

LOCATING VARIATION ABOVE THE PHONOLOGY

Laurel Elspeth MacKenzie

A DISSERTATION
in
Linguistics

Presented to the Faculties of the University of Pennsylvania
in Partial Fulfillment of the Requirements for the
Degree of Doctor of Philosophy
2012

Supervisor of Dissertation

Co-Supervisor

William Labov
Fassit Professor of Linguistics

David Embick
Professor of Linguistics

Graduate Group Chairperson

Robin Clark, Associate Professor of Linguistics

Dissertation Committee

Gillian Sankoff, Professor of Linguistics

Acknowledgements

Part of me feels like I must have done something wrong in the preparation of this dissertation, because it wasn't the agonizing and isolating experience that conventional wisdom (or maybe just PhD Comics) had led me to expect. The process was actually largely enjoyable. While it's conceivable that this is just because I wasn't working hard enough, I think the positive experience I've had throughout all six years of graduate school is more accurately attributable to the collegiality and cross-disciplinary interests that are characteristic of the Linguistics Department here at Penn. I don't think I could have written this dissertation, which connects findings from quantitative sociolinguistics with theoretical questions about the structure of the grammar, anywhere else. The fact that nearly every member of the Penn Linguistics faculty, from phoneticians to semanticists, has given me some input on this work is telling, and I am convinced that it has improved this dissertation immeasurably. So, first off, a blanket thanks to Penn Linguistics for being what it is.

The members of my dissertation committee — Bill Labov, Dave Embick, and Gillian Sankoff — have gone out of their way on countless occasions to read horrendous early drafts, help me work through trouble spots, and provide me with additional directions to pursue, even when they were traveling abroad or occupied with a new baby (as applicable). Bill's scholarship has inspired me for years, and I have no doubt it will continue to do so. Every time I read his work I find new gems; every time he reads mine, it improves immensely. Dave has spent close to a hundred hours (I counted!) in meetings with me, helping me narrow down the topic of this thesis and guiding my research in thoughtful and perspicacious ways. Thanks to him for reminding me to keep focusing on the big picture when I started to feel too much like Contraction Lady. Gillian read every chapter of this thesis with a keen eye; if it's at all comprehensible, you have her to thank (and if it's not, it means I failed to implement her suggestions). For as much as I've learned about linguistics from my committee members, I've learned equally as much about what a great mentor and colleague looks like. If I attain even a fraction of their success on either of these fronts, I'll be happy. Thanks to all three of them for being such excellent role models. One extra thanks to Dave for all the tea.

A number of other members of the Penn Linguistics faculty have taken an interest in this work despite not formally being on my committee. Charles Yang has thought of much more creative things to do with my data than I ever could have,

and I thank him for his feedback on this work at a number of stages. Tony Kroch has likewise been interested in what I've been doing since the beginning, and was the first one to suggest I look to the literature on short-term memory for explanations of the subject length effect on contraction I present in Chapter 5. Thanks also to both of them, as well as to Mark Liberman, for demonstrating how to think about language like a scientist. And thanks additionally to Charles and Tony for frank discussion of the present and future of our field. I'm also grateful to Gene Buckley, Julie Legate, Rolf Noyer, and Florian Schwarz, each of whom has commented on this work at various points.

I'm so glad I got to spend the past six years among the members of the Penn Linguistics graduate student body. Toni Cook has been there through thick and thin, from cross-tabs to conferences, with ample gossip and stalking on the side. Thanks for all the good times and late-night emails. Joe Fruehwald, Constantine Lignos, and Kyle "KoGo" Gorman have been great pals and collaborators as well as valuable sources of R, Python, and statistics knowledge. Thanks additionally to Joe for introducing me to Sweave, which revolutionized my writing of this dissertation. I've also enjoyed collaborating with Meredith Tamminga and Anton Ingason; thanks for your discussions on the issues herein, which have clarified my thinking. The denizens of the Linguistics Lab — most recently, Aaron Dinkin, Joe Fruehwald, Sophie Holmes-Elliott, Marielle Lerner, Brittany McLaughlin, Hilary Prichard, Ingrid Rosenfelder, Meredith Tamminga, and Danielle "Bort" Turton — have made the lab (in all its various locations) a fantastic place to try out new ideas and get work done. I'm so fortunate to get to work among friends! Special thanks to Ingrid Rosenfelder for having been the best officemate I could have asked for, and for getting me up and running with the Philadelphia Neighborhood Corpus. Outside of the sociolinguistics realm, I'm grateful for the friendship and support of Elika Bergelson, Aviad Eilam, Catherine Lai, Caitlin Light, Giang Nguyen, Yanyan Sui, and Josh Tauberer. Another thanks to Aviad and Joe for being the perfect people to head ClubLing with, and another thanks to Catherine for her help running the corpora I used on the Phonetics Lab server and for debugging my Python scripts. Finally, I want to acknowledge those students who were dissertating during my formative years at Penn: Lukasz Abramowicz, Aaron Dinkin, Michael Friesner, Damien Hall, Marjorie Pak, Maya Ravindranath, Suzanne Evans Wagner, and Joel Wallenberg. They provided excellent examples for me to look up to during my time here. An additional thanks to Michael for his eagerness to provide good advice at a moment's notice on everything from introductory sociolinguistics textbooks to the academic job search, and to Maya, Suzanne, and Marjorie for serving as role models of successful women (and mothers) in academia.

The support staff in the Linguistics Department has been exemplary: thanks to Amy Forsyth and Sue Sheehan for their tireless behind-the-scenes work. My dissertation wouldn't exist if not for the Linguistic Data Consortium at Penn, which kindly provided the Switchboard and Fisher corpora that are used throughout.

Chris Cieri has been a great person to talk to about issues linguistic and non-, and Dave Graff promptly responded to a 6 PM email of mine with in-person assistance when I couldn't decrypt the Switchboard audio files. This dissertation would also be a lot skimpier if not for the valuable coding assistance provided by Katie Wallace and Alex Savoy-Knitter in the summers of 2010 and 2011, respectively — thank you both for working so diligently and intelligently on what can be a mind-numbing task. A huge thank-you to the subjects of the Switchboard, Fisher, and Philadelphia Neighborhood corpora (plus the fieldworkers of the latter) for sharing their contractions.

Florian Jaeger, Aditi Lahiri, and Sali Tagliamonte were kind enough to take time out of their schedules to discuss this work with me, for which I'm very grateful. I presented portions of this thesis at NWAVs 39 and 40, NELS 41, WCCFL 29, the LSA 2011 and 2012 annual meetings, Dave Embick's morphology seminar in the Spring of 2010, and Penn's F-MART reading group. Thanks to the audiences at those venues for providing thoughtful feedback, and to grants from Penn's School of Arts and Sciences and Graduate and Professional Student Association for getting me to the ones that were farther away. Penn's School of Arts and Sciences also deserves an additional thank-you for providing me with a five-year Benjamin Franklin Fellowship, four summers of funding, and a Dissertation Completion Fellowship to support me during my sixth year.

UC Berkeley was the perfect place to start my adventures in linguistics: I felt incredibly prepared when I entered graduate school. I don't remember whether it was Keith Johnson, Gary Holland, or Sharon Inkelas who suggested I apply to Penn (it was probably all three), but they all had a considerable impact on my time at Cal, and I thank them for the respect and encouragement they showed my undergraduate self. Since I'm reflecting on my past life, it also seems appropriate to acknowledge my future one: thanks to the Department of Linguistics and English Language at the University of Manchester for giving me a great incentive to get this thing finished.

My friends outside of linguistics have patiently tolerated the tunnel vision that has seized me over the past several months as the dissertation and the job search took their toll. Thanks to Eileen Fitzpatrick and Rebecca Wehrly for always being there, and to Jacqueline Palmer for enabling my ling addiction over the years. I'm so glad to have met the Penn BMB crew; it's so refreshing to have such a great group of friends outside the department. Thanks also to the Penn Symphony Orchestra for providing the perfect diversion over the past six years, and to the city of Philadelphia for being a place I have absolutely loved living in.

My chosen career path owes a huge debt to my parents, Duncan and Phyllis MacKenzie: the linguistic confusion that is inevitable when two Northern Californians raise a child in Southeast Texas got me thinking about language from a very early age. I love that I happened to end up in a field that is a perfect blend of both my parents' interests: my dad the scientist and my mom the word nerd. It was

my mom who first suggested that I enroll in an introductory linguistics class my first semester at Berkeley; I don't know when I would have discovered the field otherwise. And I'm so proud to follow in my dad's footsteps and add another Dr. MacKenzie to the family: all those Science Nights paid off! My brother Colin always knew when I needed a YouTube pick-me-up; thanks for keeping my spirits high and for motivating me with your many successes. A big thanks as well to my various and sundry relatives for their support, encouragement, and interest along the way, even if they still haven't quite figured out why I would voluntarily leave Northern California.

Finally, Edward Ballister has given me eight and a half years of joy and love. Every moment of work on this dissertation has been infinitely more pleasant than it would have been without him by my side. His commitment, his cheerleading, and his willingness to follow me across continents make a simple "thank you" inadequate. Hopefully "I do" will suffice. I'm so lucky to be starting the next chapter of my life with him.

ABSTRACT
LOCATING VARIATION ABOVE THE PHONOLOGY
Laurel Elspeth MacKenzie
William Labov
David Embick

The goal of this thesis is to develop a model of sociolinguistic variation that takes into account “variation above the phonology,” namely, variable phenomena that implicate the morphology and/or the syntax. I develop a model under which intra-speaker linguistic variation is the product of two systems: (a) a grammar which derives forms and is partially probabilistic; and (b) a system of language use, distinct from the grammar, which deploys variants based on psycholinguistic and sociostylistic constraints. I illustrate this proposal using data from an in-depth corpus study of the variable contraction of six English auxiliaries. Two sets of findings from the corpus study support the partially probabilistic derivational grammar. First, I show that the patterning of auxiliary forms in spontaneous speech provides evidence in favor of a two-stage model of contraction, under which variation in the morphosyntax is followed by variable phonological processes. This analysis explains a number of patterns in the data which would otherwise be accidental. Second, I examine the linguistic conditions on contraction and argue that they are incompatible with an analysis under which string frequency predicts the occurrence of contraction. Accordingly, internal conditions on contraction are best treated as being encoded in the grammar, rather than as emerging from language use. Evidence in favor of a system of language use distinct from the grammar comes from the finding that contraction shows a strong effect of the number of words in an auxiliary’s noun phrase subject, with contraction becoming less and less likely as a subject increases in length. I argue that this effect displays a kind of non-locality which is uncharacteristic of alternations that are the purview of the grammar, and that it should instead be interpreted as stemming from extra-grammatical, memory-based constraints on the system of language production. I localize these constraints, along with sociostylistic constraints on language variation, to a grammar-external system of language use. The dissertation thus provides evidence that variation in surface forms may be attributable to more than one underlying locus, and opens up new lines of research into conditions on variation that have their source in extra-grammatical systems.

Contents

Acknowledgements	ii
Abstract	vi
Contents	vii
List of Tables	xi
List of Figures	xiv
1 Introduction	1
1.1 Research questions	1
1.1.1 Overview	1
1.1.2 The relevance of variation above the phonology	2
1.1.3 Refining the question	3
1.2 Methodology: How can we study the questions at issue?	4
1.2.1 The quantitative approach	4
1.2.2 Studying variation above the phonology	6
1.2.3 Studying the systems of individual speakers	7
1.3 Overview of findings and outline of the dissertation	10
2 Past approaches to contraction	13
2.1 Introduction	13
2.2 Defining the variable	14
2.2.1 The phenomenon	14
2.2.2 Overview of auxiliary forms	16
2.3 Categorical constraints on variant occurrence	18
2.3.1 Introduction	18
2.3.2 “Right-side” effects	19
2.3.3 “Left-side” effects	20
2.4 Previous analyses	27
2.4.1 Overview	27
2.4.2 Question 1: Grammatical status of reduced variants	29
2.4.3 Question 2: Source of categorical conditions on contraction .	43

2.5	Conclusions	60
3	A new approach to contraction	63
3.1	Introduction	63
3.2	Methodology and findings	65
3.2.1	Data collection	65
3.2.2	Defining the envelope of variation	70
3.2.3	Surface forms	90
3.2.4	Distribution of forms	92
3.3	Analysis	100
3.3.1	Introduction	100
3.3.2	Overview of the analysis	102
3.3.3	Intermediate forms from underlyingly short allomorphs . . .	104
3.3.4	Intermediate forms from underlyingly long allomorphs . . .	110
3.3.5	Summary	112
3.4	Evidence supporting the analysis	113
3.4.1	Intermediate forms after pronouns	114
3.4.2	Rates of occurrence of forms	115
3.4.3	Patterning of forms by length of NP subject	120
3.5	Alternative analyses	124
3.5.1	Alternative analysis: one underlying form per auxiliary . . .	125
3.5.2	Alternative analysis: three underlying forms per auxiliary . .	125
3.5.3	Alternative analysis: two underlying forms per auxiliary; in- termediate forms from only one	126
3.6	Conclusions	127
4	Linguistic conditions on contraction	129
4.1	Introduction	129
4.2	Predictors coded	131
4.2.1	Predictors for all subjects	132
4.2.2	Predictors for noun phrase subjects	134
4.2.3	Predictors for pronoun subjects	136
4.3	Model construction and significance testing	136
4.4	Factors particular to pronoun subjects	142
4.4.1	Introduction	142
4.4.2	Findings	143
4.4.3	Discussion	148
4.5	Other types of subjects	156
4.5.1	Introduction	156
4.5.2	Findings	156
4.5.3	Discussion	160
4.6	Factors particular to noun phrase subjects	164
4.6.1	Introduction	164

4.6.2	Findings	165
4.6.3	Discussion	184
4.7	Speaking rate	185
4.8	“Auxiliary tense”	189
4.8.1	History	190
4.8.2	Frequency	192
4.8.3	Homophony avoidance	192
4.9	Conclusions and implications	197
5	The effect of subject length on contraction	198
5.1	Introduction	198
5.2	Methodology	199
5.2.1	Measuring “heaviness”	199
5.2.2	Data	207
5.3	Findings	209
5.3.1	Collinearity	209
5.3.2	Predictors in isolation	211
5.3.3	Residualization of predictors	215
5.3.4	Summary and implications	222
5.4	Possible sources of the subject length effect	226
5.4.1	A large prosodic boundary	226
5.4.2	Inability to host a clitic	227
5.4.3	Constraints on production planning	229
5.5	Conclusion	238
6	Locating external conditions on variation	241
6.1	Introduction	241
6.2	Background on internal/external independence	242
6.3	Question 1: Attestations	245
6.3.1	Refining the question	245
6.3.2	Case studies	249
6.3.3	External conditions on contraction	253
6.3.4	Conclusion	264
6.4	Question 2: Theoretical implications	264
6.5	Conclusion	268
7	Toward a model of variation in the grammar: Conclusions and directions for future work	269
7.1	Introduction	269
7.2	Conclusion 1: A partially probabilistic grammar which derives outputs	271
7.2.1	Introduction	271
7.2.2	A grammar which derives outputs	271

7.2.3	A grammar that can handle probabilities	273
7.3	Conclusion 2: A system of language use distinct from the grammar .	276
7.3.1	Introduction	276
7.3.2	Some conditions on variation as extra-grammatical	276
7.4	Avenues for future work	286
7.4.1	The uniformity of /h/ Deletion	286
7.4.2	Implications of the subject length effect on contraction	287
7.4.3	A catalog of other “use” effects on variation	288
	Bibliography	291

List of Tables

1.1	Percent use of contracted forms of six auxiliaries after pronouns in three data sets: the individual speaker Carol Meyers, the Philadelphia speech community, and the Switchboard corpus	8
1.2	Percent use of contracted forms of <i>is</i> after consonant-final vs. vowel-final non-pronoun subjects in three data sets: the individual speaker Carol Meyers, the Philadelphia speech community, and the Switchboard corpus	9
1.3	Percent use of contracted forms of <i>is</i> after non-pronoun vs. pronoun subjects in three data sets: the individual speaker Carol Meyers, the Philadelphia speech community, and the Switchboard corpus	9
2.1	Surface forms coded, with the environments in which they surface .	27
3.1	Surface forms coded, with their proposed underlying source	92
3.4	Long and short allomorphs for six auxiliaries	102
3.5	Sources of surface forms after personal pronoun subjects	113
3.6	Sources of surface forms after noun phrase subjects	113
4.1	Sources of surface forms after vowel-final personal pronoun subjects	141
4.2	Sources of surface forms after the pronoun <i>it</i> and noun phrase subjects	141
4.3	Rates of short allomorph selection for <i>will</i> by identity of pronoun subject	144
4.4	Short allomorph selection for post-pronoun <i>will</i>	145
4.5	Comparison of two models for short allomorph selection for post-pronoun <i>will</i>	145
4.6	Comparison of two models for short allomorph selection for of post-pronoun <i>will</i>	145
4.7	Rates of short allomorph selection for <i>would</i> by identity of pronoun subject	146
4.8	Short allomorph selection for post-pronoun <i>would</i>	147
4.9	Fitted probability of short allomorph selection by estimated string frequency in Switchboard	154
4.10	Rates of short allomorph selection for <i>is</i> and <i>has</i> by subject type . . .	158
4.11	Short allomorph selection for <i>is</i> and <i>has</i> after pronoun-like subjects .	159

4.12	Comparison of three models of short allomorph selection for <i>is</i> and <i>has</i> after pronoun-like subjects	159
4.13	Rates of short allomorph selection for <i>has</i> after two types of <i>it</i> subjects	161
4.14	Rates of short allomorph selection <i>has</i> with an immediately following <i>been</i> , after two types of <i>it</i> subjects	162
4.15	Rates of short allomorph selection for (pronoun) <i>it has</i> with an immediately following <i>been</i> vs. all other words immediately following the auxiliary	162
4.16	Rates of short allomorph selection for <i>is</i> after noun phrase subjects, by category of following constituent	167
4.17	Model comparison for two different models of short allomorph selection for post-noun phrase <i>is</i>	168
4.18	Short allomorph selection for post-noun phrase <i>is</i> with following constituent category collapsed to four categories	169
4.19	Rates of short allomorph selection for post-noun phrase <i>is</i> , by place of articulation of immediately preceding segment	172
4.20	Short allomorph selection for post-noun phrase <i>is</i> with a term for place of articulation of preceding segment	173
4.21	Top 6 most disfavoring words for short allomorphs of <i>is</i>	174
4.22	Rates of short allomorph selection for <i>is</i> after noun phrase subjects, by place of articulation of immediately preceding segment	175
4.23	Short allomorph selection for post-noun phrase <i>is</i> with place of articulation of preceding segment collapsed into three categories	176
4.24	Rates of short allomorph selection for post-noun phrase <i>is</i> , by manner of articulation of immediately preceding segment	177
4.25	Short allomorph selection post-noun phrase <i>is</i> with a term for manner of articulation of preceding segment	178
4.26	Short allomorph selection for post-noun phrase <i>is</i> with preceding segment manner of articulation collapsed	179
4.27	Top 15 most favoring words for short allomorphs of <i>is</i>	180
4.28	Short allomorph selection for post-noun phrase <i>is</i> with preceding segment manner of articulation collapsed and four frequent /r/-final familial terms removed	181
4.29	Rates of short allomorph selection for post-noun phrase <i>has</i> and <i>will</i> , by place of articulation of immediately preceding segment	182
4.30	Short allomorph selection for post-noun phrase <i>has</i> and <i>will</i> with a term for place of articulation of preceding segment	183
4.31	Short allomorph selection for post-pronoun <i>had</i> , <i>has</i> , <i>have</i> , and <i>is</i> with a term for speaking rate	187
4.32	Short allomorph selection for post-noun phrase <i>has</i> and <i>will</i> with a term for speaking rate	187

4.33	Estimated frequencies in Switchboard of the six auxiliaries under study, across all subject types	192
5.1	Underlying sources of surface forms of auxiliaries after noun phrase subjects	208
5.2	Coded post-NP tokens by word and corpus	208
5.3	Spearman's ρ for the correlations between five measures of subject length, <i>is</i>	210
5.4	Spearman's ρ for the correlations between seven measures of subject length, <i>is</i>	210
5.5	Spearman's ρ for the correlations between five measures of subject length, <i>has</i> and <i>will</i>	210
5.6	Spearman's ρ for the correlations between seven measures of subject length, <i>has</i> and <i>will</i>	210
5.7	Coefficients and significance values for seven measures of subject length	214
5.8	Coefficients and significance values for raw and residualized predictors, <i>is</i> data	219
5.9	Coefficients and significance values for raw and residualized predictors, <i>has</i> data	220
5.10	Coefficients and significance values for raw and residualized predictors, <i>will</i> data	220
5.11	Coefficients and significance values for raw and residualized predictors, <i>is</i> and <i>has</i> data	221
5.12	Predicted rates of contraction of post-NP <i>is</i> (left) and <i>has</i> (right), by subject length in orthographic words	224
5.13	Sample stimuli components used in Ferreira, 1991, by syntactic complexity	233
6.1	Rates of contraction of post-NP <i>is</i> for Carol Meyers by situational context	263
7.1	Rates of /h/-deletion for three words in Switchboard	287

List of Figures

3.1	Distribution of forms after pronoun subjects, in the Switchboard and Philadelphia Neighborhood corpora	94
3.2	Distribution of forms after noun phrase subjects, in the Switchboard and Philadelphia Neighborhood corpora	95
3.3	Distribution of forms of <i>will</i> after pronoun subjects, in the Switchboard and Philadelphia Neighborhood corpora	119
3.4	Distribution of forms of <i>has</i> after noun phrase subjects in the Switchboard corpus	119
3.5	Distribution of surface forms of four auxiliaries after noun phrase subjects	121
3.6	Distribution of full and intermediate forms of <i>has</i> after noun phrase subjects	123
4.1	Effect of speaking rate on short allomorph selection for several auxiliaries after pronoun and noun phrase subjects, by auxiliary	186
5.1	Distribution of surface forms of <i>has</i> , <i>is</i> , and <i>will</i> after noun phrase subjects by seven measures of subject length	213
5.2	Effect of subject number of words on contraction, with subject number of syllables held steady	216
5.3	Effect of subject number of syllables on contraction, with subject number of words held steady	217
6.1	Distribution of age, sex, and level of education among speakers coded in each of the two corpora under study	258
7.1	Model of variation from Preston, 2004	282
7.2	Model of variation incorporating linguistic, sociostylistic, and psycholinguistic factors	283

Chapter 1

Introduction

1.1. Research questions

1.1.1. Overview

This dissertation investigates how sociolinguistic variables are represented in the linguistic systems of individual speakers.

Linguists over the past several decades have documented a large number of linguistic phenomena that are variable at the level of individual speakers: to pick just a few examples, there is the vocalization of /r/ (Labov, 2006), the variation between the velar [ŋ] and the alveolar [n] suffix (Labov, 1994), the variable deletion of coronal stops in word-final consonant clusters (Guy, 1980), the leveling of verb forms (e.g. *we was* for *we were*, Smith, 2000), and the deletion of /s/ in Spanish plurals (Terrell, 1977). These instances of intraspeaker variation all raise the following question: when we see speakers exhibiting variation in the forms they produce, what is the nature of the grammatical operations that generated those varying forms?

In asking this question, I seek to connect findings from quantitative sociolinguistics with theoretical questions concerning the architecture of the grammar. This is an approach that has precursors in much previous work on grammatical

models of variation, in a number of different frameworks (see, for instance, Adger, 2006; Anttila, 2007; Parrott, 2007; Coetzee and Pater, 2011). The present work expands on these in that it seeks to develop a model that integrates both internal and external factors on variation. The desired output of this thesis is thus a model of the grammatical architecture which is sociolinguistically informed.

Because trying to capture all of sociolinguistic variation is obviously overly ambitious, in this thesis I have chosen to restrict my focus to just what I am calling “variation above the phonology.” By way of terminological clarification, by “variation” I am referring to the synchronic variability in form shown by linguistic items such as those listed in the previous paragraph. By “above the phonology,” I refer to cases in which those varying items implicate a linguistic unit(s) larger than a single phoneme, on which I will say more in Section 1.1.2.

1.1.2. The relevance of variation above the phonology

Cases of variation in higher-level grammatical phenomena comprise morphophonological, morphological, and morphosyntactic variables. Under a treatment of the grammar such as that of Halle and Marantz (1993), in which surface forms are the output of a derivation that involves inserting and combining pieces, such phenomena implicate many levels of that derivation. As such, they have the potential to display complex linguistic conditioning of the sort that isn’t necessarily found with phonological or phonetic variables, because variable processes may apply at each level of structure. Careful examination of the factors conditioning higher-level variable alternations can enable us to identify where the variation is taking place for a particular alternation and to subsequently draw broader conclusions about the nature of variation in the grammar.

The complexity and theoretical interest of variables above the phonology was

noted early on by Labov (1969), in his study of variable copula deletion in African American English (1).

- (1) He _ fast in everything he do.

Labov observed that this variable copula deletion could have a number of possible grammatical sources, and asked (p. 721):

By what kind of rule are these finite forms of *be* deleted? Is it a transformational rule which deletes the copula, or a separate set of rules which delete *is* and *are*? Or is it a phonological rule which operates at a lower level in the grammar?

The upshot is that cases of variation above the phonology are fertile ground for examining questions of how variable phenomena are represented in speakers' linguistic systems because they implicate a large chunk of those linguistic systems by passing through many levels of the grammar.

1.1.3. Refining the question

To reiterate, the goal of this thesis is to arrive at a model of speakers' linguistic systems that takes into account the patterning of sociolinguistic variation above the phonology. I've chosen to approach this goal by way of two manageable sub-questions which can each be studied with quantitative data.

Question 1. What is the underlying source of the variants we see on the surface?

This first sub-question asks to what stage(s) of the grammar we can attribute variable surface behavior. In the case of variables above the phonology, the answer to this question is not always obvious *a priori* (as the citation from Labov (1969)

above demonstrates). As Labov did before me, I show in Chapter 3 of this thesis that quantitative data can provide important evidence for its answer.

Question 2. What conditions the appearance of surface variants?

The second sub-question, which motivates Chapters 4–6, asks what factors — both linguistic and non-linguistic — make one variant more likely than another to surface.

From the answers to both of these sub-questions, I draw implications (in Chapter 7) that speak to my larger research question concerning how variable phenomena above the phonology are represented in speakers' grammars.

1.2. Methodology: How can we study the questions at issue?

1.2.1. The quantitative approach

Previous researchers have demonstrated that quantitative data on the patterning of linguistic variants can shed light on how those variants were derived. This has been effectively demonstrated by works such as Labov, 1969 and Guy, 1991. Labov, examining copula contraction and deletion in African American English, observes that the conditions on variable deletion mirror those on variable contraction, supporting an analysis under which forms of *be* are deleted only after first having been contracted. The more broadly-applicable argument is that the patterns and correlations observed in natural speech data provide evidence for the particular locus of this variable.

Guy provides a similar demonstration of the value of quantitative data for grammatical analysis. Observing an exponential effect of morphological status on variable *t/d*-deletion in English consonant clusters, he puts forth a model that

localizes deletion to three stages of lexical phonology and predicts the observed exponential effect. This model, which localizes surface variation to multiple underlying stages, again gets its support from the quantitative patterning of variants.

In the present study, I follow in these researchers' footsteps and draw on data from a large-scale corpus study of a particular variable. Specifically, I examine the variable realization of English auxiliaries, generally known pre-theoretically as auxiliary contraction. The precise nature of the variation will be outlined in Chapters 2 and 3; the basic gist of the phenomenon is that a form of an auxiliary with all its segmental material intact alternates with one which is missing phonological material and which surfaces cliticized to the preceding word. This variation in auxiliary shape is pervasive in spontaneous speech and is represented orthographically (2).

(2) Variation in auxiliary form in the Switchboard corpus

- a. While we were in town, we'd ride several miles away, like to school and the like, but when we were in the country, we would ride ten, twelve miles away. (sw_1181)¹
- b. Yeah, Salzburg's nice. Austria's nice. Europe is nice! (sw_1151)
- c. Well, I'm sure it's been done! I'm sure it has been done. (sw_1060)

Contraction was selected as a case study for two reasons. First, as will be shown in Chapter 2, this phenomenon has been analyzed from many perspectives, from phonological to syntactic, and the surface data accordingly implicate many levels of a derivation. Questions of the locus of variation are thus at the forefront, and there is potential for complex linguistic conditioning. Second, this variable occurs relatively frequently in speech, so the researcher can easily amass a large body

¹Numbers in parentheses are speaker identification numbers; those that begin with "sw" are from the Switchboard corpus.

of quantitative data from which to draw conclusions — a technique which has only recently become possible with the advent of searchable spoken corpora, and which was not available when previous work on contraction was carried out. As a result, a large-scale corpus study of contraction of multiple auxiliaries is presently lacking, but feasible. This dissertation provides such a study, and applies its results to the theoretical questions at issue here.

1.2.2. Studying variation above the phonology

As will be discussed in greater detail in Chapter 6, some researchers (e.g. Lavandera, 1978; Romaine, 1981) have raised concerns about the appropriateness of extending the concept of the sociolinguistic variable to cases of variation above the phonology. Specifically, they argue that higher-level variables may fail to satisfy the criterion of semantic equivalence necessary to count as a linguistic variable, and that the variants in such cases may be deployed intentionally, for pragmatic purposes, rather than varying inherently, with no additional (non-social) meaning attached to either. Lavandera cites the “variation” between *exhausted* and *wiped out* as synonyms for *tired* to illustrate that two forms may be stylistically conditioned (in this case, *exhausted* is more formal than *wiped out*) but should nevertheless not be treated as a sociolinguistic variable given their difference in meaning.

I sidestep this question in my work by narrowing my focus to only those surface variants that are derived from a single input. So, I treat as available for study only those cases of variation in which the two varying forms are equivalent in the elements that go into their derivation.² This thus allows us to examine the variable processes that cause a single input to surface in different forms, which is the issue

²This nods at Weinreich et al.’s (1968:167) definition of the linguistic variable as “a variable element within the system controlled by a single rule.”

addressed in Section 1.1.3's Question 1. As I show in Chapter 2, the majority of analyses of contraction that have been put forth in the literature do take a single-input approach; I adopt this approach for my own analysis in Chapter 3.

1.2.3. Studying the systems of individual speakers

Some discussion is in order concerning what I mean by studying variation at the level of “individual speakers.” I am not advocating a return to the study of the idiolect, of studying individuals without acknowledgement of the larger speech community of which they form a part (see Weinreich et al., 1968 for much discussion on this topic). I follow Weinreich et al. in recognizing that individuals have a version of the grammar characteristic to the speech community of which they form a part. But each utterance that is produced in the real world comes out of the mouth of one single speaker, and that speaker has mental systems that produced that utterance. So, my interest is in the nature of those mental systems where variation is concerned: both the architecture of the grammar, and its interaction with any systems of language processing or memory that play a role in the production of speech. Again, the grammar itself may be shared among members of a speech community (Weinreich et al.’s “grammar of the speech community”), but I assume that the psycholinguistic systems of processing and memory are speaker-specific.

The method of drawing conclusions about individual systems from the patterns of variation evident in a large corpus of many speakers has received some criticism (e.g. Newmeyer, 2003). But work in sociolinguistics has shown that the patterns in evidence at the level of the community are replicated at the level of individuals, once enough data has been collected (e.g. Guy, 1980). I have confirmed this where contraction is concerned. The top row of Table 1.1 provides the rate of use of contracted variants for six auxiliaries after pronoun subjects in the speech

of one woman, Carol Meyers, recorded over the course of her entire day, for a total of 509 minutes' worth of recording. (Section 6.3.3.2 will provide more detail on the Carol Meyers study, and Section 3.2.3 more information on the precise coding of the dependent variable of auxiliary realization. Briefly, "contracted" variants are those that take the shape of a single consonant.) Meyers' use of contracted variants shows linguistic conditioning: contracted variants are used much less often when the auxiliary is *had* or *would* than when the auxiliary is *has*, *have*, *is*, or *will*. This pattern is clearly replicated in the larger community, represented in the third row of the same table. These figures represent data compiled from 43 different members of the Philadelphia speech community (and Section 3.2.1 will provide more details on how these data were collected). In fact, the same pattern is again in evidence when we examine data collected from 965 different speakers, as part of the Switchboard corpus, in the fifth row of the same table (and, again, see Section 3.2.1 for more on this corpus and the data collection). The individuals and the community match with regard to this linguistic conditioning.

	had	has	have	is	will	would
Carol Meyers % contracted	0	100	100	100	98	72
N	8	11	20	206	116	36
Philadelphia % contracted	10	92	95	98	98	34
N	105	95	274	1988	539	847
Switchboard % contracted	33	87	92	98	91	50
N	426	393	823	432	426	353

Table 1.1: Percent use of contracted forms of six auxiliaries after pronouns in three data sets: the individual speaker Carol Meyers, the Philadelphia speech community, and the Switchboard corpus.

This individual/community correspondence is also replicated for two other linguistic factors conditioning contraction. All three data sets match in showing less contraction of *is* after a non-pronoun subject that ends in a consonant (e.g. *John*)

than one that ends in a vowel (e.g. *Sue*; Table 1.2). And all three data sets match in showing less contraction of *is* after a non-pronoun (NP) subject than after a pronoun (Table 1.3).³

	cons	vowel
Carol Meyers % contracted	37	68
N	60	22
Philadelphia % contracted	48	59
N	406	131
Switchboard % contracted	25	42
N	217	66

Table 1.2: Percent use of contracted forms of *is* after consonant-final vs. vowel-final non-pronoun subjects in three data sets: the individual speaker Carol Meyers, the Philadelphia speech community, and the Switchboard corpus.

	NP	pro
Carol Meyers % contracted	40	100
N	92	206
Philadelphia % contracted	46	98
N	590	1987
Switchboard % contracted	24	98
N	344	432

Table 1.3: Percent use of contracted forms of *is* after non-pronoun vs. pronoun subjects in three data sets: the individual speaker Carol Meyers, the Philadelphia speech community, and the Switchboard corpus.

I believe we are thus justified, in the absence of more multi-hour recordings of individuals like that of Carol Meyers, in taking the patterns attested in data pooled from many speakers as indicative of the conditioning of variants at the level of individual speakers. Accordingly, in the rest of this dissertation, I extrapolate from the trends in evidence in large-scale corpus data to a model of the linguistic system of individuals.

³All three of the linguistic conditioning factors introduced here will be discussed in more detail in Chapter 4.

1.3. Overview of findings and outline of the dissertation

Chapters 2–6 of this dissertation present the contraction case study, organized so as to address the two questions laid out in Section 1.1.3. Chapter 7 draws conclusions from the contraction findings that address the larger goal of this work, the incorporation of sociolinguistic variation into a grammatical model.

In Chapter 2, I summarize previous work on auxiliary contraction in English, which has, for the most part, treated this variable as an allomorphic alternation with both categorical and variable conditions on its occurrence. In Chapter 3, I lay out the methodology of the corpus study, including a careful delimitation of the envelope of variation in auxiliary shape. Chapter 3 also addresses my Question 1, concerning the underlying source of surface variants where auxiliary realization is concerned. I find that auxiliaries surface in three distinct phonological shapes, rather than the two that have been addressed in previous literature. Based on the patterning of these three surface forms in quantitative corpus data, I argue that contraction is best interpreted as a two-stage process, with a variable alternation in the morphology followed by low-level phonetic and phonological processes.

Chapters 4–6 address my Question 2, concerning the conditioning of variants. In Chapter 4 I examine a number of linguistic effects on auxiliary realization. One important finding presented in this chapter is that an observed conditioning effect of pronoun identity cannot be attributed to collocation frequency, a result which argues against approaches to variation that treat conditioning factors as emergent from language use. I devote Chapter 5 to an examination of another linguistic factor: the effect of the length of an auxiliary’s non-pronoun subject on contraction. I show that the probability of contraction decreases with longer subjects, and argue that this effect displays a kind of non-locality which is uncharacteristic of alterna-

tions that are the purview of the grammar. Chapter 6 discusses the representation of sociostylistic effects in speakers' grammars, and investigates social and stylistic effects on contraction (though few are found).

Finally, Chapter 7 draws implications from the findings of the previous chapters, and sketches a model of language that can account for them. Based on the answers to my two questions, I conclude that intra-speaker linguistic variation must be the product of two systems, as follows.

1. A partially probabilistic grammar in which output forms are derived. The motivation for proposing a derivational⁴ grammar comes from the fact that the best analysis of the patterns presented in Chapter 3 is one in which surface forms pass through multiple stages of processes before being output. The motivation for proposing a grammar that is partly probabilistic comes from the pronoun identity data presented in Chapter 4, which argues against at least some conditions on variation being emergent from language use and in favor of them being represented grammatically instead.
2. A system of language use, distinct from the grammar, which deploys variants based on psycholinguistic and sociostylistic constraints. The motivation for proposing this system of language use comes from the effect of subject length on contraction presented in Chapter 5. The non-locality of this effect differentiates it from alternations that are the purview of the grammar, and I argue that it should instead be interpreted as stemming from extra-grammatical, memory-based constraints on the system of language production. These constraints are taken, broadly, to be the purview of a system of language use.

⁴By "derivational," I mean "derives forms in some way." I am remaining agnostic on, for instance, whether the phonology is characterized by ordered rule application or constraint ranking. So, I am not using the term "derivational" in the traditional phonological sense of "ordered rule-based."

The dissertation thus provides evidence that variation in surface forms may be attributable to more than one underlying locus, meaning that surface probabilities should not simply be taken at face value. It also, as I demonstrate at the close of Chapter 7, opens up new lines of research into conditions on variation that have their source in extra-grammatical systems.

Chapter 2

Past approaches to contraction

2.1. Introduction

The present chapter reviews the existing body of literature on auxiliary contraction, the phenomenon through which the theoretical questions at issue in this thesis are to be examined. As we will see, previous researchers have approached contraction from a number of different perspectives, from phonological to syntactic. Consequently, those questions of the grammatical locus of surface variation that are at issue in this thesis are at the forefront. The surface variation in auxiliary phonological shape also has a number of categorical conditions on it, and enumeration of these (Section 2.3) will serve both to delimit the envelope of variation for the corpus study discussed in subsequent chapters, and to lay the groundwork for discussion of the grammatical operations underlying the surface variation in auxiliary form (Section 2.4). This will subsequently set us up for investigation of the variable constraints on contraction, via the corpus study that is reported on in the following four chapters.

2.2. Defining the variable

2.2.1. The phenomenon

The phenomenon under study in this dissertation is the variation in phonological shape of English auxiliaries. The precise nature of the attested varying forms will be outlined below; the basic gist of the phenomenon is that a form of an auxiliary with all its segmental material intact alternates with one which is missing phonological material and which surfaces cliticized to the preceding word. This variation in auxiliary shape is pervasive in spontaneous speech and is represented orthographically (3, repeated from 2).

- (3) Variation in auxiliary form in the Switchboard corpus
- a. While we were in town, we'd ride several miles away, like to school and the like, but when we were in the country, we would ride ten, twelve miles away. (sw2979: sw_1181)¹
 - b. Yeah, Salzburg's nice. Austria's nice. Europe is nice! (sw2333: sw_1151)
 - c. Well, I'm sure it's been done! I'm sure it has been done. (sw2505: sw_1060)

For the moment, I will refer to the phonologically reduced, cliticized forms as “reduced,” and the phonologically intact forms as “unreduced”; this is intended to be a theory-neutral description of the phenomenon, for which a complete analysis will be given in Chapter 3. I will henceforth use the term “contraction” to refer to the surface variation between reduced and unreduced forms without any commitment to a particular analysis of the phenomenon. I will argue, in Chapter 3, that

¹Numbers in parentheses beginning with “sw” indicate that a token comes from the Switchboard corpus; the first number is the number of the conversation the token was taken from and the second is the identification number of the speaker who uttered it.

reduced forms actually come from more than one source underlyingly.

A sampling of the precise phonological shapes that auxiliaries may surface in is provided in 4. In each case, the unreduced form of an auxiliary is provided first, followed by any reduced forms that are available. The tildes are meant to indicate that all provided forms are equally grammatical in a particular environment, though we will see in subsequent chapters that the forms are not in free variation; a number of linguistic conditions govern their appearance. Note that what I am calling “reduced forms” may be either syllabic (e.g. [əd]) or non-syllabic (e.g. [d]), though I reiterate that these forms are lumped together as “reduced” simply for expository purposes. In Chapter 3, I will propose that syllabic and non-syllabic reduced forms do not necessarily derive from the same source in synchronic grammar.

(4) Variable phonological forms of auxiliaries

- a. We [hæd] ~ [əd] ~ [d] been waiting for several hours.
- b. It [wɪl] ~ [əl] take a while to get there.
- c. My car [hæz] ~ [əz] ~ [z] been having trouble starting.
- d. Those guys [hæv] ~ [əv] been waiting there for a while.

My inclusion of syllabic reduced forms as an object of study alongside non-syllabic reduced forms is relatively novel: as will be demonstrated in Section 2.4.2, most previous work on auxiliary realization has focused primarily on the distribution of non-syllabic reduced forms. This is due in large part to the fact that most previous researchers focused on the contraction of *is* only, an auxiliary for which there is no syllabic reduced form distinct from the unreduced form. But my inclusion of other auxiliaries in this thesis necessitates consideration of syllabic reduced forms too, as 4 shows.

The auxiliaries that exhibit contraction in Standard English are *had*, *has*, *have*, *will*, *would*, *is*, *are*, *am*, *does*, and *did* (these last two only in *wh*-questions). In this thesis, I'll be focusing on only the first six of these, since one factor that will prove to be important to the discussion is the nature of the subject that an auxiliary surfaces after, and the latter three auxiliaries occur after a set of environments too limited to allow in-depth study. As for *are*, it was omitted from study because its phonological shape makes it incapable of displaying any variation of interest after non-pronoun subjects, where it surfaces categorically as a vowel of some quality followed by an /r/. (Other auxiliaries at least have an initial consonant that may be lost in this environment, and some lose their vowel as well.)

2.2.2. Overview of auxiliary forms

Coding for the corpus study (the methodology behind which is described in more detail in Chapter 3) found that auxiliaries surface in three distinct phonological shapes, as exemplified in 4. These shapes were described in the preceding section as “unreduced,” “syllabic reduced,” and “non-syllabic reduced.” For ease of exposition, I rename these forms *full*, *intermediate*, and *contracted*, respectively, though I will continue to reserve the term “reduced” as a blanket term covering both contracted and intermediate forms. The phonological shape of each form for each auxiliary under study is enumerated in 5–7.

- (5) **Full** forms (formerly “unreduced”) have all phonological material intact.²
- | | |
|-------------------------------|--------------------------------|
| a. <i>had</i> : [hæd], [həd] | d. <i>is</i> : [ɪz], [əz] |
| b. <i>has</i> : [hæz], [həz] | e. <i>will</i> : [wɪl], [wəl] |
| c. <i>have</i> : [hæv], [həv] | f. <i>would</i> : [wʊd], [wəd] |

²Full forms of auxiliaries are subject to a variable process of vowel reduction, hence the alternative forms with schwa; see Kaisse (1985) for more on this process. I assume that this process is distinct from contraction and do not deal with vowel reduction here.

- (6) **Intermediate** forms (formerly “syllabic reduced”) are lacking an initial consonant.³
- a. *had*: [əd]
 - b. *has*: [əz]
 - c. *have*: [əv]
 - d. *will*: [əl]
 - e. *would*: [əd]
- (7) **Contracted** forms (formerly “non-syllabic reduced”) are lacking their initial consonant and their vowel.
- a. *had*: [d]
 - b. *has*: [z], [s][†]
 - c. *have*: [v]
 - d. *is*: [z], [s][†]
 - e. *will*: [l]
 - f. *would*: [d]

[†]These auxiliaries have two single-consonant forms whose appearance is predictable from the voicing of the preceding segment.

As the discussion to follow will reveal, the fact that these three forms are distinguishable on the surface is not necessarily evidence that they are distinct in any deeper linguistic sense. On the contrary, the analysis presented in Chapter 3 will argue that surface intermediate forms are not uniquely represented underlyingly. Instead, the three-way alternation in form observed on the surface will be argued to be traceable back to an underlying two-way distinction, between one short and one long allomorph for each auxiliary.

The three forms outlined in 5–7 are not unconditionally interchangeable. On the contrary, there are both categorical constraints — that is, certain forms are ungrammatical in certain environments — and gradient constraints — that is, certain forms are dispreferred in certain environments — on their occurrence. Section 2.3

³Intermediate forms are so named because they are phonologically in between an auxiliary’s full and contracted forms. There is no intermediate form of *is* distinct from its full form to be coded.

will discuss the categorical restrictions on the distribution of auxiliary forms. Gradient constraints on the distribution of forms will be the topic of Chapters 4–6. As these gradient constraints implicate both grammatical and extra-grammatical systems, Chapter 7 will tie them together with the analysis of contraction arrived at in this chapter and the next chapter, hence providing a model of the grammatical architecture that incorporates the findings presented herein.

2.3. Categorical constraints on variant occurrence

2.3.1. Introduction

The environments in which the variation between reduced and unreduced auxiliary forms is restricted have been a subject of much interest in the linguistic literature. Though the present study is concerned primarily with the nature of, and conditions on, this variation where it *does* occur, I nonetheless survey in this section those environments in which contraction has been said to be unacceptable. The categorical conditions on contraction have played a role in past researchers' analysis of the phenomena underlying the surface variation (Section 2.4.3) and will also serve to delimit the envelope of variation for the corpus study (Chapter 3), so a thorough consideration of them is relevant.

The categorical constraints on auxiliary contraction can be divided into those that stem from the nature of the environment to an auxiliary's right (Section 2.3.2) and those that stem from the nature of the environment to an auxiliary's left (Section 2.3.3). I will discuss each in turn. The constraints on contraction presented in this section are based on the intuitions of authors of earlier work on contraction. The validity of these intuitions will be tested with corpus data in Chapter 3, when I lay out the envelope of variation for the corpus study.

2.3.2. “Right-side” effects

Both intermediate and contracted forms are illicit in the following environments: those in which an auxiliary precedes a movement (8a) or a deletion (8b) site, and comparative sub-deletion constructions (8c). Though *is* is the only auxiliary that surfaces in many of these environments, in those cases where another auxiliary may also occur (the prime examples below), both types of reduced forms are similarly ungrammatical.⁴

(8) Environments in which reduced forms are illicit

- a. I wonder where Gerard [ɪZ] (*[z]) __ today. (King, 1970)
- b. I'm as tall as Bill [ɪZ] (*[z]) __. (Sells, 1983)
- b'. I've been there, but no one else in my family [hæz] (*[əz], *[z]) __.
- b''. John's read more books than I [hæv] (*[əv], *[v]) __.
- b''''. John wants me to come, so I [wɪl] (*[əl], *[l]) __.
- c. Marie's a better scientist than Pierre [ɪZ] (*[z]) an __ engineer. (Anderson, 2008)

The environments exemplified in 8 can all be characterized as those in which reduced forms are illicit due to the nature of the environment to the auxiliary's right. That is, it is not the nature of the auxiliary's host that can be said to be blocking contraction here. In each sentence, contraction can be made acceptable when something different follows the auxiliary. This is shown in the examples in 9, modified from those in 8.

(9) Reduced forms in environments in 8 become acceptable when following environment changes.

⁴Most previous work on the blocking of contraction has concentrated on *is* only. When judgments on other auxiliaries are provided here, they are my own, though they will be supported with corpus data in Chapter 3.

- a. I wonder where Gerard [ɪz] ~ [z] going ____.
- b. I'm as tall as Bill [ɪz] ~ [z] going to be ____.
- b'. I've been there, but no one else in my family [hæz] ~ [əz] ~ [z] been there.
- b''. John's read more books than I [hæv] ~ [əv] ~ [v] heard of ____.
- b''''. John wants me to come, so I [wɪl] ~ [əl] ~ [l] come.⁵
- c. Marie's a better scientist than Pierre [ɪz] ~ [z] ever going to be ____.

More will be said in Section 2.4.3.3 concerning why reduced forms may be illicit in the environments in 8 but not in those in 9, and the treatment of these environments in the corpus study will be addressed in Chapter 3.

Finally, Kaisse (1983) and Anderson (2008) observe the ungrammaticality of contraction before a parenthetical (10).

- (10) John [ɪz] (*[z]), my dear, a bastard. (Anderson, 2008)

2.3.3. “Left-side” effects

There also exists another set of environments in which alternation between unreduced and reduced forms is said to be restricted, and these are all characterized by the nature of the material to the auxiliary's left. Contracted forms of auxiliaries other than *is* or *has* are illicit when preceded by a coordinated or embedded pronoun (11a); they are also illicit when preceded by a consonant which would create an unacceptable cluster or a geminate (11b).⁶ Note that I am restricting the dis-

⁵In fact, Chapter 3 will demonstrate that the auxiliary *will* does not surface as [əl] after pronoun subjects in spontaneous speech (a gap that is a natural consequence of the analysis given in that chapter). Instead, the forms [əl] and [l] are in complementary distribution in speech, with the former surfacing after non-pronouns and the latter after pronouns. Because this makes example-writing awkward, the pronoun *I* is used in this example simply for convenience; the sentence is acceptable with [əl] when a noun phrase subject such as *Bill* is used in place of *me/I*.

⁶This latter fact is unsurprising given the nature of English phonotactics, but shouldn't be neglected in a precise delimitation of the scope of variation.

cussion for the moment only to **contracted** forms; the corpus data presented in Chapter 3 will demonstrate that **intermediate** reduced forms are acceptable in the environments in 11, and this fact will constitute a crucial component of the analysis presented in that chapter.

(11) Environments in which contracted forms are illicit

- a. John and I [hæv] (*[v]) got it. (Kaisse, 1983)
- a'. The guy next to you [wil] (*[l]) speak first. (Zwicky, 1970)
- b. It [wil] (*[l]) be a while before we get there.
- b'. That [wud] (*[d]) be a good idea.
- b''. Those guys [hæv] (*[v]) been waiting there for a while.
- b''''. The cheese [hæz] (*[z]) gone bad.

There is an additional set of environments in which there is some dispute in the literature concerning the acceptability of auxiliaries' contracted forms. These conflicting judgments arise with regard to the auxiliaries *had*, *would*, *will*, and *have* when following subjects that are not personal pronouns and where a contracted form would not be ruled out on phonotactic grounds. Kaisse (1983) and Sells (1983) assert that these auxiliaries may not surface in their contracted form in such an environment. Other authors are less categorical in their description of the facts, but it is clear that contracted forms are restricted to some degree in these environments, as follows.

The contracted form of *had* and *would* (that is, [d]) is said by Zwicky (1970) to be acceptable after vowel-final noun phrases (12a) but not consonant-final ones (12b), though he allows that it is "marginal" after /r/ (12c). McElhinny (1993), by contrast, finds no evidence in her corpus to support 12a, 12b, or 12c: she finds that [d] never surfaces after noun phrases at all.

The contracted form of *will* ([l]) is said by Zwicky to be unacceptable after non-personal pronoun subjects (12d); by contrast, McElhinny finds 9% of post-noun phrase *will* tokens to surface with the contracted form (though she doesn't give an indication of how many tokens this represents.)

Finally, the contracted form of *have* ([v]) is said by Zwicky to be unacceptable after non-personal pronoun subjects (12e); McElhinny's corpus data confirms this, with zero tokens attested.

(12) Environments in which contracted forms may be illicit (examples and judgments from Zwicky, 1970)

- a. Mary [wʊd] ~ [d] go.
- b. John [hæd] (*[d]) gone.
- c. The car [hæd] ~ ?[d] been destroyed.
- d. Sue [wɪl] (*[l])...
- e. The foci [hæv] (*[v])...

However, this is not to say that no reduced form may appear in the environments in 11–12. Unlike what was the case for the environments in 8, my intuition — and the corpus data presented in Chapter 3 will confirm this, though it is not a fact that has received much attention in the literature — is that **intermediate** forms are acceptable in 11–12. I reproduce 11–12 below, as 13, indicating the acceptability of intermediate forms and ungrammaticality of contracted forms in these environments.

(13) Environments in which contracted forms are illicit, but intermediate forms are not.

- a. John and I [hæv] ~ [əv] (*[v]) got it.

- a'. The guy next to you [wɪl] ~ [əl] (*[l]) speak first.
- b. It [wɪl] ~ [əl] (*[l]) be a while before we get there.
- b'. That [wʊd] ~ [əd] (*[d]) be a good idea.
- b''. Those guys [hæv] ~ [əv] (*[v]) been waiting there for a while.
- b'''. The cheese [hæz] ~ [əz] (*[z]) gone bad.
- c. Mary [wʊd] ~ [əd] (*[d]) go.
- d. John [hæd] ~ [əd] (*[d]) gone.
- e. The car [hæd] ~ [əd] (*[d]) been destroyed.
- f. Sue [wɪl] ~ [əl] (*[l])...
- g. The foci [hæv] ~ [əv] (*[v])...

Kaisse (1979, 1983) provides a further set of environments in which the nature of the material to an auxiliary's left can be said to be blocking contracted forms from appearing. The environments that Kaisse addresses are those in which the auxiliary follows a preposed negative adverbial (14a), a preposed verb phrase (14b), a preposed comparative adverbial (14c), a preposed prepositional phrase (14d), a multi-word, non-subject *wh*-phrase (14e), a sentential subject (14f), a pseudocleft (14g), or a distributed nominalization (14h).

- (14) Environments in which contracted forms are illicit (examples and judgments from Kaisse, 1983).
- a. Only at night [ɪz] (*[s]) it possible to get KUOW on my radio.
 - b. Speaking tonight [ɪz] (*[s]) our star reporter.
 - b'. Speaking tonight [hæz] (*[s]) been our star reporter.
 - c. More important [ɪz] (*[s]) her insistence on honesty.
 - d. Under this slab [ɪz] (*[z]) buried Joan of Arc.

- d'. Under this slab [hæz] (*[z]) been buried a fabulous treasure.
- e. How likely [ɪz] (*[z]) it to rain?
- f. That you're eating lots of food [ɪz] (*[z]) obvious.
- f'. That you eat a lot [hæz] (*[s]) been making her happy.
- g. What I wonder [ɪz] (*[z]) whether we'll win.
- h. The decision [ɪz] (*[z]) to go ahead with it.

Wilder (1997), Roberts (2000), and Close (2004) discuss the inability of reduced forms to surface after adverbs.

(15) Environments in which reduced forms are illicit

- a. He never [hæz] (*[z]) liked them. (Close, 2004)
- b. He probably [wil] (*[əl]) (*[l]) turn up later. (Close, 2004)
- c. He really [wil] (*[l]) finish tomorrow.⁷ (Roberts, 2000)
- d. We probably [hæv] (*[v]) said enough. (Roberts, 2000)

These authors observe that after adverbs, auxiliaries must occur in an unreduced form, with vowel quality intact and even bearing stress. Wilder notes that there are some sentences in which it looks like contracted forms are surfacing after an adverb (16), but that these putative adverbs are better analyzed as being parentheticals.

(16) Acceptability of reduced forms after parenthetical adverbs (examples and judgments from Wilder, 1997)

- a. John apparently[z] on drugs.
- b. John probably [əl] leave later.

⁷While Close observes that both intermediate and contracted forms are unacceptable after adverbs, Roberts does not talk about intermediate forms, focusing only on contracted ones.

- c. John actually [əd] be a good candidate.

Interestingly, though, the judgment that contraction is acceptable after a parenthetical is not universally shared. Though Anderson (2008) agrees with it, giving as an example the sentence *John, my dear, 's a bastard*, which he considers grammatical, Inkelas and Zec (1993) give the example sentence in 17a, in which they deem contraction to be **ungrammatical** because it follows a parenthetical. Their explanation for this is that the parenthetical introduces a pause before the auxiliary, and they connect this to the failure of contracted forms sentence-initially (17b), something which is also discussed by Kaisse (1983) and Close (2004). These conflicting judgments on post-parenthetical auxiliary contraction will be revisited with corpus data in Chapter 3.

- (17) Environments in which contracted forms are illicit (examples and judgments from Inkelas and Zec, 1993)
- a. Matt, as you know, [ɪz] (*[z]) eyeing the door.
 - b. [ɪz] (*[z]) Anne eating green beans?

Where contraction in initial position is concerned, the literature is again not entirely in agreement with Inkelas and Zec's judgment. Bresnan (1978), for instance, uses the purported **acceptability** of sentence-initial contraction as support for a treatment of contracted forms as proclitics: contraction, under her analysis, involves an auxiliary attaching to the material that **follows** rather than precedes it, hence allowing contraction sentence-initially but prohibiting it before gaps and movement sites (8). Other authors (Zwicky and Pullum, 1983b; Wilder, 1997) have also argued for the acceptability of sentences such as 17b, though they have attributed them not to contraction but to a more general phonological process of Left Edge Reduction that deletes sentence-initial material up to a sentence's first main

stress (Napoli, 1982). Wilder, for instance, observes that there are some environments in which sentence-initial auxiliaries may surface in their single-consonant form, but always agreeing in voicing with the segment that preceded them underlyingly (18a–b). His analysis of such forms is that they represent (leftward) contraction of an auxiliary to its host, followed by the later process of Left Edge Reduction, which deletes the material the auxiliary has contracted to and leaves the contracted form of the auxiliary with its predetermined voicing intact. Left Edge Reduction can delete varying amounts of material preceding the first stress; compare the equally acceptable 18c.

- (18) Left Edge Reduction (examples a and b and corresponding judgments from Wilder, 1997)
- a. 's not true. (<*it's*) [s] / *[z]
 - b. 's not here. (<*he's*) [z] / *[s]
 - c. 't's not true. (<*it's*) [ts]

Sentences like those in 18 provide evidence, via the voicing of the auxiliary, that the single-consonant form was what was originally inserted. But a sentence like 17b provides no such evidence, because there was no original host for the auxiliary that could have changed its voicing. Moreover, other auxiliaries do not show the voicing alternations that *is* and *has* do. Sentences like 17b, and analogous sentences with different auxiliaries (say, [*v*] *they been eating green beans?*), are thus ambiguous between an instance of the short allomorph, and an instance of the long allomorph which has lost its initial segmental material through Left Edge Reduction. For this reason, while the realization of sentence-initial auxiliaries is an interesting question which deserves corpus-based investigation (particularly given the diversity of grammaticality judgments on sentences like 17b), it is not

one I will be examining here, because contraction *per se* may not be the mechanism underlying the variation in auxiliary shape.

Table 2.1 summarizes the three auxiliary shapes under study and a rough characterization of the environments in which they surface, according to the majority opinion of previous researchers' judgments.

Surface form	Distribution
Full (CVC)	Surfaces in all environments
Intermediate (əC)	Contingent on right-side environment (8)
Contracted (C)	Contingent on right- (8, 10) and left-side (11, 12, 14, 17) environments

Table 2.1: Surface forms coded, with the environments in which they surface.

2.4. Previous analyses

2.4.1. Overview

Contraction has been a topic of interest in the linguistic literature dating back to Labov (1969). This section reviews the analyses of contraction and the environments that block it that have been put forward in earlier work.

There are two main questions to be addressed in an analysis of contraction:

1. What is the grammatical status of reduced auxiliary variants (i.e., contracted and intermediate forms)?
2. What is the source of the categorical constraints on the occurrence of the reduced variants outlined in Section 2.3?

These questions encompass a number of sub-questions, as follows:

1. What is the grammatical status of reduced auxiliary variants (i.e., contracted and intermediate forms)?

- (a) Do reduced variants represent distinct objects in memory, or can contracted and/or intermediate forms be construed as derivative from a stored form?
 - i. If reduced variants are derivative, what processes derive them?
 - ii. If at least some reduced variants are distinctly stored, what is their underlying form?
 - (b) By what mechanism do reduced variants attach to their host?
2. What is the source of the categorical constraints on the occurrence of the reduced variants outlined in Section 2.3?
- (a) Why are reduced forms of all auxiliaries illicit in the environments in 8?
 - (b) Why are contracted forms of some auxiliaries illicit in the environments in 11 and, subject to the findings from corpus data, 12?

There are naturally a number of additional questions raised by the variable nature of this phenomenon: for instance, when we see variation in auxiliary shape on the surface, to where in the grammatical derivation can we trace this variation? And what conditions the appearance of reduced variants in those contexts where variation between unreduced and reduced may occur? I will set these questions to the side for the moment and revisit them in subsequent chapters.

I will address questions 1 and 2 in turn, making reference to their sub-questions as appropriate.

2.4.2. Question 1: Grammatical status of reduced variants

2.4.2.1. Reduced variants as derivative

The earliest work on contraction (Labov, 1969; King, 1970; Lakoff, 1970) treated our “contracted” forms as the output of phonological rules. Specifically, a cascade of phonological processes would delete an auxiliary’s initial /h/ or /w/, delete its vowel (having been reduced to [ə] by an earlier process), and resyllabify the remaining consonant with the preceding word. In other words, the proposal was that for each auxiliary, there is a single form stored in memory; phonological rules variably operate in order to produce single-consonant “contracted” forms. Zwicky (1970) provides one such analysis. The processes he proposes are Glide Deletion, an allegro speech rule which deletes initial /h/ before unstressed syllables and /w/ and /ð/ in a particular set of function words; and Auxiliary Reduction, which deletes the vowel of only those contractable auxiliaries.⁸

A similar analysis is put forward by Sells (1983), who proposes processes of glide deletion (restricted to only those auxiliaries that are subject to contraction), vowel reduction (to schwa) and subsequent deletion, and resyllabification of the remaining consonant to its host. Selkirk (1984) is another analysis that can be included in this category: the source of reduced forms is not her primary focus, so she does not provide any specifics, but she alludes to phonological rules that derive single-consonant contracted forms (though she does still allow, fn. 39, that “some” reduced variants may be suppletive forms). Wood (1979), similarly, alludes to phonological processes of reduction that derive reduced forms, but doesn’t pro-

⁸Zwicky does allow that Auxiliary Reduction may instead be simply a rule that cliticizes an onsetless auxiliary to its host, with vowel loss effected by preexisting rules that delete the underlying vowel in past tense and plural suffixes (resulting in alternations such as *kissed* [kɪst] ~ *patted* [pætɪd]). The underlying syllabicity of those suffixes is not universally agreed upon, however; see, e.g., Anderson (1973) and Borowsky (1986), and further discussion in Section 3.3.3.1.

vide specifics.

An analysis of contraction under which each auxiliary has one single form, with all its phonological material, stored in memory, and is then subject to variable processes of reduction, has some appealing attributes. There is a ready explanation for the existence of intermediate forms: they are generated when the stored form undergoes deletion of its initial consonant, but variable vowel deletion subsequently does not apply.⁹ Contracted forms are derived when the two processes occur in tandem. (Provisions must be made so that the proposed process of vowel deletion does not apply without consonant deletion already having applied, to result in a vowelless syllable; presumably this falls out of phonotactic constraints on the language.) A phonological source for reduced forms is additionally appealing because there is existing evidence for fast-speech processes deleting /h/ and [ə] in English, the former affecting function words such as possessive and reflexive pronouns and the latter applying to the unstressed initial syllable of words such as *believe* and *tomato* (Kaisse, 1985).

2.4.2.2. Reduced variants as stored

Kaisse provides a number of arguments against an analysis of contracted forms as the output of phonological rules. (She, like many other authors, does not devote much attention to intermediate forms, though see Section 2.4.2.2.1.) First of all, the proposed initial consonant deletion rule has to be quite narrowly restricted to accurately account for the facts where deletion of /w/ is concerned, because only

⁹This is not the only possible source of intermediate forms under such an analysis, of course. Sells (1983) has a rule of Schwa Epenthesis that applies when a single-consonant contracted form has been generated (via glide and vowel deletion) but cannot attach to its host. This, of course, raises objections to its “Duke-of-York” nature (Pullum, 1976): a vowel present in the underlying form is deleted just to have a vowel subsequently inserted again.

the auxiliaries *will* and *would* contract; *was* and *were* do not.¹⁰ At the least, then, an analysis of contraction in terms of phonological rules would need two separate processes: one that deletes fast-speech /h/ in an array of function words, and one that deletes /w/ in two particular auxiliaries only. Kaisse also puts forth a stronger argument against a phonological analysis of contraction. She argues that, while it is true that *h*-Deletion and *ə*-Deletion are independently motivated *fast-speech* rules, any phonological rules that generated contracted auxiliaries would need to apply in *slow speech* as well: contraction is acceptable in slow speech, but *h*-Deletion of other words is not. A phonological analysis, then, would require two distinct processes of *h*-deletion: one affecting an array of function words in fast speech, and the other affecting only the contractable auxiliaries, at all rates of speech. Combined with the auxiliary-specific rule of /w/-deletion that is also required, this analysis of contraction is difficult to sustain, since the necessary rules have no place in the rest of the language.

As will be shown in Chapter 3, the distribution of attested auxiliary forms in spontaneous speech provides a further argument against a phonological analysis of reduced forms. Figure 3.1 will show that, after pronouns, the auxiliary *had* surfaces in full, intermediate, and contracted forms; in the same environment, *would* surfaces as only full and contracted, with intermediate forms of that auxiliary unattested. For this fact to be accounted for under an analysis such as that proposed by Zwicky (1970), the variable rule of vowel deletion must be categorical when the auxiliary is *would* and initial consonant deletion has applied, so that the intermediate form [əd] is never generated. At the same time, vowel deletion must be variable when the auxiliary is *had*, so as to sometimes fail to occur once the initial

¹⁰Jespersen (1928) discusses a historical rule of /w/-deletion that operated in words such as *answer* and *two*, but I assume this is no longer active in the synchronic grammar.

/h/ has been deleted, generating intermediate forms, and sometimes successfully occur once the initial /h/ has been deleted, generating contracted forms. This would require what are meant to be fast-speech processes not only to be able to make reference to lexical identity (so that *would* is treated differently from *had*), but also to the previous application of other fast-speech processes, and even then, inconsistently so (with initial consonant deletion sometimes categorically triggering vowel deletion and sometimes triggering it only variably).¹¹

Given Kaisse's arguments against a derivational phonological account of reduced forms of auxiliaries, subsequent work (Kaisse, 1983; Inkelas and Zec, 1993; Close, 2004; Anderson, 2008) has instead treated contracted forms as suppletive clitic allomorphs of the full auxiliaries. Under this view, contraction translates into an underlying alternation between one phonologically intact and one phonologically reduced form for each auxiliary. There are thus two forms stored in memory for each auxiliary, which I will subsequently be calling "long" and "short," to distinguish these underlying allomorphs from the surface "full," "intermediate," and "contracted" forms.

A major parameter on which these analyses tend to differ is the precise phonological shape of that short allomorph. The short allomorph may be phonologically a single consonant, such as [v] for the short form of *have* (Kaisse, 1983; Close, 2004; Anderson, 2008), or phonologically a syllable, such as [əv]. Some authors (Inkelas and Zec, 1993; Wilder, 1997) have taken a hybrid approach, under which the short allomorph is a syllable for some auxiliaries and a single consonant for others.

The underlying syllabicity of the short allomorph is important to establish, because it bears on questions of the underlying source of surface intermediate forms.

¹¹The existence of intermediate forms of post-pronoun *had* but nonexistence of intermediate forms of post-pronoun *would* will fall out naturally from the analysis provided in Chapter 3.

The fact that auxiliaries are found to display *three* distinct forms on the surface is a priori difficult to reconcile with the *two-way* underlying alternation proposed by most previous analyses. If the underlying short allomorph is syllabic, the provenance of surface intermediate forms is clear: they are faithful representations of that underlying short allomorph. Under such an analysis, however, the provenance of surface contracted forms requires a separate explanation. If the underlying short allomorph is nonsyllabic, it serves as an obvious source of contracted surface forms, and intermediate forms become those which require an explanation. Alternatively, the two-form allomorphic alternation analysis could be expanded such that intermediate forms are the faithful surface representation of an allomorph distinct from an auxiliary's full and its single-consonant form, meaning that surface contraction is best represented as a *three-way* alternation underlyingly. The next two sections briefly review how previous authors have addressed this issue (to the extent that they have), through a discussion of how authors have chosen to represent the shorter of the two underlying allomorphs phonologically. My own analysis of surface intermediate forms — which treats them as hybrid, coming from both underlying long and underlying short forms — will be presented in Chapter 3.

2.4.2.2.1. Short allomorphs as single consonants

Analyses under which the short allomorph is represented underlyingly as a single, nonsyllabic, consonant include Kaisse, 1983; Close, 2004, and Anderson, 2008. How do these authors handle the existence of intermediate forms in environments such as those given in 13?

Kaisse (1983:98) allows that there are “version[s] of the AUX that contain an initial schwa,” which surface when, for instance, *have* or *will* follow a non-pronoun

subject. However, she is unclear about whether or not she sees these (our “intermediate forms”) as distinct allomorphs from single-consonant forms underlyingly. She does refer to them as “allomorphs,” and lists them alongside single-consonant forms on her page 94, where she enumerates reduced forms for each auxiliary. However, she comments that *is* and *has* are the only auxiliaries that can exhibit reduced forms after non-pronoun and embedded pronoun subjects. This would seem to imply that she does not consider a form such as [əv] as equivalent to one such as [z]: if [əv] counted as a “reduced form,” she would have no cause to say that it cannot occur after non-pronoun or embedded pronoun subjects, because it can (13). Because Kaisse focuses only on *is* and *has* for the majority of the paper, the status of syllabic forms ends up not being particularly relevant (despite the fact, which she does not address, that intermediate forms of *has* **are** attested in spontaneous speech, see Figure 3.2 in the next chapter), so this brief discussion leaves the issue unresolved. She also notes, in passing, that intermediate forms may be phonologically derived: there is “regular, phonologically produced reduction via Unstressed Vowel Reduction” which results in the generation of intermediate forms. However, she doesn’t elaborate further on what other phonological processes must be at play. The vowel reduction process that she references serves to reduce vowels to schwa. The only allomorph which contains a vowel is the long one, but this form also has an initial consonant which must be lost, and she doesn’t provide an explanation of what would cause that to happen. In general, then, Kaisse alludes to two possible sources of intermediate forms — a distinct, stored syllabic allomorph, and phonological processes that generate syllabic allomorphs — but does not go into great detail on either.

Close (2004) is clearer on the status of intermediate forms under her analysis. She sets up an underlying allomorphic alternation between “full” forms (with all

their segmental material intact) and “clitic” forms (consisting only of a single consonant). Syllabic, onsetless forms (what she calls “weak” forms) are exclusively derived phonologically from full forms. This means that in environments such as when *will* follows the pronoun *it*, where only intermediate and full forms of the auxiliary are grammatical (13b), the clitic form is simply banned from surfacing: “*it* does not occur with the clitic form of a modal auxiliary” (fn. 7). Similarly, after a sibilant-final noun phrase, the clitic form of *has* must be banned, with only full forms available for insertion (and, hence, weak forms allowed to surface) (fn. 31). In both instances, weak forms have their source in the application of phonological reduction processes to the full allomorph, meaning that there is no allomorphic variation in such an environment: only full allomorphs are inserted. Like Kaisse, though, Close doesn’t go into any detail concerning which phonological reduction processes would generate these weak forms from full ones.

Finally, Anderson (2008:3), who follows Kaisse in treating contraction as an alternation between two lexically-listed items, is clear that the shorter of those two listed items “consist[s] of a single consonant.” Despite this, he exemplifies the reduced variant of *will* with the form *Fred'll*, in which the auxiliary clearly must be syllabic. For a syllabic surface form to represent a stored single-consonant form would seem to require some process of schwa-epenthesis (and see Chapter 3 for much more on this under my own analysis), but Anderson makes no reference to such a process, and thus leaves the existence of such intermediate forms unaccounted for.

The three authors surveyed thus far are clear that the underlying alternation auxiliaries display is between one form that is phonologically intact and one that consists only of a single consonant. Where the derivation of intermediate forms is concerned, though, these authors are split in their approach: two allude to reduc-

tion processes that derive them from the long allomorph; the other seems to imply that they are derived from the short, though in both cases, specifics are wanting. The next section surveys analyses under which intermediate forms are faithful representations of that short allomorph, which is underlyingly a syllable.

2.4.2.2.2. Short allomorphs as syllabic

Inkelas and Zec (1993), like the authors surveyed in the previous section, treat contraction as an alternation between two underlying forms (which they call “full” and “clitic”) for each auxiliary. For each auxiliary they discuss, they represent the clitic form as a single consonant, with the exception of *have*, whose clitic form they give as [əv]. This may be connected to the fact that they propose the same treatment for non-finite *have* (as in *would have*, *may have*), which never reduces to a single consonant, making a syllabic form a natural choice for its underlying representation. But finite *have* surfaces as both syllabic and as a single consonant (our “contracted”), and Inkelas and Zec provide no mechanism by which the stored short allomorph [əv] loses its vowel in a word like *we've*. Conversely, there is no discussion of how single-consonant /l/ (the short allomorph of *will*) becomes syllabic in a form like *John'll*.

Wilder (1997), on the other hand, comes closer to an analysis which accounts for the three distinct form types outlined in 2.2.2. He represents short allomorphs of *have*, *will*, *would*, and *had* as syllabic — /əv, əl, əd/ — and short allomorphs of *is* and *has* as simply /z/. Wilder also mentions in passing (pg. 325) that a rule of initial /h/-deletion may exist in “some dialects” to give [əv] from *have*. This covers much of the surface data, but there are still some gaps to be accounted for. As Figure 3.2 will show, *has* may surface in its intermediate form after non-pronoun subjects (e.g. 4c); Wilder’s treatment of short forms of *has* as single consonants doesn’t

allow for this, though presumably the rule of /h/-deletion he mentions would apply to *has* as well as *have* (and see Chapter 3 for an analysis that incorporates this). He also leaves unanswered what happens to the initial schwa when syllabic short allomorphs surface after pronouns, in forms like *we've* and *you'll*. He states in a footnote that *have*, *would*, and *had* “lack schwa when preceded by a nominative pronoun,” but doesn’t explain what causes schwa to disappear, or why he omits *will* from this list.

Finally, Ogden (1999) provides an account of contraction which most thoroughly accounts for the forms given in Section 2.2.2 and their distribution. For many auxiliaries, Ogden proposes four distinct forms stored in memory: a “strong” form, with all segmental material intact (e.g. /hæd/); a “syllabic clitic,” again retaining all segmental material but containing a reduced vowel (e.g. /həd/); an “onsetless clitic,” equivalent to our intermediate form (e.g. /əd/); and a “non-syllabic clitic,” equivalent to our contracted form (e.g. /d/). All attested surface forms are thus stored distinctly in memory, with none derived from any other (as Ogden’s account is situated in Declarative Phonology, which has no way of representing processes of deletion). There is also another way of deriving onsetless clitics under Ogden’s analysis: vowel epenthesis may make a non-syllabic clitic (e.g. /d/) syllabic ([əd]). However, the restrictions Ogden places on the distribution of onsetless clitics — both stored and derived ones — undergenerates the patterns found in spontaneous speech. As will be shown in Figure 3.1, the auxiliaries *had* and *have* are found to surface in their intermediate form after pronoun subjects; Ogden’s analysis cannot account for this. His stored onsetless clitics are constrained to surface only after noun phrases, so they cannot be the source of these post-pronoun forms. His vowel epenthesis cannot explain them, either, as it is stipulated to occur only when the non-syllabic clitic forms /d/ and /l/ appear

after coronals. It thus explains the presence of a schwa in *it* [əd], but cannot explain the existence of forms such as *she* [əd] or *they* [əd]. Ogden’s approach, which simply involves storing each form of each auxiliary, also would require stipulating some of the patterns seen in the distribution of forms, a fact that I will discuss in detail in Section 3.5.2. These patterns will be shown to derive naturally from the analysis of forms given in that chapter.

2.4.2.3. Interim summary

This section has examined previous work that discusses the grammatical source of reduced variants of auxiliaries. As we saw in Section 2.2.2, “reduced” auxiliary variants encompass those which are both syllabic and those which are non-syllabic, consisting of only a single consonant. Single-consonant forms, though initially treated as derivative in early work, have most commonly been seen as the surface reflex of allomorphs that are stored distinctly from phonologically intact allomorphs. Under the simplest scenario, a stored single-consonant form would map directly on to a surface single-consonant form, and a stored phonologically intact form would map directly onto a surface phonologically intact form. The existence of “intermediate” forms, however, complicates this. Past researchers have been less than thorough in their treatment of intermediate forms, despite the fact that, as we will see in Chapter 3, these forms occur frequently in spontaneous speech. Some researchers have alluded to reduction processes that derive intermediate forms from the longer of the two allomorphs; others have referred to a process of schwa epenthesis which derives intermediate forms from the shorter of the two, or even have suggested that the shorter of the two allomorphs is stored as a syllabic form from the beginning.

The analysis presented in Chapter 3 will follow the majority opinion that con-

traction is the underlying alternation between a long and a short form of each auxiliary. I will treat this alternation as between one phonologically complete allomorph (=long) and one single-consonant allomorph (=short), though I discuss in that chapter the possibility that the short allomorph is underlyingly syllabic (which does not substantially change the analysis). I will then propose that surface intermediate forms derive from two sources: the application of fast-speech /h/-deletion where applicable to the long allomorph (reminiscent of Wilder's approach) **as well as** the application of schwa epenthesis to the (single-consonant) short allomorph (reminiscent of Ogden's approach). In this way, I will provide a more thorough account of the range of attested auxiliary forms and their distribution than have previous authors.

Having laid out the nature of the underlying forms involved in the contraction alternation, I now turn to a discussion of host–auxiliary attachment and the categorical constraints on contraction.

2.4.2.4. Attachment of reduced variants to their host

An auxiliary that surfaces in its contracted form is clearly quite phonologically close to its host. This close attachment could in principle occur either in the syntax or the phonology, and both approaches have been put forth in the literature. Additionally, close attachment may either feed insertion of the short allomorph, or vice versa: short allomorph-insertion may be followed by close attachment. This section briefly surveys the various proposals that have been put forward on this front.

Kaisse (1983) hypothesizes a morphosyntactic rule of host–auxiliary adjunction that occurs before selection of the long or the short allomorph. Application of this rule conditions insertion of the short allomorph; non-application conditions

insertion of the long allomorph. With contraction localized to the syntax like this, she can subsequently treat the various categorical conditions on the alternation (Section 2.3) as syntactic as well (discussed further in Section 2.4.3).

Other approaches also propose a rule that brings an auxiliary close to its host, but differ from Kaisse in localizing it to the phonology rather than to the syntax. Selkirk (1984), for instance, proposes an analysis under which an auxiliary must be juncturally adjacent on a metrical grid to its host in order for it to surface as a contracted form. This junctural adjacency is achieved by default when said host is a pronoun. When the host is a noun phrase, a rule of the syntax-phonology mapping brings the auxiliary metrically close to its host, thus allowing the auxiliary to surface in its single-consonant form. Close (2004), somewhat similarly, assumes that short-allomorph insertion occurs only when an auxiliary has been brought close to its host via phonological phrasing. These approaches are similar to Kaisse's in that all three analyze attachment as feeding short allomorph insertion.

Sells (1983) proposes a phonological phrasing rule similar to that of Close, but allows it to be fed by, rather than feed, reduction: first, phonological rules reduce an auxiliary to a single consonant; then, a subsequent phonological rule (his "Syllabification") brings the remaining consonant together with its host. Wilder (1997) also treats host–auxiliary attachment as something that is fed by, rather than feeds, single-consonant forms. He differs from Sells in treating contracted forms as the output of an allomorphic alternation rather than of the application of phonological processes. But he echoes Sells in proposing a process of phonological enclisis that joins the inserted short allomorph to its host. Inkelas and Zec (1993) likewise propose no adjunction before insertion of a short form. Once inserted, the short form incorporates into a phonological word with the material that precedes it. These three approaches thus all propose short allomorph insertion (or derivation, as the

case may be) before attachment.

Finally, there is a small fraction of the literature that analyzes contracted forms as inflectional affixes (Sadler, 1997; Spencer, 1991; Steele et al., 1981), proposing that forms such as *he's* and *you'll* are in fact tensed pronouns. This literature consistently fails to mention the fact that the auxiliaries *is* and *has* may contract after noun phrases as well as pronouns: should forms like *Mary's* and *my father's* be interpreted in an analogous fashion as tensed noun phrases? Additionally, these authors conspicuously provide no discussion of why the right-side effects on contraction (8) should hold if contracted forms are inflectional affixes.¹² Because this literature is not thoroughly fleshed out on these issues, I will not be addressing it further.

The precise mechanism of host–auxiliary attachment is relevant to the present discussion for two reasons. First of all, it is implicated in questions concerning the locus of the observed surface variation in auxiliary shape. Though I do not provide answers to these questions here, I raise them for the consideration of future work. One question concerns whether what varies is a rule or the choice of an allomorph. Kaisse analyzes contraction as a syntactic rule of host–auxiliary adjunction. Assuming a treatment of the grammar that incorporates variable rules à la Labov (1969), this must be one such variable rule. But once it applies (or fails to apply), allomorph insertion is deterministic: if adjunction occurs, there is no subsequent variation in whether a short allomorph is inserted or not: it simply is. Other authors' approaches (e.g. Wilder, 1997; Inkelaas and Zec, 1993) instead localize the variation in the allomorph selection: it is in allomorph selection that the speaker has a choice; once an allomorph has been selected, the application of syllabifica-

¹²See also Zwicky and Pullum, 1983a, in which the authors provide a number of arguments for differentiating contracted auxiliaries from what they argue to be a true inflectional affix, the English negative morpheme *-n't*.

tion (or enclisis or phonological phrasing; whatever the phonological rule of host–auxiliary adjunction is assumed to be) categorically applies if the allomorph is the short one and categorically fails to apply if the allomorph is the long one. This raises questions about whether variable rules can be differentiated from variable competition between lexical items, and whether one or the other treatment is more appropriate for contraction.

The question of whether host–auxiliary adjunction precedes or follows allomorph selection raises the additional question of whether contraction should be modeled as a pan-auxiliary process which occurs regardless of which specific auxiliary is at issue, or as multiple auxiliary-specific processes. Kaisse’s syntactic adjunction rule, for instance, is written to apply regardless of auxiliary. Any gradient conditions on contraction would thus be presumed to be represented on this rule, and thus to govern the alternation between reduced and unreduced regardless of which auxiliary is at play. On the other hand, if there is no unifying adjunction rule, contraction must simply consist of distinct allomorphic alternations, one for each auxiliary. This disjunctive approach would facilitate different conditioning factors on each alternating pair; conversely, if all alternating pairs were found to be conditioned by the same factors, this approach would suffer from excessive redundancy as the same condition would have to be incorporated on each alternation.

The second reason the locus of adjunction is relevant to the present discussion will become clear in the following section. Briefly, most authors attribute the categorical left-side conditions on contraction to features of whatever process adjoins an auxiliary to its host. In other words, if an auxiliary fails to surface in its contracted form after a subject of a particular type, this is typically proposed to stem from restrictions on host–auxiliary adjunction that prohibit it from applying in that particular environment. A thorough analysis of contraction and the categorical

constraints on it requires pinning down the source of the left-side condition, and hence, discussion of the mechanism behind host–auxiliary adjunction.

2.4.3. Question 2: Source of categorical conditions on contraction

2.4.3.1. Introduction

In Section 2.4.2.2, we saw that a number of analyses of contraction treat the surface alternation in auxiliary form as deriving from underlying variation between two allomorphs, one long and one short. Additionally, we saw that the most common (though by no means the only) phonological representation of that short allomorph is as a single consonant, reminiscent of what we have been calling a surface “contracted form.” Those single-consonant forms have constraints on their occurrence, based on the nature of material both to their right (Section 2.3.2) and to their left (Section 2.3.3). In environments in which they fail to surface, something must have been blocking the insertion of that short allomorph. The following sections examine what that “something” must be: what previous researchers have proposed to account for why contracted forms do not surface after subjects of particular types (Section 2.4.3.2), or before gaps of particular types (Section 2.4.3.3).

2.4.3.2. Left-side conditions

2.4.3.2.1. Overview

The left-side environments in 13 and 14 should not necessarily be treated as a coherent set. It is immediately evident that some of the environments in 13 permit contracted forms of the auxiliaries *is* and *has* despite the fact that they disallow contracted forms of *had*, *have*, *will*, and *would*. Namely, contracted forms of the /z/-final auxiliaries **may** surface after an embedded pronoun (19a') and after noun

phrases when phonotactics permit (19c–19f). (These judgments will be backed up with corpus data in Chapter 3.)

(19) Environments in which contracted forms of *had*, *have*, *will*, and *would* are illicit, but contracted forms of *is* and *has* are not. Each example has been constructed and numbered to correspond to the analogous item in 13. Where an example in 13 does not have a counterpart in 19 (13a, 13g), it is because that example had a plural subject, meaning that an analogous example with *is* or *has* cannot be constructed.

- a'. The guy next to you [ɪz] ~ [z] a doctor.
- c. Mary [ɪz] ~ [z] going.
- d. John [hæz] ~ [z] gone.
- e. The car [ɪz] ~ [z] being destroyed.
- f. Sue [hæz] ~ [z]...

The failure of contracted forms of *had*, *have*, *will*, and *would* to surface in these environments (that is, after an embedded pronoun or after a noun phrase where phonotactics should permit it) would thus seem to be attributable to something about the nature of those auxiliaries, rather than to the mechanism of contraction itself, since this constraint is not shared by all auxiliaries. (Alternatively, maybe the auxiliaries *is* and *has* are special exceptions to a pan-auxiliary left-side constraint. There seem to be two ways of approaching the question: what it is it about *had*, *have*, *will*, and *would* that prevents them from surfacing in their contracted form after a noun phrase, or what it is it about *is* and *has* that **allows** them to surface in their contracted form after a noun phrase?)

The phonotactic constraint on contracted forms — that is, that they may not surface where they would form an unacceptable cluster or a geminate (13b) — is

shared by all auxiliaries. No author surveyed here discusses how their mechanism of contraction accounts for this, although it isn't actually trivial. For those analyses that treat contraction as an allomorphic alternation, the failure of contracted forms to surface where they would not be phonotactically acceptable would seem to imply phonologically-conditioned allomorphy: the short allomorph fails to be inserted given the nature of the preceding consonant. Or is the short allomorph nonetheless inserted, to subsequently be rescued from its syllabification failure by a process occurring at a later stage (the analysis to be proposed in Chapter 3)? Since no author discusses these possibilities, there will not be much to say on this point in this literature review.

Finally, the environments in 14 — those with preposed or sentential constituents — seem to prohibit all contracted forms, regardless of auxiliary. Kaisse exemplifies these contexts with *is* and *has* only. But since contracted forms of *had*, *have*, *will*, and *would* are phonotactically unacceptable after all noun phrases, even when they do not form part of a preposed or sentential constituent, it is safe to assume that they are similarly unacceptable here.

The upshot of all this is that there seems to be a division in left-side environments between those in which contracted forms of all auxiliaries are unacceptable (the 14 type) and those in which contracted forms of only *had*, *have*, *will*, and *would* are unacceptable (the 13 type). Consequently, one thing to be addressed in the analyses that will be discussed is what distinguishes *is* and *has* from *had*, *have*, *will*, and *would* where conditions on contraction are concerned. Naturally, also to be discussed is what it is about the environments in 14 that prohibits contraction there, even of *is* and *has*.

2.4.3.2.2. Previous explanations

As will soon be made evident, the analyses to follow differ from each other in whether they treat these left-side conditions as due to restrictions on the syntax or on the phonology, and this is naturally connected with where they localize host-auxiliary adjunction (Section 2.4.2.4). As before, I will discuss first syntactic and then phonological approaches to categorical left-side conditions.

Kaisse (1983) uses a syntactic rule of adjunction and a subsequent rule of allomorphic selection to effect contraction. As a result, she accounts for categorical conditions on contraction either by placing syntactic conditions on the application of that adjunction rule, or by placing restrictions on the allomorph selection rule. She takes care of a number of the constraints demonstrated in 14 by writing the adjunction rule so that it requires a noun phrase preceding the auxiliary (her “NP Host Condition”), thus eliminating contraction in cases 14a–f’ (assuming that sentential subjects (14f–f’) are not dominated by NP) and sentence-initially (17b).¹³ A further requirement that an auxiliary’s host c-command it accounts for the failure of contraction after conjoined and embedded pronouns (13a–a’).¹⁴ Finally, she accounts for the failure of post-NP contracted forms of *had*, *have*, *will*, and *would* by placing a restriction on the allomorphic selection rule that spells out an auxiliary as a single-consonant form once adjunction has applied. For the auxiliaries *had*,

¹³On the failure of contraction in pseudoclefts (14g) and after distributed nominalizations (14h), see Section 2.4.3.3; Kaisse attributes these to the right-side condition on contraction.

¹⁴Actually, this restriction of Kaisse’s seems to be too broad: it seems to eliminate examples like 19a’, where *is* and *has* may adjoin to an embedded pronoun. Furthermore, Kaisse is inconsistent here in what she defines as an auxiliary’s “host.” Her NP Host Condition uses “host” to refer to the entire phrase that precedes the auxiliary, regardless of its internal structure: so a noun phrase ending in a verb, like *The man I saw*, nonetheless satisfies this condition. It is the entire subject, not simply its last element, that counts as the “host” in such a case. However, her c-command requirement requires that “the host c-command the AUX” (114). She uses this to explain why contraction of *have* fails in *John and I *[v] gone to the opera*. But if “the host” refers to the entire NP *John and I*, as it would seem to given previous examples, then the c-command condition is satisfied. It is only the pronoun *I* that fails to satisfy this condition, and her NP Host Condition would seem to indicate that *I* is not strictly “the host.”

have, *will*, and *would*, this rule bears a restriction that the host must be a pronoun.¹⁵

Sells (1983) and Selkirk (1984) take a completely different approach, under which left-side conditions on contraction stem from the amount of prosodic material in the potential host, with contraction blocked when too much material intervenes between a subject and an auxiliary. I will primarily discuss Sells' approach; Selkirk's is essentially identical, but is described in less detail. Sells models contraction as the output of three phonological processes: Glide Deletion, a vowel deletion rule (his "Contraction") which is sensitive to the prosodic context that precedes, and a Syllabification rule, which incorporates the remaining consonant into the material that precedes and is sensitive to junctural adjacency. If host and auxiliary are separated by a particularly large juncture, Contraction will not apply (and, hence, an auxiliary will not get reduced to a single consonant). Juncture size is determined by the number of silent demibeats borne by a word or phrase, with demibeats assigned based on metrical size and importance. Fronted and syntactically complex constituents (14a–f'), for instance, rack up too many demibeats for contraction to occur. To account for the failure of contraction after a distributed nominalization (14h), he proposes that an auxiliary bears a pitch accent in such a construction, preventing it from destressing and thus from undergoing Contraction. As for the pronoun-subject restriction on *had*, *have*, *will*, and *would* (13c–13g), Sells takes the approach of allowing *is* and *has* to be exceptional rather than allowing *had*, *have*, *will*, and *would* to be restricted. Auxiliaries are typically not juncturally adjacent enough to a preceding noun phrase for Sells' rule of Syllab-

¹⁵This would seem to lead to a conflict of rules. If there is nothing preventing adjunction of these auxiliaries to a noun phrase, it seems that adjunction should occur. The successful application of adjunction then typically conditions short allomorph insertion. But since the short allomorphs of these auxiliaries require a pronoun host, they cannot be inserted. Does the derivation then crash, because no allomorph may be inserted? Is the long allomorph inserted by default? Kaisse does not discuss this in any detail.

ification to occur. When an auxiliary has been reduced to /z/, however, a special “/z/-rule” applies that moves the auxiliary close enough to a noun phrase that it may syllabify to it. Contraction of *is* and *has* after noun phrases thus results. This rule does not apply to the single-consonant forms of *had*, *have*, *will*, and *would*, and as a result, they are never close enough to their noun phrase subject for contraction to occur. The upshot of Sells’ analysis, then, is a requirement of junctural adjacency which is only satisfied in those cases in which contraction results.

Inkelas and Zec (1993) also attribute the left-side constraints seen in 14 to prosodic factors, though they localize them to their allomorphic selection rule (since, as we saw in Section 2.4.2.4, they do not propose a process of adjunction that precedes that rule). Their allomorphic selection rule states that an auxiliary may be realized in its short form only when a phonological word precedes it. Fronted constituents like the ones seen in 14a–d’ are instead phonological **phrases**, and introduce a phonological phrase boundary between the auxiliary and its potential host. With its subcategorization requirements unsatisfied, the short allomorph cannot be inserted in such a position. This same explanation serves to account for the ungrammaticality of contraction sentence-initially and following a parenthetical, according to their judgment (17). Inkelas and Zec do not discuss the pronoun-only restriction on *had*, *have*, *will*, and *would*.

Close (2004) also localizes left-side restrictions to an auxiliary’s allomorphic selection rule. She proposes that a short allomorph can be inserted only when an auxiliary has formed a phonological phrase with the DP that precedes it. This phonological phrase formation will not occur when the DP is branching, as all non-pronoun DPs are; correspondingly, contracted forms of *had*, *have*, *will*, and *would* will not surface after a non-pronoun DP (13c–13g). As for the exceptional behavior of *is* and *has*, she simply stipulates that those auxiliaries do not have

the same requirement as *had*, *have*, *will*, and *would*: that is, an auxiliary need not have formed a phonological phrase with the preceding DP in order for the short allomorph /z/ to be inserted. Close does not discuss the ungrammaticality of contraction after preposed constituents or sentential subjects (14), or sentence-initially or after a parenthetical (17), though presumably these latter two conditions would stem from a requirement that a short allomorph have a subject to which to cliticize. The approach I will take in Chapter 3 is similar to that of Close, except that I will propose that the problem with short allomorphs is only that they cannot surface faithfully in those environments where they fail to phrase with their host. They do not fail to be inserted, as Close suggests. This avoids the complicated interactions between morphology and phonological phrasing that Close's approach raises.

Finally, Close, Wilder, and Roberts all explain the putative failure of contraction after an adverb (15) by positing two positions in which auxiliaries may surface in English: one which is above adverbs (T) and one which is below them (Σ). Short allomorphs of auxiliaries may be inserted only in T ; Σ gets full or “strong” forms of auxiliaries.

2.4.3.2.3. Summary

The majority of work that has considered the left-side restrictions on contraction has attributed them to prosodic factors. The idea that the potential hosts in 14 are somehow heavier than a single-word noun phrase or pronoun subject is intuitively appealing. The way previous work has handled these sorts of hosts, they are either phonologically phrased separately from the auxiliary, preventing the closeness needed for a short allomorph to be inserted; or they are followed by prosodic material which separates the host from the auxiliary such that the conditions for insertion of the short allomorph are not met.

However, this is not to say that contraction is universally illicit after a complex phrase. Noun phrases that contain a relative clause may nonetheless surface with a contracted form after them, as demonstrated in the examples in 20, taken from the Switchboard corpus. Conversely, some preposed hosts (many of those given in 14, for instance), despite failing to allow contraction, are not particularly long: that is, they do not contain that many words. It is not immediately obvious why they should be more prosodically weighty than the longer NPs given in 20.

- (20) Contraction after subjects containing relative clauses.
- a. Everybody else I've spoken with[s] been in Texas. (sw2344: sw_1028)
 - b. This house we're moving into[z] only five hundred dollars a month.
(sw2582: sw_1063)
 - c. (*as part of a discussion about golf*) If you go to take lessons, the first thing they put in your hand[z] an iron. (sw3525: sw_1436)

If it is indeed the phonological phrasehood of a potential host that prohibits contraction, we need a precise definition of what constitutes a phonological phrase so that a host like *speaking tonight* (14b) is excluded from contraction, but *the first thing they put in your hand* (20c) can still count. Chapter 5 will revisit the question of the phonological phrasehood of hosts, in conjunction with questions about effects of the length of an auxiliary's noun phrase subject on contraction. It will be seen that even when a subject is a simple DP, containing no relative clause, the number of words in that NP has a gradient effect on contraction, reminiscent of the categorical effect on contraction seen by the prosodically heavy phrases in 14. Chapter 5 will consider whether these categorical and gradient effects can be united.

Single-word noun phrases are not intuitively as prosodically weighty as preposed or sentential constituents. Yet they are unacceptable hosts for contracted

forms of all auxiliaries except those from *is* and *has*. Some researchers (e.g., Sells) have derived this restriction from the same restriction on contraction that prevents it from occurring after preposed and sentential constituents; others (e.g., Close) have attributed it to a different source. As for why *is* and *has* should contract more widely than the other auxiliaries, Kaisse and Close speculate that it may be connected to the existence of several other -z morphemes elsewhere in English (e.g., the genitive, the plural, the singular present). This explanation is not airtight, however; it would seem to predict that the existence of a -d morpheme elsewhere in English (e.g. the preterite, the past participle) would enable contracted forms of *had* and *would* to surface after noun phrases too, and that is unattested (Figure 3.2). Perhaps more relevant is the phonotactic exceptionality of /s/ and /z/ in English, which may attach to consonant clusters that other consonants cannot (e.g. [siksθs]).

Finally, the failure of contracted forms to surface where they are phonotactically illicit (both after consonant-final noun phrases and after the consonant-final preposition *it*) has not received sufficient consideration in the literature. If contraction is a rule of allomorphic insertion, does this imply that it should be made sensitive to the preceding phonological context, so that short allomorphs are not inserted where phonotactics would prohibit them from surfacing? Chapter 3 will provide an analysis of contraction that avoids this complication: the rule of short allomorph insertion will not be sensitive to the preceding context; it will be a subsequent rule of phonological spell-out that prohibits contracted forms from surfacing where they are phonotactically unacceptable.

2.4.3.3. Right-side conditions

2.4.3.3.1. Overview

The right-side conditions on contraction were exemplified in 8. Unlike some of the left-side conditions on contraction, these do not seem to be restricted to a particular set of auxiliaries. In those environments in which multiple auxiliaries are grammatically acceptable, all are banned from surfacing in their contracted form.

Again, analyses of these facts can roughly be divided into those whose authors attribute the categorical conditions to syntactic constraints, and those whose authors treat the conditions as phonological. Where authors have addressed the fact that contraction in the environments in 8 may be “rescued” by the addition of extra material (9), I will address this.

2.4.3.3.2. Previous explanations

The earliest work on contraction (King, 1970; Lakoff, 1970) saw the environments in 8 as evidence for a syntactic constraint on contraction. Because contraction was, in these researchers’ view, a phonological process, this gave them reason to propose the existence of “global rules”: rules which make reference to multiple stages of a derivation.

Kaisse (1983) also attributes the failure of contraction in 8 to a syntactic source, but she differs from these earlier works in not localizing contraction to the phonology. Under her analysis, categorical right-side conditions on contraction stem from syntactic constraints on her rule of adjunction. Specifically, adjunction may not occur when the material that follows the auxiliary is not the same as that which followed the auxiliary at an earlier stage of the derivation (specifically, “NP Structure,” a stage of the grammar between Deep Structure and Surface Structure). This

eliminates contraction in any sentence in which a movement (8a) or deletion (8b–8c) site immediately follows the auxiliary. But it correctly allows contraction in sentences in which the auxiliary is separated from the movement or deletion site by additional material (9a–b, 9ab’).¹⁶ It also serves to prohibit contraction in pseudo-clefts (14g) and after distributed nominalizations (14h), both of which Kaisse analyzes as involving movement from a site immediately following the auxiliary.

Other authors (e.g. Baker, 1971; Sells, 1983; Selkirk, 1984) have noted that fast-speech vowel reduction (e.g. [həv] for *have*, [wəl] for *will*) is also illicit before gaps and movement sites, and have connected contraction to this fact. Specifically, Sells and Selkirk both propose that what unites the right-side contexts in 8 is that, were an auxiliary to remain in its uncontracted form in those environments, it would have to surface in what Selkirk calls “its strong stressed form” (402). In other words, auxiliaries may not be destressed in the environments in 8. This explains why auxiliaries may not surface with a reduced vowel in these environments: vowel reduction requires an auxiliary to be destressed (Chomsky and Halle, 1968). It also, under an analysis such as Sells’, explains why contracted forms cannot surface there: under Sells’ analysis, contracted forms are the output of a cascade of phonological rules, an early one of which is a rule of destressing, which feeds vowel reduction, which subsequently feeds contraction. Where destressing is blocked, contraction will consequently be blocked too.

Pullum and Zwicky (1997) appeal to a similar argument to explain the failure of contraction in rejoinders, as in 21.

¹⁶Note that Kaisse’s analysis cannot account for the ungrammaticality of contraction in a comparative sub-deletion construction like 8c, where (under Anderson’s analysis of these constructions, at least) the auxiliary does not immediately precede a deletion site. Anderson places the relevant deletion site within the noun phrase, so that it is separated from the auxiliary by a determiner. Kaisse does not discuss this complication for her account because she analyzes sentences like 8c as having the deletion site preceding the determiner: so, immediately following the auxiliary. Under that analysis of this type of construction, her proposal holds.

- (21) I [æm] (*[m]) TOO gonna fix it!

Their proposal, echoing that of Selkirk and Sells for right-side effects, is that an auxiliary bears a light stress in a construction like 21 and, as such, may not contract. Analyses which attribute the failure of contraction in 8 to the fact that the auxiliary precedes a deletion or movement site cannot account for the facts of 21, in which no such gap site follows the auxiliary.

A stress-based analysis could also explain the observed failure of contraction in constructions such as that in 22, where the auxiliary in its uncontracted form is observed to bear stress.¹⁷

- (22) Who [ɪz] (*[z]) it?

22 can be contrasted with the sentences in 23, where the auxiliary is followed by a pronoun that bears more stress than did *it* in 22. With stress apparently removed from the auxiliary, contraction is acceptable.

- (23) a. Who [ɪz] ~ [z] "It" (*player in a game such as tag*)? (Labov, 1969)
b. Who [ɪz] ~ [z] that?

The failure of contraction in 21 and 22 does lend itself well to an account under which contraction is banned when an auxiliary bears stress. But other researchers have noted environments in which contraction is illicit, despite an auxiliary not being particularly stressed. For instance, Blake (1997) provides the example in 24, in which it is *John*, not *is*, that bears primary stress.

- (24) Bill is taller than John [ɪz] (*[z]) ___. (Blake, 1997)

Pronouncing the example in 24 with the same amount of stress on the auxiliary as it bears in 22 ("Bill is taller than John *is*") makes the sentence sound unnatural,

¹⁷See Zwicky, 1970 for a similar point.

as if the auxiliary is somehow meant to be contrastive. Weak stress is thus not a sufficient condition for contraction; an auxiliary may be weakly stressed but still fail to contract, as in 24.¹⁸

Anderson (2008) similarly observes that when a clause-final auxiliary is preceded by an item that bears particular emphasis, it is that emphasized item that bears sentence stress, not the auxiliary; yet contraction of the auxiliary is still unacceptable. This is exemplified in 25, in which *John* bears contrastive stress; *is* still may not be contracted.

- (25) I'm not the one in charge; *John* [ɪz] (*[z]) ____.¹⁹

And Zwicky (1970) notes that the stress patterns in 26 and 27 are identical, but contraction in 26 is unacceptable while it is acceptable in 27.

- (26) Bruce is thin, and Thelma [ɪz] (*[z]) ____ too.

- (27) Bruce is thin, and so [ɪz] ~ [z] Thelma ____.

Certainly, there are some cases in which an illicit clause-final contraction is rendered acceptable by the addition of a following word, as if that additional word served to shift stress off the auxiliary. This is the case, for instance, when a participle follows the auxiliary (28a–28b), or an auxiliary is negated (28c). But an adverb does not have the same effect (28d–28e); neither does an adjective in a comparative construction (28f). A stress-based account would need to provide an explanation of when additional words may shift stress of the auxiliary enough for it to contract and when they fail to do so.

¹⁸That being said, my intuition is that the auxiliary in 24 still may not undergo vowel reduction, despite its lack of strong stress. So even though weak stress may not be a sufficient condition for contraction, 24 does not invalidate the possibility that vowel reduction is.

¹⁹The failure of contraction here cannot be attributed to the fact that an auxiliary is trying to contract to a subject that bears contrastive stress (*pace* Sells, 1983). Contraction becomes acceptable when more material follows the auxiliary, despite its having a contrastively-stressed host: compare *I'm not the one in charge; John's the one in charge*.

- (28) a. I wonder where Gerard [ɪz] ~ [z] going __.
- b. I've been there, but no one else in my family [hæz] ~ [əz] ~ [z] been there.
- c. Paul is going and Peter [ɪz] ~ [z] not __. (Wood, 1979)
- d. Paul is going and Peter [ɪz] (*[z]) __ too. (Wood, 1979)
- e. I wonder where Gerard [ɪz] (*[z]) __ today. (King, 1970)
- f. Bill is taller than John [ɪz] (*[z]) __ fat. (Blake, 1997)

Furthermore, it is unclear why non-finite *have* is allowed to reduce in the same sort of environments in which finite auxiliaries may not surface in their contracted forms (29). These forms of non-finite *have* are clearly destressed, making them counterexamples to the proposal that gaps and movement sites must be preceded by stressed elements.

- (29) a. If we didn't have those loans, we could have saved — in the last five years — the money for that, and I believe we would [əv] __. (sw2235: sw_1083)
- b. You know, if I could [əv] __, I would have done it! (sw2505: sw_1153)

Finally, the argument that it is the presence of stress that prevents contraction in environments like 8 is also difficult to reconcile with a treatment of contraction as allomorphy, which was argued for in Section 2.4.2.2. The stress account presumes that the structure of the entire sentence is known when the allomorphic choice of auxiliary form is made: this choice needs to make reference to where in the sentence stress will fall. But this is a violation of the sort of locality conditions typically shown by allomorphy (Embick, 2010): allomorphic alternations are found to be responsive to the nature of preceding morphemes in the same word, but the conditions on allomorphy do not extend much beyond this.

All in all, though it is true that destressing and contraction both fail to occur in some of the same environments, this does not necessarily mean that the former is a precursor to the latter. Both could be banned as separate violations of a single prohibition.

What would that prohibition be? Other authors have proposed alternate explanations for the failure of contraction in right-side environments that may be more amenable to the present analysis.

Inkelas and Zec (1993) follow previous researchers in providing a stress-based explanation for why auxiliaries cannot undergo **vowel reduction** before gaps and movement sites: without a rightmost sister with whom it can form a phonological phrase, a phrase-final auxiliary will be put in its own phrase. This forces stress on it, which prevents it from reducing. But these authors do not provide a stress-based account of why **contraction** cannot occur in the same environments. They simply stipulate the presence of a rightmost phrasal sister on the subcategorization frame of the short allomorphs that they propose underlie surface contracted forms. If a rightmost host is not available, a short allomorph cannot be inserted. This avoids conflating prosody and morphology, as phonological phrasing is only assumed to come into play in the case of vowel reduction, a phonological process. Where the allomorphic alternation is at issue, stress is not relevant; it is syntax that is at work.

Some researchers have proposed that the action of adjoining a contracted auxiliary to its host removes the auxiliary from some phrase which must not be left empty. This is the analysis put forth by Wood (1979), for example. She proposes that contraction cannot occur when it would deprive a verb phrase of its only element. This explains the contrast in acceptability between environments like 28d–28e, on the one hand, and environments like 28a–28c, on the other. Contraction in the former two cases is unacceptable, because the verb phrase that contains the

auxiliary contains no other material. By contrast, in the latter three cases, there is a participle or a negative marker that remains in the verb phrase to satisfy Wood's Empty Verb Phrase Constraint. This difference is evident graphically in the placement of the gap in the examples in 28: where contraction is acceptable, it is in those examples in which an element intervenes between the auxiliary and the gap (28a–28c); where contraction is unacceptable, it is in the example in which the auxiliary and the gap are adjacent, despite the presence of extra material (28d–28e).

The explanation Anderson (2008) provides is very similar to Wood's, except that his proposal is that contraction before a gap leaves an empty **phonological** phrase, not verb phrase: in other words, he localizes the effect to the prosody. This requires the assumption that auxiliaries head phonological phrases (or, more accurately, that the phonological phrase which contains the subject ends before the auxiliary.) With this analysis, he is able to account for the failure of contraction in a rejoinder (21) by proposing that stressed *TOO* forms its own phonological phrase, meaning that, again, the auxiliary is the only item in its phonological phrase, and contraction would leave that phrase empty.²⁰ Auxiliaries preceding parentheticals find themselves in an analogous situation. Presumably Anderson is envisioning this in a non-serial framework like Optimality Theory, though this is not made clear. Otherwise, the grammar either needs to be endowed with a look-ahead mechanism (to determine that, were a short allomorph to be inserted in such a position, it would violate this empty phonological phrase constraint once it syllabified to its host), or a “crashing” mechanism, so that when a derivation results in an output that violates a constraint, it crashes, and a default form (in this case, the long allomorph) is inserted instead.

²⁰Anderson's approach, unlike Wood's, does not seem to have a straightforward explanation for the difference in acceptability between a following participle/*not* and a following *too*, however.

Wilder (1997) proposes that the derivation of surface contracted forms includes a stage of proclisis of short allomorphs **rightward** to the element that follows (subsequently followed by a stage of enclisis **leftward** to the element that precedes, to speak to problems with Bresnan's (1978) proclisis-only account). This stage of proclisis explains what makes an auxiliary sensitive to the presence of gaps to its right: either there is no rightward material for it to procliticize to (examples like 8a or 8b), or there is a prosodic break before what rightward material there is, which also disrupts procliticization (examples like 8c). Following participles (e.g. 9a, 9b) provide rightward material that is not preceded by a prosodic break, so contraction may occur unperturbed, though a following adverb (e.g. 21; Wilder uses *now*) does introduce a prosodic break, thus prohibiting contraction. As for the failure of contraction in *wh*-questions with *it* (22), Wilder proposes that the pronoun *it* is not strong enough for an auxiliary to procliticize to, so the auxiliary behaves as if a gap immediately followed it. Wilder also observes that his analysis accounts for the putative facts concerning parentheticals: that contraction is unacceptable before one (30a) but licit after one (30b). This is accounted for under his analysis, since procliticization is banned before a prosodic break, which parentheticals introduce.

- (30) Putative differing acceptability of contraction before vs. after a parenthetical (examples and judgments from Wilder, 1997)
- a. *John's, my dear, a bastard.
 - b. John, my dear, 's a bastard.

2.4.3.3. Summary

As we have seen, there is an intuitively appealing connection between stress and contraction. There are some constructions in which an auxiliary clearly bears a stress, and contraction happens to be unacceptable (e.g., *wh*-questions such as 22). But there are others in which an auxiliary doesn't seem particularly stressed, yet contraction is still unacceptable (e.g., comparative constructions, such as 24). More rigorous work on this problem — one which actually considers a number of acoustic correlates of stress, beyond simply vowel reduction — may be able to shed some more light on these issues.

There is also the question of what kind of material may follow an auxiliary to permit contraction. As we saw in 28, a following participle or *not* may change a construction with a sentence-final auxiliary from prohibiting to allowing contraction. But a following adverb (28d) does not have the same property. Unless we want to argue that a progressive participle like *going* is stressed differently than an adverb like *too* (again, something that should be investigated acoustically), stress may not be what's going on here. The fact that the placement of the ellipsis gap differs between the two constructions points instead toward a structural explanation.

2.5. Conclusions

This chapter has examined previous accounts of (a) the source of the varying surface alternants of auxiliaries; (b) the mechanism by which those alternants surface as attached to their host; and (c) the source of the categorical conditions on the appearance of those variants. Where point (a) is concerned, most work in recent decades has been in agreement that contraction is best represented as an alterna-

tion between two allomorphs, one of which is phonologically complete, and the other of which has less phonological material. Where points (b) and (c) are concerned, however, it is difficult to reconcile the large number of accounts that have been proposed, as they come at the questions from several different perspectives. Furthermore, the reliance of the vast majority of researchers on purely intuition-based data often means that decisive conclusions are difficult to come by. For instance, there are cases in which researchers disagree in their judgments of the acceptability of a sentence. There are also facts about the data which lend themselves to a number of different feasible analyses, with no definite way of deciding between them.

The subsequent chapters will argue that considering the patterns evidenced in natural-speech data will offer new ways of adjudicating between theoretical analyses of contraction. For instance, a few conceivable treatments of surface “intermediate” forms have been put forth. Some researchers treat them as stored; others treat them as derived by rule, meaning that the division of labor between morphology and phonology in this alternation is in question. In Chapter 3, we will find that the patterning of those intermediate forms in spontaneous speech in fact argues for one analysis of those forms in particular, one in which they are derived by phonological rules from two different stored objects.

Another issue that has been approached from different directions is the proper treatment of the categorical conditions on the distribution of auxiliary forms. Concerning the right-side effects on contraction, I won’t have much to say in the present study, because, as Chapter 3 will show, there is no variation in auxiliary form in these particular environments: only one form of each auxiliary (the full form) may surface before gaps and movement sites. But a number of the left-side effects do show variation; it is simply restricted: full and intermediate forms may surface,

but contracted forms may not. Previous researchers have put forth a number of different explanations for this restriction, and these are motivated by their different approaches to how an auxiliary and its host get together. Some have proposed that short allomorphs are simply illicit in those environments where contracted forms cannot surface; others have proposed that short allomorphs may be inserted, but simply cannot attach to their host. Again, we will see in the following chapter that quantitative data can help us decide between these possibilities. We will see that intermediate forms of certain auxiliaries pattern like contracted forms of others, and that a reasonable explanation for this is that the two come from a single source. That is, we will have evidence supporting the proposal that short allomorphs are inserted even after those subjects that do not allow them to appear in their faithful contracted form.

One final issue that has been left open by this previous research is the best grammatical representation of the variability in contraction. Most researchers have focused their energies on environments in which auxiliaries **may not** vary in form, meaning that there hasn't been nearly as much discussion of what's going on where auxiliaries **may**. What is the best way to model the surface alternation between auxiliary shapes? Where is this probabilistic behavior localized? What conditions the choice of form? These questions will all be addressed throughout the discussion in the following chapters.

Chapter 3

A new approach to contraction

3.1. Introduction

The previous chapter demonstrated that auxiliary contraction is an appropriate phenomenon through which to examine the theoretical questions at issue in this thesis. Specifically, it is a variable process that implicates multiple levels of a grammatical derivation and displays at least internal linguistic conditioning.

In this chapter, I introduce the corpus study of contraction that will serve as the data source for the following three chapters, which examine the factors conditioning variable auxiliary shape. This chapter thus serves two purposes. First of all, it presents the methodology of the corpus study, including which contexts auxiliaries were coded in and which contexts were omitted, and the range of surface forms of English auxiliaries. This occupies Sections 3.2.1–3.2.3.

Second, it documents the distribution of those surface forms (Section 3.2.4) and provides a model of auxiliary contraction under which these forms and their distribution are accounted for (Sections 3.3–3.5). While I follow previous work in treating contraction as underlying variability between two allomorphs, I demonstrate that this alone cannot account for the range of surface forms that we see in spontaneous speech, and that we need to propose variable phonological processes in addition to variable morphology in order to account for the corpus data. The sec-

ond purpose this chapter serves is thus to provide an analysis of the grammatical alternations that underlie the observed surface variation in auxiliary shape. This will subsequently set us up for further analysis of the factors conditioning contraction (Chapters 4–6), since we cannot adequately model what conditions this variation if we don't know what's varying in the first place.

The findings presented in the second half of the chapter connect to my general interest in this thesis as to how variable surface behavior is localized in speakers' grammars. To reiterate, the overarching goal of the present work is to develop a grammatical model of sociolinguistic variation that accounts for the patterns observed in surface data. As indicated in Chapter 1, this can be attacked both from the point of view of the dependent variable (that is, the variable linguistic item: my Question 1 in Section 1.1.3) and of any independent variables that condition its variation (my Question 2 in Section 1.1.3). In this chapter, I address the “dependent variable” side of this question. This chapter thus asks: when we see variable surface forms of English auxiliaries, to what stage(s) in the grammar can we attribute the variation? My answer to this question — that variation in auxiliary shape is traceable to variable behavior in both the morphology and the phonology — has broader implications for the nature of the grammar. Specifically, the grammar must be capable of deriving output forms, and must comprise at least those two distinct levels; this is discussed in greater detail in Chapter 7.

The approach to the study of linguistic variation that I take here has a precedent in work such as Labov, 1969 and Guy, 1991. In each of those papers, the authors identify the factors conditioning application of a variable phenomenon (copula deletion in the former case; *t/d* deletion in the latter), and then provide a theoretical model of that phenomenon which explains why surface forms show the distribution they do (patterns of copula deletion reflect a previous stage of contraction;

patterns of *t/d* deletion reflect the application of a deletion rule at multiple levels of the phonology). This chapter thus continues a tradition in variationist work of integrating quantitative data with theoretical analysis in order to provide a fuller picture of the variables that we study, and to address questions of the locus of surface variability.

3.2. Methodology and findings

3.2.1. Data collection

Three corpora were used for the contraction case study:

- **Switchboard** (Godfrey and Holliman, 1997): A corpus consisting of about 240 total hours of speech (roughly 3 million transcribed words), collected between 1991 and 1992. Speakers were paired up at random with a partner with whom they were instructed to have a 5-minute conversation over the phone about a provided topic. Switchboard consists of approximately 2400 such conversations collected from 542 speakers.
- **The Philadelphia Neighborhood Corpus**, henceforth ‘PNC’ (Labov and Rosenfelder, 2011): A corpus comprising 40 years’ worth of sociolinguistic interviews with 318 different native Philadelphians, carried out by trained field-workers of the Linguistics 560 class at the University of Pennsylvania. The corpus contains approximately 150 hours of speech (roughly 1.6 million transcribed words). Conversation topics included speakers’ family histories and social networks, and life on their particular city block. Explicit effort was made by interviewers to elicit narratives (Labov, 1984). For the present study, only those conversations of which at least 35 minutes had been transcribed

were used, to ensure that a speaker produced a reasonably large body of auxiliary tokens. This narrowed down the corpus to 43 conversations.

- **Fisher** (Cieri, 2004): A corpus of short phone conversations on provided topics between strangers, much like Switchboard, but larger, containing over 11,000 conversations. Over 12,000 speakers were involved, including some non-native speakers of English (whose tokens were excluded from the present study). Data collection was carried out between 2002 and 2003.

The initial data collection was performed solely using Switchboard. 500 tokens of each of the six auxiliaries under study were extracted at random from the corpus. The decision was made to select tokens at random rather than to code all tokens uttered by a particular set of speakers because many speakers did not participate in more than a few conversations, meaning that it was very rare for a speaker to have participated in 30 minutes or more of conversation. With such little data from each individual speaker, large numbers of auxiliaries uttered by a single speaker would be difficult to come by. For that reason, the decision was made simply to see what the internal factors conditioning contraction were, factors that should be visible in the larger community of native English speakers (Section 1.2.3).

Once 500 randomly-selected tokens of each auxiliary were coded from Switchboard, tokens of each auxiliary after certain subjects that were not well-represented in the random sample (for instance, full noun phrases — that is, non-pronominal subjects; the pronoun/noun phrase distinction will play an important role in the analysis and discussion to follow) were targeted. (Targeting of auxiliaries after full noun phrase subjects was accomplished by a script that searched for auxiliaries when **not** following pronoun, quantifier, or *wh*-word subjects; the output was then

culled by hand to leave only post-NP auxiliaries.) As a result, the final body of tokens coded is not an accurate representation of the distribution of auxiliaries in Switchboard overall, but instead is biased to boost the token counts of auxiliaries in more uncommon contexts, or more uncommon auxiliaries in general. For instance, Figure 3.1a (presented below in Section 3.2.4) shows roughly equal token counts across all post-pronoun auxiliaries, but this is not representative of the frequency of these auxiliaries in the corpus itself. *Is* is actually far more frequent in Switchboard than the others; *had* is particularly infrequent. These differences have simply been eroded by the method of data collection, which sought to obtain a roughly equal number of tokens of each auxiliary.

All 7887 tokens from Switchboard were hand-coded, based on the audio, by me, with the exception of 411 tokens which were coded by an undergraduate research assistant who had been trained in linguistic analysis. The 7887 tokens came from 965 unique speakers.¹

To address concerns raised by (a) the fact that telephone speech is phonetically lossy and (b) the artificiality of the conversational situation in Switchboard, as well as to examine the potential for social and stylistic effects on contraction, another set of data was collected from the PNC. This study differed from the Switchboard study in that, rather than being carried out on tokens selected at random from the whole corpus, a demographically diverse set of speakers was chosen, and all tokens of the auxiliaries under study were coded for each selected speaker. This resulted in a database of 7042 tokens, collected from 43 unique speakers. 4929 of those tokens were coded by an undergraduate research assistant who was trained

¹The figure 7887 includes tokens that were subsequently excluded for being in a right-side environment or for other reasons; see Section 3.2.2, which enumerates exclusions. The token counts in the graphs and analyses to follow will, accordingly, sum to less than this number. The same holds for the figures given the next two paragraphs: they include tokens that were subsequently excluded.

in linguistic analysis.

The fact that **all** tokens of the six auxiliaries under study were coded from the selected PNC interviews means that the distribution of tokens by auxiliary differs for the PNC as compared to Switchboard. For instance, Figure 3.1b (in Section 3.2.4 below), which graphs the post-pronoun data coded from the PNC, shows many more tokens of post-pronoun *is* than any other auxiliary. This is not apparent in the token counts for the set of data collected from Switchboard (Figure 3.1a), but, again, this is only because data was collected from Switchboard so as to equalize token counts. Had I coded every token of the six auxiliaries under study in Switchboard, the distribution of tokens by auxiliary would look much more like that for the PNC, but with Switchboard being so large, I opted not to approach the data collection in this way.

Because none of the corpora selected for study are part-of-speech tagged, targeting tokens of auxiliaries required some creativity. Specifically, many auxiliaries, in either their contracted or their full forms, are homographic with other English lexical items. For instance, <'s> could be contracted *is*, contracted *has*, or the genitive suffix. Similarly, <'d> could be either contracted *would* or contracted *had*. And *had*, *has*, and *have* could be either auxiliary HAVE or main verb HAVE.

To that end, a Python script was written that attempted to target auxiliaries as follows:

- *had, has, have*: The script searches for either the full or the contracted form of the auxiliary followed by a word that either (a) ends in <-en> or <-ed> or (b) is on a list of irregular past participles, with no more than one word intervening between auxiliary and past participle (in order to permit cases in which an adverb separates them).² Though this results in the occasional

²Irregular past participles were defined as the following: *born, beat, become, begun, bent, beset, bet,*

spurious hit in which the form of HAVE is a main verb (e.g. *He has children*) or <'s> is from contracted *is* (e.g. *It's written there*), this overwhelmingly succeeds in targeting auxiliary HAVE. Spurious hits were, of course, excluded from coding (or reclassified as the correct auxiliary, as in the latter case), since all coding was done by hand (as discussed further below).

- *will*: The script searches for either the full or the contracted auxiliary, not followed by anything in particular.
- *would*: The script searches for either the full or the contracted auxiliary followed by some word that does not end in *en* or *ed*, in order to omit forms in which the <'d> comes from contracted *had*. While this by necessity omitted tokens of, e.g., *I'd need*, it seemed like a small price to pay. Tokens of *would have* found in this search were set aside and not analyzed with *would* tokens.
- *is*: The script searches for either the full or the contracted auxiliary; spurious tokens of contracted *has* or possessive 's were reclassified or omitted, respectively.

The search described above extracted the entire annotation unit containing the token under study, to provide surrounding context. Audio file excerpts matching the the annotation unit in which the token was found were also extracted, and all coding was done based on this audio, not on the written transcription. This was done primarily to ensure that any phonological distinctions between variants of

better, bound, blown, brought, broadcast, built, burnt, burst, bought, cast, caught, clung, come, cost, crept, cut, dealt, dug, done, drawn, dreamt, drunk, felt, fought, found, fit, flung, flown, foregone, gone, got, ground, grown, had, hung, heard, hit, held, hurt, kept, knelt, knit, known, laid, leapt, learnt, left, lent, let, lain, lost, made, meant, met, misspelt, mown, overcome, overdone, overthrown, paid, put, quit, read, rid, rung, run, sown, said, sought, sold, sent, set, sewn, shorn, shone, shod, shot, shown, shrunk, shut, sung, sunk, sat, slept, slain, slid, slung, slit, sown, spent, spilt, spun, spit, split, spread, sprung, stood, stuck, stung, stunk, struck, strung, sworn, swept, swum, swung, taught, torn, told, thought, thrown, thrust, understood, upheld, upset, worn, wept, wound, won, withheld, withstood, wrung.

the dependent variable that are not represented orthographically were accurately recorded, but also because Switchboard transcripts cannot be trusted where contractions are concerned; the instructions for transcribers provided in the Switchboard manual state:

5. Contractions are allowed, but be conservative. For example, contraction of "is" (it's a boy, running's fun) is common and standard, but there'll (there will) be forms that're (that are) better left uncontracted. It is always permitted to spell out forms in full, even if the pronunciation suggests the contracted form. Thus it is O K to type he is and they are and we would even if it's he's and they're and we'd you heard.

3.2.2. Defining the envelope of variation

As we saw in Chapter 2, previous researchers have identified a number of environments in which only full forms of auxiliaries are acceptable. In Section 2.3, I characterized those environments depending on whether what was blocking contraction was the nature of the material to the auxiliary's left ("left-side" environments) or the material to the auxiliary's right ("right-side" environments). If it is indeed true that there is no variation in auxiliary form in certain environments, they should be excluded as outside the envelope of variation. In this section I examine each of those proposed blocking environments, backing up previous researchers' intuitions with corpus data. As before (Section 2.2.1), I will be using the term "reduced" as a blanket term covering both intermediate and contracted forms (with those terms defined as in 6–7), and "contraction" to refer to the surface variation between reduced and unreduced forms.

Several of the environments that previous researchers identified as prohibiting contraction are not found to occur in my data. Specifically, a number of the left-

side environments cited by Kaisse (1983) we do not find in casual speech: preposed negative adverbials, preposed verb phrases, preposed comparative adverbials,³ and sentential subjects. The (non-)application of contraction in these environments is thus not relevant to the present study. Those environments in which contraction is said to be impossible and which **do** surface in spontaneous speech are examined below, with right-side environments addressed first, followed by left-side ones.

3.2.2.1. Before a gap

Auxiliaries may surface before two types of gaps: those that arise from *wh*-movement (31), and those that arise from ellipsis (32). The judgments cited in Chapter 2 indicated that contraction in these environments was unacceptable, and that is borne out by the data, with none of the 193 tokens of auxiliaries before gaps showing a reduced form of the auxiliary.

(31) Failure of contraction before a *wh*-movement site.

- a. Well, I have no idea what that [ɪz]⁴ __. (sw2343: sw_1139)⁵
- b. It showed her trying to explain to her children where daddy [ɪz] __.
(sw2535: sw_1096)
- c. If you know where Albany [ɪz] __, then uh it's about maybe an hour west of Weatherford. (sw2827: sw_1028)

(32) Failure of contraction before an ellipsis site.

- a. I didn't do it myself but my father [hæd] __. (sw2441: sw_1146)

³Actually, there was one example of this sort of construction: *Equally important is that, uh, it needs to be put into practice in, in everyday life.* (sw2377: sw_1041). The speaker used a full form of *is*.

⁴Judgments of auxiliary vowel quality are based on my own (or a research assistant's) impressions; detailed acoustic coding of vowel reduction awaits future work.

⁵Numbers in parentheses beginning with "sw" indicate that a token comes from the Switchboard corpus; the first number is the number of the conversation the token was taken from and the second is the identification number of the speaker who uttered it.

- b. It has been the best thing in the world for her. It [hæz] __. (sw2816: sw_1208)
- c. (Have you been outside the U.S. at all?) (No.) Well, I [hæv] __. (Burt McIntosh)⁶
- d. Atlanta's a good city. It really [ɪz] __. (sw2202: sw_1141)
- e. He's thinking of getting another one; I don't know if he [wɪl] __ or not. (sw3602: sw_1349)
- f. They dress like any other teacher [wʊd] __ in a classroom situation. (sw3115: sw_1305)

In some cases, a remnant of the VP remains after ellipsis. This is demonstrated in 33 and 34. This occurs relatively infrequently in my corpora, but the generalization here appears to be that contraction may occur if the remnant and gap precede a *wh*-movement site (33). I don't have enough tokens of this to be able to determine if contraction occurs at a rate parallel to that at which it occurs outside of pre-movement environments, though. When a remnant of the VP precedes an ellipsis site, however, the failure of contraction seems to be close to categorical (34). In such tokens, it is also common (although not universal) for the auxiliary to bear stress. I found only one token in which an auxiliary precedes a remnant followed by a deletion site in a construction that does not involve *wh*-movement and contraction has nonetheless occurred (34d).

(33) Contraction before a *wh*-movement site containing a remnant.

- a. We're supposed to talk about what the weather[z] been like __. (sw2371: sw_1146)
- b. I don't even know where he[z] at __. (sw2623: sw_1117)

⁶Names in parentheses indicate the PNC speaker who uttered a token.

- c. The kids don't really have a very good sense of where the money[z] going __. (sw4594: sw_1190)
 - d. I didn't realize how much I[d] paid up __ on some of them. (sw3536: sw_1359)
 - e. I don't know how she[z] doing __. (sw2523: sw_1039)
 - f. Look how much it[s] changed __. (sw2726: sw_1011)
- (34) Failure of contraction before an ellipsis site containing a remnant.
- a. (That's a long eight years, though.) Yeah, it [hæz] been __. (sw2834: sw_1229)
 - b. I don't think anyone imagined that it could possibly be as as successful and and painless as it [həd] been __. (sw2612: sw_1162)
 - c. (I was petrified.) I [wʊd] be __ too. (sw2566: sw_1027)
 - d. Exceptional token: As rainy as it[s] been __ in the last couple of years, there's a, uh, there's a section in South Dallas that has had a whole lot of flooding problems because of the rain. (sw2772: sw_1232)

Accordingly, **all tokens in which an auxiliary preceded a *wh*-movement or ellipsis site were excluded from analysis, with the exception of those in which the auxiliary preceded a VP remnant of *wh*-movement.**

3.2.2.2. In a comparative sub-deletion construction

My data contains 6 tokens of auxiliaries in comparative sub-deletion constructions, which are represented in 35.

- (35) Comparative sub-deletion constructions
- a. I've seen in more in Durham than I [hæv] __ Raleigh. (sw3495: sw_1421)

- b. He's replaced almost as many clubs as he [hæz] __ balls. (sw2983: sw_1264)
- c. Well, that's easier done in a company than it [ɪz] __ in, uh, school teaching. (sw2085: sw_1071)
- d. She works for one here in Dallas which is more a retirement village than it [ɪz] __ a nursing home. (sw3057: sw_1264)
- e. It's more of a bother sometimes than it [ɪz], uh, __ a real invasion to me. (sw2824: sw_1181)
- f. That's as broad as it [ɪz] __ long. (Antonette Lembolini)

Not a single one of these is contracted, despite the fact that they all contain a pronoun subject and should thus be prime candidates for contraction (given the high rate of post-pronoun contraction attested in Section 3.2.4's Figure 3.1). **Comparative sub-deletion constructions were accordingly omitted from analysis.**

3.2.2.3. Before a parenthetical

Tokens before parentheticals are difficult to come by, and we aren't likely to find tokens like *John is, my dear, a bastard* (the example given in much of the literature, e.g. Anderson, 2008) in spontaneous speech. One fruitful way to locate them is by searching for auxiliaries that precede *I think* or *you know*. When we look at these tokens, a sampling of which is provided in 36, there turn out to be a number of instances in which auxiliaries surface in their contracted form before one of these parentheticals.

(36) Following parentheticals

- a. That[s], I think, part of why I moved down here as opposed to Center City. (Amy)

- b. It[s], I think, Tony and Ruth. (Amy)
- c. And she[z], you know, a hundred percent Asian. (Amy)
- d. That's great they[v], you know, had such great fortune here. (sw2234: sw_1148)
- e. When the country [iz], you know, in a in a crisis like this... (fe01066: fe_4747)⁷
- f. When you start having two of them, it[s], you know, a little bit tougher. (sw2945: sw_1171)
- g. It[s], you know, it's not just homosexuals; it[s], you know, heterosexuals; it[s], you know, the drug users; it's innocent people. (sw3531: sw_1415)
- h. You can look businesslike in in a pant— uh, the same pant suit you [wud], you know, wear for other things. (sw3175: sw_1130)
- i. He [wud], you know, laugh with the kids. (sw4153: sw_1503)

In fact, of the 12 tokens of *is* with a pronoun subject that precede one of these parentheticals, 100% of them are contracted. Not every auxiliary, of course, contracts at a high rate before parentheticals: there are 4 tokens of *would* with a pronoun subject that precede a parenthetical, and none of them are contracted. However, Figure 3.1 will show that *would* contracts at a low rate after pronouns regardless of what follows, so this is unsurprising. The upshot of this is that **tokens of auxiliaries before parentheticals were retained for the present study**. Previous researchers' intuitions that contraction is illicit here are most likely better attributed to the unnatural example sentences that they derived.

⁷Numbers in parentheses beginning with "fe" indicate that a token comes from the Fisher corpus; the first number is the number of the conversation the token was taken from and the second is the identification number of the speaker who uttered it.

3.2.2.4. In a pseudo-cleft construction

Collins (1991) identifies three different pseudo-cleft constructions that implicate the auxiliary *is*: *wh*-clefts, *th*-clefts, and *all*-clefts. I will discuss each in turn.

Wh-clefts are the prototypical pseudo-cleft, with a *wh*-word-initial introductory clause (37a–37d). The clause following that introductory clause may be sentential, in which case the introductory clause contains a form of *do* (37c–37d). There are also reverse pseudo-clefts, in which the *wh*-clause follows the copula (37e–37f).

(37) *wh*-clefts and reverse *wh*-clefts

- a. Well, if, if somebody says to me, "How are your neighbors?", I say, "Great." What I'm talking about [iz] the people over here and over here and across the street. (Fannie Brown)
- b. What our teachers charge in our school [iz] between twenty-five and thirty-five an hour. (Brooke)
- c. So what you would do [iz] you would draw, say, a circle. (Burt McIn-tosh)
- d. What we had to do [iz] we had to get on the trail or on the road.
(sw2820: sw_1028)
- e. RSD [iz] what it's called. (Jenny McPhee)
- f. Half ball[z] what they're doing right now. (Bill A.)

My database contains 68 tokens of *wh*-cleft sentences. Of these, I only found a contracted form of *is* in one of them (38).

(38) What America stands for[z] the right to be able to disagree with the government. (sw2780: sw_1124)

This is a contraction rate of 1%, far below the 38% contraction rate that we find for *is* after subjects of two or more words elsewhere in the corpus. (All *wh*-cleft sentences contain an auxiliary following a *wh*-phrase of at least two words, with the shortest being *what's happened*, so the comparison to other non-pronoun subjects was restricted accordingly.) Given this near-categorical rate of contraction of *wh*-clefts, then, **all *wh*-cleft constructions were omitted from analysis.** As for reverse *wh*-clefts (37e–37f), my database contained only six, of which one (the one given in 37f) displayed a contraction. This is a contraction rate of 17%, so these tokens were not omitted from analysis, although in such small number they presumably couldn't really bias the data either way.

The *th*-cleft members of the pseudo-cleft category consist of a relative clause that begins with *the* followed by a noun such as *thing, one, place, time, reason, or way* (Collins, 1991). As Massam (1999) observes, there are a few different configurations of *be* that may then follow: two verbs, which may (39a) or may not (39b) differ in tense; one verb only, in the “setup” (the first half of the clause) (39c); or one verb only, in the “counterweight” (the second half of the clause) (39d). These latter two possibilities are distinguished by intonation: when the auxiliary is in the setup (39c), it bears comma intonation, with falling/rising intonation and a following pause. In the counterweight (39d), there is no such intonation pattern.

(39) *th*-clefts

- a. And the funny thing was, [ɪz] the neighbors on the street noticed it before [she did]. (Earl Carlin)
- b. And the other thing [ɪz], [ɪz] that if you park certain areas, they — they double-park you in, because there's parking problems around here.
(Earl Carlin)

- c. Well, the problem [ɪz], that most of the record players now will not play them. (sw2131: sw_1128)
- d. The reason that I, uh, uh, am conscious of that now, [ɪz] because my cousin... (Fannie Brown)

Massam also discusses constructions which are syntactically similar to those in 39, but with the introductory clause beginning with a deictic *that*. She calls these “reduced *thing-is* constructions.” In both types of *thing-is* construction, she argues, *be* is being used as a focus marker. Reduced *thing-is* constructions appear occasionally in my data (40). Frequently, these sentences are constructed such that, were the *that* removed, they would be a typical *wh*-cleft or *all*-cleft.

(40) Reduced *thing-is* constructions

- a. That's all you can do [ɪz] pray. (Jean)
- b. That's what Texas needed to do also [əz] to discriminate as to, uh, which should be taxed and what shouldn't be taxed. (sw3413: sw_1112)
- c. That would be the downside of an increase [ɪz] that I would expect an increase in the minimum wage by the government would cause, uh, an increase in, uh, the amount of labor that is done outside the country for companies. (fe10772: fe_88360)
- d. It's all he talks about [ɪz] a cruise. (Cathy Kay)

My data set contains 144 tokens of either a *th*-cleft or a reduced *thing-is* construction. Of those, I found a contracted form of *is* in only two of them (41).

(41) Contraction in a *th*-cleft

- a. The thing with Philadelphia, though[z] the salary cap just, just totally, just totally wiped the Sixers. (fe09526: fe_12040)

- b. They probably stole, they robbed, they murdered, they killed, they did everything, you know. Oh and — okay, and then the thing[z] they just got themselves into a position where it's like they finally started to get some power. (Jerome Long)

Of these, the construction in 41a is interrupted by an adverb (*though*), while 41b may be a speech error, since it comes after a period of hesitation.⁸ Given this low contraction rate (again, 1%), **all *th*-clefts were omitted from analysis.**

Finally are *all*-clefts, in which the introductory clause is headed by *all* (42).

(42) *all*-clefts

- a. They now have keyboards where all they have to do [əz] talk. (fe05748: fe_11527)
- b. All I know [ɪz] I didn't vote for him. (fe06891: fe_96003)
- c. All you hear [ɪz] cops. (Burt Crane)

My data set contains 29 tokens of *all*-clefts, of which only one had a contraction (43).

- (43) All I know[z] that when I came here in eighty seven, they still had— uh, it was the last year to to put all your punch cards in. (sw2122: sw_1167)

Again, with such a low contraction rate (3%), there was no reason to examine this environment, so **all tokens of *all*-clefts were omitted from analysis.**

3.2.2.5. In certain types of *wh*-questions

There are two types of *wh*-questions in which contraction is said to be illicit. The first is those questions in which the *wh*-phrase consists of a single word and the

⁸This speaker is one who happens to use a lot of *th*-clefts, however — of the 54 *th*-clefts in the PNC, a full 52% come from him alone — so it is probable that this construction was what he intended to produce.

auxiliary is followed by one of the personal pronouns *it*, *he*, or *she*, with no following verbal complement (44).

(44) *wh*-word/personal pronoun constructions

- a. Why [iz] it that, uh, that they can be such model citizens and, uh, yet... (sw3752: sw_1359)
- b. How [iz] it down there? (sw2705: sw_1231)
- c. Where [iz] it? (sw2203: sw_1107)
- d. What [iz] it? (Jim Lewis)
- e. What [iz] she now? (Sam Y)

My data contain 21 instances of this construction, and contraction is unattested in them. Note that contraction becomes acceptable when the auxiliary is followed by a demonstrative (45a), or when a verbal complement follows the personal pronoun (45b–45c).

(45) *wh*-word/personal pronoun constructions

- a. What[s] that? (sw2374: sw_1024)
- b. How[z] it going? (sw2158: sw_1167)
- c. Where[z] it going to be? (sw3082: sw_1327)

I omit all sentences of the 44 type from analysis.

The other environment in which contraction is said to be restricted is after multi-word *wh*-phrases (Kaisse, 1983). Where that multi-word *wh*-phrase is a subject (46a), Kaisse finds contraction acceptable, but where it is an object (46b) or an adjunct (46c, 46d), she finds contraction to be illicit.

(46) Failure of contraction after a multi-word, non-subject *wh*-phrase. Judgments and examples from Kaisse (1983).

- a. Which dog [hæz] ~ [z] been jumping on the sofa?
- b. Which dog [ɪz] (*[z]) he buying?
- c. How likely [ɪz] (*[z]) it to rain?
- d. On which day [ɪz] (*[z]) John leaving?

There are 18 examples of tokens in which a multi-word, non-subject *wh*-phrase precedes the auxiliary in my data. Examples are given in 47.

(47) Multi-word, non-subject *wh*-phrases

- a. How lame [əz] that? (fe02367: fe_47998)
- b. How old[z] your daughter? (fe10748: fe_66858)
- c. How long [wəl] they be there? (sw2950: sw_1043)
- d. What time [əz] it there? (fe07917: fe_19884)
- e. What sort of thing [əz] she looking for? (fe06280: fe_57015)

As the examples indicate, in most of them (the precise number is 15/18) the *wh*-phrase consists of only 2 words. Of those 2-word non-subject *wh*-phrases, the only one to show any contraction is *how old*. My database contains 9 tokens of *is* after *how old*, and 4 of those are contracted. This is a contraction rate of 44%, exactly in keeping with the contraction rate of *is* after two-word noun phrases in my corpus (46%).⁹ Among the other 5 examples of 2-word non-subject *wh*-phrases, though, there is no contraction at all, and likewise for the longer *wh*-phrases (though there are only 3 examples of those).

The simplest conclusion here would be that that contraction after a multi-word non-subject *wh*-phrase is indeed illicit, as Kaisse proposes, **except** when that phrase

⁹Maybe a better comparison here would compare the rate of contraction after 2-word non-subject *wh*-phrases to that after 2-word **subject** *wh*-phrases, but there were only 5 such tokens in my data.

is *how old*. A better generalization might bring prosody into the discussion, as follows. A non-subject *wh*-phrase will be by necessity followed by a subject, and that subject will frequently be a pronoun. In fact, in all of those examples of multi-word *wh*-phrases in my corpus in which the *wh*-phrase is **not** *how old*, it is followed by a pronoun. The lack of stress on that pronoun may be what's blocking contraction (compare the failure of contraction in a question like *Who is it?*, versus *Who's your teacher?* in which contraction is acceptable.). Among the examples in my corpus that contain *how old*, on the other hand, the auxiliary is followed by a noun phrase (*your daughter, your granddaughter, Kayla*) in all but one. (That one token is *How old is he?*, and the auxiliary is uncontracted). The effect on contraction of the stress pattern of the element **following** the auxiliary is clearly something that deserves investigation in future work. In the meantime, **I omit from analysis all tokens in which a multi-word, non-subject *wh*-phrase is followed by a pronoun subject.**

3.2.2.6. After a preposed prepositional phrase

My data contains 12 tokens of the auxiliary *is* following a preposed prepositional phrase (48).

(48) Preposed prepositional phrases

- a. Across the street [ɪz] Grandma and next to Grandma **is** the uncle.
(fe08763: fe_87857)
- b. Half a block up [ɪz] the original swimming pool when I was a kid. (John Stevens)
- c. Four blocks in another direction[z] Epiphany. (Gary Salvi)

Of these 12 tokens, only one was contracted (48c), for a contraction rate of 8%. This rate of contraction does not actually differ statistically from the rate after noun

phrase subjects greater or equal to three words in length (the minimum length of one of these preposed prepositional phrases), but to be on the safe side, I omitted these tokens from analysis.

3.2.2.7. After an embedded or coordinated pronoun

My data contains only 6 examples of subjects that end in a nominative pronoun.¹⁰ These are provided in 49, with the form of the auxiliary transcribed.

(49) Coordinated and embedded pronouns

- a. *had*: My wife and I [əd] thought about going down there. (sw2489: sw_1102)
- b. *had*: Both my husband and I [həd] been living separately. (sw3031: sw_1268)
- c. *have*: My son and I [həv] been out for a couple of walks today. (sw3878: sw_1484)
- d. *is*: The guy next to you[z] smoking a five dollar cigar. (fe04766: fe_55546)
- e. *will*: You and I [wɪl] pay for it. (sw2714: sw_1245)
- f. *will*: My husband and I [wəl] go out to dinner. (sw3720: sw_1367)

The number of tokens is really too small to draw any serious conclusions from, but the intuition of previous researchers is not contradicted. Auxiliaries other than *is* do not surface in their contracted form after a coordinated pronoun. The appearance of *had* in its intermediate form (49a) does indicate that some variation of form in this environment is nonetheless possible for those other auxiliaries (and cf. a

¹⁰There are actually 7 such tokens, but in one, the auxiliary is in an ellipsis environment, and thus wouldn't be expected to contract no matter what its subject (Section 3.2.2.1).

similar sort of alternation for *have*, *will* and *would* after coordinated and embedded pronouns: they may appear in their intermediate but not in their contracted form, according to my judgment, though this type of subject is so rare that I was unable to find any attestations of this). For this reason, **tokens after coordinated and embedded pronouns were retained in the analysis**, though with no more than two such tokens per auxiliary, we again can't expect much of an effect on the data either way. These tokens were, however, treated as having full noun phrase subjects for the analysis, not as having pronoun subjects (and see Section 3.2.4 for more on the noun phrase/pronoun distinction).

3.2.2.8. After a parenthetical or an adverb

Both parentheticals and adverbs can serve to interrupt a host/auxiliary collocation. Frequent parentheticals encountered in my data include *you know* (50a), *I think* (50b), and *I guess* (50c), but others (50d, 50e, 50f) are also attested.

(50) Preceding parentheticals

- a. Everything, you know, [əz] like yellow. (fe07349: fe_76980)
- b. The NASA program I think [əz] been very beneficial for this country.
(sw3603: sw_1435)
- c. That statistic I guess [həz] been growing every year. (sw2790: sw_1232)
- d. Bishop Newman I said [iz] now Saint John's Newman. (Bag O'Donuts)
- e. And everyone that'd come in, like you, [wʊd] sit down. (Samantha)
- f. Relative pay, which is a major way we value people, [həz] been poorer
and poorer over the years. (sw2379: sw_1110)

My data set contains 39 tokens of auxiliaries after parentheticals. Among these, there are 7 tokens in which auxiliaries surface in their intermediate form. A sam-

pling of these, with their auxiliary form transcribed, is provided in 51. Of these 7 tokens, one is the auxiliary *would*; the other 6 are /h/-initial auxiliaries.

- (51) Variation in auxiliary form after a parenthetical
- a. The equality of, uh, the roles now between the sexes, I guess, [əz] been dramatically demonstrated with this war. (sw2145: sw_1152)
 - b. The big discussion — just kind of what you were mentioning — [əz] been the color. (sw2185: sw_1142)
 - c. Dining out, especially with the kids, [əz] always been a major, you know, thing. (sw2588: sw_1219)
 - d. Solar, of course, [əd] be the clean— cleanest. (sw3148: sw_1315)

However, there are no tokens of a **contracted** form of any auxiliary after a parenthetical. Section 3.3 will argue that the presence of intermediate forms of /h/-initial auxiliaries in some environment should not be interpreted as evidence that the variation that underlies surface contraction may take place there. This is because intermediate forms of /h/-initial auxiliaries may still surface even where the underlying variation is blocked (and again, see Section 3.3 for much more on this). Only contracted forms of auxiliaries can provide indisputable evidence for the underlying variation having occurred, and they are unattested here. Accordingly, I **omit tokens of auxiliaries following parentheticals from study**.

My data contains 115 tokens of auxiliaries after adverbs. A sampling of these is provided in 52. In many of these tokens, the auxiliary follows a single-word adverb (e.g. 52a–52e), but longer adverbial phrases (e.g. 52f–52g) also exist.

- (52) Preceding adverbs
- a. That just [ɪz] impossible. (Fannie Brown)

- b. I get the feeling that she kinda [əz] like almost happier now. (Amy)
- c. It was the most reliable car he ever [həd] purchased. (sw3849: sw_1462)
- d. They obviously [həd] been done. (sw2501: sw_1072)
- e. One of them though [həz] been coming with his girlfriend. (sw2518: sw_1016)
- f. One woman, uh, many many years ago, [həd] given a huge sum of money to to the university. (sw3061: sw_1292)
- g. Here's a guy who for twenty years [həz] been working toward, you know, getting the party nomination. (sw4814: sw_1623)

Among these preceding-adverbial tokens, I coded 7 in which the auxiliary surfaced in its contracted form. These are reproduced in 53.¹¹

(53) Contracted forms after an adverb

- a. I sure[v] enjoyed, uh, talking about this. (sw2064: sw_1148)
- b. I really[v] enjoyed the conversation. (sw2262: sw_1148)
- c. I really[v] enjoyed this conversation (sw2292: sw_1148)
- d. The king salmon fishing too[z] fun, too. (sw3975: sw_1499)
- e. A sun roof really[z] a snow roof, you know: "Ooh, look, snow!"
(sw4749: sw_1676)
- f. We're convinced that she probably[d] be better off in a geriatric—
(sw3310: sw_1379)

¹¹There are also 4 more tokens (1) in which an auxiliary surfaces in its contracted form after an adverb, but the adverbs in these cases are attached to the subject. These were retained in the analysis.

- (1) a. Crime here[z] increased. (sw2160: sw_1123)
- b. The real estate out here[z] been pretty good. (sw3011: sw_1174)
- c. The local news here[z] kind of lousy. (sw2276: sw_1063)
- d. The younger one especially[z] really good at it. (sw2592: sw_1020)

g. My reading lately[z] been fairly heavy. (sw3442: sw_1317)

Note that tokens 53a–53c were all uttered by the same speaker. As an additional interesting side note, tokens 53b, 53c, and 53e were “corrected” in the transcript so that the adverb actually followed the auxiliary (e.g. *I've really*).

In spite of the existence of these few tokens, though, these auxiliaries certainly do not contract after adverbs at a rate anywhere near the rate at which they contract after those pronouns that frequently precede the adverb (based on the values plotted in Section 3.2.4's Figure 3.1). They don't contract after adverbs like they do after noun phrases, either: for instance, *is* contracts after adverbs at a rate of only 5%; compare this to the much higher post-noun phrase *is* contraction rate plotted in Figure 3.2. Accordingly, **I have omitted from study all tokens of auxiliaries after adverbs.**

3.2.2.9. Other omitted environments

All negated tokens were excluded from analysis, since some auxiliaries show a wider envelope of variation when negated: for instance, negated *is* can surface as *is not*, *isn't*, and *'s not* (see, for instance, Tagliamonte and Smith, 2002; Yaeger-Dror et al., 2002). This included tokens negated by *never*.

Auxiliaries that formed part of a compound modal (i.e. *will have*, *would have*) were not examined, as the envelope of variation there may differ from what it is for auxiliaries that are not part of a compound. Specifically, my impression is that contraction of *would* alone (*I'd*) is more common than the same contraction of *would* in a compound (*I'd have*), though this deserves closer study. At any rate, these tokens were set aside as being different in structure than tokens of isolated modals. Similarly, tokens of non-finite *have* were not coded, either in compound modal constructions, or in a construction such as *seem to have*, simply because these

were structurally different from tokens of finite *have*.

Auxiliaries following a pause long enough to hear the speaker take a breath were omitted, under the assumption that the auxiliary was too far separated from its potential host for contraction to apply. Auxiliaries were also omitted when no subject preceded them: either because they were part of a coordinate structure (54a), because the speaker stopped and restarted the sentence (54b), or simply because the subject had been dropped (54c).

(54) Null subjects

- a. The man had stolen— uh, not stolen, but [əd] kidnapped uh some wealthy ex-athlete’s daughter. (sw2879: sw_1260)
- b. What trees were were there when we moved in, uh— uh— were— [hæd] been put in by the developer. (sw2984: sw_1188)
- c. My middle daughter is interested in day care, uh, [hæz] been since she was in high school. (sw2816: sw_1208)

Tokens in which an auxiliary bore stress (55) were omitted because there is no way for an auxiliary to bear stress when contracted, making contraction illicit.¹²

(55) If I [hæd] voted, I would have voted for him. (sw3938: sw_1359)

Auxiliaries were also omitted from analysis when in initial position (i.e. fronted to begin a *yes-no* question), since, as discussed previously in Section 2.3.3, such tokens require further investigation to determine whether contraction or Left Edge Reduction (Napoli, 1982) is at work.

Tokens were also omitted if they were whispered, obscured due to laughter or background noise, or otherwise unintelligible. Tokens that were incomplete due

¹² A different question is whether contraction applies as expected when its *host* is contrastively stressed; this deserves future study.

to a speaker stopping midway through them or stuttering were likewise omitted. If a speaker uttered a full token but then stopped and restarted or repeated the token, the first token was coded only if its identity could be clearly discerned. For instance, in a case such as *John [əz]—John [əz] been there*, the first token would not be coded because it is potentially ambiguous with a reduced form of *is*. Similarly, if a speaker began *They have* and then changed course, the token would be omitted for being ambiguous between auxiliary and main verb *have*. But in the case of *John [əl]—John [əl] be there*, both tokens would be coded.

Tokens were not collected from any speaker who was judged to be speaking African American English, which has a process of copula deletion (Labov, 1969, et seq.). This way, the envelope of variation in auxiliary realization was the same for all speakers coded.

Finally, tokens of *has got* after pronoun subjects have been omitted from the analysis to follow, because they were found to contract categorically ($N = 129$). As something of an aside, this was an unexpected finding, and one which I do not believe has been reported before. Post-pronoun *has got* is fully categorical in its contraction; other versions of this collocation also contract at a very high rate: post-pronoun *have got* is at 0.98; post-pronoun *has gotten* is at 0.97. (Section 3.2.4's Figure 3.1 shows that the rate of contraction of post-pronoun *has* with other past participles is lower than this, around 0.90.) It is often tempting to look to string frequency for an explanation of results like this: for instance, Bybee (2002, 2006) argues that frequently-repeated collocations come to be pronounced with greater efficiency and, hence, more gestural overlap and reduction. We might thus expect that *has* reduces most in collocations in which it's used most frequently. (See Section 4.4.3 for more on the putative connection between collocation frequency and contraction.) However, *got* is not the most frequent past participle to combine

with post-pronoun *has*. That honor goes to *been*, which follows *has* in 233 of post-pronoun *has* tokens compared to *got*'s 128, yet shows a contraction rate of only 0.93. This is significantly lower than the rate of post-pronoun *has got* contraction ($\chi^2 = 8.24, p < 0.01$). String frequency thus isn't the cause of the high rate of *has got* contraction. For another possibility, see Crowell, 1959, who presents the hypothesis that the expression *have got* began to supplant main verb *have* when the widespread contraction of main verb *have* deprived listeners of an audible verb in sentences that contained it. A historical connection between contraction of *have* and its collocation with *got* could explain why that construction's contraction rate is so high today.¹³

Results from Switchboard and the PNC will be presented separately in the graphs in this chapter, but will be pooled for regression analyses, which will include a term for the corpus a token came from.¹⁴

3.2.3. Surface forms

For those tokens that were not omitted for being in any one of the environments given in Section 3.2.2, the shape of the auxiliary was coded according to the three-level distinction in form laid out in Section 2.2.2 (repeated, for convenience, in 56–58). The decision to use this three-way distinction for coding was justified not only by the phonological distinctness of each of the three shapes, but also by the fact that each surfaces in a different set of environments (see Table 2.1).

(56) Full: all phonological material intact, vowel of variable quality

¹³This explanation does nonetheless leave a lot of questions open: for instance, why something similar hasn't happened with *is*, which also contracts widely as a main verb; and whether Crowell's proposal that *have got* arose in environments where *have* was contracted can account for the fact, discussed in Kroch, 1989:fn. 5, that *have got* is favored in negative sentences and questions.

¹⁴To reiterate from Section 3.2.1, data was also collected from Fisher, but only for tokens of *is* after full noun phrase subjects, so in most cases there is no Fisher data to present alongside that from the other two corpora.

- | | |
|-------------------------------|--------------------------------|
| a. <i>had</i> : [hæd], [həd] | d. <i>is</i> : [ɪz], [əz] |
| b. <i>has</i> : [hæz], [həz] | e. <i>will</i> : [wɪl], [wəl] |
| c. <i>have</i> : [hæv], [həv] | f. <i>would</i> : [wʊd], [wəd] |

(57) **Intermediate:** lacking an initial consonant¹⁵

- | | |
|-----------------------|------------------------|
| a. <i>had</i> : [əd] | d. <i>will</i> : [əl] |
| b. <i>has</i> : [əz] | e. <i>would</i> : [əd] |
| c. <i>have</i> : [əv] | |

(58) **Contracted:** lacking an initial consonant and a vowel

- | | |
|-------------------------------------|-----------------------|
| a. <i>had</i> : [d] | d. <i>is</i> : [z] |
| (e.g. he'd [hid], you'd [jud]) | |
| b. <i>has</i> : [z] | e. <i>will</i> : [l] |
| (e.g. it's [ɪts], Jimmy's [dʒɪmɪz]) | |
| c. <i>have</i> : [v] | f. <i>would</i> : [d] |
| (e.g. I've [ajv], we've [wiv]) | |
| (e.g. he'd [hid], you'd [jud]) | |

Occasionally, an auxiliary was inaudible. This happened most frequently when *have* preceded the past participle *been*, and is presumably due to coarticulation of [v] with the following [b]. Such tokens were coded as contracted.¹⁶

The fact that the three forms in 56–58 are distinguishable on the surface is not necessarily evidence that they are distinct in any deeper linguistic sense. On the

¹⁵No distinction was made in the coding between a syllabic consonant and a consonant preceded by schwa, as I was unable to find a reliable study in the literature that gave evidence for an acoustic difference between the two. See Section 3.3.3.1 for a review of work on the **gestural** differences between different types of schwa which may be relevant.

¹⁶There is a slight complication to this posed by the fact that some speakers are capable of using past participles for the preterite: for instance, *I seen him* for *I saw him*. It is thus possible that a token of *I seen him*, which was interpreted by the coder as *I've seen him* with an inaudible [v], was not actually an instance of the present perfect at all. However, it occurred so infrequently that an auxiliary was inaudible that this cannot be seen as something that heavily skewed the results.

contrary, the analysis presented in Section 3.3.2 will argue that surface intermediate forms are not uniquely represented underlyingly. Instead, the three-way alternation in forms observed on the surface will be argued to be traceable back to an underlying two-way distinction, between one short and one long allomorph. Intermediate forms will be shown to be best represented as a conditioned surface reflex of long and short allomorphs, not as a distinct allomorph underlyingly. Table 3.1 previews the analysis of Section 3.3.2 by giving the hypothesized underlying source of each form.

Surface form	Underlying source
Full (CVC)	Long allomorph
Intermediate (əC)	Short and long allomorphs
Contracted (C)	Short allomorph

Table 3.1: Surface forms coded, with their proposed underlying source as detailed in Section 3.3.2.

3.2.4. Distribution of forms

As discussed in Chapter 2, contracted forms are somewhat restricted in their distribution, as most auxiliaries do not surface in their contracted form after subjects that are not personal pronouns. For that reason, I separate the data for the discussion to follow: tokens with personal pronoun subjects are kept distinct from tokens with full noun phrase subjects.¹⁷ Additional motivation for doing so comes from previous researchers' findings that subject type — specifically, pronoun versus noun phrase — has an effect on copula contraction rate (Labov, 1969; McElhinny, 1993). In other words, subject type appears to have both a categorical and a

¹⁷Personal pronoun subjects were defined as *I*, *you*, *he*, *she*, *it*, *we*, and *they*. Expletive, *wh*-word, demonstrative pronoun, and quantifier subjects were not included in either the personal pronoun or the full noun phrase group. Though these elements are pronoun-like, they are set aside here to keep from complicating the analysis and will be revisited in Chapter 4.

gradient effect on contraction, depending on which auxiliary is at issue.

Figures 3.1a and 3.1b show the distribution of the three coded phonological shapes (56–58) for auxiliaries after personal pronouns in Switchboard and the PNC, respectively.¹⁸ These graphs represent only data in which an auxiliary did not surface in one of the omitted environments given in Section 3.2.2. Figures 3.2a and 3.2b show the same for tokens after noun phrase subjects. Each graph has an accompanying table of proportions. Section 3.2.4.1 outlines which tokens are included in these graphs/tables and which were omitted (for envelope of variation reasons), and Section 3.2.4.2 identifies the major conclusions that should be drawn from these graphs, setting us up for subsequent analysis and discussion.

It is evident from the graphs in Figures 3.1 and 3.2 that a number of internal linguistic conditions are operative on the distribution of auxiliary variants. For instance, after pronoun subjects (Figure 3.1), contracted forms of *has*, *have*, *is*, and *will* are much more prevalent than are contracted forms of *had* and *would*. Additionally, contracted forms of *has* and *is* are much more prevalent after pronoun subjects than after noun phrase subjects (Figure 3.2). These and other internal conditions on contraction will be discussed in Chapter 4.

¹⁸The number of tokens coded per auxiliary differs between the two corpora due to the differing methods of data collection described in Section 3.2.1.

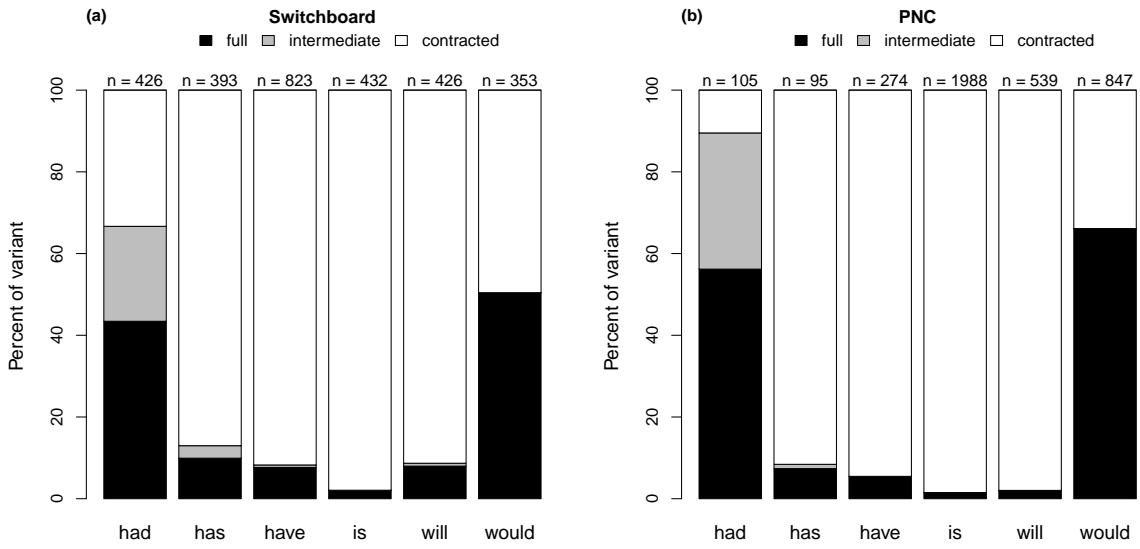


Figure 3.1: Distribution of forms after pronoun subjects, in the Switchboard (a) and Philadelphia Neighborhood (b) corpora. Pronoun subjects were defined as detailed in Section 3.2.4.1.

	had	has	have	is	will	would
Contracted	33	87	92	98	91	50
Intermediate	23	3	1	0	1	0
Full	43	10	8	2	8	50

(a) Switchboard

	had	has	have	is	will	would
Contracted	10	92	95	98	98	34
Intermediate	33	1	0	0	0	0
Full	56	7	5	2	2	66

(b) PNC

Table 3.2: Percentages accompanying the graphs in Figure 3.1.

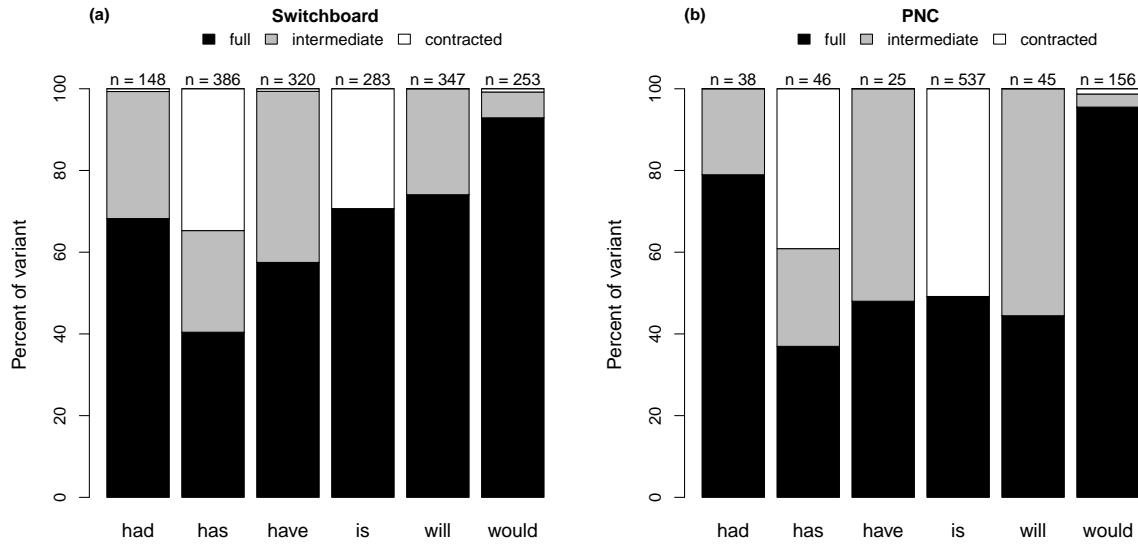


Figure 3.2: Distribution of forms after noun phrase subjects, in the Switchboard (a) and Philadelphia Neighborhood (b) corpora.

	had	has	have	is	will	would
Contracted	1	35	1	29	0	1
Intermediate	31	25	42	0	26	6
Full	68	40	57	71	74	93

(a) Switchboard

	had	has	have	is	will	would
Contracted	0	39	0	51	0	1
Intermediate	21	24	52	0	56	3
Full	79	37	48	49	44	96

(b) PNC

Table 3.3: Percentages accompanying the graphs in Figure 3.2.

3.2.4.1. Criteria for examination

Only environments that allow the full range of forms of an auxiliary to surface are included in Figures 3.1a and 3.1b. This means that:

- No auxiliary is included that follows a coordinated or embedded pronoun, environments in which a smaller range of variants is found than after lone pronouns (Section 3.2.2.7). Tokens whose subjects ended in coordinated or embedded pronouns (e.g. *my wife and I, the guy next to you*) were instead treated as full noun phrases and are hence included in the data plotted in Figures 3.2a and 3.2b.
- The collocations *it had*, *it will*, and *it would* are not included in the data plotted in Figures 3.1a or 3.1b. The full range of variants is not possible in this environment: contracted forms may not surface for phonotactic reasons.¹⁹ Realization of these three auxiliaries after *it* will be revisited in Section 4.4.
- The collocation *has got* has been omitted, as it surfaces categorically with a contracted form in these corpora.
- Other exclusions (e.g. before a gap, following a pause) were carried out as detailed in Section 3.2.2.

These decisions were made in order to prevent certain host-auxiliary combinations from biasing the results. For instance, *will* after a vowel-final pronoun subject (e.g. *he*) may surface in the full range of attested forms: contracted [l], intermediate [əl], full [wil]. On the other hand, after the pronoun *it*, the contracted form

¹⁹This glosses over the fact that *had* and *would* in fact are found to surface — on occasion — in what appears to be their contracted form after *it*, accompanied by consonant cluster simplification: so, [ɪd] for *it'd*. As an additional variable process affecting auxiliary realization, this deserves further examination (see also Labov, 1969 and Blake, 1997 for discussion of a similar process in African American English, which produces [ðæs, ɪs] for *that's, it's*). To keep things simple in the present study, though, I simply set these environments aside for the moment.

may not surface for phonotactic reasons, but the intermediate and full forms are allowed. Tokens of *will* after *it* are thus not directly comparable to tokens of *will* after vowel-final pronouns. So, to keep tokens of *it will* from artificially inflating the distribution of variants, they are not included in Figure 3.1 (though I will return to the distribution of forms of *will* after *it* in Section 3.4.2).

The criteria for which tokens to include in Figures 3.2a and 3.2b were less stringent, as follows:

- All tokens of *had*, *have*, *will*, and *would* after noun phrases were examined. Though some researchers have asserted that contracted forms of these auxiliaries are ungrammatical after noun phrases (see 2), the uncertainty regarding this context in the literature meant that no host–auxiliary combination was guaranteed to show a differing range of acceptable variants than another, and thus that all were available for study.
- Tokens of *has* and *is* were omitted after sibilant-final noun phrases. Again, this keeps from biasing the results, as this context shows a narrower range of variation than noun phrases that don't end in sibilants, with contracted forms of *is* and *has* being phonotactically illicit after sibilants. (I will return to the distribution of forms of *has* after sibilants in Section 3.4.2.)

3.2.4.2. Patterns observed in the data

Below, I enumerate a number of patterns apparent in the data presented in Figures 3.1 and 3.2. These will be revisited and accounted for in Section 3.4.

In Figures 3.1a and 3.1b:

- The auxiliaries under study differ markedly in how often they surface in their contracted form after personal pronoun subjects.
 - *Is* appears nearly categorically in its contracted form after pronouns, with only 2% of tokens surfacing as full in either corpus.
 - *Has, have, and will* form a group, with each surfacing in its contracted form at a high rate (percentages in the 90s or upper 80s) in each corpus.
 - *Had* and *would* surface the least often in their contracted forms; of the two, contracted forms of *would* are more frequent than those of *had*.

A pairwise test of proportions with the Bonferroni correction for multiple comparisons confirms that *has* and *have* do not differ from each other in rate of contracted form occurrence in either corpus ($p = 0.19$ for Switchboard; $p = 1$ for the PNC), nor do *have* and *will* ($p = 1$ for Switchboard; $p = 0.23$ for the PNC).²⁰ *Has* and *will* do not differ from each other in Switchboard ($p = 0.39$) and barely differ in the PNC ($p = 0.04$). Accordingly, these three auxiliaries were collapsed together for a mixed-effects logistic regression analysis carried out in R using the `lme4` package.²¹ Separate regressions were run on post-pronoun data from each corpus. Each regression included fixed effects of speaking rate, speaker sex, speaker date of birth, speaker level of education, subject pronoun (1st singular, 2nd singular, etc.), and auxiliary identity (with *has, have, and will* collapsed together and treated with sum contrasts) and random effects of speaker identity, following word, and speaker dialect

²⁰All p -values have been rounded to the nearest hundredth. When a value was below 0.01, $p < 0.01$ is used.

²¹Additionally, the auxiliary *is* does not differ from *will* in rate of contracted form occurrence in the PNC ($p = 1$), though the two do differ in Switchboard ($p < 0.01$). However, since *is* differs significantly from *have* and *has* in the PNC ($p < 0.01$ in both cases), the decision was made to keep *is* separate but to collapse *has, have, and will* together in the subsequent regression.

region.²² The regression confirmed that *is*, *has/have/will*, *had*, and *would* all differ from each other in rate of contracted form occurrence in each corpus (all $p < 0.01$).

- The auxiliaries also differ markedly in how often they surface in their intermediate form.
 - *Would* conspicuously does not display a single instance of an intermediate form in either corpus.
 - *Had* shows the most intermediate forms of any auxiliary.
 - *Has*, *have*, and *will* show very few intermediate forms. When considered together with *had*, these auxiliaries would seem to lend support to a claim that the more full forms an auxiliary displays, the more intermediate forms it displays. This is strikingly contradicted by *would*, however.

In Figures 3.2a and 3.2b:

- The data are clear in showing that contracted forms of *had*, *have*, *will*, and *would* are nearly categorically avoided after noun phrase subjects. This contradicts, in part, Zwicky's (1970) intuition that contracted forms of *had* and *would* are acceptable after at least some noun phrases, depending on the nature of the segment that precedes the auxiliary.²³ It also goes against the patterns found in McElhinny's (1993) data, where *will* was found to occasionally surface in its contracted form after noun phrases.

²²Much more will be said about the effects of these internal and external conditioning factors, and the reason for their inclusion, in Chapters 4 and 6. Here, they are simply included as controls.

²³Specifically, Zwicky proposes that contracted forms of *had* and *would* should be acceptable after vowel-final noun phrases; I find only 1 such token out of 86 total tokens of *had* and *would* after vowel-final noun phrases across the two corpora. After /r/, Zwicky says contracted forms of *had* and *would* are "marginal"; I find 3 such tokens out of 84 total tokens of *had* and *would* after /r/-final noun phrases.

- *Has* and *is*, the only auxiliaries which surface in their contracted form after noun phrases, do so much less frequently than they did after pronouns. This replicates the trends found in Labov, 1969 and McElhinny, 1993.
- Post-noun phrase *has* shows a similar breakdown of forms to post-pronoun *had*: both auxiliaries show all three forms under study to be well represented in those particular environments.
- Of the four auxiliaries that permit only full and intermediate forms after noun phrases — *had*, *have*, *will*, and *would* — both corpora find *would* to display the fewest intermediate forms. The lower rate of intermediate forms of *would* as compared to the other three auxiliaries is confirmed with a pairwise test of proportions with the Bonferroni correction ($p = 0.03$ for *would* vs. *had* in the PNC; all other $p < 0.01$). This low rate of intermediate form occurrence for *would* after noun phrases is parallel to the (comparatively) low rate of contracted form occurrence for *would* after pronouns.

3.3. Analysis

3.3.1. Introduction

We have now seen the phonological shapes auxiliaries may surface in, and we have an idea of their distribution after two different types of subjects. This section discusses how to incorporate these findings into an analysis of the grammatical processes underlying contraction.

As we saw in Section 2.4.2, the majority of recent analyses of contraction have treated the phenomenon as stemming from an underlying alternation between one short and one long allomorph for each contractable auxiliary. But none of this

earlier work has been sufficiently thorough where our “intermediate” forms are concerned, despite the fact that, as demonstrated in Figures 3.1 and 3.2, intermediate forms are very frequent in actual use, and surface in a number of different environments. This necessitates a new analysis of contraction, one which takes intermediate forms and, particularly, their distribution into account.

Numerous treatments of these intermediate forms are conceivable. Intermediate forms could represent the faithful surface representation of an allomorph distinct from an auxiliary’s full and its single-consonant form, meaning that surface contraction is best represented as a three-way alternation underlyingly (similar to Ogden’s (1999) proposal). Or, contraction could be underlyingly a two-way alternation, one that opposes full forms to intermediate ones, with surface contracted forms being derived from the latter (similar to Wilder’s (1997) analysis). Alternatively, it is also conceivable that surface intermediate forms could be the derivative ones, with phonological processes generating them from single-consonant short allomorphs, phonologically-intact long allomorphs, or both. For instance, a process of schwa insertion before a single-consonant short allomorph would generate an intermediate form. Likewise, a process that deleted the initial consonant of a long allomorph with a reduced vowel would also generate an intermediate form.

In the following sections, I will show that the quantitative data argues for one analysis of intermediate forms in particular: an analysis under which each auxiliary has two allomorphs underlyingly, and intermediate forms may be derived from each. Under this treatment, intermediate forms are the output of phonological processes that have operated on the allomorph inserted by the morphology; auxiliary realization is thus the output of two stages of processes. Section 3.3.2 describes this analysis in detail; Section 3.4 demonstrates how this analysis accounts for a number of distributional patterns evident in the data presented in Figures 3.1

and 3.2.

3.3.2. Overview of the analysis

As indicated, I follow previous authors in proposing an underlying alternation for each auxiliary under study, between one long and one short allomorph. Each auxiliary's long allomorph contains all segmental material; each short allomorph consists of a single consonant.²⁴ These forms are laid out in Table 3.4 for the auxiliaries under study.

	<i>had</i>	<i>has</i>	<i>have</i>	<i>is</i>	<i>will</i>	<i>would</i>
Long	/hæd/	/hæz/	/hæv/	/ɪz/	/wɪl/	/wʊd/
Short	/d/	/z/	/v/	/z/	/l/	/d/

Table 3.4: Long and short allomorphs for six auxiliaries.

This analysis implements the idea, following Kaisse, that surface contracted forms cannot be generated by phonological rules having operated on the long allomorph. In other words, surface contracted forms presume underlying insertion of a short allomorph. Conversely, I also assume that surface full forms presume underlying insertion of the long allomorph: no phonological processes add material to a short allomorph to generate a surface full form.

To see how intermediate forms emerge from this analysis, the first step is to refer back to their distribution in the surface data. A close inspection of Figures 3.1 and 3.2 reveals that not every host/auxiliary combination permits intermediate forms to surface. Descriptively, intermediate forms are found:

- As forms of *had* (and, to a much lesser extent, *has*, *have*, and *will*) after vowel-final pronouns.

²⁴This is not the only way of representing the short allomorph; see Section 3.3.3.1 for discussion.

- As forms of all auxiliaries (except for *is*, which has no intermediate form) after noun phrases.

These environments can be sorted into two categories, as follows:

- (59) Intermediate forms that surface where contracted forms **are also** possible:
- Pronoun + *had*: intermediate *he* [əd] surfaces alongside contracted *he'd* [hid]
 - Noun phrase + *has*: intermediate *Sue* [əz] surfaces alongside contracted *Sue's* [suz]
- (60) Intermediate forms that surface where contracted forms **are not** possible...
...for reasons of phonotactics, seen previously in 11:
- Consonant-final pronoun + *had/will/would*: intermediate *it* [əd]/[əl] has no contracted counterpart *it'd/it'll* *[itd]/*[itl]
 - Consonant-final noun phrase + *had/will/would*: intermediate *Pat* [əd] / [əl] has no contracted counterpart *Pat'd/Pat'll* *[pætd]/*[pætl]
 - Consonant-final noun phrase + *have*: intermediate *children* [əv] has no contracted counterpart *children've* *['tʃɪldrɪnv]
- ...for reasons other than phonotactics, seen previously in 12:
- Vowel-final noun phrase + *had/have/would/will*: intermediate *Sue* [əd] / [əl] or *three* [əv] has no contracted counterpart *Sue'd/Sue'll* *[sud] / *[sul] or *three've* *[θriv]

In Sections 3.3.3 and 3.3.4 I lay out an analysis under which intermediate forms in 59-type environments are of a different source than intermediate forms in 60-type environments. Specifically, those in 60 come from the insertion of a short allomorph that fails to syllabify with its host, while those in 59 do not have their

source in short allomorphs at all: they are long allomorphs that have lost their initial consonant. Section 3.3.3 describes in more detail intermediate forms of the 60 type, and Section 3.3.4 intermediate forms of the 59 type.

Under this analysis, intermediate forms constitute a hybrid category, with surface intermediate forms derived from each of the two underlying allomorphs. This differentiates intermediate forms from the other attested surface forms: surface contracted forms come only from short allomorphs; surface full forms come only from long allomorphs. I demonstrate in Section 3.4 that the hybrid analysis of intermediate forms accounts for the quantitative facts in a way that models that attribute intermediate forms to one allomorph only cannot.

3.3.3. Intermediate forms from underlyingly short allomorphs

An important point to recognize in our analysis of intermediate forms is that an auxiliary's failure to surface in its contracted form in a particular environment does not imply that its short allomorph was not inserted. In other words, presence of a contracted form on the surface implies insertion of a short allomorph, but not the other way around: insertion of a short allomorph does not imply presence of a surface contracted form. This is because phonological processes may operate subsequent to the insertion of the short allomorph, thereby changing its surface form.

Specifically, I propose, extending an idea from Ogden (1999), that a process of Schwa Epenthesis is operative whenever a short form is inserted that cannot syllabify with its host. This then results in that short allomorph surfacing as an intermediate form. Short allomorphs of auxiliaries are thus parallel in their behavior to the English regular present and past tense suffixes, traditionally analyzed as single-consonant /-z/ and /-d/, respectively (Anderson, 1973; Pinker and Prince,

1988; Yip, 1988; Fromkin, 2000; Benus et al., 2004; Baković, 2005). After sibilants and alveolar stops, respectively, these suffixes cannot surface as-is, and so the single consonant gains a preceding epenthetic schwa which allows it to surface (giving, e.g., plural *church*[əz] and past tense *patt*[əd]). When we see intermediate forms where contracted forms are not phonotactically licit, then, we are seeing a short allomorph which has been phonologically altered, via Schwa Epenthesis, to surface as an intermediate form.

Taking this a step further, this analysis can be extended to other instances in which contracted forms fail to surface, even when phonotactics are not the cause. Forms like *three* [əv] and *Sue* [əl], which have no counterparts *[θriv] and *[sul], may again be the result of a contracted form failing to syllabify with its host, with a [ə] repair. An obvious question here is why the short allomorph should fail to surface in its contracted form in these cases where the contracted form should be phonotactically acceptable. It may be related to the similar failure of contracted forms to surface after conjoined and embedded pronouns (11): *John and I've* (*[v]) *got it* and *The guy next to you'll* (*[l]) *speak first* are both illicit with a contracted form, but acceptable with an intermediate form instead (13).²⁵ For instance, under a treatment of morphology that incorporates cyclic Spell-Out (Embick, 2010), it could be proposed that a short allomorph must be spelled out in the same cycle as its host in order to surface as a contracted form. Pronouns and short allomorphs would be spelled out in the same cycle, but full noun phrases — including those that contain embedded pronouns — would be spelled out in a separate cycle from the auxiliary that follows them, such that host and short allomorph would not be spelled out in the same cycle. This would prohibit the auxiliary from surfacing in

²⁵This fact constitutes important evidence that contraction is sensitive to syntactic structure: the range of phonological forms after embedded pronouns is restricted in a way that it isn't after non-embedded pronouns. Contraction is thus affected by more than just surface strings.

its contracted form, and this failure to syllabify would require Schwa Epenthesis as a repair.²⁶

In sum, there are certain environments in which contracted forms are not acceptable, but intermediate forms are, and I propose that the two share a single underlying source. Intermediate forms surface when short allomorphs cannot surface as-is; i.e., as a single consonant. It is important to note that this holds only for “left-side” environments. In “right-side” environments, e.g., before gaps, we do not see intermediate forms (61), even though contracted forms may not surface either.

(61) No intermediate forms before gaps

- a. I think they [wil] (*[əl]) (*[l]) __ as long as they can. (sw2250: sw_1133)
- b. If women’s roles change drastically, men’s roles [wil] (*[əl]) __ too.
(sw2370: sw_1138)

My analysis of this is that short allomorphs simply are not inserted before gaps: there is no variable allomorph selection there. This explains the failure of **any** reduced form to surface. After noun phrases and other subjects, by contrast, short allomorphs **may** be inserted. There are simply restrictions on their syllabification, hence the lack of contracted but attestation of intermediate forms.

3.3.3.1. Excursus: A note on the syllabicity of short allomorphs

In Table 3.4 I proposed that the surface alternation in auxiliary form was attributable to underlying variation between one allomorph with all its segmental ma-

²⁶Something would obviously need to be different for *is* and *has*, which **may** surface after noun phrases and embedded pronouns. Perhaps the fact that /s/ is phonotactically special elsewhere in English — attaching to large consonant clusters, for instance (e.g. *sixths*) — and attaches as a number of other morphemes (the plural, the genitive, the third singular present...) means that /s/ can still syllabify with its host even when the two aren’t spelled out in the same cycle.

terial intact and one allomorph consisting only of a single consonant. This thus gives us the formation of intermediate forms via Schwa Epenthesis that we just discussed. But this short allomorph could conceivably be a syllabic consonant — i.e., one with the schwa already underlying — rather than a single consonant. Under this alternative analysis, it would be surface **intermediate** forms that are the faithful representation of the short allomorph, rather than surface contracted forms. This analysis does have as a precursor a few researchers' approaches to the single consonant–syllabic consonant alternation in English past and present morphology. Bloomfield (1933) and Borowsky (1986, 1987) treat present -es and past -ed as syllabic underlyingly — as /-əz/ and /-əd/ — with a deletion process operating to remove the schwa where applicable (though this is, again, not the majority approach to these alternations).

Where contraction is concerned, neither of these two possible approaches stands out as being obviously preferable. The single-consonant analysis (the one presented in Table 3.4) has the disadvantage that the environment for Schwa Epenthesis is somewhat unnatural. Schwa Epenthesis does not apply only where it is required phonotactically; it also applies after vowel-final noun phrases (e.g. *Sue* [əl]), an environment in which single-consonant forms should be phonotactically licit. There is no obvious phonological motivation for this. On the other hand, the syllabic consonant analysis requires a process of schwa-**deletion** after pronouns, for which there is likewise no phonological motivation. After all, forms in which the schwa remains, e.g. *he* [əz], may, as demonstrated in Figure 3.1, coexist alongside forms with no schwa separating them (e.g. [hiz]), raising the question of when and why schwa would delete. A syllabic-consonant analysis would also require us to propose syllabic consonants (or consonants preceded by schwa) underlyingly, which violates a traditional tenet of generative phonology that predictable material

be derivable by rule. In most environments in English, syllabic consonants *are* predictable; they occur when resonants follow consonants with which they may not syllabify. Chomsky and Halle (1968) set up a rule of sonorant syllabification to this effect to account for the alternation in forms such as *remember* ~ *remembrance*, *hinder* ~ *hindrance*, *disaster* ~ *disastrous*, etc. On the other hand, maybe the distribution of syllabic consonants in English is **not** entirely predictable by rule, given, again, the fact that they appear in forms of auxiliaries after vowel-final noun phrases where they could in principle surface without schwa. In essence, purely theory-based reasoning about whether these allomorphs are syllabic or non-syllabic does not seem to get us very far: there is a case to be made for each side.

Stepping into the empirical domain, there is a small body of literature on the gestural realization of schwa in English that has the potential to shed light on this question. Smorodinsky (2002) and Benus et al. (2004) examine whether the schwa at the end of a word like *Anita*, where it is presumed to be underlying (or, at least, derived by a feature-changing rule from a vowel of some other quality which is present underlyingly), differs acoustically from the schwa in a word like *needed*, where it is presumably epenthesized (under the analysis of Anderson (1973) and the others cited above). The hypothesis under examination is that epenthetic schwas, having no gestural target, will be more similar in tongue position to the vowels surrounding them than will underlying schwas, which have actual gestural targets. If a reliable difference between epenthetic and underlying schwas could be observed, we could then see which one intermediate forms of post-noun phrase auxiliaries more closely resemble, and hence have evidence for whether short allomorphs are underlyingly syllabic or not.

However, in order to investigate the question of schwa gestural realization, the above-cited researchers have gone to great lengths to devise minimal pairs that

differ in whether their schwa is epenthesized or underlying. This means conclusions end up being drawn from subjects' readings of stimuli such as *If needed even once* (epenthesized) vs. *If Needa'd even known* (underlying) or *He banded Asty's arm* (epenthesized) vs. *The panda'd asked for more* (underlying). But in order for these stimuli to be legitimate minimal pairs, they require that speakers closely attach a contracted /d/ to a vowel-final noun phrase. And as we have already seen (Figure 3.2; fn. 23), this simply does not happen in spontaneous speech. Speakers produce forms like *Needa'd* and *panda'd* with two distinct schwas separating the /d/s: these forms are trisyllabic, not disyllabic. The experimental stimuli are thus problematic. Let's put this aside and take Benus et al.'s results at face value for a moment, though: they do end up finding (via electromagnetic midsagittal articulometer measurement) that the tongue position for epenthetic schwa is more dependent on that of the surrounding vowels than is the tongue position for lexical schwa, which would seem to confirm the existence of a gestural difference between the two. It might be beneficial to replicate this experiment with the underlying schwa coming from the determiner *a* (e.g. *I need a deal*) rather than from a vowel-final noun phrase followed by an alleged contracted form. The gestural configuration of this underlying schwa could then be compared more accurately to that of the presumed epenthesized schwa in forms such as *needed*, and that of the schwa in an intermediate auxiliary form such as *meat* [əd].

At any rate, the take-home point of this section is that there are some surface intermediate forms that are in clear complementary distribution with contracted forms in certain environments. Attributing the two to the same underlying source is thus a logical approach, and, as we will see in the following sections, successfully explains certain patterns in the quantitative data that would be otherwise mysterious. Whether that underlying source is itself syllabic or not is a question

that requires future research, but, I believe, is not one that has any direct bearing on the analysis presented here. The distribution of auxiliary forms in quantitative data can be accounted for either with a syllabic or a non-syllabic short allomorph. For ease of exposition, in the sections to follow I will assume an underlying non-syllabic (i.e., single-consonant) allomorph, and assume that a process of Schwa Epenthesis turns it into an intermediate form when it cannot surface as-is.

3.3.4. Intermediate forms from underlyingly long allomorphs

The previous section argued that intermediate forms in environments in which a contracted form is illicit could still be traced to an underlyingly short allomorph. This was used to account for intermediate forms of the 60 type. But 59-type intermediate forms are attested as well, surfacing alongside contracted forms.

One possible explanation for 59-type intermediate forms is that they are of the same source as 60-type forms: a short allomorph has been inserted, and a schwa has been epenthesized. There is no obvious reason why Schwa Epenthesis would occur in this type of environment, though, because contracted forms are able to surface here. It is this coexistence of contracted and intermediate forms that differentiates environments of the 59 type from those of the 60 type. In principle, one way to account for this coexistence would be to propose that Schwa Epenthesis applies variably in 59-type environments, but the quantitative data discussed in Section 3.4 will provide strong evidence that these intermediate forms should not be treated as short allomorphs with Schwa Epenthesis.

Instead, these intermediate forms should be treated as underlying long allomorphs which have undergone phonological processes that have reduced them such that they are phonologically similar to intermediate forms derived from a short allomorph plus Schwa Epenthesis. What processes could generate interme-

diate forms from long allomorphs? We need one process to reduce a long allomorph's vowel to schwa, and another to delete its initial consonant. As mentioned in Chapter 2, both such processes are in fact independently attested in English, and both are presented in Kaisse's (1985) discussion of fast speech rules. The first, Kaisse's Vowel Reduction, affects unstressed syllables and applies commonly to function words; the second is manifested in Kaisse's process of /h/ Deletion, which deletes /h/ when it begins unstressed syllables, applying, again, to pronouns and function words (e.g. *his, herself*) in conversational speech.²⁷ This set of phonological processes thus gives us another way of deriving intermediate forms, this time from long allomorphs of /h/-initial auxiliaries.

A crucial component of this analysis, first put forward by Kaisse (1985) and corroborated by the quantitative data presented in Section 3.4, is that there is no process that deletes initial /w/ in a fashion analogous to /h/ Deletion. Intermediate forms of the /w/-initial auxiliaries *will* and *would* must have their source only in Schwa Epenthesis on short allomorphs: they are 60-type only. Where the long allomorph of these auxiliaries is inserted, I assume, it surfaces as-is. Evidence supporting this hypothesis will be provided in Sections 3.4.1 and 3.4.3.²⁸

One final point. Recall, again, that intermediate forms of auxiliaries are not attested before gaps. This was exemplified in 61 with *will*, but also holds for other

²⁷/h/ Deletion also shows up in certain alternations in English: for instance, *ve[Ø]jicle* ~ *ve[h]icular*. I assume that this is a lexicalized instance of the same process. Note also that deletion of /h/ is more widespread in other dialects of English, affecting lexical as well as functional items (see, e.g., Trudgill, 1974 for British; Bell and Holmes, 1992 for New Zealand). All data in the present study comes from speakers of American English, but the reliance of the analysis proposed here on a stage of /h/ Deletion means that auxiliary realization in one of these /h/-deleting dialects would be an interesting topic for future study.

²⁸There really does seem to be no evidence for fast-speech /w/-deletion based on the data in Figure 3.1: we would expect at least one token of intermediate [əd] for *would* if this were the case, yet neither my research assistants nor I ever heard one. However, I am not convinced that /w/-deletion does not exist at all in fast speech in English; in my personal experience, I have heard tokens of the new verb of quotation (*I was like*) that have been pronounced such that the /w/ is essentially inaudible. This is an important area for future work.

auxiliaries (62).

- (62) I couldn't believe they'd given him a contract like they [hæd] (*[əd]) (*[d])
—.

This seems to contradict the present proposal that intermediate forms of /h/-initial auxiliaries may owe their source to long allomorphs. Where long allomorphs may be inserted, we should expect to see both full and intermediate forms, but that is not borne out before gaps where only the former may surface. I do not think this invalidates the present proposal, though. Various processes of phonological reduction appear to be blocked before gaps: for instance, vowel reduction to schwa. If, say, vowel reduction is a precursor to /h/ Deletion, /h/ Deletion would be blocked before gaps, meaning that intermediate forms could not be derived. In essence, then, the fact that we do not see intermediate forms before gaps doesn't necessarily mean that long allomorphs aren't inserted there. They may be inserted, only to have to surface as-is due to other constraints.

3.3.5. Summary

The proposal developed here posits two sources of surface intermediate forms: fast speech /h/ Deletion on long allomorphs, and Schwa Epenthesis on short allomorphs. This analysis of intermediate forms maintains an underlying bipartite distinction between long and short allomorphs, despite there being a tripartite distinction in phonological shape on the surface. It does so by making reference to two stages of processes: the first, the alternation in the morphology; the second, a set of phonetic and phonological processes that act on the allomorph inserted at the first stage. Tables 3.5 and 3.6 summarize the source of each auxiliary's surface

forms after pronoun and noun phrase subjects, respectively.²⁹

	<i>is</i>	<i>has</i>	<i>have</i>	<i>had</i>	<i>will</i>	<i>would</i>
Underlying short allomorph surfaces as:	contracted					
Underlying long allomorph surfaces as:	full		full & interm. (from /h/ Del.)		full	

Table 3.5: Sources of surface forms after personal pronoun subjects as detailed in Section 3.2.4.1.

	<i>is</i>	<i>has</i>	<i>have</i>	<i>had</i>	<i>will</i>	<i>would</i>	
Underlying short allomorph surfaces as:	contracted	intermediate (from Schwa Epenthesis)					
Underlying long allomorph surfaces as:	full		full & interm. (from /h/ Del.)		full		

Table 3.6: Sources of surface forms after noun phrase subjects.

Note that, after noun phrase subjects (Table 3.6), intermediate forms of *have* and *had* can come from both Schwa Epenthesis on short allomorphs and /h/ Deletion on long allomorphs. In other words, they are of ambiguous origin. This fact will come into play when we examine the effects of subject length in Section 3.4.3.

3.4. Evidence supporting the analysis

The analysis detailed in the previous section explains a number of facts concerning the distribution of forms in Figures 3.1 and 3.2, many of which were laid out in the

²⁹Table 3.5 allows no way of generating intermediate forms of *will* after vowel-final pronouns, yet Figure 3.1a reveals that this combination does occur in Switchboard, although extremely infrequently: the precise count is 3 out of 426 times. Of these three tokens, one sounds slightly as if there may be something [w]-like; this requires closer acoustic inspection. The other two are uttered with some hesitation; it may be that the speaker is drawing out the form so that it sounds like two syllables. No intermediate forms of *will* were found after vowel-final pronouns in the Philadelphia Neighborhood Corpus (N = 539).

bullet points in Section 3.2.4.2. In this section, I go through them one by one and identify the aspects of the present analysis that account for them.

The findings presented in Sections 3.4.1 and 3.4.2 are attested in both Switchboard and the PNC; accordingly, data from both are presented here. However, due to the infrequent occurrence of several auxiliaries with noun phrase subjects in the PNC (as evidenced by the low token counts in Figures 3.2a and 3.2b), not enough data is available to permit PNC replication of the findings presented in Section 3.4.3.

3.4.1. Intermediate forms after pronouns

There are two relevant findings concerning the distribution of intermediate forms after pronouns that are explained by the current analysis.

- The more full forms an /h/-initial auxiliary displays, the more intermediate forms it displays, with *had* displaying the most full and intermediate forms, and *have* and *has* markedly fewer full and intermediate forms. This follows naturally under the current analysis, under which intermediate forms of /h/-initial auxiliaries after pronouns are derived exclusively from /h/ Deletion on the long allomorph (Table 3.5). The more long allomorphs have been inserted, the more intermediate forms there will be.
- *Would* conspicuously displays no intermediate forms after vowel-final pronouns, and the same is effectively true for *will*, with the exception of three tokens (addressed in footnote 29). This follows naturally from the fact that there is no process that would generate intermediate forms of /w/-initial auxiliaries after a vowel-final pronoun (Table 3.5). Short allomorphs of *will* and *would* after vowel-final pronouns surface as contracted forms with no

need for Schwa Epenthesis. Long allomorphs of *will* and *would* will surface as full forms, with no process of /w/-deletion attested that would remove their initial consonant and cause them to surface as intermediate forms.³⁰

3.4.2. Rates of occurrence of forms

Certain parallels in the rates of occurrence of forms are also explained under the present analysis.

- After vowel-final pronouns (Figure 3.1), *would* surfaces in its contracted form at a much lower rate than all other auxiliaries except *had*.³¹ This low rate of contracted forms of *would* is echoed after noun phrases, where *would* surfaces in its intermediate form at a very low rate compared to *had*, *have*, and *will* (the other auxiliaries that alternate only between full and intermediate forms after noun phrases).³² The present analysis, which treats post-pronoun contracted forms of *would* as underlyingly the same as post-NP intermediate forms of *would*, can account for this parallelism. All that is required is a general dispreference for short allomorphs of this auxiliary, and each surface form will appear at a low rate as expected.

³⁰One alternative explanation that could be put forth to account for the lack of intermediate forms of *would* is one that implicates homophony avoidance: intermediate forms of *would* are disfavored because they would be homophonous with intermediate forms of *had*. But this is contradicted by the fact that homophonous **contracted** forms of the two do nonetheless surface (e.g. *he'd*). See Section 4.8.3 for more on the potential effects of homophony on contraction of *had* and *would*.

³¹This is confirmed by by-corpus regressions as detailed in Section 3.2.4.2. With rate of contracted form appearance as the dependent variable and *would* as the reference level for the factor AUXILIARY IDENTITY, positive coefficients are returned for AUX = *has*, *have*, *is*, and *will* and negative coefficients for AUX = *had* ($p < 0.01$ in all cases.)

³²This is confirmed by by-corpus regressions with fixed effects of speaking rate, subject length in words, preceding consonant vs. vowel, auxiliary identity, and the demographic factors enumerated in Section 3.2.4.2, and random effects of speaker identity, preceding word, following word, and speaker dialect region. With rate of intermediate form occurrence as the dependent variable and *would* as the reference level for the factor AUXILIARY IDENTITY, positive coefficients are returned for AUX = *had*, *have*, and *will* ($p < 0.01$ in all cases.)

- Along the same lines, another auxiliary that appears in its contracted form at a particularly low rate after pronoun subjects is *had*. By the same reasoning as was employed for *would* — i.e., that the relative rate of use of an allomorph will be consistent regardless of the nature of its host and hence regardless of its surface form — we would expect intermediate forms of *had* after noun phrases to surface at a comparably low rate. The rate of intermediate forms of *had* after noun phrases in fact does not appear as low as expected, particularly when compared with that of *would*. However, if we take into account the fact that intermediate forms of *had* have an additional source — namely, /h/ Deletion applying to the long allomorph (Table 3.6) — we can account for the unexpectedly high number of intermediate forms of post-NP *had*. Some are the short allomorph, having been inserted at a low rate, as it was after pronouns, and gaining a vowel through Schwa Epenthesis; others are the long allomorph, having lost its initial consonant to surface as a homophonous intermediate form. The relative rate of intermediate form occurrence for post-NP *had* is thus in keeping with there being two derivational sources of this form.
- The distribution of forms of *had* after pronouns is quite comparable to the distribution of forms of *has* after noun phrases. Namely, each surfaces with full forms appearing at roughly 1.5 times the rate of intermediate forms. In each case, intermediate forms are hypothesized to be the output of /h/ Deletion on the long allomorph. Conversely, full forms are hypothesized to be the long allomorph having not undergone /h/ Deletion (the process being variable). If /h/ Deletion is indeed a low-level fast speech process (Kaisse, 1985), we would expect it to apply at a consistent rate irrespective of an auxiliary's identity. The comparable rates of intermediate form appearance — i.e. of

/h/ Deletion application — across these two different environments support this. In neither corpus is the ratio of full to intermediate forms found to be significantly different between post-pronoun *had* and post-NP *has* (Switchboard: $\chi^2 = 0.47, p = 0.49$; PNC: $\chi^2 = 0.04, p = 0.85$), as we would expect if a process of /h/ Deletion were applying at a consistent rate in each context to generate those intermediate forms.³³

Under the present analysis, intermediate forms surface where contracted forms would fail for phonotactic reasons. Furthermore, if intermediate forms are simply the phonological exponent of short allomorphs, then, if two hosts are equivalent in all but their final consonant, we should expect a short allomorph to be inserted at the same rate after each of them, with those short allomorphs being realized as intermediate forms in the case where they cannot surface as contracted and as contracted in the other environment. Put simply, intermediate and contracted forms should be in complementary distribution, surfacing at the same rate, when two hosts differ only in their phonology. Tests of this proposal are discussed below.

- The short allomorph of *will*, /ɪ/, can surface with no phonological modification (i.e., as the contracted form) after vowel-final pronouns, but after the consonant-final pronoun *it*, the short allomorph would be phonotactically illicit in its contracted form. If Schwa Epenthesis is indeed a way of resolving this phonotactic incompatibility, we should expect to see intermediate forms of *will* appearing after *it* at a comparable rate to contracted forms of *will* after vowel-final personal pronouns (*he*, *she*, *I*, etc.). This is borne out in both corpora, as shown in Figures 3.3a and 3.3b: contracted forms of *will* are

³³Naturally, another interesting avenue for future study will be obtaining a value for the rate of natural-speech /h/ Deletion occurrence in other environments: so, for instance, on the pronoun *he* or the main verb *have*. All other things being equal, /h/ Deletion should occur at the same rate regardless of lexical item. Section 7.4.1 provides some preliminary results to this effect.

prevalent after vowel-final pronouns; after *it*, it is intermediate forms that are prevalent.³⁴

- The short allomorph of *has*, /z/, can surface as the contracted form after all noun phrases except those that end in a sibilant. After a sibilant, only two realizations of *has* are acceptable: the intermediate form and the full form. The full form, under the present analysis, is the faithful surface reflex of the long allomorph, while the post-sibilant intermediate form has two possible sources: the short allomorph, having gained a vowel via Schwa Epenthesis in order to surface, and the long allomorph, having lost its initial consonant via /h/ Deletion. Once again, all other things being equal, we expect the short allomorph to be inserted at the same rate in each environment: that is, after sibilant-final noun phrases as well as after noun phrases that end in other segments that do not necessitate Schwa Epenthesis. Likewise, /h/ Deletion, as a low-level phonetic process, is predicted to apply at the same rate in each environment. From this follows the prediction that, for *has*, the rate of intermediate forms after sibilant-final noun phrases will equal the rate of intermediate forms plus the rate of contracted forms after non-sibilant-final noun phrases. This is clearly borne out in Figure 3.4 ($\chi^2 = 0.08, p = 0.77$). (There is not enough data to permit replication of this finding in the PNC.)

³⁴In Switchboard, the ratio of full forms to contracted forms after vowel-final pronouns nonetheless differs significantly from the ratio of full forms to intermediate forms after *it*: $\chi = 7.95, p < 0.01$. As will be discussed in Chapter 4, there seems to be an additional factor suppressing short allomorph selection where it cannot attach closely to a pronoun host: when *will* and *would* combine with *it*, the short allomorph is dispreferred compared to when they combine with vowel-final pronouns. But similar, if not identical, ratios of long to short allomorphs are undeniably in evidence after the two types of pronouns.

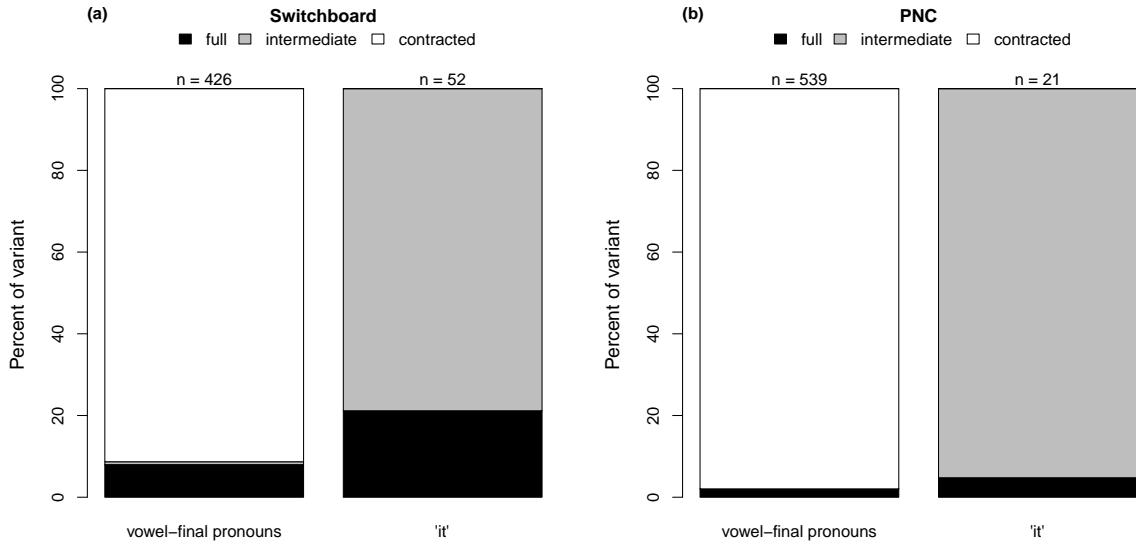


Figure 3.3: Distribution of forms of *will* after pronoun subjects, in the Switchboard (a) and Philadelphia Neighborhood (b) corpora.

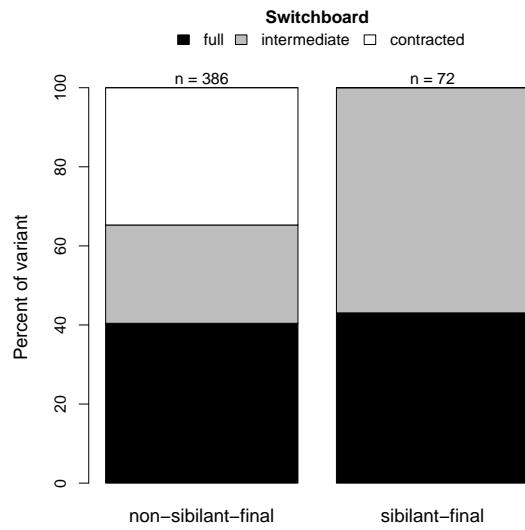


Figure 3.4: Distribution of forms of *has* after noun phrase subjects in the Switchboard corpus.

3.4.3. Patterning of forms by length of NP subject

Additional support for the analysis presented here comes from the distribution of forms after subjects of varying length. The hypothesis under examination is that an auxiliary's short allomorph is less likely after longer subjects. (Evidence that this hypothesis is on the right track comes from the clear difference in short allomorph selection rate between pronoun and noun phrase subjects, found in this study as well as many others, beginning with Labov (1969).) Since, however, we cannot directly see the rate of selection of the short allomorph, we have to extrapolate it from the rate of occurrence of the corresponding surface forms. This can be done by way of the correspondences laid out in Table 3.6.

This investigation was carried out only for the auxiliaries *has*, *have*, *is*, and *will*. The remaining two auxiliaries, *had* and *would*, surface at such a high rate of full forms — i.e., the long allomorph — that there are not enough tokens of the short allomorph to merit study.

Figure 3.5 opposes, for each of these four auxiliaries, the hypothesized surface manifestation of its full form to the hypothesized surface manifestation of its contracted form. Each data point represents a single token, coded for the number of orthographic words in its subject. We begin with *is*, for which underlying short allomorphs are hypothesized to surface as contracted forms. The plot demonstrates a clear effect of subject length on selection of short allomorphs for this auxiliary: as subjects increase in length, contracted forms taper off. The effect of subject number of words is found significant by a mixed-effects logistic regression analysis incorporating the factors enumerated in fn. 32 ($\beta = -0.53$, $p < 0.01$). (Henceforth, all p -values are from such regressions, restricted to data from the auxiliary in question.)

In the case of *has*, contracted forms are opposed to full and intermediate forms,

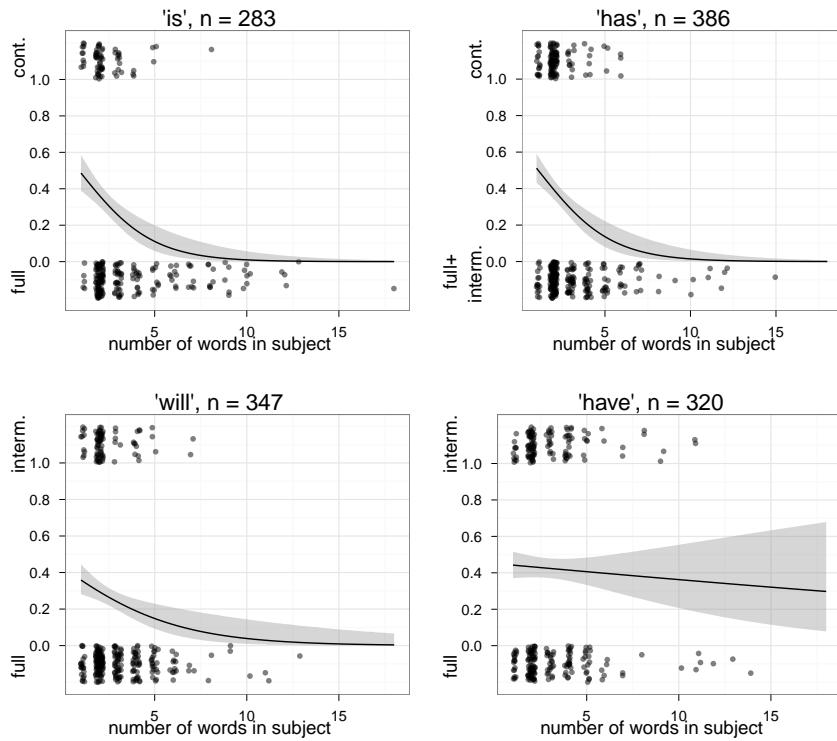


Figure 3.5: Distribution of surface forms of four auxiliaries after noun phrase subjects. Each point represents one token, coded for phonological shape (“cont.” = contracted, “interm.” = intermediate) and number of words in its subject. Smoothing line fit via GLM. Values on the y-axis represent the fitted proportion of contraction for a given subject length. The choice of which forms are opposed to which differs by auxiliary for reasons explained in the text (Section 3.3.5).

as intermediate forms are by hypothesis underlyingly the long allomorph which has undergone /h/ Deletion, and as such, should be grouped with full forms, faithful reflexes of the long allomorph. A pattern identical to that observed for *is* surfaces: contracted forms taper off with subjects of increasing length ($\beta = -0.59, p < 0.01$).

This same effect is also in evidence for *will*, where intermediate forms have been opposed to full forms, under the analysis that underlyingly short allomorphs of *will* cannot surface as single consonants after noun phrases, and so surface as

intermediate forms instead ($\beta = -0.4$, $p < 0.01$).

However, the plot for *have*, in which intermediate forms have again been opposed to full, is a clear outlier in this set of four, with no tapering off of intermediate forms as subject length increases ($\beta = -0.08$, $p = 0.21$). But this is actually expected under the current analysis, which attributes intermediate forms of *have* to **two** sources. As shown in Table 3.6, the short allomorph of *have* surfaces as intermediate after noun phrases; additionally, the long allomorph of *have* may also surface as intermediate, as its surface reflex is subject to /h/ Deletion. Intermediate forms of *have* are thus of ambiguous origin, and there is no way to separate their two sources on the surface. As a result, they fail to show the same subject length effect, with a number of them — by hypothesis, those that were full underlyingly — continuing to surface after long subjects. This plot, then, can be taken as clear evidence of a fundamental difference between intermediate forms of *have* and those of *will*.

Another finding that can be gleaned from Figure 3.5 is that speakers' use of /h/ Deletion does not taper off with increasing subject length: those intermediate forms of *have* that surface after long subjects are hypothesized to come from /h/ Deletion, meaning that it must still be operative. This hypothesis is corroborated by the patterning of full and intermediate forms of post-noun phrase *has*, plotted in Figure 3.6. By hypothesis, intermediate forms of *has* after noun phrases are (exclusively) the long allomorph having undergone /h/ Deletion. If /h/ Deletion is not disfavored with increasing subject length, there should be no evidence of intermediate forms of *has* tapering off as subject length increases, and Figure 3.6 confirms this ($\beta = 0$, $p = 0.98$). Again, this is in keeping with Kaisse's characterization of /h/ Deletion as a fast speech process: we would expect it to be local in its conditioning, and an effect of subject length would be surprising.

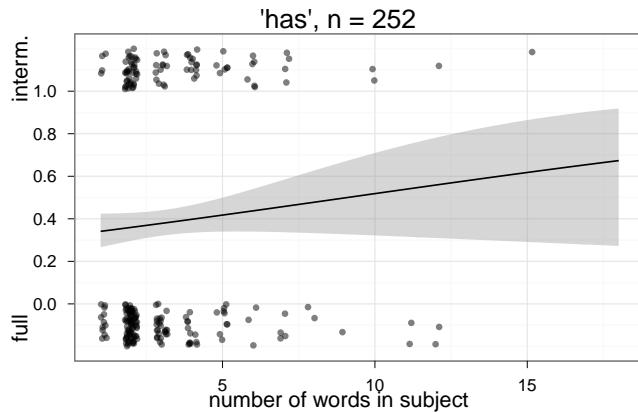


Figure 3.6: Distribution of full and intermediate forms of *has* after noun phrase subjects.

Finally, the different patterns displayed by intermediate forms of *will* and those of *have* offer confirmation that no fast-speech rule of /w/-deletion exists to turn full forms of *will* into intermediate ones. If intermediate forms of *will* came from two sources, we should see them patterning like those of *have*. The fact that they do not, and that they pattern precisely like contracted forms of *is* and *has*, is evidence that those three surface forms that show an effect of subject length have a shared underlying source.

The diagnostics discussed in this section point to two important conclusions. The first is that the patterning of the various phonological forms of auxiliaries can only be sufficiently explained by making reference to two stages of processes affecting auxiliary shape: an alternation in the morphology followed by rules of the phonology and phonetics.³⁵ I will return to this point in more detail in Chapter 7. The second, more general point, is that simple introspection about which variants

³⁵In principle, these lower-level processes could be approached from a constraint-based (e.g. Optimality Theory), rather than an ordered rule, perspective; I remain agnostic on the rules vs. constraints issue here.

are and are not possible in which environments does not give us the whole picture of a variable phenomenon. It is only by considering quantitative data that we see that, for instance, intermediate forms of *have* pattern differently after noun phrases than do intermediate forms of *will*. Moreover, it is only with an informed theory of the processes that affect auxiliary realization that we can make sense of this result. I have thus shown that theory can be crucial for the interpretation of quantitative data, but also that quantitative data is essential for a thorough theoretical account.

The finding that subject length plays a strong role in conditioning contraction is also in itself inherently interesting. This topic is the subject of Chapter 5. In that chapter, I examine numerous possible metrics of subject length to determine which one best explains the patterns in the data, and I discuss the implications of the subject length finding for a model of how contraction — and variable phenomena more generally — are represented in speakers' linguistic systems.

3.5. Alternative analyses

In Section 3.3, I laid out an analysis under which auxiliary realization is shaped by two stages of processes. The first is an alternation in the morphology by which a short form of each auxiliary alternates with a longer one. The second is a set of phonological processes that operate on those inserted forms, turning long and short allomorphs into intermediate forms in some cases. In this section I consider alternatives to this analysis, and present arguments to show that they fail to provide sufficient explanation of the quantitative findings.

3.5.1. Alternative analysis: one underlying form per auxiliary

One conceivable alternative analysis is that each auxiliary is represented underlyingly by one form only, rather than an alternation between two forms. This would effectively reduce contraction to a cascade of phonological rules (initial consonant deletion, vowel deletion) deriving single-consonant forms from forms with all segmental material intact, and is thus not ideal for the reasons that were laid out in Chapter 2: namely, the specificity of phonological rules required. But the quantitative data presented here provide additional arguments against such an analysis. For one, the finding that *will* and *would* fail to surface in their intermediate form after pronouns but do so after noun phrases would require complicated entailments to be set up between the required rules: for instance, when initial consonant deletion applies to post-pronoun *would*, vowel deletion must categorically apply afterward (to account for the nonexistence of intermediate forms of *would* after pronouns, Figure 3.1), but when initial consonant deletion applies to post-noun phrase *would*, vowel deletion must never apply afterward (to account for the lack of contracted forms in this environment, Figure 3.2). The subject length facts illustrated in Figure 3.5 are also less amenable to a phonological analysis, as they require the length effect to be localized in two places — in vowel deletion (to account for the patterns displayed by *is* and *has*) as well as in /w/-deletion (to account for the patterns displayed by *will*) — rather than simply in the selection of the short allomorph, as in the analysis given in Section 3.3.2.

3.5.2. Alternative analysis: three underlying forms per auxiliary

An additional alternative analysis is effectively the opposite of the one given in Section 3.5.1, and is reminiscent of that of Ogden (1999). Rather than the three at-

tested surface forms being derived from one form stored in memory, this analysis would propose three distinct forms stored in memory: one each for the surface full, intermediate, and contracted form of each auxiliary, as attested in the data. Under this analysis, the differential behavior of intermediate forms when conditioned by subject length (Figure 3.5) becomes an accident: there is no explanation for why intermediate forms of *will* pattern differently from those of *have*. Under the analysis of Section 3.3.2, which allows for two ways of deriving intermediate forms, this finding has a principled explanation. The distribution of intermediate forms given in Figures 3.3 and 3.4 also loses meaning under a three-form model, which has no explanation for why intermediate forms and contracted forms surface in complementary distribution, with intermediate forms appearing where contracted forms are illicit. Deriving intermediate and contracted forms from the same source — the short allomorph — in this case again eliminates the accidental nature of this finding.

3.5.3. Alternative analysis: two underlying forms per auxiliary; intermediate forms from only one

A final alternative analysis is the “non-hybrid” version of the one put forth here. Specifically, this would treat each auxiliary as displaying a bipartite alternation underlyingly between short and long allomorphs, but would derive intermediate forms from only one of those allomorphs. Again, this fails to provide a coherent explanation of the subject length facts presented in Section 3.4.3. If intermediate forms are derived exclusively from long allomorphs for all auxiliaries, then intermediate forms of *will* would not be predicted to show the subject length effect that they do, because the length effect, based on data from *is* and *has*, is operative only on short allomorphs. Conversely, if intermediate forms are derived exclusively

from short allomorphs for all auxiliaries, we are left to explain why intermediate forms of *have* do not show an effect of subject length. Again, the hybrid model of intermediate forms provides a simple explanation for the difference in patterning of intermediate forms of *will* and *have*.

In essence, the quantitative findings presented in Section 3.4 point to a model of contraction that attributes the phonological realization of auxiliaries to two levels of processes: a variable alternation between short and long allomorphs, followed by later processes of /h/ Deletion and Schwa Epenthesis that operate on the inserted allomorph to generate intermediate forms. This analysis provides a natural explanation for the distribution of intermediate forms after both pronouns and noun phrases, and the differing behavior of intermediate forms with regards to subject length. Other analyses are left to stipulate the sources of these patterns.

3.6. Conclusions

This chapter has presented a novel analysis of auxiliary realization in English, one that is based on consideration of the phonological forms in which auxiliaries occur in spontaneous-speech data and the distribution of those forms. Having first carefully delimited the envelope of variation, I develop a model that treats “contraction”—that is, the surface alternation between reduced and unreduced forms—as the output of two stages of processes. Contraction has its source in an alternation between allomorphs, but later phonological and phonetic processes may obscure the shape of these allomorphs, such that an underlying bipartite distinction becomes tripartite on the surface.

This analysis makes sense of a number of distributional patterns observed in the quantitative data which would otherwise have no clear explanation. The patterning of forms with regard to subject length, the non-existence of intermedi-

ate forms of some auxiliaries in certain environments, and the rate of occurrence of intermediate forms in others all receive a principled explanation given a two-stage model of contraction under which intermediate forms have two derivational sources. The quantitative data, in turn, has allowed us to come down decisively in favor of one analysis in particular. As such, these findings and their interpretation serve as an important demonstration of the value of quantitative data for linguistic theory, and vice versa. With both quantitative data and theoretical analysis, we are able to go beyond simple documentation of patterns of variation to give an explanation for their existence.

The proposed analysis also serves as a reminder of the complexity of variable phenomena that implicate multiple levels of a grammatical derivation. Auxiliary contraction lends itself to syntactic, morphological, and phonological analyses; this is evidenced by the variety of approaches adopted in previous literature (Chapter 2). A model of the surface alternation that attributed variation to only one of those stages would fail to provide a satisfactory account of the patterns that we find in the corpus data, as detailed in Sections 3.5.1 and 3.5.2. What this chapter has thus shown is that a sufficient analysis of the surface distribution of auxiliary shapes necessitates a model of the grammar in which objects pass through multiple levels of representation. We have thus addressed Question 1 from Section 1.1.3, which seeks to trace back the variation in some linguistic item(s) to its grammatical source.

Chapter 4

Linguistic conditions on contraction

4.1. Introduction

In this chapter, I examine the internal linguistic conditions on auxiliary realization in English. In doing this, I have two major goals.

The first is simply to provide thorough documentation of these internal factors. To this end, Sections 4.4–4.8 of this chapter present several novel results concerning the effects of material preceding and following an auxiliary on its contraction. I also point out confounds and alternative explanations for some of these findings and for results that have been found by previous researchers.

The second goal is to connect these conditioning factors to a model of how probabilistic surface behavior is represented in speakers' grammars (Section 1.1.3's Question 2). As I did in Chapter 3, here I draw conclusions from quantitative findings about the nature of the system that produces variable output.

Specifically, in Section 4.4.3 I consider whether string frequency can account for pronoun identity effects on contraction of post-pronoun auxiliaries. A connection between string frequency and contraction is predicted by usage-based approaches to grammar. For instance, Bybee (2002, 2006) proposes that frequently-encountered collocations are more likely to be stored and accessed as units. Speakers access these units with greater neuromotor fluency than they do collocations that are not

stored as such, and this results in a greater degree of gestural overlap and, hence, phonological reduction. Since contraction results in surface phonological reduction, this model of collocation access and production would predict that the most frequent collocations involving auxiliaries will show the most contraction, and the least frequent, the least contraction (see also Krug, 1998). I show that this does hold for the extreme ends of the frequency scale (i.e., the most and least frequent host/auxiliary combinations do contract at a high and a low rate, respectively), but that the string frequency/contraction connection does not hold to any degree of granularity in the middle. In the end, I conclude that some internal conditions on contraction must be stipulated in the grammar, as they cannot be attributable to some other, extra-grammatical source. This conclusion is precisely the opposite of the conclusion I will come to in Chapter 5, in which I argue that the effect of subject length on contraction in fact has its source **outside** the grammar. This is not contradictory, however: in Chapter 7, I develop a model of the linguistic system in which surface variation is governed both by constraints that are represented in the grammar and by extra-grammatical systems, such as short-term memory. The upshot is that in determining the source of conditions on surface variability, we must consider multiple representational loci.

Since subject type is a major factor affecting the shape in which an auxiliary may surface (Chapter 3), and the internal conditions on contraction are often specific to subject types, I have divided this chapter up into the types of subject coded for. Following sections on coding (Section 4.2) and statistical methodology (Section 4.3), I examine those internal factors that are relevant to personal pronoun subjects (namely, pronoun identity; Section 4.4). I then examine the effects of other pronoun-like subjects that auxiliaries may combine with (Section 4.5), followed by a consideration of those factors that are relevant to full noun phrase subjects (e.g.

place and manner of articulation of the segment preceding the auxiliary; Section 4.6). Finally, there are two internal factors that are relevant regardless of subject type, which I examine at the end of this chapter. One is speaking rate (Section 4.7). The other is the low rate of contraction with the auxiliaries *had* and *would* as compared to the others under study (first demonstrated in Figures 3.1 and 3.2, and see discussion in Section 3.4.2). In Section 4.8, I examine potential explanations for this finding.

4.2. Predictors coded

Data for the corpus study (for which the methodology and dependent variable coding were presented in Chapter 3) were coded for a number of linguistic predictors. (Non-linguistic predictors were also coded; an overview of these is given in Section 4.3, and findings are discussed in more detail in Chapter 6.) Primary among them is subject type, since, as demonstrated in Chapter 3, contraction of an auxiliary is both categorically and gradiently affected by the nature of its subject. The types of subject coded for in this study are given in 63.

(63) Subject types coded

- a. Personal pronoun: *I, you, he, she, it, we, they*
- b. Full noun phrase, encompassing determiner phrases as well as sentential subjects. All subjects in this category will be referred to as “noun phrase” subjects in the discussion to follow, even if they are technically sentential. What is relevant is that they do not fit into any of the other categories enumerated here, and often contain more than one word.
- c. Demonstrative: *that, this, these, those*
- d. Quantifier: *something, nothing, everything, anything, someone, no one, ev-*

eryone, anyone

- e. Wh-word: *how, what, where, which, who, why*
- f. Expletive pronoun: e.g. *There will be a test tomorrow; It'll rain today; It'll be nice to take a break; It'll be five years since...¹*

The majority of the other internal predictors coded for are properties of an auxiliary's subject. There are, however, a few predictors that were coded regardless of subject type, which are given in Section 4.2.1. These are followed by enumeration of the predictors coded that are specific to noun phrase subjects (Section 4.2.2) and the predictors specific to personal pronoun subjects (Section 4.2.3).

4.2.1. Predictors for all subjects

Speaking rate. Speaking rate was calculated as follows. The transcripts for Switchboard, Fisher, and Philadelphia Neighborhood Corpus (PNC) conversations are divided into annotation units, lasting 5 seconds on average (specifically, the median annotation unit duration across the three corpora is 4.79 seconds and the mean is 5.87 seconds). For each token, the number of orthographic words in the annotation unit containing that token was divided by the duration of that annotation unit, to give a measure of words per second for that particular annotation unit. For the underlined token in 64, the annotation unit is reproduced in its entirety. It contains 40 orthographic words (the item '[laughter]' is excluded from this count), and its duration is 13.6 seconds, for a speaking rate of 2.9 words per second.

- (64) Yeah, I've always uh been pretty lucky, the real estate out here's been pretty good. It's uh the the prices of, well the prices came down last year — we've

¹The judgment of whether *it* was functioning as a personal pronoun or as a semantically empty expletive subject was made by the coder with consideration of the sentential context.

we had sort of like a Dallas syndrome [laughter] the past uh—
(sw3011: sw_1174)

This is admittedly a coarse way of measuring speaking rate, though it is comparable to that used in previous work (e.g. Frank and Jaeger (2008), who calculate speaking rate as syllables per second within a given window of speech). Ideally, the speaking rate of a particular annotation unit would be normalized based on a given speaker's overall rate for an entire conversation. Speaker A may produce an annotation unit at a rate that is particularly slow relative to the production of some Speaker B, but for Speaker A, that rate may be on the faster end of what is considered normal for him. Speaker-level normalization of speech rate awaits future work.

Following word identity. The identity of the word following an auxiliary was retained as a predictor.

Following constituent category. Much work on contraction of the copula, particularly in African American English (e.g., Labov, 1969; Baugh, 1980; Rickford et al., 1991; McElhinny, 1993) has identified an effect of the nature of the constituent following the *is*. Accordingly, this was coded, for the auxiliary *is* only. (The other auxiliaries studied are invariant in the category of word that follows them: forms of HAVE are always followed by past participles; *will* and *would* are always followed by infinitives.) 65 provides the categories that were coded for *is*.

(65) Following constituent categories coded for *is*

- a. Adjective: e.g. That's great; It's good for me²
- b. *going to* or *gonna*

²A following past participle was also coded as an adjective: *I don't know how hail's formed*.
(sw2676: sw_1092)

- c. Discourse marker or quotative *like*: e.g. *My daughter's like "Mommy"; It's like, I just love it*
- d. Locative: e.g. *He's at work; It's in the North*³
- e. Noun phrase or clause: e.g. *That's the hard part; All they'd rather do is give you a little sound byte*
- f. Progressive verb: *He's feeding the dog*
- g. [none] : The following constituent is unavailable for coding (for instance, if the recording was cut off, or the speaker changed the direction of the sentence).

4.2.2. Predictors for noun phrase subjects

The following predictors were coded for tokens with full noun phrase subjects. Noun phrase subjects were defined as indicated at the beginning of this section.

Stress of preceding syllable. The syllable immediately preceding the auxiliary was coded as stressed (e.g. *alarm*), unstressed (e.g. *people*), or a monosyllabic word (e.g. *boy*).

Grammatical class of preceding word. The word immediately preceding the auxiliary — that is, the final word of the determiner phrase or sentential subject — was coded for a number of possible grammatical classes, as enumerated in 66.

(66) Grammatical classes coded for

- a. Adjective: e.g. *something tragic, everybody else, when your life becomes sedentary*⁴

³Not all prepositional phrases were uniformly coded as locatives. A construction like *He's on TV* was coded as a following adjective.

⁴The complete sentence here was *When your life becomes sedentary is when you have to make yourself a plan.*

- b. Embedded or coordinated pronoun: e.g. *my wife and I, three of them, the guy next to you*⁵
- c. Noun: e.g. *people, my friends, one couple in our church, taking care of the children*
- d. Preposition: e.g. *everybody else that I've talked to, the first thing I would look for, the town I live in*
- e. Verb: e.g. *what do you think, the role of women changing, everything she's taken*
- f. Quantifier: e.g. *this one, everything that they do to somebody*

Preceding segment: The segment immediately preceding the auxiliary was coded for manner and place of articulation. Note that this decision was made based on the **underlying** nature of the relevant segment, regardless of how that segment actually surfaced. So, for instance, a token such as *as the verdict's been reached* would be coded as having a /t/ preceding the auxiliary *has*, even if that /t/ was not produced.⁶

Subject heaviness. As will be discussed in great detail in Chapter 5, noun phrase subjects were coded for “heaviness” (also referred to as length or weight). That chapter will discuss and tease apart the various different measures of heaviness that were investigated. In the present chapter, I anticipate the result presented

⁵Tokens whose subject ended in an embedded or coordinated personal pronoun were coded as having a full noun phrase, rather than a personal pronoun, subject, since embedded and coordinated personal pronouns do not condition the same range of auxiliary variants as lone personal pronouns do; see Section 3.2.2.7.

⁶*t/d-deletion* (Guy, 1980 and much following work) interacts with contraction in interesting ways. If a noun ends in an /st/ cluster (e.g. *test*) and the /t/ is not deleted, a sibilant-final auxiliary (that is, *is* or *has*) may appear in its contracted form (*test's* [tests]). If the /t/ is deleted, we would expect the auxiliary to appear in its intermediate form ([tes əz]). This implies that Schwa Epenthesis (Section 3.3.3) follows, and may be fed by, *t/d-deletion*. Whether this is consistently the case, or whether simplification (e.g. [tes] for *test's*) can occur instead, could be an interesting topic for future study, as could comparing the realization of *test's* (with a contracted auxiliary) to *tests* (the plural form).

therein that orthographic word count is a strong predictor of contraction. Accordingly, I include a `LOG(SUBJECT_WORD_COUNT)` term in my analyses of noun phrase subjects, with “word count” understood to mean “**orthographic** word count.” I save presentation and discussion of this factor’s patterning for that chapter.

Preceding word. The identity of the word preceding the auxiliary was retained as a predictor.

4.2.3. Predictors for pronoun subjects

Only one predictor was coded that was specific to personal pronoun subjects: **person and number of pronoun.**

4.3. Model construction and significance testing

Mixed-effects logistic regression was used to test the significance of the predictors enumerated in Section 4.2. In mixed-effects modeling, fixed-effect predictors — those predictors which are replicable across studies and which contain few levels, such as AUXILIARY IDENTITY or SUBJECT TYPE — are used alongside random effects — predictors that are drawn from a larger population, such as SPEAKER or PRECEDING WORD (Baayen, 2008). Recent work (e.g. Johnson, 2009; Gorman, 2009) has discussed the suitability of mixed-effects modeling for sociolinguistic data: data in sociolinguistic studies typically consists of multiple observations from each speaker studied, violating the assumption of fixed-effects logistic regression that each data point is an independent observation. A mixed-effect model with a random effect of speaker identity resolves this issue.

All fixed-effect predictors were analyzed using sum contrasts, unless otherwise indicated. Sum contrasts compare each level of a predictor to an abstract mean

across all levels, while the alternative, treatment contrasts, compare each level of a predictor to one level that has been designated as the default, or “untreated” level. Though treatment contrasts are a natural choice for experimental work in which one group is often “untreated” in some sense, this often does not have a natural parallel in the type of predictors that are used in linguistics (for instance, there is no sense in which males are “untreated” as compared to females, or vice versa), and so sum contrasts are used instead. I use sum contrasts here unless otherwise specified.

With each predictor we add to a model, there is a tradeoff between the complexity that predictor introduces and the amount of variation it explains. There are several ways of determining whether the complexity introduced by a predictor is justified.

- **Likelihood ratio test.** This test compares the log likelihoods of two nested models (i.e., two models that contain all the same predictors, but one contains one additional predictor that the other doesn’t have). The formula is $-2 * (\text{log likelihood of model with fewer parameters} - \text{log likelihood of model with more parameters})$. This test statistic is then compared to a chi-square distribution with degrees of freedom as the difference in degrees of freedom between the two models. If the difference is significant, we can reject the null hypothesis that the additional predictor is unnecessary. We can thus say that the model with the additional predictor has a significantly better fit. If the difference is not significant, we cannot reject the null hypothesis that the additional predictor is unnecessary. This test can be performed easily in R using the `anova()` function. (Baayen, 2008)
- **Analysis of deviance.** The test compares the residual deviances of two nested

models. The formula is $(\text{deviance of model with fewer parameters}) - (\text{deviance of model with more parameters})$. This is again compared to a chi-square distribution with the difference in degrees of freedom between the two models.

- **Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC).**

These are measures of model goodness-of-fit that balance the number of predictors in a model (complexity) with the amount of variance explained (accuracy). The model with the smaller AIC or BIC value is preferred, with the BIC being the more conservative of the two measures. In order to reduce AIC, an added model parameter must reduce deviance by at least two units; in order to reduce BIC, an added model parameter must reduce deviance by at least $\log(n)$ units ($n = \text{number of observations}$).⁷

I will be using likelihood ratio tests throughout this chapter to compare nested models and hence determine whether the addition of a predictor is justified. If the likelihood ratio test returns a non-significant result, the additional predictor may be removed from the model without significantly worsening the fit. I will also make reference to AIC and BIC values.

Many of the linguistic predictors outlined in Section 4.2 have a number of levels. When it was theoretically and statistically sound, these levels were collapsed, to minimize degrees of freedom and to cut down on multiple comparisons. This was done only when (1) there was a valid theoretical reason to suppose that two levels would not behave differently; and (2) this collapse was not found to have

⁷See <https://stat.ethz.ch/pipermail/r-sig-mixed-models/2011q1/008342.html> for more on model comparison techniques. Douglas Bates, author of the `lme4` package for running mixed-effects models in R, advocates the likelihood ratio test for comparing nested models, as its output (a probability that our data would look the way it does if the null hypothesis were true) is more easily interpretable than are either AIC or BIC values.

an effect statistically. There are two ways of determining whether a collapse might have an effect statistically. A pairwise test of proportions can tell us whether the rate of application of the dependent variable differs between two levels of a given predictor (so, for instance, whether the rate of contraction with a following noun phrase differs from that of a following adjective). When there were multiple pairwise comparisons to be made (for instance, a predictor has 7 levels, meaning that 21 unique pairwise comparisons can be made), the Bonferroni correction for multiple comparisons was used. If no significant difference was found between levels of a predictor, and there was a good reason to collapse those levels, two regressions were run, one with levels collapsed, and one with levels left separated. A likelihood ratio test (using the `anova()` function in R) was then used to compare the two models and determine whether the model with the collapse differed significantly in log likelihood from the model without the collapse. If there was no significant difference in log likelihood — meaning that the collapsed predictor did not significantly worsen the fit of the model — the model with the collapse was retained.

Fixed linguistic effects included in the analyses were those enumerated in Section 4.2. Two random linguistic effects were also included: the identity of the word following the auxiliary and (in the case of noun phrase subjects only) the identity of the word preceding the auxiliary. (With non-noun phrase subjects, the identity of word preceding the auxiliary has few enough levels that it may be included as a fixed effect.) The following non-linguistic predictors were also included in the analyses:

- Speaker decade of birth (“DOB” in the regression outputs to follow)⁸

⁸I attempted to run the models with year, rather than decade, of birth, but this resulted in false convergence.

- Speaker sex
- Speaker education level, on a 4-point scale: less than high school, less than college, college, more than college. This is how education was coded in Switchboard. Despite the fact that both Fisher and the PNC recorded more fine-grained education information (specifically, the precise number of years of schooling for each speaker), this had to be recoded to match Switchboard's 4-step education scale. Hence, the education predictor in the models to follow is called "EDUC_STEP," to represent the fact that this is not raw education data, but is instead on a 4-step scale.
- Corpus (data were pooled across the three corpora used: Switchboard, Fisher, and the PNC; see Section 3.2.1 for descriptions of these corpora)
- Speaker identity (random effect)
- Speaker dialect region (random effect)

These external predictors were included as controls. Their effects will be presented in more detail in Chapter 6.

Logistic regression requires each observation to be coded as either a hit or a miss. In the present study, a "hit" was defined as the use of a short allomorph, and a "miss" as the use of a long allomorph. The analyses to follow thus present internal conditioning factors on **short allomorph selection**. How the underlying allomorph subsequently surfaced (for instance, whether the long allomorph of *has* underwent /h/ Deletion) is not addressed here. All surface forms have simply been coded as whether they derived from a long allomorph or from a short one.

Coding of a surface form as having derived from a long or a short allomorph was carried out by way of the correspondences provided in Tables 4.1 and 4.2 (re-

peated from Tables 3.5 and 3.6). Table 4.1 refers specifically to vowel-final personal pronouns: i.e., all personal pronouns except *it*. These are the only environments in which *had*, *have*, *will*, and *would* may occur in their single-consonant contracted forms. After *it*, these four auxiliaries behave as they do after noun phrases: their short allomorph may not occur in its contracted form and surfaces as intermediate instead. Hence, the correspondences in Table 4.2 account for auxiliary behavior after both noun phrases and the pronoun *it*.

	<i>is</i>	<i>has</i>	<i>have</i>	<i>had</i>	<i>will</i>	<i>would</i>
Underlying short allomorph surfaces as:	contracted					
Underlying long allomorph surfaces as:	full	full & interm. (from /h/ Del.)			full	

Table 4.1: Sources of surface forms after vowel-final personal pronoun subjects.

	<i>is</i>	<i>has</i>	<i>have</i>	<i>had</i>	<i>will</i>	<i>would</i>
Underlying short allomorph surfaces as:	contracted		intermediate (from Schwa Epenthesis)			
Underlying long allomorph surfaces as:	full	full & interm. (from /h/ Del.)			full	

Table 4.2: Sources of surface forms after the pronoun *it* and noun phrase subjects.

As is evident from Table 4.2, there are some surface forms of auxiliaries which are impossible to identify as either a hit or a miss. This occurs for certain auxiliaries with certain subjects. For instance, when the intermediate form of *have*, [əv], surfaces after a noun phrase subject, it could in principle be traceable to either the application of /h/-deletion on a long allomorph (=a miss), or the application of Schwa Epenthesis on a short allomorph (=a hit; see also Section 3.4.3). The existence of such ambiguous forms meant that certain host+auxiliary combinations

had to be excluded from analysis. For instance, internal conditions on the realization of *have* could not be studied after noun phrases.

There are also, as indicated in Section 4.2, some predictors that were coded only for a subset of auxiliaries. For instance, following constituent is relevant only to *is*. In such cases, auxiliaries need to be divided up and analyzed separately, rather than the data from multiple auxiliaries being pooled with AUXILIARY IDENTITY as a predictor. Similarly, when auxiliaries differed in the levels of a predictor they were coded for, they could not be pooled for a single analysis. So, for instance, all post-pronoun auxiliaries were coded for pronoun identity, but the auxiliary *have* does not combine with the pronoun *it*, while the other auxiliaries do. So *have* was analyzed separately from the others after pronouns. In essence, when it was possible for data from different auxiliaries to be pooled, it was.

4.4. Factors particular to pronoun subjects

4.4.1. Introduction

This section examines the linguistic factors conditioning post-pronoun short allo-morph selection. All auxiliaries were analyzed in isolation for this section, since a number of factors prevented data from being pooled across the auxiliaries, as follows. *Is* was coded for following constituent, but none of the other auxiliaries were, so it had to be kept separate for this reason. Other auxiliaries had to be separated because they differed in the pronouns they combine with. For instance, *have*, *will*, and *has* all combine with a different set of pronouns, so none of them could be collapsed either. Finally, *had* was also kept separate because tokens of *had* that surface as intermediate (i.e., [əd]) after the pronoun *it* are ambiguous — they cannot be definitively attributed to an underlying source (Table 4.2). As a result,

they were excluded, meaning that this auxiliary also could not be pooled with the others, since it had this gap.

Section 4.4.2 presents the findings concerning linguistic conditioning of post-pronoun auxiliary realization. I demonstrate a few cases of pronoun identity effects on short allomorph selection, but show that most auxiliaries are not sensitive to the identity of the pronoun with which they combine. Section 4.4.3 discusses this finding in regards to previous work purporting to demonstrate a connection between the frequency of a pronoun/auxiliary collocation and its contraction rate.

4.4.2. Findings

The auxiliary *is* was coded for the category of its following constituent (65), but this was found to have no significant effect on post-pronoun short allomorph selection for this auxiliary. (Section 4.6.2.2 examines the effects of this factor on **post-noun phrase** *is*, where it **is** found to have a strong effect.)

The other linguistic factor relevant to post-pronoun auxiliary realization is pronoun identity. Four auxiliaries showed no effect of pronoun identity on short allomorph selection: *has*, *have*, *had*, and *is*. For each of these four auxiliaries, a pairwise test of proportions with the Bonferroni correction for multiple comparisons found no significant differences in short allomorph selection rate across the various pronoun subjects; a regression found no significant effect of any of the pronouns coded for; and a likelihood ratio test between a model containing a term for pronoun identity and one without did not find that the pronoun identity term significantly increased likelihood. Note that these four auxiliaries differ in how many and which pronouns they combine with: only *he*, *she*, *it* for *is* and *has*; *you*, *we*, *they* for *have*; and all pronouns for *had*. I will further consider pronoun/auxiliary collocations in Section 4.4.3.

Will and *would*, by contrast, each show pronoun effects. Table 4.3 shows the pronoun-by-pronoun short allomorph rates for *will*. Short allomorph selection is especially low after *it*.⁹ A pairwise test of proportions finds significant differences between *it* and *I* (though $p = 0.04$) and *it* and *we* ($p < 0.01$).

	<i>I</i>	<i>you</i>	<i>he</i>	<i>she</i>	<i>it</i>	<i>we</i>	<i>they</i>
short allomorph rate	0.95	0.92	0.96	1	0.84	0.98	0.94
N	428	91	70	56	74	157	163

Table 4.3: Rates of short allomorph selection for *will* by identity of pronoun subject. Underlined values differ significantly in short allomorph rate from the rate for *it will* (0.84).

We can collapse many of the levels of PRONOUN, since they do not appear to differ from one another. Specifically, I collapsed all vowel-final pronouns and opposed them to *it* (i.e. used treatment contrasts with vowel-final as the untreated level), under the hypothesis that it is the differing phonology of *it* that is driving the effect. This is clearly upheld in the regression in Table 4.4, with *it* significantly lowering the log-odds of short allomorph selection compared to vowel-final pronouns ($\beta = -1.72$, $p < 0.01$). A likelihood ratio test between the model with the collapsed pronoun factor and a model with no pronoun factor at all finds a significant difference between the two, with lower AIC and BIC values for the model with the pronoun term ($p < 0.01$; Table 4.5); there is, however, no significant difference between the model with the collapsed pronoun term and the model with the uncollapsed one, indicating that this collapse did not significantly worsen model fit ($p = 0.15$; Table 4.6). We are thus justified in saying that **there is an effect of pronoun identity on selection of short allomorphs of *will*, with short allomorphs less likely after *it*.**

⁹Recall that, even though *will* may not surface in its **contracted** form after *it*, its short allomorph is unambiguously identifiable from its **intermediate** form; see Table 4.2.

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	3.59	1.57	2.29	0.02
PRONOUN = 'it'	-1.72	0.51	-3.37	0.00
SPEAKING_RATE	0.41	0.27	1.50	0.13
SEX = F	-0.39	0.25	-1.57	0.12
DOB	-0.06	0.17	-0.34	0.74
EDUC_STEP	-0.42	0.40	-1.03	0.30
CORPUS = PNC	0.86	0.70	1.22	0.22

Table 4.4: Short allomorph selection for post-pronoun *will*.

	Df	AIC	BIC	logLik	Chisq	Chi Df	Pr(>Chisq)
model0	9	380.08	424.23	-181.04			
model1	10	371.61	420.67	-175.80	10.47	1	0.0012

Table 4.5: Comparison of two models for short allomorph selection for post-pronoun *will*: without pronoun identity (Model 0) and with pronoun identity, collapsed (Model 1).

	Df	AIC	BIC	logLik	Chisq	Chi Df	Pr(>Chisq)
model1	10	371.61	420.67	-175.80			
model2	15	373.46	447.05	-171.73	8.15	5	0.1483

Table 4.6: Comparison of two models for short allomorph selection for of post-pronoun *will*: with pronoun identity collapsed (Model 1) and uncollapsed (Model 2).

In the case of post-pronoun *would*, pronoun identity again seems like it may be playing a role based on the raw proportions, with less short allomorph selection after *it* (reminiscent of what we saw for *will*) and more after *you* (Table 4.7). In fact, these differences are upheld by a pairwise test of proportions, which finds that *you* differs significantly from *I*, *it*, and *they* (all $p < 0.01$).

	<i>I</i>	<i>you</i>	<i>he</i>	<i>she</i>	<i>it</i>	<i>we</i>	<i>they</i>
short allomorph rate	<u>0.35</u>	0.55	0.36	0.34	<u>0.22</u>	0.4	<u>0.32</u>
N	470	195	74	87	99	177	197

Table 4.7: Rates of short allomorph selection for *would* by identity of pronoun subject. Underlined values differ significantly from the rate for *you would* (0.55).

A regression on the *would* data that incorporates PRONOUN differs significantly via likelihood ratio test from a model lacking it ($p < 0.01$). I then examined whether any of the levels of pronoun could justifiably be collapsed to reduce degrees of freedom. I tried three logical collapses. First, I opposed *it* to all other pronouns, using the same division that was found to be effective for *will*. However, a likelihood ratio test between this model and the uncollapsed-pronoun model found a significant difference ($p < 0.01$), meaning that the collapse should not be retained. Collapsing pronoun into *you* vs. all others (based on the significantly different pairwise proportions for *you* and a number of other pronouns found above) likewise results in a significant difference between the collapsed and the uncollapsed models ($p < 0.01$), as does collapsing PRONOUN into *it* vs. *you* vs. all others ($p = 0.01$). There is no other way of dividing up the pronoun data that has any obvious theoretical motivation, so PRONOUN was left uncollapsed for this analysis. The model incorporating pronoun is presented in Table 4.8.

We find out the following from the model in Table 4.8. The effect of PRONOUN comes from several pronouns: *it* significantly disfavors short allomorph selection,

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	1.17	0.65	1.79	0.07
PRONOUN = I	-0.12	0.14	-0.81	0.42
PRONOUN = you	0.72	0.18	4.04	0.00
PRONOUN = he	0.20	0.26	0.75	0.45
PRONOUN = she	0.05	0.24	0.21	0.83
PRONOUN = it	-1.24	0.28	-4.49	0.00
PRONOUN = we	0.62	0.18	3.36	0.00
SPEAKING RATE	-0.11	0.09	-1.22	0.22
SEX = F	-0.28	0.12	-2.31	0.02
DOB	-0.15	0.07	-2.18	0.03
EDUC_STEP	0.01	0.20	0.07	0.95
CORPUS = PNC	-1.00	0.34	-2.95	0.00

Table 4.8: Short allomorph selection for post-pronoun *would*.

while *you* and *we* significantly favor it. Interestingly, however, the effect of *it* is strongest, as evidenced by its large β value (-1.24). This is reminiscent of the findings for *will*: once again, **short allomorph selection is disfavored when a short allomorph cannot closely attach to a particular pronoun.**

4.4.3. Discussion

The only linguistic factor that could have an effect on short allomorph selection for auxiliaries after pronouns is the identity of that pronoun. The previous section has shown that, for the majority of auxiliaries (namely, *is*, *has*, *had*, and *have*), there is no effect of pronoun identity on short allomorph rate. Only for the auxiliaries *will* and *would* do we find pronoun identity effects. The pronoun *it* has a significant negative effect for both *will* and *would*; *you* and *we* additionally have positive effects for *would*. It is almost certainly relevant that *it will* and *it would* are collocations in which close attachment of the auxiliary's short allomorph to its host is phonotactically impossible without Schwa Epenthesis (Section 3.3.3). The other auxiliaries under study do not combine with any pronouns that prohibit close attachment (with the exception of *had*, which does combine with *it*, but which was omitted from study here for reasons described at the beginning of Section 4.4). The general finding, though, is that there is no consistent, regular effect of pronoun identity on short allomorph selection.

This finding in fact contrasts with findings put forth in previous work, as follows. Kjellmer (1997) found an effect of subject pronoun on contraction such that contraction occurred frequently after *I* and *you* and infrequently after *they*, with other pronouns somewhere in between. There are a number of differences between Kjellmer's study and my own, however. First and foremost, Kjellmer examined only contraction in writing, where contracted forms could be being deployed as a deliberate stylistic choice on the part of an author. In fact, the relevance of contraction in writing to a study of contraction in speech is rendered questionable from the outset by the fact that Kjellmer found that forms of post-pronoun BE contract at a rate of only 23% in his corpora: a far cry from the 99% contraction of *is* attested

in Switchboard (Figure 3.2).¹⁰ Kjellmer also did not perform any statistical analysis on his data, though his sample sizes are large (each pronoun had $N > 200$). Finally, Kjellmer did not cross-tabulate pronoun identity and auxiliary identity, meaning that if a low-contracting auxiliary — for instance, *had* — occurred frequently with a particular pronoun (say, *they*), the rate of contraction for that pronoun would be dragged down simply by virtue of a confound. Separating out each auxiliary, as I have done here, keeps particular auxiliaries from biasing the findings.

Another study which addresses the issue of pronoun-specific contraction rates is Krug (1998). Krug examined contraction of *has*, *have*, *is*, *am*, and *are* after personal, demonstrative, expletive, and interrogative pronouns. His data come from two corpora of spoken British English, though he appears to have coded all his data simply based on transcripts, because no discussion of auxiliary phonological shape is presented. Krug initially presents his findings as supporting a hierarchy of pronoun hosts under which contraction occurs more often after singular than after plural pronouns, and more often after first person pronouns than second person, and second person than third. Krug then goes on to show, however, that this apparent effect of pronoun person/number is better attributed to string frequency: that is, the more frequently a particular pronoun and auxiliary are combined, the more likely that combination is to display contraction. For instance, of the pronouns with which the auxiliary *have* may combine, Krug finds that *have* occurs most frequently with *I*; he also finds that *have* contracts more after *I* than after any other pronoun. This effect extends beyond the person/number of personal pronouns to the other types of pronouns he examines: *have* also occurs more often

¹⁰It is true that Kjellmer lumps together all forms of BE, meaning that he considered *am* and *are* in addition to *is*. I did not examine the first two of these. Nonetheless, McElhinny (1993), who does examine contraction of *am* and *are* in spontaneous speech, finds the former of these to contract at a rate of 94% and the latter at 67%, so Kjellmer's contraction rates for the written language are clearly not reminiscent of the spoken language.

ten with personal pronouns than with *wh*-words; it likewise contracts at a higher rate after personal pronouns than after *wh*-words. Krug finds the string frequency effect to hold across auxiliaries: *it is*, the most frequent pronoun-auxiliary collocation in his corpora, contracts more than do less-frequent collocations like *we are*. He connects these findings to models of grammar under which more frequent items become more deeply “entrenched” in the mental lexicon (i.e., usage-based models in which all received input is subsequently stored), and concludes that, based on his findings, “string frequency [...] can safely be considered the most important motivation in phonological and morphological changes that result in the cliticization and merger of two adjacent items across languages” (309).

I am naturally sympathetic to any endeavor to determine the source of probabilistic surface behavior (see my Section 1.1.3), but I believe Krug’s claim to be overstated. The collection of pronoun/auxiliary collocations he examines ranges in frequency from *it is/has* (frequency in the Bank of English Corpus: 59,746; contraction rate: 87%) to *why is/has* (frequency in the BEC: 474; contraction rate: 12%).¹¹ With the two ends of the scale showing such widely different frequencies and contraction rates like this, the significant effect of frequency he reports is unsurprising. The collocations that involve personal pronouns, however, all have contraction rates between 80% and 90%. Krug makes claims like “*It’s*, although a third-person pronoun, has higher contraction rates than first-person *we’re* because it is far more frequent” (296). But the contraction rate for *it+is/has* is 87%; for *we+are*, 80%. Is this difference really meaningful? Does the frequency effect really hold within personal pronoun subjects, or is it really only relevant to the difference between personal pronouns and other types of subjects? Furthermore, there is a sense in which it is

¹¹Krug does not make an effort to distinguish whether ‘s comes from contracted *is* or contracted *has*, and likewise lumps together uncontracted *is* and uncontracted *has* in his frequency counts.

misleading to compare the contraction rate after personal pronouns to that after interrogative pronouns, as Krug does. Interrogative pronouns are accompanied by subject-auxiliary inversion, so these pronoun/auxiliary combinations do not behave like personal pronoun/auxiliary collocations syntactically, and maybe not prosodically either. We thus might not expect interrogative pronouns to condition contraction at the same rate as personal pronouns irrespective of their frequency. A more convincing investigation of the effect of string frequency on contraction would focus on personal pronoun/auxiliary collocations only, to remove this confound.

In Section 4.4.2, I was able to perform statistical analysis on data restricted to tokens with personal pronoun subjects only. I found that, for most auxiliaries, contraction rate — which I have also operationalized differently than Krug, as short allomorph selection as inferred from an auxiliary’s phonological shape (Section 4.3) — does not differ across the different pronoun subjects under examination. The only auxiliaries I found to show an effect of pronoun identity were *will*, which showed less short allomorph selection after *it*, and *would*, which showed less after *it* and more after *you* and *we*. Can these effects be attributed to string frequency?

Like Krug, I tabulated string frequency for a given pronoun/auxiliary combination by counting how many times that combination occurred in the corpus transcripts, **either** with the auxiliary orthographically contracted or uncontracted. (I restricted this experiment to Switchboard only.) However, I was more judicious in my counting. Krug acknowledges that ‘s can be either contracted *has* or contracted *is*, but does not make the effort to distinguish which one a token of [pronoun]’s came from.¹² This is understandably difficult and time-consuming in a corpus that

¹²Krug also apparently doesn’t distinguish between whether tokens of *have* and *has* came from main verbs or auxiliaries, something that is crucial to do when using corpora of American English, where main verb HAVE does not contract, but that is less relevant in the corpora of British English

has not been syntactically parsed, but there are ways of estimating it; mine was as follows. I first searched the corpus for every instance of each pronoun/auxiliary collocation, and got a raw frequency count.¹³ I then pulled 100 tokens at random of every pronoun/auxiliary collocation that could be ambiguous in some way. (This was, in fact, the majority of them: for instance, tokens of *I would* could actually be the compound modal *would have* which has been excluded from the present study; tokens of *I have* could be instances of main verb *have*, instances of deontic *have to*, or instances of causative *have*, as in, *I have my house cleaned twice a month*; these latter three are not contractable in American English and are thus not relevant to the study of auxiliary contraction and must be excluded from token counts.) Of these random 100, I counted how many were in fact spurious tokens of a form other than the auxiliary under study. I then used the proportion of non-spurious auxiliary hits out of the random 100 to estimate how many of the tokens in the raw frequency count were real. For instance, to get a frequency count for *I had*, I searched for tokens of *I had* or *I'd* that were followed by either a word ending in *-en* or *-ed* or one of a list of irregular past participles, with no more than one word intervening. This resulted in 836 hits. Of those, I selected 100 at random, and found that 22 of those 100 were spurious in that they were not instances of auxiliary *had*: tokens such as *I had to run* or *I'd be surprised* or *I had her spayed*. That was a spurious rate of .22, meaning that we can estimate the total count of *I had/I'd* collocations in Switchboard at 652 (i.e., $836 * (1 - .22)$).

I also examined model-fitted probabilities of short allomorph selection, rather that Krug uses, as main verb *have* contracts in British English as well. That said, Axelsson (1998), in her study of British newspapers, finds that main verb *have* contracts much less than auxiliary verb *have* (7% vs. 31%, respectively), so perhaps care should have been taken in Krug's study to distinguish the two such that main verb *have* did not bias the results.

¹³I used the searches laid out in Section 3.2.1: so, for instance, tokens of HAVE were only counted when they were followed by either a word ending in *-en* or *-ed* or one of a list of irregular past participles, with no more than one word intervening, to help cut down on spurious hits.

than raw proportions, for each pronoun/auxiliary string, using the models from Section 4.4. This works as follows. Each model gives us an intercept parameter, representing the log-odds of short allomorph selection with all predictors set to their default level (if treatment contrasts) or to an abstract mean (if sum contrasts). Each model also gives us a parameter for each particular pronoun under examination, representing the change in log-odds from the abstract mean when the auxiliary appears in combination with that particular pronoun. If we sum the coefficient for the level of pronoun we're interested in with the intercept value, we get the log-odds of short allomorph selection for that particular pronoun (again, assuming all other predictors are held at a default or mean).¹⁴ Taking the exponential of this value (reversing the log) gives us the odds, and since odds are just $p/(1-p)$, we can solve for the fitted probability (p). A shortcut for doing this in R is `plogis()`.

Table 4.9 provides the estimated string frequencies and model-fitted probabilities of short allomorph selection for each pronoun+auxiliary combination under study. They have been arranged in descending order of string frequency.

To determine the degree of correlation between string frequency and short allomorph rate, I calculated Spearman's ρ .¹⁵ Spearman's ρ is interpreted just like Pearson's r , with a value of -1 indicating a perfect negative correlation, a value of 1 indicating a perfect positive correlation, and a value of 0 indicating no correlation. For this data, we get a ρ of 0.45, which is significantly different from 0 ($p = 0.01$). Interestingly, however, an examination of the data reveals that a large number of the

¹⁴For the two continuous predictors in these models, speaking rate and decade of birth, I added to the sum their coefficient multiplied by their mean. This is because the coefficient for these predictors is based on an idealized default level of 0, which is obviously unreasonable for these kinds of predictors.

¹⁵This measure was used instead of Pearson's r because neither the frequency counts nor the probabilities were found to be normally distributed via a Shapiro-Wilkes test; $p < 0.01$ for both.

	freq	p		freq	p
<i>it is</i>	26605	1.00	<i>I had</i>	652	0.22
<i>I have</i>	6386	0.96	<i>we would</i>	608	0.60
<i>I would</i>	3543	0.42	<i>it will</i>	594	0.97
<i>we have</i>	2400	0.98	<i>he has</i>	583	0.90
<i>he is</i>	2278	1.00	<i>you will</i>	429	0.99
<i>I will</i>	2040	0.99	<i>she has</i>	295	0.85
<i>they have</i>	1561	0.96	<i>he will</i>	271	0.99
<i>she is</i>	1275	1.00	<i>he would</i>	233	0.49
<i>it would</i>	1234	0.19	<i>she would</i>	217	0.46
<i>it has</i>	1195	0.87	<i>they had</i>	197	0.18
<i>you have</i>	1109	0.98	<i>she will</i>	147	1.00
<i>they will</i>	1030	0.99	<i>he had</i>	145	0.20
<i>you would</i>	926	0.62	<i>we had</i>	140	0.18
<i>they would</i>	836	0.39	<i>she had</i>	109	0.21
<i>we will</i>	758	1.00	<i>you had</i>	40	0.24

Table 4.9: Fitted probability of short allomorph selection by estimated string frequency in Switchboard.

lowest-frequency strings are collocations with *had*. Krug’s study didn’t examine data from *had* (or *would*, for that matter). If we omit *had*, the ρ (0.12) is no longer significantly different from 0 ($p = 0.56$). What we basically have, then, is what could conceivably be string frequency effects at either extreme of the hierarchy — categorical short allomorph selection with *it is*, the most frequently occurring pronoun/auxiliary string, and low short allomorph selection with strings containing *had*, the least frequently occurring auxiliary — but no real effect of string frequency in the middle.¹⁶

At any rate, we initially set out to examine string frequency to see if it could account for the few pronoun-specific effects we found in the data. First of all, a number of pronoun/auxiliary strings differ in frequency while showing no significant difference in short allomorph rate. For instance, we found no difference in

¹⁶Omitting the collocation *it is* in addition to all collocations with *had* results in a ρ of 0.03 , again not significantly different from 0 ($p = 0.9$)

short allomorph rate by pronoun for *is*, yet the different pronouns differ widely in their frequency of collocation with *is*, from over 26,000 tokens of *it is* to only 1275 for *she is*. The pronoun effects we did find were restricted to *will* and *would*, both of which displayed fewer short allomorphs after *it* than after other pronouns. But of the collocations with *would*, *it would* is the second-most frequent at 1234 tokens, second only to *I would* (3543). *It will* is a bit better behaved, coming in fourth of the *will* collocations (after *I will*, *they will*, and *we will*), but it still beats out *you will*, *he will*, and *she will* in frequency, despite favoring short allomorphs less than any of them.

The upshot, then, is that the attested pronoun-specific effects on short allomorph selection cannot be explained by string frequency alone. Certain pronouns may favor the short allomorph of certain auxiliaries (though most auxiliaries show no pronoun-specific effects), but this cannot be attributed to the fact that those auxiliaries occur more frequently with those pronouns than with others. Auxiliary contraction thus cannot be neatly explained by the entrenchment of certain host/auxiliary collocations in memory. If it were, we would expect much more contraction of the relatively common *I would*, say, and much less of the relatively uncommon *she will*. Instead, we find coarse frequency effects — the ends of the scale behave as predicted — but not gradient ones.

4.5. Other types of subjects

4.5.1. Introduction

Chapter 3 showed that short allomorph rate differs between personal pronoun and full noun phrase subjects for all six auxiliaries under study, and Sections 4.4 and 4.6 examine pronoun and full noun phrase subjects, respectively, in more detail. But the behavior of auxiliaries following the other types of subjects given in 63 still remains to be determined. Are these subject types similar enough to personal pronouns to be lumped together with them? Or do at least some of them constitute a separate class?

As indicated in 63, there were a number of “other” types of subjects to be coded for. Only *is* and *has* displayed robust enough numbers of these various subjects to allow analysis, so the data in this section comes from these two auxiliaries only.

Of the different categories of “other” subjects coded for, some of them comprise a number of different lexical items. For instance, there are many different quantifiers that were all coded as “quantifier,” and two different expletives, *it* and *there*. There were not enough tokens of the different types of quantifiers to allow any meaningful analysis, so they were all lumped together. No significant difference in short allomorph rate was found between the two expletive pronouns examined, so pronoun identity was not included in subsequent analyses of post-expletive data.

4.5.2. Findings

The “pronoun-like” subjects examined were as follows:

- Personal pronouns (with *he*, *she*, and *it* all lumped together, not differentiated by pronoun given the findings from Section 4.4.2)

- Expletives (with *it* and *there* both lumped together as there was found to be no significant effect of expletive pronoun identity)
- Quantifiers (with data from a number of different quantifiers — *anybody*, *everybody*, *everyone*, *everything*, *nobody*, *one*, *somebody*, *someone*, *something* — lumped together since the quantifiers weren't individually well-represented enough to allow comparisons across them)
- Demonstrative *that* (the only demonstrative that surfaces with these two auxiliaries that does not end in a sibilant — post-sibilant forms of *is* and *has* are of ambiguous origin; see Section 3.4.2)

Treatment contrasts were used to compare the rate of short allomorph selection after the various pronoun-like subjects to the rate after personal pronouns (the default level). Though following constituent category (65) had been coded for the *is* data, it was omitted from analysis given that Section 4.4.2 did not find it to have a significant effect on post-pronoun data.

Examining the table of raw proportions (Table 4.10) finds some differences between the subject types. For *is*, short allomorph selection is essentially at ceiling for all subject types except quantifiers, which contract at a much lower rate than the others ($p < 0.01$ for all comparisons). For *has*, every pair differs significantly ($p < 0.01$ for all comparisons except demonstrative *that*/pronoun for which $p = 0.03$) except for demonstrative *that*/quantifier, which show no significant difference. Essentially, these two are at the bottom of the hierarchy of short allomorph rates, with personal pronouns in the middle and expletive pronouns at the top.

The effect of these different subject types was tested in a regression containing an interaction between auxiliary identity and subject type, to allow for the possibility indicated in Table 4.10 that short allomorph rate is differently sensitive to

	pronoun	expletive	dem. <i>that</i>	quantifier
<i>is</i> short allomorph	0.98	0.98	0.98	<u>0.7</u>
N	2420	483	914	104
<i>has</i> short allomorph	0.88	0.98	0.73	0.64
N	488	127	51	55

Table 4.10: Rates of short allomorph selection for *is* and *has* by subject type. The underlined value of *is* differs significantly from all other values in its row. The italicized values of *has* **do not** differ significantly from one another, while all other pairs in that row **do** differ significantly.

subject type depending on which auxiliary is at issue. Table 4.11 presents the results of this analysis, which offers a significantly improved fit over a model lacking the interaction term and one lacking the subject type term entirely (as calculated by the likelihood ratio tests in Table 4.12).

The model in Table 4.11 can be interpreted as follows. When the auxiliary is *is* (as opposed to *has*), log-odds of short allomorph selection increase substantially, by 2.21; this represents the fact that the short allomorph is selected for *is* at a higher rate overall. The three PREC_GRAMM_CLASS coefficients that follow are interpretable for the auxiliary *has* only and are in comparison to the default level of personal pronoun. For *has*, expletive subjects increase the log-odds of short allomorph selection relative to personal pronouns; demonstrative *that* and quantifiers decrease it. This is all perfectly in keeping with the raw values in Table 4.10: for *has*, expletives condition the most short allomorphs, and quantifiers and demonstrative *that* the least, with personal pronouns in the middle. The three interaction coefficients at the bottom of the table represent the effect these subject types have on *is* relative to their effect on *has*. For instance, to find the effect of expletive subjects on short allomorph selection for *is*, we add the *is/expletive* interaction coeffi-

cient to the expletive coefficient given at the top of the model (which was relevant to *has* only). In other words, we find that, for *is*, the log-odds of short allomorph selection with an expletive change by $-2.18 + 1.89$ in relation to personal pronouns: in other words, not much, as can be confirmed by the raw values in Table 4.10. The coefficient for demonstratives is likewise effectively zeroed out when we add the *is*-specific value (0.92) to the *has*-specific one (-1.19). The big difference comes from quantifiers: they do disfavor short allomorph selections to pronouns for *has* ($\beta = -1.69$), but do so even more for *is* ($\beta = -1.69 + -1.91$). The effect of a quantifier subject on short allomorph selection, then, is stronger for *is* than for *has*.

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	1.04	0.78	1.34	0.18
AUXILIARY = is	2.21	0.32	6.93	0.00
SUBJECT_TYPE = expletive	1.89	0.78	2.43	0.02
SUBJECT_TYPE = demonstrative	-1.19	0.40	-3.00	0.00
SUBJECT_TYPE = quantifier	-1.69	0.36	-4.74	0.00
SPEAKING_RATE	0.11	0.11	0.95	0.34
SEX = F	-0.32	0.11	-2.82	0.00
DOB	0.16	0.07	2.51	0.01
EDUC_STEP	-0.36	0.18	-2.04	0.04
CORPUS = Fisher	-0.99	0.75	-1.33	0.18
CORPUS = Switchboard	0.37	0.41	0.89	0.37
AUXILIARY = is:SUBJECT_TYPE = expletive	-2.18	0.87	-2.52	0.01
AUXILIARY = is:SUBJECT_TYPE = demonstrative	0.92	0.51	1.80	0.07
AUXILIARY = is:SUBJECT_TYPE = quantifier	-1.91	0.48	-4.01	0.00

Table 4.11: Short allomorph selection for *is* and *has* after pronoun-like subjects.

	Df	AIC	BIC	logLik	Chisq	Chi Df	Pr(>Chisq)
model0	11	1397.63	1467.94	-687.81			
model0a	14	1286.77	1376.27	-629.39	116.85	3	0.0000
model1	17	1263.20	1371.87	-614.60	29.57	3	0.0000

Table 4.12: Comparison of three models of short allomorph selection for *is* and *has* after pronoun-like subjects: without subject type (Model 0), with subject type and auxiliary identity but without an interaction between them (Model 0a), and with the interaction between the two (Model 1).

4.5.3. Discussion

It is safe to say that short allomorph selection for *is* is essentially at ceiling after pronoun-like subjects, and further, that expletives and the demonstrative *that* qualify as “pronoun-like.” The lowered short allomorph rate after quantifiers indicates that, despite the fact that quantifiers are a closed class, like pronouns, they behave more like noun phrases in terms of short allomorph selection: i.e., short allomorphs are not inserted near-categorically after quantifier subjects. The majority of quantifiers are polysyllabic; thus, this could be yet another instance of subject “heaviness” disfavoring short allomorphs (see Chapter 5 for more on this). This is not to say, however, that quantifiers behave strictly like single-word noun phrases where short allomorph selection is concerned. For both *is* and *has*, I ran regressions on data that combined tokens with single-word noun phrase subjects and tokens with quantifier subjects. For each auxiliary, the coefficient for quantifiers was significantly higher than that for noun phrases, indicating that, while quantifiers may condition short allomorphs less than pronouns do, they still do so at a higher rate than noun phrases of equal heaviness. (*is*: $\beta = 1.02, p < .01$; *has*: $\beta = 1.07, p = 0.01$.) The implication of this middle-of-the-road behavior of quantifiers is something to set aside for future work.

We have already seen that short allomorphs of *has* after personal pronouns are selected at a lower rate than those of *is* in the same environment (e.g. Figure 3.1, and the values in Table 4.9), so it is not surprising that short allomorph rates for *has* are lower than those for *is* after other subject types, too (attested by the positive coefficient for AUXILIARY = IS in the model in Table 4.11). But expletives represent an unexpected exception to this: *has* short allomorph selection after expletives is perfectly in line with *is* short allomorph selection after expletives, with both essentially at ceiling (evidenced by the near-zero IS / EXPLETIVE interaction coefficient in

Table 4.11). Particularly interesting about this is the fact that it means that short allomorphs of *has* are selected more after *it* when *it* is a semantically empty expletive pronoun than when it is a contentful personal pronoun. This is confirmed in the rates of short allomorph selection provided in Table 4.13; this table consists only of tokens of *has* after *it*. The two types of *it* differ significantly via a χ^2 test ($\chi^2 = 9.8$, $p < 0.01$), though the effect is certainly small.¹⁷

	pronoun	expletive
short allomorph rate	0.88	0.99
N	248	99

Table 4.13: Rates of short allomorph selection for *has* after two types of *it* subjects: personal pronoun *it* and expletive *it*.

We can come up with a few plausible explanations for this finding. Maybe allomorph selection is sensitive to the syntactic role of the pronoun to which it is attaching. After all, we have already seen that auxiliaries do not contract to embedded personal pronouns in the same way that they do to stand-alone personal pronouns, indicating that it is more than simply the phonology of an auxiliary's host that affects short allomorph selection. There may also be a prosodic effect. Expletive *it* is never subject to stress; maybe it phrases with the following auxiliary more often than does personal pronoun *it*. Perhaps also relevant is the fact that the two types of *it* differ widely in which words may follow the auxiliary when that *it* is the subject. Specifically, when the *it* subject is an expletive, a full 93% of these following words are the past participle *been*.¹⁸ When the *it* subject is a personal pronoun, on the other hand, only 52% are *been*: there is a much wider range of past

¹⁷Gillian Sankoff notes the similarity of this effect to a finding from her study of Montreal French, where women were observed to delete /l/ in impersonal *il* at a much higher rate than in personal *il* (Sankoff, 1980a, Table 3-2).

¹⁸Apart from *been*, expletive pronouns in my data are followed by three past participles — *gotten*, *rained*, and *supposed* — and two adjectives: *really* and *just*.

participles used with the pronoun subject. The past participle *been* may be, for instance, reduced, or prosodically light, in a way that favors the short allomorph of the preceding auxiliary. Prosody of the word following the auxiliary is something that it will be fruitful to examine in future work (and see also Section 7.4.3).

There are a number of ways we can investigate whether it really is *been* that is playing a role here. First, I restricted the data to just those tokens in which *been* immediately follows the auxiliary, for both types of *it* subjects. We find that the rate of *has* short allomorph selection with personal pronoun *it* raises to 0.93 (Table 4.14; the rate of short allomorphs of *has* after expletive *it* does not change). These values do not differ significantly ($\chi^2 = 3.06, p = 0.08$). We also find that, if we split the post-personal pronoun *it has* data into tokens for which the past participle is *been* and all other tokens, the short allomorph rate is significantly higher with a following *been* (Table 4.15; $\chi^2 = 6.48, p = 0.01$).

	pronoun	expletive
short allomorph rate	0.93	0.99
N	129	92

Table 4.14: Rates of short allomorph selection for *has* with an immediately following *been*, after two types of *it* subjects: personal pronoun *it* and expletive *it*.

	been	other
short allomorph rate	0.93	0.82
N	129	119

Table 4.15: Rates of short allomorph selection for (pronoun) *it has* with an immediately following *been* vs. all other words immediately following the auxiliary.

I also performed a regression solely on tokens of *it has*, containing (in addition to the usual control predictors) a fixed effect of subject type (pronoun or expletive) and a random effect of following word. Subject type does not turn out to be a

significant predictor in the model ($\beta = 7.51$ but $p = 0.33$, and a standard error of 7.76 means that the 95% confidence intervals include what is essentially zero).¹⁹

It appears, then, that the apparent short allomorph-favoring effect of an expletive subject on *has* may actually have more to do with the fact that expletives and the past participle *been* tend to go together, and future work which pays closer attention to the nature of the word(s) following an auxiliary may have more to say about this.

In sum, then, **short allomorph selection for *is* is essentially at ceiling for all pronoun-like subjects. Short allomorph rate of *has* is also high for pronoun-like subjects, and nearly categorical in *it's been* collocations. For both auxiliaries, quantifiers do not condition short allomorphs to the extent that pronouns do, but exceed noun phrases of similar heaviness.**

¹⁹However, it is important to note that a comparison of this model to a model that is lacking a term for subject type finds that the model with subject type is significantly different ($p < 0.01$), and lowers both AIC (from 194.91 to 178.16) and BIC (from 229.5 to 216.6) values. So subject type is not doing nothing.

4.6. Factors particular to noun phrase subjects

4.6.1. Introduction

The amount of data we can look at is reduced with post-noun phrase auxiliaries. Based on the correspondences from Table 4.2, we can examine post-noun phrase allomorph selection for only four auxiliaries: *has*, *is*, *will*, and *would*. This is because *had* and *have* surface in post-noun phrase intermediate forms which are impossible to trace back with confidence to either the short or the long allomorph. Along with this, there is the issue that, as Figure 3.2 showed, short allomorph selection for *would* is particularly low after noun phrase subjects, so we are not likely to find particularly strong conditioning effects since non-application is practically at ceiling (and see Section 4.6.2.1 for a confirmation of this). That essentially leaves us with three auxiliaries with which to examine conditioning on allomorph selection that comes from elements of the noun phrase subject. I devote Section 4.6.2.2 to *is* and Section 4.6.2.3 to *has* and *will*.

All regressions reported below included a term for number of orthographic words (technically, the log of the number of orthographic words, represented in the regression outputs as $\text{LOG}(\text{SUBJECT_WORD_COUNT})$), anticipating the findings from Chapter 5 that this measure plays a significant role in short allomorph selection after noun phrase subjects. All regressions also incorporated a random intercept of the word immediately preceding the auxiliary (so, the last word of the noun phrase subject).

4.6.2. Findings

4.6.2.1. *would*

The auxiliary *would*'s rate of long allomorph selection is essentially at ceiling, with an intermediate form rate (i.e., short allomorph selection rate) of 6%. With such a low rate of "hits," mixed-effects models frequently fail to converge, so it is difficult to get an idea of what's going on. Random effects have to be omitted in order to prevent false convergence. In those models that I could get to converge, I tested fixed effects of subject number of words, preceding segment phonology, and preceding grammatical class (all as outlined in Section 4.2.2). None was found to be significant and none significantly improved model log likelihood. The rate of *would* short allomorph selection after noun phrases just seems to be especially low, such that conditioning factors cannot manifest.

4.6.2.2. *is*

The auxiliary *is* was examined separately from the others under study in order to test for effects of following constituent category (65), something that was not relevant for *has*, *will*, or *would*. Though Section 4.4.2 found no effect of following constituent category on post-pronoun *is*, short allomorph selection in that environment was essentially at ceiling anyway, so there wasn't much room for variation to begin with. There was reason to believe that post-noun phrase *is*, with a short allomorph rate of 40%, would behave differently.

Neither preceding syllable stressedness nor grammatical class of preceding word turned out to be significant predictors of short allomorph selection for post-noun phrase *is*. In the two sections to follow, I consider in detail the effects of following constituent category (Section 4.6.2.2.1) and preceding segment phonology

(Section 4.6.2.2.2) on realization of this auxiliary. Where following constituent is concerned, I replicate the hierarchy found in previous research (e.g., Labov, 1969; Baugh, 1980; Rickford et al., 1991; McElhinny, 1993), and investigate whether its source may lie in the information structure of different types of copular clauses. As concerns preceding segment phonology, I replicate the finding of previous work that short allomorphs are favored after vowels (Labov, 1969), and I also investigate the possible sources of an apparent disfavoring effect of a preceding velar.

4.6.2.2.1. Following constituent category

Table 4.16 shows short allomorph rate for post-noun phrase *is* by the different categories of following constituents that were coded for. Simply based on significance tests of these raw proportions, we find support for the hierarchies found in previous research. Short allomorphs are less likely before a noun phrase, and much more likely before a progressive verb (the two categories significantly differ in short allomorph selection rate, $p < 0.01$).²⁰ *Gonna* and *like* are somewhere in between, not differing significantly in short allomorph rate from any other category. Finally, adjective and locative join progressive at the top of the hierarchy. These three do not differ in short allomorph rate from each other, but all differ from a following noun phrase ($p < 0.01$ in all cases).

I first carried out a regression that incorporated following constituent (“FOLL-CONSTIT” in the models to follow) with no levels collapsed. This model was found to differ significantly via likelihood ratio test from a model lacking following con-

²⁰One question raised by the “progressive verb” category is whether short allomorph rate is differently affected by the presence of an adverb separating the auxiliary from its progressive participle: i.e. whether *It's still sitting there* patterns differently from *It's sitting there*. There were only 13 tokens in which an adverb separated the auxiliary and the progressive participle, compared to 81 with no intervening adverb, and the adverb tokens did not differ in short allomorph rate from the no-adverb tokens ($\chi^2 = 0.57$, $p = 0.45$). From this we can conclude that it is the progressive construction, not the linear sequence of auxiliary + progressive participle, that is driving the effect.

	adjective	<i>gonna</i>	<i>like</i>	locative	noun phrase	none	progressive
short allomorph rate	0.45	0.58	0.32	0.57		0.32	0.22
N	439	33	28	67	474	37	94

Table 4.16: Rates of short allomorph selection for *is* after noun phrase subjects, by category of following constituent. Underlined values differ significantly from the short allomorph rate with a following noun phrase (0.32).

stituent ($p < 0.01$). This confirms that following constituent is necessary for explaining the variation in post-noun phrase *is* realization.

I then examined whether any of the following constituent categories could be collapsed to reduce degrees of freedom. I first constructed a model with *gonna* and progressive verb collapsed into a **verbal** category, and adjective and locative collapsed into an **adjectival** category. I also collapsed “none” with noun phrase, the most common following constituent (the two did not differ significantly via the pairwise test of proportions performed above; $p = 1$). Tokens with a following *like* were left alone. A model with FOLLOWING CONSTITUENT collapsed thusly does not differ significantly from one without FOLLOWING CONSTITUENT collapsed ($p = 0.71$; Table 4.17); we are thus justified in retaining the collapse. We may also be justified in further collapsing tokens with a following *like* into the “adjectival” category; such a model does not differ significantly from the collapsed model that leaves *like* in its own category (though $p = 0.04$).²¹ Pace Rickford et al. (1991), a model in which following constituents are reclassified as those in which the verb is functioning as an auxiliary (*so, gonna* and progressive verbs) vs. functioning as a copula (all other environments) is not justified; it differs significantly via likelihood ratio test from a model with FOLLOWING CONSTITUENT uncollapsed ($p < 0.01$).

²¹Either way, the data on following *like* must be interpreted with caution. Tokens are few, and many of them (57%) come from two speakers’ semantic differential tests, meaning that there could

	Df	AIC	BIC	logLik	Chisq	Chi Df	Pr(>Chisq)
model2	15	1336.14	1411.72	-653.07			
model1	18	1340.77	1431.47	-652.39	1.37	3	0.7134

Table 4.17: Model comparison for two different models of short allomorph selection for post-noun phrase *is*: without (Model 1) and with (Model 2) following constituent collapsed.

The four-category model is displayed in Table 4.18. The observed hierarchy of following constituents — noun phrase < adjectival < verbal — mirrors findings from previous research.²² Work on copula contraction in African American English (e.g. Labov, 1969; Rickford et al., 1991) has consistently found less contraction before noun phrases and more contraction before progressive verbs.²³ Work on copula contraction in white English has tended to show similar patterns (Labov, 1969; McElhinny, 1993); this provides yet another demonstration. In sum, **following constituent has a significant effect on short allomorph selection for post-noun phrase *is*, and we are justified in collapsing across constituents, resulting in the hierarchy noun phrase < adjectival < verbal.**

Why should the hierarchy go in this way? One avenue to explore is the information structure of different types of copular sentences. Sentences in which the copula is followed by a noun phrase can differ in information structure from those in which the post-copula constituent is of a different category. Specifically, sentences in which the copula is followed by a noun phrase or a clause may be either

be a style confound.

²²Since we are using sum contrasts, we don't get a coefficient for the VERBAL level, but we can estimate it by adding up the coefficients for the other levels and multiplying this sum by -1. The result (1.29) is positive, indicating that a following verbal constituent favors short allomorph selection, and is greater than the coefficient for a following adjective.

²³Though see Rickford et al. (1991) for discussion of an alternative way of defining the envelope of variation for contraction in AAE that reverses the hierarchy.

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-1.35	0.61	-2.21	0.03
FOLL_CONSTIT = adjectival	0.47	0.20	2.31	0.02
FOLL CONSTIT = like	-1.31	0.49	-2.68	0.01
FOLL_CONSTIT = noun phrase	-0.45	0.23	-1.98	0.05
log(SUBJECT_WORD_COUNT)	-1.43	0.20	-7.01	0.00
SPEAKING_RATE	0.06	0.11	0.55	0.58
SEX = F	-0.30	0.10	-2.88	0.00
DOB	0.22	0.06	3.64	0.00
EDUC_STEP	-0.22	0.15	-1.48	0.14
CORPUS = Fisher	-0.28	0.16	-1.78	0.08
CORPUS = Switchboard	-0.40	0.19	-2.17	0.03

Table 4.18: Short allomorph selection for post-noun phrase *is* with following constituent category collapsed to four categories: following noun phrase vs. adjectival vs. *like* vs. verbal.

“specification,” meaning that the item that follows the copula identifies or renames the subject (67a), or “predication,” meaning that the item that follows the copula describes the subject (67b). Sentences in which the copula is followed by a verb or adjective, on the other hand, are exclusively predication (67c). Mikkelsen (2004:102) identifies specification copula constructions as having discourse-old subjects.

- (67) Different types of copula clauses, with constituents identified as “individuals” or their “properties” following Mikkelsen (2004)
 - a. Specificational: [The youngest]_{property} is [Casey]_{individual}. (Amy)
 - b. Predication: [My daughter]_{individual} is [a pediatric nurse]_{property}. (Jean)
 - c. Predication: [Casey]_{individual} is [twenty-two]_{property}. (Jenny McPhee)

If sentences in which the copula is followed by a noun phrase are largely of the specification variety, and other types of copular constructions are (by default)

predicational, the observed difference in short allomorph selection rate by following constituent could be better attributable to an effect of the differing information structure patterns between the types of sentences (though the difference between following adjectivals and verbs demonstrated in Table 4.18 would still need to be accounted for, as both are predicational). However, it is not the case that copular sentences with noun phrase complements are overwhelmingly specifical: in my data, only 19% of them are, not enough to bias the results.

Moreover, there is no indication that short allomorphs are less likely in specifical sentences. A regression on the post-noun phrase *is* data, restricting the data to only those tokens in which the copula takes a noun phrase complement, and incorporating a term for whether a sentence is specifical or predicational, finds no significant effect of the information structure of the sentence.

Detailed coding of the discourse status of the components in a copular sentence is something that remains for future work. An effect of information structure on copula contraction has been found in one previous study, on a very local level: Frank and Jaeger (2008) find contraction of forms of BE (and forms of HAVE, as well) to be less likely when the auxiliary in question is less predictable given the two words preceding it. They also find that contraction of an auxiliary is less likely when that auxiliary precedes a contextually unlikely item. Their proposal is that elements that are themselves high in information content or that precede elements that are high in information content (with amount of information content operationalized by unpredictability) are less likely to be reduced. This maintains a uniform transmission of information throughout the signal.

Future work can examine whether this extends to the level of larger constituents. Preliminary results from my data appear conflicting, and require closer examination. My data contain 11 tokens that take the structure *The topic is...* from

speakers recorded for the Fisher corpus introducing the topic they are to discuss with their interlocutor. None of these is contracted, and this 0% rate of short allomorph selection is significantly different from the 47% rate observed with other two-word subjects ($\chi^2 = 7.81, p = 0.01$). This would seem to imply a low rate of short allomorph use before a source of new information, along the same lines as what Frank and Jaeger (2008) found, though we would need more data to be able to say this for sure. On the other hand, sentences in which the speaker introduces a name (e.g. *my/your/his/her/their name is...*) also present discourse-new information after the copula, yet show no significant difference in short allomorph rate as compared to other two-word subjects ($\chi^2 = 0, p = 0.95$). Detailed coding of the discourse status of the constituents surrounding the copula will be necessary in order to determine conclusively whether there is a pragmatic effect on contraction. This may subsequently speak to questions concerning extra-grammatical conditions on linguistic variation (see Chapter 7).

4.6.2.2.2. Preceding segment phonology

Place of articulation. Four places of articulation were coded for the segment immediately preceding an auxiliary (i.e. the final segment of a noun phrase subject): labial, coronal (comprising interdental, alveolar, palatal, and alveopalatal), velar, and vocalic (including diphthongs). The table of raw proportions (Table 4.19) appears to indicate that short allomorphs are selected less often with a preceding velar than with any other segment ($p < 0.01$ for vowels and coronals; $p = 0.01$ for labials), and a likelihood ratio test finds a model lacking PRECEDING SEGMENT PLACE OF ARTICULATION differs significantly from one containing it ($p < 0.01$).

	vocalic	velar	labial	coronal
short allomorph rate	0.51	0.22	0.40	0.41
N	266	109	236	561

Table 4.19: Rates of short allomorph selection for post-noun phrase *is*, by place of articulation of immediately preceding segment. All values differ significantly from the value for velar (0.22).

The negative effect of a preceding velar is in evidence in the output of the model (Table 4.20), as is a positive effect of a preceding vowel. The favoring effect of a preceding vowel is familiar from previous studies of copula contraction (Labov, 1969), but the velar effect is novel.

Why would there be an effect of preceding velar like this? There are two possibilities that I can think of. First of all, many velar-final words are *-ing* words: gerunds, or progressive participles at the end of sentential subjects (e.g. *what winds up happening, whatever you think you're accomplishing*). Complex subjects disfavor short allomorphs (Chapter 5), so it's conceivable that the putative effect of velar-final words is more accurately attributable to a low rate of short allomorphs af-

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-1.59	0.62	-2.55	0.01
PLACE = vocalic	0.67	0.19	3.60	0.00
PLACE = velar	-0.72	0.27	-2.66	0.01
PLACE = labial	0.02	0.25	0.09	0.93
FOLL_CONSTIT = adjectival	0.46	0.20	2.28	0.02
FOLL_CONSTIT = like	-1.24	0.49	-2.51	0.01
FOLL_CONSTIT = noun phrase	-0.47	0.23	-2.06	0.04
log(SUBJECT_WORD_COUNT)	-1.34	0.20	-6.55	0.00
SPEAKING_RATE	0.07	0.11	0.62	0.54
SEX = F	-0.32	0.11	-3.05	0.00
DOB	0.22	0.06	3.67	0.00
EDUC_STEP	-0.21	0.15	-1.41	0.16
CORPUS = Fisher	-0.27	0.16	-1.69	0.09
CORPUS = Switchboard	-0.42	0.19	-2.25	0.02

Table 4.20: Short allomorph selection for post-noun phrase *is* with a term for place of articulation of preceding segment (“PLACE”).

ter subjects ending in an *-ing* word.²⁴ In order to investigate this, I examined the by-word random intercepts generated by a model **lacking** a term for PLACE (but containing all the other control predictors as usual). These give us an indication of the effect each individual word has on short allomorph selection before the effect of the place of articulation of its final segment has been factored out. We can thus see if it is reasonable to propose that the disfavoring effect of velars could instead be coming from a number of *-ing*-final words with negative intercepts. In fact, we find that *-ing* words have a negative random intercept 76% of the time, while non-*ing* velar-final words have a negative random intercept only 68% of the time. (This difference is not significant by a χ^2 test, though: $\chi^2 = 0.17$, $p = 0.68$.)

²⁴I would have hoped that including a SUBJECT NUMBER OF WORDS predictor in the model, as I have consistently been doing with noun phrase subjects, would have accounted for this effect, but see Section 5.4.3.2 for a discussion of the possibility that syntactic complexity and word count may contribute separate effects on short allomorph selection.

The other possibility is that certain words are biasing the data despite the inclusion of a random PRECEDING WORD effect. There are some likely candidates for this. The six words with the most negative intercepts from the model lacking a term for PLACE are presented in Table 4.21, alongside the number of times they preceded *is* in the coded data (“Count”). These are the words that most disfavor short allomorphs according to that model.

Word	Count	Intercept	Place
thing	10	-1.03	velar
Cottman	3	-0.98	coronal
oldest	7	-0.94	coronal
topic	11	-0.86	velar
math	2	-0.79	coronal
youngest	5	-0.78	coronal

Table 4.21: Top 6 most disfavoring words for short allomorphs of *is*, based on word-level random intercepts from a model that does not contain a PRECEDING SEGMENT PLACE OF ARTICULATION term. “Count” represents the number of tokens in which each word preceded *is*; “Place” indicates the place of articulation of the final segment of the word. The more negative a word’s intercept, the more it disfavors short allomorphs of *is*.

There are two velar-final words among the top six, both of which occur relatively frequently in the data: *thing* and (as seen previously in Section 4.6.2.2.1) *topic*. In fact, of the words that disfavor short allomorphs — that is, all the words with negative intercepts — *topic* occurs in the most tokens, and *thing* in the second-most (tied with *do* and *son*). It is conceivable, then, that even with a random effect of PRECEDING WORD in our models, these two relatively frequent words are biasing the data and introducing an effect of a final velar that cannot actually be generalized to the larger population of words.

I first investigated the possibility that the velar effect is really coming from -*ing* words. This seemed to me to be more conceivable than the possibility that

our random effect is somehow failing us by being biased by two words. Table 4.22 shows the raw proportions of short allomorph selection that we get when we divide preceding segment up into coronal, velar from an *-ing* word, labial, velar not from an *-ing* word, and vocalic. We immediately see that, though non-*ing* velars do contract at a low rate, *-ing*-velars contract at an even lower rate. A pairwise test of proportions finds that *-ing* and velar both differ significantly from vocalic ($p < 0.01$ in both cases). There are no other significant differences.

	coronal	ing	labial	velar	vocalic
short allomorph rate	0.41	<u>0.18</u>	0.4	<u>0.25</u>	0.51
N	561	45	236	64	266

Table 4.22: Rates of short allomorph selection for *is* after noun phrase subjects, by place of articulation of immediately preceding segment. Velar-final words have been split into those that end in *-ing* and those that do not. Underlined values differ significantly from the rate of short allomorphs after a vowel (0.51).

The optimal collapse of PRECEDING SEGMENT turns out to be one in which the data is divided into three categories: “consonantal” (encompassing labial, coronal, and non-*ing* velar), *-ing*, and vowels. This model does not significantly differ via likelihood ratio test from the model with five categories for PLACE ($p = 0.36$). And, in fact, it shows a disfavoring effect of *-ing*, as predicted. Table 4.23 presents this model, with PLACE treated as treatment contrasts. The “vocalic” level is the untreated one (hence its omission from the model summary). I opted to do this based on Labov’s (1969) proposal that contraction of *is* may be sensitive to the formation of consonant clusters, hence the disfavoring effect of a preceding consonant on contraction that he found in his data. There would thus be a logical reason for a preceding consonant to have an effect on contraction, and we have already discussed a logical reason for preceding *-ing* to have an effect on contraction, but there is no obvious reason why a preceding vowel should have an effect on con-

traction, hence my decision to make it the untreated category. In fact, as Table 4.23 shows, this way of analyzing the data finds significant disfavoring effects of both a preceding consonant and a preceding *-ing*.²⁵

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-0.87	0.63	-1.38	0.17
PLACE = consonantal	-0.71	0.23	-3.10	0.00
PLACE = ing	-1.60	0.62	-2.57	0.01
FOLL_CONSTIT = adjectival	0.45	0.20	2.24	0.03
FOLL_CONSTIT = like	-1.25	0.49	-2.53	0.01
FOLL_CONSTIT = noun phrase	-0.47	0.23	-2.08	0.04
log(SUBJECT_WORD_COUNT)	-1.35	0.21	-6.57	0.00
SPEAKING RATE	0.06	0.11	0.58	0.56
SEX = F	-0.32	0.11	-2.98	0.00
DOB	0.22	0.06	3.62	0.00
EDUC_STEP	-0.21	0.15	-1.42	0.16
CORPUS = Fisher	-0.27	0.16	-1.70	0.09
CORPUS = Switchboard	-0.42	0.19	-2.23	0.03

Table 4.23: Short allomorph selection for post-noun phrase *is* with place of articulation of preceding segment collapsed into three categories. PLACE is analyzed using treatment contrasts; vocalic is default.

We can thus conclude that **the specific place of articulation of the segment preceding *is* does not play a significant role in short allomorph selection**. What variance there is can be attributed either to a consonant vs. vowel distinction (exactly as was found by Labov in the earliest work), or to the effect of *-ing*-final words driving down the rate of short allomorphs.

²⁵Performing the same analysis on this data, but omitting tokens in which the preceding word is *topic* or *thing*, finds the same effects to be significant, in the same direction, with comparable coefficients: so the velar effect was not coming simply from these two words.

Manner of articulation. The manners of articulation coded for were vowel (including diphthongs), stop, sibilant, non-sibilant fricative, nasal, /l/, and /r/. Preceding sibilants were omitted from study for *is* due to the impossibility of determining whether the schwas that invariably follow them were underlying or derived (see Section 3.4.2). Based on the findings of the previous section, I also added a category for *-ing* words, so that we don't end up with a spurious effect of a preceding nasal that is actually attributable to the effect of these words that we found previously.

Table 4.24 shows the raw proportions of short allomorph selection for post-noun phrase *is* by the different preceding segment manners of articulation coded for. Short allomorphs are significantly more likely after a vowel than after a stop, a non-sibilant fricative, or an *-ing* word (all $p < 0.01$). Likewise, short allomorphs are selected after a following /r/ at a significantly higher rate than after a stop, a non-sibilant fricative, an *-ing* word, or a nasal (all $p < 0.01$).

	ing	l	nasal	nonsib fric	r	stop	vocalic
short allomorph rate	<u>0.18</u>	0.43	<u>0.4</u>	<u>0.18</u>	0.62	<u>0.31</u>	0.51
N	45	46	331	51	132	301	266

Table 4.24: Rates of short allomorph selection for post-noun phrase *is*, by manner of articulation of immediately preceding segment. Underlined values differ significantly from the rate with a preceding /r/ (0.62) and also (with the exception of nasal) from the rate with a preceding vowel (0.51).

Table 4.25 displays the model including PRECEDING SEGMENT MANNER OF ARTICULATION (abbreviated in the model as MANNER). We find significant effects of non-sibilant fricatives (negative) and /r/ (positive). The regression with a MANNER term is an improvement over the one without, significantly differing via likelihood ratio test ($p < 0.01$) and reducing both AIC (from 1336.14 to 1302.92) and BIC (from 1411.72 to 1408.73) values.

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-1.61	0.63	-2.55	0.01
MANNER = ing	-0.85	0.51	-1.68	0.09
MANNER = l	0.14	0.38	0.37	0.71
MANNER = nasal	-0.01	0.24	-0.03	0.98
MANNER = nonsib fric	-1.15	0.51	-2.27	0.02
MANNER = r	1.48	0.28	5.28	0.00
MANNER = stop	-0.35	0.22	-1.64	0.10
FOLL_CONSTIT = adjectival	0.45	0.21	2.18	0.03
FOLL_CONSTIT = like	-1.34	0.50	-2.67	0.01
FOLL_CONSTIT = noun phrase	-0.41	0.23	-1.81	0.07
log(SUBJECT_WORD_COUNT)	-1.37	0.20	-6.70	0.00
SPEAKING_RATE	0.04	0.11	0.41	0.68
SEX = F	-0.32	0.11	-3.05	0.00
DOB	0.23	0.06	3.75	0.00
EDUC_STEP	-0.21	0.15	-1.39	0.16
CORPUS = Fisher	-0.25	0.16	-1.58	0.11
CORPUS = Switchboard	-0.38	0.19	-2.01	0.04

Table 4.25: Short allomorph selection for post-noun phrase *is* with a term for manner of articulation of preceding segment (“MANNER”).

Because some levels are not found to have a significant effect or differ from each other in proportion of short allomorphs, I collapsed some levels. Specifically, I grouped nasal, stop, and /l/ together in a “consonantal” category. I left /r/ and non-sibilant fricatives separate because of their significant effects, and I left *-ing* words separate as well given the discussion from the previous section. The results of this model are displayed in Table 4.26, with treatment contrasts and vocalic as the untreated level.²⁶ This model shows, broadly, that short allomorph selection for *is* is disfavored after consonants, an effect that is particularly strong when the consonant is a non-sibilant fricative, or part of an *-ing* word. There is also a rela-

²⁶The collapsed model doesn’t differ significantly via likelihood ratio test from the model with no collapse ($p = 0.39$); it also lowers AIC (from 1302.92 to 1300.81) and BIC values (from 1408.73 to 1396.54) from those of the uncollapsed model.

tively weak but significant positive effect of a preceding /r/.

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-0.87	0.63	-1.38	0.17
MANNER = consonantal	-0.92	0.23	-3.95	0.00
MANNER = ing	-1.60	0.61	-2.62	0.01
MANNER = nonsib fric	-1.91	0.61	-3.13	0.00
MANNER = r	0.74	0.34	2.17	0.03
FOLL_CONSTIT = adjectival	0.46	0.21	2.24	0.02
FOLL_CONSTIT = like	-1.38	0.50	-2.75	0.01
FOLL_CONSTIT = noun phrase	-0.40	0.23	-1.75	0.08
log(SUBJECT_WORD_COUNT)	-1.39	0.21	-6.75	0.00
SPEAKING RATE	0.04	0.11	0.39	0.70
SEX = F	-0.32	0.11	-3.06	0.00
DOB	0.23	0.06	3.77	0.00
EDUC_STEP	-0.20	0.15	-1.35	0.18
CORPUS = Fisher	-0.26	0.16	-1.63	0.10
CORPUS = Switchboard	-0.39	0.19	-2.03	0.04

Table 4.26: Short allomorph selection for post-noun phrase *is* with preceding segment manner of articulation collapsed. MANNER is analyzed using treatment contrasts; vocalic is default.

The two phonological effects — of a preceding non-sibilant fricative and a preceding /r/ — are unexpected, and required a little investigation. As before, I examined the by-word random intercepts to see if a particular family of words may be biasing the data. I first considered the positive effect of /r/. If we look at the most positive by-word intercepts from a model with no preceding segment term, we do indeed find that many of them are frequent words ending in /r/. Table 4.27 shows the 16 most positive by-word intercepts (that is, the 16 words that most favor short allomorphs). Among them are *daughter*, *brother*, *mother*, and *sister*, all of which immediately precede *is* with some frequency in the corpus under study.

Could there be some effect of these kinship terms that causes them to be strong short allomorph promoters, thereby skewing the results of /r/-final words? In order to test this, I tried omitting these four words (*daughter*, *brother*, *mother*, *sister*)

Word	Count	Intercept	Place	Manner
daughter	11	1.91	coronal	r
mom	14	1.59	labial	nasal
name	114	1.31	labial	nasal
brother	10	1.11	coronal	r
husband	20	0.93	coronal	stop
government	5	0.91	coronal	stop
family	23	0.90	vocalic	vocalic
country	8	0.90	vocalic	vocalic
guy	10	0.88	vocalic	vocalic
money	3	0.87	vocalic	vocalic
mother	17	0.81	coronal	r
baby	6	0.81	vocalic	vocalic
sister	8	0.77	coronal	r
hand	1	0.77	coronal	stop
Terry	4	0.76	vocalic	vocalic

Table 4.27: Top 15 most favoring words for short allomorphs of *is*, based on word-level random intercepts from a model that does not contain a term for the phonology of the preceding segment. “Count” represents the number of tokens in which each word preceded *is*; “Place” indicates the place of articulation of the final segment of the word; “Manner,” the manner of articulation. The more positive a word’s intercept, the more it favors short allomorphs of *is*.

and running the regression in Table 4.26 again. This resulted in a loss of 46 tokens. The results are in Table 4.28: /r/ is no longer a significant promoter of short allomorphs.²⁷ The connection between these four kinship terms and contraction needs to be set aside for future work.

The disfavoring effect of a preceding non-sibilant fricative does appear to be

²⁷ After having written this section, I coded some additional data and noted a few instances in which I had difficulty determining whether or not a copula had contracted after an /r/. Something about the sonorance of the /r/ made it difficult to determine whether or not a vowel followed. I do not remember encountering this during the coding of the data presented here, but it is conceivable that the putative /r/ effect could be an artifact of a coding bias. Note, of course, that I was not the only person who coded the data examined here (Section 3.2.1), but future work should perform reliability testing on coding in this environment before too much is made of this /r/ effect. It may be relevant that the four kinship terms all have the same prosodic shape; all end in [ər].

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-0.98	0.64	-1.52	0.13
MANNER = consonantal	-0.92	0.23	-3.98	0.00
MANNER = ing	-1.60	0.61	-2.63	0.01
MANNER = nonsib fric	-1.93	0.60	-3.20	0.00
MANNER = r	0.46	0.37	1.25	0.21
FOLL_CONSTIT = adjectival	0.55	0.22	2.52	0.01
FOLL_CONSTIT = like	-1.60	0.54	-2.93	0.00
FOLL_CONSTIT = noun phrase	-0.32	0.24	-1.34	0.18
log(SUBJECT_WORD_COUNT)	-1.38	0.21	-6.71	0.00
SPEAKING_RATE	0.03	0.11	0.28	0.78
SEX = F	-0.37	0.11	-3.48	0.00
DOB	0.25	0.06	3.95	0.00
EDUC_STEP	-0.22	0.15	-1.50	0.13
CORPUS = Fisher	-0.26	0.16	-1.62	0.10
CORPUS = Switchboard	-0.41	0.19	-2.14	0.03

Table 4.28: Short allomorph selection for post-noun phrase *is* with preceding segment manner of articulation collapsed and four frequent /r/-final familial terms (*daughter, brother, mother, sister*) removed.

real. I again examined the by-word random intercepts to see if any of the words ending in /f, v, θ, or ð/ stuck out as obvious confounds, but none did.²⁸ This effect may be best interpreted as dissimilatory; it is reminiscent of the fact that the short allomorph of *is* cannot surface as-is after sibilants (Section 3.4.2).

We can thus sum up the effect of preceding segment as follows. **Consonants in general disfavor short allomorphs as compared to vowels, but this is intensified when the consonant is a non-sibilant fricative.**

²⁸The non-sibilant fricative-final words that precede *is* in my data are *wife, stuff, love, of, myself, life, with, truth, earth, itself, belief, have, live, ninety-five, alive, drive, Steve, Eve, North, roof, math, and Thirtieth*.

4.6.2.3. *has* and *will*

I grouped data from post-noun phrase *has* and post-noun phrase *will* together, since they were coded for all the same predictors.

Preceding segment place of articulation. Once again, the four places of articulation coded for were examined separately for differing proportions (Table 4.29). The only significant effect came from the difference between coronal and velar segments for *has* ($p < 0.01$).

	vocalic	velar	labial	coronal
<i>has</i> short allomorph rate	0.36	0.12	0.26	0.4
N	102	40	47	243
<i>will</i> short allomorph rate	0.26	0.23	0.16	0.31
N	38	13	31	310

Table 4.29: Rates of short allomorph selection for post-noun phrase *has* and *will*, by place of articulation of immediately preceding segment. Underlined values differ significantly from each other.

A model with PLACE improves log likelihood over one without ($p < 0.01$) and lowers AIC (from 929.54 to 923.03), but no one place of articulation reaches significance at the $p = 0.01$ level (Table 4.30). Collapsing the various places of articulation into consonant vs. vowel, which did not change likelihood in the case of *is* (Section 4.6.2.2.2), **does** change log likelihood in the case of *has + will*, indicating that the collapse should not be retained ($p < 0.01$). The source of the apparent preceding segment effect on *has + will* is thus not as simple as a consonant/vowel divide, but pinning down its exact nature will probably require additional data on these auxiliaries.²⁹

²⁹It may be that one of the two auxiliaries shows a preceding segment effect while the other doesn't, although adding an interaction between PLACE and auxiliary identity does not improve model log likelihood ($p = 0.75$) and also serves to raise both AIC (from 923.03 to 927.82) and BIC (from 993.28 to 1012.13). Again, more data on these two auxiliaries may shed light on this issue.

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-2.54	0.77	-3.31	0.00
PLACE = vocalic	0.45	0.24	1.89	0.06
PLACE = velar	-0.66	0.38	-1.75	0.08
PLACE = labial	-0.40	0.31	-1.29	0.20
AUXILIARY = will	-0.33	0.22	-1.48	0.14
log(SUBJECT_WORD_COUNT)	-1.24	0.20	-6.28	0.00
SPEAKING_RATE	0.42	0.14	2.93	0.00
SEX = F	-0.25	0.11	-2.24	0.03
DOB	0.25	0.08	3.20	0.00
EDUC_STEP	-0.39	0.18	-2.13	0.03
CORPUS = PNC	0.36	0.40	0.92	0.36

Table 4.30: Short allomorph selection for post-noun phrase *has* and *will* with a term for place of articulation of preceding segment (“PLACE”).

Neither manner of articulation of preceding segment or stress of preceding syllable were significant predictors of short allomorph selection for *has* and *will*. Where preceding grammatical class is concerned, there is simply not enough data on *has* or *will* to examine this variable. Of the 432 tokens of *has*, 88% of them end in a noun; for *will*, the numbers are 93% of 392.

4.6.3. Discussion

Apart from the major conditioning factor of subject length, which will be examined in more detail in Chapter 5, and the previously-attested conditioning factor of following constituent in the case of *is*, there are not many linguistic effects on short allomorph selection when auxiliaries combine with noun phrase subjects. The auxiliary *is* shows a strong effect of following constituent category, as has been shown in previous work; effects of information structure on copula contraction remain to be determined.

Phonological effects are robust only for *is*, and even then, are basically only attributable to a vowel vs. consonant effect, with short allomorphs less likely after consonants. When Labov (1969) found the same in his study, he suggested that the dispreference for contraction of *is* after a consonant could be attributed to a dispreference for consonant clusters: speakers fail to contract where they would generate, say, [ts], or [dz]. This point was underscored by the fact that the opposite was shown for **deletion** of *is*, which was **favored** by a preceding consonant. Under Labov's proposal that deletion applies on the output of contraction, this can be attributed to the same constraint against consonant clusters, which would be formed by contraction but can be subsequently simplified by deletion. However, the fact that we do not find a disfavoring effect of a preceding consonant on short allomorph selection for *has* (Section 4.6.2.3) would seem to contradict the

consonant cluster proposal, at least for the dialects of English examined here. The same consonant clusters may form when *has* surfaces in its contracted form, yet its short allomorph is not disfavored after consonants. This leads me to suspect that, rather than post-*is* contraction being **disfavored after consonants**, we should instead think of it as being **favored after vowels**. The difference is relevant because after vowels, the full form of *is* creates hiatus, with two adjacent vowels — e.g. *Mary is* — while the full form of *has* does not — e.g. *Mary has*. This could be a likely source of the asymmetry between the two auxiliaries where the preceding segment effect is concerned.³⁰

4.7. Speaking rate

Frank and Jaeger (2008), who examined contraction of forms of BE and HAVE as transcribed in Switchboard, found a significant effect of speaking rate on contraction. Following them, I take the logarithmic transform of speaking rate. I also grouped tokens from multiple auxiliaries together where possible. When an auxiliary was coded for some factor that other auxiliaries were not, I had to examine it separately (e.g. post-noun phrase *is*, which was the only auxiliary coded for following constituent type), but when multiple auxiliaries were coded for all of the same factors, they were grouped.

The effect of speaking rate in my data turned out to be somewhat inconsistent. The four auxiliaries *had*, *has*, *have*, and *is*, which were analyzed together, were found to show an effect of speaking rate, in the expected direction (i.e., greater short allomorph usage as speaking rate increases; Table 4.31). A term for speaking rate improved log likelihood over a model that lacked it ($p < 0.01$), though a term

³⁰Labov does note that “the tendency runs strongly in” African American English to reduce consonant clusters through a variety of different means, so it is not inconceivable that different factors could be driving the consonant/vowel effect in the different dialects.

capturing the interaction between auxiliary identity and speaking rate did not ($p = 0.28$). Still, the graph of this data in Figure 4.1a shows wide confidence intervals in the lower ranges of speaking rate. Additionally, as was seen already in Figure 3.1, the auxiliaries plotted here (with the exception of *had*) predominantly favor their short allomorph after pronouns, such that there isn't much variation to examine, and the model may not be reliable.³¹

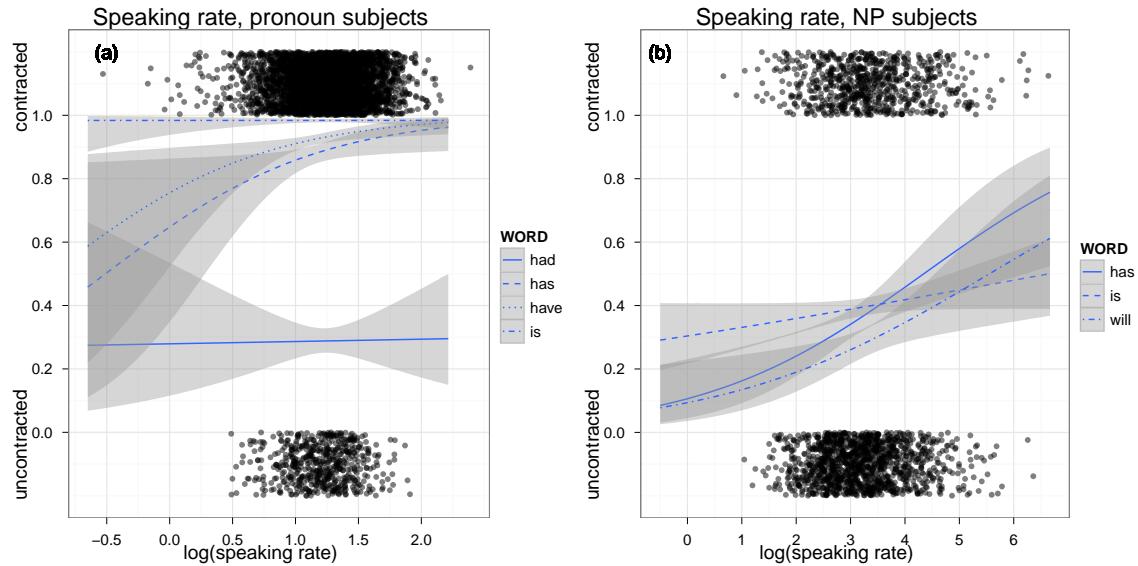


Figure 4.1: Effect of speaking rate on short allomorph selection after pronoun (a) and noun phrase (b) subjects, by auxiliary. “Contracted” = the surface reflex of an auxiliary’s short allomorph was observed; “uncontracted” = the surface reflex of the long allomorph. Smoothing lines fit via GLM.

Where post-noun phrase auxiliaries are concerned, we again see auxiliary-specific behavior. After noun phrases, the combined *has/will* data shows a significant effect of speaking rate (Figure 4.1b; Table 4.32; improves log likelihood, $p < 0.01$), but *is* does not. Again, an interaction between auxiliary identity and

³¹The few contracted tokens with very short speaking rates may be tokens in which the annotation unit (which, recall, was the basis for speaking rate calculation; see Section 4.2.1) consisted of only a single word. This occurred from time to time, when, for instance, a speaker started talking but was immediately interrupted, or interrupted themselves by hesitating, so these points should be interpreted with caution.

speaking rate (for the *has/will* data) does not improve model fit ($p = 0.71$).

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-0.67	0.69	-0.96	0.33
log(SPEAKING_RATE)	0.89	0.34	2.63	0.01
AUXILIARY = had	-3.56	0.14	-25.62	0.00
AUXILIARY = has	0.13	0.16	0.85	0.40
AUXILIARY = have	0.64	0.13	4.72	0.00
SEX = F	-0.43	0.11	-3.88	0.00
DOB	0.32	0.07	4.40	0.00
EDUC_STEP	-0.08	0.17	-0.49	0.62
CORPUS = PNC	-0.14	0.42	-0.34	0.74

Table 4.31: Short allomorph selection for post-pronoun *had*, *has*, *have*, and *is* with a term for speaking rate.

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-2.60	0.79	-3.28	0.00
log(SPEAKING_RATE)	1.20	0.44	2.74	0.01
PLACE = vocalic	0.44	0.24	1.86	0.06
PLACE = velar	-0.66	0.38	-1.74	0.08
PLACE = labial	-0.40	0.31	-1.26	0.21
AUXILIARY = will	-0.33	0.23	-1.45	0.15
log(SUBJECT_WORD_COUNT)	-1.25	0.20	-6.30	0.00
SEX = F	-0.25	0.11	-2.28	0.02
DOB	0.25	0.08	3.23	0.00
EDUC_STEP	-0.39	0.18	-2.10	0.04
CORPUS = PNC	0.45	0.39	1.14	0.25

Table 4.32: Short allomorph selection for post-noun phrase *has* and *will* with a term for speaking rate.

The failure of post-noun phrase *is* to show a speaking rate effect when post-noun phrase *has* and *will* do is likewise surprising. Possibly relevant is the fact that for *is*, speaking rate and subject length are positively correlated: with longer subjects, speaking rate increases. (The correlation, via Spearman's ρ , is very weak, at $\rho = 0.08$, but significant, at $p < 0.01$).³² This is not the case for the post-noun

³²I residualized speaking rate against number of words in my regression on the post-noun phrase

phrase *has/will* data, $\rho = -0.02$, $p = 0.48$). This correlation for the *is* data could serve to wash out the speaking rate effect, with no such thing occurring for the *has/will* data. But this is speculative. The effect of speaking rate on short allomorph section deserves a closer look, with more careful coding (e.g. normalization of rate by speaker, and calculation of rate over a larger span of speech, as described in Section 4.2.1). Where phonological rules are concerned, conditioning by speaking rate has been shown to be a relevant factor in localizing processes in different stages of PF (see, e.g. Pak, 2008); if we can confirm an effect of speaking rate on short allomorph selection, this may have interesting theoretical implications for the grammatical locus of this alternation.

is data accordingly. See Section 5.3.3 for more on the methodology behind residualization of correlated predictors.

4.8. “Auxiliary tense”

Figure 3.1 demonstrated that short allomorph selection after pronouns for *had* and *would* is conspicuously lower than it is for the other auxiliaries under study (*is*, *has*, *have*, and *will*), which are all close to categorical in their rate of short allomorph selection. With judicious attribution of intermediate forms, we found that this effect was replicated after full noun phrase subjects as well (Section 3.4.1). This section considers a number of possible explanations of the source of this effect.

I titled this section “auxiliary tense” in scare quotes because the difference between *had/would* and the other auxiliaries can be described as a difference in tense: the auxiliaries ending in /d/ express the past tense (e.g. in the pluperfect for *had*; in the imperfect for *would*), while the others express present. The /d/ in *had* and *would* additionally evokes the past tense -*d* morpheme. But this is not an explanation for the low rate of short allomorphs with these auxiliaries, simply a description. Likewise, both low-contracting auxiliaries end in /d/, but it is not immediately clear why this should lead to low rates of short allomorph selection. English clearly has no dispreference against affixing words with /d/; this is, after all, how the regular past tense is formed when a verb ends in a vowel (e.g. *played*). It is thus impossible to determine whether this effect should be attributed to an auxiliary’s expressing the past tense or to its ending in /d/: the two are impossible to tease apart. This section will thus try to find a better explanation for the low short allomorph selection rate of *had* and *would* than simply “they are both past tense” or “they both end in /d/.”

4.8.1. History

I first considered whether the contraction of *had* and *would* was a recent phenomenon and thus had simply not yet achieved the same rate of application as the other auxiliaries.³³ Simply looking at contraction of *would* in real time does not necessarily lend support to this claim. As will be demonstrated in Section 6.3.3.2, we actually find a significant **negative** effect of year of birth on short allomorph selection for post-pronoun *would*, with speakers who were born recently contracting **less** than those born closer to the beginning of the century. On this small scale, then, there is no indication that *would*-contraction is a recent development.

Contractions of *had* and *would* can be documented even earlier, as well. Jespersen (1928:365) notes that the forms *I'd* and *Ide* for contracted *I had* can be attested back to Elizabethan English. I also identified a number of instances of contracted *would* in the works of Shakespeare, by searching the corpus of digitized plays available at <http://www.rhymezone.com/r/ss.cgi> for the strings *I'd*, *I'd*, *you'd*, *you'd*, *he'd*, *he'd*. 68 gives some examples.

(68) Historical contraction of *would*

- a. The rest **I'd** give to be to you translated. (A Midsummer Night's Dream: I, i)
- b. **You'ld** be king o' the isle, sirrah? (The Tempest: V, i)

³³This would contradict what we know about how a change progresses through different environments. Specifically, Kroch (1989) proposes that a change that occurs in multiple environments begins at the same time in each and proceeds at the same rate in each; any lower rate of application of the change we see in one of them is simply due to external factors unrelated to the actuation of the change. Under Kroch's model, then, a single change may not start at two different times in two different environments. But Kroch's model represents cases in which a single underlying grammatical change manifests in multiple surface environments (what he calls "contexts tied together grammatically," p. 240); it is not clear whether contraction should be treated in the same way. Contraction of the various auxiliaries that undergo it could conceivably be distinct grammatical operations.

- c. To show his sorrow, **he'l**d correct himself. (Pericles, Prince of Tyre: I, iii)

The fact that *would*-contraction can be traced back over 400 years argues against its present-day low contraction rate being the result of a later start. Conversely, *has* is a present-day high contractor, yet it is scarcely attested in its contracted form in Shakespeare. When we search the same data base for <'s>, of the first 500 hits, only one can be unambiguously attributed to contracted *has* (69).³⁴

(69) Historical contraction of *has*

- a. That **it's** had it head bit off by it young. (King Lear: I, iv)

This low rate of historical *has*-contraction can probably be attributed to the fact that the majority third singular form of HAVE was *hath*, not *has*, into the 1700s (Kytö, 1993). With a low rate of use of *has* to begin with, a scarcity of contracted forms of that auxiliary is probably not surprising. The auxiliary *has* thus provides another counterexample to the hypothesis that a late contraction start date results in a lower present-day contraction rate: *has* most likely **did** have such a late start date, but is a high present-day contractor. We thus cannot draw any firm connections between diachronic actuation of contraction and present-day contraction rate.

³⁴I found among these 500 three instances of <'s> that could conceivably be either contracted *has* or contracted *is*:

- (1) Historical contraction of *is* or *has*
- a. You took the moon at full, but now **she's** changed. (Love's Labour's Lost: V, ii)
 - b. To work my mind, when body's **work's** expired. (Sonnets: XXVII)
 - c. There the grown serpent lies; the worm **that's** fled. (Macbeth: III, iv)

4.8.2. Frequency

In Section 4.4.3 I considered the possibility of string frequency effects on short allomorph selection. I showed that collocations containing *had* are low in both frequency and short allomorph rate. It is tempting to connect the two, but as we saw in that section, other low-contracting collocations (namely, those with *would*) are not particularly low in frequency.

Table 4.33 lays out the estimated frequency in Switchboard of each auxiliary under study.³⁵ Rather than separating out the auxiliaries into different pronoun collocations, this table reports overall frequencies for all subject types. They are arranged in decreasing order of frequency. Though *had* is still at the bottom, *would* exceeds both *will* and *has* in frequency, despite these latter two auxiliaries showing much higher short allomorph rates in Figures 3.1 and 3.2. Frequency can't be the whole story here.

	<i>is</i>	<i>have</i>	<i>would</i>	<i>will</i>	<i>has</i>	<i>had</i>
	75872	14978	10985	7106	4934	1857

Table 4.33: Estimated frequencies in Switchboard of the six auxiliaries under study, across all subject types.

4.8.3. Homophony avoidance

One final possibility for an explanation of the low short allomorph selection rates of *had* and *would* may lie in the fact that the two contract to the same single consonant. Maybe short allomorphs have become disfavored where homophony would result. Confusion between these auxiliaries is attested: Jespersen (1931) cites the

³⁵These values are “estimated” because they have been reduced by the mean rate of spurious hits found for the pronoun subjects in Section 4.4.3. For instance, for *had*, our examination of the data pronoun-by-pronoun found an average rate of 33% of all hits being spurious, so the raw token count for *had/d* followed by past participle has been reduced accordingly.

use of *would better* for *had better*, which presumably comes about when people mis-perceive the source of the contracted form in expressions such as *you'd better*.

The homophony avoidance explanation immediately suffers from the fact that *is* and *has* also contract to the same single consonant, but both are nonetheless high contractors. We can easily come up with examples which are ambiguous between *is* and *has*: for instance, the past participle *expired* can be used with both *has* (e.g. *these drugs have expired*) and *is* (e.g. *these drugs are expired*); in the third singular, then, it can be ambiguous (e.g. *this drug's expired*). This hasn't served to keep the short allomorph rate of these auxiliaries down, though.

Contraction of *had* and *would* can truly result in homophony when the element that follows the auxiliary is ambiguous between a past participle and an infinitive (e.g. *I would put... ~ I had put...*). I found 25 verbs of this sort; they are given in 70.

- (70) *beat* (non-standard form of *beaten*), *become*, *bet*, *broadcast*, *burst*, *cast*, *come*,
cost, *cut*, *fit*, *hit*, *hurt*, *knit*, *let*, *put*, *quit*, *rid*, *run*, *set*, *shut*, *slit*, *spit*, *split*, *thrust*,
upset

If speakers are really contracting *had* and *would* at low rates to avoid potential homophony, this effect should be intensified when what follows the auxiliary truly would lead to homophony. So, we should see even less selection of short allomorphs for these auxiliaries when they precede one of the verbs given in 70.

There are 61 tokens of *would* for which the word following the auxiliary is ambiguous between a past participle and an infinitive, and 14 for *had*. Neither auxiliary shows significantly decreased rates of short allomorphs in these environments compared to their rate in non-homophonous environments (*would*: $\chi^2 = 0$, $p = 0.95$; *had*: $\chi^2 = 0.59$, $p = 0.44$).

However, this is a naive approach to the homophony issue. Work on sentence

processing (e.g. Boland and Blodgett, 2001) has shown that, when confronted with a homophonous word, speakers initially access the more frequent of its two possible representations, **even when** that item does not make sense in context. For instance, eye-tracking studies have shown that in a sentence like *She saw his duck and chickens near the barn*, where the noun *duck* has a homographic verbal counterpart which exceeds it in frequency, speakers will fixate longer on the noun *duck* than they will on the verb *duck* in an analogous sentence (e.g. *She saw him duck and stumble near the barn*). The noun *duck* is initially difficult to process since it is dwarfed in frequency by the verb, despite the fact that the verb could not surface in such a context (i.e. after the genitive pronoun *his*). The connection of this finding to contraction is as follows: when speakers hear a contracted '*d*', we expect them to initially access the more frequent of its possible representations (namely, *would*), regardless of whether what follows is one of the ambiguous verb forms in 70, or is unambiguously a past participle, such as *written*. So, in a sentence such as *She'd written this book*, speakers are predicted to access the *would* form before the *had* one, despite the inappropriateness of the *would* form in context.³⁶

In fact, Charles Yang (personal communication) suggests a connection between the frequency bias in homography resolution and the low rate of short allomorph selection for *had* and *would*, based on the model of merger spread put forth in Yang, 2009.³⁷ In communities undergoing the merger of two phonemes, language learn-

³⁶This is something that it would be interesting to look into in future experimental work, though there is an important asymmetry between homographic contractions and homographic content words like those Boland and Blodgett examined. With contractions, the disambiguating item **follows** the contraction: it is an infinitive or a past participle. In the data Boland and Blodgett considered, the disambiguating item is a pronoun — *him* or *his* — which **precedes** the homograph. Boland and Blodgett thus found people hesitating more on the homographic item when they initially identified it as one which did not fit the sentence based on the word that had come before: i.e., the context set them up to expect a noun, but they accessed the more frequent verb. With contraction, we would expect people to hesitate more on the word **following** the homographic auxiliary, since frequency has set them up to expect an infinitive, but they see a past participle.

³⁷Similar findings to Boland and Blodgett's frequency bias in homography have been attested in

ers entertain two possible grammars: one conservative one without the merger (e.g. containing two separate phonemes, /ɑ/ and /ɔ/), and one innovative one with it (e.g. a single phoneme /ɔ/ doing the work of two). A learner using the merged grammar to parse input will not have recourse to two phonemes when he hears a word with an /ɑ/ or one with an /ɔ/; if it is ambiguous which word it is (e.g. *Don* or *Dawn*, two forms that differ in having /ɑ/ vs. /ɔ/), he will initially interpret it as the more frequent of the two, and this will be wrong only as often as it was intended to be the one of lesser frequency. Each time a grammar initially misparses input and must reanalyze a form, that grammar will be penalized. As more and more merged speakers move into the community, the grammar without the merger will start to be penalized more and more, as it parses merged input with a delay, relying as it does on hearing a distinction that is not there.³⁸ Eventually (Yang calculates that this will happen once the number of merged speakers in the community reaches approximately 20%), the penalties incurred when the unmerged grammar parses merged input will outweigh those incurred when the merged grammar makes an incorrect frequency-based interpretation, and the merger will take over.

The extension to contraction is as follows. We need to hypothesize that language learners entertain three grammars: one in which contracted 'd comes from *would*, one in which contracted 'd comes from *had*, and one in which no contraction occurs. Because *would* is more frequent than *had*, each time a learner hears an ambiguous 'd, he will initially interpret it as coming from *would*, regardless of which grammar was chosen and regardless of any disambiguating context. Each time this is incorrect and the speaker must reanalyze the form once context is taken into

homophony; see Yang (2009) for citations.

³⁸The merger example in Yang's study also has the unmerged grammar incurring an additional penalty when one of the two phonemes is incorrectly recognized due to misperception.

account, the grammar will be penalized. So every time the intended form is *had*, the grammar that was selected will be penalized. Both grammars will end up getting penalized as often as *had* was the intended form. Because *had* is the intended form about 15% of the time ($2000/(2000+10000)$, approximating the frequencies in Table 4.33), penalization of each grammar will occur with some frequency, keeping contraction rates down as speakers use the “don’t contract” grammar instead. When we compare the situation for the other homographically-contracting pair *is* and *has*, on the other hand, the frequency distribution is much more lopsided. The more frequent form, *is*, will be selected whenever ‘s is heard, but this will be an incorrect guess only about 6% of the time, when *has* was intended instead ($5000/(5000+75000)$, again approximating the frequencies from Table 4.33). With a penalization rate less than half of that for the ‘d-contracting grammars, the ‘s-contracting grammars will not be suppressed, hence the overall higher contraction rates of *is* and *has*.

There are some complications to this analysis that need to be worked out: for instance, whether it is reasonable to entertain the hypothesis of an additional grammar that contracts both *would* and *had* (or both *is* and *has*, as the case may be), and how reasonable it is to propose that speakers select grammars that don’t do what they’re intended to (specifically, the *had*-contraction grammar consistently defaults to hearing a contracted ‘d as coming from *would*, even though this is a grammar that contracts *had*). Additionally, it would need to be confirmed experimentally that speakers really do process homophonous ‘d and ‘s forms with ignorance of any surrounding disambiguating context. Nevertheless, this analysis may hold promise in that it combines the conspicuously high frequency of *is* and low frequency of *had* with the fact that each of these auxiliaries contracts in a way that results in homophony with some other auxiliary.

4.9. Conclusions and implications

Chapter 3 argued for a model of contraction under which variable surface behavior is localized to two stages: a variable alternation in the morphology followed by phonological rules. As discussed in Section 2.4.2.4, there are two conceivable ways of operationalizing this variable alternation in the morphology. It could be effected by a variable rule of host–auxiliary adjunction which conditions deterministic allomorph selection. Alternatively, allomorph selection could be variable, with adjunction applying deterministically depending on which auxiliary is inserted. In using the term “short allomorph selection” to refer to the variation at hand, I have tried to remain agnostic as to the precise mechanism. Either way, there is some sort of variable process — either morphosyntactic adjunction or allomorph selection — which, as we have seen here, displays linguistic conditioning.

In general, the factors that have emerged as significant in this chapter are easily incorporable into a grammatical model of contraction, regardless of whether we go with the “allomorphic alternation” approach or the “variable adjunction” approach. For instance, Section 4.6.2.2 demonstrated that short allomorph selection for *is* is sensitive to whether the preceding segment is a consonant or a vowel. Allomorphic alternations conditioned by the nature of a preceding segment are attested elsewhere in the world’s languages, as well (Paster, 2006). In fact, where we have tried to represent conditions on short allomorph selection as deriving from outside the grammar — specifically, treating pronoun identity effects as emergent from collocation frequency (Section 4.4.3) — we have been unsuccessful. Instead, there is no strong argument to be made for representing the conditioning factors seen here as grammar-external. The factors that are the subject of Chapters 5 and 6 will prove to be a different story.

Chapter 5

The effect of subject length on contraction

5.1. Introduction

By way of addressing Section 1.1.3's Question 2, concerning how the conditioning of variable alternations is represented in speakers' linguistic systems, Chapter 4 examined internal factors affecting the variation in allomorph selection for auxiliaries in English (the analysis of auxiliary contraction I laid out in Chapter 3). In Chapter 4, I entertained approaches to linguistic variation under which conditioning factors are not represented as grammar-internal probabilities. Specifically, I considered models of production under which patterns of variation are emergent, for instance, based on the frequencies of stored tokens. I showed that these models do not sufficiently explain the findings where contraction is concerned, and that in at least some cases, we need to propose that probabilistic effects must be encoded in the grammar.

By contrast, the present chapter introduces a constraint on contraction which, I argue, is best **not** represented as encoded in the grammar. This is the effect of subject length (or "heaviness"; there are several ways of characterizing this measure, as will be discussed in Section 5.2). I will show that contraction of an auxiliary is sensitive to the precise number of words in that auxiliary's subject (Section 5.3), and I will argue that this finding necessitates an extra-grammatical treatment, as

this is not the type of effect that we find conditioning categorical phenomena in natural language (Section 5.4).

We have already seen an indication that an auxiliary's behavior may be contingent on the weight of its subject. Specifically, we saw in Chapter 3 that one major factor that influences auxiliary realization is whether an auxiliary's subject is a pronoun or a full noun phrase (that is, a determiner phrase or sentential subject, using the definition given in Section 4.2). Pronouns are prosodically lighter than noun phrases: for instance, pronouns may surface in weak forms that do not constitute a prosodic word, while noun phrases do not share this characteristic (Selkirk, 1995). Given this finding, I chose to investigate whether this effect of heaviness was observable when the data was restricted to only noun phrase subjects: does the weight of an auxiliary's noun phrase subject affect the rate of short allomorph selection? If the situation within noun phrase subjects parallels what we have seen between pronoun and noun phrase subjects, we predict that the rate of short allomorph selection will decrease after longer or heavier noun phrases. This chapter will demonstrate that this is in fact borne out.

5.2. Methodology

5.2.1. Measuring "heaviness"

5.2.1.1. Background

The amount of "mass" in a noun phrase has been shown in much previous work to play a significant role in the realization of variable phenomena, particularly those involving NP movement. Among the phenomena that have been found to be conditioned by NP length or weight are heavy-NP shift (Wasow, 1997; Arnold et al., 2000; Stallings and MacDonald, 2011), relative clause extraposition (Francis, 2010),

the dative alternation (Wasow, 1997; Arnold et al., 2000), the genitive alternation (Rosenbach, 2005; Shih and Grafmiller, 2011), the placement of particles in various languages (Sankoff and Laberge, 1980; Wasow, 1997), the ordering of elements in a binomial (Benor and Levy, 2006), the omission of a verb after an *as far as* construction (Rickford et al., 1995), complementizer omission (Fox and Thompson, 2007), and copula contraction (Walker and Meechan, 1999).

As is commonly recognized, there are numerous ways to operationalize noun phrase “mass,” also referred to throughout the literature as “length,” “weight,” “heaviness,” and “complexity,” depending on the measure at issue. I will use “length” as a blanket cover term, and in anticipation of the finding (presented in Section 5.3.3) that it is word count that the effect is most accurately attributed to. Measures of this attribute have ranged from syntactic to phonological, and include the following:

- **Syntactic complexity** of the noun phrase, either as raw counts of syntactic nodes or maximal projections (Wasow, 1997; Shih and Grafmiller, 2011) or as discrete measures of complexity based on the presence or absence of certain clauses (Rickford et al., 1995)
- Number of **orthographic words**, either as raw counts (Rickford et al., 1995; Rosenbach, 2005; Fox and Thompson, 2007; Shih and Grafmiller, 2011) or as a relative measure of the size of one constituent compared to the one it varies in conjunction with (Wasow, 1997; Arnold et al., 2000; Francis, 2010; Stallings and MacDonald, 2011)
- Number of **content or phonological words**, either as raw counts (Sankoff and Laberge, 1980; Shih and Grafmiller, 2011) or in bins of “one vs. many” (Rickford et al., 1995) or “simple” vs. “complex” (Walker and Meechan, 1999)

- Number of **syllables** (Rickford et al., 1995; Shih and Grafmiller, 2011; Benor and Levy, 2006)

Many of the authors cited above have considered only one of these possible measures of length (typically orthographic word count). Where more than one measure from the above list has been considered, researchers have remarked at how strongly correlated they tend to be (Wasow, 1997; Szmrecsányi, 2004) and have gone to varying lengths to try to piece apart which one the observed effects may be attributed to, as follows. Rickford et al. find no effect of number of syllables on *as far as* verb deletion, but significant effects of syntactic complexity, number of orthographic words, and prosodic branching. However, removing word count from their regression results in no difference in model log likelihood, while removing syntactic complexity results in a significant difference, so the authors take this to mean that syntactic complexity is the primary source of the observed length effect. Shih and Grafmiller (2011) present two statistical methods of piecing apart which of many correlated measures of length could be driving the effects on the dative and the genitive alternations they observe. They compare measures of Akaike's Information Criterion across separate mixed-effects logistic regression models, each with one of five length predictors; they also fit a random forests model with all length predictors. Both methods reveal number of syntactic nodes to be the primary source of length effects for both of the two variables under study, with number of orthographic words equally acceptable for the dative alternation. The following sections will examine a number of different length metrics, and will use statistical residualization (Section 5.3.3) to piece apart which of these strongly-correlated measures the observed effects are best attributed to.

5.2.1.2. The present study

Following the literature cited above, a number of different measures were taken of the noun phrase subjects in the data set under study, as enumerated below. These measures will be exemplified with the token in 71.

- (71) The real estate out here's been pretty good. (sw3011: sw_1174)

Number of syllables. The example in 71 received a count of 6.

Number of orthographic words. The example in 71 received a count of 5. This measure will henceforth be referred to simply as “word count.”

Number of prosodic words and **number of function words.** Selkirk (1984) identifies the prosodic word as a unit of phonological representation bearing “main word stress.” Selkirk (1995) subsequently observes that lexical words consistently map to prosodic words, but that unstressed function words do not.¹ Accordingly, prosodic words were defined for this study as all non-function words. Function words, in turn, were taken to be those given in the list provided in Selkirk, 1984:352–354, comprising prepositions, auxiliaries, modals, pronouns,² determiners, conjunctions, and complementizers. Each token was coded (automagically, using a Python script) for the number of function words in its subject. This number was then subtracted from the total number of orthographic words in the subject

¹Specifically, Selkirk proposes that function words map to prosodic words only when (1) focused, (2) in isolation, or (3) phrase-final; in all other occurrences, they are “prosodic clitics” and do not constitute prosodic words on their own.

²The pronouns *him* and *them* were not counted as function words. This is because Selkirk (1995) indicates that, while these object pronouns do not form prosodic words on their own, their union with a preceding lexical word **does** form a prosodic word (**in addition** to the prosodic word that the lexical word itself constitutes). That is, a lexical item+object pronoun unit constitutes **two** prosodic words, while, say, a determiner+lexical item unit constitutes only one. For this reason, the object pronouns *him* and *them* were included in the count of prosodic words.

The pronoun *her* is ambiguous between a possessive pronoun and an object pronoun, but since what we are coding is subject noun phrases, it is more likely that it will be functioning as the former (e.g. *her book*) than the latter (e.g. *saw her*). For this reason, *her* **was** counted as a function word and did not contribute to the prosodic word count.

to leave the number of prosodic words. The example sentence in 71 has a subject containing 2 function words (*the* and *out*, according to Selkirk's list); the remaining 3 words are prosodic words.

Number of words between NP head and auxiliary (henceforth "head-aux distance") One possible explanation for any observed disfavoring effect of subject length on contraction refers to the amount of material separating an auxiliary from the head of its host noun phrase. That is, when a head noun and its auxiliary are immediately adjacent (as they are when the host is a pronoun or a single-word noun phrase), contraction would be predicted to be more likely to occur; the more words that separate a head and an auxiliary, the less likely contraction becomes, as the size of the dependency between the two increases. Dependency size has been appealed to to explain, for instance, the difference in processing facility between subject- and object-extracted relative clauses: it is more difficult to process object relative clauses because the dependency between the fronted item and the gap from which it has moved is larger than is the case for subject relative clauses (see Kwon et al., 2010 for a review of pertinent literature). As a result, the processing system is taxed as the fronted item is held in memory for a relatively long time in anticipation of the upcoming gap. A similar explanation could theoretically be extended to contraction: the longer a head noun is held in memory before its associated auxiliary is reached, the less likely contraction will be to occur. Note that this would effectively reduce any observed effects of subject length purely to the number of words in any post-nominal modifiers, irrespective of the presence of any pre-nominal modifiers. This will be tested below.

Post-nominal modifiers observed in the data were prepositional phrases (72a), post-nominal adjectives (72b), and relative clauses (72c). In partitive constructions, such as those exemplified in 72d and 72e, the word preceding the *of* was counted

as the head, on the model of constructions such as *one of my friends* in which it is the singular *one* that a verb agrees with, not the plural *friends*. Where there was no *of*, as in 72f, the plural noun was counted as the head. Disfluencies did not contribute to the word count.

- (72) Examples of post-nominal modifiers. Each subject NP is underlined with its head noun in bold; the number of words separating that head from the following auxiliary is given after each sentence.
- a. I guess now you have to think about uh if the **money** in the bank will get more interest: 3 (sw4818: sw_1680)
 - b. The **plant** itself will grow about eighteen inches tall: 1 (sw2969: sw_1149)
 - c. Everybody else I've spoken with's been in Texas: 4 (sw2344: sw_1028)
 - d. Hopefully some of their players will come through: 3 (sw2804: sw_1237)
 - e. Most of the places will take uh the Visa card anyway: 3 (sw2409: sw_1147)
 - f. All the special interest groups will have to renegotiate all of their their payoffs and kickbacks: 0 (sw3692: sw_1258)

The example given in 71 has a post-head word count of 2 (*out here*).

Height of syntactic parse. The Penn Treebank (Marcus et al., 1993) contains a portion of the Switchboard corpus which has been syntactically parsed. This means that syntactic parses for a fraction of the tokens that were coded for the present study (specifically, 7% of them — no parsed versions of Fisher or the PNC exist) are available. For those tokens for which syntactic parses are available, the height of the tree for the token's subject was recorded. Height was determined

automatically for each parsed token using the Natural Language Toolkit (NLTK) for Python, which counts the number of nodes on the path between the lowest and the highest items on the tree (including that lowest item in the count). The count for the example in 71 was 5; the structure in 73 shows how this number was arrived at, with each of the five counted nodes indicated in bold. The lowest item in the tree is the word *here*, which is an adverb node, which is in an adverb phrase, which is in a prepositional phrase, which is part of the subject NP.

- (73) **(NP-SBJ**
 (NP (DT The) (JJ real) (NN estate))
 (**PP-LOC** (IN out) (**ADVP** (**RB here**))))

Number of syntactic brackets following final word. One factor that may affect contraction is the depth of embedding of the final item in an NP subject, manifested in the size of the boundary following that item. As we saw previously in Section 3.2.2.7, this kind of embedding has a categorical effect on the ability of pronouns to serve as hosts for short allomorphs: embedded pronouns may not be followed by contracted forms of auxiliaries other than *is* or *has* (74).

- (74) a. The guy sitting next to you [wil] (*[l]) be there.
 b. The people across from you [hæv] (*[v]) been waiting a while.

Depth of embedding has also been found (via impressionistic judgments, at least) to have a probabilistic effect on the phenomenon of flapping in English: Wagner (2010) observes that flapping may fail to occur over strong boundaries even when it occurs over weaker ones. This can be seen in the example in 75. Given the syntactic grouping indicated by the parentheses, flapping in *rat* cannot occur without flapping also occurring in *cat*, but flapping may occur in *cat* without

concomitant flapping in *rat*. Wagner attributes this to the fact that the stronger the syntactic boundary between two items (relative to boundaries between other items in that sentence), the more likely those items are to phrase into separate prosodic domains. The boundary between *rat* and the *and* that follows it is stronger than the boundary between *cat* and the *or* that follows it, given the syntactic grouping of these words; hence, flapping over the stronger boundary may be less likely than flapping over the weaker one.

- (75) (A cat or a rat) and a hat

In order to examine whether depth of embedding has a similar probabilistic effect on contraction, the number of syntactic brackets following the final word of the subject were counted for all tokens for which Treebank parses were available. The example in 71 received a count of 4, as is evident from its parse in 73.

5.2.1.3. A note on subject duration

Another plausible measure of subject length is subject duration. While subjects that contain more words will necessarily be longer in duration, it is conceivable that subjects that contain few words, but were uttered more slowly, could disprefer contraction in a similar way. However, subject duration was not examined in the present study, for the following reason. Subject duration must be highly influenced by speaking rate; even a short subject would have a particularly long duration if a speaker were speaking slowly. Subject duration would thus need to be somehow normalized by a given speaker's overall speaking rate, making the question one of whether a given subject is particularly long or short by the standards of that particular speaker. Due to this complication, subject duration was not one of the predictors of length examined in the present study.

5.2.1.4. A note on disfluencies

Noun phrase subjects may contain disfluencies, as exemplified in 76.

- (76) a. My boys and um my husband have been talking recently about having a dog. (sw3122: sw_1303)
- b. The uh civil liberties unions and so forth will lobby against that.
(sw2571: sw_1014)

Subjects containing disfluencies were **included** in the current study. Section 5.3.2.1 examines the effect of a disfluency on contraction.

5.2.2. Data

The data base used for the subject length study is a subset of the tokens collected for the contraction study, as detailed in Section 3.2.1. Specifically, only tokens that had full noun phrase subjects, as defined in Section 3.2.4, were analyzed. Tokens came from Switchboard, Fisher, and the PNC, as described in that chapter. Tokens in any of the environments identified in Section 3.2.2 as showing no variation in auxiliary shape were omitted.

Recall that the hypothesis at issue in this chapter, given the grammatical analysis of contraction presented in Chapter 3, is that short allomorph selection will show an effect of subject length, with short allomorphs becoming less likely as an auxiliary's subject increases in length. In order to test this, an auxiliary's short allomorph needs to be unambiguously identified in the surface data. We saw in Section 3.3.3 that short allomorphs do not always surface true to their single-consonant underlying form after noun phrase subjects; some short allomorphs may instead be altered by the process of Schwa Epenthesis, surfacing as intermediate forms. Table 5.1, repeated from Table 3.6, lays out the correspondences

between underlying and surface forms of post-noun phrase auxiliaries.

	<i>is</i>	<i>has</i>	<i>have</i>	<i>had</i>	<i>will</i>	<i>would</i>
Underlying short allomorph surfaces as:		contracted			intermediate (from Schwa Epenthesis)	
Underlying long allomorph surfaces as:	full		full & interm. (from /h/ Del.)		full	

Table 5.1: Underlying sources of surface forms of auxiliaries after noun phrase subjects.

Table 5.1 indicates that for only four auxiliaries — *has*, *is*, *will*, and *would* — can the short allomorph be unambiguously identified on the surface after noun phrases. For the remaining two auxiliaries, *had* and *have*, the short allomorph surfaces as an intermediate form, but so may the long allomorph, meaning that the surface reflex of the short allomorph of these auxiliaries cannot be isolated. For this reason, these two auxiliaries were not considered for the subject length study. This is not to say that short allomorphs of these auxiliaries are not conditioned by subject length, but we can't see it if they are. The auxiliary *would* was also omitted from study because its low rate of intermediate forms (and hence short allomorphs) after noun phrase subjects (see Figure 3.2 and discussion in Section 3.4.2) means that there is little variation to examine.

Table 5.2 provides the number of tokens of each auxiliary from each data source.

	Switchboard	PNC	Fisher	Total
has	386	46	0	432
is	283	537	352	1172
will	347	45	0	392

Table 5.2: Coded post-NP tokens by word and corpus.

Note, again, that those measures which refer to a syntactic parse of the subject are applicable only to a portion of the data; specifically, of the 1996 post-NP

subjects in my data, only 192 have been syntactically parsed (78 *has*, 42 *is*, and 72 *will*).

5.3. Findings

In this section, I first (Section 5.3.1) demonstrate the collinearity of the various length metrics under study, as justification for performing statistical analysis on each of them separately (Section 5.3.2). I identify those that are significant predictors of short allomorph selection, and then turn to the issue of distinguishing which one of these highly collinear predictors the variation can be attributed to (Section 5.3.3).

5.3.1. Collinearity

Unsurprisingly, the length metrics under study are highly correlated with one another: the more words in a subject, the more syllables in that subject, etc. This is shown in Tables 5.3 and 5.4 for *is*, and Tables 5.5 and 5.6 for *has* and *will*. For these calculations, I separated *is* data from *has* and *will* data, since these correlations will be used as the basis for residualization of predictors, which will in turn be done for each regression carried out (and *is* must be separated from *has* and *will* for regression analysis, given that it is significantly conditioned by different predictors than the other two, as we saw in Section 4.6.2.2). These tables show Spearman's ρ , a non-parametric measure of correlation that is interpreted just like Pearson's r , with a value of -1 indicating a perfect negative correlation, a value of 1 indicating a perfect positive correlation, and a value of 0 indicating no correlation.

	sylls	words	p-words	f-words
words	0.69***			
p-words	0.65***	0.71***		
f-words	0.51***	0.84***	0.30***	
head-aux distance	0.59***	0.69***	0.60***	0.66***

Table 5.3: Spearman's ρ for the correlations between five measures of subject length, *is*. '***' = $p < .001$. This table represents data that was not syntactically parsed, $N = 1167$.

	sylls	words	p-words	f-words	head-aux distance	depth
words	0.86***					
p-words	0.86***	0.91***				
f-words	0.70***	0.87***	0.65***			
head-aux distance	0.74***	0.81***	0.79***	0.84***		
depth	0.76***	0.82***	0.77***	0.79***	0.91***	
brackets	0.70***	0.79***	0.72***	0.85***	0.94***	0.94***

Table 5.4: Spearman's ρ for the correlations between seven measures of subject length, *is*. '***' = $p < .001$. This table represents data that was syntactically parsed, $N = 42$.

	sylls	words	p-words	f-words
words	0.77***			
p-words	0.74***	0.77***		
f-words	0.55***	0.84***	0.38***	
head-aux distance	0.60***	0.70***	0.59***	0.64***

Table 5.5: Spearman's ρ for the correlations between five measures of subject length, *has* and *will*. '***' = $p < .001$. This table represents data that was not syntactically parsed, $N = 805$.

	sylls	words	p-words	f-words	head-aux distance	depth
words	0.77***					
p-words	0.80***	0.81***				
f-words	0.56***	0.87***	0.46***			
head-aux distance	0.59***	0.67***	0.57***	0.63***		
depth	0.59***	0.74***	0.58***	0.72***	0.82***	
brackets	0.57***	0.73***	0.58***	0.69***	0.89***	0.89***

Table 5.6: Spearman's ρ for the correlations between seven measures of subject length, *has* and *will*. '***' = $p < .001$. This table represents data that was syntactically parsed, $N = 145$.

The fact that these metrics are highly correlated ($p < .001$ for all comparisons) means that we need to start out by performing regression analysis on each one separately, to see which ones can be said to be affecting short allomorph selection.

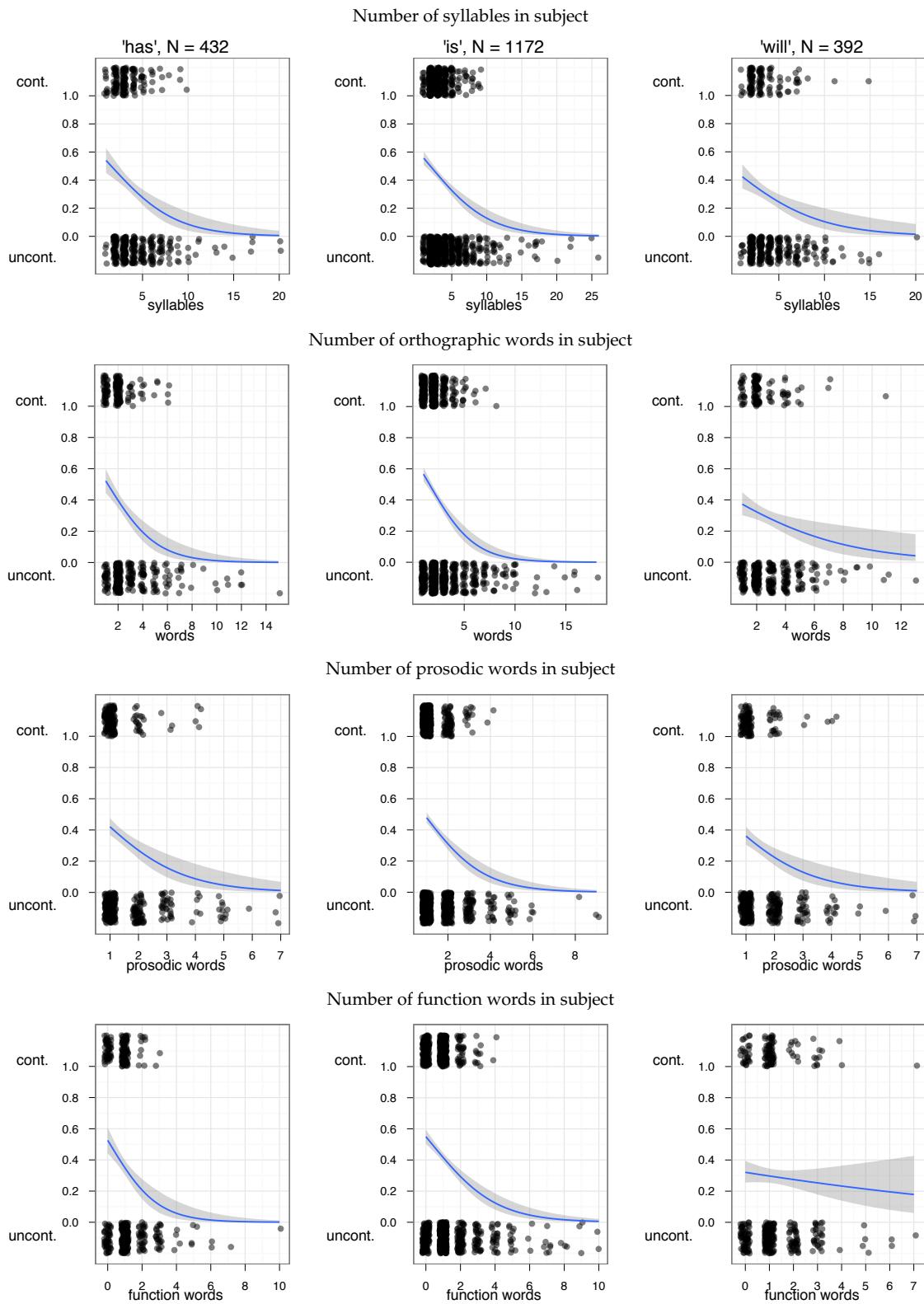
5.3.2. Predictors in isolation

Figure 5.1 (split over 2 pages) plots the application vs. non-application of short allomorph selection for post-NP *has*, *is*, and *will* by the seven different measures of subject length under study.

Each measure of subject length was tested, one at a time, in a mixed-effects model. As before, data from *is* was examined separately from that from *has* or *will*, due to the fact that the *is* models need a term for following constituent type while the other two auxiliaries do not (Section 4.6.2.2). Those internal factors that were found to be significant for these auxiliaries in that chapter were included in the regression (see Section 4.6.2.3 for *has* and *will*), as well as the external “control” factors (Section 4.3), and, naturally, the measure of subject length in question. No model ever contained more than one of the subject length predictors plotted in Figure 5.1, since, as Section 5.3.1 showed, these predictors are massively collinear. In all cases, the log of the relevant subject length measure was taken, since the relationship between subject length and contraction was found to be non-linear in the majority of the graphs in Figure 5.1.³

For subject depth and number of right brackets, the two measures that rely on syntactic parses, there are very few data points to work with, as most of the corpora under study were not syntactically parsed. This prevented a full model from converging, so the social fixed-effect predictors, as well as the term for preceding

³For number of function words and number of words between head and auxiliary, 1 had to be added to the raw value, since they were frequently 0 and there is no $\log(0)$.



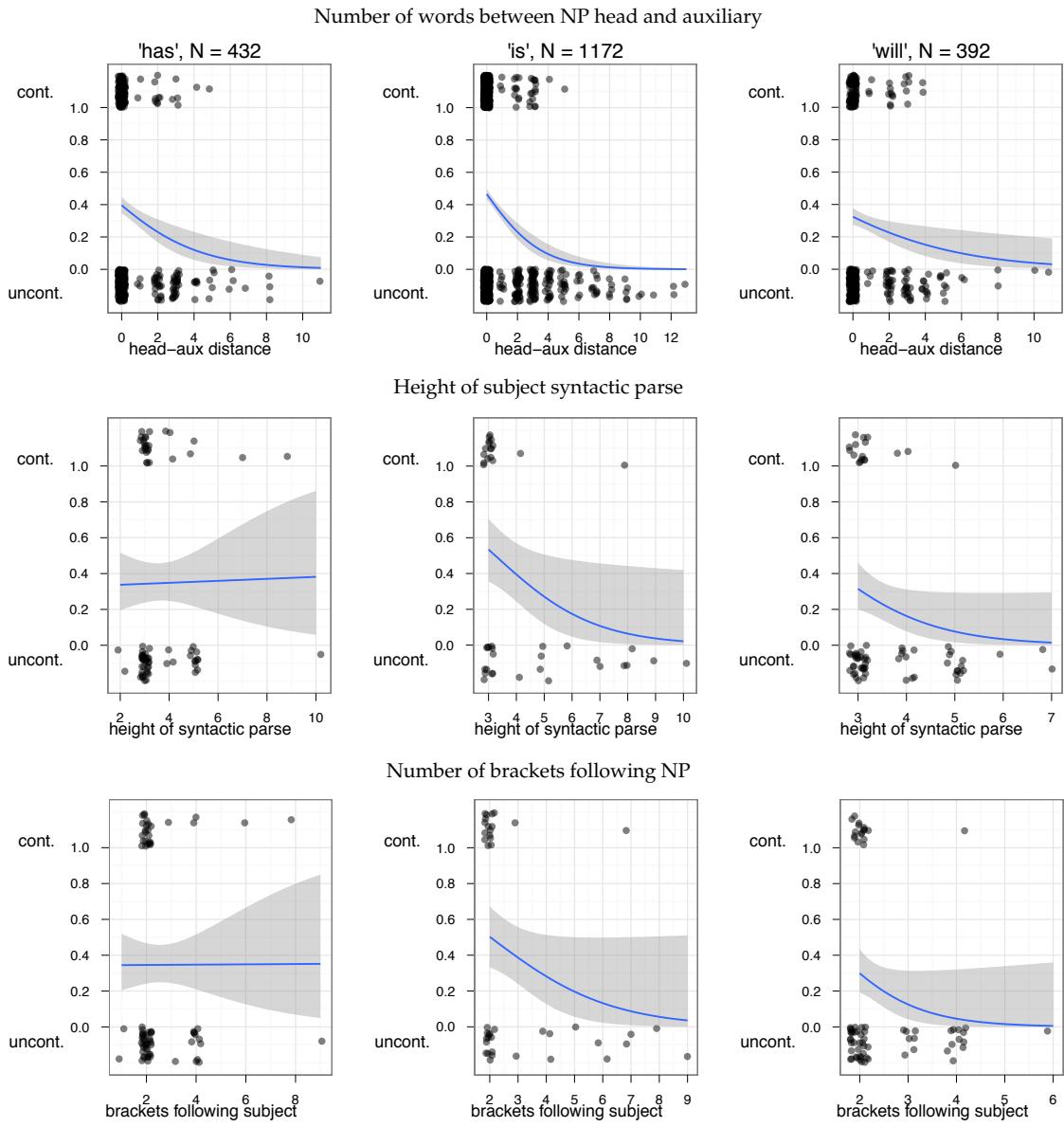


Figure 5.1: Distribution of surface forms of *has*, *is*, and *will* after noun phrase subjects by seven measures of subject length. Each point represents one token, coded for whether its phonological shape is traceable to an underlying short allomorph (“cont.” for “contracted”) or an underlying long allomorph (“uncont.” for “uncontracted”) via the correspondences in Table 5.1. Smoothing line fit via GLM. Values on the y-axis represent the fitted proportion of contraction for a given subject length.

segment manner of articulation in the case of *is*, had to be omitted from the model in order for convergence to be reached.

With the exception of the two syntactic measures (height of syntactic parse and number of syntactic brackets following the final word) — for which, remember, there is much less data to work with — each length predictor turns out to be highly significant in isolation. Coefficients and *p*-values for each are provided in Table 5.7.

	<i>is</i>	<i>has/will</i>
syllables	$\beta = -1.06, p < 0.01$	$\beta = -1.23, p < 0.01$
words	$\beta = -1.38, p < 0.01$	$\beta = -1.25, p < 0.01$
prosodic words	$\beta = -1.33, p < 0.01$	$\beta = -1.58, p < 0.01$
function words	$\beta = -1.37, p < 0.01$	$\beta = -1, p < 0.01$
head-aux distance	$\beta = -1.2, p < 0.01$	$\beta = -0.8, p < 0.01$
syntactic height	$\beta = -2.19, p = 0.11$	$\beta = -1.42, p = 0.15$
following brackets	$\beta = -1.21, p = 0.23$	$\beta = -0.92, p = 0.22$

Table 5.7: Coefficients and significance values for seven measures of subject length.

The first five of these measures — the ones that reach significance at the $p < 0.01$ level — will be taken up again in Section 5.3.3, where I will use residualization to determine which one is driving the effect.

5.3.2.1. The effect of disfluencies

For only 2% of the tokens under study did the subject contain a disfluency, so it is unlikely that any robust effect of disfluencies on contraction will be detected.⁴ Nonetheless, I examined, first, whether there was evidence that the use of a disfluency becomes more likely the longer a subject; and second, whether the presence of a disfluency in a subject was a predictor of (non-)contraction.

⁴“Disfluencies” for the present study comprise “uh” and “um.” Though tokens whose subject contained a stutter or restart were also included in the present data, they were not coded as containing a disfluency, though this should be examined in future work.

When the data from the three auxiliaries under study is pooled, a mixed-effects model with disfluency presence as the response, the log of the subject length in words as a fixed effect, and speaker identity as a random effect (any other fixed or random effects prevented the model from converging) does find subject length to be a significant predictor of disfluency presence ($\beta = 2.51$, $p < 0.01$). Indeed, the median subject length in the pooled data overall is 2, while for those tokens that contain a disfluency in their subject it is 5.

However, I re-ran all of the regressions in Section 5.3.2 with disfluency presence included as a predictor. For no auxiliary with any measure of subject length was it found to have a significant effect on contraction at the $p < 0.05$ level. There is thus no evidence that disfluency presence disfavors contraction any more than simply having a long subject, which tends to go along with disfluency presence, already does. Disfluency presence will accordingly not be included as a predictor in regressions in this chapter.

5.3.3. Residualization of predictors⁵

We have seen so far that five out of seven of the length measures under study significantly explain the variance in short allomorph selection on their own. But we have also seen that these predictors are highly correlated. How do we know which one is really driving the effect? In other words, if increased syllable count increases the likelihood of contraction, but increased syllable count also frequently means increased word count, to which of the two is the effect actually attributed to?

One way of determining this is to hold one predictor at a time constant, and

⁵This section represents joint work with Constantine Lignos, which was presented as MacKenzie and Lignos, 2012.

see if other predictors still show an effect. For instance, Figure 5.2 shows the rate of contraction by subject number of words with subject number of syllables held at 2, 3, or 4. We appear to find more contraction with a 1-word, 2-syllable NP (e.g. *Tuesday*) than with a 2-word, 2-syllable NP (e.g. *my son*). In other words, the disfavoring effect of word count on contraction seems to hold irrespective of syllable count. By contrast, the same does not seem to apply when the situation is reversed (Figure 5.3): we do not see the same obvious downward trend that would show more contraction with a 1-syllable, 1-word NP (e.g. *John*) than with a 2-syllable, 1-word NP (e.g. *Tuesday*), a 3-syllable, 1-word NP (e.g. *Anthony*), or a 4-syllable, 1-word NP (e.g. *society*). This indicates that, between word count and syllable count, word count is the one driving the effect.

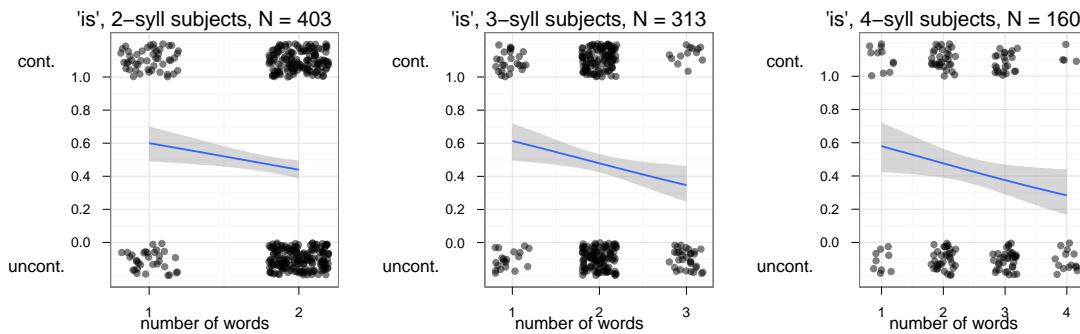


Figure 5.2: Effect of subject number of words on contraction, with subject number of syllables held steady at 2, 3, and 4.

This method runs into problems, however, once counts exceed five or so, because data starts to be sparsely represented. A better way of addressing the issue of predictor collinearity is residualization (Gorman, 2010). Residualizing predictors works as follows. Given two predictors, say WORD_COUNT and SYLLABLE_COUNT, we perform a linear regression on them, with one (we'll choose SYLLABLE_COUNT) as the response and the other as the predictor (77). We then take the residual errors from this regression. These represent the variance in SYLLABLE_COUNT that is

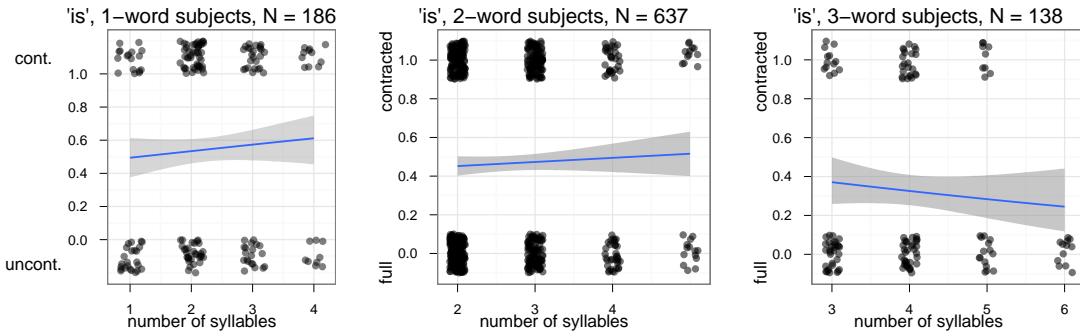


Figure 5.3: Effect of subject number of syllables on contraction, with subject number of words held steady at 1, 2, and 3.

not accounted for by WORD_COUNT: in other words, what SYLLABLE_COUNT explains **beyond** what WORD_COUNT explains. Then we can perform a regression on our actual dependent variable (i.e., allomorph choice) using both the unaltered WORD_COUNT measure and the residualized SYLLABLE_COUNT values in a single model, to see whether contraction is predicted by WORD_COUNT, or by the variance in SYLLABLE_COUNT that remains once WORD_COUNT has been factored out. If SYLLABLE_COUNT is still a significant predictor after residualization, we know that syllables are a significant predictor of contraction independent of any correlation with words. If SYLLABLE_COUNT is no longer significant, we know that its apparent effects were in fact coming from word count instead. We can also do the opposite: residualize WORD_COUNT by SYLLABLE_COUNT and see if words are still a significant predictor independent of any correlation with syllables.

```
(77) lm(log(SYLLABLE_COUNT) ~ log(WORD_COUNT),
      data = is.NP)$resid
```

Given the fact that word count was found to outweigh syllable count in predictive power in Figures 5.2 and 5.3, I residualized each of the four significant length

metrics (syllables, prosodic words, function words, and head-aux distance) against number of words, to leave the contribution of these predictors beyond the effect of word count. I also did the reverse, residualizing word count against each of these four metrics, to leave the contribution of word count beyond the effects of the other four predictors. If word count is what's driving the effect, we should expect to find that the other four metrics become non-significant once word count has been factored out (i.e., once they have been residualized against number of words). We should also expect to find that word count **remains** significant once one of the other metrics has been factored out (i.e., once word count has been residualized against another metric).

Table 5.8 shows that this prediction is perfectly borne out for *is*. Rows 1–4 demonstrate that residualizing each of syllable count, prosodic word count, function word count, and head-aux distance against number of words results in that measure's no longer being a significant predictor of contraction. By contrast, rows 5–8 demonstrate that residualizing word count against each of syllable count, prosodic word count, function word count, and head-aux distance still finds word count to be a significant predictor of contraction rate. **For *is*, word count is the driving force behind the subject length effect. Any effect of the other metrics is due only to their correlation with word count.**

For the combined *has/will* data (not shown), the findings do not mirror that for *is*: three out of the four predictors remain significant even when they have been residualized against word count. I examined this more carefully and found that, when we isolate the *has* data, the pattern looks exactly like that for *is*: that is, predictors are no longer significant once word count has been factored out (Table 5.9). **So, word count is the driving force behind the subject length effect for *has* as well.** For the *will* data in isolation, though, it is actually prosodic words

that, when the other predictors are residualized against it, results in those other predictors no longer being significant (Table 5.10). In other words, **prosodic word count is the driving force behind the subject length effect for *will*.**

These differing results are surprising and not easily explained. One obvious difference between *has/is*, on the one hand, and *will*, on the other, observed in Section 3.3.3, is that the short allomorph of the former two may surface as a non-syllabic single consonant, while the short allomorph of the latter must surface as syllabic after noun phrase subjects (which, of course, are what's under study in this examination of subject length). It could be that the syllabic form [əl] is more responsive to prosodic factors, by virtue of its contributing to the prosodic shape of the output string, while this is not relevant to the non-syllabic form [s]/[z]. More data on post-NP *has* and *will* may elucidate the problem (currently, there is nearly three times as much data on *is* than on either of the other two auxiliaries).

residualized predictor	raw predictor
syllables: $\beta = -0.05, p = 0.85$	words: $\beta = -1.38, p < 0.01$
prosodic words: $\beta = -0.23, p = 0.52$	words: $\beta = -1.38, p < 0.01$
function words: $\beta = 0.04, p = 0.93$	words: $\beta = -1.38, p < 0.01$
head-aux distance: $\beta = -0.43, p = 0.15$	words: $\beta = -1.45, p < 0.01$
words: $\beta = -1.34, p < 0.01$	syllables: $\beta = -1.07, p < 0.01$
words: $\beta = -1.24, p < 0.01$	prosodic words: $\beta = -1.37, p < 0.01$
words: $\beta = -1.41, p < 0.01$	function words: $\beta = -1.39, p < 0.01$
words: $\beta = -1.08, p < 0.01$	head-aux distance: $\beta = -1.21, p < 0.01$

Table 5.8: Coefficients and significance values for raw and residualized predictors, *is* data. Rows 1–4 show the results of regressions with four predictors residualized against word count. Rows 5–8 show the results of regressions with word count residualized against each of four predictors. Each predictor in the “residualized” column has been residualized by the other predictor in its row.

residualized predictor	raw predictor
syllables: $\beta = -0.4, p = 0.3$	words: $\beta = -1.67, p < 0.01$
prosodic words: $\beta = -0.36, p = 0.46$	words: $\beta = -1.68, p < 0.01$
function words: $\beta = 0.47, p = 0.48$	words: $\beta = -1.66, p < 0.01$
head-aux distance: $\beta = 0.14, p = 0.71$	words: $\beta = -1.65, p < 0.01$
words: $\beta = -1.37, p < 0.01$	syllables: $\beta = -1.48, p < 0.01$
words: $\beta = -1.42, p < 0.01$	prosodic words: $\beta = -1.66, p < 0.01$
words: $\beta = -1.98, p < 0.01$	function words: $\beta = -1.72, p < 0.01$
words: $\beta = -1.76, p < 0.01$	head-aux distance: $\beta = -1.15, p < 0.01$

Table 5.9: Coefficients and significance values for raw and residualized predictors, *has* data. Rows 1–4 show the results of regressions with four predictors residualized against word count. Rows 5–8 show the results of regressions with word count residualized against each of four predictors. Each predictor in the “residualized” column has been residualized by the other predictor in its row.

residualized predictor	raw predictor
syllables: $\beta = -0.28, p = 0.51$	prosodic words: $\beta = -1.71, p < 0.01$
words: $\beta = 0.52, p = 0.22$	prosodic words: $\beta = -1.68, p < 0.01$
function words: $\beta = 0.36, p = 0.33$	prosodic words: $\beta = -1.69, p < 0.01$
head-aux distance: $\beta = 0.24, p = 0.51$	prosodic words: $\beta = -1.71, p < 0.01$
prosodic words: $\beta = -1.45, p = 0.01$	syllables: $\beta = -1.21, p < 0.01$
prosodic words: $\beta = -2.15, p < 0.01$	words: $\beta = -0.85, p < 0.01$
prosodic words: $\beta = -1.82, p < 0.01$	function words: $\beta = -0.3, p = 0.39$
prosodic words: $\beta = -1.88, p < 0.01$	head-aux distance: $\beta = -0.61, p = 0.04$

Table 5.10: Coefficients and significance values for raw and residualized predictors, *will* data. Rows 1–4 show the results of regressions with four predictors residualized against **prosodic** word count. Rows 5–8 show the results of regressions with prosodic word count residualized against each of four predictors. Each predictor in the “residualized” column has been residualized by the other predictor in its row.

The strong influence of orthographic words on contraction of *is* and *has* is surprising, since orthographic words themselves are not a linguistic unit. But, as is obvious from Tables 5.8 and 5.9, we cannot get word count to go away: it explains the variation better than any other length metric. Could it be that orthographic words are serving as a proxy for something else? In other words, is there some measure that will make word count stop being significant once we residualize word count on it?

In fact, there is, but it turns out to be a combination of two measures. If we residualize word count against a combination of prosodic words and function words, word count stops being significant.⁶ This is shown in Table 5.11, for both *is* and *has*.

	prosodic words _{raw}	function words _{r-pwords}	words _{r-pwords-fwords}
<i>is</i>	$\beta = -1.44, p < 0.01$	$\beta = -1.06, p < 0.01$	$\beta = -0.1, p = 0.93$
<i>has</i>	$\beta = -1.66, p < 0.01$	$\beta = -1.12, p < 0.01$	$\beta = -1.64, p = 0.35$

Table 5.11: Coefficients and significance values for raw and residualized predictors, *is* and *has* data. Values come from one regression per word including three subject length coefficients: raw prosodic words, function words residualized on prosodic words (“r-pwords”), and orthographic words residualized on both prosodic words and function words (“r-pwords-fwords”).

Since the orthographic word count is simply a measure of the number of prosodic words plus the number of function words, the fact that putting prosodic words and function words as separate terms in a model can outweigh the effect of orthographic words is surprising. Why should prosodic words + function words not behave identically to orthographic words?

⁶To residualize one predictor — in this case, word count — against two predictors which themselves are correlated — in this case, prosodic words and function words — we have to residualize one of those two predictors against the other first. So, technically, word count is residualized against raw prosodic words and residualized function words. Residualizing word count against raw function words and residualized prosodic words yields the same result: the same coefficients are significant.

Part of the answer is that having prosodic words and function words as separate predictors in the model allows them to contribute differently to explaining the variation: they have different coefficients, as Table 5.11 shows. Specifically, for each auxiliary, the prosodic words term is more negative than the function words term. Both coefficients are negative, so adding either one to a subject makes contraction less likely, but adding a prosodic word makes contraction less likely than adding a function word does. The implications of this finding will be explored in Section 5.4.

5.3.4. Summary and implications

The previous sections have shown that, for the three auxiliaries whose post-NP surface forms can be unambiguously attributed to either the short or the long allomorph, selection of that short allomorph is disfavored with increased subject length. For *will*, subject length appears to be most accurately measured in terms of number of prosodic words. For *is* and *has*, the effect is best captured with a combination of prosodic words and function words, which sums to the number of orthographic words, but allows each to contribute individually.

Figure 5.1 demonstrates that, in addition to this monotonic downward trend, there is an apparent cut-off effect by which no contracted forms of *is* or *has* surface after a subject of greater than eight orthographic words in length. In the case of *will*, the auxiliary for which prosodic words are the operative unit of heaviness, the cut-off for short allomorphs is at four prosodic words.⁷

⁷My data actually contains two tokens of *will* which are exceptional in showing intermediate forms after particularly long subjects. The first is in 1, where an intermediate form follows a subject of 6 prosodic words.

- (1) With desktop publishing and stuff, I think a lot more magazines that are — that aim to a smaller market [əl] be coming out. (sw3645: sw_1458)

Because the speaker stops and changes direction here, it could be argued that only the second

If these cut-off effects are real, they would appear to constitute evidence of a grammatical process (i.e. allomorph insertion) displaying sensitivity to a particularly high number. This would invalidate the received wisdom in linguistics that “grammars can’t count”: grammatical operations are not typically sensitive to values greater than two. (See Selkirk, 1986 for some references to this proposal where phonological rules are concerned.) Alternatively, it could be the case that short allomorphs **may** surface after subjects greater than eight words in length, just at a very low rate. And since such long subjects are difficult to come by in spontaneous speech, the “cut-off” is only illusory, a consequence of sparse data.

We can get predicted values for different subject lengths by using the `predict()` function in R on the models we fit in Sections 4.6.2.2 and 4.6.2.3.⁸ These predicted values, presented in Table 5.12, indicate that, while the rate of contraction of *is* or *has* with, say, a 10-word subject is very low, it is not strictly predicted to be 0. More likely, were we to collect enough tokens with subjects of this length, we would find a contraction every once in a while (about 7 times out of 100, according to our models), but their sparsity in spontaneous speech gives them the

half of the subject — the part after the restart — is serving as the subject of this auxiliary. In that case, the “subject” would contain only three prosodic words. Because the restart makes the true “subject” somewhat ambiguous, I have excluded this token from the data under analysis. Further data collection may shed light on whether hesitations, restarts, and disfluencies do indeed “reset” the subject length count in this way.

The other token does not exceed the “cut-off” of 4 prosodic words that is reflected in the other tokens, but does show an intermediate form after a subject containing 7 function words, which makes it exceptional based on the graphs in Figure 5.1. (The rest of the data all obeys a “cut-off” of 4 function words.) This token is given in 2.

- (2) Pretty much me, like my girlfriend Lisa, or a couple of my neighbors [əl] just sit out front.
(Jenny McPhee)

The actual subject of this sentence is somewhat ambiguous, since the speaker pauses slightly between each conjunct. It could thus be interpreted as having only the third conjunct as the actual subject of the auxiliary, after two restarts. Omitting this token from the analysis does not change any of the results below, and it less obviously contain a restart than does the token in 1, so it has been retained.

⁸Strictly speaking, `predict()` only works on fixed-effect models, so the random effects under study were omitted in order to calculate these predictions.

appearance of being categorically non-contracting.

word count	predicted rate	word count	predicted rate
1	0.60	1	0.58
2	0.44	2	0.38
3	0.33	3	0.28
4	0.24	4	0.19
5	0.22	5	0.17
6	0.17	6	0.10
7	0.12	7	0.12
8	0.12	8	0.09
9	0.08	9	0.04
10	0.08	10	0.07

Table 5.12: Predicted rates of contraction of post-NP *is* (left) and *has* (right), by subject length in orthographic words.

That said, even if there is not a categorical cut-off point, the gradual decline in rate of short allomorph selection with increasing (prosodic) word count still implies a numerical sensitivity that we are not accustomed to seeing in classical allomorphic alternations. In keeping with the general theme of this thesis (Section 1.1.3), our interest here is in identifying how this conditioning effect may be represented in the linguistic systems of individual speakers. There are, coarsely, two possible options:

1. This effect is encoded in speakers' grammars, via probabilities that are sensitive to a precise word count.
2. This effect is the purview of some extra-grammatical system. It is not encoded grammatically at all.

To preview the discussion that will take place in Chapter 7, I argue that option 1 is not correct: this effect is not appropriately represented as the purview of the generative grammar. Briefly, this comes from the following three-step line of argumentation, which will be treated more thoroughly in that chapter:

1. If a variable alternation is the purview of the grammar, the grammar must have access to the factors that condition it.
2. Categorical alternations are the purview of the grammar.
3. This predicts that all those factors which condition that variable alternation will be available to condition categorical alternations, too.

In the case of the subject length effect on contraction, point 3 does not hold. Categorical alternations are not conditioned by precise subject length in this way. To the extent that point 1 is true, then — that a variable alternation's being in the grammar gives the grammar access to those factors that condition it, for subsequent conditioning of categorical alternations — the subject length condition on contraction must not be represented grammatically. Note, importantly, that this does not mean that **all** conditions on contraction are not represented in the grammar. It simply means that this one, the subject length effect, must not be.

This differentiates the subject length effect from the effect of pronoun identity considered in Section 4.4.3. I considered an extra-grammatical source for that effect — namely, collocation frequency — and found that it did not satisfactorily explain the variation. I proposed that the conditioning factor of pronoun identity was stipulated in the grammar instead. If the subject length effect is not encoded in the grammar, to what should we attribute it? In the next section, I will argue that the effect of subject length on contraction is best understood as stemming from constraints on production planning. This makes the subject length effect on contraction, under my analysis, parallel to the restrictions on center-embedding in natural language: proposed to fall out from constraints on the language production system, rather than from any particular grammatical stipulation (see Karlsson, 2007 for citations of many works in which this has been put forth).

5.4. Possible sources of the subject length effect

5.4.1. A large prosodic boundary

It is tempting to connect the dispreference for contraction after long subjects to the failure of contraction after embedded pronouns (78a–b, repeated from 11).

- (78) Forms that may surface after an embedded pronoun
- a. John and I [hæv] ~ [əv] (*[v]) got it. (Kaisse, 1983)
 - b. The guy next to you [wil] ~ [əl] (*[l]) speak first. (Zwicky, 1970)
 - c. The guy next to you [iz] ~ [z] a doctor.

In both cases, there is a sense in which the final word of the subject is too deeply embedded to allow a contracted form. After all, as we saw in Tables 5.4 and 5.6, subject word count is strongly correlated with the number of right brackets at the end of a subject: the more words in a subject, the more likely the final word of that subject is to be deeply embedded. And as discussed in Section 5.2.1.2, deeply embedded elements may phrase into a separate prosodic domain from what follows.

But the facts in these two cases are different. After embedded pronouns, the auxiliaries *had*, *have*, *will*, and *would* may not surface in their contracted form, but **may** surface in their intermediate form (78a–b). Moreover, the auxiliaries *is* and *has* may surface in their contracted form in this environment (78c). I accounted for this behavior in Section 3.3.3 by proposing that after full noun phrase subjects (whether or not they happen to end in a pronoun), short allomorphs of *had*, *have*, *will*, and *would* may be inserted, but may not surface as-is, without the application of Schwa Epenthesis. But the variation between long and short allomorphs may nonetheless take place in this environment.

By contrast, what tapers off after long subjects (Figure 5.1) is an auxiliary's surface realization of its short allomorph: so, intermediate forms, for *will*; contracted forms, for *is* and *has*. In other words, after embedded pronouns, short allomorphs may still be inserted, while after long subjects, short allomorphs actually appear to stop being inserted (the apparent cut-off effect discussed in Section 5.3.4). So, the connection between auxiliary behavior after embedded pronouns and auxiliary behavior after long subjects is only apparent. Both environments do restrict contracted forms, but not of the same auxiliaries.

5.4.2. Inability to host a clitic

Under Selkirk's (1995) prosodic hierarchy, the noun phrase subjects in our data would differ from each other in the prosodic domains they constitute. Single-word noun phrases (e.g. *Mary*) are prosodic words. Noun phrases preceded by determiners are phonological phrases. Presumably, once a subject reaches a certain number of phonological phrases, it becomes an intonational phrase. Is there some restriction on whether intonational phrases may host clitics that could account for the decreasing acceptability of short allomorphs with longer subjects? Potentially related to this is the fact that the 's genitive suffix, another English clitic, similarly decreases in use as the noun phrase to which it would attach increases in raw word count (Rosenbach, 2005).

Kim (1999) attempts to use this line of reasoning to explain the failure of contracted forms of *had*, *have*, *will*, and *would* to surface after non-pronoun subjects. Under his proposal, as a subject increases in length, the likelihood that it constitutes a separate intonational phrase increases. (By "increases in length," Kim means "is a full noun phrase rather than a pronoun" — he is not referring to the gradient effect of raw subject length that is under study here.) When the subject

and the auxiliary are in separate intonational phrases, contraction will be blocked: it may not apply across an intonational phrase boundary.⁹

Kim presents this as an explanation for why non-*{is, has}* auxiliaries may not surface in their contracted forms after noun phrase subjects (e.g. 78); to reiterate, I do not believe this effect to be directly relevant to the gradient effect of subject length which operates directly on short allomorph selection. But perhaps a similar explanation could be extended to the gradient subject length effect: the longer (in number of words, or number of prosodic words, or whatever unit is relevant) a subject, the more likely it is to form an intonational phrase; when a subject is an intonational phrase, an auxiliary may not contract to it.

This is a possibility that could be explored in future work, but we need a precise definition of an intonational phrase. What phonetic diagnostics will tell us whether we have one? And what is it about an intonational phrase boundary that would prevent contraction? One possibility is that a large prosodic domain like an intonational phrase might be followed by a pause (Lahiri and Plank, 2010). Since contraction cannot occur when too great of a pause separates the auxiliary from its host, maybe subjects that are intonational phrases are followed by pauses, blocking contraction, and this is the actual source of the subject length effect.

As the coder of the majority of the tokens under examination, I made a point (and trained my research assistants accordingly) of omitting from consideration all tokens in which an audible pause or intake of breath separated the auxiliary from its host, so none of the tokens plotted in Figure 5.1 have large pauses after the subject, regardless of how long that subject is. But the duration of the space between the subject and the auxiliary, and its possible correlation with subject length, is still

⁹Kim provides no explanation for why *is* and *has* may nonetheless contract over such a boundary.

something that could be examined empirically in future work.

The intonational phrase explanation also redefines the locus of variation for the subject length effect. Specifically, it proposes that variation in contraction rate after long subjects stems in part from variation in intonational phrase formation. When no intonational phrase boundary intervenes between a subject and the following auxiliary, contraction may variably occur, but when a separate intonational phrase containing the subject is formed, contraction is categorically blocked. The longer a subject, the more likely it is that an intonational phrase is formed. But what governs intonational phrase formation, and why would it sometimes occur and sometimes not occur over subjects of the same length? In the absence of concrete answers to these questions, or decisive diagnostics of intonational phrasehood, we are essentially just restating the generalization: something about long subjects makes contracted forms unlikely to follow them. Maybe that “something” is an intonational phrase boundary, but we have no theory about when that boundary is inserted, other than that it is more likely to be after long subjects.

In the next section, I present another possible source of the subject length effect which is reminiscent of and compatible with the intonational-phrase-formation proposal, but which is psycholinguistically grounded.

5.4.3. Constraints on production planning

The idea here, briefly, is that the longer a subject, the more likely it is to be planned separately from the auxiliary that follows it. Elements are planned in a short-term memory buffer. When subject and auxiliary are not in the same short-term memory buffer, contraction may not occur. As long subjects stretch the capacity of speakers' short-term memories, contractions following them become increasingly rare.

5.4.3.1. Previous work

There are two lines of work in psycholinguistics that support this proposal, one demonstrating that the unit of production planning (in the laboratory, at least) is the prosodic word (reminiscent of the importance of prosodic word count found in Section 5.3.3); the other demonstrating that, once the subject of a sentence reaches a particular complexity, it is planned separately from the material that follows.

The primacy of the prosodic word in production planning was first shown by Sternberg et al. (1978), who had speakers memorize lists and then repeat them back after a delay. Lists varied both in how many items they contained and in whether those items were monosyllabic (79a), disyllabic (79b), or monosyllabic word + function word pairs (79c). The experimenters measured onset latency, the time it took for speakers to begin speaking after given a signal to repeat what they had memorized.

(79) Sample 3-item stimuli used in Sternberg et al. (1978)

- a. *bay, rum, track*
- b. *baby, rumble, tractor*
- c. *bay and rum and track*

Sternberg et al. found overall onset latency to be slightly longer for lists of disyllabic rather than monosyllabic items. But they also found that latency slope by number of items was the same regardless of whether a list contained monosyllabic or disyllabic items. In other words, increasing the number of syllables in a list's items only added a constant to a list's onset latency; syllable count did not interact with item count where onset latency was concerned. This was found regardless of whether the disyllabic items in the list were single words (79b) or lexical word + function word pairs (79c).

From these results, they sketched the following model of production planning. Upon receiving the signal to speak, the subjects in their experiment had to (1)

search through their memorized list, and (2) plan the first element in it. Process 1 is not sensitive to items' syllabic structure, but process 2 is. The sensitivity of first-element planning (process 2) to syllabic structure explains why onset latency is longer for lists of disyllabic items than for lists of monosyllabic items. With a list of disyllabic items, it will take longer to plan the first element than it would were that element half as long. But the insensitivity of the searching process (process 1) to syllabic structure explains why latency increase by word count displays a constant slope regardless of list items' length in syllables. To the searching process, it is as if each item were identical. Sternberg et al. propose that it is "stress groups" (equivalent to our prosodic words), rather than syllables or raw word count, that are the operative unit in list storage and searching.

Wheeldon and Lahiri (1997) followed up on these findings by testing whether stressed items are likewise the unit of planning in more spontaneous speech. They used a question-and-answer paradigm under which speakers were shown a noun phrase (e.g. *het water*, 'the water' — the experiment was carried out in Dutch) and given 500 ms to prepare it. They then heard a question to which that noun phrase was intended to be the answer (e.g. *Wat zoek je?* 'What do you seek?'), and, after another delay, were instructed to answer the question in a complete sentence using the memorized noun phrase (e.g. *Ik zoek het water* 'I seek the water').

The noun phrases to be memorized varied in phonological shape between a function word plus a content word (e.g. *het water* 'the water'), two content words (e.g. *vers water* 'fresh water'), a bare noun (e.g. *water*), or a stressed pronoun (e.g. *het* 'it'). By Wheeldon and Lahiri's account, their prosodic structure in a complete sentence is as given in 80, where each bracketed group constitutes a phonological word.¹⁰ Crucially, unstressed determiners such as *het* are presumed to cliticize

¹⁰"Phonological word" is Wheeldon and Lahiri's term; I believe it should be taken as equivalent

leftward in Dutch, forming a prosodic unit with what precedes (see Lahiri and Plank, 2010 for more on this).

- (80) Sample stimuli used in Wheeldon and Lahiri, 1997. Each bracketed group constitutes a phonological word.
- | | |
|---|---|
| a. function + content:
[ik zoek het] [water] | c. two content:
[ik zoek] [vers] [water] |
| b. bare noun: [ik zoek] [water] | d. stressed pronoun: [ik zoek] [het] |

If production planning is sensitive to phonological word count, rather than to orthographic word or syllable count, then 80c should have a longer onset latency than 80a, despite the fact that the two sentences have the same raw word count. This was borne out: it was the sentences with more prosodic words that took longer to initiate. The additional finding that there is no difference in onset latency between 80b and 80a indicates that the complexity of the first prosodic word does not affect production either, and the lack of a difference in onset latency between 80d and 80a indicates that the number of content words also has no effect.

Wheeldon and Lahiri also examined unprepared speech, in an experimental paradigm where subjects were asked to answer the question immediately upon hearing it, rather than waiting for a signal. In this case, it was observed that onset latency to sentences of type 80a was longer than to either sentences of type 80c or type 80b: evidence that it was the complexity of the first phonological word that was playing a role in production in this case, as type 80a sentences are the only ones in the paradigm to have three syllables in their first phonological word. In unprepared speech, Wheeldon and Lahiri conclude, speakers do not have enough time to plan out their entire utterance before they initiate it, and instead plan and

to Selkirk's "prosodic word," which I have been using here.

produce it one unit at a time. This differs from prepared speech, in which the whole utterance is planned in advance. But in both cases, the operative unit in production planning is the phonological word.

The second part of the equation comes from the findings of Ferreira (1991). Ferreira examined speakers' onset latencies in producing memorized sentences, though her sentences were by design more complex than those of Wheeldon and Lahiri, allowing her to also examine whether speakers would pause part of the way through reciting them. She manipulated the syntactic complexity of the subjects and objects in her stimuli, while holding prosodic word count constant. Subjects and objects were of "low," "medium," or "high" complexity as exemplified in Table 5.13; all combinations of these subject and object types were generated. (For the examples in Table 5.13, the verb separating the subject and object was *pleased* in all cases.)

	low	medium	high
subject	<i>the enthusiastic band</i>	<i>the pianist in the band</i>	<i>the man who started the band</i>
object	<i>the very impatient crowd</i>	<i>the senator in the crowd</i>	<i>the girl who was in the crowd</i>

Table 5.13: Sample stimuli components used in Ferreira, 1991, by syntactic complexity.

Ferreira found the following:

- The more complex a sentence's subject, the greater speakers' onset latencies in producing it.
- When both subject and object are complex, a speaker will pause after producing the subject and before producing the verb phrase.

She interprets these findings as follows. Before producing a sentence, speakers must translate it from a syntactic representation to a phonological one. The more

syntactic nodes there are in the sentence, the longer this translation process will take, as it operates one maximal projection at a time. When possible, this process of translation occurs simultaneously with speaking: that is, as speakers are producing the first component of a sentence, they are simultaneously planning the next one (see also Levelt, 1989). But translation takes up short-term memory capacity, and it is possible for short-term memory to become overloaded when there is too much to plan. Specifically, Ferreira proposes that when subject and object are both complex, speakers become unable to plan the object while they produce the subject, and instead break the sentence up into two components: the subject, and the verb phrase that follows it. Accordingly, and her results corroborate this, we will be more likely to find speakers pausing between the subject and the verb phrase when the two are planned separately than when they are planned together.

5.4.3.2. Connections to contraction

Given these findings, and to the extent that they carry over to non-laboratory settings, we can roughly sketch out a possible psycholinguistic source of the subject length effect on contraction demonstrated here. When a speaker's short-term memory buffer is occupied with the planning of a particularly complex subject, under Ferreira's proposal, they will be unable to plan beyond that subject to the following verb phrase. When it comes time for them to plan the verb phrase, then, the chunk of the sentence containing the subject will have already been shipped off from the planning to the execution phase of production. Without its subject in the same short-term memory buffer as it, there will be nothing for the auxiliary to contract to, and contraction may not occur.¹¹

¹¹See Wagner (to appear) for another potential example of production planning constraints on variation. Wagner examines the effect of following segment place of articulation on the variable alternation between *-ing* and *-in'*, and finds that following segment has more of an assimilatory

Note that Ferreira proposes that subject and verb phrase are planned separately only when both subject and object are complex. Object complexity wasn't measured in the present study. But I don't think my results are necessarily incompatible with Ferreira's model. The longest subjects in my data are much longer than Ferreira's, which consisted of at most seven words. It may simply be that planning such a long subject is enough to fill up a speaker's short-term memory buffer and inhibit contraction, without bringing planning of the object into the mix. The complexity of the verb phrases in the tokens under study is certainly something to be investigated in future work.

Ferreira's finding that syntactic nodes are implicated in planning seems to conflict with Sternberg et al. and Wheeldon and Lahiri's finding that it is prosodic words that are the unit of planning. Ferreira held prosodic word count constant and manipulated syntactic nodes; these other authors held syntactic nodes constant and manipulated prosodic words. In a way, the present study unites these findings, as Section 5.3.3 found significant effects of both prosodic words **and** function words on contraction of *is* and *has*. To the extent that function words introduce syntactic nodes (which they generally seem to do, as they comprise prepositions, complementizers, *wh*-words, determiners, etc.), they serve as proxies for syntactic structure, so this is essentially like finding that both prosodic words and syntactic nodes are playing a role in the subject length effect on contraction. (Recall that, without a fully parsed corpus, we didn't have enough data coded for true syntactic nodes to find a significant effect of that measure, but function words, which every token was coded for, were found to be significant; see Section 5.3.2.)

One fact that may help resolve the apparent conflict over which unit is important when the two are close enough to permit being planned together. When a boundary separates the *-ing* suffix from what follows, assimilation becomes less likely, which Wagner takes to mean that assimilation is connected to whether what follows the *-ing* has been planned.

plicated in planning is that Sternberg et al. and Wheeldon and Lahiri's stimuli were shorter than Ferreira's. Maybe prosodic words are implicated in the planning of short structures, while syntactic nodes begin to play a role once sentences get longer. Once a sentence reaches a certain length, perhaps, every word — both prosodic and function — starts to count. This could explain why, in the present study, prosodic word count was found to have a more negative coefficient than function word count for the contraction of *is* and *has* (Table 5.11): prosodic words count against contraction regardless of overall subject length, but function word count matters only when we get into the upper reaches.

Unfortunately, this is difficult to test with the data we have available. I tried restricting the data to two-word subjects, to see whether function words play a role in contraction rate in such cases. Two-word subjects have either no function words (e.g. 81), or one function word (e.g. 82).

(81) Puerto Rico's cheaper, too. (fe02405: fe_90301)

(82) My husband's twenty-seven. (fe01124: fe_7787)

In keeping with Lahiri and Wheeldon's results, function word presence does not constitute a significant predictor of contraction rate in these short-subject cases (*is*: $\beta = -0.22, p = 0.56$; *has*: $\beta = 0.49, p = 0.45$). I predict that this result would change as we get into longer and longer subjects, but that turns out to be impossible to test with the data we have available; mixed-effect models fail to converge once we start testing subjects of longer than 2 total words. The relative contribution of prosodic words and function words to contraction rate is another avenue to explore in future work, with the help of additional long-subject data.

We may even be able to make a connection between Ferreira's proposal that planning ahead fails once short-term memory fills up and the apparent contrac-

tion cut-off above 8 words in the present data (Figure 5.1). Miller (1956), citing a number of studies, places the limit on short-term memory capacity at “seven plus or minus two.” It may be that beyond an eight-word subject, short-term memory capacity for the majority of speakers is simply too full to allow contractions. This is not to say that contractions will never occur after this point, as presumably there is inter-speaker variation in memory span, but we should expect them to be much less likely than with subjects below eight words in length, as indeed we find.¹²

Ferreira also connects her proposal to the formation of intonational phrases, hypothesizing that intonational phrases may be built over performance units. This could connect nicely with the intuition, discussed in Section 5.4.2, that long subjects represent prosodic units of a type that is somehow too large to host a clitic. Rather than this being a stipulated grammatical fact, it would turn out to be a natural consequence of the way sentences are planned: complex subjects are planned separately from their following verb phrase; separately planned units are mapped to intonational phrases, with the upshot being an apparent disfavoring effect of intonational phrasewhood on contraction. Any evidence of an intonational phrase boundary, or even a pause (Section 5.4.2) between subject and auxiliary could then be psycholinguistically grounded. A psycholinguistic source of the subject length

¹²If the subject length effect on contraction is indeed connected to restrictions on production planning and short-term memory, we might predict that we would find more contractions after long subjects in written texts than in spontaneous speech, since writing does not have the same kind of memory restrictions as online production. A study of the realization of *is* and *has* in the Penn Treebank corpus (Taylor et al., 2003; Brown and Wall Street Journal materials only) finds 228 tokens of *is* and 143 tokens of *has* with a subject of greater than eight words, none of which displays a contraction. However, even when the subject is only a single-word NP — an environment in which contraction is predicted to occur 60% of the time in speech, according to the models in Table 5.12 — contraction occurs only at a rate of 6% (*is*) or 2% (*has*) in the written corpora. So the comparison is unfair from the outset. That said, I did encounter the sentence in 1 in Suzanne Collins’ *Mockingjay* (pg. 100), which shows a contraction after a 10-word subject, so they could still be out there, if we find the right texts.

- (1) Like some guy who’s spent his life in this rabbit warren’s going to fix me up.

effect also provides a nice explanation for why all three of the auxiliaries studied here (*is*, *has*, and *will*) show a similar tapering off around eight words (Figure 5.1): the effect is a natural consequence of constraints on the language production system, and will not be expected to show auxiliary-specific behavior.

5.5. Conclusion

This chapter has examined an effect of subject noun phrase length on short allomorph selection for three auxiliaries, *is*, *has*, and *will*, the three whose surface forms are (as I argued in Chapter 3) unambiguously traceable to a long or a short allomorph. All three auxiliaries were found to show an effect of subject length by which selection of the short allomorph becomes increasingly less likely as subjects increase in length. This was found to hold for a number of different conceivable ways of measuring length, but prosodic word count was found to be the best predictor after residualization for *will*, while orthographic word count (represented by a combination of prosodic word count and function word count, allowing each to contribute differently) was the best for *is* and *has*.

As the interest of this thesis is the representation of variable phenomena in the grammars of individual speakers, it is important to carefully consider the locus of the observed subject length effect. Is this effect represented grammar-internally? I have argued here, anticipating somewhat the discussion in Chapter 7, that the answer to this question should be no, because precise subject length is not the kind of factor we find conditioning invariable alternations — alternations which I take to be the purview of the generative grammar. Localizing the subject length effect in the grammar would mean that the grammar must have some ability to “count,” but we crucially do not find this attested in invariable phenomena.

Instead, I have proposed, based on the findings from a number of studies in

psycholinguistics, that this effect may be grounded in the system of speech planning and production. Experimental work has shown that prosodic words are the unit of speech planning; it has also found evidence that particularly long sentences are planned in separate chunks, and that a sentence's subject and its verb phrase may be planned separately when this happens. The hypothesis for why this would happen is that an overly complex subject exceeds the capacity of a speaker's short-term memory, preventing him from planning ahead to the verb phrase that follows. Then, when it comes time to plan that verb phrase, the host is no longer available for the auxiliary to contract to, so contraction may not occur.

Connecting the subject length effect to short-term memory capacity may speak to why we find a gradual tapering-off of short-allomorph use, rather than a sharp cut-off point.¹³ Presumably speakers differ in their short-term memory capacities, and even on the level of individual speakers, this may be something that can be affected by situational context. We should thus not expect to see hard-and-fast subject length effects, but rather the gradual effects that come from differing memory capacities (but all which have an upper bound somewhere around eight). On a related note, the connection between short-term memory and contraction after long subjects should be something that we can manipulate in the laboratory, by occupying speakers' memory with, say, a string of digits, and then seeing whether their ability to contract after long subjects decreases accordingly. (See Harnsberger and Pisoni, 1999 for evidence that such a cognitive load can affect the speech of some, though not all, experimental participants.) Assuming we can find a reliable way to elicit contractions with subjects of manipulated lengths in the laboratory,

¹³Though the raw data presented in Figure 5.1 did show a cut-off point, recall that the model-fitted values in Tables 5.8–5.10 predicted a low but non-zero rate of contraction even where no such tokens were attested. Because tokens with particularly long subjects are rare in the data, the observed cut-off could just be a result of low token counts.

we could also test for a correlation between a speaker’s longest permitted subject length with a contraction and their performance on short-term memory tasks (see, e.g., Sprouse et al., 2012, in which the authors examine whether speakers’ acceptability of island violations can be connected to their short-term memory capacity, though they find no evidence that it can).

There are also a number of directions in which we can take future corpus work on this topic. One obvious next step is to look at the intonation contours of subjects: is there evidence that, when a subject is long, it is intonationally phrased separately from what follows it? That would lend support to the proposal that planning, and hence intonational unit formation, may separate a long subject from its auxiliary. Verb phrase complexity could also be interesting to look at in light of Ferreira’s finding that it is the complexity of both the subject and the object that leads to the generation of separately-planned units. We would expect shorter subjects to be less likely to show contractions when they are followed by a particularly complex VP. Finally, the question of what other linguistic variables may be sensitive to constraints on production planning is an intriguing one. The variation between *-ing* and *-in'* may be one such instance (Wagner, to appear); variable movement phenomena have also been suggested to implicate speech production systems (Wasow, 1997; Arnold et al., 2000). This is a promising direction for future variationist work, and one which connects with important questions concerning whether all constraints on variation must be grammatically encoded.

Chapter 6

Locating external conditions on variation

6.1. Introduction

This chapter follows up on Chapters 4 and 5 by addressing Section 1.1.3's Question 2, concerning how the factors conditioning variation are represented in speakers' linguistic systems. In those two previous chapters, I considered factors that were linguistic in nature, exemplifying these with findings from the case study of variable auxiliary contraction I have been presenting. These internal factors have included features of the elements immediately surrounding the contracting auxiliary, such as the lexical identity of its pronoun subject or the phonology of the immediately preceding segment (factors which I have argued are represented grammar-internally), and features of larger elements, such as the number of words in its entire subject (which I have argued is the purview of a system of language production distinct from the grammar). The present chapter considers external factors on variation — factors that are not linguistic in nature. The question at issue is how external factors are represented in speakers' linguistic systems. Relevant to this is what linguistic elements or material external factors may “see,” or operate on. Previous researchers have indicated that external conditioning may be restricted to certain elements of language but may not operate on others. If this holds, a model of variation in the grammar needs to be able to account for it.

In this chapter, I consider a body of literature that maintains that internal and external factors do not interact in the conditioning of linguistic variation (Section 6.2). After narrowing the discussion to **intra**-speaker external conditioning — namely, stylistic variation — I discuss the implications of this finding for grammatical representations of probabilistic behavior (Section 6.3.1). I also examine a few case studies of variable phenomena with both internal and external conditions on their application, and I demonstrate that internal/external interactions are in some cases apparent, but can be explained away as having another source (Section 6.3.2). In other words, I am unable to find any solid evidence that external conditions on variation can “see” internal ones. I also examine the potential for external conditioning on the contraction case study I have been presenting throughout this thesis, though I find very little evidence of any (Section 6.3.3).

The chapter concludes by considering the theoretical implications of internal/external independence (Section 6.4). I briefly outline a model of language under which a generative grammar is distinct from a system of language use, so that external conditions are crucially separate from the grammar. This echoes my treatment of the subject length condition on contraction presented in Chapter 5, and sets us up for further discussion in Chapter 7.

6.2. Background on internal/external independence

Discussion of which linguistic elements social conditioning may attach to can be traced back to Weiner and Labov, 1983, an early study of variation “above the phonology” that examines the alternation between the agentless passive and the generalized active. These researchers found the linguistic constraints on the passive/active alternation to be consistent across sex, class, age, and ethnicity: in other words, there was no interaction between any social group and any linguistic condi-

tioning factor.¹ All social groups were thus found to treat this alternation the same where internal conditioning factors were concerned. Weiner and Labov remarked on the “substantial independence of the two sets of constraints” (i.e., internal and external) that this implied, and inferred from it that “social factors operate primarily upon surface patterns rather than abstract syntactic alternatives” (56).

Though Lavandera (1978) and Romaine (1981) subsequently raised concerns over whether the active/passive alternation was really best treated as a sociolinguistic variable, a construct typically reserved for lower-level alternations such as /r/-vocalization and [ɪŋ]~[ɪn] variation (Labov, 2006), this finding of internal/external independence continued to resurface. Later work (Sankoff and Labov, 1979; Labov, 2001b, 2010) thus cites Weiner and Labov, 1983 along with other studies demonstrating similar outcomes (e.g. Braga, 1982; Labov, 2010) as evidence that the internal and external constraints on variation do not interact. Labov (2001b:29) has rephrased this slightly differently as evidence for “relative segregation of social and structural elements in language.” The general idea is that linguistic conditions on variation operate independently of any social conditions, and vice versa.

Any demonstrated independence of internal and external constraints on variation has important ramifications for the locus of external probabilities in speakers’ grammars. If internal and external constraints are never found to interact, they must instead somehow be separate: external conditioning must apply across-the-board to linguistic variables, rather than being dependent on the context in which the variable happens to be occurring. This is not too different from the line of argumentation that we briefly considered in Section 5.3.4 (and to which we will devote more time in Chapter 7) as motivation for representing the subject length effect on

¹Chronologically speaking, there is in fact an earlier mention of this finding, in Sankoff and Labov, 1979, but only because Sankoff and Labov were citing an earlier version of Weiner and Labov, 1983.

contraction as grammar-external. In that previous chapter, the finding that precise word count can condition variable but not categorical alternations was taken as evidence that at least some variable alternations are the purview of a different component of the linguistic system than categorical alternations, so that the subject length effect is kept distinct from categorical alternations. If the subject length effect were the purview of the same system that governs categorical alternations, we would expect to see categorical alternations conditioned in that way, but we do not. By the same reasoning, if internal and external constraints on variation were represented in the same component of the linguistic system, this would open up the possibility that we would find them to interact — to “see” each other — in some cases. If this is not in fact attested, a better model of the grammar would instead have these conditions on variation as the purview of distinct components.

The two questions at issue, then, are:

1. Is it true that internal and external conditions on linguistic variation are not found to interact?
2. If so, why is this? (What about the structure of the grammar makes it so?)

I address Question 1 in Section 6.3, where I first refine the question so that it focuses only on speaker-level, rather than community-level, interactions (as my primary interest in this thesis is in the treatment of variability within the grammars of individual speakers). I also examine in that section some case studies that bear on the issue, and present alongside them some data on external constraints on contraction. I address Question 2 in Section 6.4, where I consider models of the language system that separate internal from external conditions on variation.

6.3. Question 1: Attestations

6.3.1. Refining the question

Before reviewing the literature on the putative lack of internal/external interactions, I would first like to refine the question at issue by clarifying what an interaction between internal and external constraints would look like, and by delimiting the relevant scope of this generalization.

In a situation of interaction, we would find internal constraints differently ranked for each level of the external constraint in question, or vice versa. As a hypothetical example, let's take the variation between [ɪŋ] and [ɪn] (represented in shorthand variable notation as (ing); Labov, 2001b). This variation has been found to be conditioned by, among other linguistic factors, the grammatical class of the word with the *-ing* suffix, such that progressive participles (e.g. *We were running*) show more [ɪn] than gerunds (e.g. *I like running*). This variable also shows an effect of style, such that [ɪn] is used less in more formal styles. If (ing) were to show an interaction between internal and external factors, we might find the hierarchy of internal constraints re-ranked by style: in formal styles, [ɪn] would be used more in progressives than in gerunds, while in informal styles, the ranking would be swapped, with more [ɪn] in gerunds than progressives. Essentially, there would be style-specific internal constraint rankings. The converse of this would also count as an interaction: finding that, when an *-ing* suffix was used in a progressive, the [ɪn] variant was the one used in informal styles, while when the suffix was used in a gerund, the [ɪŋ] variant was the informal one. If the ranking of internal constraints remained constant by style, and conversely, if the social evaluation of each variant remained constant for each linguistic environment, we would have **no** evidence of

internal/external interaction.²

It is, in fact, not difficult to find examples of apparent internal/external interaction when our external variable is the particular speech community under study. One famous example of this is the re-ranking of internal constraints on word-final cluster simplification across speech communities. Specifically, Guy (1980) finds that speakers from New York delete word-final coronal stops more before a pause than before a vowel, while Philadelphians delete them more before a vowel than before a pause. The internal constraint of following environment thus interacts with the “external constraint” of speech community.

Naturally, this isn’t the sort of effect that researchers like Sankoff and Labov (1979) have been considering when they have remarked on the non-interaction of internal and external constraints. They confine their observations to the level of the speech community, where speakers are presumed to share a common grammar (Weinreich et al., 1968). Weiner and Labov, for instance, observe that, where the passive/active alternation is concerned, “the same [internal] constraints are found throughout the speech community.” Braga (1982), similarly, confines her study to linguistic variation in a single speech community: in her case, the variables are left-dislocation and topicalization in Capeverdean Creole, for which she finds a consistent hierarchy of internal factors across age, sex, and social class.³

What these researchers have found, then, is that internal constraints on variation tend not to interact with **community-level** external constraints. That is, they

²In fact, Fruehwald (2009) finds exactly this, using a body of data collected from sociolinguistic interviews in Philadelphia: there is no interaction between the grammatical class of an *-ing* word and the style of speech. In other words, the effect of grammatical class on the [ŋ]~[m] alternation is consistent across styles.

³Kroch’s (1989) demonstration that a syntactic change progresses at the same rate in different linguistic environments is itself an instance of internal/external independence, with the external condition being the particular time period. The diachronic progression of the change in question does not interact with the various linguistic environments in which it surfaces.

have demonstrated that socially-defined subgroups within a community (groups defined by, for instance, shared sex, ethnicity, or social class characteristics) all have the same ranking of internal constraints on a particular variable.⁴ But this finding can start to sound dangerously circular given some definitions of the speech community as demonstrating a “uniform structural base” (Labov, 1989). The observed non-interaction begins to seem less like a property of where internal and external probabilities are located in individual speakers’ grammars and more like a result of how a speech community is defined. In fact, several researchers have explicitly referenced speakers’ shared internal constraints on variation as the way they have defined subgroups within a community (Rousseau and Sankoff, 1978; Sankoff and Labov, 1979; Lim and Guy, 2005). The tendency for non-interaction between internal and external constraints within a speech community, then, may in many cases be an artifact of the way speakers are grouped.⁵

Moreover, my interest in this thesis is, again, in the representation of variable phenomena in the grammars of individual speakers. The relevant question is how variation is represented in the cognitive systems of those speakers that produce the varying forms. Factors like gender, age, and social class divide up the speech community into subgroups, but each individual speaker has only one setting for each of them at a given point in time. In other words, looking at the community as a whole, we can see whether, say, the different age-based groups share internal

⁴Though see Kay and McDaniel (1979) for some discussion of possible counterexamples to this, which they propose invalidate the assumption that variable rules can be written to represent the shared grammar of a community. Some of their examples I find unconvincing, however; for instance, they argue that subgroup-specific raising of /ay/ or /aw/ on Martha’s Vineyard demonstrates internal/external interaction, as a single process of /a/-centralization is advanced by different groups depending on whether centralization occurs pre-/y/ or pre-/w/. But it is not clear to me why this should be seen as a single process occurring in two linguistic environments rather than two separate phonological changes.

⁵See also Paolillo, 2011, who argues that non-interaction between internal and external factors in linguistic variation is a null hypothesis and hence an untestable assumption, and one that may be an artifact of the nature of the data under examination.

constraints on a variable. But this question is not relevant to individual speakers, who find themselves in only one age-based subgroup at a time. This is not to say, of course, that an individual speaker will not change his orientation toward any one of these community-level categories over his lifetime, with possible concomitant changes in his linguistic system (for such an example, see Sankoff and Blondeau, 2007 for the case of “Lysiane B.”, who increases her use of a prestige variant as she ages and advances in the social hierarchy). But an individual speaker cannot manipulate his social class on an utterance-by-utterance basis. In the short term, individual speakers’ values for these macro-level social parameters are fixed.⁶ So, the finding that internal and external constraints on variation do not interact at the level of a speech community is not particularly informative for how probabilities are represented in **individuals’** linguistic systems. In individuals, there is no opportunity for macro-level external factors to interact with internal ones, because macro-level external factors are not manipulable; they do not vary synchronically. Accordingly, researchers working in the variable rule framework (e.g. Cedergren and Sankoff, 1974) have modeled each demographic subgroup in a community as having a single, group-specific input probability, rather than giving each subgroup access to the probabilities of all other subgroups. It thus goes without saying that, for an individual speaker, his hierarchy of internal constraints on a particular variable will not change with different levels of sex, or age, or social class. He only has one value for each of those parameters at any given time.

On the other hand, speakers **may** change their style of speaking on an utterance-by-utterance basis. This differentiates speech style from the other external pa-

⁶Weinreich et al. (1968), as well as Labov (1973), observe that speakers must have knowledge of the variants and values used by social groups other than that to which they belong, because they are capable of understanding forms that they do not themselves use. Though I am not opposed to this line of reasoning, it deals with perception, rather than production, and it is the latter that I am interested in (though see also fn. 7).

rameters that are often considered in sociolinguistic work: style is the only non-linguistic conditioning factor that is directly manipulable in online production. Since my interest, then, is in those factors which affect linguistic output in a probabilistic way each time a speaker goes to produce a variable form — those factors which affect language production in real time — **speech style** is the external factor that is relevant to the questions at issue here.⁷

So, does the proposed independence of internal and external constraints hold on the level of the individual? That is, we have seen that subgroups within a speech community tend to show the same ordering of internal constraints; do the various styles controlled by individuals do the same? In order to answer this, we need data on variables that are both conditioned by several internal factors, and that have been collected in multiple speech styles. Conveniently, there are a few case studies that can be brought to bear on this. These are discussed in the next section, along with a few apparent counterexamples that appear to demonstrate internal/external interactions but have been explained in previous work as having some other cause.

6.3.2. Case studies

One relevant example is the tensing of /æ/ in Philadelphia. Labov (2001b) mentions in a footnote (pg. 442) that (æhN) (that is, /æ/-tensing in syllables closed by nasals, as in *man*) “is the most highly stigmatized of the Philadelphia variables,” likely to be corrected in more formal situations. Tensing of /æ/ occurs in several linguistic environments in Philadelphia: in addition to the pre-nasal environment,

⁷Following up on fn. 6, style-shifting has been modeled as designing one’s speech toward the speech of interlocutors (Bell, 1984). Such a model presumes that speakers have grammatical knowledge of the variants and values used by other social groups **and** use them in production as well. Under this treatment of style-shifting, we would no longer want to say that individual speakers have no access to the values that are characteristic of other subgroups.

tensing also occurs in syllables closed by voiceless fricatives (e.g. *laugh*) and in a small set of words ending in /d/ (e.g. *bad*). If we were to confirm that social evaluation of this variable, and hence style-shifting, were contingent on linguistic environment, that would indeed be an instance of internal/external interaction on the level of an individual speaker.

As reported in Chapter 6 of Labov, 2001b, Labov solicited Philadelphians' reactions to various pronunciations of each of four vowels, all of which were involved in change in the Philadelphia dialect. Of the four, the vowel which elicited the greatest amount of negative comments was indeed (æhN), which Labov identified as displaying "a high degree of social recognition and considerable social stigma" (204). But (æhN) was not explicitly compared in this experiment to (æh) in other linguistic environments, to determine whether this social evaluation interacts with linguistic context. It was compared only to other variables that are in the process of change in the Philadelphia speech community. Additionally, when speakers are asked to evaluate pronunciation of (æhN), (æhS), and (æhd) via subjective reaction tests, Labov does not report any difference in evaluation for the different phonological environments, and underscores this with a note earlier in the book that "it is almost unknown for subjects to speak spontaneously of [...] differences in conditions on rules" (29). Evaluation of /æh/ in Philadelphia thus shows no evidence of an interaction with linguistic environment.

As Lim and Guy (2005) observe, a similar case of internal/external independence was found in Labov's 1966 study of /r/-vocalization by employees of New York City department stores (Labov, 2006). Labov elicited tokens of coda /r/ in two linguistic environments — word-internal (*fourth*) and word-final (*floor*) — and in two styles — a speaker's initial response, and his (more emphatic) repetition of that response. In each style, there was more /r/-vocalization word-internally than

word-finally: no interaction of the internal constraint on this variable with style.⁸

Lim and Guy (2005) themselves consider a case in which internal/external independence appears **not** to hold. They examine the linguistic constraints on *t/d*-deletion among speakers of Singapore English who were interviewed in the United States, where they were attending college. Lim and Guy find that these speakers display different rankings of internal constraints on *t/d*-deletion depending on whether they are speaking informally (in an interview setting) or formally (reading passages or lists of words): for instance, there is a re-ranking of the effect of a following pause on deletion between the two styles, and a similar re-ranking of the effect of irregular past tense forms. But this situation is complicated because the speakers in question may command two dialects: Lim and Guy observe that the linguistic situation in Singapore has been characterized as diglossic. If speakers' style-shifting is more accurately interpreted as dialect switching, that means this isn't strictly a counter-example to the proposed independence of internal and external constraints within a speaker's grammar. Singapore English speakers may have multiple grammars that they are effectively code-switching between, which may themselves have different rankings of internal constraints on *t/d*-deletion. In a way, then, it is perhaps more apt to compare the Singapore English situation to the situation of *t/d*-deletion constraint re-ranking between Philadelphia and New York discussed in 6.3.1, than to a case like that of /æ/-tensing in Philadelphia.

Finally, Warner (2005) presents another apparent counterexample of internal/external interaction: specifically, of what looks like style-shifting of a variable in only particular linguistic environments, which would appear to contradict Labov's

⁸Lim and Guy (2005:166) describe the independence of internal constraint rankings and speech style as a conventional assumption in sociolinguistics which is "well supported by empirical studies," though the only example they actually cite from the literature is Labov's department store study.

(2001b:29) proposal that there is “relative segregation of social and structural elements in language.” Warner examines the rise of *do*-support in Early Modern English in various linguistic environments (e.g. declaratives and questions, both negative and affirmative). He finds that, for negative declaratives (83a), there is a sharp, half-century long drop in the use of *do* (which had been increasing up until that point) in more formal writing. This same formal-register drop is evident in negative questions, too, but only in those negative questions where *not* precedes the subject (83b); crucially, it is not in evidence in those negative questions in which *not* follows the subject (83c). There is also no drop in evidence in affirmative declaratives or affirmative questions.

(83) *Do*-support environments

- a. Negative declarative: [Subject] *does not* [verb].
- b. Negative question, order 1: *Does not* [subject] [verb]?
- c. Negative question, order 2: *Does* [subject] *not* [verb]?

On the face of it, this would appear to represent the stigmatization of a variable in particular linguistic environments — the type of interaction that has been proposed to be unattested within the grammars of monodialectal speakers. But Warner observes that the Early Modern English facts are in fact compatible with another explanation. He proposes instead that this patterning is due to stigmatization of the reduced form of *not* that surfaces when following a form of *do*. That is, it is not necessarily the phenomenon of *do*-support that is stigmatized in these particular environments; it is instead the form that would be output on the surface were *do*-support to apply. This proposal provides a concise explanation for why the social evaluation should be directed differently at the two different question orderings (83b vs. 83c); it also jibes with Labov’s (2001b:28) proposal that “the

force of social evaluation, positive or negative, is generally brought to bear only upon superficial aspects of language.” This example is thus perfectly compatible with an analysis under which it does not constitute a counterexample to the proposal that stylistic conditioning operates independently of linguistic conditioning. Social evaluation may target elements of a surface form, but we do not have any solid evidence of it targeting linguistic structure.

In the next section, I examine the potential for sociostylistic effects on contraction, a variable which displays multiple opportunities for internal conditioning, since both subject type and auxiliary identity condition its application.

6.3.3. External conditions on contraction

6.3.3.1. Background: Sociolinguistic variables above the phonology

Before examining the potential for external constraints on contraction, I would like to briefly review a line of research that has addressed the apparent dearth of sociolinguistic variables above the phonology and has speculated on whether the upper levels of the grammar are available for social evaluation at all. Are we wasting our time by even attempting to look for external conditioning of contraction? In fact, there has been a decades-long discussion regarding the potential of (morpho)syntactic variables to be socially conditioned, and, more broadly, the potential of higher-level variables analogous to phonological or morphological variables to exist at all. Many researchers have been pessimistic concerning the potential for there to be sociolinguistic variables above the level of the phonology. If there truly is a division between (morpho)syntax and the other levels of the grammar with regards to each level’s potential to take on social evaluation, this is something a

model of variable competence should be able to account for.⁹

The question of the applicability of the sociolinguistic variable to alternations above the phonology was first raised by Lavandera (1978) and, following her, Romaine (1981). Both were responding to two early studies of supra-phonological variables, Weiner and Labov, 1983 and Sankoff, 1973. Lavandera and Romaine comment on the fact that the variables discussed by Sankoff and Weiner and Labov in fact display no social or stylistic conditioning, and that, in the case of the active/passive alternation at least, the variants in question also may not satisfy the criterion of semantic equivalence necessary for identifying a linguistic variable. They question the extension of the concept of the linguistic variable to alternations that may instead be pragmatically-governed, and discuss the importance of semantic equivalence in defining a variable. This thread is later followed by Winford (1996), who proposes that a criterion of “strict semantic equivalence” is essential in defining a linguistic variable above the level of the phonology.¹⁰

As I observed in Chapter 1, the point about equivalence is an important one to keep in mind when examining supra-phonological variation from the point of view that we are addressing it here. Since I am interested in the grammatical operations that generate variable output, it is crucial to distinguish equivalent variants of a single input from alternating items with distinct inputs that are deployed for distinct pragmatic purposes. In this thesis, I have taken the position that above the level of the phonology, equivalent variants are those that are generated from the same input: they are equivalent in what goes into the derivation. Even if the ear-

⁹Bill Labov points out (personal communication) that much of this discussion, while purporting to be about syntactic variation, has more specifically focused only on the tense and aspect domains and has not addressed more strictly syntactic phenomena, such as word order.

¹⁰Sankoff and Thibault (1981) take this even farther, identifying as linguistic variables alternations that show “weak complementarity” in the speech community (i.e. show roughly complementary distribution between opposite ends of the social spectrum), even if they differ in syntactic or semantic representation.

liest supra-phonological variables did not satisfy this criterion, as Lavandera and Romaine argue, many higher-level linguistic variables do, such as the alternation between the past tenses *dived* and *dove* (both the output of a root DIVE and a past tense node; Embick, 2008) and alternations between word orders due to competing parameter settings, such as the loss of main verb V-to-I raising discussed in Kroch (1989). Contraction is another of these, taking (under, say, Kaisse's (1983) analysis) a subject and a Tense node and spelling out that Tense node with a lexical item of some phonological shape. Past researchers' concerns about semantic equivalence thus do not hold up where contraction is concerned.

Even with issues of equivalence satisfied, though, subsequent work on syntactic variation continued to cast doubt on the possibility of a socially-evaluated syntax, as supra-phonological variables turned out to be sparsely represented in the ever-growing body of sociolinguistic literature.¹¹ Hudson (1980, 1996) and Cheshire (1999) attributed this lacuna to the infrequency of particular syntactic constructions. They propose that what syntactic differences there are in language tend to occur relatively rarely in speech, making them not only difficult to study (hence their rareness in the literature) but also less likely to be socially evaluated.

The infrequency hypothesis seems off the mark, though, when compared to the variables that have been studied in historical syntax, which tend to involve word-order changes which would be implicated in a large proportion of sentences (e.g. Kroch, 1989). In citing the infrequency of syntactic variables, Cheshire (1999) gives as an example Rickford et al.'s (1995) study of the loss of the verb in *as far as* constructions (a shift from *as far as X goes/is concerned* to *as far as X*), which is indeed infrequent in speech, as Rickford acknowledges, but also seems to be less of a truly

¹¹Or, at least, researchers had the impression that this was the case; Labov (personal communication) indicates that the number of studies of variation above the phonology at the time was much greater than was generally acknowledged.

syntactic variable than those discussed by Kroch, since it pertains only to a specific collocation. In fact, this example underscores a larger problem inherent in early work on “syntactic” variation: variables above the phonology have frequently been lumped together as “syntactic” or “grammatical,” despite the fact that they may range in kind from morphophonological to truly syntactic (Cheshire, 1987). These infrequency-based hypotheses, then, may be applicable to morpholexical variables, but cannot explain any putative lack of a socially-conditioned syntax. That said, we will see below that those auxiliaries that would undergo contraction, a variable that will be found to display very little sociostylistic conditioning of any sort, are in some cases quite difficult to come by in spontaneous speech, so the effect of frequency should not be ruled out here.

6.3.3.2. Findings

As indicated in Section 6.3.1, the external condition that speaks most directly to the question of how variable phenomena are represented in individuals’ grammars is speech style. A few works have addressed the question of stylistic conditioning on contraction, outside of the well-known and prescriptively enforced constraint that contractions are used less in writing than in speech.¹² However, given the attested speech/writing distinction (see, e.g., Chafe and Danielewicz, 1987), and the fact that we tend to associate reduced forms (like contractions) with casual speech, it is perhaps surprising that no robust effects of style on contraction have been found in spoken language. Instead, Finegan and Biber (1986) find that, when the data is restricted to the spoken modality, contractions play a role only in differentiating

¹²For instance, the online version of the *Random House Dictionary*, accessed June 2012, has the following usage note: “Contractions such as *isn’t*, *couldn’t*, *can’t*, *weren’t*, *he’ll*, *they’re* occur chiefly, although not exclusively, in informal speech and writing. They are common in personal letters, business letters, journalism, and fiction; they are rare in scientific and scholarly writing. Contractions occur in formal writing mainly as representations of speech.”

telephone conversations from speeches and broadcast speech (which themselves are simply writing that is read aloud); contraction rate does not significantly distinguish whether a telephone conversation was for personal or for business reasons. McElhinny (1993:391) likewise observes that “contracted and noncontracted forms cannot be clearly mapped onto formal and informal speech occasions” in her data: the rate of contraction, at least after pronoun subjects, is simply too high in either style. And the white speakers examined in Labov’s (1969:730) study of copula contraction actually show **less** contraction after noun phrase subjects in group as compared with individual conversation (59% compared to 74%, respectively).

The study of contraction reported on in this thesis draws on two different spoken modalities: telephone conversations between strangers (Switchboard) and face-to-face sociolinguistic interviews (PNC). As a first and very rough approximation of stylistic effects on contraction, we can examine whether corpus has a significant effect on this variation. The PNC contains narratives and discussions of personal history; conversations in Switchboard are generally too short to allow for story-telling, and narratives of personal experience, which increase a speaker’s likelihood of using the vernacular, were not explicitly targeted. The interviews in the PNC were also designed to allow the interviewee to guide the conversation (Labov, 1984); in Switchboard, participants were given a topic and were asked to stay on that topic as much as possible (Godfrey and Holliman, 1997), which may have underscored the artificiality of the situation. Given these differences, we expect conversations in the PNC to have a better chance of getting at the vernacular.

Contextual style is only one factor that differentiates the two corpora, though. Figure 6.1 gives a breakdown of the demographic differences between the two samples of speakers used in the present study.¹³

¹³Note that the data plotted in Figure 6.1 represents only those speakers who were targeted for

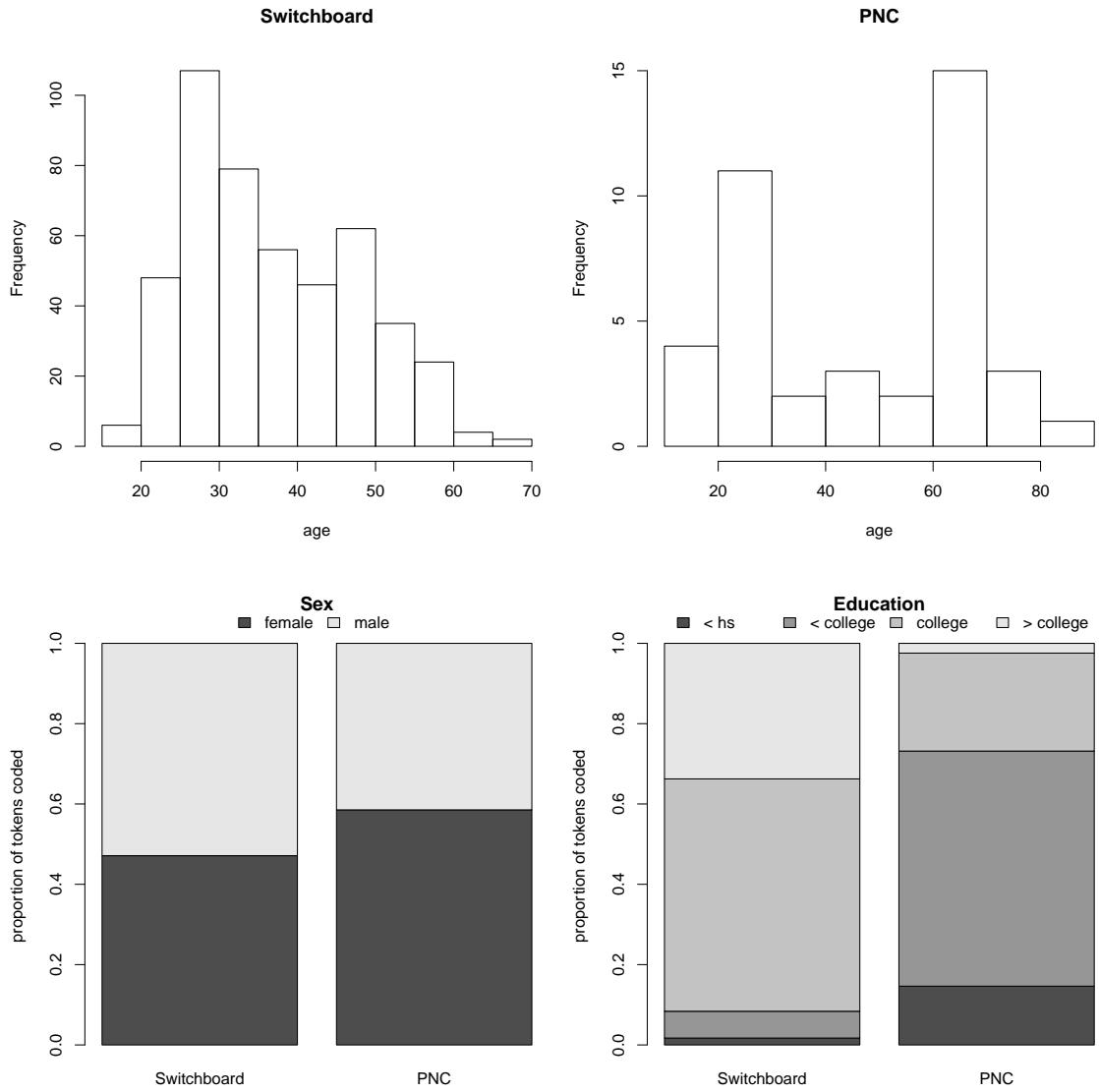


Figure 6.1: Distribution of age, sex, and level of education among speakers coded in each of the two corpora under study. N = 469 unique speakers coded for Switchboard; 41 for the PNC. “Age” represents a speaker’s age at time of recording; this is used rather than year of birth because the PNC data were collected over a span of four decades, making year of birth difficult to interpret.

To reiterate from Section 4.3, we are limited in which demographic factors we can examine by the corpus whose demographic coding was the least detailed; this is Switchboard, in which data was coded only for speaker sex, year of birth, and level of education (with this latter on a coarse scale: less than high school, less than college, college, more than college).¹⁴ The average level of education attained is much higher in Switchboard than in the PNC, with nearly three times as many speakers in the former having completed college.

CORPUS was included as a variable in each regression performed in Chapter 4. But, notwithstanding the various social and stylistic differences between the two corpora, CORPUS comes out significant in only three of the regressions in that chapter. Contraction of post-pronoun *had* and *would* shows strong negative effects of data from the PNC: that is, these auxiliaries show less contraction after pronouns in the PNC than they do in Switchboard (*had*: $\beta = -1.26$, $p = 0.02$; *would*: $\beta = -1$, $p < 0.01$). By contrast, contraction of post-noun phrase *is* shows a strong negative effect of data from the **telephone corpora**: that is, *is* contracts less after noun phrases in Switchboard and Fisher than in the PNC ($\beta = -0.98$, $p < 0.01$). (Adding CORPUS to the regression results in a significant change in log likelihood for all three auxiliaries, confirming the significance of this predictor; $p < 0.05$ in all cases.)

If we refer back to the rates of surface forms plotted in Figure 3.1, the fact that corpus comes out significant for post-pronoun *had* and *would* only is not especially surprising. Contraction of auxiliaries other than these two is nearly at ceiling in both corpora in this environment. With contraction in Switchboard already at such

the contraction study and is not necessarily representative of either corpus as a whole.

¹⁴The Switchboard manual leaves ambiguous whether “college” means only those with a college degree, or includes those who completed some college but did not earn a degree. Similarly, “less than college” could mean only those with a high school degree, or could include those who had completed some college.

a high rate, there is essentially no way for contraction rate to increase in the PNC.¹⁵

Had and *would* are the only two auxiliaries which do not contract at rates of 90% or above. However, the finding that they should contract **less** in the PNC is somewhat unexpected. It is as if the treatment of these auxiliaries in Switchboard is magnified in the PNC: *had* and *would* are a disfavoring environment for contraction in telephone speech, and they become even more of a disfavoring environment in sociolinguistic interviews.

The corpus effect on post-noun phrase *is* conforms more with intuition, with less contraction in the presumably less casual telephone speech. However, it is surprising that for other post-noun phrase auxiliaries, no significant effect of corpus is in evidence: not even for *has*, which contracts to a surface form that is identical to that of *is*.

It is certainly conceivable that corpus is not an appropriate proxy for speech style, given the various demographic differences between the two corpora. In order to more thoroughly investigate the effect of speech style on contraction, we need data from the same speakers in different situational contexts. The natural place to look for this is the PNC, as sociolinguistic interviews have been found in past work to be a fruitful domain for style-shifting (e.g. Labov, 2006). However, the low rate of use of some auxiliaries in that corpus (see fn. 15) means that these hour-long sociolinguistic interviews don't contain enough data on the various auxiliaries under study in different styles.

Instead, I turned to another data source, a series of recordings of one woman

¹⁵Perhaps also relevant to the failure to find a significant corpus effect for contraction of most post-pronoun auxiliaries is the fact that some of them — in particular, forms of HAVE — are difficult to find in the PNC. Speakers in the PNC just seem not to use the past or present perfect with any frequency. Thus, despite coding over 21 hours' worth of data from the PNC, I encountered only 95 tokens of *has*. This works out to each speaker producing a mean of only 2 tokens of post-pronoun *has* per interview (and interviews average 55 minutes in length). This may not be enough for any differences between the corpora to become apparent.

who was taped throughout the course of her day. The subject, known in the sociolinguistic literature under the pseudonym Carol Meyers, was recorded in 1972 in three situational contexts: at work as a travel agent, at home during dinner with her family, and during a bridge game with friends, for a total of 509 minutes' worth of transcribed speech. As Hindle (1979) discusses, Meyers' speech at the office comprises short telephone conversations with customers and airline employees as well as more extended interaction with her co-workers. At home, there is slow chatter, while at the bridge game, conversation is animated and constant. Meyers' recordings are thus a fruitful arena to look for style-shifting.

In fact, where phonetic variables are concerned, Hindle does find evidence of stylistic effects on Meyers' speech. For a number of phonetic variables that are undergoing or have undergone change in Philadelphia (e.g. the raising of /aw/, the raising of /ey/, the fronting of /ow/), Meyers is found to use more advanced variants in the game setting. Hindle attributes this to the female-led nature of these changes in the community and the presence of women at the game: Meyers "talks more like a woman when she is talking to women" (171). Moreover, Labov (2001b) observes that in the case of the one male-led change, /ay/-raising before voiceless consonants, Meyers is more advanced at the office and least advanced at the bridge game: further evidence that her vowel advancement is connected to the demographics of her interlocutors. Labov concludes that Meyers' "shifts in social interaction can be said to mirror the sexual differentiation of the variables in the community" (442).

What is the "sexual differentiation of the variables in the community" where contraction is concerned? In fact, there is none. For all six auxiliaries under study, regardless of subject type, restricting the data to the PNC and performing the regressions carried out in Chapter 4 finds no significant effect of sex in any case.

There are a few community-level social effects on contraction that are attested in the PNC, but they do not follow any sort of pattern. Both post-pronoun *have* and post-pronoun *would* show year of birth effects, with increased contraction of *have* among younger speakers and **decreased** contraction of *would* among younger speakers (*have*: $\beta = 0.53$, $p < 0.01$; *would*: $\beta = -0.25$, $p < 0.01$). This age effect on *would* is not attested in the apparent-time data from Switchboard, and it may be the reason that our model found an effect of corpus on the contraction of this auxiliary. There is also a negative effect of years of schooling on contraction of both post-pronoun and post-noun phrase *is*: so, more highly-educated speakers contract less in each case (post-pronoun: $\beta = -0.34$, $p < 0.01$; post-NP: $\beta = -0.15$, $p = 0.02$). This could conceivably be attributed to increased familiarity with the written language, where contractions are prescribed against, on the part of these speakers, though it is unclear why this wouldn't extend to contraction of other auxiliaries. Either way, since it goes in the same direction as the between-corpus effect mentioned above, it is again conceivable that education level, rather than style, could be the source of that previous effect.

Though the effect of years of schooling might give us reason to expect style-shifting (see, e.g., Bell, 1984 for the proposal that intra-speaker variation derives from inter-speaker variation), in fact Carol Meyers shows **no significant effect of style on contraction of any auxiliary, in any environment**.¹⁶ For post-pronoun *had*, *has*, and *have*, she actually displays categorical contraction in all three social situations. Her contraction rates for post-pronoun *is* and *will* are similarly essentially categorical, with only 1 out of 206 *is* tokens uncontracted, and 4 out of 123 *will* tokens. Where post-pronoun *would* is concerned, she does show variable be-

¹⁶Analysis of the Carol Meyers data was carried out using the same coding of dependent and independent variables, and statistical analysis, as described in Sections 4.2–4.3.

havior, contracting 65% of the time, but this value does not significantly change by style (though she also produces only 40 total tokens of post-pronoun *would*).

Her post-noun phrase *is* data, which likewise does not show categorical behavior, also shows no significant effect of social situation. The raw percentages (Table 6.1) would appear to indicate that she contracts less at the office, but since this goes away in a regression, it must be due to some confound. One possibility is subject length: Meyers' subjects are significantly longer at the office than at the bridge game ($p = 0.04$ via Wilcox test).

	game	dinner	office
contraction rate	0.61	0.62	0.35
N	23	8	51

Table 6.1: Rates of contraction of post-NP *is* for Carol Meyers by situational context.

Labov's proposal that Meyers style-shifts to match the sexual differentiation in the community, then, is not refuted by contraction; there simply is no sexual differentiation, and there is no style-shifting either. What few social effects on contraction we do observe in the community are not consistent: for instance, there is no obvious stigmatization of this variable evident from the behavior of women and more educated speakers. Contraction, with the numerous internal conditions on its application (e.g. subject type, auxiliary identity), would seem to be an opportune variable for examining potential internal/external interactions, and the few social effects attested here are intriguing. Future research can perform, for instance, subjective reaction or matched guise tests, to examine whether any overt social evaluation of the few socially-conditioned contractions is in evidence, or whether the social effects found here are simply the result of statistical noise.

6.3.4. Conclusion

We have considered here a few case studies of variable phenomena which are conditioned by a number of internal factors. In no case can we conclude that we have irrefutable evidence of external conditioning targeting linguistic structure: of internal and external conditions on variation interacting. Though there are attestations of certain collocations bearing social evaluation, it is never abstract structure that is referenced (exactly as Labov (2001b) proposed). Collocation-specific social evaluation (namely, Warner's *do-support* findings) can be just as easily explained if we propose that output forms are what external factors may act on. The following section addresses this proposal in more detail.

6.4. Question 2: Theoretical implications

Assuming that the lack of internal/external interaction holds up in cases of sociolinguistic variation — and we have not yet seen any convincing examples in which it does not — why should this be the case? Why would external conditioning not operate on linguistic structure?

I believe a fruitful way to approach this question is by taking seriously Labov's (2001b:29) proposal that there is "relative segregation of social and structural elements in language." Specifically, one way of ensuring that social conditioning is not sensitive to internal linguistic conditions is by modeling external factors as operating after linguistic derivation has been completed.

This approach is not altogether different from that taken in early work on variable rules. Cedergren and Sankoff (1974), for instance, model variable phenomena as rules with both internal conditions and an input probability. The internal conditions are each associated with a value between 0 and 1, representing probabilistic

rule application that is more or less likely in certain linguistic environments. The input probability represents the external factors relevant to a particular speaker. Though Cedergren and Sankoff do not address **intra-speaker** internal/external independence, they do demonstrate that modeling internal and external constraints separately can account for **community-level** independence (Section 6.3.1). The input probability raises or lowers the values of all internal constraints by a fixed amount, so that, across demographic groups, speakers show the same hierarchy of internal constraints on a variable. A speaker’s input probability may make it so that those internal constraint values are all higher than those of a speaker from a different demographic group, or all lower, but the important point is that they are simply modulated up or down: they are not rearranged from speaker to speaker.

Where style-shifting is concerned, if we want internal/external independence to hold across styles, we need a way to prevent internal constraint rankings from being rearranged from **style to style**. In other words, the effect of style should be like that of the input probability: it should modulate internal constraint values up or down, but not rearrange them. The traditional way of doing this seems to be in fact to incorporate values for style into the input probability, an approach which Lim and Guy (2005:157) describe as effecting “a quantitative shift in the rate of use across all [linguistic] contexts.” Labov (1972) indeed suggests capturing style-shift in /r/-vocalization by adjusting the input probability accordingly. Similarly, Guy and Boberg (1997:149) treat style as “another independent parameter” affecting variation, distinct from linguistic conditions and also distinct from a speaker’s demographic characteristics. Under their interpretation, demographic characteristics are represented by a speaker’s input probability; style then serves to modulate that input probability. They do not go into this in any detail, but presumably the idea is compatible with an audience design-type model of style-shifting: in casual

speech, say, a speaker’s input probability is adjusted to more closely resemble that of a subgroup that uses the variable at a higher rate.

My one reservation to incorporating style-shifting values into the same input probability where demographic factors such as age and social class are represented is that those demographic factors, as I discussed in Section 6.3.1, are stable during linguistic production. Speakers do not manipulate them across utterances. Speech style is different: speakers can switch in and out of styles during the course of a conversation (Labov, 2001a). So, in order to account for this, I suggest that the linguistic mechanism governing style-shifting be separate from that which represents the values that characterize a speaker’s demographic subgroup.

An alternative way of incorporating stylistic variation into a grammatical model might have style-shifting operating directly on the output of the grammar, rather than on the input probability. Here I present a very rough model of how this might work, taking a cue from Preston’s (2004) “psycholinguistic models of variation.” Preston proposes a model of the linguistic systems governing variable output under which the grammar outputs two variants, which are biased according to the relevant linguistic context. For instance, to take the (ing) example set up in Section 6.3.1, the grammar produces two possible variants, [ɪŋ] and [ɪn].¹⁷ They are probabilistically weighted depending on grammatical class: for instance, if the form in question is a progressive, [ɪn] will be weighted more heavily than [ɪŋ], as the former is found to be the more frequent variant in this environment. These values are then modulated by something akin to Preston’s “sociocultural selection device”: a mechanism that boosts or lowers a variant’s probability depending on style. Crucially, however, the effect of the linguistic environment has already taken

¹⁷I am abstracting away from what the actual variable mechanism is that generates the competing [ɪŋ] and [ɪn] variants: i.e. whether this is a phonological rule or an allomorphic alternation.

place by this point. Style is thus operating only on the output of the earlier linguistic conditioning, much in keeping with Labov's (2001b:28) proposal that "social evaluation [...] is generally brought to bear only upon superficial aspects of language." Once this weighting has occurred, a selection process akin to a coin flip with a weighted coin takes place, and a variant is selected based on the probability value that it has accumulated given the linguistic and stylistic context.

This type of model could elegantly capture Warner's (2005) *do*-support data, for instance. Variable *do*-support applies with some internal conditioning based on linguistic environment, such that it is more likely to occur in, say, negative questions as compared to negative declaratives (based on data from Ellegård (1953) as presented in Kroch, 1989). Once the two possible variants ("use *do*-support" and "don't use *do*-support") have been weighted according to their linguistic environment, they are output to the "selection" mechanism, which is sensitive to style. It is here that the forms of the variants are socially evaluated and their probabilities are re-weighted depending on stylistic factors. This is where sequences of DO + *not* would be stigmatized in elevated registers, disfavoring the use of *do*-support variants in this context. Crucially, stylistic evaluation is not acting on the particular linguistic environment that conditions the application of *do*-support; it is acting on the **output** of *do*-support.

Regardless of the specifics concerning how style-shifting is incorporated, the various models proposed here have in common that linguistic and social conditions on variation are kept distinct. In fact, this is an approach to language variation that has been endorsed by a number of researchers (Fasold, 1991; Wolfram, 1991; Romaine, 1985; Embick, 2008), and which connects to questions of the separation of grammar and use, which I will address in the next chapter.

6.5. Conclusion

Case studies of sociolinguistic variation have provided evidence that both community-level external factors (that is, the demographics that define social subgroups) and the speaker-level external factor of style do not interact with internal factors. Naturally, trying to prove the non-existence of something is a fruitless task, so I am certainly open to learning of counterexamples to this generalization that cannot be explained away, as were those we considered in Section 6.3.2. But to the extent that internal/external independence does hold in linguistic variation, grammatical models of variable phenomena need a way of accounting for it.

The model of variable production that I have put forth here separates internal and external conditions on variation by representing speaker-level demographic factors in an input probability, and manipulable stylistic effects as the purview of a selection mechanism that boosts probabilities on outputs. This allows community-level internal/external independence to hold for a different reason than speaker-level independence. Community-level independence holds because individuals within a speech community share the same linguistic constraints on a variable process, while speaker-level independence holds because the mechanism that governs style-shifting operates on outputs rather than on linguistic conditioning. Roughly, what I have sketched is a model of language under which the system that outputs forms — the generative grammar — is distinct from the system which uses them in particular situations — Preston’s “sociocultural selection device,” which we might rename a system of use. Though our contraction case study has not had much to offer where external conditioning is concerned, we will return to it in the next chapter, where I extend the proposal that grammar and language use are distinct, and connect it with the subject length findings on contraction from Chapter 5.

Chapter 7

Toward a model of variation in the grammar: Conclusions and directions for future work

7.1. Introduction

My goal in this thesis has been to develop a model of sociolinguistic variation that can account for the patterning of variable phenomena above the level of the phonology. I have chosen as my source of data a detailed case study of auxiliary contraction in English, operationalized as the variable selection of short allo-morphs of auxiliaries (Chapter 3) and examined for both linguistic (Chapters 4 and 5) and sociostylistic (Chapter 6) conditions on the variation. The present chapter discusses the theoretical implications of the findings I have drawn from the contraction case study where they concern the architecture of the system that produces linguistic variants.

I began this thesis (Section 1.1.3) with two questions. I reprint them below, with the answers that I have gleaned from the contraction case study.

Question 1. What is the underlying source of the variants we see on the surface?

Answer: Surface auxiliary variants are the output of two stages of processes: an alternation in the morphology followed by low-level phonetic and phonological processes that operate on the output of the morphology.

Question 2. What conditions the appearance of surface variants?

Answer: A number of linguistic factors condition the appearance of surface auxiliary variants. These range from phonological and lexical properties of the word immediately preceding an auxiliary to the precise length of an auxiliary's subject.

I take these answers as evidence for two major conclusions concerning the architecture of the system that outputs linguistic variants.

1. Surface forms are derived by passing through a generative grammar which comprises a series of linguistic levels, where input forms are (variably) operated on before being output.
2. The generative grammar which derives surface forms is distinct from a system of language use, which deploys alternants based on psycholinguistic and sociostylistic constraints.

The proposal that the grammar comprises variable processes allows some conditions on variation to be encoded in the grammar, much as Weinreich et al. (1968) originally proposed them to be. They are not emergent from string frequency or other patterns of language use (Section 7.2). But other conditions on variation, I argue, are not grammatically encoded (Section 7.3). They are instead the purview of the system of use. These conditions are those that display a kind of non-locality that is not characteristic of alternations that are the purview of the grammar.

I will discuss each of these two conclusions in turn.

7.2. Conclusion 1: A partially probabilistic grammar which derives outputs

7.2.1. Introduction

The findings in Chapters 3 and 4 support a model of the grammar that (a) derives output forms and (b) is capable of capturing probabilistic behavior. By “derives output forms,” I mean that linguistic representations must pass through multiple levels, undergoing alteration and combination before surfacing in some particular output. In other words, items are not stored identically to how they surface. By “partially probabilistic,” I mean that some conditions on variation must be encoded in the grammar, rather than being emergent from language use. This does not mean that **all** grammatical operations are probabilistic, but some must be.¹

Neither of these points is without controversy, and the following sections discuss them each in turn, relating them to other proposals that have been put forth in the literature.

7.2.2. A grammar which derives outputs

As Hay and Baayen (2005) conceptualize the debate, models of morphology can either be combinatorial — meaning that surface forms derive from stored pieces which are combined prior to output — or connectionist — meaning that whole words are stored as such and related to others through paradigmatic analogy. The connectionist approach dispenses with the formation of words via pieces and rules; words are stored as they surface, and any similarity between words comes from shared connections rather than shared underlying pieces.

But a crucial finding of Chapter 3 is that the patterns in the contraction data are explicable only if surface representations are distinct from underlying ones.

¹This also does not mean that all conditions on variation have their locus in the grammar; see Section 7.3 for more on that.

This necessitates a component of the linguistic system in which elements are operated on before they are output. The specific argumentation underlying this is as follows. As Chapter 3 showed, English auxiliaries surface in a number of different phonological shapes, identified in that chapter as “full,” “intermediate,” and “contracted” (Section 3.2.3). When we consider the distribution of these surface shapes in spontaneous speech, some of them pattern together (Section 3.4). For instance, when we examine the realization of the auxiliaries *is*, *has*, and *will* after subjects of increasing length (Section 3.4.3), we find that intermediate forms of *will* pattern just like contracted forms of *is* and *has*. All three of these forms become less and less likely with longer subjects. By contrast, intermediate forms of *have* are found to pattern differently: they do not show the same subject length effect. Instead, they pattern much more like intermediate forms of *has*, which don’t show the subject length effect either.

A natural explanation of this finding falls out from a model of the grammar under which phonological processes operate on underlying forms to derive the forms that surface. Those surface forms whose underlying source is of the same type behave in the same way on the surface because the subject length effect applies on that underlying form. Specifically, I proposed in that chapter (Section 3.3) that each auxiliary shows alternation between two underlying forms, one “long” allomorph and one “short” one. Each auxiliary’s underlying short allomorph is dispreferred after long subjects, and this dispreference manifests on the surface in whatever an auxiliary’s surface reflex of that allomorph is. Under the analysis in that chapter, intermediate forms of *will* and contracted forms of *is* and *has* all have their source in the short allomorph of their respective auxiliaries. Accordingly, these three phonological shapes all show an effect of subject length on the surface. By contrast, the failure of intermediate forms of *have* and *has* to show the subject

length effect is explained if we assume that **these** surface forms come from a **different** underlying source. Specifically, in that chapter I argue that their source is (at least in part) in the long allomorph, which is **not** dispreferred after long subjects.

What is crucial here is that certain surface forms can be traced back to a source of the same type: a long or a short allomorph of the auxiliary in question. If output forms are stored, the reason why the contracted form of *is* and *has* behaves identically to the intermediate form of *will*, while the intermediate form of *have* behaves differently, is lost. This behavior becomes simply a coincidence. A grammatical model under which output forms are derived by passing through multiple linguistic levels instead provides us with an elegant explanation of the data.

7.2.3. A grammar that can handle probabilities

When it comes to localizing variation in speakers' linguistic systems, there has been debate in the field concerning whether variable phenomena and the conditions that govern them are encoded grammatically or emergent from usage. The former alternative can be traced back to Weinreich et al. (1968) and Labov (1969), who put forward the idea of "inherent variability": as summarized by Guy and Boberg (1997:149), this is "the hypothesis that the human language faculty necessarily accommodates and generates variation, and that the workings of grammar have a quantitative, noncategorical, and nondeterministic component." This approach to variability has been incorporated into both rule-based (e.g., Labov, 1969; Cedergren and Sankoff, 1974) and constraint-based (e.g., Anttila and Cho, 1998) models of grammar; in each case, variable alternations and the conditions that govern them are encoded in the same mechanism as that which generates categorical outputs. In essence, the frequency of and conditions on sociolinguistic variants are understood to be part of speakers' grammatical competence.

The traditional alternative to this approach holds that the grammar is categorical, with variation being the purview of a system of “performance.” Kiparsky (1972) is an early proponent of this; he raises the concern that localizing conditions on variation in the grammar is stipulative when these conditions appear to be grounded in performance. As an example, he cites the disfavoring effect of the past tense on English *t/d*-deletion, an effect which appears to reduce homophony between past and present; this, he proposes, facilitates perception, and should accordingly fall out of functional rather than formal mechanisms. Kiparsky thus questions “whether variable frequencies are part of the statement of grammatical rules, or whether they might be predictable, wholly or in part, by universal conditions” (223). But at least where *t/d*-deletion is concerned, convincing evidence has been put forth in the literature that conditions on this variable are intricately entwined with grammatical representation. For instance, Guy (1991) demonstrates the connection of deletion rate to rule application at multiple levels of the phonology. And Guy (1980) shows that a following pause has opposite effects on *t/d*-deletion depending on which speech community a speaker belongs to, a finding that must be part of grammatical competence — must be **learned** — as functional motivations could not explain why a single constraint would have conflicting effects on a single variable. (See Guy, 1997 for more discussion on this same point.)

Newmeyer (2003) provides a more recent critique of grammar-internal variation. Newmeyer argues in favor of a strict separation of grammar and language use; while I am sympathetic to this (see Section 7.3), he goes so far as to argue that there is no reason the grammar should be probabilistic at all. Many of Newmeyer’s arguments in support of the invariant, categorical grammar have been discussed and dismissed in Chapter 1 of this thesis. For instance, he is skeptical of the possibility for higher-level grammatical variables to display strict semantic equiva-

lence and hence to constitute sociolinguistic variables like the phonological ones that have traditionally been considered. However, I have argued here (e.g. Section 6.3.3.1) that in the case of contraction, the varying surface forms are perfectly equivalent in the elements that go into the derivation: they have identical inputs. Contraction thus does not raise the same issues of equivalence that other higher-level grammatical variables have. Newmeyer also criticizes models of variable competence because they project probabilities evident at the level of the community into the grammars of individual speakers, and “there is no way that one can draw conclusions about the grammar of an individual from usage facts about communities” (696). But this argument ignores decades’ worth of work in sociolinguistics. A major point of Weinreich et al., 1968 was the orderly relation of individuals to their speech communities. Exemplifying this, Guy (1980) demonstrates that individuals perfectly mirror community-level linguistic constraints on *t/d*-deletion once enough tokens have been collected from a speaker. At the very least, the assumption that individuals mirror community-level behavior should be taken as a hypothesis to be proven, rather than a falsehood to be dismissed outright.

In Chapter 4, I considered whether the conditions on contraction could be emergent from language use. Approaches to linguistic variation in which grammar and usage are conflated (e.g. Bybee, 2006) make clear predictions about the effects of collocation frequency on reduction processes: the more frequently we find an auxiliary in a particular context, the more often we should find it surfacing in its reduced form, as repeated motions are more fluent and hence display gestural overlap. But this was not borne out with any degree of granularity when the frequency of auxiliaries with different pronominal subjects was examined, thus failing to explain the differing frequencies of contraction of certain auxiliaries with certain pronouns (Section 4.4.3). With this usage-based explanation unsatisfying,

I concluded that at least this condition on contraction must be grammar-internal: part of speakers' competence.

7.3. Conclusion 2: A system of language use distinct from the grammar

7.3.1. Introduction

Section 7.2 argued that some conditions on variation must be represented grammatically internally, meaning that the grammar is in part probabilistic. But in this section, I argue that localizing **all** conditions on variable phenomena in the grammar predicts the existence of alternations which are not in fact attested. Specifically, as briefly discussed in Sections 5.3.4 and 6.4, certain conditions on variation — here, the effect of subject length on contraction, as well as the effect of style more generally — must be the purview of some system that is distinct from the grammar. I call this a system of use. In this section, after presenting my argumentation for the extra-grammaticality of these effects, I roughly sketch a model of language that separates a probabilistic grammar from this system of use.

7.3.2. Some conditions on variation as extra-grammatical

As summarized in Section 5.3.4, the line of argumentation for representing the subject length effect on contraction as being grammar-external is as follows.

1. If a variable alternation is the purview of the grammar, the grammar must have access to the factors that condition it.
2. Categorical alternations are the purview of the grammar.
3. This predicts that all those factors which condition that variable alternation will be available to condition categorical alternations, too.

This section steps through this argumentation in more detail.

Several researchers have commented on the tendency for variable phenomena to be conditioned by the same factors that condition categorical phenomena. Notable among these are Guy and Boberg (1997), who examine linguistic conditions on *t/d*-deletion. They find the hierarchy of preceding-segment effects on deletion given in 84. Specifically, the most deletion is found after /n/, then sibilants and stops, then non-sibilant fricatives, and finally /l/.

- (84) /nt/ > /st/ = /pt/ > /ft/ > /lt/

Guy and Boberg analyze this as an effect of the Obligatory Contour Principle (OCP): the more features a /t/ or /d/ shares with the segment that precedes it, the more likely that alveolar stop is to delete. So, /n/, which shares [+coronal] and [-continuant] with /t/, is a strong promoter of deletion, while /l/, which shares only [+coronal], is only a weak promoter. Assuming that this effect is indeed attributable to the OCP, and taking into account the facts that (1) the Obligatory Contour Principle is known to condition invariant alternations, and (2) invariant alternations are assumed to be grammar-internal, then representing this OCP effect on **variable** *t/d*-deletion as also the purview of the grammar avoids what Coetzee and Pater (2011:406) call “considerable duplication of formal machinery.” In other words, interpreting this preceding segment effect as stemming from a distinct system of use or performance would mean that there were one invariant version of the OCP which conditioned the types of alternations in phonology that have traditionally been used to demonstrate OCP effects (e.g. segment and tone deletion), and another, variable, version of the OCP which drove *t/d*-deletion effects. As Guy (1997:134) puts it, giving “each competence constraint, [which] summariz[es] invariant facts, [...] a separate but equal performance twin, which accounted for

variable facts” would be “manifestly absurd, and we should be deeply suspicious of a conceptual framework that leads to such theoretical apartheid, if only because of Occam’s Razor.”

t/d-deletion provides one example in which a variable alternation is conditioned by the same factor that conditions a categorical alternation, but others are not difficult to come by, even when we just restrict the data to conditions on auxiliary contraction. For instance, we saw in Section 4.4 that host identity plays a role in contraction, with more or less contraction of the auxiliaries *will* and *would* after certain pronouns. The lexical identity of a host can condition categorical alternations, as well: for instance, the past tense suffix in English alternates between $-\emptyset$ (as in *hit*), $-t$ (as in *left*), and $-d$ (as in *played*), depending on the identity of its host. To give another example, we saw in Section 4.6.2.2 that contraction of *is* is conditioned by whether the segment that precedes it is a vowel or a consonant. The consonantality of a preceding segment is also something that has been found to condition categorical alternations: the Korean nominative suffix shows an allo-morphic alternation between *-i* and *-ka* depending on whether it follows a vowel or a consonant (Odden, 1993).

Judging only on the examples cited here, then, factors that condition variable alternations are the same as those that condition categorical ones. This finding thus serves to bolster the proposal that was put forth in Section 7.2: a model of language needs a system of grammatical competence that can handle probabilistic effects. The overlap in conditioning factors between invariant and variant alternations is too conspicuous for variable alternations to be solely the purview of a grammar-external system of performance. Since categorical and variable phenomena share the same conditioning factors, the most parsimonious approach is a unified treatment, such that both types of alternations are localized in the same

component of the linguistic system.²

However, the subject length condition on contraction demonstrated in Section 3.4.3 is, conspicuously, **not** the kind of factor that has been found to condition categorical alternations. The decreasing likelihood of contraction by increased subject length shows a sensitivity to word count that violates the locality attested in invariant grammatical alternations (Embick, 2010) and the received wisdom in linguistics that “grammars can’t count.” Guy and Boberg (1997:163) propose that variation stems from “an extension of the same processes that generate categorical outputs.” But there is no categorical process that behaves in this way. Categorical alternations are not conditioned by precise length like this. This indicates that some conditions on variation must be part of a system separate from that which handles categorical alternations. And assuming that categorical alternations are handled by the generative grammar, this means that some conditions on variation

²Bresnan and Nikitina (2009:174) point out a similar finding, but draw a different conclusion from it. Specifically, they examine constraints on the dative alternation in English, and find that the person of a pronoun recipient has an effect on whether the double-object or the prepositional dative is used. Third-person recipients favor the prepositional dative (e.g. *gave X to him*); first- and second-person recipients favor the double-object construction (e.g. *gave me/you X*). They then demonstrate that, in the Nilo-Saharan language Kanuri, when the recipient of the verb *give* is third-person, it is categorically represented in a prepositional phrase; when the recipient is first- or second-person, it is “normally expressed as a direct object prefix on the verb.” This overlap between categorical and variable constraints leads them to propose that “the boundaries between categoricity and gradience are fluid” (175). But it is not clear to me why this finding, and the others I have presented, necessarily shows a breakdown between what is categorical and what is variable. They seem equally compatible with a model under which variable phenomena are represented in the same linguistic component as those categorical alternations whose conditions they share, despite there being a clear difference between the two.

must be grammar-external.³

This is not the first time it has been observed that some conditions on variation are extra-grammatical in nature. Coetzee and Kawahara (to appear) acknowledge that constraints on variation may be grammatical or “non-grammatical,” with this latter group comprising effects of speech style and usage frequency. They also observe that traditional grammatical models of variation, particularly various flavors of stochastic or probabilistic Optimality Theory, have failed to account for these non-grammatical factors. They provide an attempt at filling this gap by modeling frequency effects on *t/d*-deletion in Noisy Harmonic Grammar. Noisy Harmonic Grammar has weighted, rather than ranked, constraints. Each violation of a constraint penalizes a candidate form by that constraint’s weight; weights are summed for each candidate and the candidate with the least penalized score wins. Variability is modeled by the addition of noise to each run of the grammar, which causes the weights to fluctuate slightly. Frequency effects, in turn, are modeled by scaling a faithfulness constraint’s weight by a constant that is representative of a word’s relative frequency. The more frequent a word, the smaller its scaling factor and the lower the weight of the faithfulness constraint that enforces retention of /t/ or /d/. With faithfulness constraints carrying very little penalty when words are frequent, unfaithful candidates — those without /t/ or /d/ — will be more likely

³Relevant to this is the fact that, to me, at least, a contraction before a gap (e.g. 1a) sounds much worse than a contraction after a long subject (e.g. 1b). I would not call contraction after a long subject ungrammatical, *per se*, but I **would** call pre-gap contraction ungrammatical. This is based only on my own intuition, but it would be interesting to determine whether others share it. That would support the hypothesis that there are different reasons for the lack of contraction in spontaneous speech in these two types of environments.

- (1) a. *There is a grass that you can use that is shade tolerant, but I don’t remember what it’s ___. (sw2393: sw.1068; no contraction in original)
- b. ?One of the things that I do like about New York’s the fact that people are forced to use subways and buses so much. (fe05690: fe_36378; no contraction in original)

to win. *t/d*-deletion is thus accurately modeled as occurring more often with more frequent words.

However, this approach seems to me to blur the lines between grammar and use, despite Coetzee and Kawahara's professed interest in doing otherwise. There seems to be no way to prevent non-grammatical constraints, like frequency effects, from conditioning **invariant** phenomena. Scaling factors work on constraint weights, and, under Harmonic Grammar, categorical constraints have weights just like variable constraints do. Variation only comes in when noise is applied at the running of the derivation. So, while I am sympathetic to Coetzee and Kawahara's interest in representing non-grammatical constraints differently from grammatical ones, I think the separation should be even more stark.

Instead, I propose a model of language that strictly separates derivation from use. Roughly, I envision this along similar lines as the model presented in Preston, 2004. Preston provides a number of variations on his model, the most basic of which is reprinted in Figure 7.1. A later model (his Figure 8.6) adds another box below the "sociocultural selection device" called "processing" which likewise points to the "grammar" box.

Based on the discussion in the preceding chapters of this thesis, there are three types of conditions such a model of variation needs to account for:

1. Linguistic: local effects of the type that can condition categorical phenomena
2. Sociostylistic: dynamic effects of style as well as stable demographic effects
3. Psycholinguistic: effects of memory, processing, frequency...

Figure 7.2 sketches a model that incorporates these three types of conditions. I exemplify the derivation with contraction of *is* after consonant-final non-pronoun subjects.

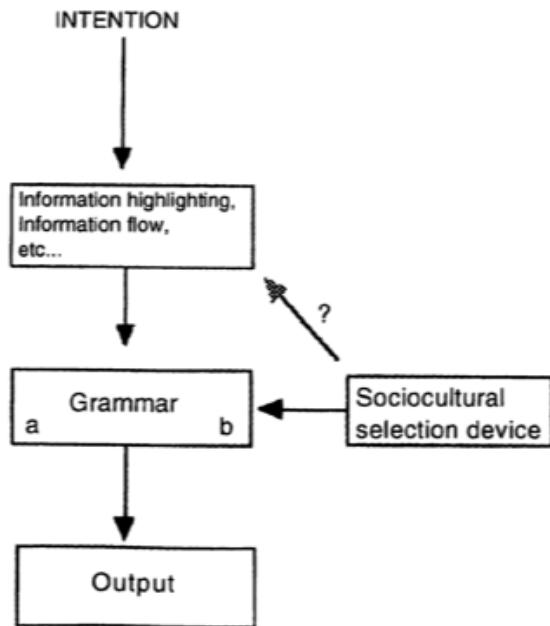


Figure 7.1: Model of variation from Preston, 2004 (his Figure 8.1).

The input to the grammar (schematized in the “Input” box in Figure 7.2) is an auxiliary (“Aux”) that is immediately adjacent (hence the “ \frown ”, notation from Embick, 2007) to some potential host (“X”; this is shorthand for the immediately preceding word, whatever its grammatical class may be) which, in this case, happens to end in a consonant. That input is run through the grammar (“Grammar” in Figure 7.2), which contains a variable morphosyntactic rule of host-auxiliary adjunction (following Kaisse’s 1983 treatment of contraction). The squiggly arrow in this rule is my way of representing variability; the rule takes an auxiliary that is adjacent to some item and variably adjoins it to that item (with adjunction represented by brackets). This variable rule has linguistic conditions on its application; here, I have simplified things by only representing the preceding segment effect on *is*-contraction, but other grammar-internal factors, such as following constituent

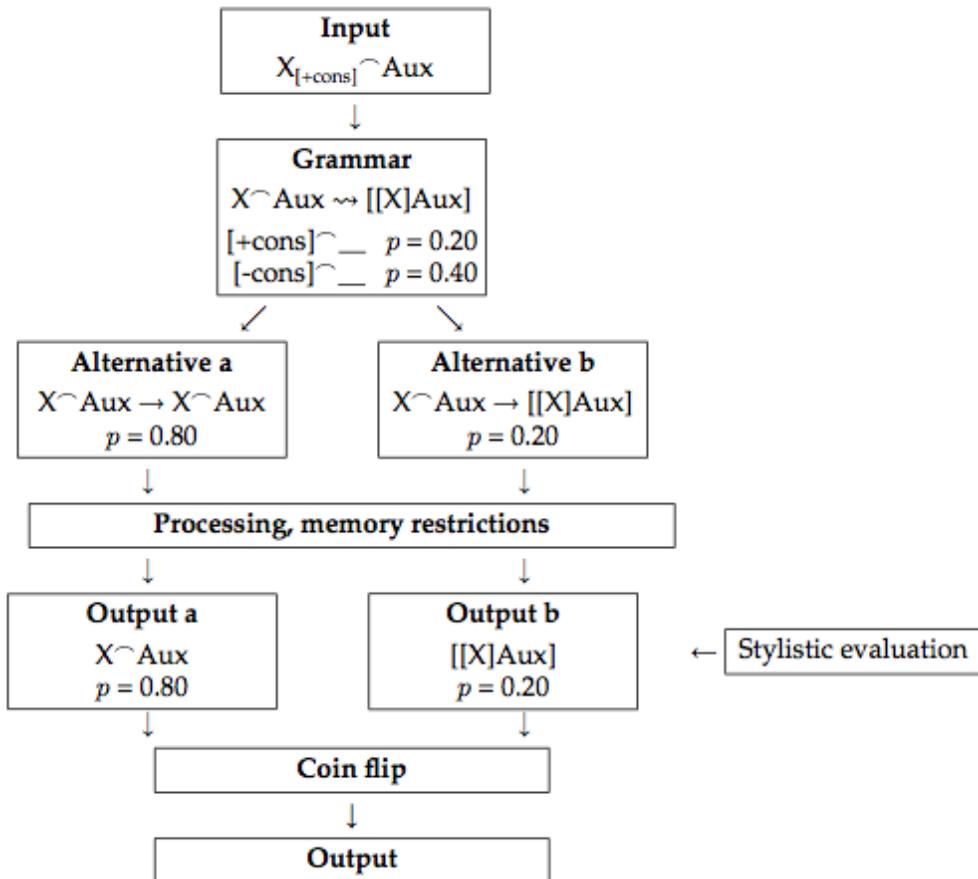


Figure 7.2: Model of variation incorporating linguistic, sociostylistic, and psycholinguistic factors. Model is exemplified with contraction of *is* after consonant-final non-pronoun subjects.

type (Section 4.6.2.2.1), would be represented here too. Each linguistic condition comes with a weight which represents the probability of contraction in that environment (which I've calculated for this example from the model given in Table 4.23). So, all other things being equal, the adjunction rule applies for *is* at $p = 0.20$ after consonant-final NPs, and at $p = 0.40$ after vowel-final NPs. This covers the treatment of linguistic conditions.

Since the derivation here is exemplified with post-consonantal *is*, the rate of application of variable adjunction will be 0.20; the rate of non-application, 0.80. These alternatives are presented in the “Alternative” boxes. They represent the two possible derivations of the input and their likelihood.

These alternatives are then derived, subject to psycholinguistic conditions. Where contraction is concerned, memory effects on production planning are the psycholinguistic conditions I have suggested are relevant. Specifically, in Section 5.4.3.2, I proposed that when an auxiliary’s subject is long, speakers will plan it separately from the auxiliary that follows. Host and auxiliary will thus not be active in short-term memory at the same time, and the necessary environment for contraction will fail to be generated. One way of effecting this in a model of language would be to have the system actually (attempt to) derive in parallel the two alternatives that are produced by the grammar: in this example case, adjunction (alternative b, $p = 0.20$) and non-adjunction (alternative a, $p = 0.80$). It is in the process of these derivations that psycholinguistic effects would come into play. Where an auxiliary’s subject consisted of only one word, both derivations could go through successfully. But the longer the subject, the more likely it would be that restrictions on short-term memory prevented it from being derived. The alternant with no adjunction would thus be selected by default.

In cases where both alternants are successfully derived, the grammar has two outputs under consideration, each weighted by those linguistic factors that are relevant. These are presented in the “Output” boxes. For those variables that show stylistic conditioning, their weights can be modulated up or down dynamically by the style. Variation also reflects a speaker’s demographic characteristics, as discussed in Section 6.4. This could be captured with probabilities that are by default higher for particular social groups, or by giving all members of a speech community the same probabilities, which are then modulated upward or downward based on a speaker’s demographics. What is essential is that these sociostylistic conditions be kept separate from internal conditions on variation, and that they apply only on output forms, as discussed in Section 6.4.⁴

Once the alternatives have passed through the various modules, there is essentially a coin flip with a weighted coin, the two weights being the probabilities of the two outputs. In the present example, given several identical runs of this derivation, we would get contraction 20% of the time and no contraction 80%. These values assume no additional influences of linguistic, psycholinguistic, or stylistic factors, of course; the presence of such effects would change the probabilities.

There are clearly many details to be worked out here; this is a very rough first approximation of how a model of intra-speaker linguistic variation would work. What is crucial is that the system is characterized by modularity. It has a grammar which comprises distinct linguistic levels (Section 7.2). And, that grammar is distinct from language use, thereby accounting for the independence of internal and external conditioning factors, and for the existence of conditions on variable alternations that are not found to affect categorical ones (Section 7.3).

⁴It is possible that stylistic and psycholinguistic constraints are part of a single module — a combined system of use. One argument in favor of keeping them separate is that stylistic constraints on variation are learned, while psycholinguistic constraints are presumably innate.

7.4. Avenues for future work

This thesis has raised a number of questions for future work, ranging from specifics of contraction to larger issues concerning the architecture of the grammar. I outline a few here.

7.4.1. The uniformity of /h/ Deletion

Section 3.3 laid out a model of auxiliary realization under which intermediate forms of some auxiliaries were generated when a phonetic process of /h/ Deletion applied to long allomorphs. Specifically, I proposed that this process of /h/ Deletion was what generated intermediate forms of post-pronoun *had* (e.g. *she* [əd]) and post-NP *has* (e.g. *John* [əz]).

If /h/ Deletion is indeed a phonetic process, we would expect it to apply at the same rate to all words that are subject to it. So, the rate of /h/ Deletion for post-pronoun *had* should be the same as that for post-NP *has*. And those rates should also match the /h/ Deletion rate for non-auxiliaries, such as *he*, which is also subject to /h/ Deletion in spontaneous speech.

Based on a preliminary study that I've carried out of /h/ Deletion in three environments, this does seem to hold. Specifically, I calculated the rate of /h/ Deletion for post-pronoun *had* and post-NP *has* in Switchboard by dividing the total number of intermediate forms of these auxiliaries by the total number of full + intermediate forms, under the assumption that full and intermediate forms of these auxiliaries share a source in the long allomorph, and the only thing differentiating them is the application of /h/ Deletion. I also examined the rate of /h/ Deletion in the pronoun *he*, which I found to undergo variable /h/ Deletion after conjunctions, *wh*-words, complementizer *that*, and *then*. For each item, I calculated a fitted

rate of /h/ Deletion using mixed-effects modeling with speaker and neighboring words as random effects.

Table 7.1 gives the fitted rate of /h/ Deletion and the number of tokens coded for each environment. The rates are very close; pooling the data and running a regression on /h/ absence with LEXICAL ITEM as a predictor finds no significant effect of the identity of the /h/-deleting word (*had*: $\beta = 0.2$, $p = 0.62$; *has*: $\beta = 0.16$, $p = 0.6$).

	he	had	has
/h/-deletion rate	0.33	0.38	0.36
N	273	284	252

Table 7.1: Rates of /h/-deletion for three words in Switchboard.

Though these findings should be confirmed with larger Ns, additional lexical items, and other corpora (particularly a corpus that does not contain telephone speech, to ensure that /h/s are being heard accurately), they are suggestive of two things. First of all, they lend support to the analysis of auxiliary realization put forth in Section 3.3, which relies on /h/ Deletion affecting auxiliaries in the same way. Second, they speak to work on the independence of morphology and phonetics and hence modularity of the grammar (e.g. Bermúdez-Otero, 2010), since /h/ Deletion shows no lexical specificity in its application.

7.4.2. Implications of the subject length effect on contraction

There is plenty of work that can be done both to probe the subject length effect on contraction and to examine its implications for other variable phenomena. As described in Chapter 5, our knowledge of the subject length effect can be refined by determining, for instance, whether contraction is blocked after long subjects

because they introduce a pause before the auxiliary; whether giving speakers a cognitive load results in a sharper drop-off in contraction with subjects of increasing length; whether a similar length effect is found on contraction in writing; and whether other variable phenomena show length effects that similarly cut off around 8 words. Though NP length effects have been documented for a number of other variables (see Section 5.2.1.1 for a review), connections have not always been drawn to constraints on planning, so exploring the nature of these other length effects could be informative of the source of the contraction effect.

If the contraction finding is best attributed to planning, considering other sociolinguistic variables in this light could be informative; see Wagner (to appear) for another potential example of production planning constraints on variation, this time on the variation between *-ing* and *-in'*. One fruitful next step could be a corpus study of the variation between *a* and *an* in spontaneous speech; use of one of these allomorphs in the “wrong” environment (e.g. *a* before a vowel-initial word) may indicate failure to plan the phonology of the following word.

7.4.3. A catalog of other “use” effects on variation

My argument for attributing the subject length effect on contraction to a system of use rather than the grammar comes from the fact that the mechanism underlying contraction would have to “count” the number of words in the subject, and this behavior is uncharacteristic of grammatical alternations. An important next step for future work, to help us refine our model of this system of use, will be to examine other variable phenomena that display conditioning of a sort that seems extra-grammatical in nature. What we would be looking for are variables where the conditioning appears to be operating on domains that are larger than what the grammar can normally see.

For instance, it has been demonstrated that some cases of variation are conditioned by the prosody of the string that results when a particular output form is chosen. Schlüter (2005) finds that, when a pair of synchronically alternating doublets differs in syllable count (e.g. *lit* ~ *lighted*), speakers' choice of alternant shows a tendency to preserve a strong-weak stress alternation. So, in attributive contexts, *lighted* tends to be used, which Schlüter attributes to the fact that English nouns generally bear initial stress (e.g. *lighted mátch* rather than the clash-inducing *lít mátch*). Another instance of the phonology of an output string conditioning variation is seen in the phenomenon known as "horror aequi," under which adjacent identical sequences are dispreferred (e.g. *to try to win, starting quitting smoking*; Ross, 1972; Rohdenburg, 2003). We also saw a small but significant effect by which *it has* contracts more when the following word is *been* than when it is some other past participle (Section 4.5.3); future work can investigate more thoroughly whether the prosodic shape of the word following an auxiliary has an effect on its contraction, along the lines of Schlüter's findings. The phonological shape of a multi-item output string, implicated in all these cases, is outside the locality domain of categorical allomorphic alternations (Embick, 2010), placing string prosody effects in the same category as the subject length effect on contraction: potentially extra-grammatical.

Another instance of conditions on variation operating outside a grammatically local domain comes from persistence (also known as priming) phenomena (Scherre, 2001; Szmrecsányi, 2006), where a variable is conditioned by its previous realization in the discourse. This is another likely candidate for a use-based, rather than grammar-based, localization of the variation; see Tamminga (2011) for such a treatment.

The upshot, all told, is that this thesis presents a new way of thinking about so-

ciolinguistic variation, as a phenomenon that is shaped by both an internal grammar and the use of that grammar's output in production and interaction. Recognizing this multi-faceted nature of variation gives us a convincing explanation for why certain variables pattern the way that they do, and opens up a number of new questions for future exploration.

Bibliography

- Adger, David. 2006. Combinatorial variability. *Journal of Linguistics* 42:503–530.
- Anderson, Stephen R. 1973. Remarks on the phonology of English inflection. *Language and Literature* 1:33–52.
- Anderson, Stephen R. 2008. English reduced auxiliaries really are simple clitics. *Lingue e Linguaggio* 7:169–186.
- Anttila, Arto. 2007. Variation and optionality. In *The Cambridge Handbook of Phonology*, ed. Paul de Lacy, 519–536. New York: Cambridge University Press.
- Anttila, Arto, and Young-mee Yu Cho. 1998. Variation and change in optimality theory. *Lingua* 104:31–56.
- Arnold, Jennifer E., Thomas A. Wasow, Anthony Losongco, and Ryan Ginstrom. 2000. Heaviness vs. newness: The effects of structural complexity and discourse status on constituent ordering. *Language* 76:28–55.
- Axelsson, Margareta Westergren. 1998. *Contraction in British Newspapers in the Late 20th Century*. Acta Universitatis Upsaliensis. Studia Anglistica Upsaliensia 102. Stockholm: Almqvist and Wiksell International.
- Baayen, R. H. 2008. *Analyzing Linguistic Data: A Practical Introduction to Statistics Using R*. New York: Cambridge University Press.
- Baker, C.L. 1971. Stress level and auxiliary behavior in English. *Linguistic Inquiry* 2:167–181.
- Baković, Eric. 2005. Antigemination, assimilation and the determination of identity. *Phonology* 22:279–315.
- Baugh, John. 1980. A re-examination of the Black English copula. In Labov (1980), 106–133.
- Bell, Allan. 1984. Language style as audience design. *Language in Society* 13:145–204.
- Bell, Allan, and Janet Holmes. 1992. H-droppin: Two sociolinguistic variables in New Zealand English. *Australian Journal of Linguistics* 12:223–248.
- Benor, Sarah Bunin, and Roger Levy. 2006. The chicken or the egg? A probabilistic analysis of English binomials. *Language* 82:233–278.
- Benus, Stefan, Iris Smorodinsky, and Adamantios Gafos. 2004. Gestural coordination and the distribution of English geminates. In *Penn Working Papers in Linguistics*, ed. Sudha Arunachalam and Tatjana Scheffler, 33–46.

- Bermúdez-Otero, Ricardo. 2010. Currently available data on English *t/d*-deletion fail to refute the classical modular feedforward architecture of phonology. Paper presented at Manchester Phonology Meeting 18, May 20, 2010.
- Blake, Renée. 1997. Defining the envelope of linguistic variation: The case of “don’t count” forms in the copula analysis of African American Vernacular English. *Language Variation and Change* 9:57–79.
- Bloomfield, Leonard. 1933. *Language*. Chicago: University of Chicago Press, 1984.
- Boland, Julie E., and Allison Blodgett. 2001. Understanding the constraints on syntactic generation: Lexical bias and discourse congruency effects on eye movements. *Journal of Memory and Language* 45:391–411.
- Borowsky, Toni. 1986. Topics in the Lexical Phonology of English. Doctoral Dissertation, University of Massachusetts Amherst.
- Borowsky, Toni. 1987. Antigemination in English phonology. *Linguistic Inquiry* 18:671–678.
- Braga, Maria Luiza. 1982. Left-dislocation and Topicalization in Capeverdean Creole. Doctoral Dissertation, University of Pennsylvania.
- Bresnan, Joan. 1978. Contraction and the transformational cycle in English. Indiana University Linguistics Club, Bloomington, Indiana.
- Bresnan, Joan, and Tatiana Nikitina. 2009. The gradience of the dative alternation. In *Reality Exploration and Discovery: Pattern Interaction in Language and Life*, ed. Linda Uyechi and Lian-Hee Wee, 161–184. Stanford, CA: CSLI Publications.
- Bybee, Joan. 2002. Word frequency and context of use in the lexical diffusion of phonetically conditioned sound change. *Language Variation and Change* 14:261–290.
- Bybee, Joan. 2006. From usage to grammar: The mind’s response to repetition. *Language* 82:711–733.
- Cedergren, Henrietta, and David Sankoff. 1974. Variable rules: Performance as a statistical reflection of competence. *Language* 50:333–355.
- Chafe, Wallace, and Jane Danielewicz. 1987. Properties of spoken and written language. In *Comprehending Oral and Written Language*, ed. Rosalind Horowitz and S. Jay Samuels, 83–113. New York: Academic Press.
- Cheshire, Jenny. 1987. Syntactic variation, the linguistic variable, and sociolinguistic theory. *Linguistics* 25:257–282.
- Cheshire, Jenny. 1999. Taming the vernacular: Some repercussions for the study of syntactic variation and spoken grammar. *Cuadernos de Filología Inglesa* 8:59–80.
- Chomsky, Noam, and Morris Halle. 1968. *The Sound Pattern of English*. Cambridge, MA: The MIT Press.
- Cieri, Christopher et al. 2004. *Fisher English Training Speech Parts 1 and 2*. Philadelphia: Linguistic Data Consortium.

- Close, Joanne. 2004. English Auxiliaries: A Syntactic Study of Contraction and Variation. Doctoral Dissertation, University of York.
- Coetzee, Andries, and Shigeto Kawahara. To appear. Frequency and other biases in phonological variation. To appear in *Natural Language & Linguistic Theory*. ROA #1098-0810.
- Coetzee, Andries, and Joe Pater. 2011. The place of variation in phonological theory. In *The Handbook of Phonological Theory, 2nd edition*, ed. John A. Goldsmith, Jason Riggle, and Alan C. L. Yu, 401–434. Malden, MA: Blackwell.
- Collins, Peter. 1991. *Cleft and Pseudo-cleft Constructions in English*. London: Routledge.
- Cowell, Thomas L. 1959. *Have got*, a pattern preserver. *American Speech* 34:280–286.
- Ellegård, Alvar. 1953. *The auxiliary do: The establishment and regulation of its use in English*. Gothenburg Studies in English. Stockholm: Almqvist and Wiksell.
- Embick, David. 2007. Linearization and local dislocation: Derivational mechanics and interactions. *Linguistic Analysis* 33:303–336.
- Embick, David. 2008. Variation and morphosyntactic theory: Competition fractionated. *Language and Linguistics Compass* 2:59–78.
- Embick, David. 2010. *Localism versus Globalism in Morphology and Phonology*. Cambridge, MA: The MIT Press.
- Fasold, Ralph W. 1991. The quiet demise of variable rules. *American Speech* 66:3–21.
- Ferreira, Fernanda. 1991. Effects of length and syntactic complexity on initiation times for prepared utterances. *Journal of Memory and Language* 30:210–233.
- Finegan, Edward, and Douglas Biber. 1986. Toward a unified model of sociolinguistic prestige. In *Diversity and Diachrony: Current Issues in Linguistic Theory* 53, ed. David Sankoff, 391–397. Philadelphia: John Benjamins Publishing Co.
- Fox, Barbara A., and Sandra A. Thompson. 2007. Relative clauses in English conversation: Relativizers, frequency, and the notion of construction. *Studies in Language* 31:293–326.
- Francis, Elaine J. 2010. Grammatical weight and relative clause extraposition in English. *Cognitive Linguistics* 21:35–74.
- Frank, Austin, and T. Florian Jaeger. 2008. Speaking rationally: Uniform information density as an optimal strategy for language production. In *The 30th Annual Meeting of the Cognitive Science Society (CogSci08)*, 939–944.
- Fromkin, Victoria A., ed. 2000. *Linguistics: An Introduction to Linguistic Theory*. Malden, MA: Blackwell.
- Fruehwald, Josef. 2009. Summer R study group report: What I couldn't have done otherwise. Paper presented at Splunch, University of Pennsylvania.
- Godfrey, John J., and Edward Holliman. 1997. *Switchboard-1 Release 2*. Philadelphia: Linguistic Data Consortium.

- Gorman, Kyle. 2009. Hierarchical regression modeling for language research. University of Pennsylvania Institute for Research in Cognitive Science Technical Report No. IRCS-09-02.
- Gorman, Kyle. 2010. The consequences of multicollinearity among socioeconomic predictors of negative concord in Philadelphia. *University of Pennsylvania Working Papers in Linguistics* 16:66–75.
- Guy, Gregory R. 1980. Variation in the group and the individual: The case of final stop deletion. In Labov (1980), 1–36.
- Guy, Gregory R. 1991. Explanation in variable phonology: An exponential model of morphological constraints. *Language Variation and Change* 3:1–22.
- Guy, Gregory R. 1997. Competence, performance, and the generative grammar of variation. In *Variation, Change, and Phonological Theory*, ed. Frans Hinskens, Roeland van Hout, and W. Leo Wetzel, 125–144. John Benjamins Publishing Co.
- Guy, Gregory R., and Charles Boberg. 1997. Inherent variability and the obligatory contour principle. *Language Variation and Change* 9:149–164.
- Halle, Morris, and Alec Marantz. 1993. Distributed morphology and the pieces of inflection. In *The View from Building 20*, ed. Kenneth Hale and Samuel J. Keyser, 111–176. Cambridge, MA: The MIT Press.
- Harnsberger, James D., and David B. Pisoni. 1999. Eliciting speech reduction in the laboratory II: Calibrating cognitive loads for individual talkers. Research on Spoken Language Processing Progress Report No. 23, Indiana University.
- Hay, Jennifer, and R. H. Baayen. 2005. Shifting paradigms: Gradient structure in morphology. *TRENDS in Cognitive Sciences* 9:342–348.
- Hindle, Donald Morris. 1979. The Social and Situational Conditioning of Phonetic Variation. Doctoral Dissertation, University of Pennsylvania.
- Hudson, Richard A. 1980. *Sociolinguistics*. New York: Cambridge University Press, first edition.
- Hudson, Richard A. 1996. *Sociolinguistics*. New York: Cambridge University Press, second edition.
- Inkelas, Sharon, and Draga Zec. 1993. Auxiliary reduction without empty categories: A prosodic account. In *Working Papers of the Cornell Phonetics Laboratory* 8, ed. Corinne Moore and Ann Bradlow, 205–253.
- Jespersen, Otto. 1928. *A Modern English Grammar on Historical Principles, Part I: Sounds and Spellings*. Heidelberg: Carl Winters Universitätsbuchhandlung.
- Jespersen, Otto. 1931. *A Modern English Grammar on Historical Principles, Part IV: Time and Tense*. Heidelberg: Carl Winters Universitätsbuchhandlung.
- Johnson, Daniel Ezra. 2009. Getting off the GoldVarb standard: Introducing Rbrul for mixed-effects variable rule analysis. *Language and Linguistics Compass* 3:359–383.

- Kaisse, Ellen M. 1979. Auxiliary reduction and the derivation of pseudoclefts. *Linguistic Inquiry* 10:707–710.
- Kaisse, Ellen M. 1983. The syntax of auxiliary reduction in English. *Language* 59:93–122.
- Kaisse, Ellen M. 1985. *Connected Speech: The Interaction of Syntax and Phonology*. New York: Academic Press.
- Karlsson, Fred. 2007. Constraints on multiple center-embedding of clauses. *Journal of Linguistics* 43:365–392.
- Kay, Paul, and Chad K. McDaniel. 1979. On the logic of variable rules. *Language in Society* 8:151–187.
- Kim, Young-Sun. 1999. English cliticization and intonational phrase. *Studies in Generative Grammar* 9:429–465.
- King, Harold V. 1970. On blocking the rules for contraction in English. *Linguistic Inquiry* 1:134–136.
- Kiparsky, P. 1972. Explanation in phonology. In *Goals of Linguistic Theory*, ed. Stanley Peters, 189–227. Englewood Cliffs, NJ: Prentice Hall.
- Kjellmer, Göran. 1997. On contraction in modern English. *Studia Neophilologica* 69:155–186.
- Kroch, Anthony. 1989. Reflexes of grammar in patterns of language change. *Language Variation and Change* 1:199–244.
- Krug, Manfred. 1998. String frequency: A cognitive motivating factor in coalescence, language processing, and linguistic change. *Journal of English Linguistics* 26:286–320.
- Kwon, Nayoung, Yoonhyoung Lee, Peter C. Gordon, Robert Kluender, and Maria Polinsky. 2010. Cognitive and linguistic factors affecting subject/object asymmetry: An eye-tracking study of pre-nominal relative clauses in Korean. *Language* 86:546–582.
- Kytö, Merja. 1993. Third-person present singular verb inflection in early British and American English. *Language Variation and Change* 5:113–139.
- Labov, William. 1969. Contraction, deletion, and inherent variability of the English copula. *Language* 45:715–762.
- Labov, William. 1972. *Language in the Inner City: Studies in the Black English Vernacular*. Philadelphia: University of Pennsylvania Press.
- Labov, William. 1973. Where do grammars stop? In *Report of the 23rd Annual Round Table Meeting on Linguistics and Language Studies*, ed. Roger W. Shuy, 43–88. Georgetown University Press.
- Labov, William, ed. 1980. *Locating Language in Time and Space*. New York: Academic Press.

- Labov, William. 1984. Field methods of the project on linguistic change and variation. In *Language in Use: Readings in Sociolinguistics*, ed. John Baugh and Joel Sherzer, 28–66. Prentice Hall.
- Labov, William. 1989. Exact description of the speech community: Short *a* in Philadelphia. In *Language Change and Variation*, ed. Ralph W. Fasold and Deborah Schiffrin, 1–57. Philadelphia: John Benjamins Publishing Co.
- Labov, William. 1994. *Principles of Linguistic Change: Internal Factors*. Malden, MA: Blackwell.
- Labov, William. 2001a. The anatomy of style-shifting. In *Style and Sociolinguistic Variation*, ed. Penelope Eckert and John R. Rickford, 85–108. New York: Cambridge University Press.
- Labov, William. 2001b. *Principles of Linguistic Change: Social Factors*. Malden, MA: Blackwell.
- Labov, William. 2006. *The Social Stratification of English in New York City*. New York: Cambridge University Press.
- Labov, William. 2010. *Principles of Linguistic Change: Cognitive and Cultural Factors*. Malden, MA: Blackwell.
- Labov, William, and Ingrid Rosenfelder. 2011. The Philadelphia Neighborhood Corpus.
- Lahiri, Aditi, and Frans Plank. 2010. Phonological phrasing in Germanic: The judgement of history, confirmed through experiment. *Transactions of the Philological Society* 108:370–398.
- Lakoff, George. 1970. Global rules. *Language* 46:627–639.
- Lavandera, Beatriz. 1978. Where does the sociolinguistic variable stop? *Language in Society* 7:171–182.
- Levett, William J. M. 1989. *Speaking: From Intention to Articulation*. Cambridge, MA: The MIT Press.
- Lim, Laureen T., and Gregory R. Guy. 2005. The limits of linguistic community: Speech styles and variable constraint effects. In *U. Penn Working Papers in Linguistics* 10.2: *Selected Papers from NWAVE 32*, ed. Maciej Baranowski and Uri Horesh, 157–170.
- MacKenzie, Laurel, and Constantine Lignos. 2012. Size matters: The effect of subject length on contraction. Paper presented at the 2012 Georgetown University Round Table on Languages and Linguistics.
- Marcus, Mitchell P., Mary Ann Marcinkiewicz, and Beatrice Santorini. 1993. Building a large annotated corpus of English: The Penn Treebank. *Computational Linguistics* 19:313–330.
- Massam, Diane. 1999. *Thing is* constructions: The thing is, is what's the right analysis? *English Language and Linguistics* 3:335–352.

- McElhinny, Bonnie S. 1993. Copula and auxiliary contraction in the speech of White Americans. *American Speech* 68:371–399.
- Mikkelsen, Line. 2004. Specificational subjects: A formal characterization and some consequences. *Acta Linguistica Hafniensia* 36:79–112.
- Miller, George A. 1956. The magical number seven, plus or minus two: Some limits on our capacity for processing information. *The Psychological Review* 63:81–97.
- Napoli, Donna Jo. 1982. Initial material deletion in English. *Glossa* 16:5–111.
- Newmeyer, Frederick J. 2003. Grammar is grammar and usage is usage. *Language* 79:682–707.
- Odden, David. 1993. Interaction between modules in lexical phonology. In *Phonetica and Phonology, vol. 4: Studies in Lexical Phonology*, ed. Sharon Hargus and Ellen M. Kaisse, 111–144. New York: Academic Press.
- Ogden, Richard. 1999. A declarative account of strong and weak auxiliaries in English. *Phonology* 16:55–92.
- Pak, Marjorie. 2008. The Postsyntactic Derivation and its Phonological Reflexes. Doctoral Dissertation, University of Pennsylvania.
- Paolillo, John C. 2011. Independence claims in linguistics. *Language Variation and Change* 23:257–274.
- Parrott, Jeffrey K. 2007. Distributed Morphological Mechanisms of Labovian Variation in Morphosyntax. Doctoral Dissertation, Georgetown University.
- Paster, Mary. 2006. Phonological Conditions on Affixation. Doctoral Dissertation, University of California, Berkeley.
- Pinker, Steven, and Alan Prince. 1988. On language and connectionism: Analysis of a parallel distributed processing model of language acquisition. *Cognition* 28:73–193.
- Preston, Dennis R. 2004. Three kinds of sociolinguistics: A psycholinguistic perspective. In *Sociolinguistic Variation: Critical Reflections*, ed. Carmen Fought, 140–158. Oxford University Press.
- Pullum, Geoffrey K. 1976. The Duke of York gambit. *Journal of Linguistics* 12:83–102.
- Pullum, Geoffrey K., and Arnold M. Zwicky. 1997. Licensing of prosodic features by syntactic rules: The key to auxiliary reduction. Paper presented at the 1997 annual meeting of the Linguistic Society of America.
- Rickford, John R., Arnetha Ball, Renée Blake, Raina Jackson, and Nomi Martin. 1991. Rappin on the copula coffin: Theoretical and methodological issues in the analysis of copula variation in African-American Vernacular English. *Language Variation and Change* 3:103–132.
- Rickford, John R., Thomas A. Wasow, Norma Mendoza-Denton, and Juli Espinoza. 1995. Syntactic variation and change in progress: Loss of the verbal coda in topic-restricting *as far as* constructions. *Language* 71:102–131.

- Roberts, Ian. 2000. Auxiliary reduction and negation reduction—a rough sketch. *Snippets* 1.
- Rohdenburg, Günter. 2003. Cognitive complexity and *horror aequi* as factors determining the use of interrogative clause linkers in English. In *Determinants of Grammatical Variation in English*, ed. Günter Rohdenburg and Britta Mondorf. New York: Mouton de Gruyter.
- Romaine, Suzanne. 1981. On the problem of syntactic variation: A reply to Beatriz Lavandera and William Labov. In *Working Papers in Sociolinguistics* 82. Austin: Southwest Educational Development Laboratory.
- Romaine, Suzanne. 1985. Variable rules, ok? Or can there be sociolinguistic grammars? *Language & Communication* 5:53–67.
- Rosenbach, Anette. 2005. Animacy versus weight as determinants of grammatical variation in English. *Language* 81:613–644.
- Ross, John Robert. 1972. Doubl-ing. *Linguistic Inquiry* 3:61–86.
- Rousseau, Pascale, and David Sankoff. 1978. A solution to the problem of grouping speakers. In *Linguistic Variation: Models and Methods*, ed. David Sankoff, 97–117. New York: Academic Press.
- Sadler, Louisa. 1997. English auxiliaries as tense inflections. In *Essex Research Reports in Linguistics* 24, 1–16.
- Sankoff, David, and William Labov. 1979. On the uses of variable rules. *Language in Society* 8:189–222.
- Sankoff, David, and Pierrette Thibault. 1981. Weak complementarity: Tense and aspect in Montreal French. *Syntactic Change: Natural Language Studies* 25:205–216.
- Sankoff, Gillian. 1973. Above and beyond phonology in variable rules. In *New Ways of Analyzing Variation in English*, ed. Charles-James N. Bailey and Roger W. Shuy, 44–62. Washington, D.C.: Georgetown University Press.
- Sankoff, Gillian. 1980a. A quantitative paradigm for the study of communicative competence. In Sankoff (1980b), chapter 3.
- Sankoff, Gillian. 1980b. *The Social Life of Language*. Philadelphia: University of Pennsylvania Press.
- Sankoff, Gillian, and Hélène Blondeau. 2007. Language change across the lifespan: /r/ in Montreal French. *Language* 83:560–588.
- Sankoff, Gillian, and Suzanne Laberge. 1980. On the acquisition of native speakers by a language. In Sankoff (1980b), chapter 10.
- Scherre, Maria Marta Pereira. 2001. Phrase-level parallelism effect on noun phrase number agreement. *Language Variation and Change* 13:91–107.
- Schlüter, Julia. 2005. *Rhythmic Grammar: The Influence of Rhythm on Grammatical Variation and Change in English*. Berlin: Mouton de Gruyter.

- Selkirk, Elisabeth O. 1984. *Phonology and Syntax: The Relation Between Sound and Structure*. Cambridge, MA: The MIT Press.
- Selkirk, Elisabeth O. 1986. On derived domains in sentence phonology. *Phonology Yearbook* 3:371–405.
- Selkirk, Elisabeth O. 1995. The prosodic structure of function words. In *Optimality Theory in Phonology: A Reader*, ed. John J. McCarthy, chapter 25, 464–482. Malden, MA: Blackwell.
- Sells, Peter. 1983. Juncture and the phonology of auxiliary reduction in English. In *University of Massachusetts Occasional Papers in Linguistics 8*, ed. Toni Borowsky and Daniel Finer, 76–105.
- Shih, Stephanie, and Jason Grafmiller. 2011. Weighing in on end weight. Paper presented at the 2011 annual meeting of the Linguistic Society of America.
- Smith, Jennifer. 2000. Synchrony and Diachrony in the Evolution of English: Evidence from Scotland. Doctoral Dissertation, University of York.
- Smorodinsky, Iris. 2002. Schwas With and Without Active Gestural Control. Doctoral Dissertation, Yale University.
- Spencer, Andrew. 1991. *Morphological Theory: An Introduction to Word Structure in Generative Grammar*. Cambridge, MA: Blackwell.
- Sprouse, Jon, Matt Wagers, and Colin Phillips. 2012. A test of the relation between working memory capacity and syntactic island effects. *Language* 88:82–123.
- Stallings, Lynne M., and Maryellen C. MacDonald. 2011. It's not just the "heavy NP": Relative phrase length modulates the production of Heavy-NP shift. *Journal of Psycholinguistic Research*.
- Steele, Susan M., Adrian Akmajian, Richard Demers, Eloise Jelinek, Chisato Kitagawa, Richard Oehrle, and Thomas A. Wasow. 1981. *An Encyclopedia of AUX: A Study in Cross-Linguistic Equivalence*. Cambridge, MA: MIT Press.
- Sternberg, Saul, Stephen Monsell, Ronald L. Knoll, and Charles E. Wright. 1978. The latency and duration of rapid movement sequences: Comparisons of speech and typewriting. In *Information Processing in Motor Control and Learning*, ed. George E. Stelmach, chapter 6, 117–152. New York: Academic Press.
- Szmrecsányi, Benedikt. 2004. On operationalizing syntactic complexity. In *Actes des 7es Journées internationales d'Analyse statistique des Données Textuelles*, 1031–1038.
- Szmrecsányi, Benedikt. 2006. *Morphosyntactic Persistence in Spoken English: A Corpus Study at the Intersection of Variationist Sociolinguistics, Psycholinguistics, and Discourse Analysis*, volume 177. Walter de Gruyter.
- Tagliamonte, Sali, and Jennifer Smith. 2002. "Either it isn't or it's not": Neg/aux contraction in British dialects. *English World-Wide* 23:251–281.
- Tamminga, Meredith. 2011. Stylistic microcovariation at the interface of language and use. Qualifying paper, University of Pennsylvania.

- Taylor, Ann, Mitchell Marcus, and Beatrice Santorini. 2003. The Penn Treebank: An overview. In *Treebanks: Building and Using Parsed Corpora*, ed. Anne Abeillé, 5–22. Norwell, MA: Kluwer Academic Publishers.
- Terrell, Tracy. 1977. Constraints on the aspiration and deletion of final /s/ in Cuban and Puerto Rican Spanish. *Bilingual Review/La Revista Bilingüe* 4:35–51.
- Trudgill, Peter. 1974. *The Social Differentiation of English in Norwich*. New York: Cambridge University Press.
- Wagner, Michael. 2010. Prosody and recursion in coordinate structures and beyond. *Natural Language & Linguistic Theory* 28:183–237.
- Wagner, Michael. To appear. Production planning constraints on allomorphy. In *Proceedings of the 2011 Annual Meeting of the Canadian Acoustical Association*.
- Walker, James A., and Marjory Meechan. 1999. The decreolization of Canadian English: Copula contraction and prosody. In *Actes du Congrès annuel de l'Association canadienne de linguistique 1998/Proceedings of the 1998 Annual Conference of the Canadian Linguistic Association*, ed. John Jensen and Gerard Van Herk, 431–441.
- Warner, Anthony R. 2005. Why DO dove: Evidence for register variation in Early Modern English negatives. *Language Variation and Change* 17:257–280.
- Wasow, Thomas A. 1997. Remarks on grammatical weight. *Language Variation and Change* 9:81–105.
- Weiner, E. Judith, and William Labov. 1983. Constraints on the agentless passive. *Journal of Linguistics* 19:29–58.
- Weinreich, Uriel, William Labov, and Marvin Herzog. 1968. *Empirical Foundations for a Theory of Language Change*. Austin: University of Texas Press.
- Wheeldon, Linda, and Aditi Lahiri. 1997. Prosodic units in speech production. *Journal of Memory and Language* 37:356–381.
- Wilder, Chris. 1997. English finite auxiliaries in syntax and phonology. In *Clitics, Pronouns and Movement*, ed. James R. Black and Virginia Motapanyane, 321–362. Philadelphia: John Benjamins Publishing Co.
- Winford, Donald. 1996. The problem of syntactic variation. In *Sociolinguistic Variation: Data, Theory, and Analysis: Selected Papers from NNAV 23 at Stanford*, ed. Jennifer Arnold, Renée Blake, Brad Davidson, Scott Schwenter, and Julie Solomon, 177–192. Stanford: CSLI Publications.
- Wolfram, Walter A. 1991. The linguistic variable: Fact and fantasy. *American Speech* 66:22–32.
- Wood, Winifred J. 1979. Auxiliary reduction in English: A unified account. In *Papers from the 15th Regional Meeting of the Chicago Linguistics Society*, ed. Paul R. Clyne, William F. Hanks, and Carol L. Hofbauer, 366–377.
- Yaeger-Dror, Malcah, Lauren Hall-Lew, and Sharon Deckert. 2002. It's not or isn't it? Using large corpora to determine the influences on contraction strategies. *Language Variation and Change* 14:79–118.

- Yang, Charles. 2009. Population structure and language change. Ms., University of Pennsylvania.
- Yip, Moira. 1988. The Obligatory Contour Principle and phonological rules: A loss of identity. *Linguistic Inquiry* 19:65–100.
- Zwickly, Arnold M. 1970. Auxiliary reduction in English. *Linguistic Inquiry* 1:323–336.
- Zwickly, Arnold M., and Geoffrey K. Pullum. 1983a. Cliticization vs. inflection: English *n't*. *Language* 59:502–513.
- Zwickly, Arnold M., and Geoffrey K. Pullum. 1983b. Deleting named morphemes. *Lingua* 59:155–175.