Chapter 2

Phonological Change in Philadelphia

/æ/

While the scale of sociolinguistic data has increased dramatically, given technological advances in recording, transcription, and measurement, most corpora still fall short of the necessary data to analyze the mechanism of phonological change. The problem of capturing the elusive timing of a change, as outlined in Hockett (1958) "on such-and-such a day, for such-and such- a speaker or tiny group of speakers, the two fell together [...] and the whole system [...] was restructured" requires any empirical investigation into phonological change to contain data from speakers before this sudden restructuring as well as data from speakers after this sudden restructuring. Because phonological restructuring does not occur as frequently as phonetic change, any corpus that encompasses the entire change – before and after – must either be specifically targeted towards a potential change (as in the case of Johnson's 2010 investigation of the spread of the low-back merger in Massachusetts) or contain enough longitudinal data to capture a change. As sociolinguistic corpora continue to be built up (e.g., Buckeye Corpus, Origins of New Zealand English Corpus, Philadelphia Neighborhood Corpus, Voices of California Project, *inter alia*) this longitudinal data will become more and more possible. In addition to requiring a large longitudinal corpus to capture a change, any phonological change resulting in a merger or a split also will require a massive amount of per-speaker data in order to disambiguate between the three mechanisms

of phonological change: since phonetic similarity renders individual tokens difficult to classify phonologically, an analysis of the mechanism of change for a merger or a split will rely primarily on the distribution of the data.

In this dissertation, I focus on a phonological change currently under way in Philadelphia English. This change has two important benefits for investigating the mechanism of phonological change. First, because it is occurring in Philadelphia English, we have a wealth of apparent-time data from before and during this change from the Philadelphia Neighborhood Corpus (PNC). Second, this change is an allophonic restructuring between two /æ/ systems, where both the old system and the new system have two allophonic targets. This means that (1) we have the relevant apparent-time data on the community level to identify the sociolinguistic nature of this change, and (2) it will require less data per speaker to identify the mechanism of change.

Here, I provide an analysis of the community-level pattern and social divisions within this larger community that have an effect on the spread of this allophonic restructuring. I end with an analysis of the intergenerational pattern of this change, analyzing the production of two different families that represent different stages in the allophonic change. Versions of my work presented in this chapter have appeared in Labov et al. (2016) and Fisher et al. (2015). With the goal of limiting a reiteration of previously published work, here I focus on and expand the analysis of those aspects of Labov et al. (2016) and Fisher et al. (2015) that are the most relevant to the question of the mechanism of phonological change.

2.1 Philadelphia /æ/

Philadelphia English, like a number of dialects along the Mid Atlantic region of the United States, traditionally contains a split in the /æ/ phoneme into a lax form and a tense form. Lax forms are produced as a short low front nonperipheral [æ], while tense forms are raised and typically inglided, resulting in one of the following productions: [ɛːᵊ,eːᵊ, iːᵊ]. The tense forms, but not the lax, have been found via matched guise test and self-reports to be socially salient and stigmatized (Labov, 2001). The distribution of tense and lax forms can be largely described by a single productive allophonic rule, shown in 5. I will henceforth refer to this traditional /æ/ split as PHL. The

phonological nature of PHL – as an allophonic split or a phonemic one – has been the topic of some debate in the literature (see, e.g. Ferguson, 1972; Payne, 1980; Labov, 1989; Kiparsky, 1995; Dinkin, 2013). Here and in recent work (Labov et al., 2016; Sneller, 2018), we have taken the position that PHL is an allophonic split with some lexical specificity. In Labov et al. (2016), this position is based on the empirical pattern of community level variation (see §2.3); in Chapter 3, I expand on this by providing a more detailed theoretical account of PHL as a productive allophonic rule. Here, I represent the tense allophone of /æ/ as æh, following the conventions of Labov (1989).

(5) **PHL:** æ → æh[+anterior] ∩ ([+nasal] ∪ [-voice / +fricative])] σ

Encroaching on the centuries-long stability of PHL in Philadelphia, there has also been emerging evidence of a new allophonic split governing /æ/ documented in the geographic area surrounding Philadelphia (Ash, 2002) and in more recent years in younger Philadelphian speakers as well (Labov et al., 2013; Prichard and Tamminga, 2012; Labov et al., 2016). This incoming allophonic system, which I refer to as NAS, is shown in 6 below, in which /æ/ is tensed preceding any nasal token. NAS can be found in speech communities across America, including New Haven (Johnson, 1998), the Midland region (Boberg and Strassel, 2000), Ohio (Durian, 2012), Indiana (Fogle, 2008), the St. Louis Corridor (Friedman, 2014), New York City (Becker and Wong, 2009), the West Coast (Hall-Lew et al., 2010), and Michigan (Wagner et al., 2015). Socially, NAS holds the position of being a supraregional standard, which is exemplified by its use in national media outlets such as NPR.

(6) **NAS:** æ → æh / _[+nasal]

Here, I've used featural representations to describe both PHL and NAS; this is partially to highlight the fact that NAS can be seen as a featural subset of PHL, and partially because our investigation into the inevitability of NAS replacing PHL in Chapter 6 relies on a featural analysis. For PHL, this rule is represented as a tensing process triggered by a disjoint set of phonological conditions: nasals or voiceless fricatives which are also anterior and syllable final. This produces tense *hand*, where /æ/ is followed by a syllable final anterior nasal /n/, but lax *manner*, where the following /n/ is syllabified as the onset of the following syllable. For clarity of exposition, both PHL and NAS may also be represented by simply listing the set of segmental triggers, as in (7) and (8). As

discussed in Chapter 1, I adopt a stratal theory of phonology, enabling us to stipulate that PHL is a phonological rule that applies only at stem-level but not also at word- or phrase-level. This accurately captures the fact that an /æ/ followed by an open syllable in the stem (e.g., *manage*) is produced as lax but that any open syllable created by an inflectional morpheme (e.g., *man+ning the ship*) is invisible to the PHL, resulting tense *manning the ship*. See Chapter 3 for a more detailed account of the phonology of PHL.

(7) **PHL:** / _ æ → æh / _{m, n, f, θ, s}] σ

(8) **NAS:** æ → æh / _{m, n, ŋ}

While NAS appears to be on the rise in dialects across the country, it is worth noting that the phonological effects of NAS as an incoming allophonic system will differ by the regional dialect it is usurping. In many dialects, NAS replaces a phonologically simple system, as in the raised single-target Northern Cities Shift system or the continuous /æ/ system of Eastern New England (Labov et al., 2006). For the White speakers in Philadelphia whose speech is the focus of this dissertation, the incoming NAS system is in community-level competition with one of the most complex allophonic /æ/ systems in English dialects. This provides a particularly interesting case study for the question of the mechanism of phonological change: a changing complex system will enable us to see more clearly whether change does in fact affect all aspects of a complex system simultaneously, as we would expect to find in cases of phonological change via intraspeaker grammar competition or spontaneous phonologization but not necessarily for phonetic incrementation.

There are several additional points to make here about the differences between PHL and NAS, which I will return to throughout the dissertation. First, unlike PHL, NAS is typically a surface-true rule that does not have any lexical specificity (though anecdotal evidence has found some NAS speakers with lexical specificity, particularly in highly frequent words such as the speaker's name adhering to PHL rather than NAS). This makes NAS a phonologically simpler rule, which is often thought to be an inevitable direction for sound change to occur. Not only is NAS a surface-true rule and therefore presumably easier for a language learner to acquire, NAS is also a featural subset of PHL; if we removed three conditions from PHL ([+anterior], [+voiceless fricative], [σ]) this would

result in NAS, suggesting a potential route by which PHL could be restructured into NAS. This set of facts raises an important question: whether the allophonic change from PHL to NAS was an inevitable simplification; I return to this question in Chapter 6.

Secondly, because NAS is a featural subset of PHL, there are some tokens that would be produced the same under both PHL and NAS: tense /æ/ in words like *hand*, in which /æ/ precedes a tautosyllabic anterior nasal, and lax in words like *cat*, which fall into the elsewhere condition for both allophonic systems. Tokens belonging to either of these shared conditioning factors will be referred to as *shared* or *training* tokens throughout the dissertation, while tokens belonging to any of the four primary distinguishing factors will be referred to as *test* tokens. Table 2.1 displays the six primary conditioning factors for PHL and NAS, along with their expected realization under each system, their type frequency and their token frequency (see Chapter 3 for a full run down of all conditioning factors and lexical exceptions). For expositional ease, I will refer to each conditioning factor as a lexical set or class of words, following the example in Table 2.1. For instance, a token of the word *path* is considered to be a LAUGH class word, since it has a tautosyllabic anterior voiceless fricative. I refer to the four conditions that differentiate between PHL and NAS (LAUGH, MAD, MANAGE, HANG) as *test conditions* and the tokens that fall under these conditions as *test tokens*. I briefly note that the MAD class in Table 2.1 represents a somewhat strange "conditioning factor," as it is a class of three lexical exceptions produced as tense (*mad, bad, glad*). This list of exceptions remains useful as a condition for PHL, because of its stability across speakers. In contrast, the lexical exceptions produced as lax vary somewhat from speaker to speaker; for this reason, I use the MAD class as a reliable test condition but do not rely on the more unreliable lax exceptions as a test condition. As shown in Table 2.1, the vast majority of /æ/ words, as measured either by token frequency or type frequency, fall under the HAND class or the CAT class, which are the two classes of words that are produced the same under PHL and NAS.

Most critically for a dissertation investigating the mechanism of phonological change, this shift from PHL to NAS in the Philadelphia speech community is a change in the abstract phonological rules governing /æ/ allophony. This allophonic restructuring is a phonological change.

Conditioning Factor	Class	PHL	NAS	Token frequency	Type frequency
Tautosyllabic anterior nasal	HAND	tense	tense	.20	.19
Tautosyllabic anterior voiceless fricative	LAUGH	tense	lax	.16	.07
Lexical exceptions as tense	MAD	tense	lax	.05	.001
Intervocalic nasal	MANAGE	lax	tense	.06	.10
Velar nasal	HANG	lax	tense	.03	.04
Elsewhere	CAT	lax	lax	.5	.6

Table 2.1: The six primary phonological conditioning factors between PHL and NAS. Token and Type frequency obtained from the IHELP corpus.

2.2 Why this change is particularly useful

The allophonic change from PHL to NAS provides a uniquely convenient testing ground for investigating the mechanism of phonological change, for several reasons. First and perhaps most importantly, we have an unprecedented scale of data from speakers born before, during, and even from some speakers after the change. This means that we have unprecedented access to data from transitional cohort speakers, which will allow us to test the mechanism of phonological change using data from speakers during the actual change, providing insight that a post-hoc analysis cannot give us.

Secondly, the structure of PHL and NAS results in both shared and test tokens, enabling us to more easily identify whether any particular token is consistent with either PHL or NAS: both systems have two distinct targets, and the differences in conditioning environments governing which tokens belong in which target between PHL and NAS enables us to identify the underlying system for a given test token of /æ/. For example, a token of *manage* produced in the acoustic space of a speaker's lax allophone is consistent with PHL conditioning but not NAS conditioning, allowing us to identify that specific token as adhering to PHL.

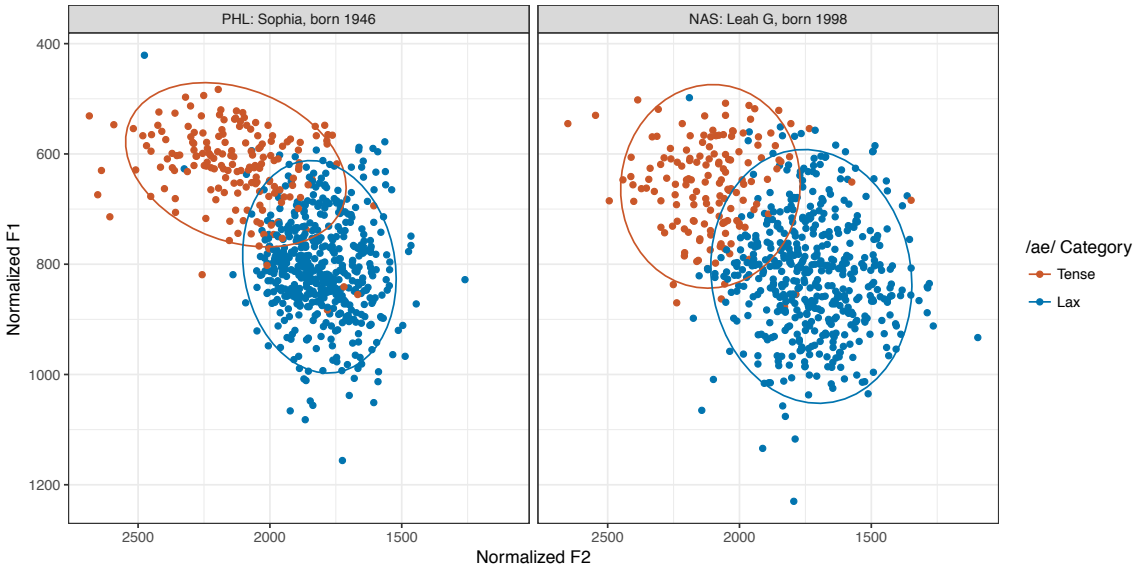

Figure 2.1: PHL (left) and NAS (right) have similar phonetic targets for tense and lax

Thirdly, the acoustic targets of tense /æ/ and lax /æ/ are very similar for the PHL speakers and NAS speakers. Figure 2.1 shows the acoustic output of a PHL system speaker (left) and a NAS system speaker (right) with normalized values of F1 along the y-axis and normalized values of F2 along the x-axis. That the phonetic realizations of the tense and lax allophones of both systems are similar means that the community-level acoustic variation presented here in Chapter 2 is most attributable to phonological change rather than idiosyncratic phonetic implementation of each rule.

2.3 Community Level Pattern

2.3.1 Corpora

The data in this chapter come from two main data sources. The first is the Philadelphia Neighborhood Corpus (henceforth: PNC), which has been thoroughly described in previous literature (Labov et al., 2013; Fruehwald, 2013). The second is the Influence of Higher Education on Local Phonology corpus (henceforth: IHELP), which was previously described in Labov et al. (2016).

The IHELP corpus was designed specifically to obtain data on the reorganization of /æ/ by

the population of college students most affected. In contrast to the PNC, which was developed over a period of forty years and was designed to obtain a representational sample of Philadelphia speech, the IHELP corpus was developed between September of 2013 and September of 2016 and was designed to target speakers who acquired language during the period of allophonic restructuring. For the IHELP corpus, twelve undergraduates were recruited from different colleges in Philadelphia, and were trained to conduct sociolinguistic interviews following the classic protocol outlined in Labov (1984). Interviewers primarily targeted their high school and college friends, but also obtained some data from family members. The resulting corpus comprised 170 speakers ranging in date of birth from 1922 to 2006, with the majority of speakers born after 1983. To date, 106 speakers have been transcribed and analyzed using the Forced Alignment and Vowel Extraction (FAVE) program.

2.3.2 Diachronic Acoustic Pattern

Diachronically, PHL has been stable in Philadelphia for over a hundred years; it is only within the last few decades that echoes of a NAS invasion come into play. On the community level, Labov et al. (2016) demonstrate an abrupt shift towards NAS, where all phonological contexts affected begin to shift simultaneously rather than one phonological context at a time. Figure 2.2, adapted from (Labov et al., 2016) depicts this synchronization for the six primary conditioning factors of PHL and NAS, for all White speakers from the PNC and IHELP corpora who produce more than ten tokens of /æ/ in each conditioning environment. To mitigate the possible effect of a talkative speaker skewing the results, each point on the plot represents a single speaker's mean phonetic production of one of the six conditioning factors. F1 and F2 measurements were z-scored by participant, and y-axis represents the measure of the front diagonal (F2-2*F1), with a higher value representing a tenser token. Date of birth is displayed along the x-axis.

The diachronic stability of PHL in Philadelphia is immediately clear: the three traditionally tense main conditioning factors (HAND, LAUGH, MAD) remain tense for much of the recorded data while the three traditionally lax main conditioning factors (MANAGE, HANG, CAT) remain lax. We see the four test conditions exhibit a sudden reanalysis beginning with speakers born

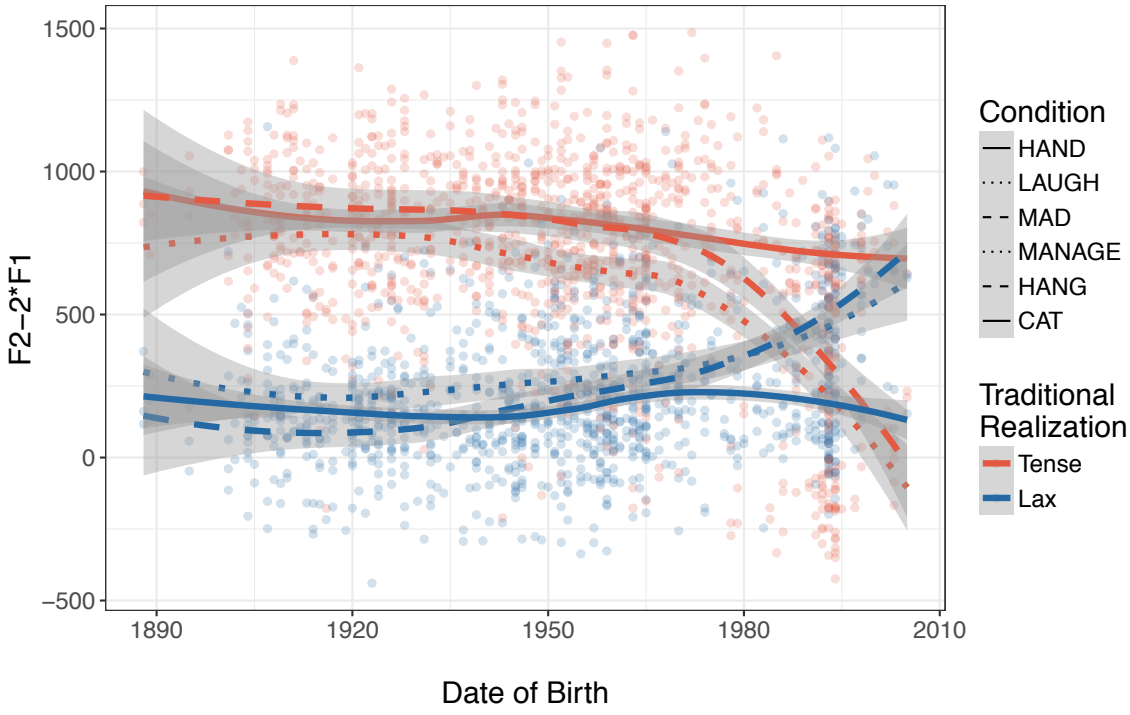

Figure 2.2: Transition of traditional PHL to NAS: LOESS diagram of height along the front diagonal (F2-2*F1) by date of birth. Allophonic restructuring begins around 1983.

around 1983, when MANAGE and HANG begin to rise in average tenseness for the community while MAD and LAUGH begin to plummet in average tenseness. A change point analysis was run separately for each of these four test conditions using the changepoint package in R. This analysis selected 1985 as the change point date for the MAD class, 1983 for LAUGH, 1981 for MANAGE, and 1983 for HANG. These dates are remarkably close, and suggest a wholesale change between two systems on the community level rather than a piecemeal change affecting one conditioning factor at a time.

2.3.3 Measuring Conformity to PHL and NAS by Pillai scores

In this chapter, I analyze the degree of conformity to PHL and NAS for each speaker using the Pillai-Bartlett statistic, following the analysis done in Labov et al. (2016). Each /æ/ system defines a cluster of tense and a cluster of lax vowels, resulting in a bimodal distribution of nearly separate clusters for those speakers who exhibit maximum conformity to either system. In this chapter, I report individual speakers' overall conformity to PHL or NAS using the Pillai-Bartlett statistic (Hay et al., 2006; Hall-Lew, 2010); in Chapter 4 I will take a closer look at each speaker's production of individual tokens. The Pillai-Bartlett statistic uses MANOVA to measure separation, evaluating both the distance between two distributions as well as their variances.

The output is mathematically bounded by 0 (no difference in either mean or variance between the two distributions) and 1 (maximum separation). Used as a measure of acoustic separation for vowels, the maximum separation score lies around .8. To provide a frame of reference, I've included normalized F1-F2 vowel plots of two phonemic distinctions along with their corresponding Pillai scores in Figure 2.3, which displays the separation scores for Leah Green's phonemic distinction between two front phonemes /ɪ/ and /ɛ/ (left) as well as the separation score for her two most distinct vowels /i/ and /a/. As shown in Figure 2.3, a robust phonemic distinction produced in the front vowel space reaches a Pillai separation score of 0.5, while the most acoustically distinct vowel separation in Leah's inventory achieves a 0.8 score.

In comparison then, we see in Figure 2.4 that the acoustic distinction between the tense and lax allophones of /æ/ is relatively robust for both the PHL speaker (left) and the NAS speaker (right).

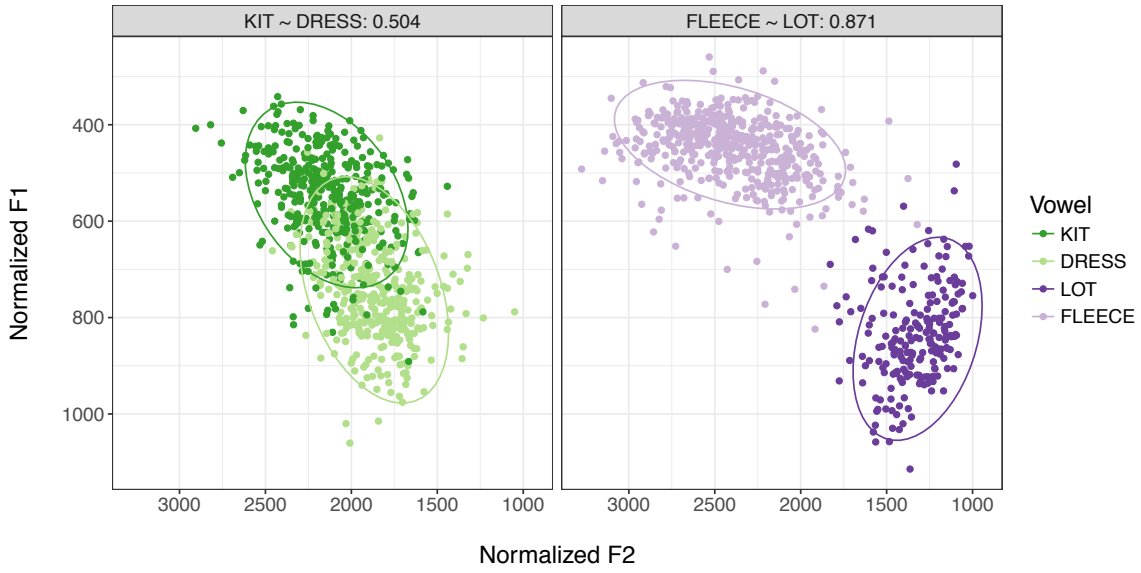

Figure 2.3: Pillai scores for Leah Green's phonemic distinction between KIT and DRESS (left) and FLEECE and LOT (right).

The left panel of Figure 2.4 displays the normalized F1-F2 distribution of /æ/ vowels for the IHELP subject with the highest Pillai score for PHL, 55-year-old Antonio Lyons who has a PHL Pillai score of .769, and the right panel displays the distribution of /æ/ vowels for 16-year-old Leah Green, the IHELP subject with the highest Pillai score for NAS (.727).

We apply the Pillai-Bartlett statistic to the /æ/ distributions of each of the 106 IHELP speakers that have been transcribed and analyzed in FAVE individually, assigning each speaker two Pillai scores: one to measure their conformity to PHL and one to measure their conformity to NAS. These overall conformity results are shown in Figure 2.5, which shows the PHL Pillai score along the x-axis and the NAS Pillai score along the y-axis for each speaker. The higher each score, the better a participant's data conforms to either PHL (along the x-axis) or NAS (along the y-axis). Participants are broken into White speakers (left panel) and Black speakers (right panel).

Each speaker in the IHELP corpus is represented by a single point on the plot. As we will see in §2.3.4, high school education plays a major role in the likelihood that a speaker will conform to PHL or NAS; the two primary educational factors are represented here by color and shape. Catholic

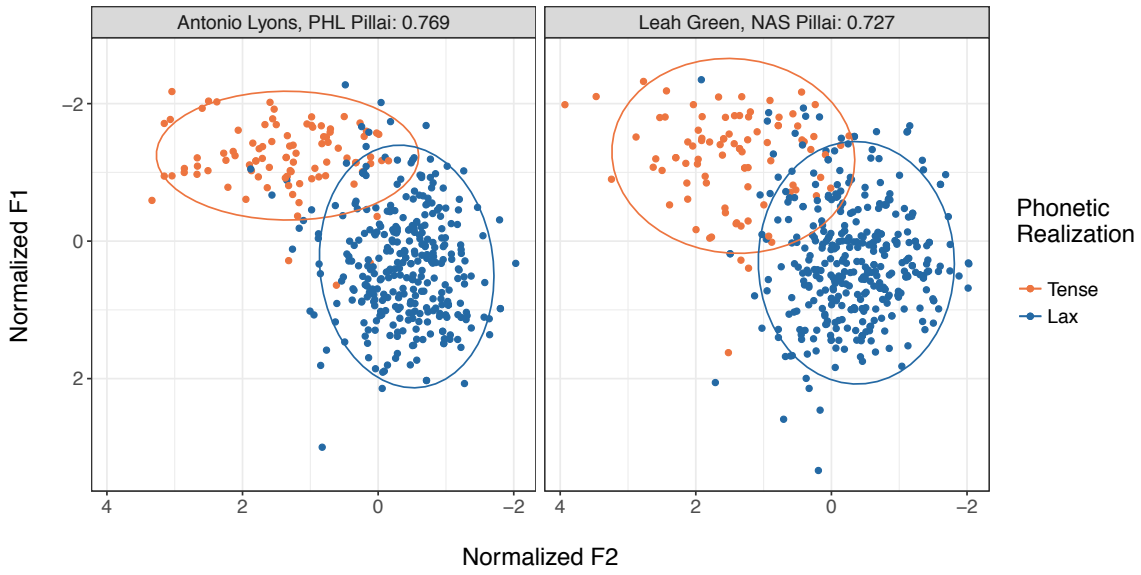

Figure 2.4: Antonio Lyon's 0.77 Pillai production of PHL (left); Leah Green's 0.73 Pillai production of NAS (right).

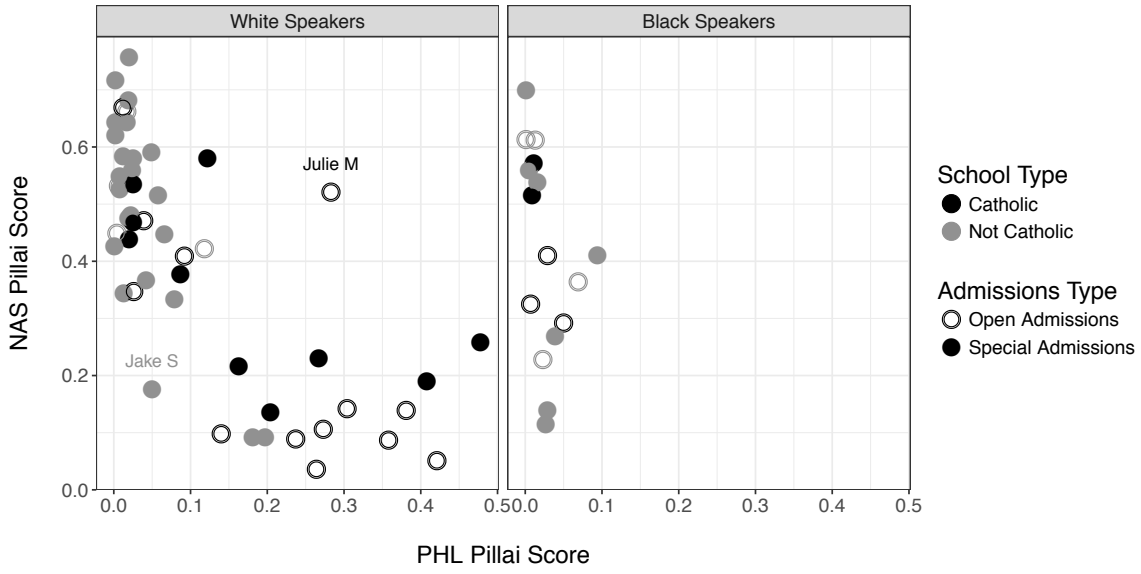

Figure 2.5: PHL and NAS Pillai scores for White speakers (left) and Black speakers (right)

high schools are represented in black while non-Catholic high schools are represented in gray; additionally, Special Admissions schools are represented with solid points while Open Admission schools are represented with open points. The role of Open Admissions Catholic high schools (black open points) in maintaining PHL for White speakers can clearly be seen in the congregation of these speakers along the x-axis.

I've highlighted two White speakers in Figure 2.5, whose Pillai scores stand out as exceptional: Julie M., who exhibits high conformity to both NAS and PHL, and Jake S., who exhibits low conformity to both NAS and PHL. I examine these speakers in some detail in §2.3.4 below.

2.3.4 Social factors conditioning the use of /æ/ systems

In this section, I provide some discussion on the major social factors conditioning conformity to PHL and NAS.

Ethnicity

The separation of White speakers and Black speakers in Figure 2.5 has a theoretical underpinning. The traditional African American Philadelphia /æ/ system is not a split system like PHL or NAS, but rather an /æ/ system with a single phonetic target typically realized acoustically as a long /ɛː/. We see clearly in Figure 2.5 that Black speakers in Philadelphia are also participating in the shift to NAS, employing this change in the service of social mobility alongside White Philadelphians (Labov et al., 2016). However, because the traditional African American /æ/ pattern is a single target, those speakers with a more traditional African American /æ/ show up in the lower left corner with a low separation score for both PHL and NAS.

Contrast this to the White speakers, who for the most part show a PHL-conforming cluster along the x-axis and a NAS-conforming cluster along the y-axis, with almost no speakers in the lower left hand space. Aside from Jake and Julie, the White speakers fall into two clear groups: predominately PHL, with PHL Pillai scores above .15 and NAS Pillai scores lower than .3, and predominately NAS, with NAS Pillai scores above .3 and PHL Pillai scores lower than .15. In Chapter 4 I take a closer look at the production of each speaker; here, I will take an overarching view and bin

the White speakers according to these two groups.

The participation of Black Philadelphians in the supraregional change to NAS is an an important example of cohesion across historically distinct dialect groups, and is explored in further detail in (Labov et al., 2016). However, because the phonological change at play in the speech of Black Philadelphians is between the traditional African American Philadelphia English /æ/ system with a single phonetic target and the incoming NAS system with two targets, this change is not useful for analyzing the mechanism of phonological change within individual speakers: analyzing any individual token as conforming to the old neutralized system or the new NAS system will require far more data than we have access to. A change involving two phonetic targets in both the old and the new systems, such as the change from PHL to NAS, enables the classification of each token as conforming to the old system or the new system, making it easier to determine which mechanism of phonological change is at play. For this reason, I focus on the White speakers throughout the rest of the dissertation, whose allophonic change is between two two-target systems and whose output is most likely to bear on the mechanism of phonological change.

Education

For the White speakers, there is ample evidence that we have encountered a systematic "change from above" (Labov, 2001) in which education plays a major role, and here we examine in some detail how the structure of educational institutions in Philadelphia also structures linguistic change, by simultaneously maintaining and exaggerating social class differentials. There is already evidence that speakers with higher education produce less phonetically extreme forms of the salient aspects of the Philadelphia dialect, and in particular less phonetically extreme forms of the tense traditional PHL system (Labov, 2001; Labov et al., 2013). Prichard and Tamminga (2012) and Prichard (2016) demonstrated an effect of a hierarchy of national, regional, and local institutions of higher education (colleges and universities). While these studies suggest a strong effect of the *type* of higher education on the production of local phonology, the data from our IHELP subjects suggest an earlier social impetus for linguistic change. We see, for instance, that even the youngest subjects of the IHELP corpus already display differentiation by high school even though they have

not yet enrolled in college (see, e.g., our prototypical NAS speaker, 16-year-old Central High School student Leah Green).

A closer look at the structure of high schools in Philadelphia reveal two main dimensions along which high schools contribute to social stratification. The first of these dimensions is a Catholic vs. non-Catholic distinction. Catholic schools in Philadelphia, particularly in the inner city, historically served the working and middle classes and are seen by many residents as an alternative to neighborhood public schools. While Catholic schools in Philadelphia are open to students from any cultural background, many diocesan schools waive the tuition fee for students whose parents are a member of the local Catholic diocese; this results in a social pattern where Catholic schools, practically speaking, have traditionally served as the White alternative to the predominately Black-serving public schools. This reality can be seen in the relative proportions of White and Black students between Catholic and neighborhood public schools: in Philadelphia Catholic schools today, roughly a third of Catholic high schools are predominately (> 70%) White and one third are overwhelmingly (< 10%) non-White. In comparison, only 1% of the district public schools are predominately white, while two-thirds of local public schools are overwhelmingly non-White.

Among the White speakers in our corpus, those who attend non-Catholic schools typically attend either a Quaker school or an elite public school. Admittance into a Quaker school relies on expensive tuition or on academic scholarships for students whose family can not afford the tuition fee. Admittance into elite public schools is similarly difficult, as I outline below.

Differentiation by Special Admission

In addition to an effect of Catholic vs. non-Catholic school, there is a second educational trait that we find associated with the preference for NAS. A pilot study of high school students in J. R. Masterman High School found all students, regardless of ethnicity, adopting NAS.[2] Masterman holds the position of being an elite Philadelphia high school: it has the highest SAT scores in the state of Pennsylvania, with highly competitive admission procedures and a high rate of success in

[2]The data for this pilot study are not available to be reported here in detail, as the study was conducted by a high school student at Masterman and is not IRB approved for detailed dissemination.

sending graduates to nationally oriented and Ivy League universities like the University of Pennsylvania. Eighteen of the 106 IHELP subjects are graduates of Masterman High School, with 16 of these speakers exhibiting clear NAS productions, one exhibiting potential variation between NAS and PHL (Jerry P.), and one whose data is discussed below as an outlier (Jake S.). A second elite public high school, Central, also shows consistent NAS systems for the seven Central students in the IHELP sample. The three Quaker private schools represented in the IHELP sample similarly show high academic achievement levels overall, along with 4/4 White graduates of thse schools demonstrating high conformity to NAS in our sample.

The academic success that we are associating with the label "elite" here can also be found in several of the Catholic schools. Two schools found in our sample – Nazareth Academy and Roman Catholic – rival the elite public schools in terms of college admissions; these two schools also show a preference for NAS. Much of our background understanding of schools' academic achievement was drawn from the greatphillyschools.org website, which displays high academic ratings for many of the high schools in our sample that have high levels of NAS speakers. However, this site is not useful as a way to operationalize school eliteness, because many of the elite high schools in our sample are not rated on the site. We turn instead to the concept of "special admissions" as a way to distinguish "elite" from "non-elite" schools.

This rating system relies on the social stratification inherent in the structure of the Philadelphia public school system which distinguishes between three types of schools: "Neighborhood", "City Wide", and "Special Admissions." Neighborhood schools have an attendance boundary that gives admission priority to students living within that boundary. Students living outside of the neighborhood boundary are able to submit an application for acceptance consisting of a request to join, and final acceptance is selected by lottery. For these Neighborhood schools, academic performance does not factor into admissions. Both City Wide and Special Admissions schools require a more extensive application to attend, and admission is based upon entrance requirements that include both behavioral and academic performance. Although City Wide schools–which include technical and vocational curricula–have an element of competitive entrance requirements, the final selection for admission is made via computerized lottery. Special Admissions schools, on the

other hand, select successful candidates based upon a rigorous set of requirements that include behavior records, test scores, and in-person interviews. For a child applying to a Special Admissions elementary school, the vetting process may include several trial "play dates" with the child and a parent in attendance, as an assessment tool. Higher level schools, both middle and high school, often require a formal interview.

The two elite Catholic high schools in our sample are distinguished by the same criterion. The Nazareth Academy admissions page features a 7th grade Practice Test as well as an 8th grade entrance examination. The Roman Catholic admissions process advertises a 1st, 2nd, and 3rd Entrance Test and warns that "any student wishing to attend Roman Catholic is required to take the High School Placement Test." In this process, academic admissions tests are kept separate from any scholarship examinations which determine how much financial aid will be offered to accepted students. Contrast this to Father Judge, a non-elite Catholic school, which begins the admissions page by stating that "all 8th grade students who would like to compete for an academic scholarship must take the Scholarship/Placement test." For Father Judge, this test is not required for admission but rather only taken in the event that a student wishes to apply for financial aid.

Regression Analysis of Social Factors

Table 2.2 shows the results of two separate linear regression models for the 71 IHELP subjects who were enrolled as undergraduates during the period of data collection, predicting Pillai score for each of the two systems. Although the effect of college type on retreat from local dialect features is a significant indicator for the speakers and features analyzed in Prichard (2016), including students' choice of college (whether Locally, Regionally, or Nationally-oriented) did not significantly improve either model fit here, and therefore was taken out of the model.

We find in Table 2.2 overall confirmation of the patterns described above. The Catholic status of a speaker's high school is the strongest predictor of their overall conformity to /æ/ system, with Catholic schools favoring PHL and Non-Catholic schools favoring NAS. We see also an effect of Special Admissions for both Catholic and Non-Catholic schools, with the elite Special Admissions schools favoring NAS. There is an effect of Ethnicity on conformity to PHL; this is unsurprising,

	PHL Pillai		NAS Pillai	
	Estimate	p-value	Estimate	p-value
Non-Catholic	-0.18	$p < 0.001 * **$	0.19	$p = 0.04*$
Special Admissions	-0.04	$p = 0.03*$	0.07	$p = 0.03*$
Ethnicity (Black)	-0.09	$p = 0.005 * *$	-0.00	$p = 0.99$
Gender (M)	0.037	$p = 0.17$	-0.08	$p = 0.11$
Non-Catholic:Special Admissions	0.04	$p = 0.45$	-0.07	$p = 0.5$

Table 2.2: Social factors conditioning PHL and NAS Pillai scores among college students in the IHELP data set.

since we find traditional White Philadelphia English producing PHL but traditional Black Philadelphia English producing a neutral /æ/ system. In contrast, we find no effect of Ethnicity on conformity to NAS; this is unsurprising, as we have seen in Figure 2.5 that Black speakers participate in this change to NAS. It is worth briefly pointing out that we do not find any effect of Gender on conformity to PHL or NAS; this is somewhat surprising given that changes from above typically exhibit an effect of gender, with females leading in the use of the incoming standard (Labov, 2001).

Outliers

Here I return to the two speakers whose Pillai scores for NAS and PHL make them outliers amongst the White speakers. The first outlier is Julie M, whose short interview yielded a total of 171 /æ/ tokens (avg. 324 per speaker in the IHELP data set) which consisted of a higher than average proportion of training tokens (72% in Julie's interview, avg. 49.4% in the IHELP data set). Because Julie's Pillai scores were based on tokens that primarily conformed to both systems (being predominately training tokens), her PHL Pillai score and NAS Pillai score are both high. Julie's output is displayed in Figure 2.6, where her HAND class tokens, represented in red, display her tense target and her CAT class tokens, represented in blue, display her lax target. Julie's test tokens are plotted in black lettering above her plot.

In terms of Julie's Pillai scores, her high conformity to both PHL and NAS is driven by the proportion of training tokens to test tokens (153 training: 18 test). The fact that Julie produces some of

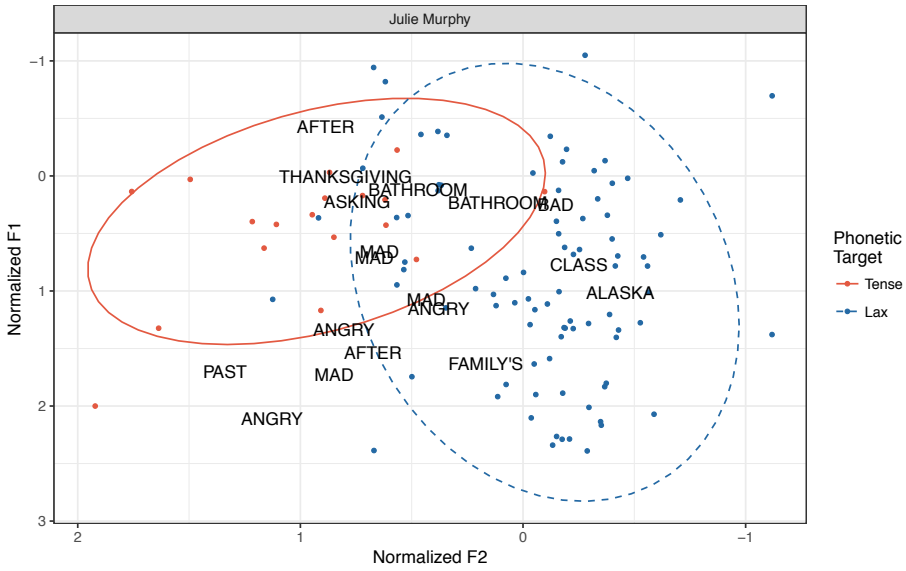

Figure 2.6: Julie Murphy's production of /æ/.

her LAUGH class tokens as tense (e.g. *after, asking, bathroom*) and some as lax (e.g., *class, Alaska*) suggests the operation both PHL and NAS as competing grammars in Julie's production, since the tense tokens conform to PHL while the lax tokens conform to NAS. However, we note that even in Labov (1989)'s analysis of traditional PHL speakers, conducted before the incursion of NAS into Philadelphia, participants produced up to 15% of their tokens as incongruent with their dominant traditional PHL conditioning. In other words, Labov (1989) found participants laxing traditionally tense words up to 15% of the time. Of Julie's 18 test tokens, this proportion would predict roughly 2.7 incongruous tokens, of which only *class* and *Alaska* are unambiguous examples. In other words, Julie simply does not produce enough data for us to analyze any particular mechanism of phonological change. In fact, as we will see in Chapter 4, a paucity of test tokens per speaker in the IHELP data is a common problem for our program of determining the mechanism of phonological change. As it stands, we must simply set aside Julie's data as too sparing to be useful.

The second outlier in Figure 2.4 is Jake S, whose production is displayed in Figure 2.7. Unlike

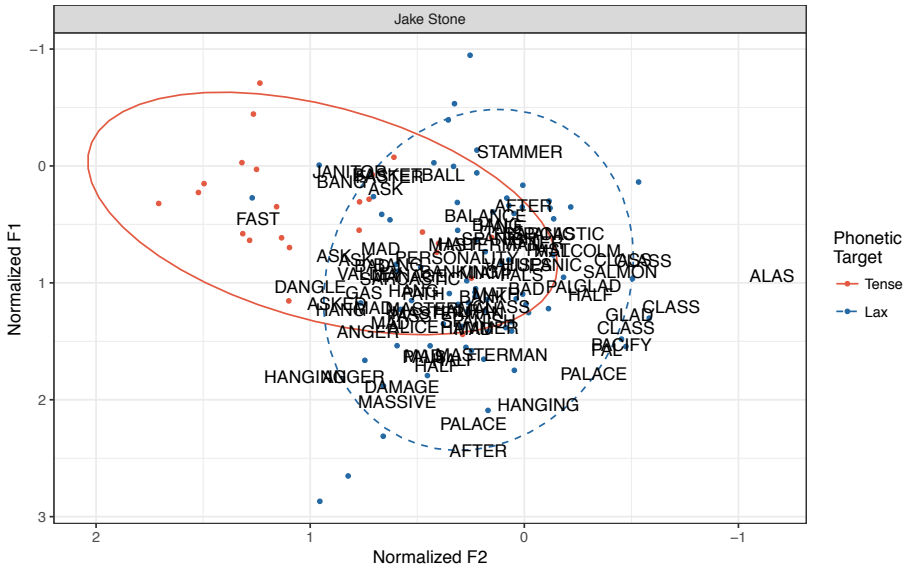

Figure 2.7: Jake Stone's production of /æ/

Julie, and in fact unlike the rest of the IHELP speakers, Jake produces a clear phonetic lowering of his traditionally tense PHL test tokens (LAUGH and MAD classes). This production is predicted by a phonetic incrementation mechanism of phonological change; if speakers habitually laxed their stigmatized tense productions of LAUGH and MAD, this would result in transition cohort speakers producing outputs similar to Jake's. This cohort would then be followed by a cohort of speakers that reorganizes the apparent merger, and begin to tense NAS test tokens (MANAGE and HANG classes).

In phonological change via phonetic incrementation, productions like Jake's would drive sound change and result in incremental steps toward NAS. However, as we have seen in Figure 2.5 and in the results of the regression analysis presented in Table 2.2, Jake's age and social cohort predicts that he would produce NAS. As we have seen, nearly all of his classmates at Masterman produce a NAS system, and Jake emerges as an outlier given his education. This social situation suggests that Jake's production is *phonetic mitigation* rather than phonetic incrementation. In other words, Jake's production is more likely the result of phonetically laxing his underlyingly tense PHL test to-

kens in *response* to his NAS-speaking environment than it is the driving factor in his peers adopting NAS. As Jake's data is an outlier due to phonetic mitigation rather than phonetic incrementation, I set his data aside.

2.3.5 Network Analysis

As we have seen in the outputs from the regression analyses of Pillai scores, a Philadelphian's educational history has a clear impact on their adoption of local or supraregional /æ/. In Figure 2.8, a bipartite social network (Dodsworth, 2014) provides a visual representation of the impact of school networks. Unlike typical social network diagrams, which place individuals as nodes on the graph and link these nodes together with edges to represent personal connections or interactions between two individuals, bipartite social networks have two types of nodes. One type of node is the individual. These individuals are linked to the second type of node, which here is the educational institutions they attended. This method has been used successfully by Dodsworth (2014) to demonstrate the importance of school affiliation and centrality in the retreat from the Southern Vowel Shift in Raleigh. One of the benefits of a bipartite social network diagram such as this is that it can capture the socialization effects that an institution typically has on individual speakers; while two speakers in our sample who graduated from the same school may not be connected personally, these two speakers will have both been strongly influenced by the norms of that institution.

Because I find school type (Catholic vs. not Catholic) and admissions type (Special Admissions vs. Open Admissions) to be the strongest effect on which /æ/ system the White IHELP speakers conform most to, in Figure 2.8 I bin our school nodes along these two dimensions. Each point in the network diagram represents a single speaker, and the edges in the diagram connect each speaker to the type of middle school they attended as well as the type of high school they attended. This plot only traces the White speakers, which is the community that varies between PHL and NAS. Speakers have been binned according to their location on the PHL-NAS Pillai score plot (Figure 2.5): all speakers with a PHL score above 0.17 and a NAS score below 0.27 have been classified as PHL-dominant speakers and are represented in orange while speakers with a PHL score below 0.17

and a NAS score above 0.27 have been classified as NAS-dominant speakers, represented in green. Note that Julie M. and Jake S., the exceptions from Figure 2.5, are excluded from Figure 2.8.

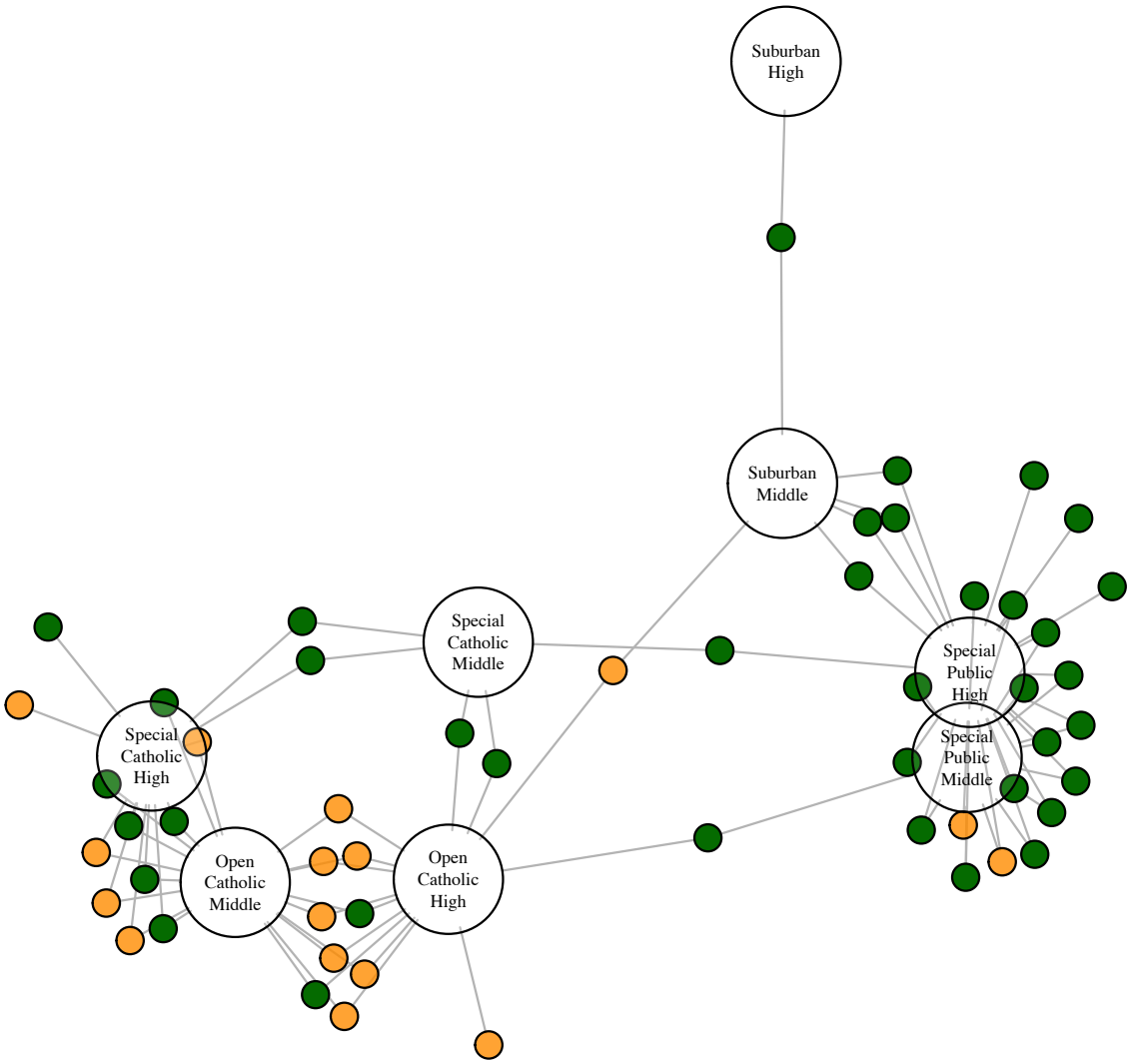

Figure 2.8: Educational paths follwed by IHELP subjects from middle school to high school. Orange = PHL speaker, Green = NAS speaker.

The nodes at the bottom left of the graph show the speakers who attended Open Admissions Catholic schools and Special Admissions Catholic schools. We can see that several speakers in our sample have moved from an Open Admissions Catholic middle school to a Special Admissions Catholic high school; these speakers are more likely to exhibit a NAS-dominant system than their

peers who went from an Open Admissions Catholic middle school to an Open Admissions Catholic high school. On the right side of the plot we see the strongly NAS-dominant cluster of speakers who attended Special Admissions middle and high schools. It is worth noting that none of the White speakers analyzed from the IHELP sample attended an Open Admissions public school. This is in large part due to the socioeconomic split in religious schools in Philadelphia whereby working-class Whites use Catholic schools as an alternative to public schools while upper-class Whites turn to elite public schools or expensive private (typically Quaker) schools. In other words, Open Admissions public schools are not a typical choice for White students in general, and are especially underrepresented in this sample of speakers which focuses heavily on speakers who were accepted into regionally and nationally oriented universities. I have included a node for Suburban middle school and Suburban high school; these nodes represent schools that are Open Admissions but are located in a wealthy suburb of Philadelphia. The funding model for these schools, like most American public schools, draws largely on the property taxes of houses in the school's catchment area, meaning that students attending high school in a wealthy suburb of Philadelphia are largely from relatively wealthy or socially elite backgrounds. Perhaps unsurprisingly, speakers who share a connection to the Suburban schools overwhelmingly produce the high prestige NAS system.

Figure 2.8 clearly shows the fragmentation of Philadelphia delineated along school institution type. Students from one type of middle school rarely attend a different type of high school. Perhaps most strikingly, the strongest PHL holdout (Open Admissions Catholic high schools) have almost no connection with the strongest NAS section of the community (Special Admissions Public schools). We can see clearly that the fragmentation of the speech community along the lines of educational institution plays a large role in the diffusion of this linguistic change across the city. As we have noted in Labov et al. (2016), the Catholic school system in Philadelphia serves here as a conservative linguistic force, in which PHL still has a foothold amongst young speakers and NAS may only just be on the way in now. We see also that for the IHELP speakers, the path of linguistic change follows the social fragmentation of the city. In this case, the elite school systems act as filtering devices for young Philadelphians, selecting those that will become the next generation of socially elite and imbuing them with the linguistic capital to signal this social mobility.

2.4 Intergenerational Pattern

In any sound change in progress, intergenerational data provides important insight into the development of the change by tracing its transmission from parent to child. In the course of collecting the IHELP corpus, several of our interviewers obtained data from their family members, which enables us to take a close look into the intergenerational pattern of /æ/. I have previously discussed some of this data in Fisher et al. (2015), which includes a discussion of speakers' productions of THOUGHT as well as speakers' conformity to PHL and NAS as measured by Pillai score. Here, I take a more focused look at the productions of /æ/ for the white speakers reported on in Fisher et al. (2015), using both the overall measure of Pillai score as well as a more in depth look into the production of individual word tokens.

2.4.1 Data from the Family

Here, we have an opportunity to investigate both how children adapt the linguistic system given to them by their parents as well as how those children's peer groups have potentially influenced that system as well. Previous work has found that while children initially acquire the linguistic system of their parents, these early acquired patterns are often lost unless they are reinforced by their peer group. Lacking this reinforcement, children tend to match their peer input by the time they reach adolescence (Labov, 1972; Kerswill and Williams, 2000).

As I've shown in detail above, the educational systems that children attend also have an effect on their language use. In the case of Philadelphia, this is at least partially due to simple population effects – people speak like the people they are around, and as we've seen, the educational system in Philadelphia serves in practice to separate people into distinct subgroupings with relatively little interchange between the subgroups. Education has also been found to play a more directly social role in language use, even after adolescence. In a panel study, De Decker (2006) investigated the production of four young women from a small town in Ontario as they attended college in the larger cities of Toronto and Waterloo. Two of the four women produced a more retracted /æ/ over time, shifting their production to match their more urban-oriented peers. This finding is echoed in Prichard (2016), who found that speaker's local dialect features (in Philadelphia and Raleigh, NC)

were affected by the type of college they attended, with local features more likely to be maintained by students attending locally-oriented universities and more likely to be abandoned by students attending nationally-oriented universities.

Lyons Family

I begin this section with a close look at the linguistic production of the Lyons Family. The Lyons are an Irish-Italian family from Northeast Philadelphia. Christine, who was a 20-year-old undergraduate at the University of Pennsylvania at the time of her recording in 2014, was one of the undergraduate interviewers for the IHELP project who interviewed her family members as part of the project. Her father, Antonio, has been referenced above as the speaker in the IHELP data set with the highest conformity to PHL as measured by Pillai scores. Here, we analyze the production of her parents, Antonio and Theresa, Christine, and her younger brother Rocco.

In the figures that follow, each speaker's HAND and CAT class words are plotted in gray with a solid line (for MAN) or a dotted line (for CAT) marking the 95% confidence ellipse. This provides a benchmark for each speaker's tense and lax phonetic targets. Each test token is plotted in text above this, with words in the LAUGH and MAD class plotted in red (as they would be produced as tense under PHL) and words in the MANAGE and HANG class plotted in blue (as they would be produced as lax under PHL). A speaker who fully conforms to PHL should produce red tokens in their HAND cloud and blue tokens in their CAT cloud, while a speaker who fully conforms to NAS will produce blue tokens in their HAND cloud and red tokens in their CAT cloud.

I begin by first analyzing the productions of the parents, Antonio (Figure 2.9) and Theresa (Figure 2.10). Antonio's production fits straightforwardly with a classic PHL system. He produces a phonetically extreme distinction between his tense and lax targets, with almost categorical adherence to PHL. A few exceptional words stick out clearly in Antonio's production: one token of *planet* clearly produced in his tense range, and one token of *asteroid's* clearly produced in his lax range. Overall, however, his production fits with the expected realization of a classic PHL speaker, resulting in a very high PHL Pillai score of 0.74. His NAS Pillai score ranks very low, at only 0.12. Theresa, likewise, produces a classic PHL distribution, with a clear distinction between her tense

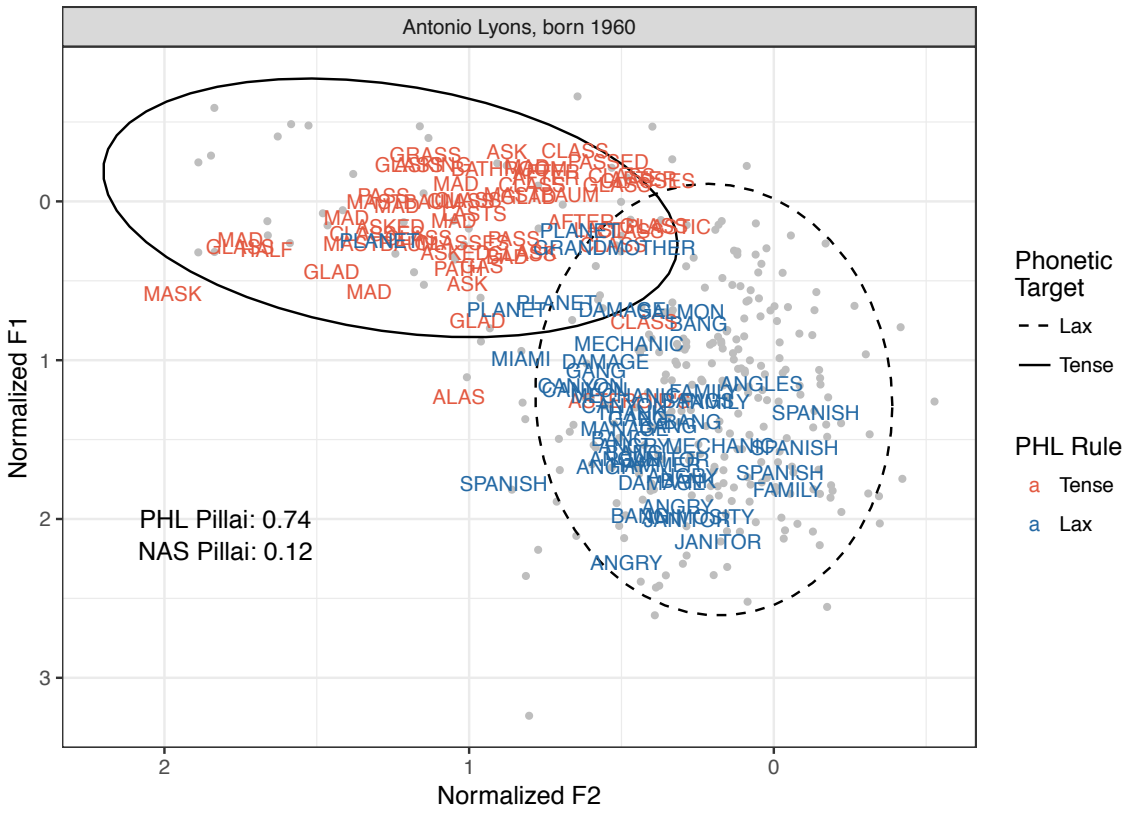

Figure 2.9: Antonio Lyons PHL production.

and lax targets (PHL Pillai: 0.62, NAS Pillai: 0.11). She also produces a token of *planet* as exceptionally tense, as well as a token of *alas* as exceptionally lax. Both of these words are not surprising as lexical exceptions; as discussed above, Brody (2011) found *planet* emerging as a lexical exception to tense for some speakers, and the words *alas* and *asteroid* both classify as "learned words", which are typically produced as exceptionally lax by PHL speakers (Labov, 1989). Overall, the picture from the Lyons parents is that the input to the children would have been a clear PHL system from both parents.

Turning to the children's productions, it becomes possible to see the effect of peer group and the changing community norms on the speech of the children. We begin by examining the speech of Rocco, a 15-year-old high school student at Father Judge, an Open Admissions Catholic school. Based on what we know about his parents' input to him and his demographic data as having

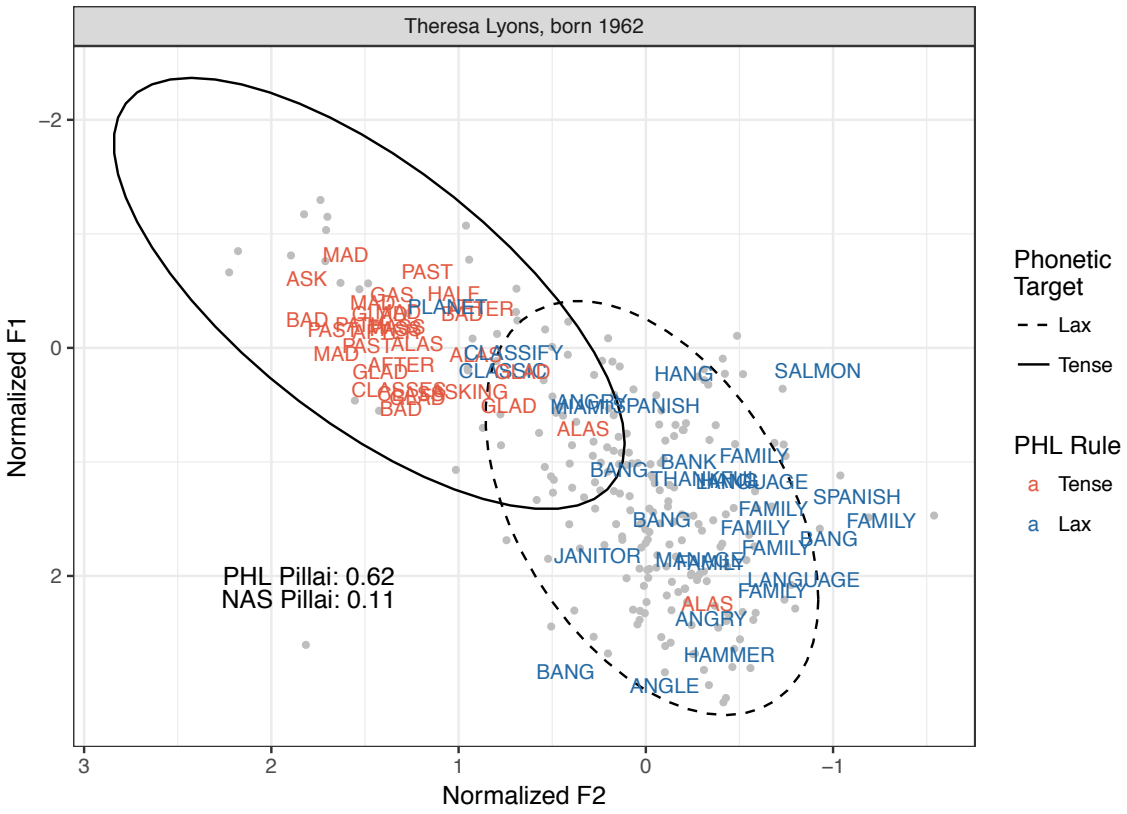

Figure 2.10: Theresa Lyons PHL production.

attended his local diocesan school for middle school and Father Judge for high school, Rocco is a prime candidate for retaining the traditional PHL system. As we can see in Figure 2.11, this is more or less the case. He produces most of his LAUGH and MAD words (in red) relatively in line with his tense target and most of his MANAGE and HANG words (in blue) relatively in line with his lax target. We can see a few exceptional tokens emerging: the unsurprising *planet* as tense, as well as a tense production of *angry* and *hang*. Overall, Rocco produces an output that conforms quite well to the traditional PHL system, even as his Pillai scores appear quite low (PHL: 0.45, NAS: 0.15). This low value for Pillai is partially due to the fact that he was not a verbose speaker, generally providing his sister with very short answers to her interview questions, as perhaps may be expected for a high school boy speaking with his older sister. This low token count increased the standard deviation for each word class, which in turn decreases the Pillai score for both PHL and NAS. Even so, it is clear from his Pillai scores as well as from an examination of his vowel plots that Rocco conforms overall to the expected traditional PHL pattern.

It's in the production of Christine that we begin to see some breakdown of the traditional PHL pattern. Like her parents, she still produces a clear and phonetically distinct tense target and lax target. Her Pillai scores, however, do not reveal a strong conformity to one system over another (PHL: 0.33, NAS: 0.26). In Fisher et al. (2015), using only the Pillai score, we classified Christine as a "weak PHL system speaker". Here, I take a closer look at her actual production to determine the driving force behind her overall Pillai scores. It is clear that Christine produces far more tokens incongruently with PHL than her parents or brother did. We see one tense token of the HANG class (*banker*), and quite a number of lax productions of her LAUGH class. Unlike Jake S., whose production I analyze as a PHL speaker who has phonetically mitigated his LAUGH and MAD class tokens, Christine exhibits clear variation, producing some of her LAUGH tokens as tense and some as lax. This provides a suggestion of the operation of competing PHL and NAS in her linguistic system, which I will return to in Chapter 3. Importantly, Christine's educational background also plays an important role in her linguistic production. Like her brother Rocco, Christine attended her local diocesan middle school followed by an Open Admissions Catholic high school. However, Christine also has gone on to attend the nationally-oriented University of Pennsylvania, which

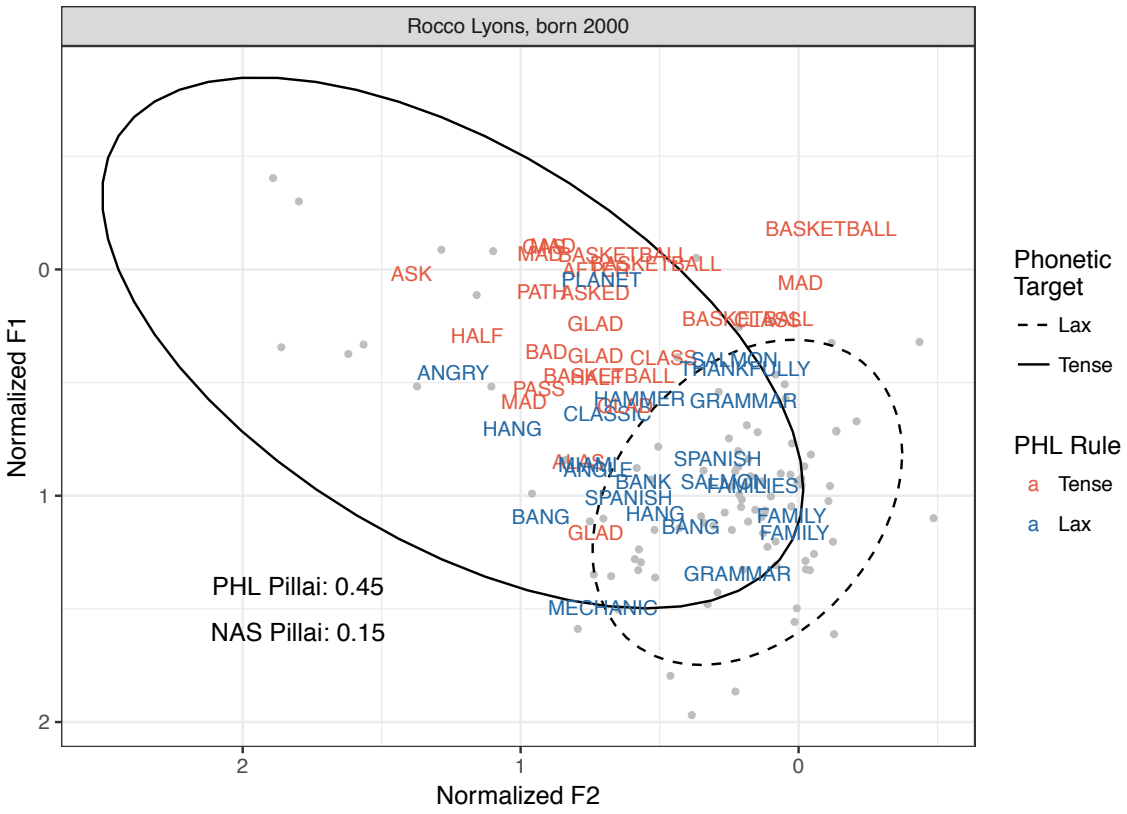

Figure 2.11: Rocco Lyons PHL production.

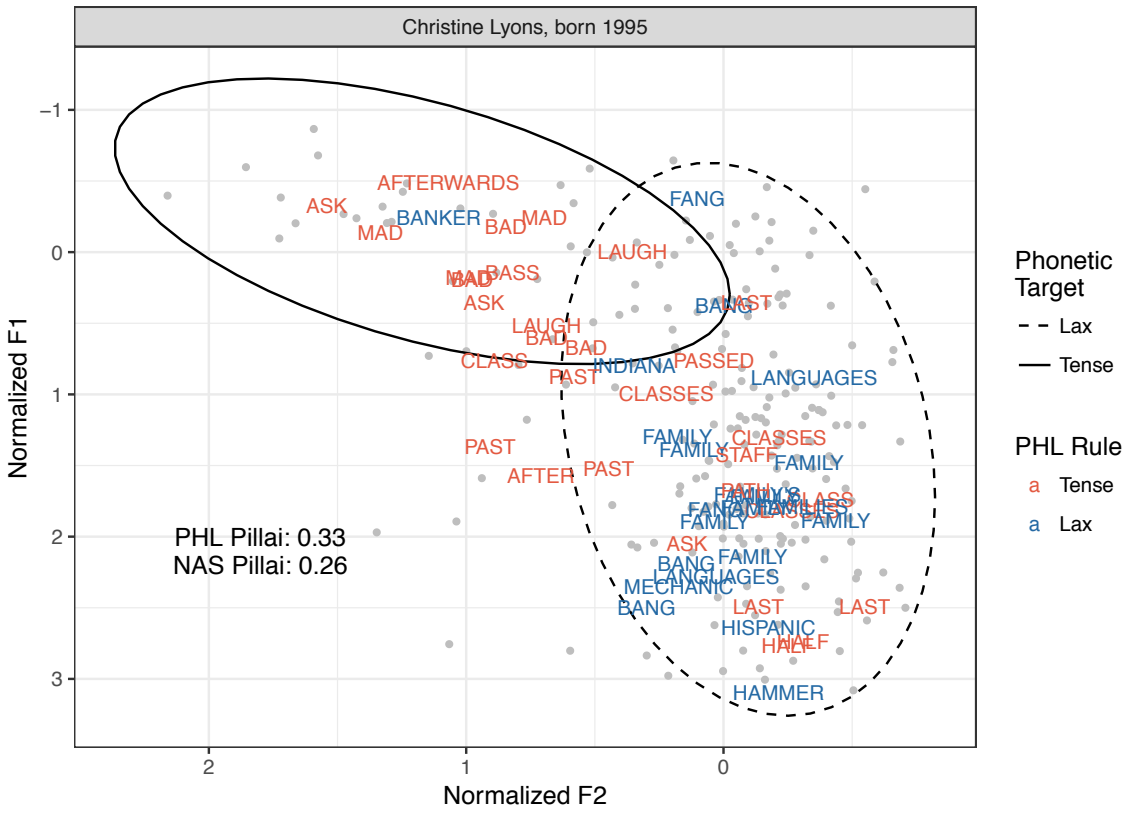

Figure 2.12: Christine Lyons intermediate production between PHL and NAS.

has been found in Prichard (2016) to have an effect on local dialect features. We see this clearly in Christine's production, whereby she produces some lax tokens of traditionally tense PHL words and at least one tense token of a traditionally lax PHL word.

Through close analysis of the Lyons family, we are provided with an in-depth look into how children are adapting the linguistic input of their parents to a intermediate, or potentially mixed-system, production. The Lyons parents provide a classic PHL input to their children. The children in turn, and aligning with their educational history, take that PHL input and either reproduce it (as in Rocco) or take it a step towards NAS (as in Christine). We see clearly the influence of both family and peer education group on the linguistic production of the children, as well as a piece of insight into how PHL becomes NAS intergenerationally.

Vos Family

Just as the Lyons family represents the first step in the transition from PHL to NAS, the Vos family exemplifies the final step the transition to NAS. The Vos family is of Jewish and Persian descent. Data from the mother, a non-native speaker of English, is not presented here, since non-native features are typically disregarded by second-generation children during acquisition (Labov, 2007).

I begin by examining the production of Harry, the Vos family father. Harry's Pillai scores (PHL: 0.29, NAS: 0.2) are immediately reminiscent of Christine's. In Fisher et al. (2015), we similarly classify Harry as a "weak PHL system speaker" based on these overall scores. In Figure 2.13, I take a closer look at how his production of individual tokens has driven this intermediate set of Pillai scores. We can immediately see that, like Christine, Harry produces some of each class of words as both tense and lax. He produces tense forms of MANAGE class words (*Amherst, Miami*) as well as lax forms of these words (*annex, janitor, stammer, planet*). Similarly, he produces instances of HANG as both tense (*hanging, anger, dangle*) and lax (*bank, strangle*). In the word classes that would be produced tense under PHL, we see a similar pattern of variation, with some tense (*after, half, mad*) and some lax (*classes, last, glad, bad*) from each word class. Like Christine's production, Harry's production is suggestive of competing grammars.

That Harry produces an intermediate or mixed-system production is somewhat expected, given his educational history. His parents were also from Philadelphia; while I do not have production data from them to analyze, it is almost certain that Harry would have been given traditional PHL input. Harry attended a prestigious suburban high school outside of Philadelphia. As I have discussed briefly above, suburban schools operate as similarly elite to the Special Admissions non-Catholic schools in Philadelphia. From this, Harry went on to attend a nationally-oriented university (Harvard). This social and educational history aligns with Harry's resultant mixed-system output.

Harry's children, having been given this mixed-system input, take the final step and turn it into a NAS-dominated output. I begin with the production of Nate, who at the time of recording was a 10-year-old Masterman student. As we've seen, Masterman emerges as a stronghold of NAS in Philadelphia. In Figure 2.14 and in Nate's Pillai scores (PHL: 0.06, NAS: 0.73) we see that Nate's

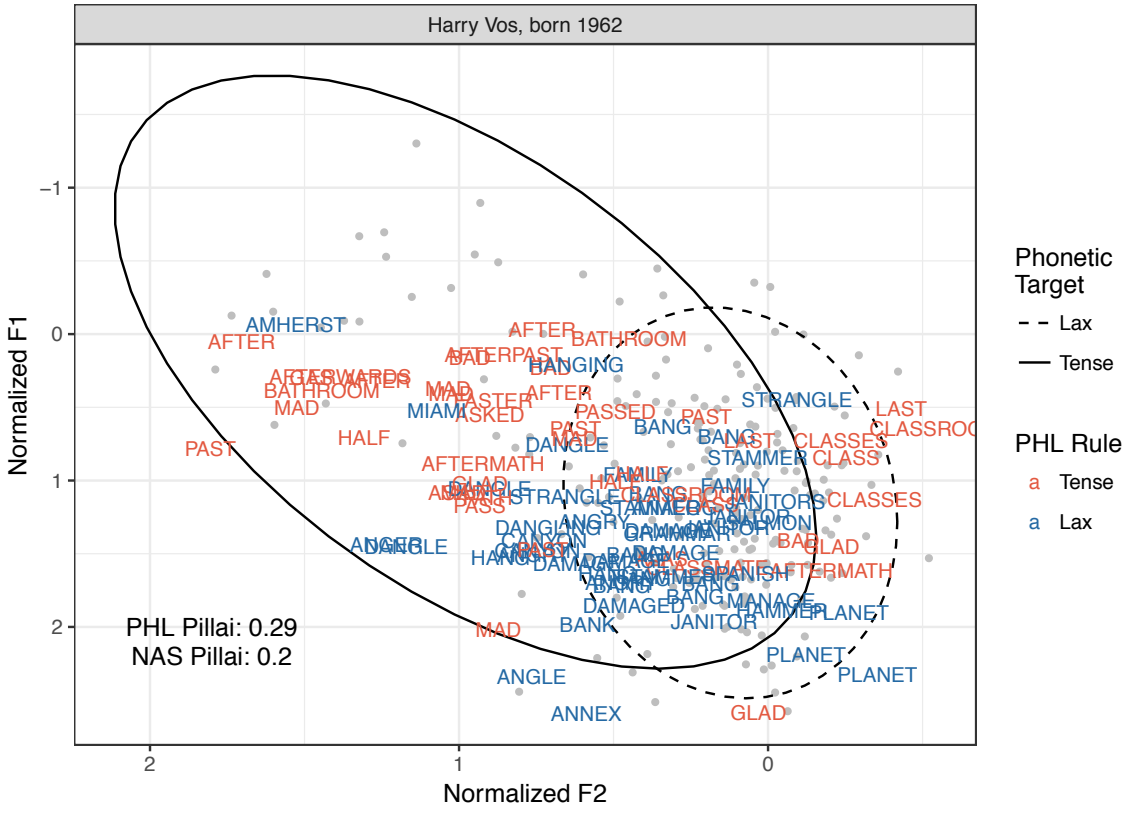

Figure 2.13: Harry Vos intermediate production between PHL and NAS.

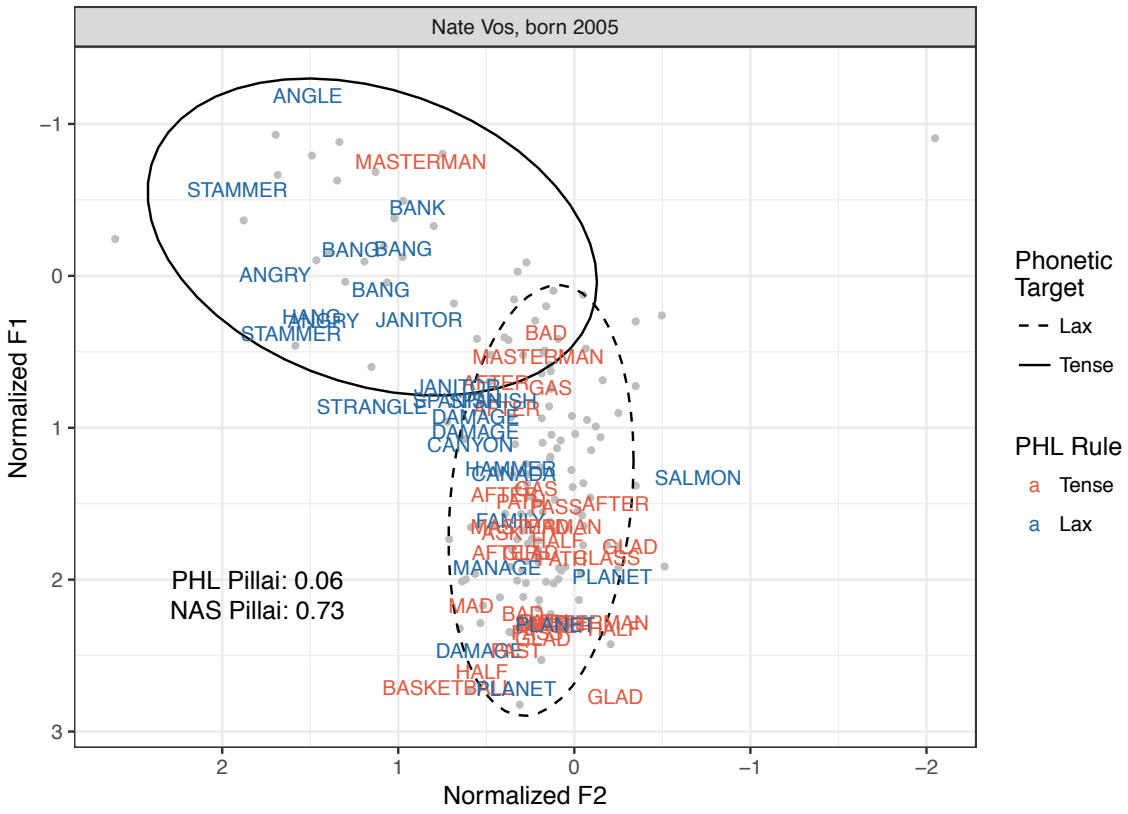

Figure 2.14: Nate Vos NAS production.

production is, overall, dominated by NAS. There are a few exceptional tokens: a tense token of *Masterman*, and a few lax tokens that align with the traditional PHL system (*salmon, planet, manage, family, Canada*). While Nate's attendance at Masterman may predict a stronger NAS system with no lexical exceptions, it is important to note his age at the time of recording. Masterman begins at 5th grade, which 10-year-old Nate had just begun when he was recorded in December of his first semester in Masterman. It is possible, then, that Nate's production represents the beginning of a Masterman influence on his parental input.

His older sister Percia, a 20-year-old undergraduate at the University of Pennsylvania at the time of recording, on the other hand, exhibits the overall expected effect of having attended Masterman through middle and high school as well as the nationally-oriented University of Pennsylvania during college. Her production is shown in Figure 2.15, which clearly exhibits a near-perfect

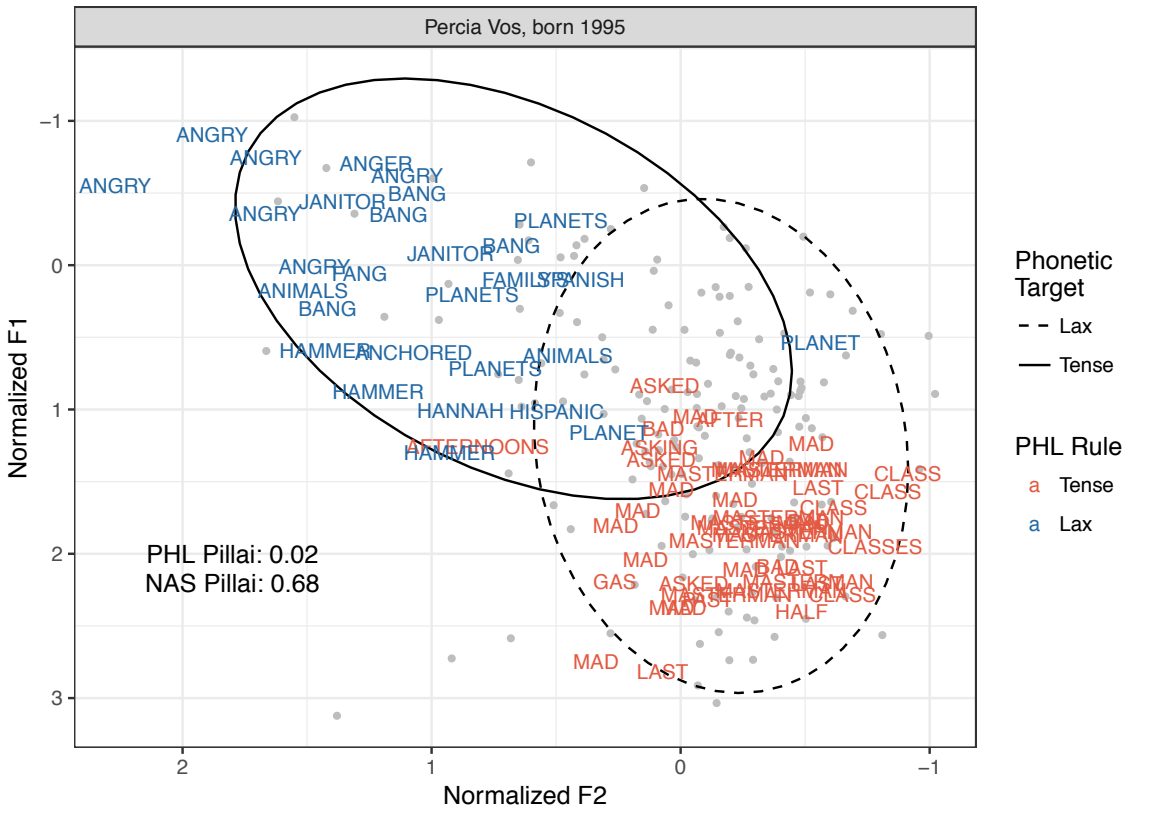

Figure 2.15: Percia Vos NAS production.

conformity to NAS. The only potential exceptions in Percia's production is in a marginally tense form of *afternoons* and a lax form of *planet*. This conformity is also clearly represented in her Pillai scores (PHL: 0.02, NAS: 0.68).

2.4.2 Summary of Intergenerational Change

In both the Lyons and the Vos families, the effect of parental input as well as educational history play an important role in the vowel systems of the children. The data presented here suggest that the transition from PHL to NAS in Philadelphia occurs over a period of three generations, with the first generation (Antonio, Theresa) producing the traditional PHL system as input, the second generation (Christine, Harry) taking that traditional input and, in response to their peer influence, altering it into a mixed-system output, which the third generation (Percia, Nate) take

and, in conjunction with their own peer influence, alter this mixed-system input into a fully fledged NAS output. In other words, complete phonological restructuring from PHL to NAS requires the convergence of both parental and peer influence for speakers to take the next step in the change.

Finally, it is also important to note that the Lyons and Vos families can be seen as exemplars from different social subgroupings of Philadelphia. The Lyons send their children to Open Admissions Catholic schools, which we found to be a stronghold for PHL in the community and likewise has a conservative effect on the Lyons' language production. The Vos family, on the other hand, enter into our study having already experienced elite schooling, and continue this trajectory with the children. Here, we see that the fragmentation of Philadelphia along educational system lines has a strong effect not only on the adoption of allophonic restructuring by speakers, but also on the timing of the allophonic restructuring of PHL to NAS. The Vos family, with its educational history of attending elite public schools, exhibits this change a generation ahead of the Lyons family.

2.5 Conclusions

In this chapter, I've gone some depth into the background of /æ/ variation in Philadelphia, providing a detailed look into the community-level pattern of this change as well as the intergenerational pattern of change.

The community-level pattern of this change, as following the fragmentation of the community along educational system lines, provides a detailed sociolinguistic backdrop for the current investigation of phonological change. The sociolinguistic background will emerge in Chapter 4 as a critical component of analyzing the variability within individual speakers. Without an understanding of the community-level pattern, it is impossible to identify the production of an individual as driving phonological change or simply phonetic mitigation as a result of contact with speakers who have already completed the change.

Finally, that this change is found in 2.4 to occur over the course of three generations provides a clear direction to searching for transitional cohort speakers. For younger Philadelphians, particularly those with a Catholic background, transitional cohort speakers are most likely to be those who have attended a combination of Open Admissions Catholic schools and nationally-oriented

university. In Chapter 4, this is precisely the demographic of speaker we turn to for an investigation of the mechanism of phonological change in transitional cohort speakers.