllable-timing and stress based on the auditory analysis of cassette-recorded speech. However, experimental data are lacking in this area. The difficulty one encounters in using analog cassette recordings for intonational analysis lies in the fact that even high-bias, high-resolution tapes recorded under quiet conditions sometimes fall short of the quality necessary for computing a sufficient pitch track. The portable digital tape-recording system used in the present study consistently returned a signal of sufficient quality for tracking fundamental frequency under conditions of no (or very low) background noise. It is believed that this equipment holds promise for the analysis of Jamaican Creole intonation data.

7.4.4 Research into Jamaican Vowel Perception

The finding that the basilect-dominant speakers and Kingston speakers showed differences in the reliance upon vowel duration for phonemic contrast raises the question of what this difference means for the identification and discrimination of the long:short contrast. On what do they rely in deciding if a vowel is long or short? How long does a long vowel need to be in order to be consistently identified with accuracy by speakers in either group? These questions will find their potential answers in perceptual phonetic research. A test of vowel perception between acrolect-dominant and basilect-dominant speakers could be extended to include speakers of other English dialects, with results that could increase our knowledge of where similarities and differences lie between a creole and its superordinate input language.

7.4.5 Conclusion

Because this study brought together the methods of field sociolinguistics and acoustic phonetic analysis, the body of information marshaled, analyzed, and interpreted was quite large. There is much which remains to be examined at greater length in both the phonetic and the sociolinguistic data. For example, the conversational transcripts were used only for phonetic, and some sociolinguistic, analysis, but contain a wealth of data which might be of use to researchers interested in working on conversational analyses of Jamaican discourse, or of code-switching or code-mixing behavior. The data collected for this study may make a useful contribution to larger databases of recorded speech. It is hoped that the work reported in this thesis also makes a broad contribution to various subdisciplines within the field of linguistics.

In the introduction to this thesis, the hope was expressed that this work would prove useful to research in three fields: phonetics, sociolinguistics and creole studies. The work reported here adds to the phonetics literature a detailed acoustic characterization of different varieties within an anglophone creole language. This characterization was achieved using a metric for quantifying spectral overlap which was designed for the present study, but which may prove useful to researchers conducting similar kinds of acoustic studies. Second, the demographic questionnaire developed facilitates quantification of information regarding a speaker's kinship patterns, working relationships, and informal voluntary associations. It offers sociolinguists (particularly those conducting network research) a means of avoiding certain difficulties associated with using social class as a predictor of linguistic variation in post-colonial societies like Jamaica. The questionnaire additionally makes it possible to examine the influences related to different types of kinship relations. Third, this work provides the body of literature related to creole linguistics with a study which is hoped to further our understanding of the phonetic structure of Jamaican Creole, specifically with respect to the operation of contrastive length in this language and the relative roles of spectral and temporal features in bringing about phonological contrast.

Notes to Chapter 7

[1] It was found, however, that speakers with even rudimentary reading skills, such as TI.m, were aided by the presentation of the desired word on the card with the picture.

APPENDICES

APPENDIX A

Demographic Questionnaire

The pages immediately following provide a sample of the questionnaire used to collect demographic, social network, and attitude information. (See §3.4, Speakers, and Chapter 5, Sociolinguistic Study, part 1).

APPENDIX B

Acoustic Study Wordlist

Target monosyllabic words analyzed for the acoustic study are listed below, set in the Jamaican Creole carrier sentence frame *Unu rait __ pon it.* "You (pl.) wrote __ on it." (See §3.5, Acoustic Analysis). Words are presented here in alphabetical order, but were presented to speakers in four different randomizations.

1. Unu rait babe pon it.
2. Unu rait back pon it.
3. Unu rait bad pon it.
4. Unu rait bade pon it.
5. Unu rait bag pon it.
6. Unu rait bain pon it.
7. Unu rait bait pon it.
8. Unu rait bake pon it.
9. Unu rait ban pon it.
10. Unu rait bap pon it.
11. Unu rait barb pon it.
12. Unu rait bard pon it.
13. Unu rait bared pon it.
14. Unu rait bark pon it.
15. Unu rait bars pon it.
16. Unu rait Bart pon it.
17. Unu rait base pon it.
18. Unu rait bat pon it.
19. Unu rait bath pon it.
20. Unu rait bathe pon it.
21. Unu rait baud pon it.
22. Unu rait bead pon it.
23. Unu rait beak pon it.
24. Unu rait bean pon it.
25. Unu rait beast pon it.
26. Unu rait beat pon it.
27. Unu rait beck pon it.
28. Unu rait bed pon it.
29. Unu rait been pon it.
30. Unu rait beep pon it.
31. Unu rait bees pon it.
32. Unu rait beg pon it.
33. Unu rait Ben pon it.
34. Unu rait berg pon it.
35. Unu rait Bert pon it.
36. Unu rait Bess pon it.

37. Unu rait bet pon it.
38. Unu rait Beth pon it.
39. Unu rait bib pon it.
40. Unu rait bick pon it.
41. Unu rait bid pon it.
42. Unu rait bide pon it.
43. Unu rait big pon it.
44. Unu rait bike pon it.
45. Unu rait bind pon it.
46. Unu rait bird pon it.
47. Unu rait birth pon it.
48. Unu rait bit pon it.
49. Unu rait bite pon it.
50. Unu rait board pon it.
51. Unu rait boat pon it.
52. Unu rait Bob pon it.
53. Unu rait bode pon it.
54. Unu rait bog pon it.
55. Unu rait bok pon it.
56. Unu rait bon pon it.
57. Unu rait bone pon it.
58. Unu rait boob pon it.
59. Unu rait booed pon it.
60. Unu rait boog pon it.
61. Unu rait book pon it.
62. Unu rait boon pon it.
63. Unu rait boot pon it.
64. Unu rait booth pon it.
65. Unu rait booze pon it.
66. Unu rait bop pon it.
67. Unu rait Borg pon it.
68. Unu rait boss pon it.
69. Unu rait both pon it.
70. Unu rait bought pon it.
71. Unu rait bowed pon it.
72. Unu rait bows (n) pon it.
73. Unu rait bows (v) pon it.
74. Unu rait bub pon it.
75. Unu rait buck pon it.
76. Unu rait bud pon it.
77. Unu rait bug pon it.
78. Unu rait bun pon it.
79. Unu rait bup pon it.
80. Unu rait burn pon it.
81. Unu rait burp pon it.
82. Unu rait bus pon it.
83. Unu rait but pon it.
84. Unu rait buys pon it.
85. Unu rait buzz pon it.
86. Unu rait cab pon it.

87. Unu rait cad pon it.
88. Unu rait cake pon it.
89. Unu rait can pon it.
90. Unu rait cap pon it.
91. Unu rait cape pon it.
92. Unu rait card pon it.
93. Unu rait cared pon it.
94. Unu rait cares pon it.
95. Unu rait carp pon it.
96. Unu rait cars pon it.
97. Unu rait cart pon it.
98. Unu rait case pon it.
99. Unu rait cast pon it.
100. Unu rait cat pon it.
101. Unu rait cause pon it.
102. Unu rait coast pon it.
103. Unu rait coat pon it.
104. Unu rait cob pon it.
105. Unu rait cock pon it.
106. Unu rait cod pon it.
107. Unu rait code pon it.
108. Unu rait cog pon it.
109. Unu rait coin pon it.
110. Unu rait coke pon it.
111. Unu rait con pon it.
112. Unu rait cone pon it.
113. Unu rait cooed pon it.
114. Unu rait cook pon it.
115. Unu rait coon pon it.
116. Unu rait coop pon it.
117. Unu rait coos pon it.
118. Unu rait coot pon it.
119. Unu rait cop pon it.
120. Unu rait cord pon it.
121. Unu rait corn pon it.
122. Unu rait corp pon it.
123. Unu rait cost pon it.
124. Unu rait cot pon it.
125. Unu rait could pon it.
126. Unu rait course pon it.
127. Unu rait court pon it.
128. Unu rait cowed pon it.
129. Unu rait cows pon it.
130. Unu rait cub pon it.
131. Unu rait cud pon it.
132. Unu rait cup pon it.
133. Unu rait curb pon it.
134. Unu rait curd pon it.
135. Unu rait curse pon it.
136. Unu rait curt pon it.

137.Unu rait cuss pon it.

138.Unu rait cut pon it.

139.Unu rait cute pon it.

140.Unu rait dab pon it.

141.Unu rait dad pon it.

142.Unu rait Dan pon it.

143.Unu rait dane pon it.

144.Unu rait dared pon it.

145.Unu rait dares pon it.

146.Unu rait dark pon it.

147.Unu rait darn pon it.

148.Unu rait dart pon it.

149.Unu rait dat pon it.

150.Unu rait date pon it.

151.Unu rait daub pon it.

152.Unu rait daze pon it.

153.Unu rait dead pon it.

154.Unu rait dean pon it.

155.Unu rait dearth pon it.

156.Unu rait death pon it.

157.Unu rait Deb pon it.

158.Unu rait debt pon it.

159.Unu rait deck pon it.

160.Unu rait deed pon it.

161.Unu rait deep pon it.

162.Unu rait den pon it.

163.Unu rait desk pon it.

164.Unu rait deuce pon it.

165.Unu rait dib pon it.

166.Unu rait dice pon it.

167.Unu rait Dick pon it.

168.Unu rait did pon it.

169.Unu rait died pon it.

170.Unu rait dies pon it.

171.Unu rait dig pon it.

172.Unu rait dike pon it.

173.Unu rait din pon it.

174.Unu rait dine pon it.

175.Unu rait dip pon it.

176.Unu rait Dirk pon it.

177.Unu rait dirt pon it.

178.Unu rait dock pon it.

179.Unu rait does pon it.

180.Unu rait dog pon it.

181.Unu rait don pon it.

182.Unu rait don't pon it.

183.Unu rait done pon it.

184.Unu rait dope pon it.

185.Unu rait dork pon it.

186.Unu rait dose pon it.

187.Unu rait dot pon it.

188.Unu rait dote pon it.

189.Unu rait doth pon it.

190.Unu rait doubt pon it.

191.Unu rait douse pon it.

192.Unu rait down pon it.

193.Unu rait down pon it.

194.Unu rait doze pon it.

195.Unu rait dub pon it.

196.Unu rait duck pon it.

197.Unu rait dud pon it.

198.Unu rait dude pon it.

199.Unu rait dues pon it.

200.Unu rait dug pon it.

201.Unu rait Duke pon it.

202.Unu rait dune pon it.

203.Unu rait dup pon it.

204.Unu rait dust pon it.

205.Unu rait Kate pon it.

206.Unu rait keat pon it.

207.Unu rait keen pon it.

208.Unu rait keep pon it.

209.Unu rait keg pon it.

210.Unu rait ken pon it.

211.Unu rait kept pon it.

212.Unu rait keyed pon it.

213.Unu rait keys pon it.

214.Unu rait kick pon it.

215.Unu rait kid pon it.

216.Unu rait kin pon it.

217.Unu rait kind pon it.

218.Unu rait Kirk pon it.

219.Unu rait kiss pon it.

220.Unu rait kit pon it.

221.Unu rait kite pon it.

222.Unu rait kook pon it.

223.Unu rait scope pon it.

224.Unu rait skip pon it.

225.Unu rait these pon it.

226.Unu rait this pon it.

APPENDIX C

Application of Spectral Overlap Assessment Metric

This appendix provides step-by-step calculations for the spectral overlap assessment metric introduced in §4.2. Three examples are provided: one case of "no spectral overlap" using vowels /iː,ɪ/ for speaker KF.f, one case of "partial spectral overlap" using vowels /iː,ɪ/ for speaker TB.m, and one case of "complete spectral overlap" using vowels /iː,ɪ/ for speaker TA.m. This appendix uses data presented in Table 4.5 (changing only the number of significant digits for calculation purposes) and described in the High Front subsystem analysis, in §4.4.2.1.

I. Example 1: Speaker KF.f, No spectral overlap

I.1. Using log-mean normalized values (specifically, the mean values calculated over all occurrences of a vowel for the speaker) for F1 and F2 at vowel midpoint, delineate ellipses for two vowels, /iː,ɪ/, where /iː/ = vowel 1 and /ɪ/ = vowel 2. The following are the input values:

Vowel	F1 (Hz)	*st. dev.* (Hz)	F1 (log Hz)	*st. dev.* (log Hz)	F2 (Hz)	*st. dev.* (Hz)	F2 (log Hz)	*st.dev.* (log Hz)
1: iː	284	*19*	-0.259	*0.0282*	2674	*61*	0.221	*0.0262*
2: ɪ	443	*70*	-0.070	*0.0672*	2368	*124*	0.168	*0.0230*

In two-dimensional vowel space, use log-mean normalized F1, F2 data for vowel midpoint as x and y coordinates to locate ellipse centers:
Vowel 1 (x,y) = (F2, F1) = (0.221, -0.259)
Vowel 2 (x,y) = (F2, F1) = (0.168, -0.070)

I.2. Calculate *Δ Means*, the distance between the centers of the ellipses. *ΔMeans* is the hypotenuse of a right triangle whose legs are defined by the lines $\left(\mu_{F1,V2} - \mu_{F1,V1}\right)$ and $\left(\mu_{F2,V2} - \mu_{F2,V1}\right)$. Thus, *ΔMeans* may be calculated using the Pythagorean theorem for triangles:

$$\Delta Means = \sqrt{\left(\mu_{F1,V2} - \mu_{F1,V1}\right)^2 + \left(\mu_{F2,V2} - \mu_{F2,V1}\right)^2}$$

$$= \sqrt{\left({}^{-}0.070 - {}^{-}0.259\right)^2 + \left(0.168 - 0.221\right)^2}$$

$$= \sqrt{\left({}^{-}0.189\right)^2 + \left({}^{-}0.053\right)^2}$$

$$= \sqrt{0.0357 + 0.0028}$$

$$= \sqrt{0.0385}$$

$$= 0.196$$

I.3. Calculate a unique radius, r_{vi}, for each elliptical vowel distribution. r is defined as the *twice* the two-dimensional standard deviation for each distribution following the slope, k, of the line connecting the centers of the two distributions.

I.3a. Calculate the slope, k, of the line *ΔMeans*:

$$k = \frac{rise}{run} = \frac{\mu F1_{v2} - \mu F1_{v1}}{\mu F2_{v2} - \mu F2_{v1}}$$

$$= \frac{{}^{-}0.070 - {}^{-}0.259}{0.168 - 0.221}$$

$$= \frac{0.189}{{}^{-}0.053}$$

$$= {}^{-}3.6$$

I.3b. For each vowel distribution, calculate the standard deviation, σ_{vi}*, along the line connecting the two vowel means:

Standard deviation values in log F1 and log F2:
Vowel 1: Standard deviation in x(F2) = 0.0262, Standard deviation in y(F1) = 0.0282
Vowel 2: Standard deviation in x(F2) = 0.0230, Standard deviation in y(F1) = 0.0672

Vowel 1 (/i:/):

$$\sigma_{vi}* = \sigma_{F1}\sigma_{F2}\sqrt{\frac{k^2+1}{\sigma_{F1}{}^2 + \sigma_{F2}{}^2 k^2}}$$

$$= (0.0282)(0.0262)\sqrt{\frac{{}^{-}3.6^2+1}{0.0282^2+(0.0262)^2({}^{-}3.6)^2}}$$

$$= (0.000739)\sqrt{\frac{12.96+1}{0.000795+(0.000686)(12.96)}}$$

$$= (0.000739)\sqrt{\frac{13.96}{0.00969}}$$

$$= 0.028$$

Vowel 2 (/ɪ/):

$$\sigma_{v2}* = (0.0672)(0.0230)\sqrt{\frac{(^{-}3.6)^2+1}{(0.0672)^2+(0.0230)^2(^{-}3.6)^2}}$$

$$= (0.00155)\sqrt{\frac{13.96}{0.01137}}$$

$$= 0.054$$

I.3c. Finally, for each vowel distribution calculate the radius, $r_{vi}*$, of the ellipse describing the distribution of vowel *i*. $r_{vi}*$is twice the value of $\sigma_{vi}*$.

$$r_{v1}* = 2\ \sigma_{v1}* = 2\ (0.028) = 0.056$$
$$r_{v2}* = 2\ \sigma_{v2}* = 2(0.054) = 0.108$$

The result, when plotted in F1xF2 space, is an ellipse for each vowel, scaled to a radius of twice the standard deviation of the data, as shown in the figure below. Thus, we can expect approximately 95% of normally distributed data for the vowel being considered to be inside the ellipse.

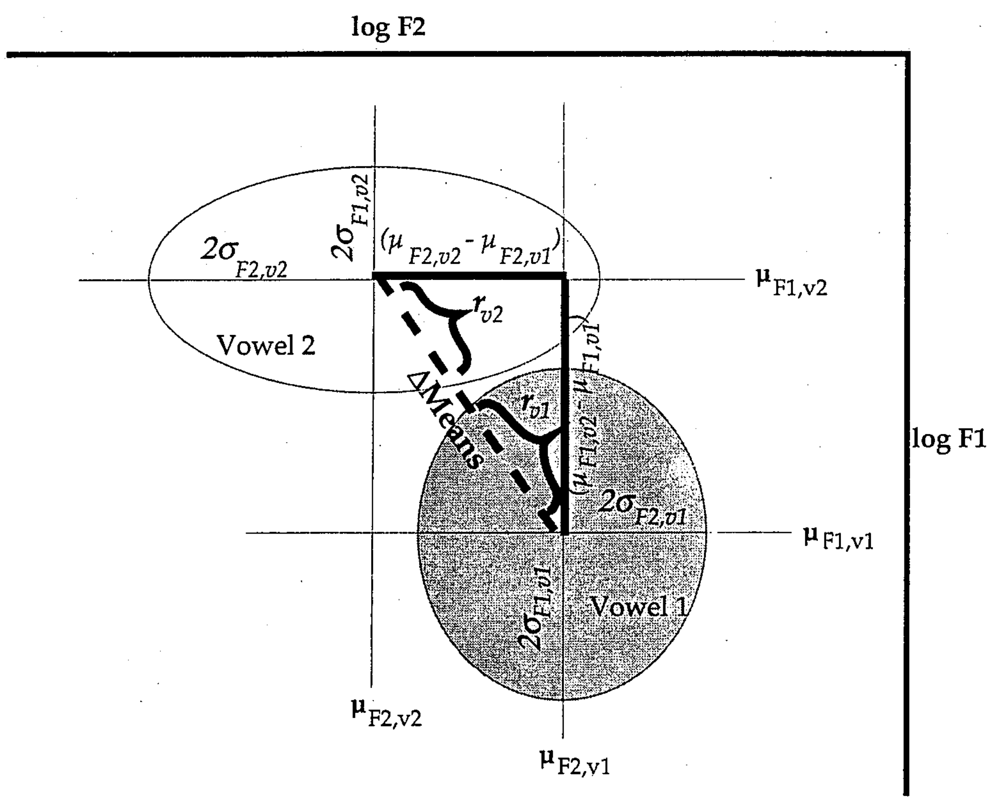


Figure A.1. Ellipses used to represent vowel distributions for /iː/ and /ɪ / in F1xF2 space.

Next the results are determined of three geometrical conditions devised for testing spectral overlap between the two vowel distributions.

I.4. Condition 1: Is *ΔMeans* larger than the sum of the radii of the two distributions? If "yes," then the two vowel distributions are said to show no overlap. If "no," then there is either partial or complete overlap. (Conditions 2 a and b together are then used to distinguish between cases of partial and complete overlap of vowel distributions.)

$$\Delta Means > \left(r_{v1}* + r_{v2}*\right)?$$

0.196 > (0.056 + 0.108) ?

0.196 > 0.164 ?

Yes. Therefore there is no overlap between the distributions.

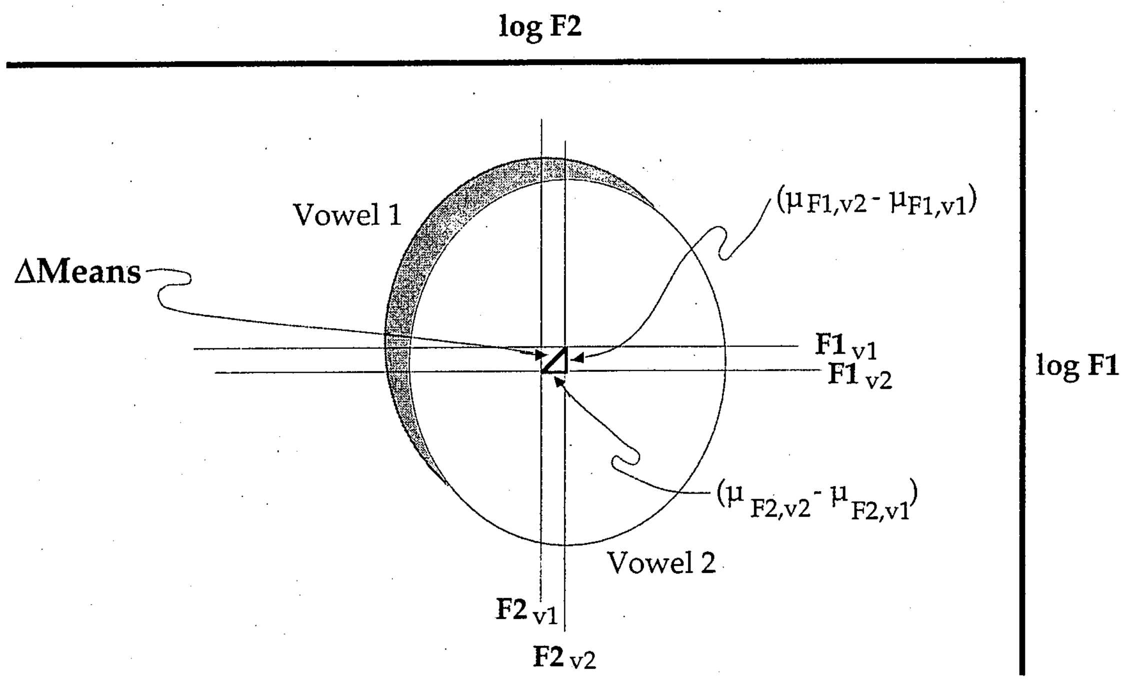
I.5. Condition 2. Distinguish between partial and complete overlap. This condition applies only when Condition 1 indicates overlap of vowel distributions, and therefore it is not needed for this example. Refer to Examples 2 and 3 for a detailed description of this condition.

Example 2: Speaker TB.m, Partial spectral overlap
II.1. Using log-mean normalized values (specifically, the mean values calculated over all occurrences of a vowel for the speaker) for F1 and F2 at vowel midpoint, delineate ellipses for two vowels, /iː,ɪ/, where /iː/ = vowel 1 and /ɪ/ = vowel 2. The following are the input values:

Vowel	F1 (Hz)	*st. dev.* (Hz)	F1 (log Hz)	*st. dev.* (log Hz)	F2 (Hz)	*st. dev.* (Hz)	F2 (log Hz)	*st.dev.* (log Hz)
1: iː	293	*33*	-0.203	*0.0498*	2217	*158*	0.182	*0.0311*
2: ɪ	365	*36*	-0.107	*0.0466*	2167	*138*	0.172	*0.0270*

In two-dimensional vowel space, use log-mean normalized F1, F2 data for vowel midpoint as x and y coordinates to locate ellipse centers:
Vowel 1 (x,y) = (F2, F1) = (0.1816, -0.2027)
Vowel 2 (x,y) = (F2, F1) = (0.1719, -0.1071)

II.2. Calculate *Δ Means*, the distance between the centers of the ellipses. *ΔMeans* is the hypoteneuse of a right triangle whose legs are defined by the lines $\left(\mu_{F1,V2} - \mu_{F1,V1}\right)$ and $\left(\mu_{F2,V2} - \mu_{F2,V1}\right)$. Thus, *ΔMeans* may be calculated using the Pythagorean theorem for triangles:



$$\Delta Means = \sqrt{\left(\mu_{F1,V2} - \mu_{F1,V1}\right)^2 + \left(\mu_{F2,V2} - \mu_{F2,V1}\right)^2}$$

$$= \sqrt{\left({}^{-}0.1071 - {}^{-}0.2027\right)^2 + \left(0.1719 - 0.1816\ \right)^2}$$

$$= \sqrt{\left({}^{-}0.0956\right)^2 + \left({}^{-}0.0097\right)^2}$$

$$= \sqrt{0.00914 + 0.000094}$$

$$= 0.0961$$

II.3. Calculate a unique radius, r_{vi}, for each elliptical vowel distribution. r is defined as the two-dimensional standard deviation for each distribution following the slope, k, of the line connecting the centers of the two distributions.

II.3a. Calculate the slope, k, of the line *ΔMeans*:

$$k = \frac{rise}{run} = \frac{\mu F1_{v2} - \mu F1_{v1}}{\mu F2_{v2} - \mu F2_{v1}}$$

$$= \frac{{}^{-}0.1071 - {}^{-}0.2027}{0.1719 - 0.1816}$$

$$= \frac{0.0956}{{}^{-}0.0097}$$

$$= -9.8$$

II.3b. For each vowel distribution, calculate the standard deviation, σ_{vi}^*, along the line connecting the two vowel means:

Standard deviation values in log F1 and log F2:
Vowel 1: Standard deviation in x(F2) = 0.0311, Standard deviation in y(F1) = 0.0498
Vowel 2: Standard deviation in x(F2) = 0.0270, Standard deviation in y(F1) = 0.0466

Vowel 1 (/iː/):

$$\sigma_{v1}^* = \sigma_{F1}\sigma_{F2}\sqrt{\frac{k^2+1}{\sigma_{F1}^2+\sigma_{F2}^2k^2}}$$

$$= (0.0498)(0.0311)\sqrt{\frac{(^-9.8)^2+1}{0.0498^2+0.0311^2(^-9.8)^2}}$$

$$= 0.00155\sqrt{\frac{96.0+1}{0.00248+0.000967(96.0)}}$$

$$= 0.00155\sqrt{\frac{97.0}{0.0953}}$$

$$=0.00155\ (31.9)$$

$$=0.0494$$

Vowel 2 (/ɪ/):

$$\sigma_{v2}^* = (0.0466)(0.0270)\sqrt{\frac{(^-9.8)^2+1}{0.0466^2+0.0270^2(^-9.8)^2}}$$

$$= 0.00126\sqrt{\frac{96.0+1}{0.00217+0.000729(96.0)}}$$

$$= 0.00126\sqrt{\frac{97.0}{0.0722}}$$

$=0.00126(36.7)$

$=0.0462$

II.3c. Finally, for each vowel distribution calculate the radius, $r_{vi}*$, of the ellipse describing the distribution of vowel *i*. $r_{vi}*$is twice the value of $\sigma_{vi}*$.

$$r_{v1}* = 2\ \sigma_{v1}* = 2\ (0.0494) = 0.0988$$
$$r_{v2}* = 2\ \sigma_{v2}* = 2(0.0462) = 0.0924$$

The result, when plotted in F1xF2 space, is an ellipse for each vowel, scaled to a radius of twice the standard deviation of the data. Thus, we can expect approximately 95% of normally distributed data for the vowel being considered to be inside the ellipse.

Next, the results are determined of three geometrical conditions devised for testing spectral overlap between the two vowel distributions.

II.4. Condition 1: Is *ΔMeans* larger than the sum of the radii of the two distributions? If "yes," then the two vowel distributions are said to show no overlap. If "no," then there is either partial or complete overlap. (Conditions 2a and b together are then used to distinguish between cases of partial and complete overlap of vowel distributions.)

$$\Delta Means > (r_{v1}* + r_{v2}*)?$$

$$0.0961 > (0.0988 + 0.0924)\ ?$$

$$0.0961 > 0.1912\ ?$$

No. Therefore there is at least some overlap between the distributions.

II.5. Condition 2: Distinguish between partial and complete overlap.

Condition 2a: Compare the two distributions to see if the elliptical distribution associated with v_2 protrudes beyond the elliptical borders of distribution v_1 by more than 40% of the radius (20% of the diameter) of v_1 at its furthest extent. If the answer is "no," the vowel pair is said to exhibit *complete spectral overlap*. The equation for Condition 2a is as follows:

$$(\Delta\text{Means} + r_{v2}) > 1.4\ r_{v1}\ ?$$

From previous calculations:

$r_{v1}* = 0.0988$
$r_{v2}* = 0.0924$
$\Delta Means = 0.0961$

So, when these numbers are input into the equation, we obtain

$$(0.0961 + 0.0924) > 1.4\ (0.0988)\ ?$$

$$(0.01885) > (0.1383)\ ?$$

Yes, thus the result is inconclusive without Condition 2b.

Condition 2b: Compare the two distributions to see if the elliptical distribution associated with v_1 protrudes beyond the elliptical borders of distribution v_2 by more than 40% of the radius (20% of the diameter) of v_2 at its furthest extent. If it does not, the vowel pair is said to exhibit *complete spectral overlap*. If complete spectral overlap is not indicated by either Condition 2a or b, then the vowel pair is said to exhibit *partial spectral overlap*.

Condition 2b is as follows:

$$(\Delta\text{Means} + r_{v1}) > 1.4\, r_{v2}\ ?$$

From previous calculations:

r_{v1} * = 0.0988
r_{v2} * = 0.0924
$\Delta Means$ = 0.0961

So, when these numbers are input into the equation, we obtain

(0.0961 + 0.0988) > 1.4 (0.0924) ?

(0.195) > (0.129) ?

Yes.

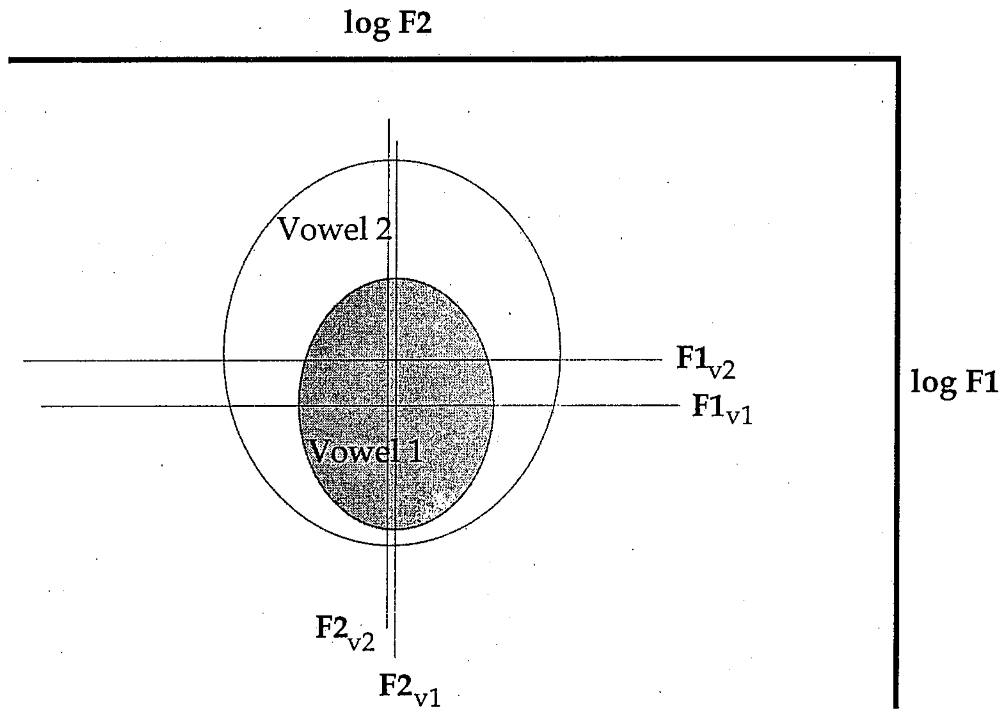
Because the answers to Conditions 2a and 2b are both "Yes", the conclusion is that the vowel distributions are *partially overlapping*.

Example 3: Speaker TA.m, Complete spectral overlap
III.1. Using log-mean normalized values (specifically, the mean values calculated over all occurrences of a vowel for the speaker) for F1 and F2 at vowel midpoint, delineate ellipses for two vowels, /i:,ɪ/, where /i:/ = vowel 1 and /ɪ/ = vowel 2. The following are the input values:

Vowel	F1 (Hz)	*st. dev.* (Hz)	F1 (log Hz)	*st. dev.* (log Hz)	F2 (Hz)	*st. dev.* (Hz)	F2 (log Hz)	*st.dev.* (log Hz)
1: i:	237	*21*	-0.2186	*0.0423*	2340	*132*	0.2322	*0.0256*
2: ɪ	285	*57*	-0.1437	*0.0775*	2275	*118*	0.2201	*0.0235*

In two-dimensional vowel space, use log-mean normalized F1, F2 data for vowel midpoint as x and y coordinates to locate ellipse centers:
Vowel 1 (x,y) = (F2, F1) = (0.2322, -0.2186)
Vowel 2 (x,y) = (F2, F1) = (0.2201, -0.1437)

III.2. Calculate *Δ Means*, the distance between the centers of the ellipses. *ΔMeans* is the hypoteneuse of a right triangle whose legs are defined by the lines $(\mu_{F1,V2} - \mu_{F1,V1})$ and $(\mu_{F2,V2} - \mu_{F2,V1})$. Thus, *ΔMeans* may be calculated using the Pythagorean theorem for triangles:



$$\Delta Means = \sqrt{\left(\mu_{F1,V2} - \mu_{F1,V1}\right)^2 + \left(\mu_{F2,V2} - \mu_{F2,V1}\right)^2}$$

$$= \sqrt{\left({}^{-}0.1437 - {}^{-}0.2186\right)^2 + (0.2201 - 0.2322)^2}$$

$$= \sqrt{(0.0749)^2 + \left({}^{-}0.0121\right)^2}$$

$$= \sqrt{0.00561 + 0.000146}$$

$$= \sqrt{0.00576}$$

$$= 0.0758$$

III.3. Calculate a unique radius, r_{vi}, for each elliptical vowel distribution. r is defined as the two-dimensional standard deviation for each distribution following the slope, k, of the line connecting the centers of the two distributions.

III.3a. Calculate the slope, k, of the line $\Delta Means$:

$$k = \frac{rise}{run} = \frac{\mu F1_{v2} - \mu F1_{v1}}{\mu F2_{v2} - \mu F2_{v1}}$$

$$= \frac{{}^{-}0.1437 - {}^{-}0.2186}{0.2201 - 0.2322}$$

$$= \frac{0.0749}{{}^{-}0.0121}$$

$$= -6.19$$

III.3b. For each vowel distribution, calculate the standard deviation, σ_{vi}*, along the line connecting the two vowel means:

Standard deviation values in log F1 and log F2:
Vowel 1: Standard deviation in x(F2) = 0.0256, Standard deviation in y(F1) = 0.0423
Vowel 2: Standard deviation in x(F2) = 0.0235, Standard deviation in y(F1) = 0.0775

Vowel 1 (/iː/):

$$\sigma_{vi} = \sigma_{F1}\sigma_{F2}\sqrt{\frac{k^2+1}{\sigma_{F1}{}^2 + \sigma_{F2}{}^2 k^2}}$$

$$= (0.0423)(0.0256)\sqrt{\frac{({}^{-}6.19)^2+1}{0.0423^2 + 0.0256^2({}^{-}6.19)^2}}$$

$$= 0.00108\sqrt{\frac{38.3+1}{0.00179+0.000655(38.3)}}$$

$$= 0.00108\sqrt{\frac{39.3}{0.0269}}$$

$$=0.00108\ (38.2)$$

$$=0.041$$

Vowel 2 (/ɪ/):

$$\sigma_{v2} = (0.0775)(0.0235)\sqrt{\frac{({}^{-}6.19)^2+1}{0.0775^2 + 0.0235^2({}^{-}6.19)^2}}$$

$$= 0.00182\sqrt{\frac{38.3+1}{0.00601+0.000552(38.3)}}$$

$$= 0.00182\sqrt{\frac{39.3}{0.0272}}$$

$$=0.00182(38.01)$$

=0.069

III.3c. Finally, for each vowel distribution calculate the radius, $r_{vi}*$, of the ellipse describing the distribution of vowel *i*. $r_{vi}*$is twice the value of $\sigma_{vi}*$.

$$r_{v1}* = 2\ \sigma_{v1}* = 2\ (0.041) = 0.082$$
$$r_{v2}* = 2\ \sigma_{v2}* = 2(0.069) = 0.138$$

The result, when plotted in F1xF2 space, is an ellipse for each vowel, scaled to a radius of twice the standard deviation of the data. Thus, we can expect approximately 95% of normally distributed data for the vowel being considered to be inside the ellipse.

Next, the results are determined of three geometrical conditions devised for testing spectral overlap between the two vowel distributions.

III.4. Condition 1: Is *ΔMeans* larger than the sum of the radii of the two distributions? If "yes," then the two vowel distributions are said to show no overlap. If "no," then there is either partial or complete overlap. (Conditions 2a and b together are then used to distinguish between cases of partial and complete overlap of vowel distributions.)

$$\Delta Means > (r_{v1}* + r_{v2}*)?$$
$$0.0758 > (0.082 + 0.138)\ ?$$

$$0.0758 > 0.220\ ?$$

No. Therefore there is at least some overlap between the distributions.

III.5. Condition 2: Distinguish between partial and complete overlap.

Condition 2a: Compare the two distributions to see if the elliptical distribution associated with v_2 protrudes beyond the elliptical borders of distribution v_1 by more than 40% of the radius (20% of the diameter) of v_1 at its furthest extent. If the answer is "no," the vowel pair is said to exhibit *complete spectral overlap*. The equation for Condition 2a is as follows:

$$(\Delta Means + r_{v2}) > 1.4\ r_{v1}\ ?$$

From previous calculations:

$r_{v1}* = 0.082$
$r_{v2}* = 0.138$
$\Delta Means = 0.0758$

So, when these numbers are input into the equation, we obtain

$$(0.0758 + 0.138) > 1.4\ (0.082)\ ?$$

$$(0.2138) > (0.1148)\ ?$$

Yes, thus the result is inconclusive without Condition 2b.

Condition 2b: Compare the two distributions to see if the elliptical distribution associated with v_1 protrudes beyond the elliptical borders of distribution v_2 by more than 40% of the radius (20% of the diameter) of v_2 at its furthest extent. If it does not, the vowel pair is said to exhibit *complete spectral overlap.* If complete spectral overlap is not indicated by either Condition 2 or Condition 3, then the vowel pair is said to exhibit *partial spectral overlap.*

Condition 2b is as follows:

$$(\Delta\text{Means} + r_{v1}) > 1.4\, r_{v2} \text{ ?}$$

From previous calculations:

r_{v1} * = 0.082
r_{v2} * = 0.138
$\Delta Means$ = 0.0758

So, when these numbers are input into the equation, we obtain

$$(0.0758 + 0.082) > 1.4\ (0.138) \text{ ?}$$

$$(0.158) > (0.193) \text{ ?}$$

No.

Because the answer to at least one of Conditions 2a and 2b was "no," the vowel pair can be said to exhibit *complete spectral overlap.*

APPENDIX D

Sample Conversation Transcript

The four pages that follow provide an excerpt of conversational session H (St. Thomas, basilect-dominant speakers) in order to demonstrate the manner in which conversational data were flagged for spectral and temporal measurement. Words which appeared as target items in the wordlist were flagged on the transcript--indicated by circles. These words were then located in the digitized sound file for the conversation and subsequently saved into individual soundfiles for acoustic analysis. Speaker S, who appears in this transcript, did not provide a wordlist reading, so her participation in the conversation was ignored. (The conversational task is described in §2.4.5 and Chapter 3).

Notes:

(1) (see transcript, line 12) Words which were derivatives of wordlist items, such as "beatin", the inflected form of word list item "beat", were not flagged.

(2) (see transcript, lines 10 and 13) Cliticized forms of words, such as "cause", as in the utterance " 'cause a mi come chrobl yu", were not flagged. Where "cause" appears as a verb, "Wa cause it", it was flagged.

1. TV.F Di judge nah go tell yu se, bwai at dat yu nuo, im tell yu se yu draw blood. So since yu draw blood, yu hafi go pae fa it <xxxx>
2. TJ.F An if im dead dem charge yu fi manslauta. Ar murda
3. TV.F Im not even se yu draw stain
4. I2 <@@@>
5. ALL <@@@>

42:00 6. TV.F Nah stain, yu hafi go pae fa it, yu draw blood
7. TJ.F Yes
8. TV.F 'Cau yu noh se dat nah go ova wid dat
9. TJ.F Any likl ting fi pae yu nuo. Suppose se mi an yu a fight an yu cut mi. From blood draw yu nuo, yu an a, dem a charge yu nuo. Dem a go se yu draw blood=
10. TV.F Wa cause it
11. TJ.F So dem hafi charge yu.
12. TV.F Maybe a noh even yu di first person du di hittin yu nuo. An noh yu du di beatin. A di ada person du di beatin.
13. TJ.F Den a noh dat aal, 'cause a mi come chrobl yu.
14. TV.F Yes. An man, tru yu love lick back blood draw
15. TJ.F So yu gi mi a harda lick an di blood come
16. I2 <@@@>
17. TJ.F An yurana a charge yu
18. I2 <@@@>
19. TJ.F 'Cau yu draw blood
20. TV.F Den noh so mi tell yu se bwai even
21. S Bot sometaim, not aal di taim, sometaim a self defense
22. TJ.F E-heh
23. S Yu will get we, bot yu pae wan likl money bot yu nuo.
24. TV.F Pae wan likl money is truu
25. S E-heh. Pae wan likl money an go home back
26. TV.F Sometaim yu pae wan likl money, di bwai se dat don' enuff, mi a go tek yu life becau yu draw mi blood
27. TJ.F E-heh
28. TV.F An yurana im nah tell im se ar mek im nuo se im noh fi du it
29. TJ.F Some a dem jus fiil se, <chirps>bwai jus kill yah man yah an jus dun
30. M Yeah
31. TJ.F Kill im, get rid of im
32. TV.F Im nah kill di man alone, especially if im inna a family
33. TJ.F Im uda kill out di hol family
34. TV.F Doun tu di very dawg
35. TJ.F <chirps> Chou
36. TV.F Nah leave noting, no stone unturn
37. ALL <@@@>
38. TV.F A we mi tell yu se dem wicked man
39. TJ.F Why dem di hafi go kill mi, mi dread man out so. Noh im dawg fuss dem did kill <@@@>
40. TV.F Yes
41. S Dem blow di bulb an dem kill im
42. TJ.F Dem kill im dawg fuss
43. TV.F Oh God
44. TJ.F An dem blow di bulb afta an den dem deal wid im case
45. TV.F Dem noh ramp fi kill a man
46. S Jus fi noting ataal
47. TJ.F Yu nuo. Fi lan, lan business. Di same lan yu nuo

48. S Well yu si, di poor innocent deh man
49. M Eh-heh, becau. Like wan day wen mi go a Macbay, mi ear wan bwai a cuss, mi waan back mi wara wara not money mi waan back mi money we mi gi dem becau dem sell di lan again pon mi
50. TV.F Den noh dat
51. M From mi pae mi money dem a sell it back
52. S A so mi a tell yu
53. M Mi noh waan nun, who
54. TJ.F Dats why mi not goin out dere go tek nun
55. S Mi noh waan nun
56. M Mama did go out dere go tek an pae tree tousand daala, <@@@>.
57. S Tree, neva a gi im sah, mi nah go go sah, mi nah go pae nun
58. TJ.F Mi noh nuo roun deh
59. M An mi noh waan nuo roun deh
60. TJ.F 'Cau mi nah jus go se mi a go tek lan, an noh nuo noting a go
61. I2 Uh-Uh
62. TJ.F An den dem a go tel yu se
63. S Yu gwaa country a go pae money every mont
64. TJ.F Yu hafi go pae dat deh money deh
65. TV.F An likl afta dat dem buldoza yu doun off deh
66. S Yu noh get back noting
67. TV.F Ah, den noh so, same ting, dem buldoza yu off
68. S Dem hav someting, meeting an yu gwaa meeting
69. TJ.F An yu gwaa how much meeting an everytaim yu go a meeting, yu hafi tro dues
70. M Yeah
71. ALL <@@@>
72. TJ.F A tell yu bwai
73. M Yu hafi tro dues nou
74. TJ.F An den nou, dem en up, 'cau mi ear se Marshal lick off dis big piece(...) Mussi a go hutel ar some store laik a so pon it
75. TV.F An im noh nuo how it come
76. TJ.F Tek ova aal a we di piipl dem tek
77. S An im hav so much, an im hav so much an im still waan more
78. TJ.F Yu nuo
79. TV.F Still waan more
46:00 80. TJ.F A so some a dem piipl stay. Dat's why some a dem a dead
81. M Want aal
82. TJ.F 'Cau dem no gi nobody noh bly
83. M Want aal, loose aal. Might noh live fi mek noh hutel. Might noh live fi mek noh hutel , so stay deh
84. S An im hav so much amongst di piipl dem
85. M Want aal loose aal man
86. TJ.F Im se a go mek hutel man
87. M Dem tuu craven
88. S Di rich a get richa an di poor a get poorer
89. TJ.F An, an deh <xxxx>
90. TV.F <xxxx>
91. M Di bibl se, di bible se fool an is money shaal *depart*
92. ALL *depart*
93. TJ.F An depart dem se im tek tu yu nuo
94. S Eh-heh
95. M Yes. Di bibl se a di fool an di money will depart an dat a noh lie
96. TV.F Is truu(...) is truu

97. S	Caan yu imagine
98. TV.F	Di man deh a mek im big barn an se bwai (...)
99. M	Yeah
100.TV.F	Mi fiil a get, arvest a come nuff nuff man an mi hav mi bannet full
101.I2	<@@@>
102.TV.F	Roun a back deh, mi hafi go puot on anada piece
103.M	Yes
104.TV.F	Mass Jesus pass an se, Emmm dis night yu soul require wid dee
105.TJ.F	EMMM
106.TV.F	Noh more barn nah mek. An im nah hav taim fi caal out Lard hav mercy becau massa God, massa Jesus se im ready fi yu, noh badda pass mi. Mi nah pass yu nida, so yu only caan come
107.ALL	Emm
108.TJ.F	So wen im ready fi yu wa yu caan do
109.M	Noting
110.TJ.F	Yu cyaa du noting
111.TV.F	Yu hafi move(...) We yu fi du
112.TJ.F	Im jus ready fi yu
113.TV.F	<@@@>
114.M	Song se wen God ready yu hafi move
115.I2	Yeah
116.M	So yu betta move
117.S	Yu got to go
118.M	<@@@>
119.TJ.F	Yu got to move
120.TV.F	Di masta an im gardna de a im yard yu nuo, di man tell im se <chirps>. Mi get wan dream lass night yu nuo, so im a tel di gardna yu nuo se deat se im a come fi mi certain an certain a our yu nuo. Im tell di man se yu nuo we mi a go du, im se a tonight im a come fi mi, so mi a go change clothes wid yu
121.S	Yeah
122.TV.F	Yu stay doun here so an mi go op so. So we yu tink im du, wen im di deat come back nou im si gardner sidoun dere so inna di clothes bot im nuo se a gardna, im se mi noh ready fi yu, mi a go opstairs. 'Cau di gardna opstairs an im leff an go kill off my man deh opstairs an di gardna sidoun deh so fi im deh clothes
123.S	Same way
124.TV.F	Im nay waan im, a noh im, im waan
125.TJ.F	Eh-heh
126.TV.F	A di wan opstairs im waan
127.TJ.F	Hmmm
128.S	<xxxx>
129.TV.F	So noh care we yu run
130.TJ.F	Noh care
131.TV.F ,M	Noh care we yu hide
132.TJ.F	Yu cyaa hide from God man
133.TV.F	An if yu fi get it yu will get it, yu a go get it. So don' need nobody taak se bwai (...)

APPENDIX E

Acoustic Study Tallies

The charts presented below provide summaries of vowel data subjected to acoustic analysis for each speaker, ordered by group, and reflect removal of words omitted from the final dataset (See §4.3). r-colored vowels were not analyzed acoustically, and are not included in these counts. While word list and conversational data were elicited for speakers in both the St. Thomas and Kingston groups, picture data were elicited for the St. Thomas group alone.

Summary of Acoustic Study Data: All speakers, All Tasks

Individual Data Tallies

Speaker	Wordlist*	Conversation	Picture	Speaker Total
KC.f	201	18	.	219
KD.f	688	17	.	705
KE.m	690	46	.	736
KF.f	688	18	.	706
KM.m	684	51	.	735
KR.m	682	5	.	687
KT.f	682	34	.	716
KU.m	687	39	.	726
KW.m	665	50	.	715
TA.m	594	47	47	688
TB.m	606	19	25	650
TE.m	674	52	37	763
TH.m	427	26	43	496
TI.m	0	27	26	53
TJ.f	525	54	49	628
TL.f	681	31	37	749
TM.f	520	48	4	572
TT.f	688	37	51	776
TV.f	665	66	58	789
TX.m	512	19	29	560
n=20	11,559	704	406	12,669

Conversational Data, By Group

Conversation (# speakers analyzed)	no. of pages	no. of words	playing time	transcriber
Tape A (1)+	2	.	0:02:00	T2
Tape B (3)	25	134	0:39:12	T2
Tape C (3)	42	89	0:36:00	T1
Tape E (2)	26	125	1:18:33	T1
Tape F (3)	53	144	1:01:54	T2
Tape G (3)	11	77	1:07:11	T2
Tape H (3)	52	99	2:10:05	T1,2
Tape J (1)	45	20	1:20:37	T1
Tape K (2)	28	871	1:03:53	T1
totals	284	1559	9:19:25	

+Tape A was the tape from which the Labelling Task excerpt was taken. Data were transcribed, but not subjected to acoustic analysis.

Speaker-by-Speaker Tallies

The charts given in the following pages present counts of vowel data subjected to acoustic analysis for each speaker, further grouped into separate tables for each task. A total count of words analyzed for a given speaker across all tasks (sessions) is provided in the top right corner of each set of charts. Counts reflect the removal of words omitted from the final dataset. Phonetic symbols in the first column represent the orthographic category associated with a particular set of vowels, not the actual phonetic realization of a particular speaker. Words listed in the second column (e.g., "keyed") exemplify the vowel associated with a particular orthographic category, however, values for that row include data averaged across all consonant contexts. Number of vowel tokens analyzed for a given category are presented in the third column. The remaining columns present means and standard deviations for the first and second formants. Means are in plain type, standard deviations are italicized. Columns headed "F1" and "F2" provide means and standard deviations in Hertz; columns headed "F1 (log Hz)" and "F2 (log Hz)" provide means and standard deviations of log-mean normalized Hertz data. Duration means and standard deviations are given in seconds.

Wordlist Data: Speaker total across all sessic 219

Speaker	KC.f	*n*	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	*18*	357.22	*27.89*	-0.12	*0.03*	2503.56	*81.60*	0.24	*0.01*	0.108	*0.022*
ɪ	"kid"	*17*	394.82	*22.77*	-0.08	*0.03*	2256.47	*124.64*	0.20	*0.02*	0.063	*0.014*
e: [ie]	"Kate"	*16*	383.25	*32.68*	-0.09	*0.04*	2302.25	*131.98*	0.21	*0.03*	0.123	*0.018*
ɛ	"Ken"	*20*	527.10	*33.04*	0.04	*0.03*	1973.00	*102.74*	0.14	*0.02*	0.093	*0.012*
a	"can"	*20*	693.95	*37.71*	0.16	*0.02*	1413.20	*161.81*	-0.01	*0.05*	0.110	*0.023*
ɑ:	"cause"	*5*	658.40	*24.73*	0.14	*0.02*	1240.00	*93.35*	-0.06	*0.03*	0.158	*0.009*
o [uo]	"coat"	*15*	424.47	*46.23*	-0.05	*0.05*	790.40	*75.64*	-0.26	*0.04*	0.122	*0.017*
ɔ	"cot"	*18*	677.83	*33.52*	0.15	*0.02*	1225.56	*59.22*	-0.07	*0.02*	0.101	*0.022*
u:	"coos"	*22*	359.64	*38.87*	-0.12	*0.04*	791.05	*145.32*	-0.26	*0.07*	0.116	*0.029*
ʊ	"cook"	*3*	394.33	*32.62*	-0.08	*0.04*	753.00	*150.57*	-0.28	*0.08*	0.051	*0.007*
ʌ	"cud"	*25*	562.72	*25.35*	0.07	*0.02*	1074.40	*105.17*	-0.13	*0.04*	0.094	*0.016*
aɪ	"kite"	*14*	665.43	*28.76*	0.15	*0.02*	1666.71	*109.97*	0.07	*0.03*	0.153	*0.011*
aʊ	"cowed"	*7*	519.43	*31.49*	0.04	*0.03*	965.29	*47.29*	-0.17	*0.02*	0.139	*0.023*
ɔɪ	"coin"	*1*	710.00	-	0.17	-	1205.00	-	-0.07	-	0.129	-
total:		*201*										

Conversational Data:

Speaker	KC.f	*n*	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	*0*	-	-	-	-	-	-	-	-	-	-
ɪ	"kid"	*0*	-	-	-	-	-	-	-	-	-	-
e: [ie]	"Kate"	*0*	-	-	-	-	-	-	-	-	-	-
ɛ	"Ken"	*0*	-	-	-	-	-	-	-	-	-	-
a	"can"	*9*	698.56	*111.87*	0.16	*0.08*	1693.33	*77.73*	0.07	*0.02*	0.132	*0.047*
ɑ:	"cause"	*0*	-	-	-	-	-	-	-	-	-	-
o [uo]	"coat"	*3*	553.67	*43.50*	0.07	*0.03*	1159.00	*81.26*	-0.09	*0.03*	0.132	*0.044*
ɔ	"cot"	*2*	738.50	*61.52*	0.19	*0.04*	1417.00	*55.15*	0.00	*0.02*	0.133	*0.022*
u:	"coos"	*0*	-	-	-	-	-	-	-	-	-	-
ʊ	"cook"	*0*	-	-	-	-	-	-	-	-	-	-
ʌ	"cud"	*2*	630.00	*0.00*	0.12	*0.00*	1428.50	*84.15*	0.00	*0.03*	0.077	*0.029*
aɪ	"kite"	*1*	728.00	-	0.19	-	1912.00	-	0.13	-	0.260	-
aʊ	"cowed"	*1*	565.00	-	0.08	-	1054.00	-	-0.13	-	0.169	-
ɔɪ	"coin"	*0*	-	-	-	-	-	-	-	-	-	-
total:		*18*										

Wordlist Data: Speaker total across all sessic 705

Speaker	KD.f	n	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	60	367.62	37.14	-0.16	0.05	2547.90	93.43	0.20	0.02	0.132	0.031
ɪ	"kid"	63	418.43	33.07	-0.10	0.04	2270.08	229.04	0.15	0.06	0.077	0.025
e: [ie]	"Kate"	56	422.77	33.57	-0.09	0.03	2316.34	155.62	0.16	0.03	0.151	0.033
ε	"Ken"	64	596.05	77.59	0.05	0.05	2044.59	83.13	0.10	0.02	0.104	0.020
a	"can"	64	802.36	45.40	0.18	0.03	1688.77	121.72	0.02	0.03	0.120	0.025
ɑ:	"cause"	16	781.56	61.04	0.17	0.04	1343.88	135.11	-0.08	0.04	0.183	0.019
o [uo]	"coat"	51	459.71	43.73	-0.06	0.04	1032.47	260.35	-0.20	0.07	0.154	0.035
ɔ	"cot"	67	796.28	42.60	0.18	0.02	1384.64	123.09	-0.07	0.04	0.122	0.041
u:	"coos"	71	422.59	34.24	-0.09	0.03	977.86	178.99	-0.22	0.07	0.135	0.032
ʊ	"cook"	12	454.42	36.84	-0.06	0.03	1041.50	203.21	-0.20	0.08	0.062	0.016
ʌ	"cud"	88	641.07	56.87	0.09	0.04	1275.58	153.21	-0.10	0.05	0.101	0.026
aɪ	"kite"	48	729.63	86.10	0.14	0.06	1928.77	243.62	0.07	0.08	0.183	0.032
aʊ	"cowed"	24	632.13	97.96	0.08	0.07	1100.58	122.98	-0.17	0.05	0.188	0.032
ɔɪ	"coin"	4	723.75	153.53	0.13	0.10	1515.00	49.87	-0.03	0.01	0.185	0.043
total:		688										

Conversational Data:

Speaker	KD.f	n	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	0	-	-	-	-	-	-	-	-	-	-
ɪ	"kid"	6	437.83	77.96	0.58	0.04	2015.17	192.39	-0.57	0.10	0.081	0.014
e: [ie]	"Kate"	2	445.00	107.48	-0.08	0.11	2167.50	38.89	0.13	0.01	0.142	0.037
ε	"Ken"	0	-	-	-	-	-	-	-	-	-	-
a	"can"	4	646.25	75.54	0.09	0.05	1681.25	243.26	0.02	0.06	0.105	0.019
ɑ:	"cause"	0	-	-	-	-	-	-	-	-	-	-
o [uo]	"coat"	4	496.75	57.93	-0.03	0.05	1205.25	224.14	-0.13	0.09	0.140	0.006
ɔ	"cot"	0	-	-	-	-	-	-	-	-	-	-
u:	"coos"	0	-	-	-	-	-	-	-	-	-	-
ʊ	"cook"	0	-	-	-	-	-	-	-	-	-	-
ʌ	"cud"	1	597.00	-	0.06	-	1499.00	-	-0.03	-	0.152	-
aɪ	"kite"	0	-	-	-	-	-	-	-	-	-	-
aʊ	"cowed"	0	-	-	-	-	-	-	-	-	-	-
ɔɪ	"coin"	0	-	-	-	-	-	-	-	-	-	-
total:		17										

Wordlist Data: Speaker total across all sessic 736

Speaker	KE.m	*n*	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	*60*	291.02	*32.34*	-0.19	*0.05*	2326.98	*86.62*	0.19	*0.02*	0.126	*0.030*
ɪ	"kid"	*64*	358.72	*34.56*	-0.10	*0.04*	2175.34	*83.35*	0.16	*0.02*	0.069	*0.024*
e: [ie]	"Kate"	*56*	374.39	*24.90*	-0.08	*0.03*	2217.80	*58.78*	0.17	*0.01*	0.133	*0.033*
ɛ	"Ken"	*64*	521.70	*26.44*	0.06	*0.02*	1936.44	*91.91*	0.11	*0.02*	0.096	*0.022*
a	"can"	*64*	718.53	*40.22*	0.20	*0.02*	1447.70	*99.33*	-0.01	*0.03*	0.115	*0.030*
ɑ:	"cause"	*16*	582.94	*24.88*	0.11	*0.02*	1063.94	*55.55*	-0.15	*0.02*	0.175	*0.020*
o [uo]	"coat"	*52*	433.27	*49.68*	-0.02	*0.05*	908.88	*70.08*	-0.22	*0.03*	0.135	*0.029*
ɔ	"cot"	*68*	661.04	*46.41*	0.16	*0.03*	1186.94	*96.51*	-0.10	*0.03*	0.110	*0.040*
u:	"coos"	*72*	338.71	*65.72*	-0.13	*0.07*	931.42	*247.91*	-0.22	*0.10*	0.133	*0.032*
ʊ	"cook"	*12*	407.50	*75.22*	-0.05	*0.07*	996.42	*231.52*	-0.18	*0.09*	0.049	*0.014*
ʌ	"cud"	*87*	564.39	*36.64*	0.10	*0.03*	1170.14	*117.04*	-0.11	*0.04*	0.098	*0.031*
aɪ	"kite"	*47*	666.15	*44.05*	0.17	*0.03*	1694.87	*104.59*	0.06	*0.03*	0.176	*0.038*
aʊ	"cowed"	*24*	543.79	*48.90*	0.08	*0.04*	1043.54	*88.43*	-0.16	*0.04*	0.159	*0.024*
ɔɪ	"coin"	*4*	630.75	*27.00*	0.14	*0.02*	1326.75	*61.37*	-0.05	*0.02*	0.146	*0.014*
total:		*690*										

Conversational Data:

Speaker	KE.m	*n*	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	*0*	-	-	-	-	-	-	-	-	-	-
ɪ	"kid"	*4*	363.50	*31.75*	-0.10	*0.04*	1971.25	*121.50*	0.12	*0.03*	0.074	*0.031*
e: [ie]	"Kate"	*1*	369.00	-	-0.09	-	2086.00	-	0.15	-	0.105	-
ɛ	"Ken"	*4*	539.00	*87.14*	0.07	*0.07*	1882.75	*80.03*	0.10	*0.02*	0.112	*0.032*
a	"can"	*12*	633.25	*82.88*	0.14	*0.06*	1556.08	*204.42*	0.02	*0.06*	0.078	*0.028*
ɑ:	"cause"	*0*	-	-	-	-	-	-	-	-	-	-
o [uo]	"coat"	*5*	448.20	*34.93*	0.00	*0.03*	1069.40	*336.68*	-0.16	*0.12*	0.105	*0.020*
ɔ	"cot"	*5*	619.80	*24.49*	0.14	*0.02*	1181.80	*135.74*	-0.10	*0.05*	0.168	*0.050*
u:	"coos"	*0*	-	-	-	-	-	-	-	-	-	-
ʊ	"cook"	*0*	-	-	-	-	-	-	-	-	-	-
ʌ	"cud"	*7*	481.57	*41.21*	0.03	*0.04*	1192.00	*150.98*	-0.10	*0.05*	0.056	*0.014*
aɪ	"kite"	*4*	645.75	*47.45*	0.15	*0.03*	1665.00	*47.36*	0.05	*0.01*	0.136	*0.025*
aʊ	"cowed"	*4*	569.00	*40.91*	0.10	*0.03*	1351.25	*254.36*	-0.05	*0.08*	0.117	*0.069*
ɔɪ	"coin"	*0*	-	-	-	-	-	-	-	-	-	-
total:		*46*										

Wordlist Data: Speaker total across all sessic 706

Speaker	KF.f	*n*	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
iː	"keyed"	*60*	284.02	*19.26*	-0.26	*0.03*	2673.62	*160.72*	0.22	*0.03*	0.125	*0.031*
ɪ	"kid"	*64*	440.63	*60.51*	-0.07	*0.06*	2368.20	*124.37*	0.17	*0.02*	0.065	*0.016*
eː [ie]	"Kate"	*56*	480.52	*32.91*	-0.03	*0.03*	2487.59	*80.56*	0.19	*0.01*	0.147	*0.031*
ɛ	"Ken"	*64*	627.09	*70.20*	0.08	*0.05*	2142.31	*193.33*	0.12	*0.06*	0.092	*0.020*
a	"can"	*64*	872.98	*51.62*	0.23	*0.03*	1718.58	*151.84*	0.03	*0.04*	0.110	*0.025*
ɑː	"cause"	*16*	673.13	*55.92*	0.12	*0.04*	1179.06	*83.96*	-0.14	*0.03*	0.185	*0.023*
o [uo]	"coat"	*50*	491.22	*73.33*	-0.02	*0.06*	991.20	*85.67*	-0.21	*0.04*	0.149	*0.039*
ɔ	"cot"	*67*	794.25	*59.41*	0.19	*0.03*	1323.93	*85.35*	-0.08	*0.03*	0.110	*0.035*
uː	"coos"	*72*	318.57	*35.52*	-0.21	*0.05*	972.64	*228.24*	-0.23	*0.08*	0.130	*0.035*
ʊ	"cook"	*12*	479.25	*37.64*	-0.03	*0.03*	983.33	*114.40*	-0.22	*0.05*	0.057	*0.015*
ʌ	"cud"	*88*	612.72	*65.41*	0.07	*0.05*	1191.56	*112.06*	-0.13	*0.04*	0.099	*0.030*
aɪ	"kite"	*48*	785.75	*68.31*	0.18	*0.04*	2056.44	*102.49*	0.11	*0.02*	0.169	*0.033*
aʊ	"cowed"	*24*	583.13	*80.69*	0.05	*0.06*	1109.13	*94.17*	-0.16	*0.04*	0.172	*0.039*
ɔɪ	"coin"	*3*	789.00	*22.34*	0.19	*0.01*	1627.67	*95.58*	0.01	*0.03*	0.138	*0.009*
total:		*688*										

Conversational Data:

Speaker	KF.f	*n*	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
iː	"keyed"	*0*	-	-	-	-	-	-	-	-	-	-
ɪ	"kid"	*0*	-	-	-	-	-	-	-	-	-	-
eː [ie]	"Kate"	*0*	-	-	-	-	-	-	-	-	-	-
ɛ	"Ken"	*0*	-	-	-	-	-	-	-	-	-	-
a	"can"	*9*	750.44	*153.69*	0.16	*0.09*	1582.33	*198.98*	-0.01	*0.05*	0.104	*0.030*
ɑː	"cause"	*0*	-	-	-	-	-	-	-	-	-	-
o [uo]	"coat"	*1*	728.00	-	0.15	-	956.00	-	-0.23	-	0.127	-
ɔ	"cot"	*2*	715.50	*217.08*	0.13	*0.13*	1374.00	*84.85*	-0.07	*0.03*	0.131	*0.012*
uː	"coos"	*0*	-	-	-	-	-	-	-	-	-	-
ʊ	"cook"	*2*	564.50	*153.44*	0.03	*0.12*	1077.00	*386.08*	-0.19	*0.16*	0.084	*0.001*
ʌ	"cud"	*4*	610.50	*83.00*	0.07	*0.06*	1423.25	*131.73*	-0.05	*0.04*	0.062	*0.008*
aɪ	"kite"	*0*	-	-	-	-	-	-	-	-	-	-
aʊ	"cowed"	*0*	-	-	-	-	-	-	-	-	-	-
ɔɪ	"coin"	*0*	-	-	-	-	-	-	-	-	-	-
total:		*18*										

Wordlist Data: Speaker total across all sessic 735

Speaker	KM.m	*n*	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	*60*	275.78	*18.49*	-0.21	*0.03*	2057.92	*53.49*	0.20	*0.01*	0.124	*0.034*
ɪ	"kid"	*64*	367.30	*23.99*	-0.09	*0.03*	1893.48	*80.81*	0.16	*0.02*	0.066	*0.019*
e: [ie]	"Kate"	*56*	414.00	*28.09*	-0.04	*0.03*	1875.50	*49.10*	0.16	*0.01*	0.142	*0.028*
ɛ	"Ken"	*60*	522.83	*46.72*	0.06	*0.04*	1658.43	*70.67*	0.11	*0.02*	0.110	*0.109*
a	"can"	*64*	675.67	*35.33*	0.18	*0.02*	1310.78	*75.06*	0.00	*0.02*	0.114	*0.025*
ɑ:	"cause"	*16*	598.44	*16.85*	0.12	*0.01*	999.75	*58.69*	-0.11	*0.03*	0.180	*0.024*
o [uo]	"coat"	*52*	441.44	*27.84*	-0.01	*0.03*	849.90	*152.22*	-0.19	*0.06*	0.142	*0.025*
ɔ	"cot"	*68*	657.12	*31.88*	0.16	*0.02*	1096.84	*61.75*	-0.07	*0.02*	0.109	*0.026*
u:	"coos"	*68*	330.15	*25.91*	-0.14	*0.03*	808.41	*224.36*	-0.22	*0.10*	0.133	*0.034*
ʊ	"cook"	*12*	409.17	*40.94*	-0.04	*0.04*	822.67	*81.08*	-0.20	*0.04*	0.057	*0.019*
ʌ	"cud"	*88*	518.44	*45.12*	0.06	*0.04*	962.82	*80.67*	-0.13	*0.04*	0.094	*0.029*
aɪ	"kite"	*48*	634.46	*38.83*	0.15	*0.03*	1526.98	*67.20*	0.07	*0.02*	0.178	*0.031*
aʊ	"cowed"	*24*	523.88	*43.13*	0.06	*0.03*	901.67	*59.73*	-0.16	*0.03*	0.169	*0.021*
ɔɪ	"coin"	*4*	692.25	*10.53*	0.19	*0.01*	1243.75	*99.40*	-0.02	*0.04*	0.166	*0.008*
total:		*684*										

Conversational Data:

Speaker	KM.m	*n*	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	2	369.00	*31.11*	-0.09	*0.04*	1999.00	*183.85*	0.19	*0.04*	0.073	*0.017*
ɪ	"kid"	4	407.25	*25.70*	-0.04	*0.03*	1947.50	*196.07*	0.17	*0.04*	0.081	*0.022*
e: [ie]	"Kate"	2	439.50	*7.78*	-0.01	*0.01*	1933.50	*77.07*	0.17	*0.02*	0.151	0.008
ɛ	"Ken"	*0*	-	-	-	-	-	-	-	-	-	-
a	"can"	6	648.00	*95.39*	0.15	*0.06*	1495.50	*278.55*	0.06	*0.08*	0.088	*0.018*
ɑ:	"cause"	*1*	673.00	-	0.18	-	1184.00	-	-0.04	-	0.129	-
o [uo]	"coat"	4	515.50	*19.05*	0.06	*0.02*	1018.25	*109.11*	-0.11	*0.05*	0.126	*0.034*
ɔ	"cot"	7	735.29	*55.26*	0.21	*0.03*	1229.43	*64.45*	-0.02	*0.02*	0.110	*0.012*
u:	"coos"	*0*	-	-	-	-	-	-	-	-	-	-
ʊ	"cook"	4	439.50	*48.03*	-0.01	*0.05*	1069.75	*101.12*	-0.09	*0.04*	0.056	*0.005*
ʌ	"cud"	*13*	548.00	*53.83*	0.08	*0.05*	1190.23	*288.10*	-0.05	*0.09*	0.085	*0.031*
aɪ	"kite"	2	651.50	*14.85*	0.16	*0.01*	1640.00	*15.56*	0.10	*0.00*	0.105	*0.013*
aʊ	"cowed"	4	575.75	*37.62*	0.11	*0.03*	1052.00	*57.93*	-0.09	*0.02*	0.153	*0.006*
ɔɪ	"coin"	2	624.50	*23.33*	0.14	*0.02*	1162.00	*123.04*	-0.05	*0.05*	0.111	*0.009*
total:		*51*										

Wordlist Data: Speaker total across all sessic 687

Speaker	KRm	*n*	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	*60*	256.28	*26.26*	-0.22	*0.04*	2361.83	*79.10*	0.22	*0.01*	0.140	*0.027*
ɪ	"kid"	*64*	317.89	*37.97*	-0.13	*0.05*	2166.95	*108.05*	0.18	*0.02*	0.066	*0.021*
e: [ie]	"Kate"	*54*	370.39	*35.69*	-0.06	*0.04*	2184.43	*84.50*	0.19	*0.02*	0.143	*0.032*
ɛ	"Ken"	*64*	499.50	*40.10*	0.07	*0.04*	1913.33	*62.33*	0.13	*0.01*	0.097	*0.014*
a	"can"	*61*	719.15	*46.81*	0.23	*0.03*	1476.49	*134.45*	0.02	*0.04*	0.123	*0.022*
ɑ:	"cause"	*16*	690.13	*49.13*	0.21	*0.03*	1153.88	*75.73*	-0.09	*0.03*	0.194	*0.014*
o [uo]	"coat"	*51*	377.65	*40.54*	-0.05	*0.05*	786.78	*91.03*	-0.26	*0.05*	0.131	*0.028*
ɔ	"cot"	*67*	698.93	*51.47*	0.22	*0.03*	1265.24	*233.11*	-0.05	*0.06*	0.116	*0.040*
u:	"coos"	*72*	285.26	*26.65*	-0.17	*0.04*	873.71	*428.12*	-0.25	*0.17*	0.138	*0.035*
ʊ	"cook"	*12*	341.83	*47.39*	-0.10	*0.06*	799.67	*88.33*	-0.25	*0.05*	0.057	*0.013*
ʌ	"cud"	*87*	527.69	*51.49*	0.09	*0.04*	1031.61	*137.46*	-0.14	*0.06*	0.095	*0.025*
aɪ	"kite"	*46*	680.41	*54.44*	0.20	*0.04*	1766.98	*67.39*	0.10	*0.02*	0.184	*0.029*
aʊ	"cowed"	*24*	470.54	*50.84*	0.04	*0.05*	881.38	*98.81*	-0.21	*0.05*	0.160	*0.031*
ɔɪ	"coin"	*4*	681.50	*140.35*	0.20	*0.09*	1632.25	*39.02*	0.06	*0.01*	0.149	*0.018*
total:		*682*										

Conversational Data:

Speaker	KRm	*n*	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	*0*	-	-	-	-	-	-	-	-	-	-
ɪ	"kid"	*0*	-	-	-	-	-	-	-	-	-	-
e: [ie]	"Kate"	2	396.00	*100.41*	-0.04	*0.11*	1830.50	*176.07*	0.11	*0.04*	0.159	0.028
ɛ	"Ken"	*0*	-	-	-	-	-	-	-	-	-	-
a	"can"	*1*	662.00	-	0.19	-	1619.00	-	0.06	-	0.097	-
ɑ:	"cause"	*0*	-	-	-	-	-	-	-	-	-	-
o [uo]	"coat"	2	646.00	*84.85*	0.18	*0.06*	1461.00	*69.30*	0.01	*0.02*	0.087	*0.004*
ɔ	"cot"	*0*	-	-	-	-	-	-	-	-	-	-
u:	"coos"	*0*	-	-	-	-	-	-	-	-	-	-
ʊ	"cook"	*0*	-	-	-	-	-	-	-	-	-	-
ʌ	"cud"	*0*	-	-	-	-	-	-	-	-	-	-
aɪ	"kite"	*0*	-	-	-	-	-	-	-	-	-	-
aʊ	"cowed"	*0*	-	-	-	-	-	-	-	-	-	-
ɔɪ	"coin"	*0*	-	-	-	-	-	-	-	-	-	-
total:		5										

Wordlist Data: Speaker total across all sessic 716

Speaker	KT.f	n	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	60	326.38	42.75	-0.19	0.06	2667.81	145.86	0.21	0.02	0.141	0.023
ɪ	"kid"	63	413.58	38.82	-0.09	0.04	2277.25	251.54	0.14	0.05	0.085	0.022
e: [ie]	"Kate"	56	410.43	37.66	-0.09	0.04	2334.05	150.69	0.15	0.03	0.163	0.027
ɛ	"Ken"	60	529.38	103.04	0.01	0.09	1979.27	223.26	0.08	0.06	0.114	0.020
a	"can"	64	823.47	60.04	0.21	0.03	1697.28	94.66	0.01	0.02	0.136	0.025
ɑ:	"cause"	16	803.25	71.56	0.20	0.04	1325.19	80.46	-0.09	0.03	0.199	0.024
o [uo]	"coat"	52	435.96	49.10	-0.06	0.05	980.98	181.63	-0.23	0.07	0.162	0.028
ɔ	"cot"	68	814.76	62.14	0.21	0.04	1434.90	127.34	-0.06	0.04	0.129	0.034
u:	"coos"	68	393.53	30.86	-0.11	0.04	1065.12	261.63	-0.20	0.10	0.145	0.037
ʊ	"cook"	12	426.83	21.91	-0.07	0.02	1094.25	196.68	-0.18	0.07	0.069	0.019
ʌ	"cud"	87	631.89	89.21	0.09	0.06	1352.30	176.81	-0.09	0.06	0.111	0.024
aɪ	"kite"	48	805.38	54.65	0.20	0.03	1883.23	127.05	0.06	0.03	0.199	0.027
aʊ	"cowed"	24	658.38	115.75	0.11	0.08	1302.71	534.65	-0.12	0.11	0.189	0.019
ɔɪ	"coin"	4	743.50	264.93	0.14	0.20	1333.25	339.11	-0.10	0.13	0.189	0.018
total:		682										

Conversational Data:

Speaker	KT.f	n	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	2	461.50	7.78	#NUM!	#NUM!	2466.00	31.11	#NUM!	#NUM!	0.088	0.029
ɪ	"kid"	5	485.60	118.00	-0.03	0.10	2079.40	281.18	0.10	0.06	0.085	0.021
e: [ie]	"Kate"	0	-	-	-	-	-	-	-	-	-	-
ɛ	"Ken"	0	-	-	-	-	-	-	-	-	-	-
a	"can"	10	712.20	84.13	0.15	0.05	1793.20	244.05	0.04	0.06	0.083	0.021
ɑ:	"cause"	0	-	-	-	-	-	-	-	-	-	-
o [uo]	"coat"	4	667.75	166.75	0.11	0.10	1453.00	194.31	-0.06	0.06	0.138	0.037
ɔ	"cot"	0	-	-	-	-	-	-	-	-	-	-
u:	"coos"	1	434.00	-	-0.06	-	788.00	-	-0.32	-	0.147	-
ʊ	"cook"	3	401.33	68.13	-0.10	0.08	1127.33	475.19	-0.19	0.19	0.076	0.024
ʌ	"cud"	3	575.00	131.64	0.05	0.11	1414.67	139.41	-0.07	0.04	0.087	0.038
aɪ	"kite"	3	778.33	44.84	0.19	0.03	2107.67	103.78	0.11	0.02	0.097	0.016
aʊ	"cowed"	3	615.33	222.52	0.07	0.17	1408.67	198.02	-0.07	0.06	0.099	0.063
ɔɪ	"coin"	0	-	-	-	-	-	-	-	-	-	-
total:		34										

Wordlist Data: Speaker total across all sessic 726

Speaker	KU.m	*n*	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
iː	"keyed"	*60*	282.07	*31.31*	-0.23	*0.05*	2594.73	*124.27*	0.23	*0.02*	0.138	*0.028*
ɪ	"kid"	*63*	374.21	*33.73*	-0.10	*0.04*	2327.65	*141.74*	0.18	*0.03*	0.087	*0.024*
eː [ie]	"Kate"	*54*	403.94	*50.29*	-0.07	*0.05*	2342.56	*104.00*	0.18	*0.02*	0.138	*0.032*
ɛ	"Ken"	*64*	577.52	*47.91*	0.09	*0.04*	2028.73	*117.93*	0.12	*0.03*	0.106	*0.025*
a	"can"	*64*	783.56	*68.69*	0.22	*0.04*	1602.88	*120.52*	0.02	*0.03*	0.120	*0.030*
ɑː	"cause"	*16*	727.50	*57.15*	0.19	*0.03*	1156.00	*67.26*	-0.12	*0.03*	0.180	*0.020*
o [uo]	"coat"	*52*	456.65	*71.77*	-0.02	*0.07*	899.31	*104.68*	-0.23	*0.05*	0.150	*0.037*
ɔ	"cot"	*68*	718.76	*52.66*	0.18	*0.03*	1237.72	*107.63*	-0.09	*0.04*	0.118	*0.037*
uː	"coos"	*72*	311.74	*44.52*	-0.18	*0.06*	959.46	*356.12*	-0.23	*0.13*	0.140	*0.032*
ʊ	"cook"	*12*	398.33	*42.30*	-0.07	*0.05*	971.33	*194.87*	-0.21	*0.08*	0.070	*0.021*
ʌ	"cud"	*88*	624.68	*44.20*	0.12	*0.03*	1166.32	*116.41*	-0.12	*0.04*	0.109	*0.031*
aɪ	"kite"	*47*	721.64	*55.46*	0.18	*0.03*	1759.47	*126.58*	0.06	*0.03*	0.172	*0.031*
aʊ	"cowed"	*23*	586.91	*70.06*	0.09	*0.05*	1055.22	*106.29*	-0.16	*0.04*	0.176	*0.035*
ɔɪ	"coin"	*4*	608.00	*38.18*	0.11	*0.03*	1394.75	*126.92*	-0.04	*0.04*	0.152	*0.019*
total:		*687*										

Conversational Data:

Speaker	KU.m	*n*	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
iː	"keyed"	*1*	239.00	-	-0.29	-	2358.00	-	0.19	-	0.127	-
ɪ	"kid"	*6*	400.00	*87.69*	-0.08	*0.09*	1926.67	*310.75*	0.09	*0.07*	0.061	*0.011*
eː [ie]	"Kate"	*0*	-	-	-	-	-	-	-	-	-	-
ɛ	"Ken"	*0*	-	-	-	-	-	-	-	-	-	-
a	"can"	*16*	584.31	*81.70*	0.09	*0.06*	1643.69	*188.46*	0.03	*0.05*	0.100	*0.018*
ɑː	"cause"	*0*	-	-	-	-	-	-	-	-	-	-
o [uo]	"coat"	*4*	494.00	*53.72*	0.02	*0.05*	1317.00	*235.35*	-0.07	*0.08*	0.145	*0.032*
ɔ	"cot"	*0*	-	-	-	-	-	-	-	-	-	-
uː	"coos"	*0*	-	-	-	-	-	-	-	-	-	-
ʊ	"cook"	*1*	402.00	-	-0.07	-	934.00	-	-0.22	-	0.105	-
ʌ	"cud"	*6*	492.00	*26.18*	0.02	*0.02*	1482.83	*119.71*	-0.02	*0.03*	0.079	*0.022*
aɪ	"kite"	*0*	-	-	-	-	-	-	-	-	-	-
aʊ	"cowed"	*5*	508.20	*90.95*	0.03	*0.09*	1266.20	*203.18*	-0.09	*0.07*	0.159	*0.025*
ɔɪ	"coin"	*0*	-	-	-	-	-	-	-	-	-	-
total:		*39*										

Wordlist Data: Speaker total across all sessic 715

Speaker	KW.m	*n*	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
iː	"keyed"	*55*	315.27	*40.67*	-0.16	*0.05*	2446.09	*165.75*	0.23	*0.03*	0.102	*0.022*
ɪ	"kid"	*62*	343.58	*39.87*	-0.12	*0.05*	2240.58	*76.19*	0.19	*0.01*	0.062	*0.016*
eː [ie]	"Kate"	*53*	353.04	*39.52*	-0.11	*0.05*	2286.74	*92.92*	0.20	*0.02*	0.116	*0.021*
ɛ	"Ken"	*64*	522.64	*40.30*	0.06	*0.03*	2000.59	*101.13*	0.14	*0.02*	0.088	*0.012*
a	"can"	*62*	699.76	*56.78*	0.19	*0.03*	1418.18	*135.86*	-0.01	*0.04*	0.106	*0.020*
ɑː	"cause"	*15*	682.13	*32.16*	0.18	*0.02*	1208.13	*68.33*	-0.07	*0.02*	0.154	*0.014*
o [uo]	"coat"	*49*	407.43	*49.88*	-0.05	*0.06*	834.37	*96.63*	-0.24	*0.05*	0.115	*0.019*
ɔ	"cot"	*63*	677.60	*46.41*	0.17	*0.03*	1227.87	*86.91*	-0.07	*0.03*	0.098	*0.024*
uː	"coos"	*71*	331.10	*35.45*	-0.14	*0.04*	824.32	*222.10*	-0.25	*0.08*	0.111	*0.030*
ʊ	"cook"	*12*	363.75	*28.90*	-0.10	*0.03*	825.42	*83.77*	-0.24	*0.04*	0.051	*0.010*
ʌ	"cud"	*84*	553.31	*33.04*	0.09	*0.03*	1079.13	*87.27*	-0.12	*0.04*	0.089	*0.019*
aɪ	"kite"	*47*	684.45	*51.39*	0.18	*0.03*	1638.94	*110.22*	0.06	*0.03*	0.154	*0.020*
aʊ	"cowed"	*24*	508.13	*34.47*	0.05	*0.03*	955.92	*74.71*	-0.18	*0.03*	0.138	*0.019*
ɔɪ	"coin"	*4*	712.50	*5.45*	0.20	*0.00*	1363.00	*113.21*	-0.02	*0.04*	0.136	*0.005*
total:		*665*										

Conversational Data:

Speaker	KW.m	*n*	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
iː	"keyed"	*1*	315.00	-	-0.16	-	2390.00	-	0.22	-	0.120	-
ɪ	"kid"	*4*	369.00	*65.89*	-0.09	*0.08*	2224.50	*249.31*	0.19	*0.05*	0.074	*0.023*
eː [ɨe]	"Kate"	*1*	282.00	-	-0.21	-	2260.00	-	0.20	-	0.176	-
ɛ	"Ken"	*0*	-	-	-	-	-	-	-	-	-	-
a	"can"	*17*	626.59	*113.11*	0.13	*0.08*	1528.47	*233.41*	0.02	*0.07*	0.104	*0.034*
ɑː	"cause"	*0*	-	-	-	-	-	-	-	-	-	-
o [uo]	"coat"	*4*	453.25	*72.42*	0.00	*0.07*	1232.75	*218.14*	-0.07	*0.07*	0.113	*0.038*
ɔ	"cot"	*2*	678.50	*7.78*	0.18	*0.00*	1260.00	*31.11*	-0.06	*0.01*	0.118	*0.003*
uː	"coos"	*0*	-	-	-	-	-	-	-	-	-	-
ʊ	"cook"	*4*	387.75	*42.10*	-0.07	*0.05*	1181.50	*315.28*	-0.10	*0.12*	0.070	*0.021*
ʌ	"cud"	*9*	499.22	*47.55*	0.04	*0.04*	1197.33	*200.94*	-0.08	*0.08*	0.096	*0.042*
aɪ	"kite"	*4*	523.75	*136.38*	0.05	*0.13*	1917.75	*41.16*	0.13	*0.01*	0.118	*0.027*
aʊ	"cowed"	*4*	512.75	*61.05*	0.05	*0.05*	1271.00	*67.05*	-0.05	*0.02*	0.100	*0.013*
ɔɪ	"coin"	*0*	-	-	-	-	-	-	-	-	-	-
total:		*50*										

Wordlist Data: Speaker total across all sessio 688

Speaker	TA.m	*n*	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	*48*	236.75	*21.19*	-0.22	*0.04*	2339.56	*131.84*	0.23	*0.03*	0.150	*0.046*
ɪ	"kid"	*55*	284.71	*57.09*	-0.14	*0.08*	2274.76	*117.54*	0.22	*0.02*	0.074	*0.029*
e: [ie]	"Kate"	*52*	276.23	*45.50*	-0.16	*0.07*	2285.25	*94.25*	0.22	*0.02*	0.145	*0.044*
ɛ	"Ken"	*50*	406.54	*53.40*	0.01	*0.06*	2122.64	*83.42*	0.19	*0.02*	0.101	*0.027*
a	"can"	*62*	657.79	*71.56*	0.22	*0.04*	1308.21	*191.08*	-0.02	*0.06*	0.124	*0.034*
ɑ:	"cause"	*12*	636.00	*83.40*	0.21	*0.05*	1159.67	*98.71*	-0.07	*0.04*	0.193	*0.047*
o [uo]	"coat"	*43*	344.84	*67.53*	-0.07	*0.10*	724.42	*84.04*	-0.28	*0.05*	0.147	*0.039*
ɔ	"cot"	*56*	654.71	*71.19*	0.22	*0.05*	1197.70	*106.72*	-0.06	*0.04*	0.111	*0.046*
u:	"coos"	*53*	278.34	*59.05*	-0.15	*0.08*	700.38	*112.69*	-0.30	*0.07*	0.167	*0.042*
ʊ	"cook"	*9*	331.22	*48.79*	-0.08	*0.07*	775.22	*101.27*	-0.25	*0.05*	0.086	*0.042*
ʌ	"cud"	*81*	472.67	*56.60*	0.08	*0.05*	910.01	*100.37*	-0.18	*0.05*	0.102	*0.030*
aɪ	"kite"	*46*	639.17	*69.12*	0.21	*0.06*	1579.41	*166.95*	0.06	*0.04*	0.186	*0.041*
aʊ	"cowed"	*23*	426.52	*104.19*	0.03	*0.11*	823.13	*114.37*	-0.22	*0.06*	0.179	*0.036*
ɔɪ	"coin"	*4*	581.00	*101.31*	0.17	*0.08*	1504.50	*118.25*	0.04	*0.03*	0.137	*0.014*
total:		*594*										

Conversational Data:

Speaker	TA.m	*n*	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	*4*	273.75	*48.69*	-0.16	*0.08*	2162.25	*38.68*	0.20	*0.01*	0.117	*0.002*
ɪ	"kid"	*6*	296.17	*36.05*	-0.12	*0.05*	2056.83	*107.95*	0.18	*0.02*	0.111	*0.027*
e: [ie]	"Kate"	*1*	358.00	-	-0.04	-	2347.00	-	0.23	-	0.063	-
ɛ	"Ken"	*0*	-	-	-	-	-	-	-	-	-	-
a	"can"	*17*	631.76	*100.45*	0.20	*0.07*	1282.29	*155.86*	-0.03	*0.05*	0.161	*0.111*
ɑ:	"cause"	*0*	-	-	-	-	-	-	-	-	-	-
o [uo]	"coat"	*5*	421.00	*61.14*	0.03	*0.06*	1190.20	*120.32*	-0.06	*0.05*	0.110	*0.013*
ɔ	"cot"	*1*	641.00	-	0.22	-	1238.00	-	-0.04	-	0.249	-
u:	"coos"	*0*	-	-	-	-	-	-	-	-	-	-
ʊ	"cook"	*5*	380.00	*7.78*	-0.01	*0.01*	1010.20	*180.07*	-0.14	*0.08*	0.086	*0.022*
ʌ	"cud"	*4*	469.50	*24.13*	0.08	*0.02*	1048.00	*123.56*	-0.12	*0.05*	0.113	*0.026*
aɪ	"kite"	*2*	651.50	*30.41*	0.22	*0.02*	1542.50	*61.52*	0.05	*0.02*	0.130	*0.001*
aʊ	"cowed"	*2*	488.50	*61.52*	0.10	*0.05*	1379.50	*245.37*	0.00	*0.08*	0.075	*0.002*
ɔɪ	"coin"	*0*	-	-	-	-	-	-	-	-	-	-
total:		*47*										

Picture Data:

Speaker	TA.m	*n*	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	*9*	251.33	*40.63*	-0.19	*0.06*	2316.44	*109.38*	0.23	*0.02*	0.123	*0.038*
ɪ	"kid"	*7*	358.00	*70.60*	-0.04	*0.08*	2199.43	*115.89*	0.21	*0.02*	0.091	*0.028*
e: [ie]	"Kate"	*0*	-	-	-	-	-	-	-	-	-	-
ɛ	"Ken"	*2*	445.00	*46.67*	0.06	*0.05*	2097.00	*91.92*	0.19	*0.02*	0.108	*0.019*
a	"can"	*6*	696.83	*47.36*	0.25	*0.03*	1316.17	*148.07*	-0.02	*0.05*	0.125	*0.032*
ɑ:	"cause"	*0*	-	-	-	-	-	-	-	-	-	-
o [uo]	"coat"	*0*	-	-	-	-	-	-	-	-	-	-
ɔ	"cot"	*6*	696.67	*47.18*	0.25	*0.03*	1359.50	*93.81*	0.00	*0.03*	0.134	*0.064*
u:	"coos"	*3*	278.67	*38.11*	-0.15	*0.06*	702.33	*35.36*	-0.29	*0.02*	0.178	*0.016*
ʊ	"cook"	*3*	359.67	*74.33*	-0.04	*0.09*	743.67	*70.44*	-0.27	*0.04*	0.098	*0.005*
ʌ	"cud"	*4*	623.25	*122.58*	0.20	*0.08*	968.00	*77.65*	-0.15	*0.03*	0.078	*0.041*
aɪ	"kite"	*5*	684.20	*50.20*	0.24	*0.03*	1568.80	*121.46*	0.06	*0.03*	0.171	*0.034*
aʊ	"cowed"	*1*	499.00	-	0.11	-	728.00	-	-0.27	-	0.259	-
ɔɪ	"coin"	*1*	788.00	-	0.31	-	1423.00	-	0.02	-	0.173	-
total:		*47*										

Wordlist Data: Speaker total across all sessic 650

Speaker	TB.m	n	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	54	292.91	32.89	-0.20	0.05	2217.48	157.65	0.18	0.03	0.136	0.023
ɪ	"kid"	55	364.69	35.86	-0.11	0.05	2166.95	137.69	0.17	0.03	0.083	0.022
e: [ie]	"Kate"	40	440.33	47.42	-0.02	0.04	2016.90	111.19	0.14	0.02	0.143	0.019
ɛ	"Ken"	55	505.02	26.39	0.04	0.02	1867.64	86.89	0.11	0.02	0.105	0.015
a	"can"	55	693.53	45.16	0.17	0.03	1465.93	150.35	0.00	0.05	0.124	0.020
ɑ:	"cause"	13	685.85	33.25	0.17	0.02	1337.00	126.58	-0.04	0.04	0.171	0.019
o [uo]	"coat"	46	447.83	44.98	-0.02	0.04	935.72	127.32	-0.20	0.06	0.146	0.018
ɔ	"cot"	65	683.48	52.82	0.17	0.03	1359.71	148.27	-0.03	0.05	0.126	0.035
u:	"coos"	60	344.67	43.42	-0.13	0.06	874.92	212.78	-0.23	0.09	0.146	0.023
ʊ	"cook"	12	335.42	53.25	-0.15	0.07	805.92	148.33	-0.26	0.08	0.083	0.028
ʌ	"cud"	78	537.94	41.88	0.06	0.03	1152.17	183.69	-0.11	0.07	0.113	0.026
aɪ	"kite"	46	671.26	49.42	0.16	0.03	1685.41	93.44	0.06	0.03	0.164	0.015
aʊ	"cowed"	23	526.22	48.38	0.05	0.04	1088.13	127.52	-0.13	0.05	0.158	0.025
ɔɪ	"coin"	4	727.25	29.30	0.19	0.02	1599.75	147.32	0.04	0.04	0.146	0.022
total:		606										

Conversational Data:

Speaker	TB.m	n	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	2	282.00	31.11	-0.22	0.05	2391.50	78.49	0.22	0.01	0.094	0.011
ɪ	"kid"	1	391.00	-	-0.07	-	2162.00	-	0.17	-	0.052	-
e: [ie]	"Kate"	1	510.00	-	0.04	-	2216.00	-	0.18	-	0.104	-
ɛ	"Ken"	1	467.00	-	0.00	-	2010.00	-	0.14	-	0.080	-
a	"can"	10	699.30	61.77	0.18	0.04	1599.00	158.29	0.04	0.05	0.110	0.024
ɑ:	"cause"	0	-	-	-	-	-	-	-	-	-	-
o [uo]	"coat"	0	-	-	-	-	-	-	-	-	-	-
ɔ	"cot"	0	-	-	-	-	-	-	-	-	-	-
u:	"coos"	0	-	-	-	-	-	-	-	-	-	-
ʊ	"cook"	0	-	-	-	-	-	-	-	-	-	-
ʌ	"cud"	0	-	-	-	-	-	-	-	-	-	-
aɪ	"kite"	2	630.00	91.92	0.13	0.06	1797.50	115.26	0.09	0.03	0.127	0.023
aʊ	"cowed"	2	504.50	23.33	0.04	0.02	1347.00	46.67	-0.03	0.02	0.080	0.028
ɔɪ	"coin"	0	-	-	-	-	-	-	-	-	-	-
total:		19										

Picture Data:

Speaker	TB.m	n	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	5	251.80	40.12	-0.27	0.06	2265.20	99.91	0.19	0.02	0.177	0.038
ɪ	"kid"	4	380.00	20.08	-0.09	0.02	2053.25	96.62	0.15	0.02	0.097	0.044
e: [ie]	"Kate"	0	-	-	-	-	-	-	-	-	-	-
ɛ	"Ken"	1	510.00	-	0.04	-	1792.00	-	0.09	-	0.166	-
a	"can"	6	680.50	42.51	0.17	0.03	1506.33	143.35	0.01	0.04	0.129	0.024
ɑ:	"cause"	0	-	-	-	-	-	-	-	-	-	-
o [uo]	"coat"	0	-	-	-	-	-	-	-	-	-	-
ɔ	"cot"	4	646.25	50.74	0.14	0.03	1355.25	57.71	-0.03	0.02	0.130	0.045
u:	"coos"	0	-	-	-	-	-	-	-	-	-	-
ʊ	"cook"	0	-	-	-	-	-	-	-	-	-	-
ʌ	"cud"	0	-	-	-	-	-	-	-	-	-	-
aɪ	"kite"	3	636.67	24.83	0.14	0.02	1611.67	65.31	0.04	0.02	0.197	0.008
aʊ	"cowed"	1	510.00	-	0.04	-	1064.00	-	-0.14	-	0.209	-
ɔɪ	"coin"	1	760.00	-	0.21	-	1521.00	-	0.02	-	0.134	-
total:		25										

Wordlist Data: Speaker total across all sessic 763

Speaker	TE.m	n	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	60	280.95	39.98	-0.22	0.06	2338.58	129.02	0.20	0.02	0.135	0.025
ɪ	"kid"	64	364.45	56.85	-0.10	0.07	2168.97	138.79	0.16	0.03	0.083	0.019
e: [ie]	"Kate"	49	422.18	24.03	-0.04	0.02	2023.55	92.70	0.13	0.02	0.142	0.023
ɛ	"Ken"	64	501.47	30.69	0.04	0.03	1875.09	72.62	0.10	0.02	0.103	0.015
a	"can"	64	702.08	47.52	0.18	0.03	1474.17	147.25	-0.01	0.04	0.120	0.019
ɑ:	"cause"	16	701.81	32.26	0.18	0.02	1393.31	129.11	-0.03	0.04	0.174	0.018
o [uo]	"coat"	50	444.98	52.61	-0.02	0.05	982.86	208.27	-0.19	0.08	0.144	0.015
ɔ	"cot"	68	688.31	70.69	0.17	0.05	1375.57	157.14	-0.04	0.05	0.123	0.033
u:	"coos"	67	342.76	50.23	-0.13	0.06	921.10	266.35	-0.22	0.11	0.142	0.018
ʊ	"cook"	12	336.08	36.83	-0.14	0.05	817.50	119.85	-0.26	0.06	0.084	0.020
ʌ	"cud"	85	546.28	54.82	0.07	0.04	1171.04	191.71	-0.11	0.07	0.109	0.026
aɪ	"kite"	47	677.32	52.89	0.17	0.03	1679.64	95.04	0.05	0.03	0.164	0.015
aʊ	"cowed"	24	536.04	39.14	0.07	0.03	1119.29	136.38	-0.13	0.05	0.155	0.017
ɔɪ	"coin"	4	743.75	25.70	0.21	0.02	1591.50	148.97	0.03	0.04	0.147	0.018
total:		674										

Conversational Data:

Speaker	TE.m	n	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	3	278.33	33.61	-0.22	0.05	2259.33	37.53	0.18	0.01	0.093	0.063
ɪ	"kid"	5	356.00	105.01	-0.13	0.13	2016.20	196.56	0.13	0.04	0.053	0.018
e: [ie]	"Kate"	1	445.00	-	-0.01	-	2075.00	-	0.15	-	0.115	-
ɛ	"Ken"	1	467.00	-	0.01	-	1955.00	-	0.12	-	0.099	-
a	"can"	17	672.53	52.54	0.16	0.04	1452.35	148.41	-0.01	0.04	0.094	0.021
ɑ:	"cause"	0	-	-	-	-	-	-	-	-	-	-
o [uo]	"coat"	0	-	-	-	-	-	-	-	-	-	-
ɔ	"cot"	0	-	-	-	-	-	-	-	-	-	-
u:	"coos"	1	434.00	-	-0.02	-	1086.00	-	-0.14	-	0.076	-
ʊ	"cook"	5	385.80	148.30	-0.11	0.19	1112.20	139.47	-0.13	0.06	0.060	0.024
ʌ	"cud"	13	537.08	53.05	0.07	0.04	1252.62	189.00	-0.08	0.07	0.083	0.023
aɪ	"kite"	1	662.00	-	0.16	-	1749.00	-	0.07	-	0.084	-
aʊ	"cowed"	5	538.40	81.12	0.07	0.06	1329.40	293.00	-0.06	0.11	0.090	0.028
ɔɪ	"coin"	0	-	-	-	-	-	-	-	-	-	-
total:		52										

Picture Data:

Speaker	TE.m	n	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	6	244.00	25.80	-0.28	0.05	2244.83	139.84	0.18	0.03	0.178	0.042
ɪ	"kid"	4	352.50	22.90	-0.12	0.03	2088.50	83.05	0.15	0.02	0.080	0.013
e: [ie]	"Kate"	0	-	-	-	-	-	-	-	-	-	-
ɛ	"Ken"	1	510.00	-	0.05	-	1792.00	-	0.08	-	0.168	-
a	"can"	7	682.43	37.27	0.17	0.02	1486.57	144.02	0.00	0.04	0.141	0.033
ɑ:	"cause"	0	-	-	-	-	-	-	-	-	-	-
o [uo]	"coat"	0	-	-	-	-	-	-	-	-	-	-
ɔ	"cot"	4	643.50	45.67	0.15	0.03	1355.00	54.42	-0.04	0.02	0.126	0.043
u:	"coos"	3	329.00	61.99	-0.15	0.09	909.33	211.67	-0.22	0.10	0.201	0.029
ʊ	"cook"	2	325.00	0.00	-0.15	0.00	761.00	121.62	-0.29	0.07	0.082	0.013
ʌ	"cud"	4	532.00	17.96	0.06	0.01	1072.50	87.69	-0.14	0.03	0.104	0.019
aɪ	"kite"	4	662.25	46.36	0.16	0.03	1613.00	40.12	0.04	0.01	0.187	0.013
aʊ	"cowed"	1	499.00	-	0.04	-	1054.00	-	-0.15	-	0.231	-
ɔɪ	"coin"	1	749.00	-	0.21	-	1608.00	-	0.03	-	0.181	-
total:		37										

Wordlist Data: Speaker total across all sessic 496

Speaker	THm	n	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	40	274.13	37.27	-0.17	0.06	2315.30	120.45	0.19	0.02	0.122	0.025
ɪ	"kid"	42	324.45	36.28	-0.10	0.05	2161.64	131.74	0.16	0.03	0.069	0.018
e: [ie]	"Kate"	29	367.76	47.15	-0.05	0.06	2164.21	167.80	0.16	0.04	0.140	0.028
ɛ	"Ken"	47	443.55	24.57	0.04	0.02	1909.38	94.01	0.11	0.02	0.083	0.019
a	"can"	45	561.98	60.52	0.14	0.05	1437.76	218.38	-0.02	0.07	0.103	0.028
ɑ:	"cause"	11	525.00	71.42	0.11	0.06	1126.64	136.81	-0.12	0.05	0.155	0.034
o [uo]	"coat"	29	414.24	31.49	0.01	0.03	831.79	122.60	-0.25	0.07	0.143	0.028
ɔ	"cot"	36	523.86	60.52	0.11	0.05	1159.50	149.97	-0.11	0.05	0.118	0.045
u:	"coos"	24	344.96	52.65	-0.08	0.06	935.96	187.78	-0.21	0.08	0.136	0.025
ʊ	"cook"	10	379.80	39.31	-0.03	0.05	1067.10	274.94	-0.15	0.11	0.059	0.011
ʌ	"cud"	61	473.48	28.93	0.07	0.03	1105.03	153.10	-0.13	0.06	0.091	0.028
aɪ	"kite"	35	534.80	87.75	0.11	0.07	1774.14	151.48	0.08	0.04	0.158	0.026
aʊ	"cowed"	14	421.71	36.47	0.01	0.04	913.36	111.69	-0.21	0.05	0.154	0.019
ɔɪ	"coin"	4	455.75	37.62	0.05	0.03	1857.75	117.33	0.10	0.03	0.132	0.021
total:		427										

Conversational Data:

Speaker	THm	n	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	1	293.00	-	-0.14	-	1934.00	-	0.12	-	0.147	-
ɪ	"kid"	2	293.00	31.11	-0.14	0.05	2129.50	61.52	0.16	0.01	0.059	0.023
e: [ie]	"Kate"	2	407.00	53.74	0.00	0.06	1944.50	92.63	0.12	0.02	0.091	0.023
ɛ	"Ken"	0	-	-	-	-	-	-	-	-	-	-
a	"can"	9	550.11	40.40	0.13	0.03	1506.33	215.39	0.00	0.06	0.121	0.031
ɑ:	"cause"	0	-	-	-	-	-	-	-	-	-	-
o [uo]	"coat"	3	419.67	109.05	0.00	0.11	1257.67	415.14	-0.09	0.15	0.162	0.027
ɔ	"cot"	1	597.00	-	0.17	-	1162.00	-	-0.10	-	0.227	-
u:	"coos"	0	-	-	-	-	-	-	-	-	-	-
ʊ	"cook"	2	374.00	69.30	-0.04	0.08	844.00	79.20	-0.24	0.04	0.171	0.052
ʌ	"cud"	4	483.00	69.86	0.07	0.06	1124.50	74.59	-0.12	0.03	0.148	0.038
aɪ	"kite"	2	510.50	45.96	0.10	0.04	1569.50	345.78	0.02	0.10	0.124	0.019
aʊ	"cowed"	0	-	-	-	-	-	-	-	-	-	-
ɔɪ	"coin"	0	-	-	-	-	-	-	-	-	-	-
total:		26										

Picture Data:

Speaker	THm	n	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	6	245.67	22.35	-0.22	0.04	2209.83	121.28	0.17	0.03	0.131	0.038
ɪ	"kid"	4	349.75	20.82	-0.07	0.03	2091.75	21.33	0.15	0.00	0.063	0.013
e: [ie]	"Kate"	0	-	-	-	-	-	-	-	-	-	-
ɛ	"Ken"	2	450.50	38.89	0.04	0.04	1950.00	53.74	0.12	0.01	0.117	0.005
a	"can"	6	582.67	41.38	0.16	0.03	1493.67	166.70	0.00	0.05	0.104	0.031
ɑ:	"cause"	0	-	-	-	-	-	-	-	-	-	-
o [uo]	"coat"	0	-	-	-	-	-	-	-	-	-	-
ɔ	"cot"	4	643.00	31.10	0.20	0.02	1262.75	154.13	-0.07	0.05	0.124	0.051
u:	"coos"	4	295.50	27.14	-0.14	0.04	642.75	108.30	-0.37	0.08	0.157	0.027
ʊ	"cook"	2	385.00	53.74	-0.03	0.06	755.00	176.78	-0.30	0.10	0.039	0.014
ʌ	"cud"	6	521.17	90.62	0.10	0.07	1124.50	181.25	-0.12	0.07	0.072	0.020
aɪ	"kite"	4	553.50	73.62	0.13	0.06	1795.25	129.59	0.08	0.03	0.204	0.036
aʊ	"cowed"	4	464.00	18.35	0.06	0.02	933.25	78.12	-0.20	0.04	0.196	0.038
ɔɪ	"coin"	1	586.00	-	0.16	-	1825.00	-	0.09	-	0.167	-
total:		43										

Wordlist Data: Speaker total across all sessic 53

Speaker	Tl.m	*n*	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	*0*	-	-	-	-	-	-	-	-	-	-
ɪ	"kid"	*0*	-	-	-	-	-	-	-	-	-	-
e: [ie]	"Kate"	*0*	-	-	-	-	-	-	-	-	-	-
ɛ	"Ken"	*0*	-	-	-	-	-	-	-	-	-	-
a	"can"	*0*	-	-	-	-	-	-	-	-	-	-
ɑ:	"cause"	*0*	-	-	-	-	-	-	-	-	-	-
o [uo]	"coat"	*0*	-	-	-	-	-	-	-	-	-	-
ɔ	"cot"	*0*	-	-	-	-	-	-	-	-	-	-
u:	"coos"	*0*	-	-	-	-	-	-	-	-	-	-
ʊ	"cook"	*0*	-	-	-	-	-	-	-	-	-	-
ʌ	"cud"	*0*	-	-	-	-	-	-	-	-	-	-
aɪ	"kite"	*0*	-	-	-	-	-	-	-	-	-	-
aʊ	"cowed"	*0*	-	-	-	-	-	-	-	-	-	-
ɔɪ	"coin"	*0*	-	-	-	-	-	-	-	-	-	-
total:		*0*										

Conversational Data:

Speaker	Tl.m	*n*	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	*0*	-	-	-	-	-	-	-	-	-	-
ɪ	"kid"	*2*	472.00	*253.14*	0.01	*0.25*	1934.00	*476.59*	0.12	*0.11*	0.060	*0.011*
e: [ie]	"Kate"	*0*	-	-	-	-	-	-	-	-	-	-
ɛ	"Ken"	*3*	524.33	*45.24*	0.09	*0.04*	1890.33	*43.50*	0.12	*0.01*	0.079	*0.021*
a	"can"	*11*	679.09	*47.39*	0.21	*0.03*	1414.09	*163.59*	-0.01	*0.05*	0.092	*0.016*
ɑ:	"cause"	*0*	-	-	-	-	-	-	-	-	-	-
o [uo]	"coat"	*0*	-	-	-	-	-	-	-	-	-	-
ɔ	"cot"	*1*	684.00	-	0.21	-	1314.00	-	-0.04	-	0.176	-
u:	"coos"	*0*	-	-	-	-	-	-	-	-	-	-
ʊ	"cook"	*1*	804.00	-	0.28	-	1347.00	-	-0.03	-	0.051	-
ʌ	"cud"	*3*	495.67	*72.67*	0.07	*0.07*	1169.33	*250.08*	-0.09	*0.09*	0.078	*0.020*
aɪ	"kite"	*2*	630.00	*15.56*	0.17	*0.01*	1874.00	*69.30*	0.12	*0.02*	0.103	*0.006*
aʊ	"cowed"	*4*	586.00	*63.34*	0.14	*0.05*	1284.00	*268.66*	-0.06	*0.10*	0.112	*0.015*
ɔɪ	"coin"	*0*	-	-	-	-	-	-	-	-	-	-
total:		*27*										

Picture Data:

Speaker	Tl.m	*n*	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	*6*	285.00	*43.13*	-0.17	*0.06*	2404.00	*81.97*	0.23	*0.02*	0.169	*0.038*
ɪ	"kid"	*4*	327.75	*45.01*	-0.11	*0.06*	2097.00	*203.27*	0.16	*0.04*	0.084	*0.033*
e: [ie]	"Kate"	*0*	-	-	-	-	-	-	-	-	-	-
ɛ	"Ken"	*0*	-	-	-	-	-	-	-	-	-	-
a	"can"	*2*	637.00	*224.86*	0.16	*0.16*	1598.00	*22.63*	0.05	*0.01*	0.190	*0.036*
ɑ:	"cause"	*0*	-	-	-	-	-	-	-	-	-	-
o [uo]	"coat"	*0*	-	-	-	-	-	-	-	-	-	-
ɔ	"cot"	*3*	710.00	*11.00*	0.23	*-0.01*	1223.00	*101.89*	-0.07	*0.04*	0.094	*0.028*
u:	"coos"	*3*	360.00	*42.51*	-0.07	*0.05*	778.00	*113.70*	-0.27	*0.06*	0.201	*0.018*
ʊ	"cook"	*1*	419.00	-	0.00	-	764.00	-	-0.27	-	0.052	-
ʌ	"cud"	*3*	656.33	*111.43*	0.19	*0.07*	1151.33	*211.95*	-0.10	*0.08*	0.066	*0.020*
aɪ	"kite"	*2*	721.00	*76.37*	0.23	*0.05*	1647.00	*137.18*	0.06	*0.04*	0.180	*0.047*
aʊ	"cowed"	*0*	-	-	-	-	-	-	-	-	-	-
ɔɪ	"coin"	*2*	850.00	*258.80*	0.29	*0.13*	1334.50	*152.03*	-0.03	*0.05*	0.187	*0.087*
total:		*26*										

Wordlist Data: Speaker total across all sessic 628

Speaker	TJ.f	*n*	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	*45*	302.82	*36.69*	-0.26	*0.05*	2769.84	*84.01*	0.26	*0.01*	0.168	*0.034*
ɪ	"kid"	*49*	487.53	*42.70*	-0.06	*0.04*	2579.31	*106.89*	0.22	*0.02*	0.080	*0.018*
e: [ie]	"Kate"	*41*	497.88	*26.01*	-0.05	*0.02*	2538.86	*89.28*	0.22	*0.02*	0.184	*0.025*
ɛ	"Ken"	*48*	567.81	*61.91*	0.01	*0.05*	2246.67	*186.71*	0.16	*0.04*	0.112	*0.020*
a	"can"	*50*	872.52	*105.95*	0.20	*0.06*	1564.06	*264.24*	0.00	*0.08*	0.134	*0.031*
ɑ:	"cause"	*13*	774.77	*89.04*	0.14	*0.05*	1141.92	*186.93*	-0.13	*0.07*	0.237	*0.027*
o [uo]	"coat"	*38*	508.79	*35.25*	-0.04	*0.03*	868.82	*230.87*	-0.26	*0.09*	0.197	*0.034*
ɔ	"cot"	*53*	817.15	*108.52*	0.17	*0.06*	1245.45	*208.36*	-0.10	*0.07*	0.132	*0.041*
u:	"coos"	*54*	375.39	*62.07*	-0.17	*0.07*	787.87	*215.82*	-0.30	*0.10*	0.182	*0.038*
ʊ	"cook"	*9*	472.22	*69.31*	-0.07	*0.07*	767.89	*87.36*	-0.30	*0.05*	0.069	*0.019*
ʌ	"cud"	*67*	658.79	*75.14*	0.07	*0.05*	1074.07	*175.26*	-0.16	*0.07*	0.112	*0.026*
aɪ	"kite"	*36*	898.00	*99.07*	0.21	*0.05*	1768.97	*186.70*	0.06	*0.05*	0.204	*0.029*
aʊ	"cowed"	*19*	645.37	*82.11*	0.06	*0.06*	974.58	*114.72*	-0.20	*0.05*	0.203	*0.018*
ɔɪ	"coin"	*3*	792.33	*91.56*	0.16	*0.05*	1213.33	*95.42*	-0.10	*0.03*	0.185	*0.020*
total:		*525*										

Conversational Data:

Speaker	TJ.f	*n*	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	*2*	439.50	*23.33*	-0.10	*0.02*	2716.00	*76.37*	0.25	*0.01*	0.062	*0.024*
ɪ	"kid"	*7*	528.71	*83.40*	-0.02	*0.07*	2162.00	*265.45*	0.14	*0.06*	0.079	*0.018*
e: [ie]	"Kate"	*1*	380.00	-	-0.16	-	2216.00	-	0.16	-	0.104	-
ɛ	"Ken"	*6*	580.67	*58.65*	0.02	*0.05*	2142.00	*82.36*	0.14	*0.02*	0.104	*0.032*
a	"can"	*15*	731.20	*131.63*	0.12	*0.08*	1373.87	*227.00*	-0.05	*0.07*	0.116	*0.048*
ɑ:	"cause"	*0*	-	-	-	-	-	-	-	-	-	-
o [uo]	"coat"	*0*	-	-	-	-	-	-	-	-	-	-
ɔ	"cot"	*3*	871.67	*192.69*	0.19	*0.10*	1472.67	*159.65*	-0.02	*0.05*	0.167	*0.046*
u:	"coos"	*1*	391.00	-	-0.15	-	825.00	-	-0.27	-	0.337	-
ʊ	"cook"	*0*	-	-	-	-	-	-	-	-	-	-
ʌ	"cud"	*13*	607.31	*44.82*	0.04	*0.03*	1117.77	*182.90*	-0.14	*0.06*	0.117	*0.036*
aɪ	"kite"	*2*	825.00	*15.56*	0.17	*0.01*	1836.00	*0.00*	0.08	*0.00*	0.114	*0.027*
aʊ	"cowed"	*4*	646.00	*55.20*	0.07	*0.04*	1150.50	*98.04*	-0.13	*0.04*	0.181	*0.040*
ɔɪ	"coin"	*0*	-	-	-	-	-	-	-	-	-	-
total:		*54*										

Picture Data:

Speaker	TJ.f	*n*	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	*6*	293.83	*46.07*	-0.28	*0.06*	2303.17	*543.05*	0.17	*0.10*	0.192	*0.068*
ɪ	"kid"	*3*	484.00	*65.18*	-0.06	*0.06*	2588.00	*96.99*	0.23	*0.02*	0.096	*0.043*
e: [ie]	"Kate"	*0*	-	-	-	-	-	-	-	-	-	-
ɛ	"Ken"	*2*	591.50	*75.66*	0.03	*0.06*	2206.50	*75.66*	0.16	*0.01*	0.180	*0.049*
a	"can"	*9*	1044.89	*761.43*	0.22	*0.20*	1756.67	*162.28*	0.06	*0.04*	0.154	*0.033*
ɑ:	"cause"	*0*	-	-	-	-	-	-	-	-	-	-
o [uo]	"coat"	*0*	-	-	-	-	-	-	-	-	-	-
ɔ	"cot"	*5*	825.40	*68.52*	0.17	*0.04*	1395.40	*218.63*	-0.05	*0.07*	0.096	*0.011*
u:	"coos"	*4*	411.25	*122.27*	-0.14	*0.12*	748.25	*142.13*	-0.32	*0.08*	0.217	*0.048*
ʊ	"cook"	*2*	564.50	*113.84*	0.01	*0.09*	865.50	*127.99*	-0.25	*0.06*	0.067	*0.063*
ʌ	"cud"	*7*	610.14	*49.63*	0.04	*0.04*	1039.86	*217.63*	-0.18	*0.09*	0.072	*0.029*
aɪ	"kite"	*8*	849.75	*123.83*	0.18	*0.06*	1826.00	*161.15*	0.07	*0.04*	0.212	*0.058*
aʊ	"cowed"	*1*	667.00	-	0.08	-	1130.00	-	-0.13	-	0.235	-
ɔɪ	"coin"	*2*	726.00	*114.55*	0.12	*0.07*	1781.50	*205.77*	0.06	*0.05*	0.320	*0.069*
total:		*49*										

Wordlist Data: Speaker total across all sessic 749

Speaker	TL.f	n	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	58	342.60	180.72	-0.15	0.12	2588.59	197.32	0.24	0.04	0.127	0.022
ɪ	"kid"	64	353.27	23.54	-0.12	0.03	2275.08	94.27	0.19	0.02	0.066	0.022
e: [ie]	"Kate"	55	377.84	33.04	-0.09	0.04	2336.98	96.67	0.20	0.02	0.143	0.028
ɛ	"Ken"	64	494.94	44.38	0.03	0.04	2061.50	98.73	0.14	0.02	0.088	0.018
a	"can"	64	720.88	70.63	0.19	0.05	1522.27	145.99	0.01	0.04	0.103	0.023
ɑ:	"cause"	15	682.67	70.62	0.17	0.05	1194.73	199.49	-0.10	0.08	0.169	0.026
o [uo]	"coat"	52	413.10	40.97	-0.05	0.04	778.46	61.38	-0.28	0.03	0.139	0.025
ɔ	"cot"	67	730.93	39.29	0.20	0.02	1349.37	145.95	-0.04	0.05	0.100	0.032
u:	"coos"	70	355.19	26.36	-0.11	0.03	834.47	289.21	-0.26	0.10	0.135	0.024
ʊ	"cook"	12	383.67	18.96	-0.08	0.02	795.00	136.33	-0.28	0.07	0.057	0.011
ʌ	"cud"	84	563.95	57.69	0.08	0.04	1126.44	240.60	-0.13	0.09	0.088	0.021
aɪ	"kite"	48	703.58	56.74	0.18	0.04	1830.08	112.79	0.09	0.03	0.163	0.024
aʊ	"cowed"	24	471.08	58.67	0.01	0.05	842.83	58.22	-0.25	0.03	0.155	0.027
ɔɪ	"coin"	4	542.75	120.02	0.06	0.10	1800.50	138.34	0.08	0.03	0.135	0.004
total:		681										

Conversational Data:

Speaker	TL.f	n	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	0	-	-	-	-	-	-	-	-	-	-
ɪ	"kid"	2	423.50	30.41	-0.04	0.03	1944.50	77.07	0.12	0.02	0.055	0.006
e: [ie]	"Kate"	3	358.00	38.11	-0.11	0.04	2303.00	89.06	0.19	0.02	0.152	0.013
ɛ	"Ken"	1	456.00	-	-0.01	-	1858.00	-	0.10	-	0.113	-
a	"can"	8	614.88	84.90	0.12	0.06	1564.88	236.56	0.02	0.06	0.094	0.027
ɑ:	"cause"	0	-	-	-	-	-	-	-	-	-	-
o [uo]	"coat"	4	466.75	57.77	0.00	0.05	934.50	183.72	-0.21	0.09	0.126	0.047
ɔ	"cot"	1	478.00	-	0.02	-	1303.00	-	-0.06	-	0.091	-
u:	"coos"	0	-	-	-	-	-	-	-	-	-	-
ʊ	"cook"	3	404.33	46.46	-0.06	0.05	949.00	523.83	-0.23	0.22	0.086	0.020
ʌ	"cud"	7	499.43	33.12	0.03	0.03	1205.71	181.84	-0.09	0.06	0.084	0.026
aɪ	"kite"	0	-	-	-	-	-	-	-	-	-	-
aʊ	"cowed"	2	504.50	7.78	0.04	0.01	1059.00	161.22	-0.15	0.07	0.129	0.029
ɔɪ	"coin"	0	-	-	-	-	-	-	-	-	-	-
total:		31										

Picture Data:

Speaker	TL.f	n	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	6	309.00	65.13	-0.18	0.08	2568.83	129.10	0.24	0.02	0.181	0.039
ɪ	"kid"	3	358.00	29.10	-0.11	0.03	2308.33	123.80	0.19	0.02	0.090	0.027
e: [ie]	"Kate"	0	-	-	-	-	-	-	-	-	-	-
ɛ	"Ken"	2	472.00	22.63	0.01	0.02	2080.00	53.74	0.15	0.01	0.143	0.009
a	"can"	6	740.17	87.79	0.20	0.05	1633.00	206.96	0.04	0.06	0.105	0.024
ɑ:	"cause"	0	-	-	-	-	-	-	-	-	-	-
o [uo]	"coat"	0	-	-	-	-	-	-	-	-	-	-
ɔ	"cot"	7	725.86	36.09	0.20	0.02	1463.57	579.60	-0.03	0.13	0.130	0.087
u:	"coos"	2	341.50	23.33	-0.13	0.03	914.00	258.80	-0.22	0.12	0.125	0.082
ʊ	"cook"	1	369.00	-	-0.10	-	695.00	-	-0.33	-	0.092	-
ʌ	"cud"	4	540.00	67.70	0.07	0.05	966.50	147.22	-0.19	0.06	0.076	0.021
aɪ	"kite"	4	741.00	209.35	0.19	0.12	1865.75	50.57	0.10	0.01	0.213	0.051
aʊ	"cowed"	1	630.00	-	0.14	-	934.00	-	-0.20	-	0.126	-
ɔɪ	"coin"	1	565.00	-	0.09	-	1640.00	-	0.04	-	0.236	-
total:		37										

Wordlist Data: Speaker total across all sessic 572

Speaker	TM.f	n	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	43	292.05	41.63	-0.24	0.06	2850.12	107.02	0.27	0.02	0.145	0.025
ɪ	"kid"	48	398.77	46.39	-0.10	0.05	2559.04	115.52	0.22	0.02	0.056	0.022
e: [ie]	"Kate"	42	406.88	16.62	-0.09	0.02	2575.48	73.26	0.23	0.01	0.155	0.022
ɛ	"Ken"	47	466.53	72.54	-0.03	0.06	2302.21	121.19	0.18	0.02	0.077	0.019
a	"can"	49	863.78	86.50	0.24	0.04	1417.82	161.58	-0.04	0.05	0.097	0.026
ɑ:	"cause"	13	783.69	118.86	0.19	0.08	1175.31	144.31	-0.12	0.06	0.184	0.032
o [uo]	"coat"	39	415.05	26.23	-0.08	0.03	831.44	67.17	-0.27	0.03	0.161	0.027
ɔ	"cot"	54	804.07	132.37	0.20	0.07	1270.69	111.69	-0.08	0.04	0.095	0.035
u:	"coos"	49	398.47	84.97	-0.11	0.08	855.12	171.08	-0.32	0.42	0.150	0.031
ʊ	"cook"	10	446.30	48.70	-0.05	0.05	824.10	82.91	-0.27	0.04	0.046	0.015
ʌ	"cud"	65	572.60	108.97	0.05	0.08	1111.02	114.19	-0.14	0.04	0.088	0.026
aɪ	"kite"	37	868.84	141.88	0.23	0.09	1905.46	201.39	0.09	0.05	0.172	0.032
aʊ	"cowed"	22	594.50	165.58	0.07	0.11	995.68	161.91	-0.19	0.07	0.159	0.039
ɔɪ	"coin"	2	747.00	251.73	0.16	0.15	1431.50	75.66	-0.03	0.02	0.175	0.001
total:		520										

Conversational Data:

Speaker	TM.f	n	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	2	445.00	138.59	-0.06	0.14	2370.00	197.99	0.19	0.04	0.063	0.034
ɪ	"kid"	7	477.57	64.03	-0.02	0.05	2192.86	154.25	0.15	0.03	0.065	0.021
e: [ie]	"Kate"	0	-	-	-	-	-	-	-	-	-	-
ɛ	"Ken"	8	575.50	61.80	0.06	0.05	2183.63	144.41	0.15	0.03	0.092	0.034
a	"can"	11	818.00	113.87	0.21	0.06	1500.00	177.75	-0.01	0.05	0.099	0.045
ɑ:	"cause"	0	-	-	-	-	-	-	-	-	-	-
o [uo]	"coat"	0	-	-	-	-	-	-	-	-	-	-
ɔ	"cot"	3	861.67	22.90	0.24	0.01	1459.00	110.12	-0.02	0.03	0.082	0.011
u:	"coos"	1	467.00	-	-0.03	-	1271.00	-	-0.08	-	0.078	-
ʊ	"cook"	0	-	-	-	-	-	-	-	-	-	-
ʌ	"cud"	8	567.25	69.70	0.05	0.05	1174.25	204.04	-0.12	0.07	0.059	0.021
aɪ	"kite"	0	-	-	-	-	-	-	-	-	-	-
aʊ	"cowed"	8	622.75	99.36	0.09	0.07	1058.13	189.54	-0.17	0.08	0.127	0.051
ɔɪ	"coin"	0	-	-	-	-	-	-	-	-	-	-
total:		48										

Picture Data:

Speaker	TM.f	n	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	2	322.50	45.96	-0.19	0.06	2085.50	590.43	0.13	0.12	0.117	0.042
ɪ	"kid"	0	-	-	-	-	-	-	-	-	-	-
e: [ie]	"Kate"	0	-	-	-	-	-	-	-	-	-	-
ɛ	"Ken"	0	-	-	-	-	-	-	-	-	-	-
a	"can"	2	799.00	56.57	0.20	0.03	1258.00	108.89	-0.09	0.04	0.073	0.021
ɑ:	"cause"	0	-	-	-	-	-	-	-	-	-	-
o [uo]	"coat"	0	-	-	-	-	-	-	-	-	-	-
ɔ	"cot"	0	-	-	-	-	-	-	-	-	-	-
u:	"coos"	0	-	-	-	-	-	-	-	-	-	-
ʊ	"cook"	0	-	-	-	-	-	-	-	-	-	-
ʌ	"cud"	0	-	-	-	-	-	-	-	-	-	-
aɪ	"kite"	0	-	-	-	-	-	-	-	-	-	-
aʊ	"cowed"	0	-	-	-	-	-	-	-	-	-	-
ɔɪ	"coin"	0	-	-	-	-	-	-	-	-	-	-
total:		4										

Wordlist Data: Speaker total across all sessic 776

Speaker	TT.f	n	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	*59*	313.76	*18.91*	-0.15	*0.03*	2416.51	*167.60*	0.21	*0.03*	0.161	*0.038*
ɪ	"kid"	*64*	366.80	*32.34*	-0.09	*0.04*	2169.66	*176.45*	0.16	*0.04*	0.074	*0.022*
e: [ie]	"Kate"	*56*	387.84	*30.58*	-0.06	*0.03*	2309.34	*105.75*	0.19	*0.02*	0.176	*0.027*
ɛ	"Ken"	*64*	509.19	*52.30*	0.05	*0.05*	2027.17	*63.45*	0.13	*0.01*	0.101	*0.019*
a	"can"	*64*	723.22	*75.32*	0.21	*0.05*	1675.56	*189.98*	0.05	*0.06*	0.121	*0.029*
ɑ:	"cause"	*16*	647.31	*44.19*	0.16	*0.03*	1158.06	*119.27*	-0.11	*0.05*	0.222	*0.029*
o [uo]	"coat"	*52*	398.42	*38.70*	-0.05	*0.04*	790.35	*91.75*	-0.28	*0.05*	0.178	*0.025*
ɔ	"cot"	*68*	648.18	*70.15*	0.16	*0.05*	1264.34	*112.37*	-0.07	*0.04*	0.124	*0.041*
u:	"coos"	*72*	363.57	*38.95*	-0.09	*0.04*	796.15	*216.74*	-0.28	*0.09*	0.799	*5.365*
ʊ	"cook"	*12*	402.83	*21.46*	-0.05	*0.02*	841.33	*154.59*	-0.26	*0.08*	0.061	*0.015*
ʌ	"cud"	*86*	535.08	*49.18*	0.08	*0.04*	1150.19	*155.47*	-0.12	*0.06*	0.103	*0.025*
aɪ	"kite"	*48*	719.85	*82.13*	0.20	*0.05*	1944.13	*137.76*	0.11	*0.04*	0.199	*0.030*
aʊ	"cowed"	*23*	457.22	*75.39*	0.00	*0.07*	906.87	*84.30*	-0.22	*0.04*	0.208	*0.058*
ɔɪ	"coin"	*4*	461.25	*45.80*	0.01	*0.04*	1488.25	*417.55*	-0.02	*0.14*	0.150	*0.020*
total:		*688*										

Conversational Data:

Speaker	TT.f	n	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	*1*	336.00	-	-0.12	-	2510.00	-	0.23	-	0.079	-
ɪ	"kid"	*4*	420.75	*42.01*	-0.03	*0.04*	1901.25	*51.10*	0.11	*0.01*	0.074	*0.010*
e: [ie]	"Kate"	*1*	336.00	-	-0.12	-	2466.00	-	0.22	-	0.123	-
ɛ	"Ken"	*4*	540.00	*70.56*	0.08	*0.06*	2156.75	*119.53*	0.16	*0.02*	0.155	*0.048*
a	"can"	*12*	648.75	*114.57*	0.16	*0.08*	1610.33	*262.76*	0.03	*0.07*	0.122	*0.051*
ɑ:	"cause"	*0*	-	-	-	-	-	-	-	-	-	-
o [uo]	"coat"	*3*	437.67	*61.58*	-0.01	*0.06*	988.33	*197.82*	-0.19	*0.09*	0.102	*0.021*
ɔ	"cot"	*0*	-	-	-	-	-	-	-	-	-	-
u:	"coos"	*0*	-	-	-	-	-	-	-	-	-	-
ʊ	"cook"	*2*	423.00	*15.56*	-0.02	*0.02*	1162.50	*153.44*	-0.11	*0.06*	0.065	*0.033*
ʌ	"cud"	*4*	486.00	*38.00*	0.04	*0.03*	1393.25	*249.78*	-0.03	*0.08*	0.083	*0.052*
aɪ	"kite"	*1*	586.00	-	0.12	-	2075.00	-	0.14	-	0.175	-
aʊ	"cowed"	*3*	560.67	*97.44*	0.09	*0.07*	1118.67	*57.64*	-0.13	*0.02*	0.115	*0.008*
ɔɪ	"coin"	*2*	532.00	*15.56*	0.08	*0.01*	966.50	*45.96*	-0.19	*0.02*	0.152	*0.031*
total:		*37*										

Picture Data:

Speaker	TT.f	n	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	*8*	280.75	*31.18*	-0.21	*0.07*	2443.75	*221.97*	0.21	*0.04*	0.203	*0.049*
ɪ	"kid"	*5*	401.60	*36.03*	-0.05	*0.04*	2202.40	*76.23*	0.17	*0.02*	0.095	*0.036*
e: [ie]	"Kate"	*0*	-	-	-	-	-	-	-	-	-	-
ɛ	"Ken"	*2*	510.00	*15.56*	0.06	*0.01*	2162.00	*46.67*	0.16	*0.01*	0.180	*0.012*
a	"can"	*6*	756.50	*53.92*	0.23	*0.03*	1850.17	*122.97*	0.09	*0.03*	0.130	*0.028*
ɑ:	"cause"	*0*	-	-	-	-	-	-	-	-	-	-
o [uo]	"coat"	*0*	-	-	-	-	-	-	-	-	-	-
ɔ	"cot"	*8*	682.50	*66.20*	0.18	*0.04*	1476.63	*220.93*	-0.01	*0.06*	0.141	*0.079*
u:	"coos"	*4*	373.00	*44.68*	-0.08	*0.05*	825.75	*138.78*	-0.26	*0.08*	0.191	*0.049*
ʊ	"cook"	*2*	440.00	*53.74*	-0.01	*0.05*	776.00	*24.04*	-0.28	*0.01*	0.075	*0.028*
ʌ	"cud"	*6*	554.67	*38.57*	0.09	*0.03*	1073.33	*102.83*	-0.14	*0.04*	0.100	*0.035*
aɪ	"kite"	*4*	708.50	*29.96*	0.20	*0.02*	2042.50	*77.36*	0.14	*0.02*	0.232	*0.068*
aʊ	"cowed"	*3*	552.67	*16.17*	0.09	*0.01*	1050.00	*106.58*	-0.15	*0.05*	0.215	*0.033*
ɔɪ	"coin"	*3*	560.33	*5.69*	0.10	*0.00*	1318.00	*430.40*	-0.07	*0.13*	0.259	*0.097*
total:		*51*										

Wordlist Data: Speaker total across all sessic 789

Speaker	TV.f	n	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	60	356.58	66.19	-0.17	0.07	2598.73	83.62	0.21	0.01	0.123	0.021
ɪ	"kid"	63	434.70	45.52	-0.08	0.05	2419.92	78.70	0.18	0.01	0.076	0.019
e: [ie]	"Kate"	53	466.55	44.66	-0.05	0.04	2381.98	88.26	0.18	0.02	0.148	0.031
ɛ	"Ken"	61	574.47	60.28	0.04	0.05	2201.66	151.00	0.14	0.04	0.103	0.021
a	"can"	64	807.16	74.07	0.19	0.04	1537.94	152.26	-0.02	0.04	0.127	0.025
ɑ:	"cause"	15	759.20	50.86	0.16	0.03	1304.07	106.53	-0.09	0.04	0.184	0.016
o [uo]	"coat"	49	516.45	60.26	-0.01	0.05	947.80	142.98	-0.23	0.06	0.150	0.027
ɔ	"cot"	68	768.19	66.70	0.17	0.04	1325.31	122.36	-0.08	0.05	0.121	0.034
u:	"coos"	66	403.62	57.01	-0.12	0.06	825.91	140.78	-0.29	0.06	0.144	0.036
ʊ	"cook"	12	461.33	40.91	-0.06	0.04	893.92	137.72	-0.25	0.07	0.058	0.015
ʌ	"cud"	83	642.06	50.40	0.09	0.03	1212.27	122.76	-0.12	0.04	0.106	0.024
aɪ	"kite"	47	798.51	48.47	0.18	0.03	1915.19	90.10	0.08	0.02	0.175	0.030
aʊ	"cowed"	20	610.60	73.32	0.07	0.05	1070.25	143.26	-0.17	0.06	0.167	0.020
ɔɪ	"coin"	4	700.50	67.95	0.13	0.04	1428.00	111.65	-0.05	0.03	0.143	0.014
total:		665										

Conversational Data:

Speaker	TV.f	n	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	0	-	-	-	-	-	-	-	-	-	-
ɪ	"kid"	7	468.43	73.52	-0.05	0.07	2286.14	98.32	0.16	0.02	0.073	0.027
e: [ie]	"Kate"	2	450.50	7.78	-0.07	0.01	2537.00	176.78	0.20	0.03	0.137	0.042
ɛ	"Ken"	13	584.46	93.68	0.04	0.07	2118.54	187.69	0.12	0.04	0.106	0.027
a	"can"	14	806.64	152.72	0.18	0.08	1648.36	168.51	0.01	0.05	0.113	0.032
ɑ:	"cause"	0	-	-	-	-	-	-	-	-	-	-
o [uo]	"coat"	4	518.50	97.70	-0.01	0.09	1132.25	173.26	-0.15	0.06	0.145	0.028
ɔ	"cot"	1	901.00	-	0.24	-	1640.00	-	0.01	-	0.249	-
u:	"coos"	0	-	-	-	-	-	-	-	-	-	-
ʊ	"cook"	2	499.50	61.52	-0.02	0.05	948.00	250.32	-0.23	0.12	0.079	0.004
ʌ	"cud"	12	627.00	102.65	0.07	0.07	1278.00	167.68	-0.10	0.06	0.087	0.048
aɪ	"kite"	2	689.50	7.78	0.12	0.00	1955.50	14.85	0.09	0.00	0.096	0.012
aʊ	"cowed"	5	642.60	87.69	0.09	0.06	1269.80	155.98	-0.10	0.05	0.125	0.022
ɔɪ	"coin"	4	754.75	151.03	0.15	0.09	1621.25	89.44	0.01	0.02	0.185	0.090
total:		66										

Picture Data:

Speaker	TV.f	n	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	7	448.00	79.86	-0.07	0.09	2685.14	84.80	0.23	0.01	0.210	0.066
ɪ	"kid"	6	434.17	64.21	-0.08	0.06	2336.00	182.63	0.17	0.03	0.096	0.026
e: [ie]	"Kate"	2	385.00	53.74	-0.14	0.06	2536.50	7.78	0.20	0.00	0.164	0.009
ɛ	"Ken"	2	532.00	91.92	0.00	0.08	2379.50	30.41	0.18	0.01	0.132	0.030
a	"can"	9	792.78	79.03	0.18	0.05	1656.56	158.55	0.02	0.04	0.131	0.026
ɑ:	"cause"	0	-	-	-	-	-	-	-	-	-	-
o [uo]	"coat"	6	506.67	60.94	-0.02	0.05	823.50	139.10	-0.29	0.07	0.173	0.030
ɔ	"cot"	5	810.20	63.44	0.19	0.03	1383.00	128.35	-0.06	0.04	0.142	0.078
u:	"coos"	4	392.00	77.62	-0.13	0.09	709.75	37.63	-0.35	0.02	0.285	0.080
ʊ	"cook"	2	397.00	83.44	-0.12	0.09	760.00	15.56	-0.32	0.01	0.101	0.021
ʌ	"cud"	5	675.60	78.25	0.11	0.05	1190.80	215.44	-0.13	0.08	0.075	0.039
aɪ	"kite"	3	756.33	54.37	0.16	0.03	2010.00	22.00	0.10	0.00	0.200	0.056
aʊ	"cowed"	4	578.25	55.14	0.04	0.04	931.50	35.87	-0.23	0.02	0.143	0.027
ɔɪ	"coin"	3	731.00	12.12	0.15	0.01	1579.00	349.39	-0.01	0.10	0.164	0.033
total:		58										

Wordlist Data: Speaker total across all sessic 560

Speaker	TX.m	n	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	44	329.57	37.01	-0.16	0.05	2118.12	113.37	0.18	0.02	0.132	0.025
ɪ	"kid"	46	363.00	34.02	-0.12	0.04	2030.22	81.64	0.16	0.02	0.081	0.023
e: [ie]	"Kate"	43	428.16	35.73	-0.05	0.04	1924.93	91.12	0.14	0.02	0.139	0.026
ɛ	"Ken"	46	537.78	42.45	0.05	0.03	1791.39	72.28	0.10	0.02	0.115	0.017
a	"can"	48	644.75	31.34	0.13	0.02	1413.23	127.57	0.00	0.04	0.122	0.021
ɑ:	"cause"	12	651.75	33.11	0.13	0.02	1281.42	109.39	-0.04	0.04	0.171	0.013
o [uo]	"coat"	36	511.86	38.24	0.03	0.03	975.00	81.20	-0.16	0.04	0.136	0.020
ɔ	"cot"	52	648.19	31.70	0.13	0.02	1300.17	81.23	-0.03	0.03	0.121	0.025
u:	"coos"	47	401.19	41.57	-0.08	0.04	844.49	169.93	-0.23	0.07	0.134	0.024
ʊ	"cook"	9	444.44	27.99	-0.03	0.03	875.33	53.08	-0.21	0.03	0.089	0.013
ʌ	"cud"	69	567.90	35.18	0.07	0.03	1129.97	88.51	-0.10	0.03	0.113	0.022
aɪ	"kite"	38	641.21	17.95	0.13	0.01	1549.84	105.31	0.04	0.03	0.158	0.016
aʊ	"cowed"	20	530.85	58.59	0.04	0.05	1046.00	103.30	-0.13	0.04	0.156	0.025
ɔɪ	"coin"	2	661.50	7.78	0.14	0.01	1474.50	122.33	0.02	0.04	0.131	0.004
total:		512										

Conversational Data:

Speaker	TX.m	n	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	1	282.00	-	-0.23	-	2238.00	-	0.20	-	0.037	-
ɪ	"kid"	5	313.40	45.21	-0.19	0.06	1964.00	112.69	0.14	0.02	0.072	0.013
e: [ie]	"Kate"	1	402.00	-	-0.08	-	1890.00	-	0.13	-	0.080	-
ɛ	"Ken"	0	-	-	-	-	-	-	-	-	-	-
a	"can"	10	628.70	55.45	0.12	0.04	1390.50	169.23	-0.01	0.05	0.123	0.027
ɑ:	"cause"	0	-	-	-	-	-	-	-	-	-	-
o [uo]	"coat"	0	-	-	-	-	-	-	-	-	-	-
ɔ	"cot"	0	-	-	-	-	-	-	-	-	-	-
u:	"coos"	0	-	-	-	-	-	-	-	-	-	-
ʊ	"cook"	0	-	-	-	-	-	-	-	-	-	-
ʌ	"cud"	0	-	-	-	-	-	-	-	-	-	-
aɪ	"kite"	0	-	-	-	-	-	-	-	-	-	-
aʊ	"cowed"	2	494.00	22.63	0.01	0.02	1097.00	0.00	-0.11	0.00	0.123	0.053
ɔɪ	"coin"	0	-	-	-	-	-	-	-	-	-	-
total:		19										

Picture Data:

Speaker	TX.m	n	F1		F1 (log Hz)		F2		F2 (log Hz)		duration	(sec)
i:	"keyed"	5	387.00	18.35	-0.09	0.03	1965.40	417.77	0.14	0.10	0.153	0.034
ɪ	"kid"	5	436.60	29.74	-0.04	0.03	1883.80	447.65	0.11	0.13	0.128	0.029
e: [ie]	"Kate"	0	-	-	-	-	-	-	-	-	-	-
ɛ	"Ken"	1	602.00	-	0.10	-	1711.00	-	0.09	-	0.113	-
a	"can"	6	656.17	30.41	0.14	0.02	1400.83	137.75	0.00	0.04	0.152	0.016
ɑ:	"cause"	0	-	-	-	-	-	-	-	-	-	-
o [uo]	"coat"	0	-	-	-	-	-	-	-	-	-	-
ɔ	"cot"	4	699.50	24.83	0.16	0.02	1286.25	82.92	-0.04	0.03	0.127	0.034
u:	"coos"	0	-	-	-	-	-	-	-	-	-	-
ʊ	"cook"	0	-	-	-	-	-	-	-	-	-	-
ʌ	"cud"	0	-	-	-	-	-	-	-	-	-	-
aɪ	"kite"	5	656.20	31.64	0.14	0.02	1492.00	131.08	0.02	0.04	0.181	0.017
aʊ	"cowed"	2	565.00	22.63	0.07	0.02	979.50	30.41	-0.16	0.01	0.203	0.024
ɔɪ	"coin"	1	699.00	-	0.16	-	1367.00	-	-0.01	-	0.161	-
total:		29										

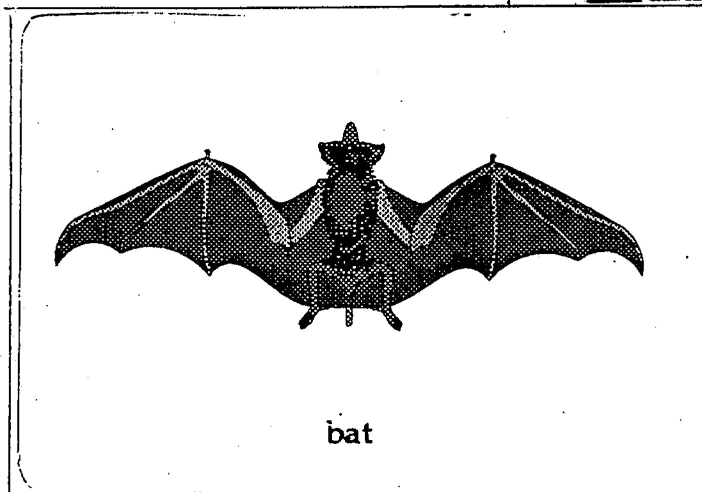
APPENDIX F

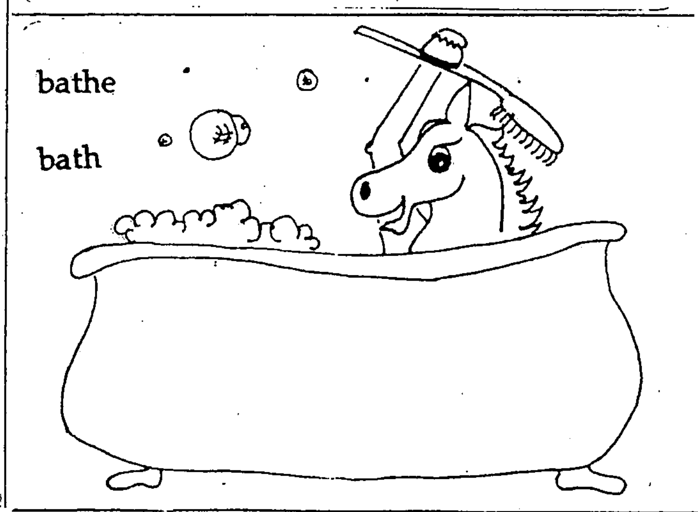
Picture Task

Pictures used to elicit target words in the picture task (described in §2.5 and Chapter 3) are provided in the pages immediately following.

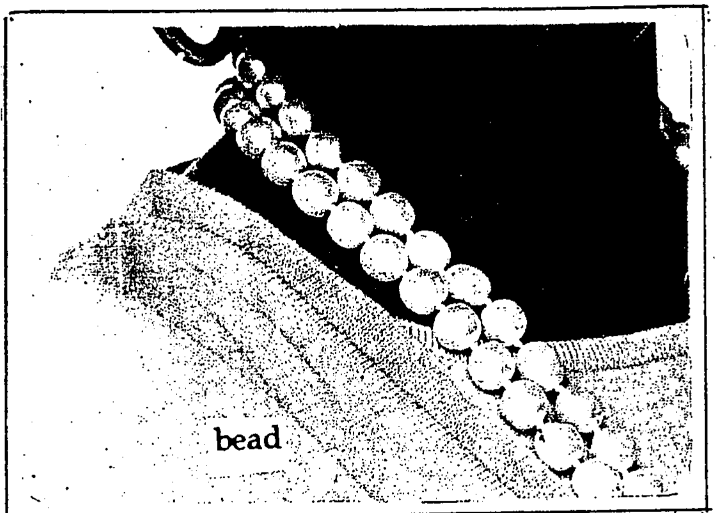

babe


back

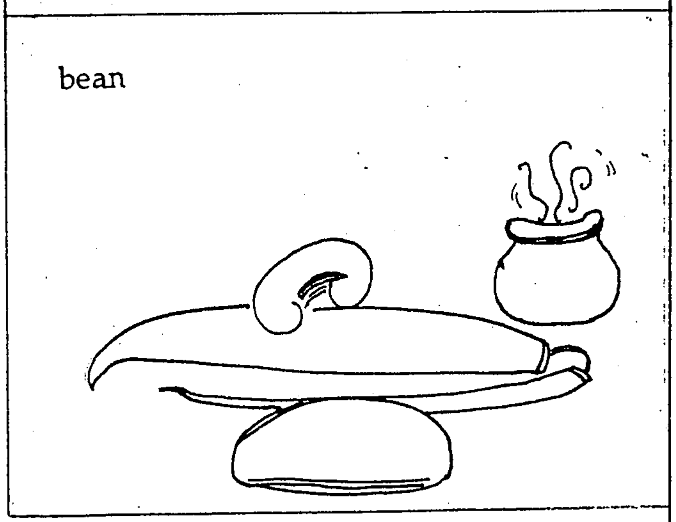

bat

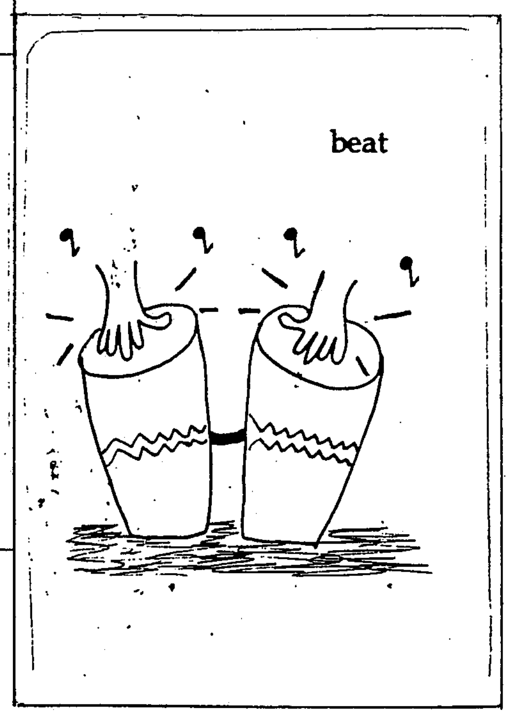

bathe
bath

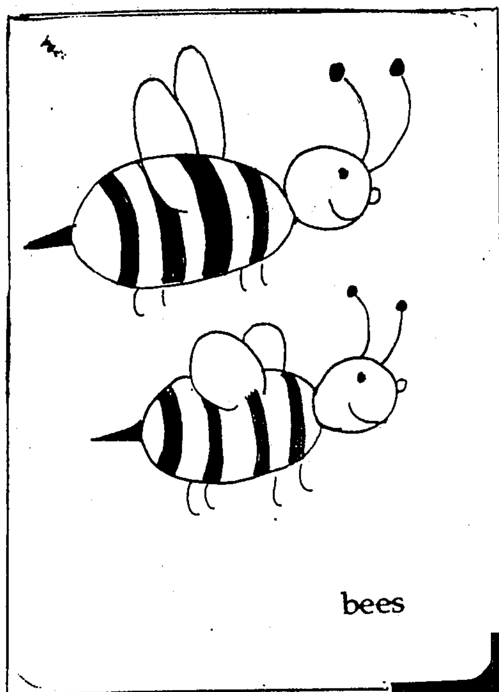

bathe


bead

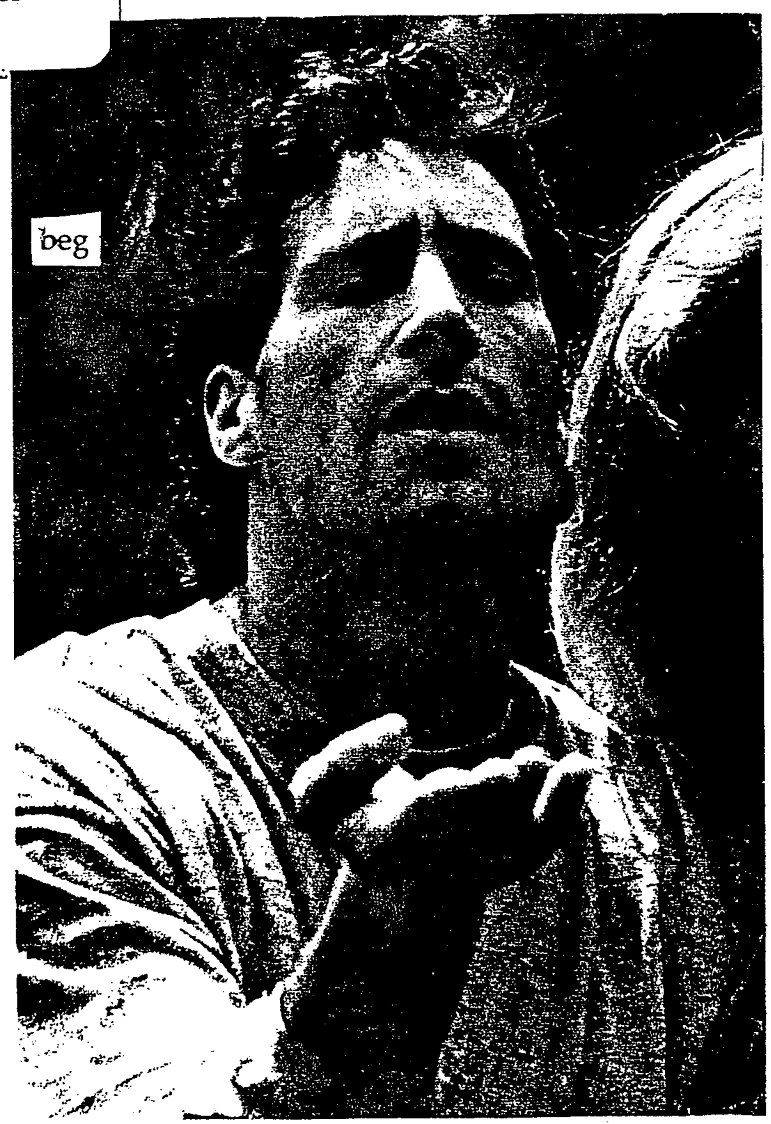

beak

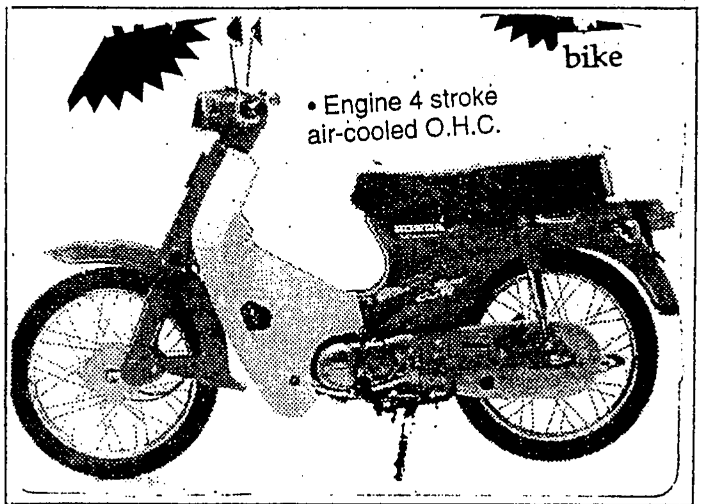

bean

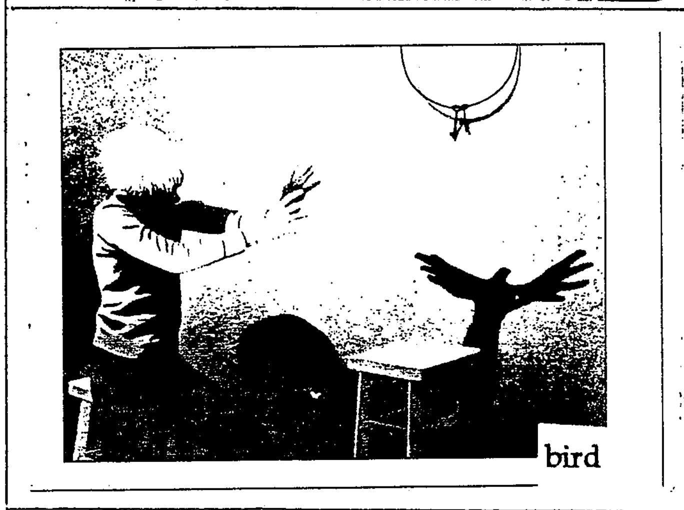

beat

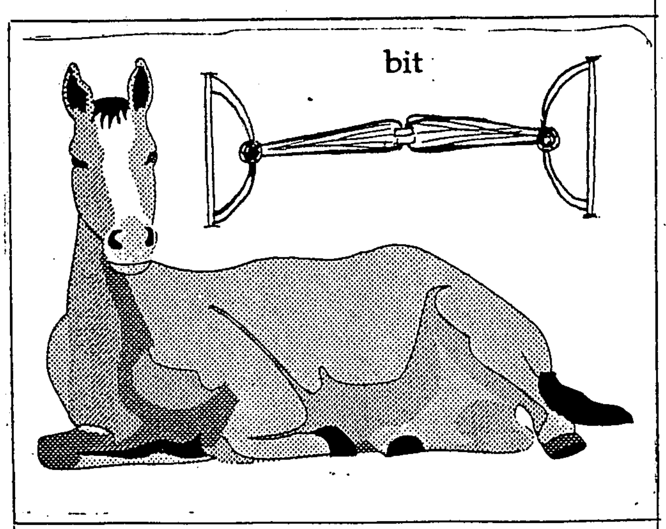

bees

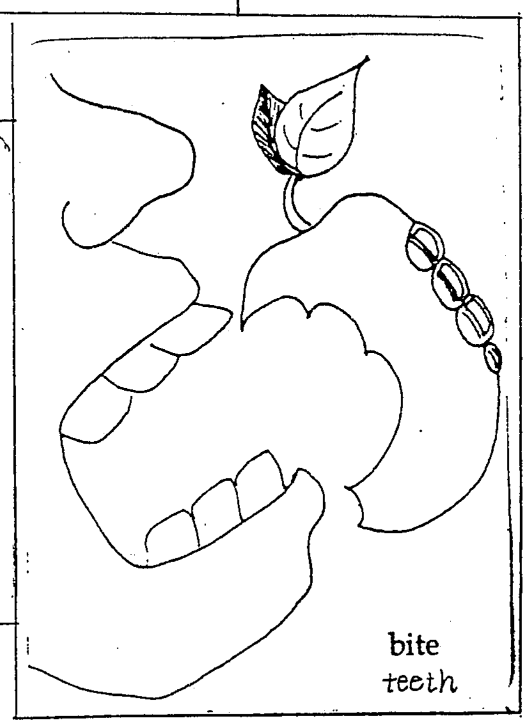

bed


beg

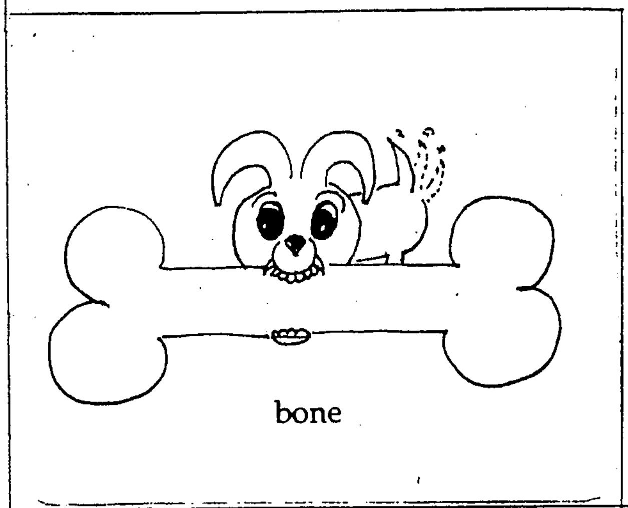

bike
• Engine 4 stroke
air-cooled O.H.C.

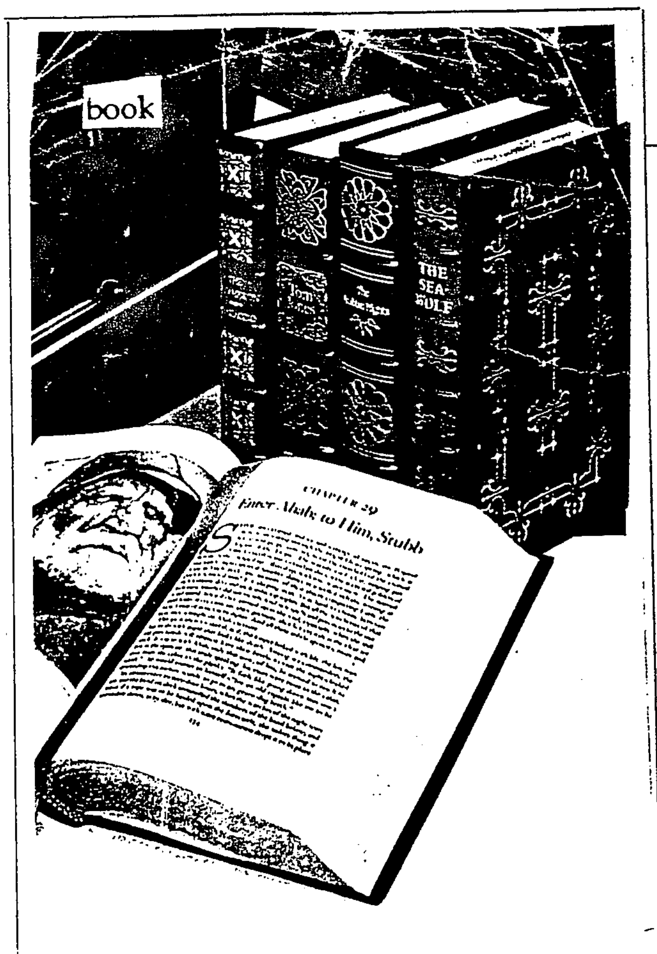

bird

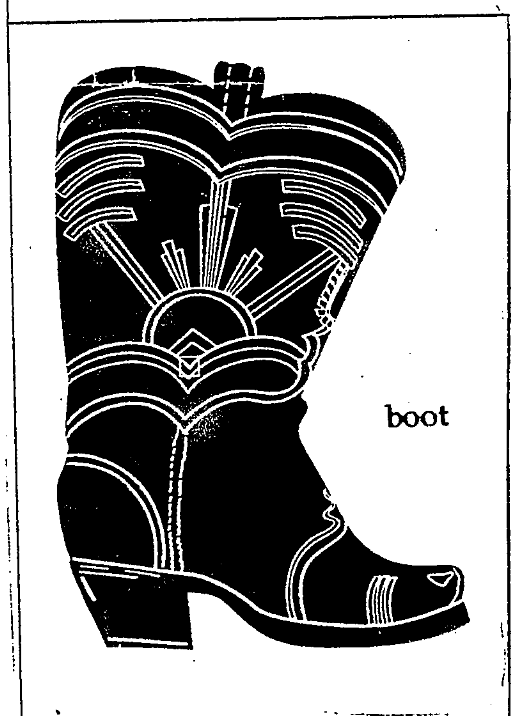

bit


bite
teeth


boat

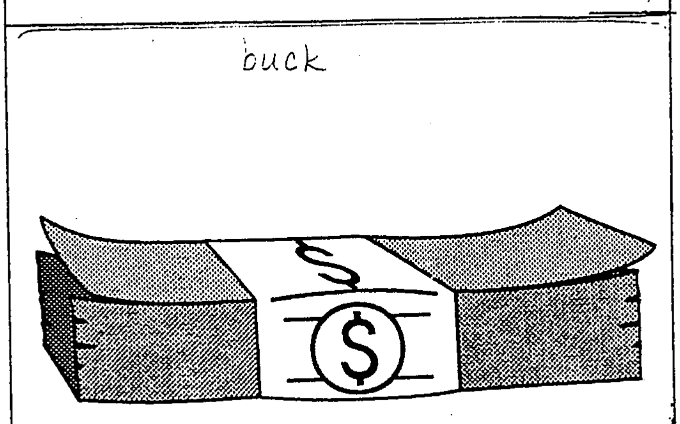

bone

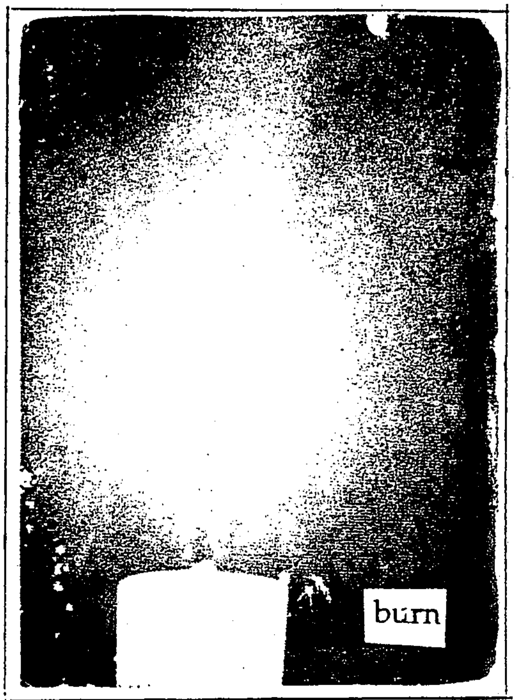

book

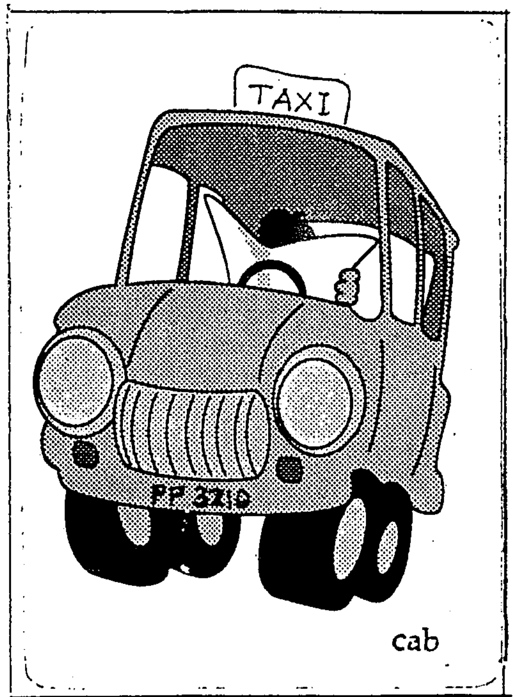

boot

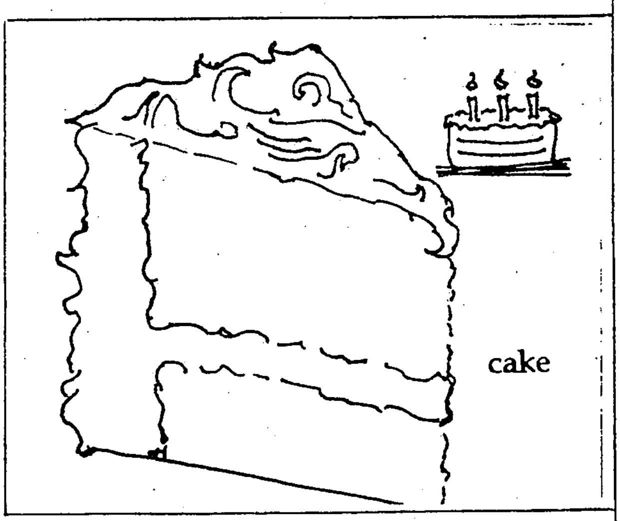

booze
MARTINI
ROSSO
MARTINI
BIANCO
MARTINI
EXTRA DRY
MARTINI
MARTINI
MARTINI
MARTINI
ROSSO
MARTINI & ROSSI
MARTINI
BIANCO
BIANCO
MARTINI
DRY
MARTINI & ROSSI
TORINO

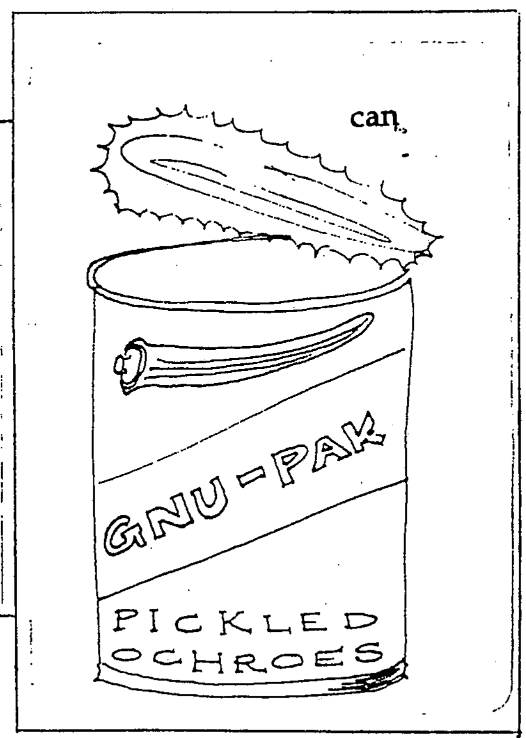

bows

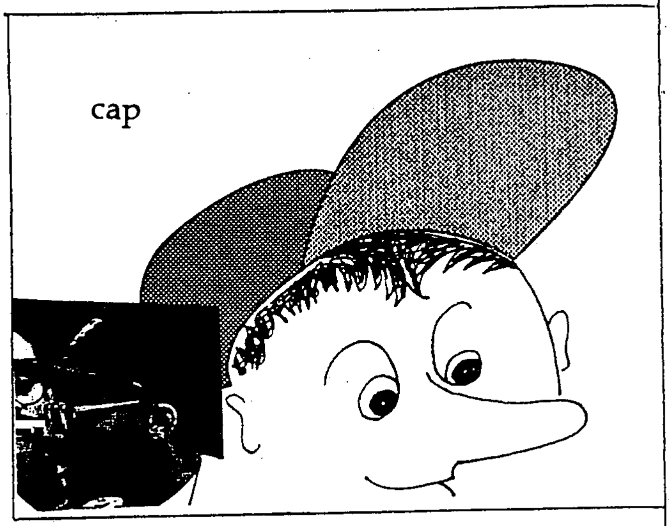

buck
$
$


burn


TAXI
cab

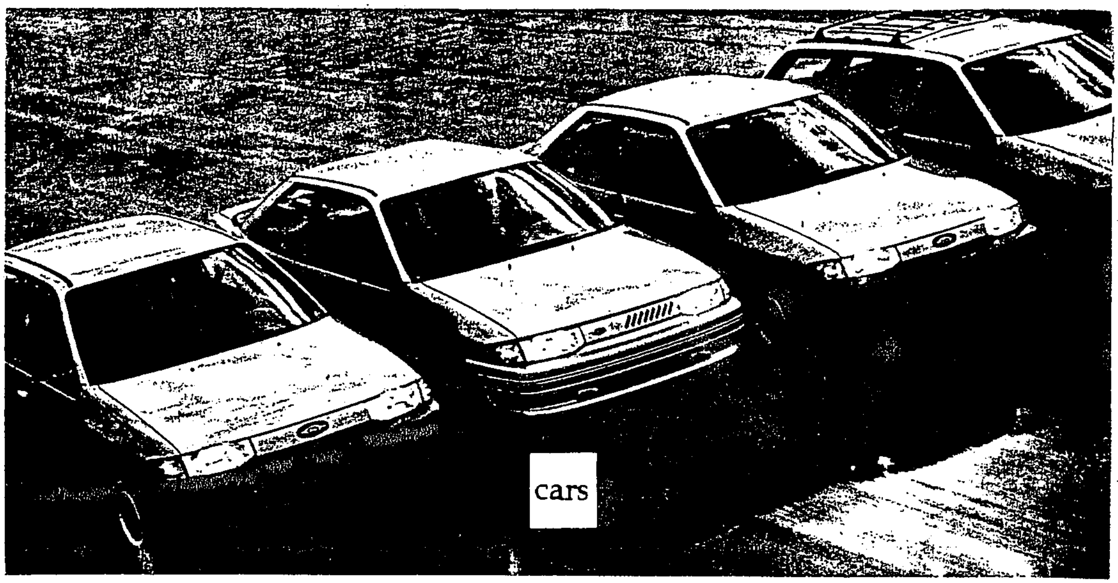

cake

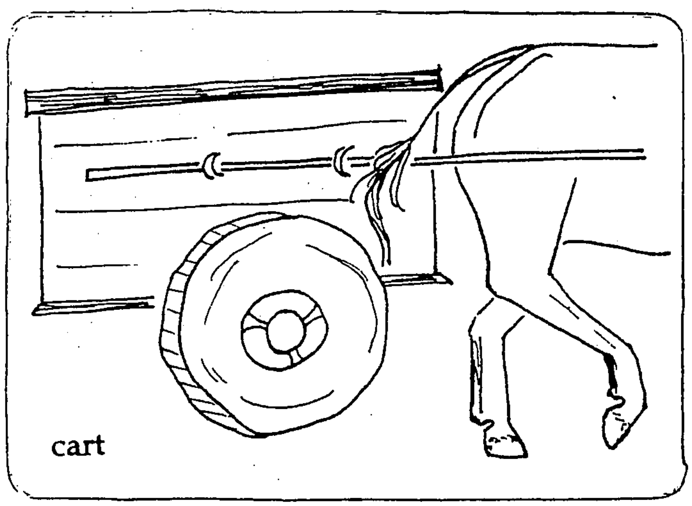

can
GNU-PAK
PICKLED
OCHROES


cap


card
THE JOKER
The United States
Playing Card Company
CINCINNATI, OHIO 45212

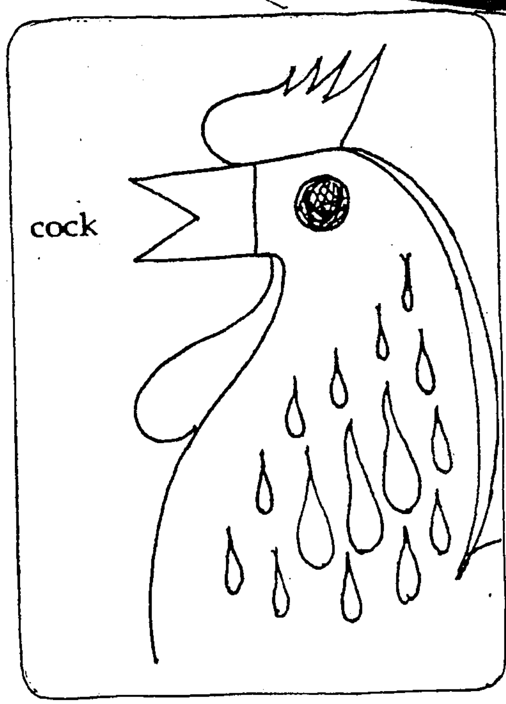

cares

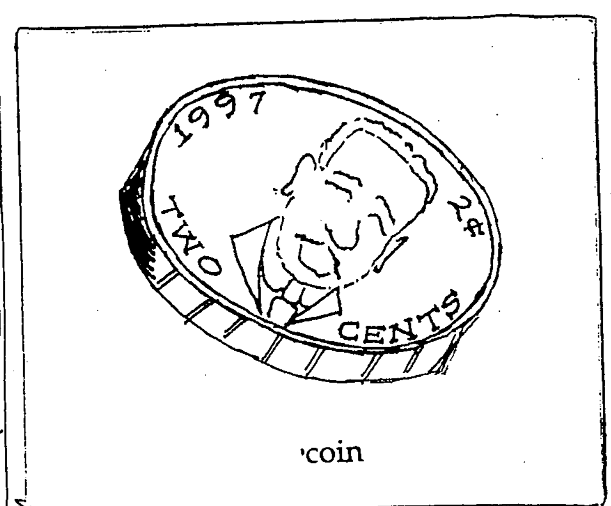

cars

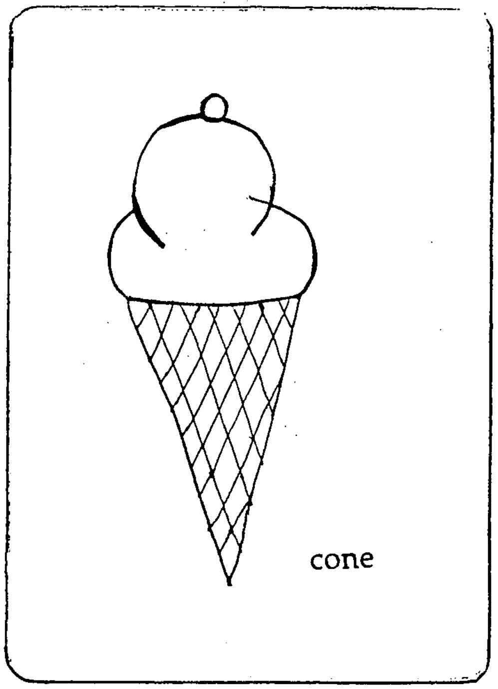

cart


cat

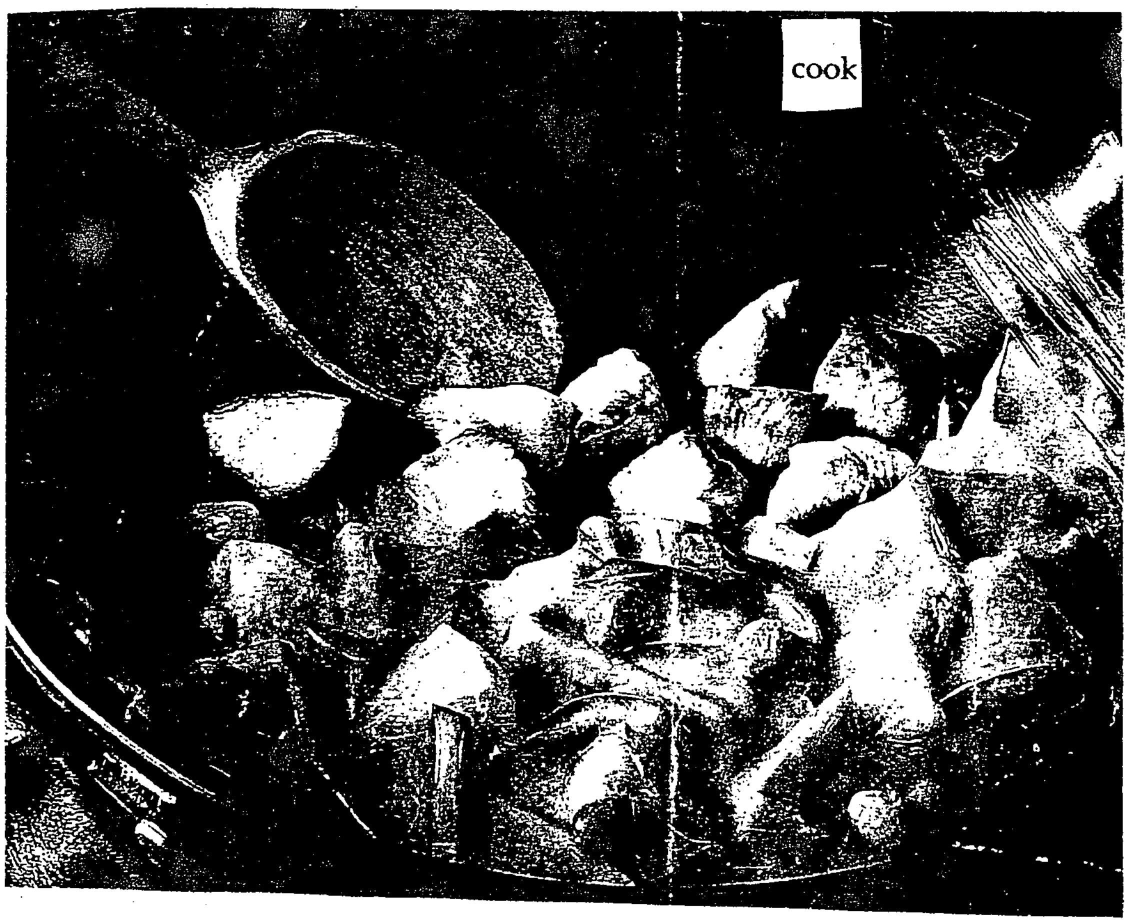

coat

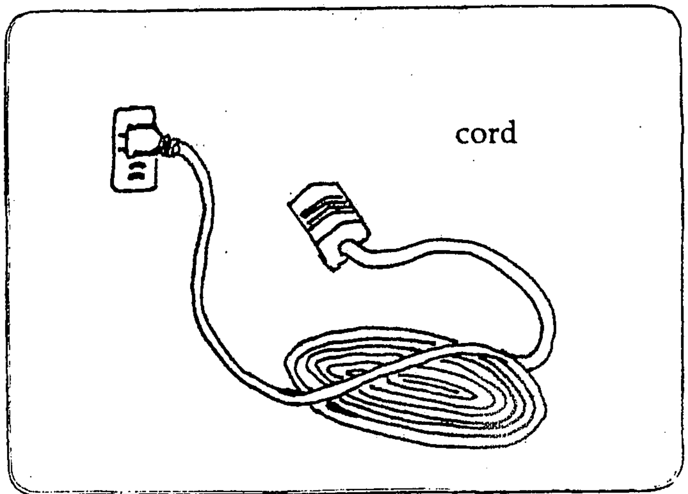

cock

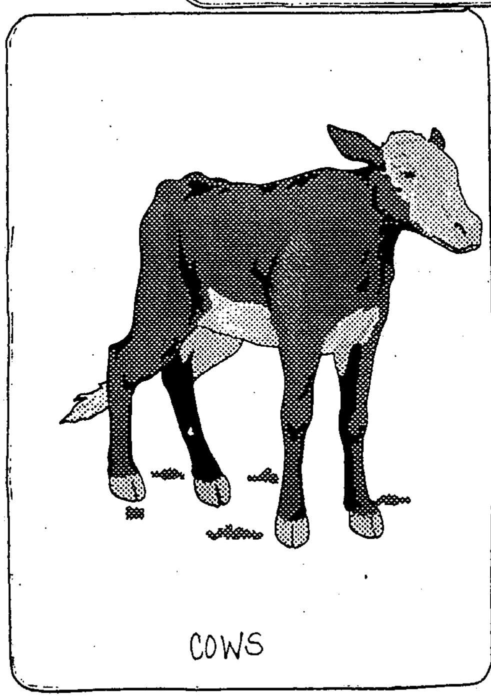

1997
TWO
2¢
CENTS
coin

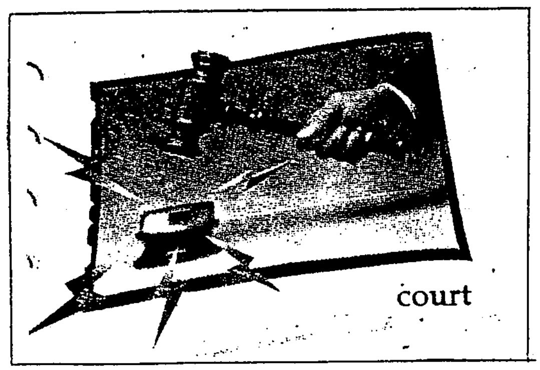

cone

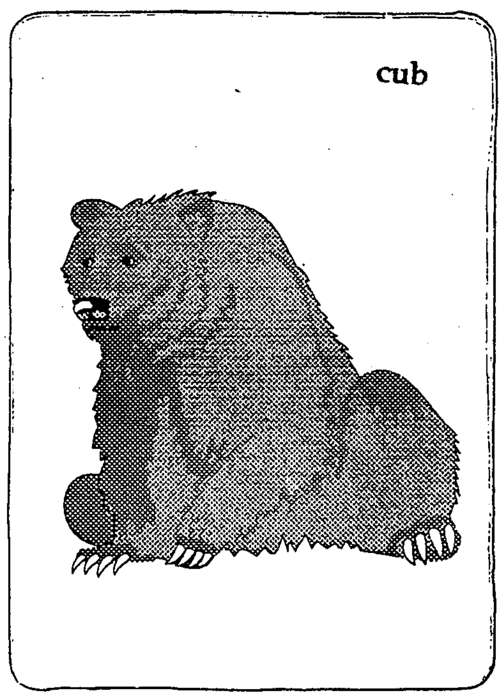

cop

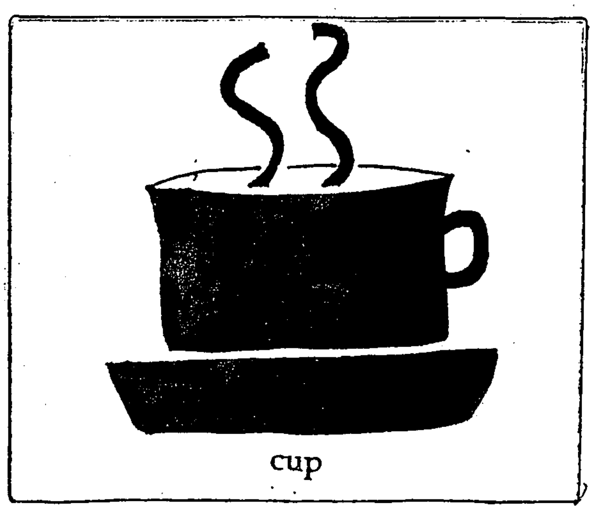

cook

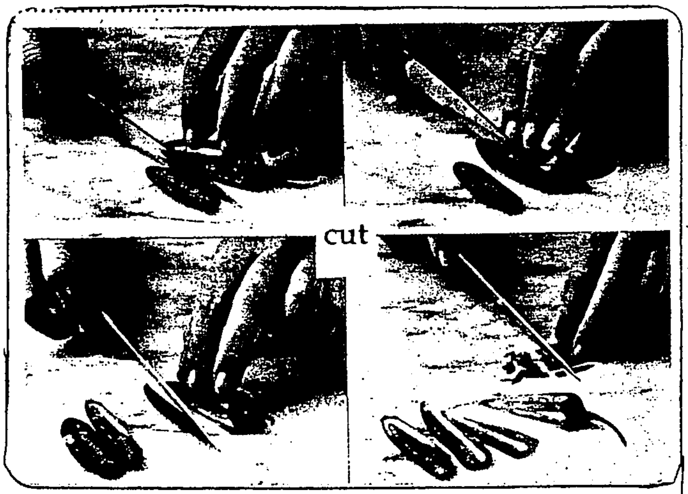

cord

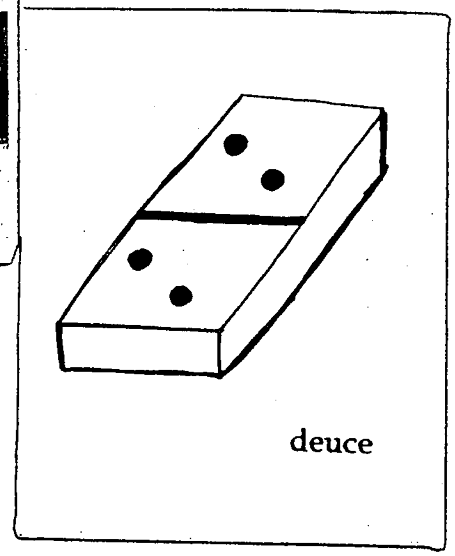

COWS


court


cub

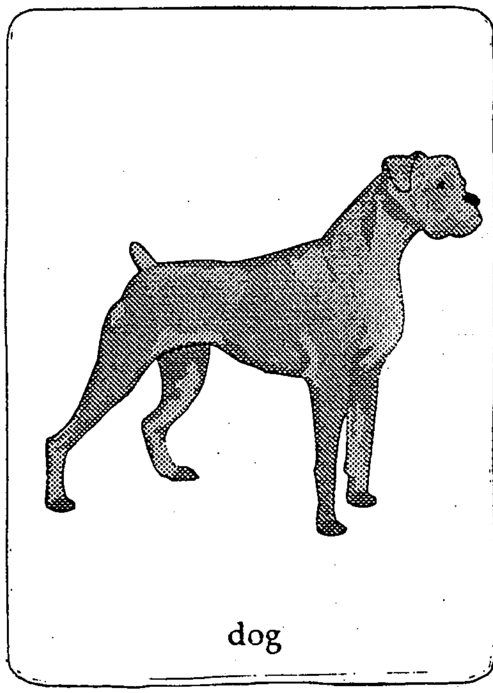

cup

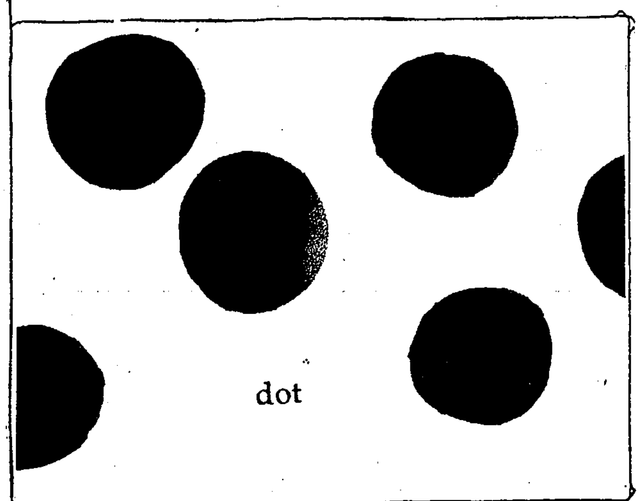

cut

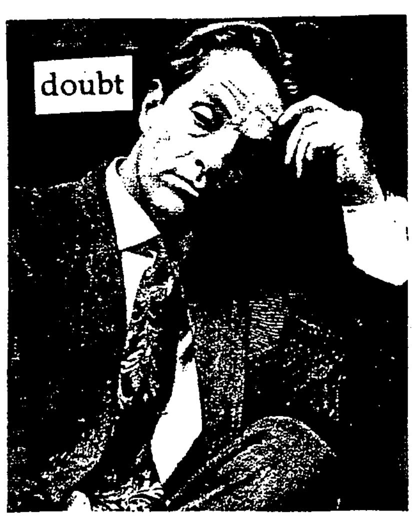

deuce

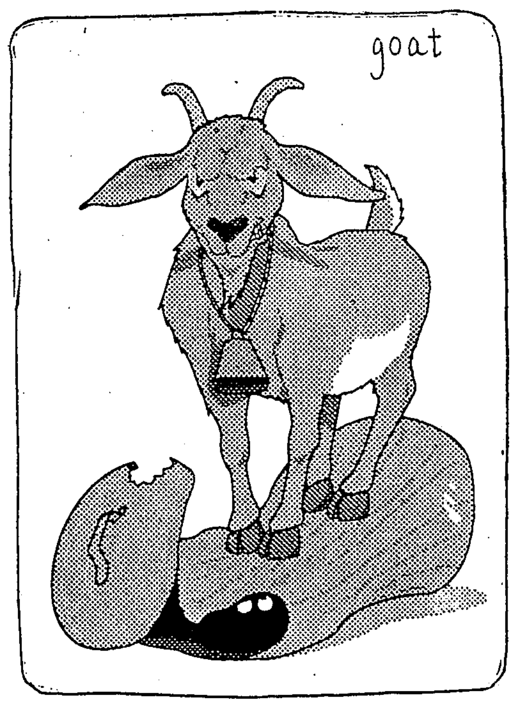

dine

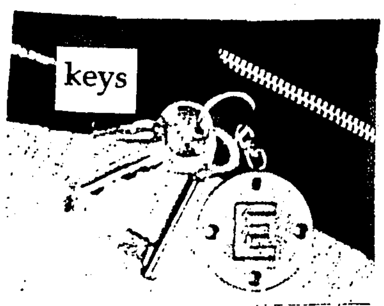

dirt

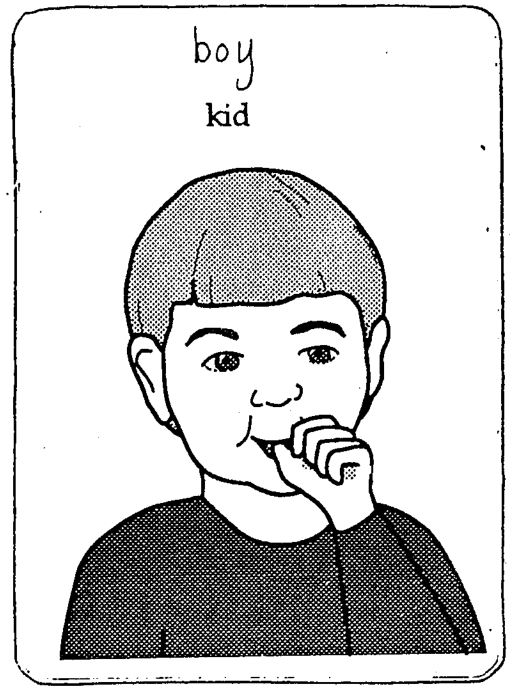

dog


dot


doubt

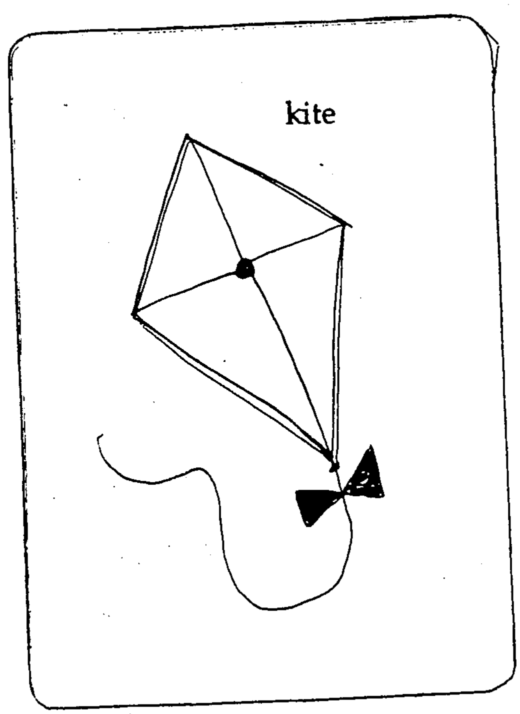

goat





EBONY • January, 1987


kiss

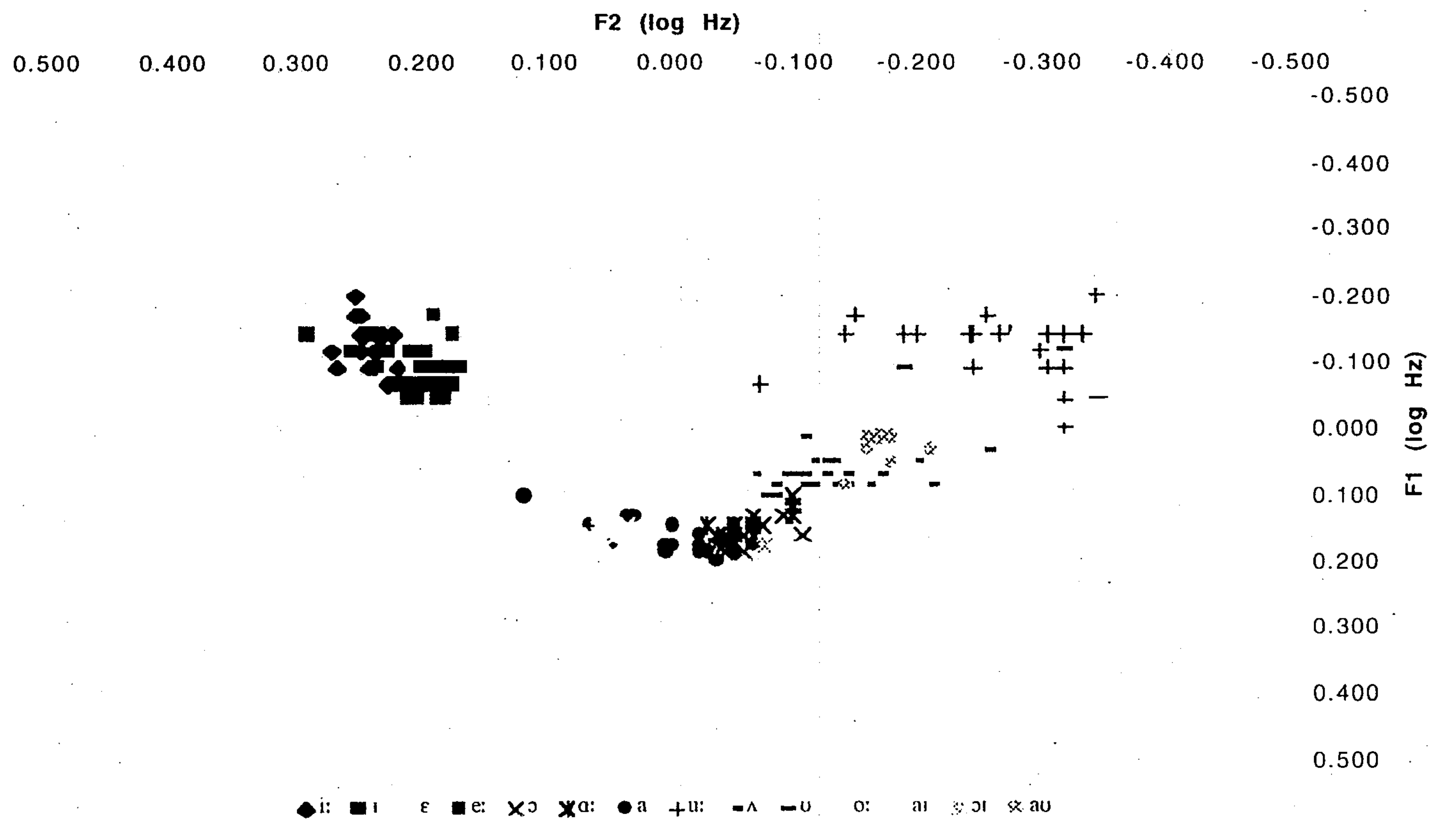

kite

APPENDIX G

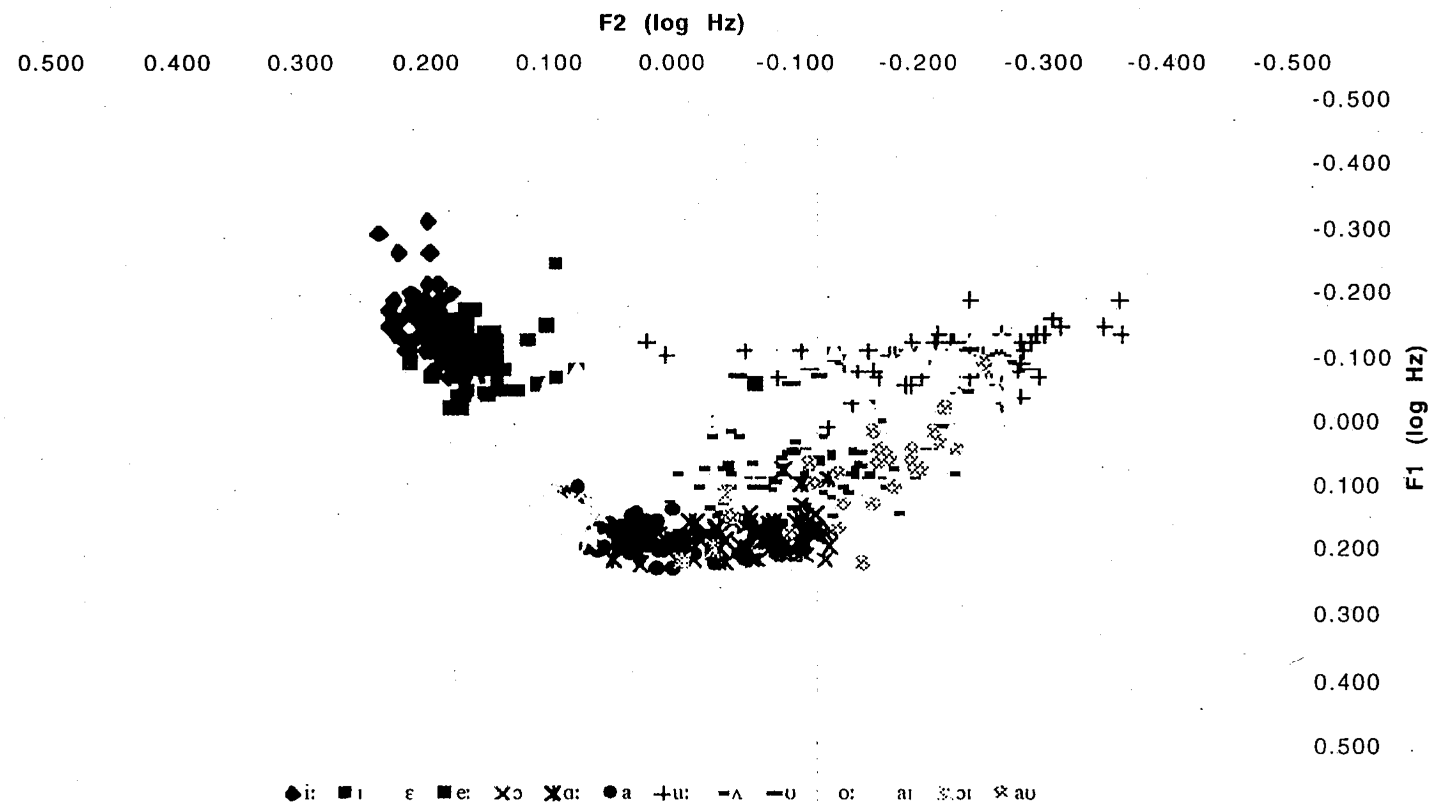
Plots of Normalized Acoustic Study Data

The charts presented in the following pages provide plots of the log-mean normalized F1 x F2 data for each speaker, for his or her word list data only. Plots reflect the removal of those words which were omitted from the final dataset (described in §4.3). Normalization procedures are described in §3.5. Monophthongal vowels are plotted using vowel midpoint, diphthongal vowels are plotted at nucleus midpoint. All datapoints (across all repetitions of the word list task) for a speaker are included.

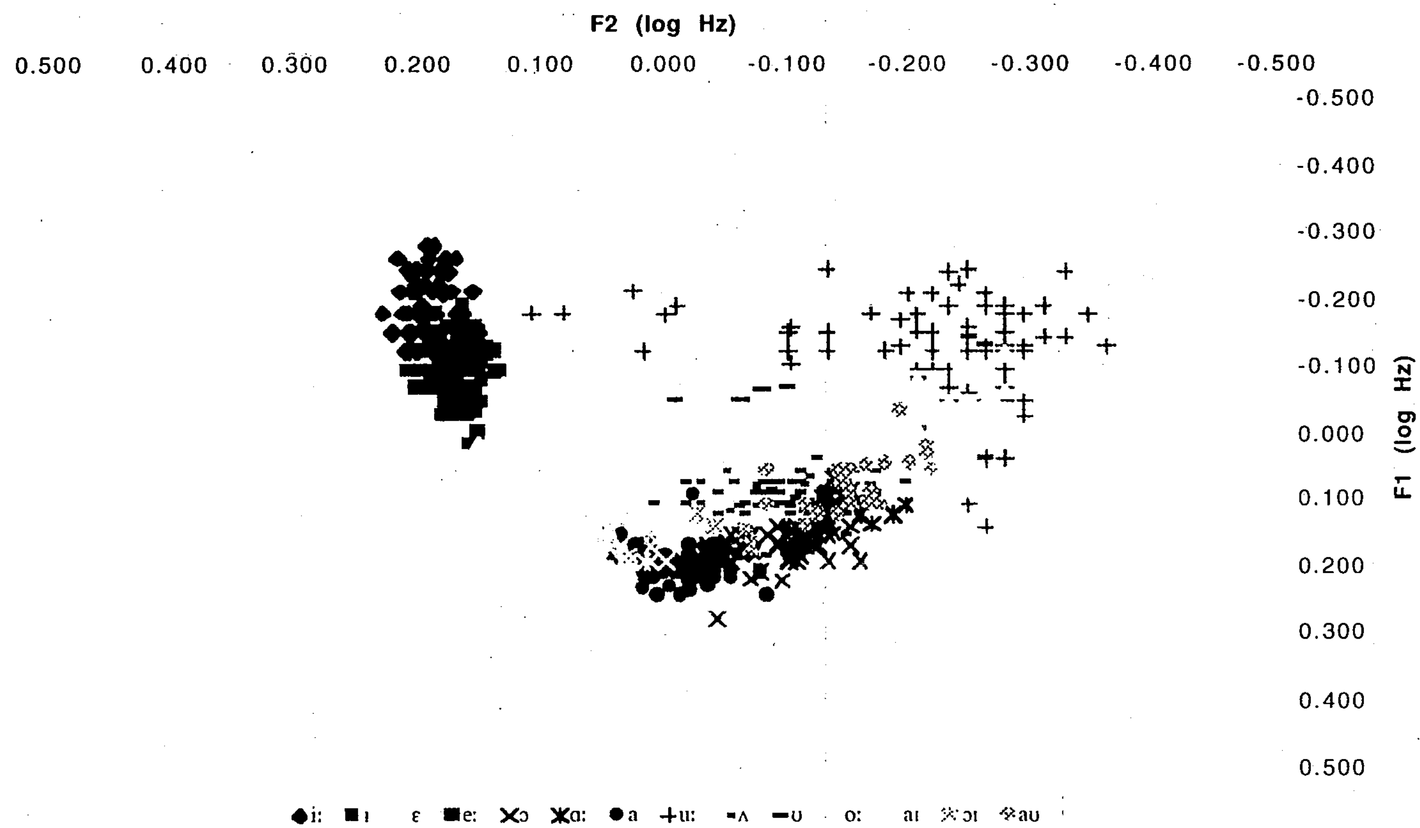
Speaker KC (female, Kingston): all vowels at midpoint
log mean normalized difference scores (wordlist only)



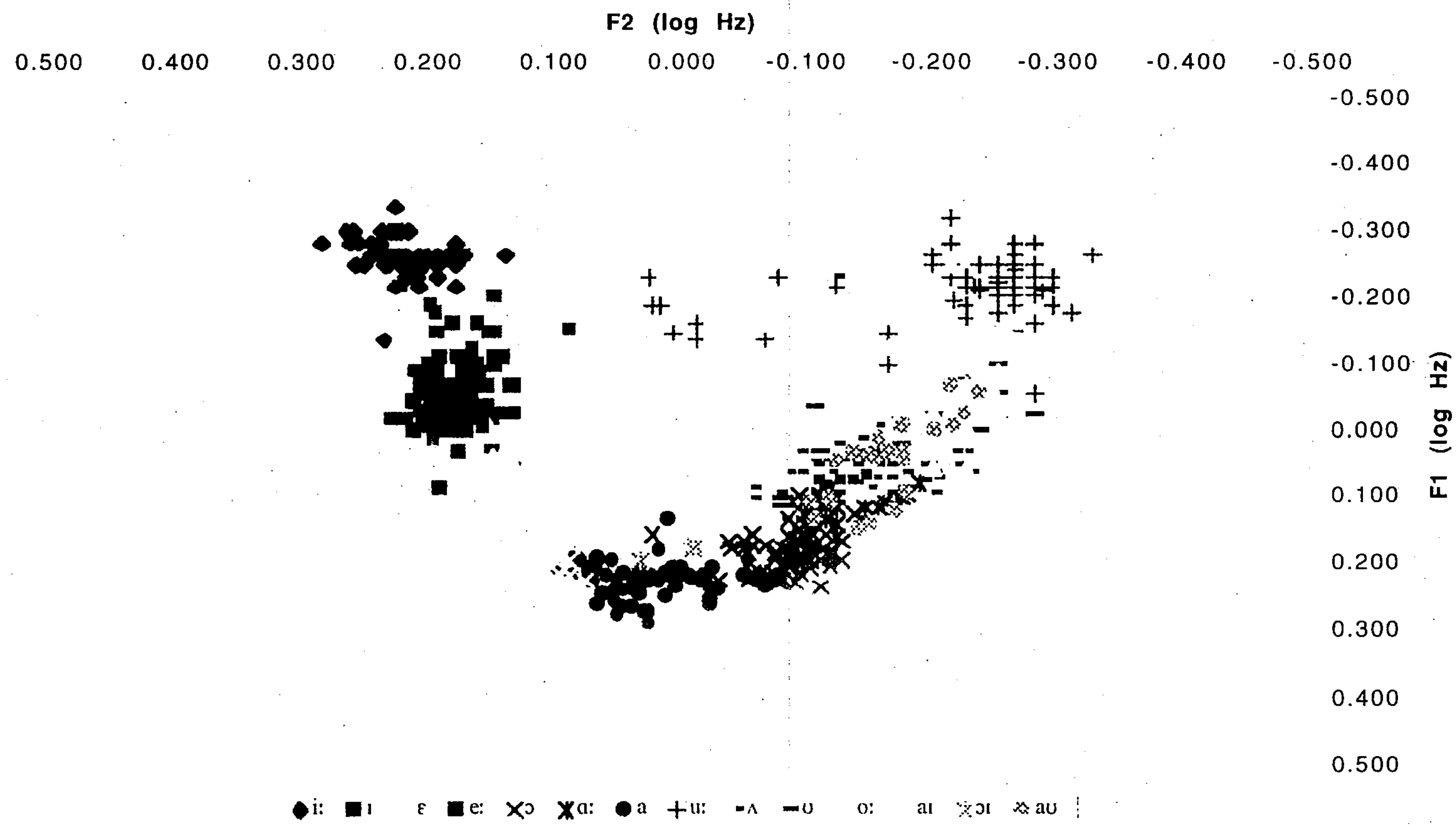
Speaker KD (female, Kingston): all vowels at midpoint
log mean normalized difference scores (wordlist only)



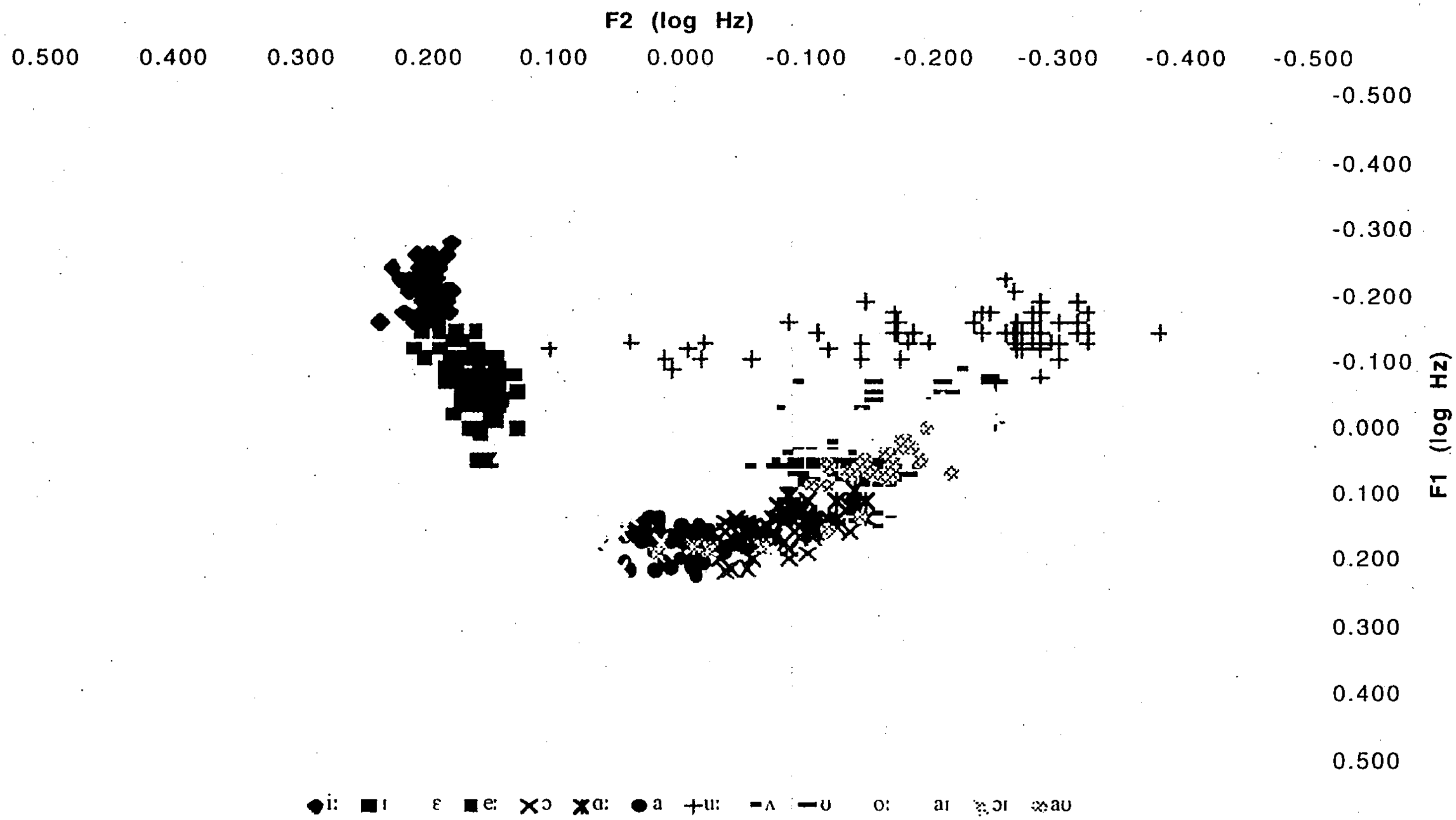
Speaker KE (male, Kingston): all vowels at midpoint
log mean normalized difference scores (wordlist only)



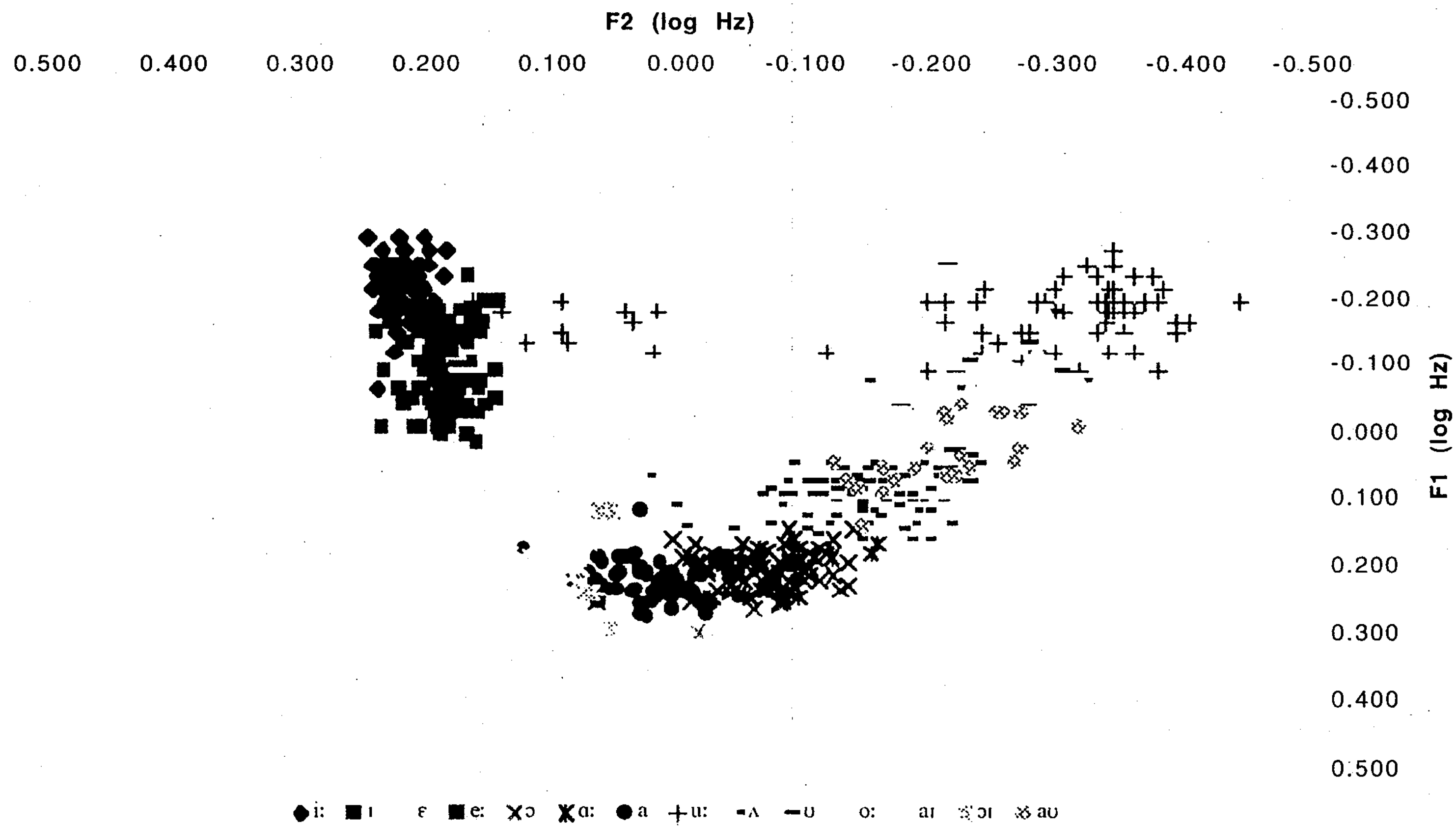
Speaker KF (female, Kingston): all vowels at midpoint
log mean normalized difference scores (wordlist only)



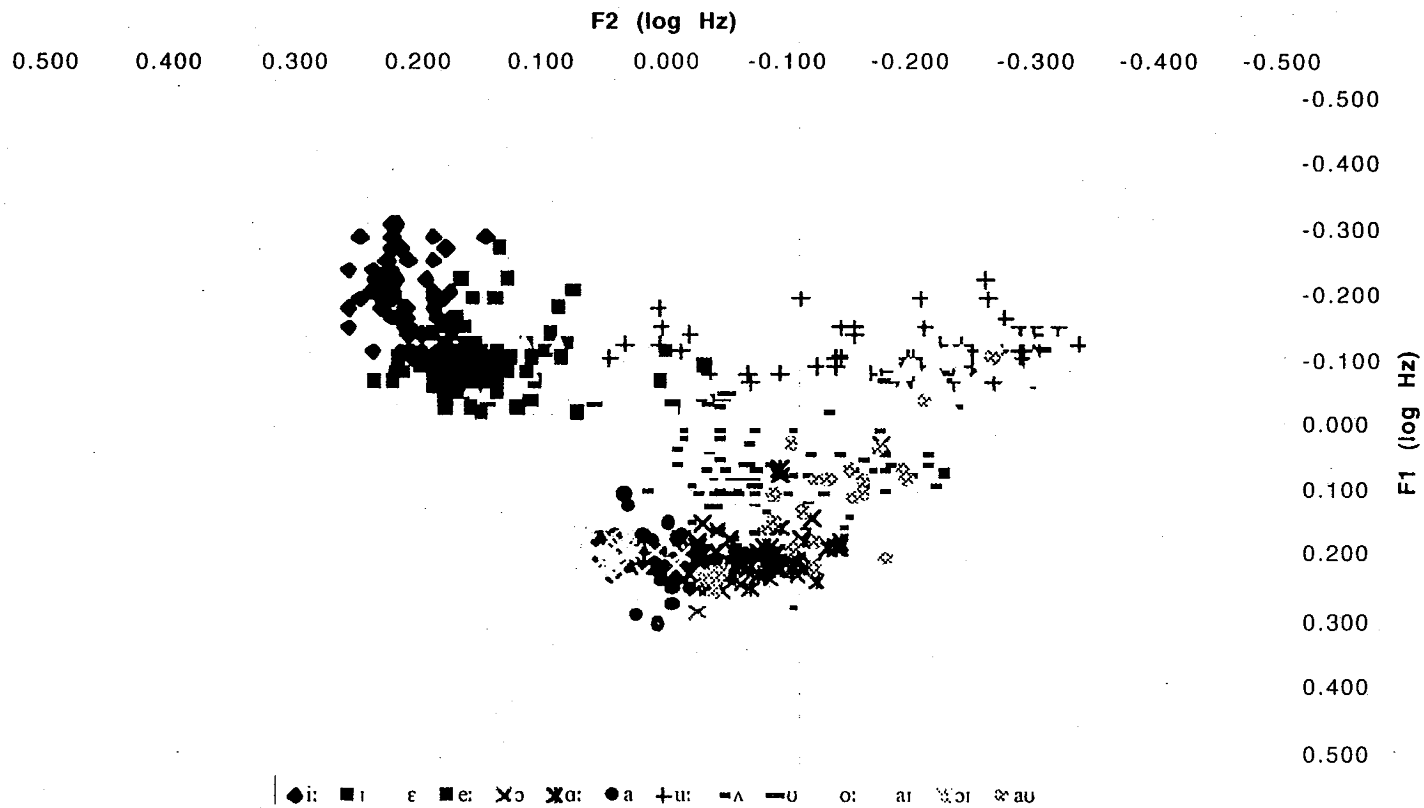
Speaker KM (male, Kingston): all vowels at midpoint
log mean normalized difference scores (wordlist only)



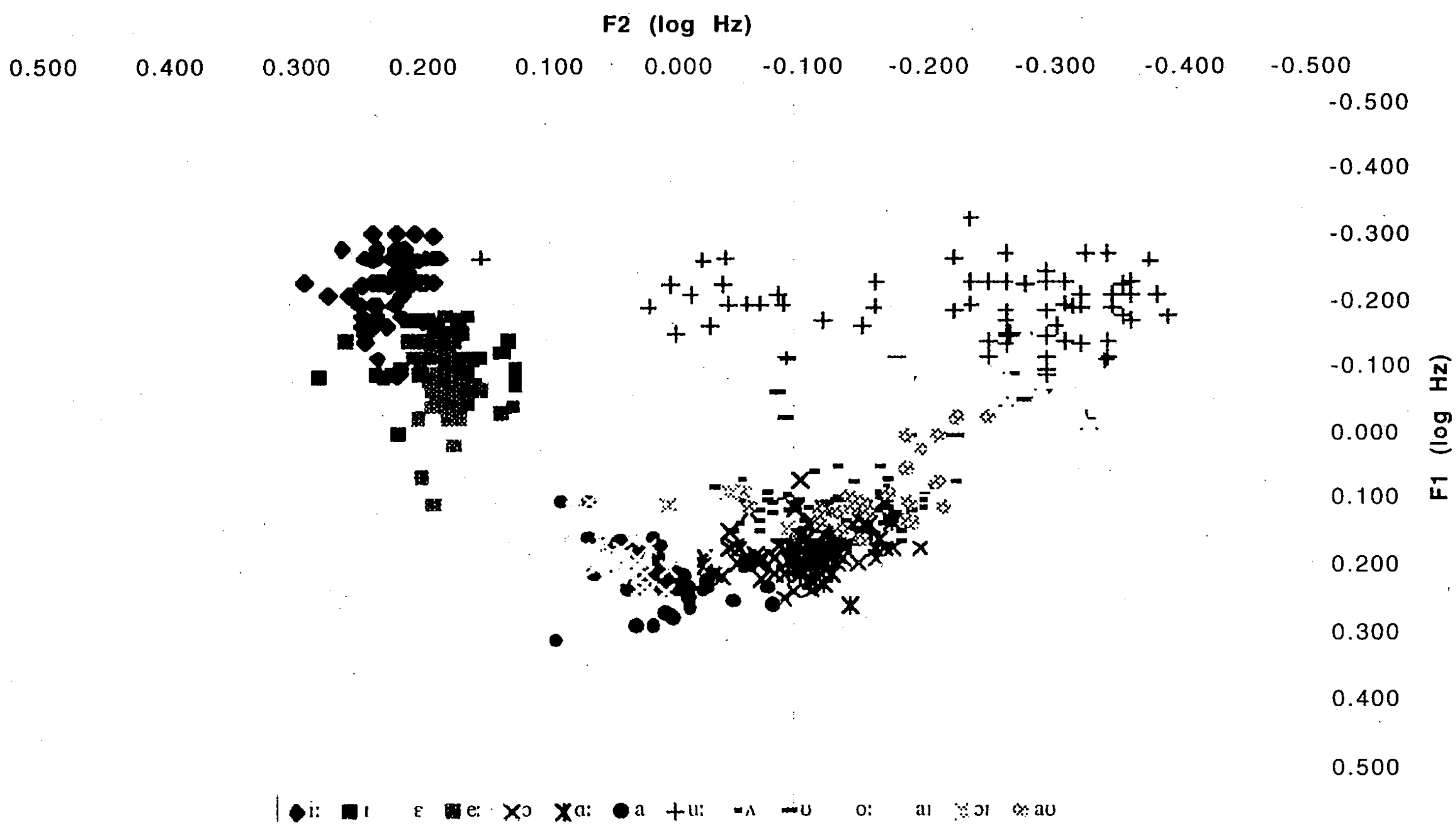
Speaker KR (male, Kingston): all vowels at midpoint
log mean normalized difference scores (wordlist only)



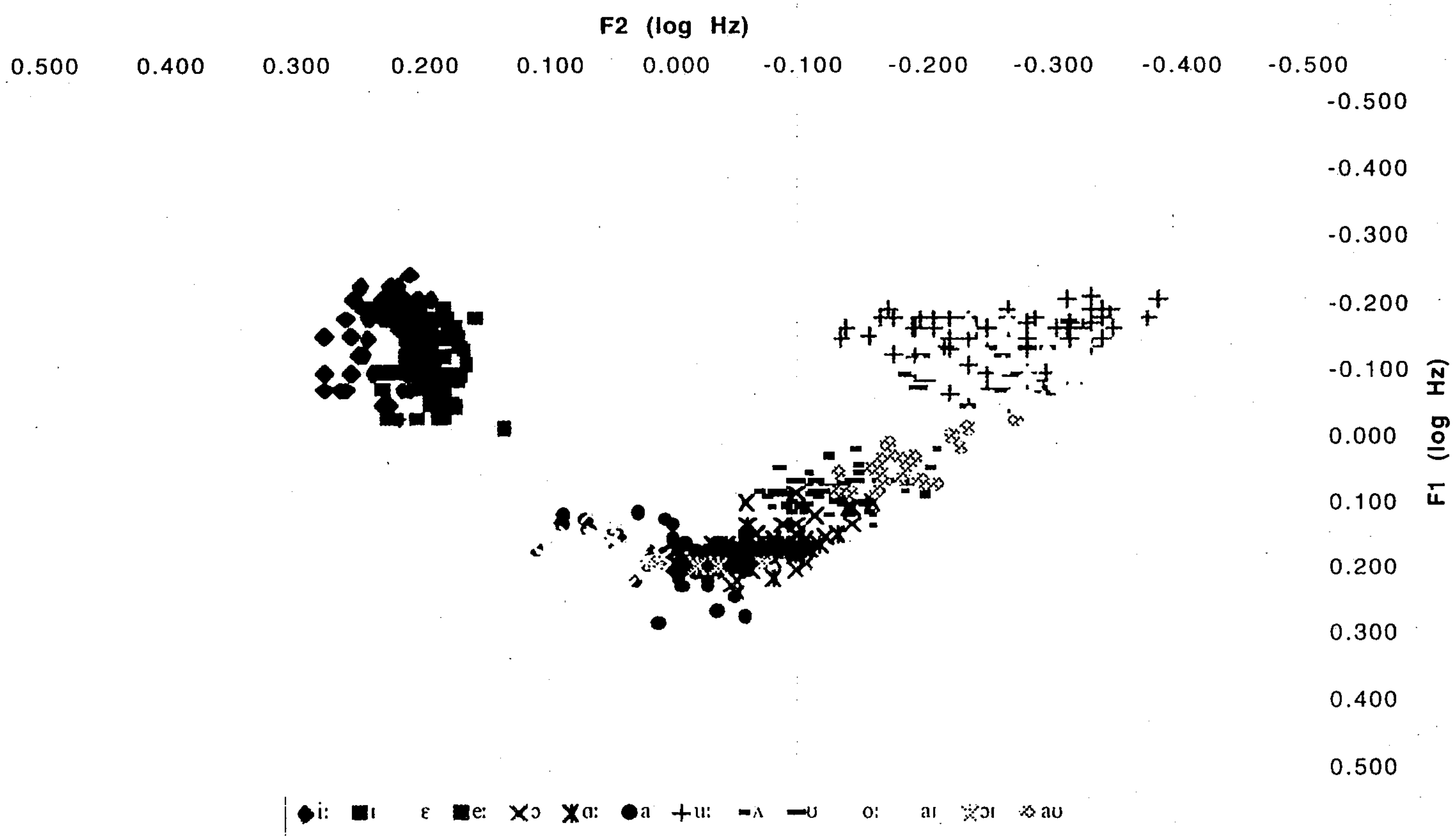
Speaker KT (female, Kingston): all vowels at midpoint
log mean normalized difference scores (wordlist only)



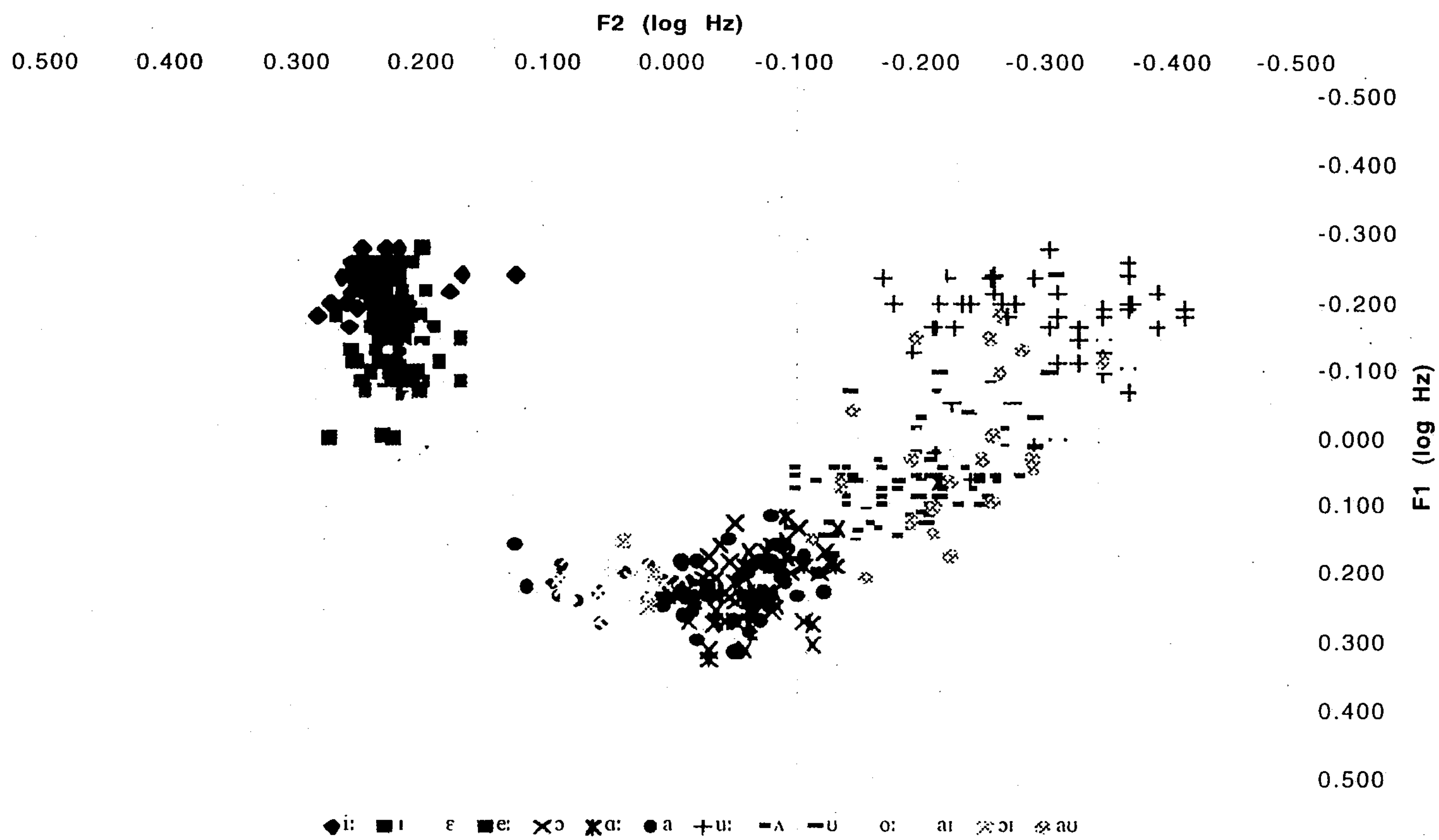
Speaker KU (male, Kingston): all vowels at midpoint
log mean normalized difference scores (wordlist only)



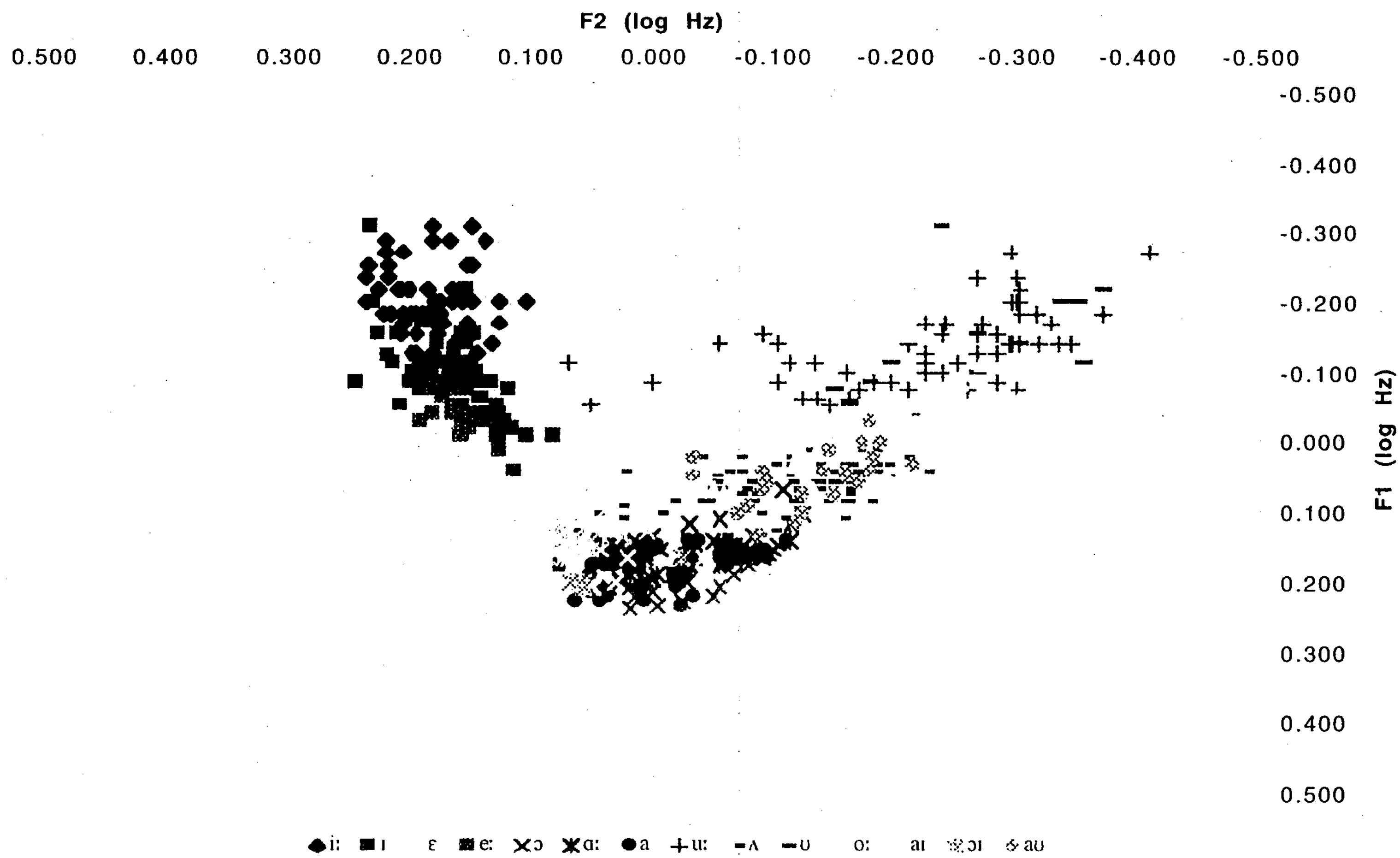
Speaker KW (male, Kingston): all vowels at midpoint
log mean normalized difference scores (wordlist only)



Speaker TA (male, St Thomas): all vowels at midpoint
log mean normalized difference scores (wordlist only)

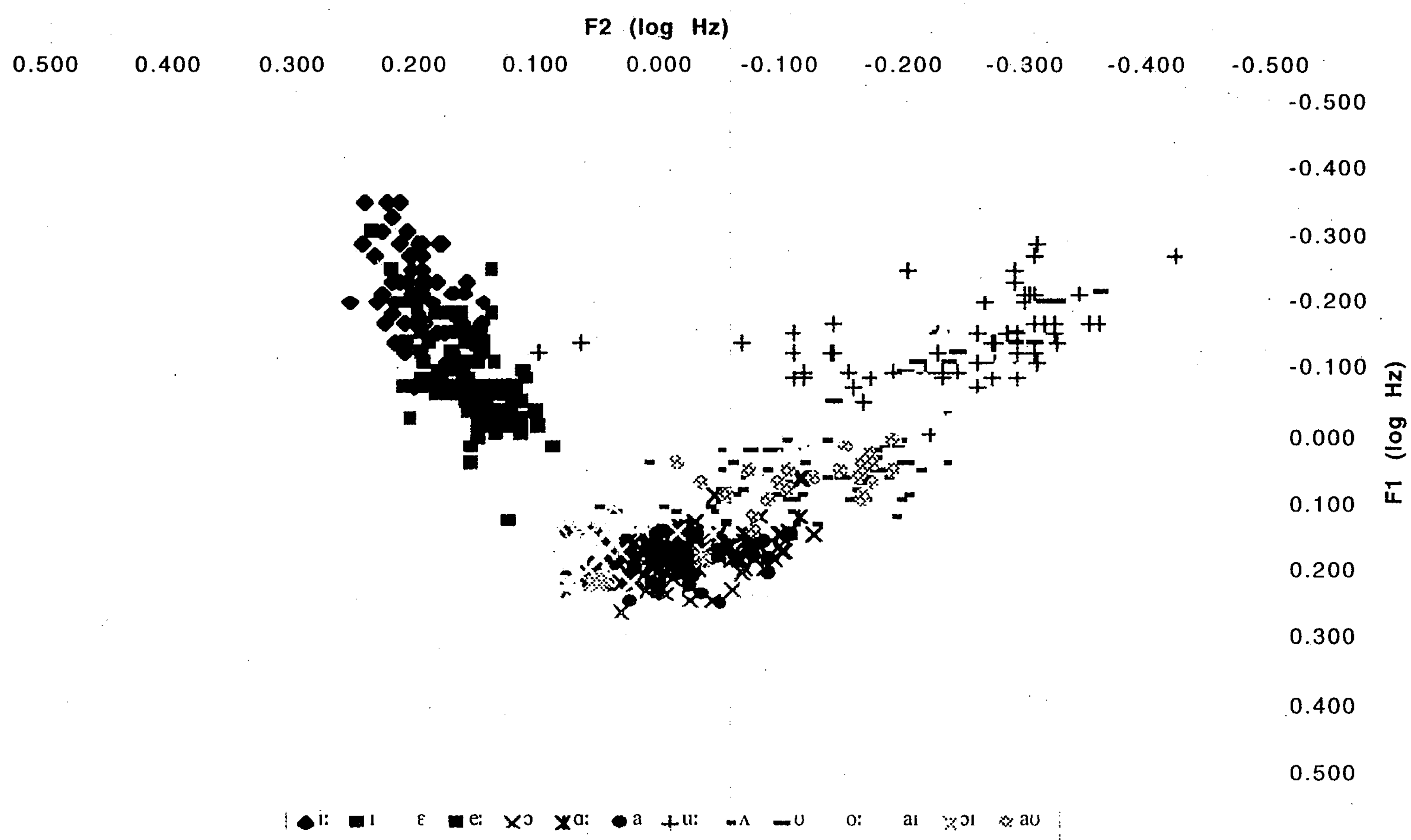


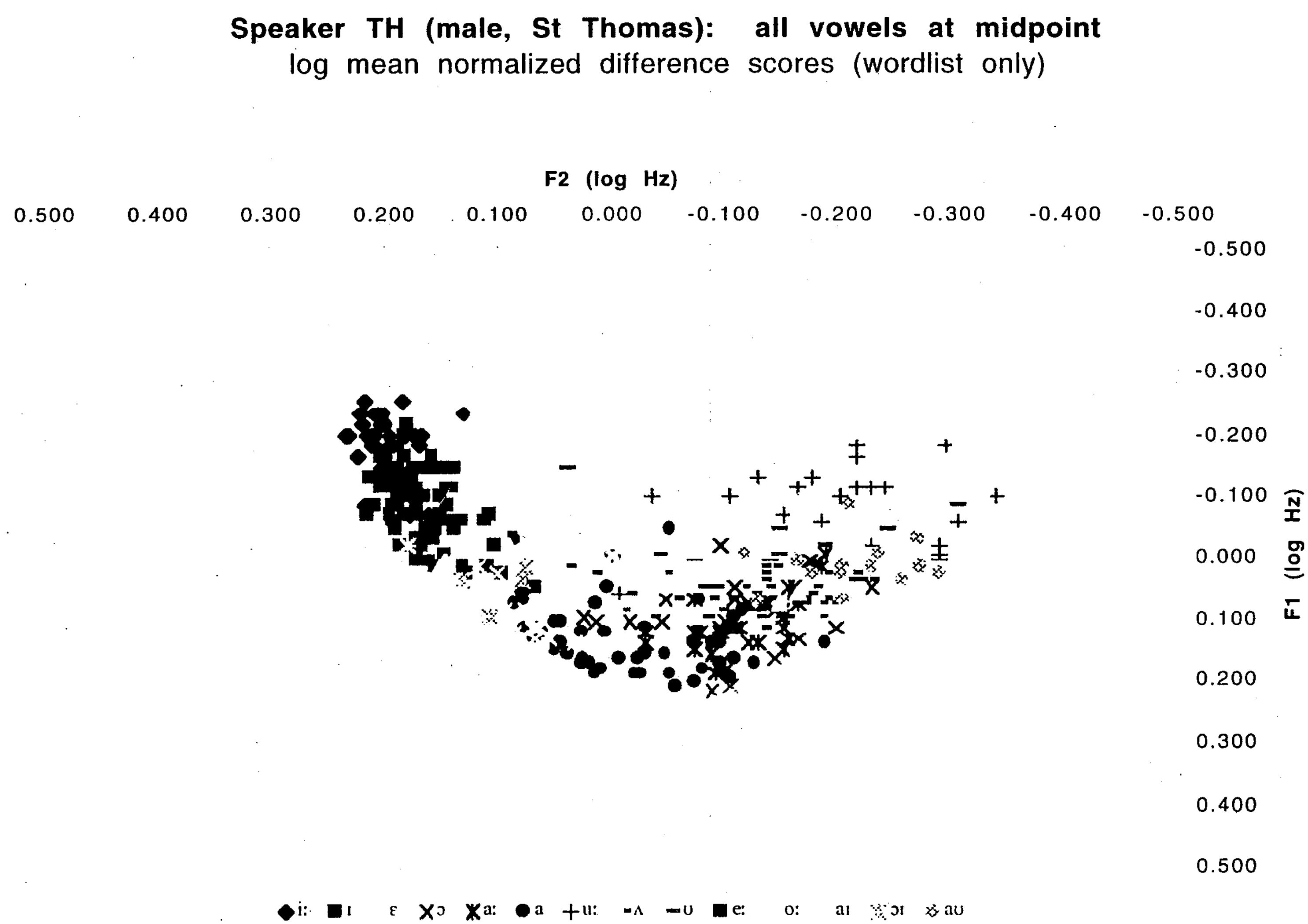
Speaker TB (male, St Thomas): all vowels at midpoint
log mean normalized difference scores (wordlist only)



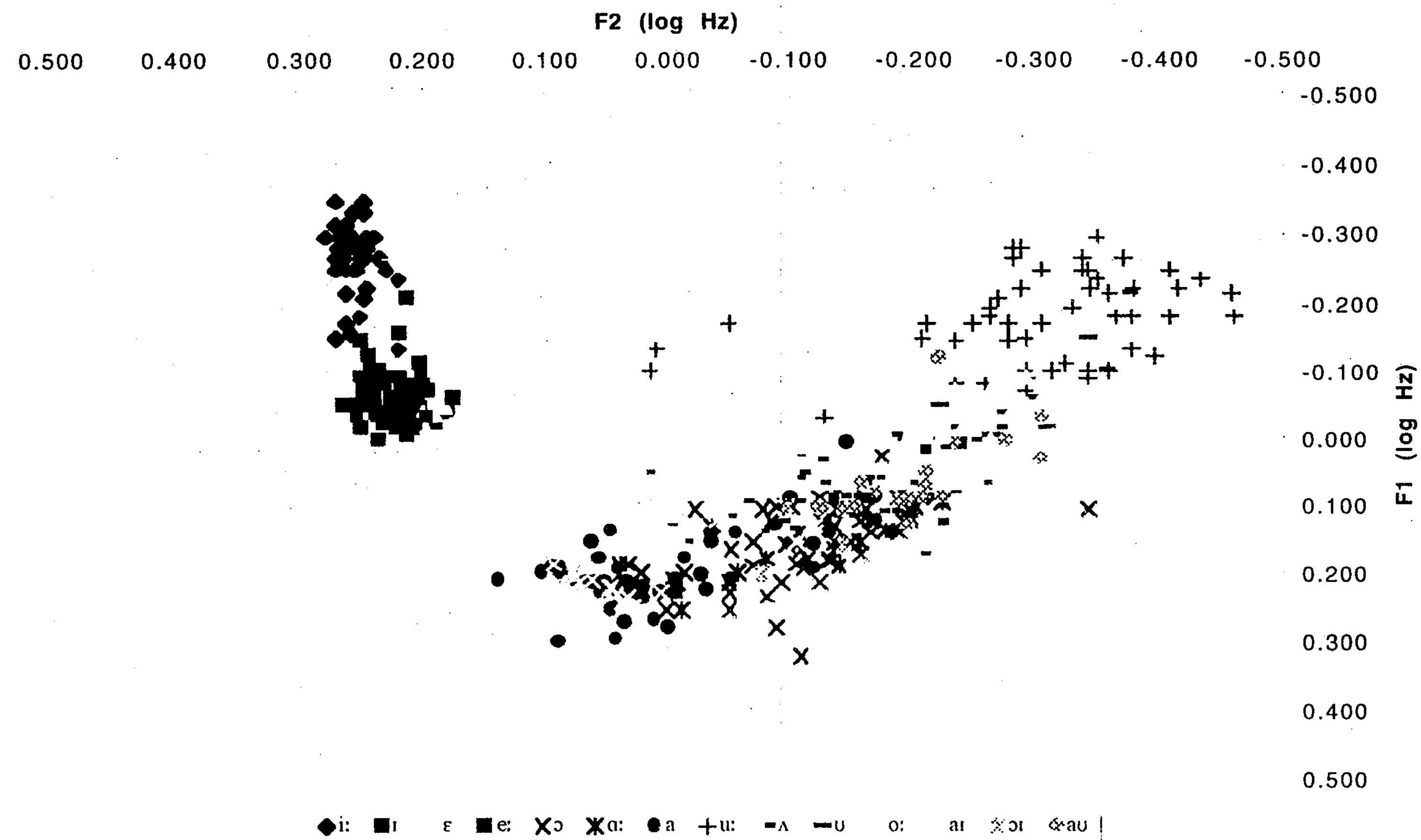
Speaker TE (male, St Thomas): all vowels at midpoint

log mean normalized difference scores (wordlist only)

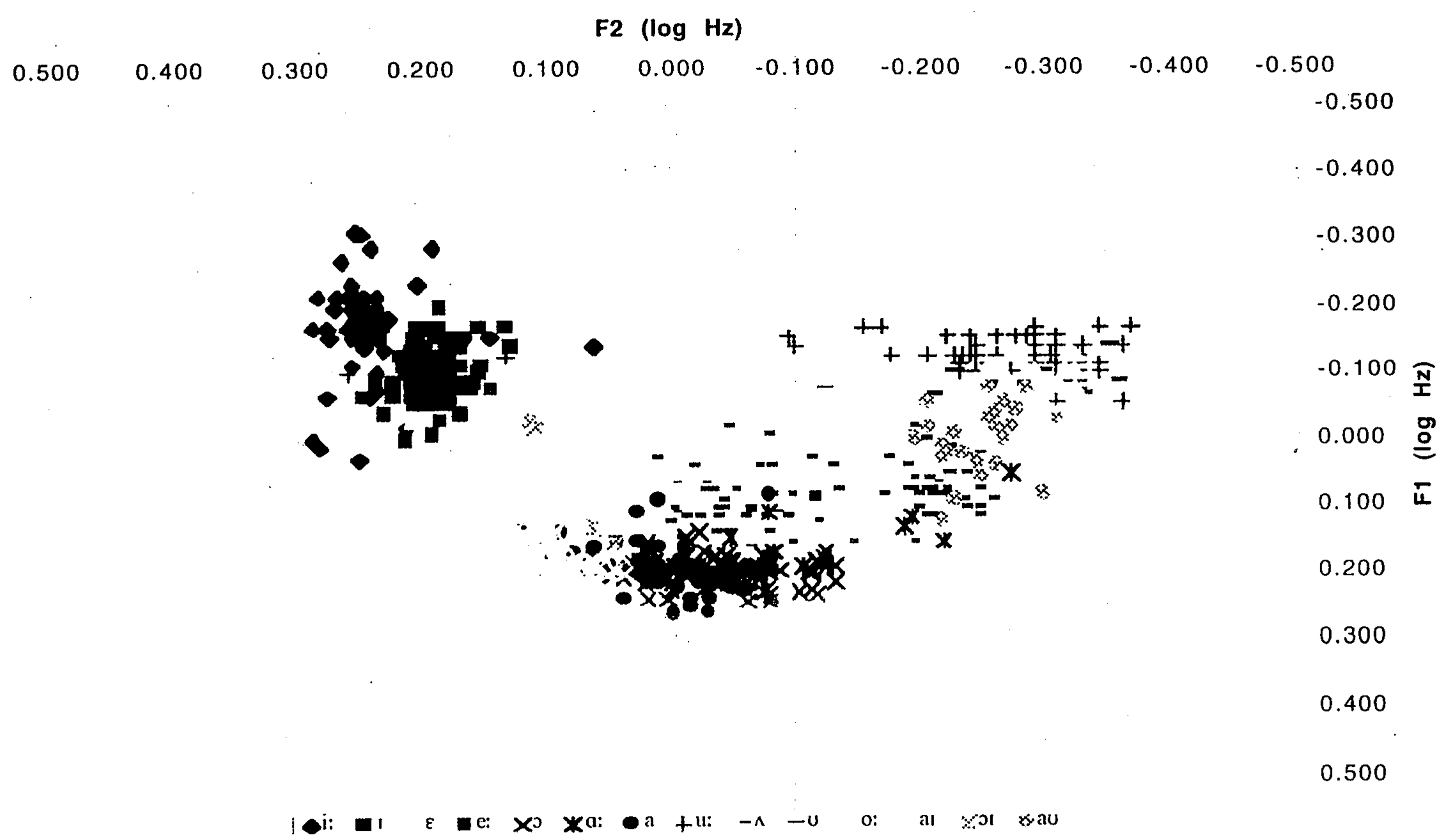


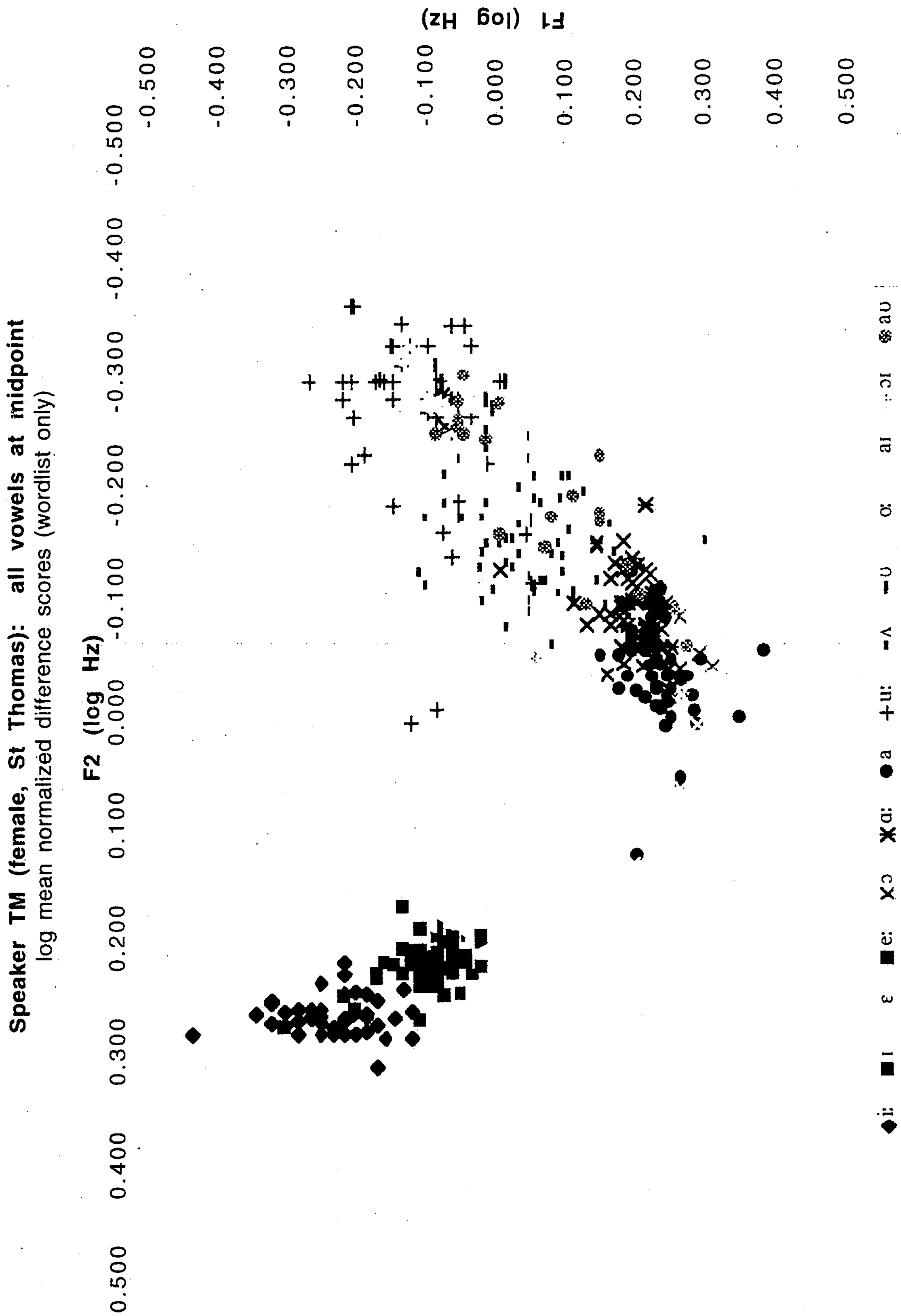

Speaker TH (male, St Thomas): all vowels at midpoint
log mean normalized difference scores (wordlist only)
F2 (log Hz)
0.500 0.400 0.300 0.200 0.100 0.000 -0.100 -0.200 -0.300 -0.400 -0.500
F1 (log Hz)
-0.500 -0.400 -0.300 -0.200 -0.100 0.000 0.100 0.200 0.300 0.400 0.500
iː ɪ ɛ ɔ aː a uː ʌ ʊ eː oː aɪ ɔɪ aʊ

Speaker TJ (female, St Thomas): all vowels at midpoint
log mean normalized difference scores (wordlist only)

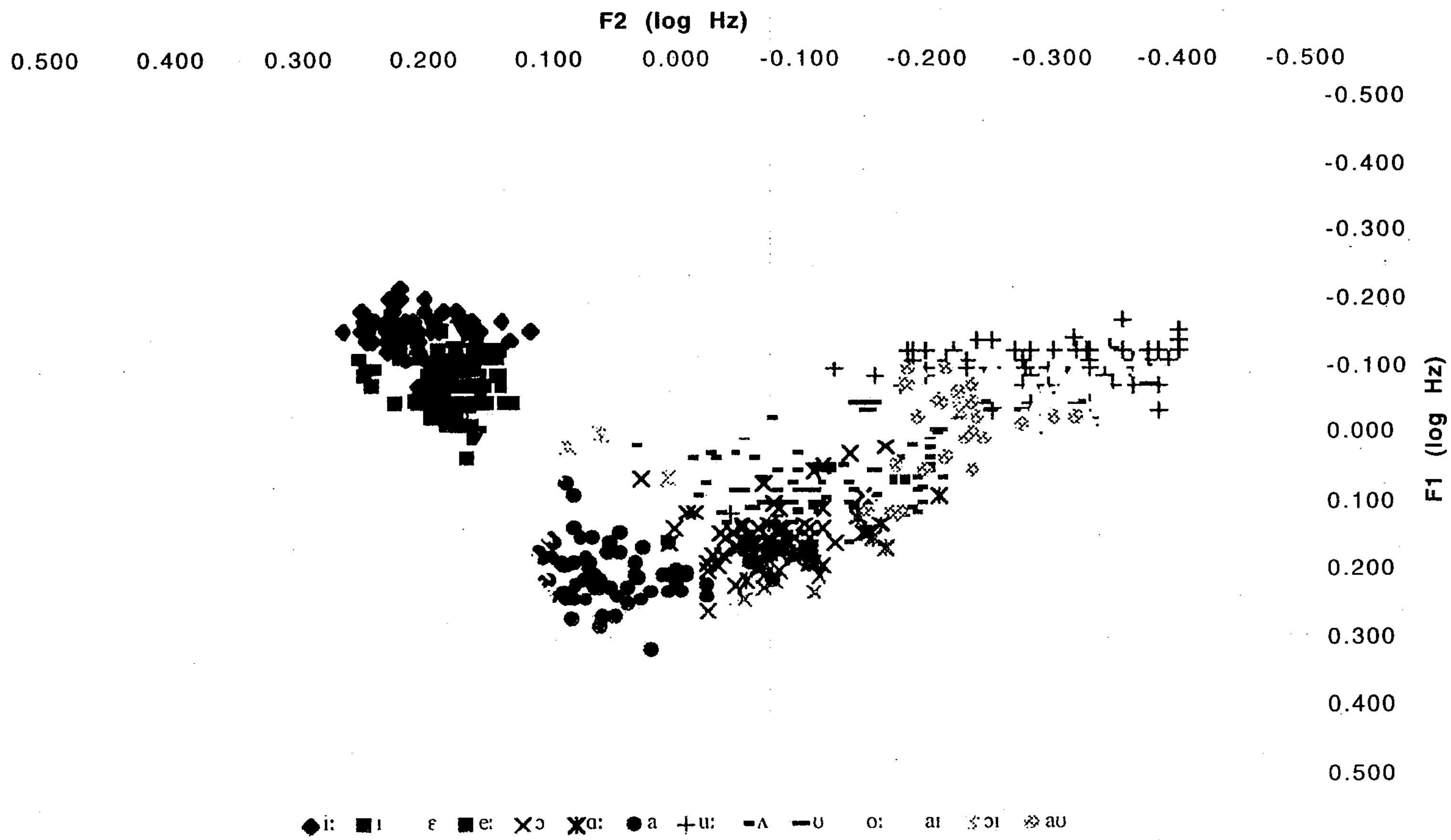


Speaker TL (female, St Thomas): all vowels at midpoint
log mean normalized difference scores (wordlist only)

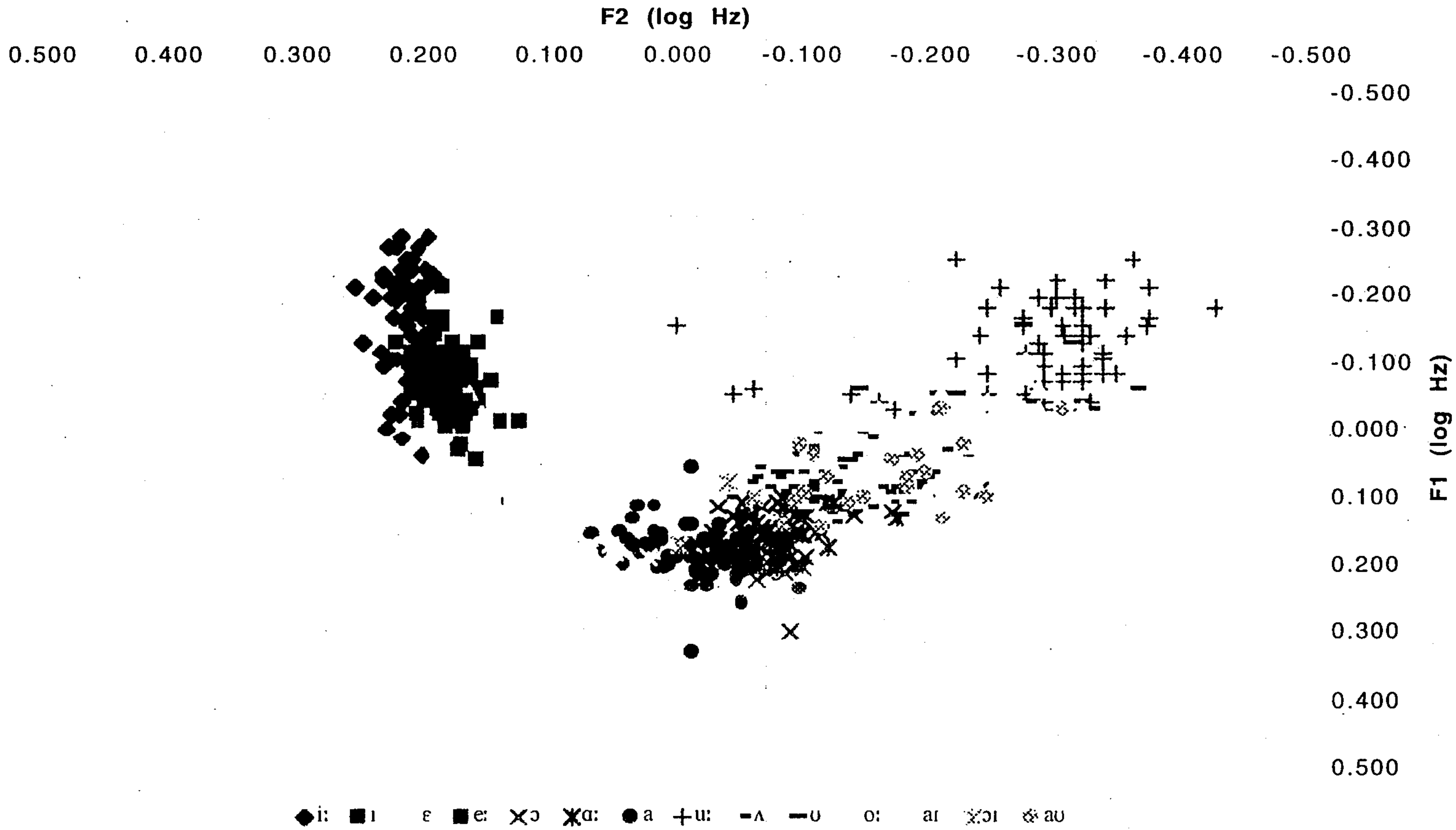



Speaker TM (female, St Thomas): all vowels at midpoint
log mean normalized difference scores (wordlist only)
F2 (log Hz)
F1 (log Hz)
-0.500
-0.400
-0.300
-0.200
-0.100
0.000
0.100
0.200
0.300
0.400
0.500
i:
ɪ
ε
e:
ɔ
ɑ:
a
u:
ʌ
ʊ
ɜ:
aɪ
ɔɪ
aʊ

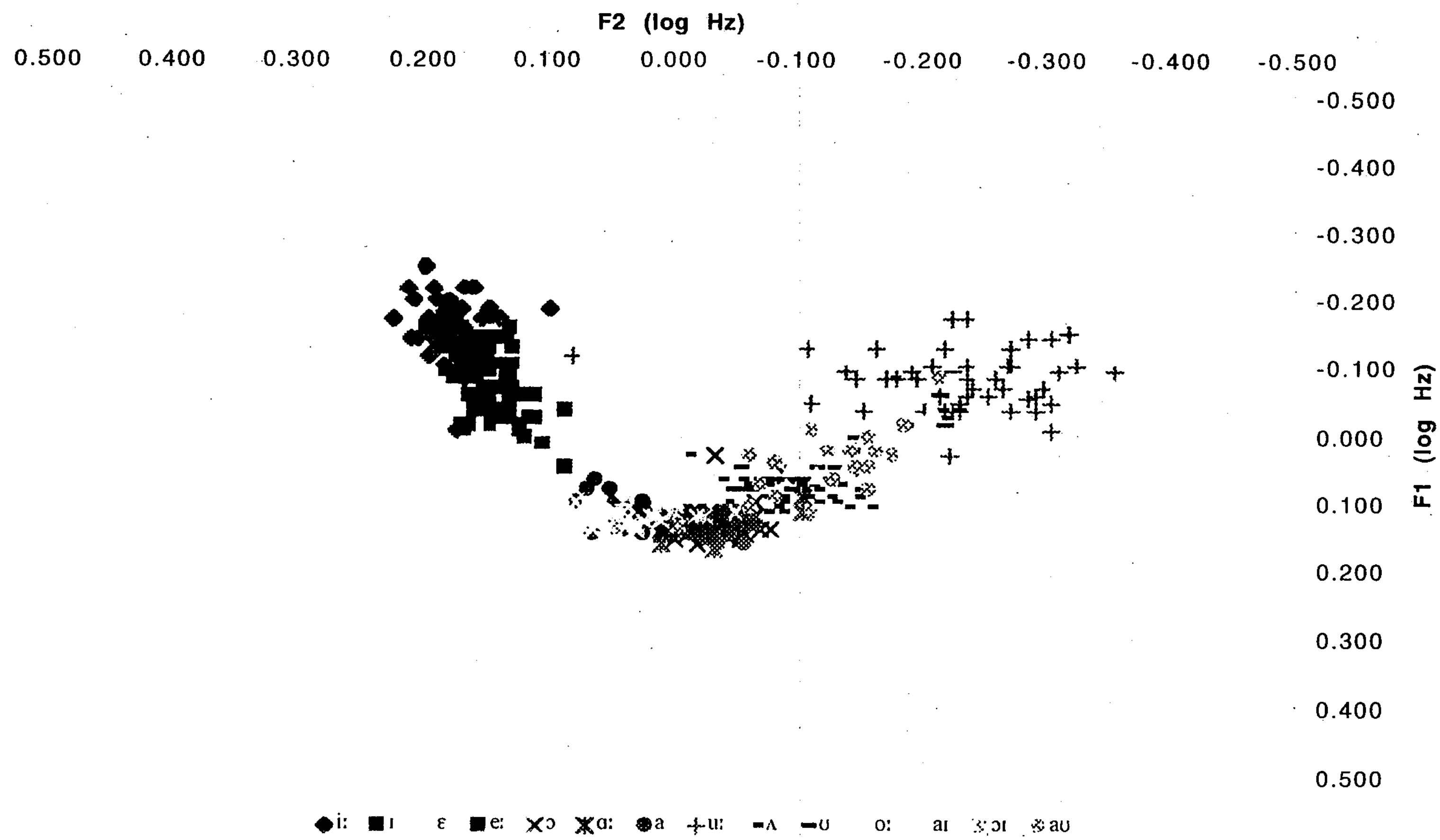
Speaker TT (female, St Thomas): all vowels at midpoint
log mean normalized difference scores (wordlist only)



Speaker TV (female, St Thomas): all vowels at midpoint
log mean normalized difference scores (wordlist only)



Speaker TX (male, St Thomas): all vowels at midpoint
log mean normalized difference scores (wordlist only)



APPENDIX H

Labeling Task Stimulus Excerpt

TAPE A: 5/13/97 S1's Hair salon, Kingston. Initial 2 minutes used for labeling task (total playing time 1:19:54)

Participants:
S1 (Miss P, female, owner of hair salon, aged early 50's)
S2 (A, female, operator of hair salon, aged early 30's)
S3 (Miss M, former domestic helper to S1, aged 70's)

Topics:
Jamaican politics

Positions:
S2 seated closest to interviewer. S3 seated approximately 10 feet away at interviewer's right. S1 seated across from interviewer and S2.

Discourse:

TIME STAMP	ID	Discourse
00:11	S1:	An im staat tu get poor people an tun dem into IDIOTS! Because that's exactly what he is doing with them now==he's
	S2:	--piipl dem are idiot tuu be<xx>
	S3:	But you have a whole heap now though.
	S1:	<xx> He is to be blamed because im hav influence over di people-dem. He is to be blamed.
	S2:	A-ow. He is tuu out of arda.
	S3:	A-ow. Well even now tuu...Is not, two timer, cause look like <background noise>
	S2:	<xx>A M-A Mr. Ferguson Frien. <xx> Nobody as EVA retaliated against my curfew...except..Mr..Seaga. A di firse taim a hiir KD taak so long! An wen *hi sed to im, NOT UNDER MY SYSTEM*!
	S3:	Him talk tuu sof'. <@@> Him tuu sof'. Him tuu sof'. Him tink se it a firs taim. *First taim*, but nuo im an crime tuu sof'.
1:00	S1:	KD. Dat taim KD nuh sof. KD a wan jinal. KD a wan jinal.
	S2:	A think hi sof', yu nuo. Dem deh piipl dem tek laang fi straik. Is laik di maanin wen di commissiona come in from Breakfast Club==
	S1:	No. No. Him is a pappy show.
	S2:	No because Mr. Seaga se im mus liiv im alone yu nuo.
	S1:	No. Him is a pappy show.
	S2:	Im tell Mr. Seaga yu nuo, man, im se luk hiir. Yu nuo "we have worked for a very long time. And, we have worked together an we didn't have anything. Don't let us have anything. What do you need a weekly report of crime for? Don't you read the papers? Please leave me alone."

S3: Oh God <@@>Yu an I tek up wit di commissiona.
S2: Pleasant, man.
1:54 S1: Is a pappy show.
S3: Im nah go if him kyaa hiir if <xx> or not.
S1: Im kyaanot duu a ting. Im is lead by di government. Dem ting Patterson an dem enforce everyting dat im duu. Im doan hav a mind of hi own. IM DOAN HAV A MIND OF HIS OWN.
S3: Him suppose to dictate to di army.
S2: No man yu sii di army man, we im niem? Mr. Sinting o neda. As yu sii fi-im face yu nuo. Yu nuo se if Mr. Seaga eva come niir mi a wuda shot im abacks. Yu si di press report?
S1: Dem doan hav a mind of dem own.
S2: Wen im wen Mr. Seaga se ahm "Soldjas firing shot" at the press conference? Hiir im. "No. Lie. Nothing like dat. No way. Cannot hapm. Any more questions?"
2:36 S1: Jeesas.
S2: Wen yu hiir dat deh sentence deh yu nuo dat man look=
S1: Whole a dem a set of disaster.
S3: Im neva a kill soldja yet. Is tuu much a di young bwai dem a dead nou from it.
S2: Is backside. Some a dem tuu wicked.
S1: Soldja kyaan jus get up fiya shat so Miss Patsy.
S3: Soldja neva get up--soldja neva du nuhting more dan==
S2: Some of di policeman-dem is tuu wicked. <xx>
S3: An di police man dem tuu wicked.
(3:02) (end excerpt)

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