Phonetics
First Year
English Department
Faculty of Arts

Table of contents

Introducing the book and the curriculum

When I tell strangers that I teach linguistics, they often look at me with a rather blank stare and ask—*What exactly is linguistics, anyway*? Even though language is so important to us in most of what we do, few of us have studied it in any meaningful way. Linguistics, the scientific study of language, is the field that studies language in all of its aspects: social, cognitive, cultural, ecological. Linguists examine the following, among other, aspects of language:

- How language is put together and how it is used
- How human language differs from animal communication
- What all languages have in common and how they differ
- How different varieties of the same language vary and how that variation carries social meaning
- How language originated and how languages have spread and changed over time
- How language is a cognitive phenomenon (how it functions in the brain) and a social/ cultural one (how it functions in society).

These questions are standard ones addressed in the study of language. Here we will address not only those questions but also some additional ones, questions having to do with language and social justice, such as the following:

- How are linguistic structure and use connected to contemporary social issues?
- What are the real-world consequences resulting from common myths about language?
- How do attitudes toward grammatical correctness and linguistic variation contribute to social inequalities?
- How are gender, race, age, ethnicity, social status, power, privilege, and marginalization all integral to an understanding of language?
- How do beliefs about language serve to privilege some groups and disadvantage others?

- How is our language use related to how we treat the environment?

As you may guess from this list, linguistics is, in essence, interdisciplinary and related to many other fields. Linguistic insights are used in sociology, psychology, computer science, artificial intelligence, communication studies, history, paleontology, and criminology to name a few fields.

Insights from those fields help linguists understand language. Each of those disciplines is connected to one or more subfields of linguistics, of which there are many: psycholinguistics, historical linguistics, sociolinguistics, pragmatics, first language acquisition, second language acquisition, discourse analysis, phonology, syntax, morphology, semantics, conversational analysis, forensic linguistics, critical discourse analysis, ecolinguistics, and others. You'll learn more about most of these as you make your way through this book, so don't worry if you're not sure what they are now.

HOW WE'LL STUDY LANGUAGE

Since humans and their societies are so complex, one would expect the main tool of human communication to be similarly complex. And, indeed, language is amazingly complex, adaptable, variable, and productive. As we approach its study, we'll be doing various kinds of linguistic analysis, ranging from analyzing small details of pronunciation to examining less tangible concepts such as social identity and power. In each case, we'll be looking for patterns that can help us understand how language works. Each area of linguistics may require different types of analysis, but in each case, we'll be asking—how do we account for the linguistic phenomena we see around us?

I have titled this book *Everyday Linguistics* because I believe it is important to connect what you are learning to everyday life, both your own and that of others. The seemingly esoteric linguistic concepts presented here are related to what we do every day. They can help us understand not only everyday interactions but also the larger social contexts within which those interactions occur and the inequalities that are often part of those contexts. This book, then, asks you to notice language use around you—your friends, neighborhood, school, family, media—and to apply the linguistic concepts you learn to what you see.

My perspective here insists that the study of language needs to integrate what linguists often divide into subdivisions. That is, structural analysis should be connected to sociocultural analysis and the whole should be connected to social justice. Such connections can help us unmask social and linguistic prejudice and oppression. In our study here, we will connect our understanding of structure to attitudes and myths about language that support such prejudices. In doing so, we will explore the ethical dimension of linguistic study.

CHAPTER 1
Getting to know a language

Dialects, varieties, and languages

I've used the terms standard language, dialect, and variety several times already without defining them, so let me do so here. The **standard language** (or the **standard**) is the variety used in schools, the government, and the media, especially the print media. It may be the one spoken by most people in a country, but that is not always the case. It is what most people think of as the language, devoid of dialect features and with no discernable accent and what most people think of as correct and proper language. That perspective misrepresents what we know about language, as we will see later. We'll return to standards and how they develop in Chapter 13.

A **dialect** is defined as a variety of a language shared by a group of speakers that is distinguished from other varieties of that language by differences in vocabulary, pronunciation, grammar, and more intangible aspects like politeness.

Now many of us are used to thinking of dialects as something other people speak. For English speakers, we talk about British, Irish, American, and Australian English, among others. Each of these is itself made up of dialects. In the United States, we distinguish among the New York, Boston, Appalachian, and various Southern dialects. In the United Kingdom, they distinguish among many regional dialects. In England, we find West Country dialects, Midlands dialects, and Southern and Northern dialects. In Wales, there are various forms of Welsh English (not the same as Welsh itself); in Scotland, there is Scottish English, and in Northern Ireland, there is Ulster English. In other parts of the world, we find Singapore English and Nigerian English, to name a few. These and other varieties around the world can differ greatly, but they are all English.

So how can we distinguish a dialect from a language? From a purely linguistic perspective, we might say that trying to distinguish a language from a dialect is a waste of time. In fact, there are only dialects, some of which resemble one another enough to get clumped into a single language, if, and only if, the cultural and political conditions favor such clumping as well. English, like all languages, only exists as a constellation of various dialects such as those mentioned earlier.

We all speak a dialect, even if we speak what is considered the standard language. We don't usually think of Standard English as a dialect, but it is. It is merely one variety of English among many, as we will see.

Dialect is a term that for many people denotes something less than a real language, something spoken by uneducated or rural people. We know that's not true, but the term dialect is still used that way by the media and many others. For that reason, linguists often use the term **variety**. The two terms mean the same thing; the latter just comes with less baggage and fewer judgments. I'll use both here.

DESIGN FEATURES OF HUMANLANGUAGE

When we talk about language as a human phenomenon, we are acknowledging that there are some underlying similarities among them all. Linguists examined these similarities and have determined there are several characteristics that all languages and all varieties of all languages share, what are called **design features**. Linguists continue to debate how many design features there are, but most agree on the following.

Semanticity

Perhaps the most basic characteristic is **semanticity**: we use language to convey meaning. We manipulate sounds or signs, words, and the form and order of those words, according to a system of rules to create meaning. That is, we manipulate the three major components that comprise all languages: a system of sounds or gestures, a lexicon or vocabulary, and a grammatical system.

Arbitrariness

In all languages, the relationship between a word and the object or concept that word refers to is **arbitrary**. In other words, there is no inherent or logical relationship between words and their meanings. This lack of any inherent relationship is referred to as **arbitrariness**, a design feature shared by all languages.

For example, take the English word for the object upon which we put our dinner: *table*. As English speakers, we have an arbitrary set of sounds that make up the meaning of our word *table*. Spanish speakers use a different set of arbitrary sounds for the same object, *mesa*, and Italian speakers use still another arbitrary set of sounds, *tavolo*. And users of sign languages do not have a spoken word at all, but rather a sign that indicates what we mean by *table*. None of these words is any more inherently connected to the meaning of *table* or more able to embody the essence of tableness; they are all equally arbitrary.

Arbitrariness is sometimes contrasted with **onomatopoeia**, the characteristic of a word sounding like what it means. Words like *buzz*, *meow*, or *oink* are onomatopoetic. In some ways, these words are non-arbitrary as there is a relationship between sound and meaning. Even with sounds such as these, however, there is some arbitrariness present, for not all languages use the same linguistic sounds to indicate the same natural sounds. In English, for example, roosters crowing at the break of dawn say *cock-a-doodle-doo*. In Russian the same rooster would say *kikiririki*.

It's not just words that are arbitrary; other parts of language are as well, including grammar. For example, English speakers use articles to distinguish a specific or known object (*the book*) from an unknown object or general idea (*a book*). In many other languages, such as Russian, there are no articles at all, no equivalent to the word *the*. Our use of articles is an arbitrary convention; Russian has other arbitrary conventions. English speakers also generally place adjectives before nouns; Spanish speakers put them after nouns. Both systems are arbitrary.

As another example of the arbitrariness of grammar, let's look at plurals. How a language marks a word as plural, or even if it does so at all, is arbitrary. In English, we mark nouns by adding an {s} at the end to indicate they are plural. Some languages do not mark nouns at all to indicate plurality; the context or a number word indicates plurality without any other marking, the equivalent of *three book*. Some languages mark nouns as either singular or plural; some mark them as singular, dual, or plural. All are equally arbitrary and equally logical.

Linguistics in your world: But that's wrong, isn't it?

How about grammar rules? Aren't they based on logic and therefore non-arbitrary? Grammar, despite what you might have been told, is not based on logic. In fact, grammar rules are arbitrary too. Take double negatives. You've probably been told that double negatives are incorrect because they are illogical. Not so. In some languages, making an assertion negative requires at least two negative elements. To say *I never saw her* in French, for example, one needs both a *ne* and a *jamais* (both negativizers): *Je ne l'ai jamais vue*, literally *I did not see her never*. The French use of what we might call double negatives is not illogical; it's just the way they say it. The same goes for some varieties of English that use two negative elements. We will discuss double negatives in more detail later; for now, it is important to realize that both ways of making a sentence negative are arbitrary; neither is more logical.

What is grammar?

A useful question here might be, What is grammar? The term grammar has many meanings. We talk about good grammar and bad grammar; we've all probably sat through grammar lessons in school; we may have had our grammar corrected by teachers or even by friends. When we talk about correct or incorrect grammar, we're using the prescriptive perspective described in Chapter 1, a perspective that assumes there is one and only one correct way to sign, say, or write something.

You'll remember from Chapter 1 that linguistics uses not a prescriptive but a descriptive approach. As a result, a radically different definition of grammar prevails. In linguistics, **grammar** refers to a system of rules that governs how we put sounds together to form words, put words together to form phrases, and put phrases together to form sentences. Sign language users put together what are called primes rather than sounds to form words using their grammar to do so. It is our knowledge of this system, our grammatical competence mentioned in Chapter 1, that allows us to speak or sign. Linguistics as a field seeks to describe this system of rules and its phonological, morphological, and syntactic components.

Cultural transmission and innateness

The ability to learn a language is **innate** in humans; we're born with this ability. Which language we learn, however, depends on which language we are exposed to as children. Children learn what they hear or see around them; the design feature known as **cultural transmission**. Which language a child learns depends not on what language her ancestors spoke, but on what language she hears around her as she is acquiring language. If a child of Norwegian parents is raised hearing only Chinese, she will learn Chinese as her native language. Unless she is also exposed to it as a child, Norwegian will be just as hard for her to learn as it is for any other speaker of Chinese. We'll discuss how children learn language in more detail later.

Displacement

All languages allow their speakers to refer to the past and the future; to refer to people, things, or events that are not present; and to refer to things that do not exist. That is, all human languages have a design feature known as **displacement**. Languages display this characteristic whenever their speakers communicate about events from the past, predictions about the future, or imaginary objects. We are, in our language use, not confined to the here and now. We can talk about holodecks and intergalactic travel, about unicorns and sea serpents, or about what we had for breakfast yesterday and what we hope to have tomorrow.

Discreteness and duality

Discreteness refers to the quality of being composed of discrete units. When we learn a language, we learn to perceive it as made up of discrete units. Take language sounds, for example. When we think about the [o] sound and the [u] sound in English, we tend to think of them as discrete, separate sounds. And when we hear them, we generally hear either one or the other, not something in-between. If we looked at the acoustic realities of these sounds, however, we'd find that there is a continuum of sound from [o] to [u] and no one clear spot in which the [o] becomes the [u] or vice versa. Our minds, because we have learned that these are separate sounds in our language, do not hear the continuum but rather two separate discrete entities.

This concept is perhaps easier to grasp with words. Think about the phrase, *an orange*, for example. We would expect to hear it pronounced with a pause between *an* and *orange*. If we listen carefully, however, we notice that it sounds more like *a norange*. Because we know the words *an* and *orange* as discrete units in English, however, we hear *an orange*.

Related to the design feature of discreteness is the design feature **duality**. All languages are structured such that discrete smaller units can be combined into larger units, so for spoken languages, sounds combine to form words, words combine to form phrases, and phrases combine to form sentences. In sign languages, primes combine to form words, words combine to form phrases, and phrases combine to form sentences. Discrete words and phrases can be recombined in different ways to form different meanings.

Duality and discreteness form the basis for what linguists call grammar—that is, the ability mentioned earlier to combine discrete units into larger units to create meaning. The smallest of these units tends to be meaningless. Take the [t] sound, for example. By itself, it has no meaning. But if we combine it with another meaningless sound [o], we create an utterance with meaning, the word *toe*. It's actually quite an amazing feat all languages do: they take these small discrete meaningless units and, by combining them with other units, create meaning.

Productivity

Discreteness and duality are key to productivity as well. The design feature of **productivity** refers to the ability of speakers of any language to produce an infinite number of sentences and to produce novel sentences, sentences they have never uttered nor heard before, an ability enabled by the ability to combine the same discrete units in different ways to create different meanings. This ability allows for the creativity all language users are capable of. As an example of a novel sentence, take the following: *Get that silly pink hippo off my tutu at once*. Chances are you've never heard that sentence before. Yet you have no problem understanding it. In similar fashion, you can produce sentences you've never heard or produced before. There are, in fact, an infinite number of sentences or utterances possible in any language. Although the number of words is obviously limited (very large, but not limitless) and the number of rules for combining them is similarly limited, in theory the number of sentences or utterances we can produce is infinite.

DO ANIMALS HAVE LANGUAGE?

Productivity is, perhaps, the property that most clearly sets human language apart from animal communication, for no animal forms of communication allow their users to produce an infinite number of utterances. There are some forms of animal communication, however, that share some characteristics of human language. Bird song, for example, at least for some species, seems to be culturally transmitted, as human languages are. Some birds won't learn to sing at all if not exposed to the song of their species, while other birds will learn the song of whatever species they are exposed to, much like human infants will learn whatever language they are exposed to.

Although some animal modes of communication share certain characteristics with human language, none shares all of them, so they are not language as we have defined it. The European honeybee, for example, does an intricate tail-wagging dance to communicate to its mates the location of a good source of nectar. It can communicate direction, distance, and the richness of a source that is up to 7 miles away. It does so by wagging its tail in both a circular and a straight-line manner, using the angle of its line to indicate direction and the excitability of its wiggling to indicate the richness of the food source. Certainly, this is a complicated communication system that serves the honeybees well. It is not, however, human language.

If I say that non-human animals do not have language, I am not implying that they are somehow less than we are. Like humans, many other animal species have developed complex systems of communication that serve their purposes well. Those forms of communication are not part of our makeup, either genetic or social. They are not the forms of communication that have evolved as humans have evolved. We can study animal modes of communication and write learned treatises on them, but as for being able to wiggle our rear ends to indicate how far and in what direction the flowers with the best nectar lie, we as humans can probably never manage that. The various skills and types of intelligence needed in non-human animal worlds are different from those needed in our human world. As such, they have led to the development of their systems of communication, which are different from human language.

Many people, linguists included, have tried to teach human language to various non-human animals, usually chimpanzees. The results have been mixed, and linguists disagree about whether it is possible. One problem in the early attempts was that chimps' vocal apparatuses are not able to produce the kinds of sounds that humans use for language. The solution was to try to teach them a sign language, often American Sign Language (ASL). The most successful attempt seems to have been Washoe, a chimpanzee raised in the 1960s by Allen and Beatrix Gardner, who raised her like a human child as much as possible, using ASL to communicate with her. Washoe learned to use around 200 signs and seemed to understand many more. Even more telling, the Gardners claimed that she could produce new combinations of signs, ones not seen by her before, a key characteristic of language use.

A decade later, Herb Terrace tried to teach another chimp, Nim Chinsky, language signs but eventually concluded that the signs Nim produced were merely repetitions of signs used by his trainers and that Nim had not really acquired language. In the 1990s, Sue Savage-Rumbaugh and Dwayne Rumbaugh claimed some success with a bonobo chimpanzee named Kanzi that they had socialized much like a human child. They showed that he could understand a complex sentence such as *Get the ball which is outside.* That sentence required him to understand the relative clause (*which is outside*) and its relation to the ball, while ignoring the ball that was inside, which he did. The debate about whether chimps, or any non-humananimal, can acquire human language continues.

OTHER CHARACTERISTICS OF HUMAN LANGUAGE

In addition to the design features discussed thus far, there are a few other characteristics of language:

- Spoken, signed and written language are different modes of communication.
- All languages change over time.
- Children everywhere learn their first language in very similar ways.
- All languages are highly structured and rule governed.
- Variation is a natural part of all languages.

CHAPTER 2
Main branches of linguistics

1. Phonetics
Definition: The study of the physical sounds of human speech.
Focus: Articulation (how sounds are produced), acoustics (properties of sound waves), and auditory perception (how sounds are heard).
2. Phonology
Definition: The study of how sounds function within a particular language or languages.
Focus: Sound systems, patterns, and rules that govern the organization of sounds.
3. Morphology
Definition: The study of the structure and formation of words.
Focus: Morphemes (the smallest units of meaning) and how they combine to form words.
4. Syntax
Definition: The study of sentence structure and the rules that govern the arrangement of words.
Focus: How phrases and sentences are constructed, including grammar rules.
5. Semantics
Definition: The study of meaning in language.
Focus: How words, phrases, and sentences convey meaning, including the relationships between signifiers and what they stand for.
6. Pragmatics
Definition: The study of how context influences the interpretation of meaning.
Focus: Language use in social contexts, including the speaker's intention and the listener's interpretation.
7. Sociolinguistics
Definition: The study of how language varies and changes in social groups.
Focus: The relationship between language and social factors such as class, ethnicity, and gender.
8. Psycholinguistics

Definition: The study of how language is processed in the mind.
Focus: Language acquisition, comprehension, and production, including how children learn language.
9. Applied Linguistics
Definition: The application of linguistic theory to real-world problems.
Focus: Areas such as language teaching, translation, and language policy.
10. Historical Linguistics
Definition: The study of how languages change over time.
Focus: Language evolution, language families, and the reconstruction of ancient languages.
11. Computational Linguistics
Definition: The intersection of computer science and linguistics.
Focus: The development of algorithms and models for processing and understanding human language using computers.
12. Discourse Analysis
Definition: The study of language use beyond the sentence level.
Focus: How larger units of language (conversations, written texts) function and convey meaning in context.
13. Neurolinguistics
Definition: The study of the relationship between language and the brain.
Focus: How language is processed neurologically, including language disorders and brain regions involved in language function.
14. Stylistics
Definition: The study of style in language.
Focus: How linguistic choices affect meaning and aesthetic quality in literature and other forms of communication.
15. Forensic Linguistics
Definition: The application of linguistic knowledge to legal matters.
Focus: Analyzing language in legal contexts, such as author identification and interpretation of legal texts.
16. Language Documentation
Definition: The process of recording and preserving languages, especially those that are endangered.
Focus: Collecting data on language structure, usage, and cultural context.
17. Language Acquisition

Definition: The study of how individuals learn language.

Focus: The processes through which children and adults acquire their first and subsequent languages.

18. Typology

Definition: The study of the systematic classification of languages based on their structural features.

Focus: Identifying and comparing languages according to their grammatical and phonological characteristics.

19. Lexicography

Definition: The art and science of dictionary-making.

Focus: Compilation, editing, and publishing of dictionaries, including definitions and usage of words.

20. Language Policy and Planning

Definition: The study of how governments and institutions manage language use in society.

Focus: Language rights, education policies, and the promotion or suppression of languages.

Test Yourself

1 What is linguistics, and why is it important in everyday life?

2. How do linguists define the relationship between language and social justice?

3. What are some common myths about language, and what are their real-world consequences?

4. How do attitudes toward grammatical correctness contribute to social inequalities?

5. What distinguishes a dialect from a language?

6. How does the standard language differ from non-standard dialects?

7. What are some examples of English dialects mentioned in the document?

8. What are the design features of human language according to linguists?

9. How does arbitrariness manifest in language?

General Linguistics

1. What is linguistics?
   - A) The study of mathematics
   - B) The scientific study of language
   - C) The study of animals
   - D) The study of history

2. Which aspect of language does sociolinguistics focus on?
   - A) Grammar rules
   - B) Language variation in social groups
   - C) Phonetic sounds
   - D) Language acquisition

3. What does the term "standard language" refer to?
   - A) A dialect spoken by few people
   - B) The variety used in formal settings
   - C) A completely new language
   - D) Any informal language

4. How do linguists view dialects?
   - A) As inferior forms of language

- B) As distinct varieties of a language
- C) As non-existent
- D) As only rural speech

5. What is the primary focus of pragmatics?
   - A) Sentence structure
   - B) Sound production
   - C) Contextual meaning
   - D) Vocabulary development

Language Structure

6. Which of the following is a design feature of language?
   - A) Semanticity
   - B) Consistency
   - C) Simplicity
   - D) Irregularity

7. What does the term "arbitrariness" in language mean?
   - A) Words have a fixed meaning
   - B) There's a logical connection between words and meanings
   - C) The relationship between words and their meanings is random
   - D) Words change meaning frequently

8. Which component is NOT part of the linguistic system?
   - A) Sounds
   - B) Vocabulary
   - C) Emotions
   - D) Grammar

9. What does "displacement" allow speakers to do?
   - A) Refer only to present events
   - B) Communicate about past and future events
   - C) Use only concrete language
   - D) Limit their conversation to immediate surroundings

10. What is an example of a phonetic study?
   - A) Analyzing sentence structure
   - B) Examining sound waves
   - C) Studying word meanings
   - D) Investigating social context

Language Learning and Acquisition
11. What is cultural transmission in language?
   - A) Learning language solely from books
   - B) Learning language through exposure in a community
   - C) The ability to learn any language instantly
   - D) A method of teaching through repetition

12. At what stage do children typically learn their first language?
   - A) Adulthood
   - B) Infancy
   - C) Middle school
   - D) Preschool

13. Which of the following is true about grammar?
   - A) It is always logical
   - B) It varies across languages
   - C) It has no rules
   - D) It is the same in every language

14. What does "grammar competence" refer to?
   - A) Knowledge of slang
   - B) Ability to speak multiple languages
   - C) Understanding of the rules of a language
   - D) Skill in writing poetry

15. How does language acquisition differ in children?
   - A) It is based on genetic factors
   - B) It is influenced by the language they hear
   - C) It is uniform across all cultures

- D) It requires formal education

Linguistic Analysis

16. What is the focus of discourse analysis?
   - A) Individual words
   - B) Sentences only
   - C) Larger units of language
   - D) Grammar rules

17. What does the term "sociophonetics" study?
   - A) Sound systems in isolation
   - B) Social factors affecting pronunciation
   - C) Historical language changes
   - D) Vocabulary development

18. In which branch of linguistics would you study language disorders?
   - A) Psycholinguistics
   - B) Phonology
   - C) Morphology
   - D) Syntax

19. Which is NOT a subfield of linguistics?
   - A) Historical linguistics
   - B) Neurolinguistics
   - C) Geographical linguistics
   - D) Lexicography

20. What is typology in linguistics?
   - A) The study of language evolution
   - B) The classification of languages based on structure
   - C) The analysis of language in the brain
   - D) The teaching of language

Language and Society

21. How do linguistic varieties carry social meaning?

- A) They are all equally valued
- B) They reflect social identities and statuses
- C) They are irrelevant to social issues
- D) They only vary by region

22. What role does language play in social justice?
- A) It has no role
- B) It can perpetuate inequalities
- C) It is always equitable
- D) It only affects legal matters

23. How can attitudes toward language contribute to social inequality?
- A) By promoting uniformity
- B) By valuing certain dialects over others
- C) By encouraging diversity
- D) By eliminating language differences

24. What is the relationship between language and power?
- A) Language has no connection to power
- B) Language can reinforce power dynamics
- C) Power is only related to formal education
- D) Language is always neutral

25. How does media influence perceptions of language?
- A) It has no influence
- B) It can reinforce stereotypes
- C) It encourages linguistic diversity
- D) It only promotes standard language

Historical and Evolutionary Linguistics
26. What does historical linguistics study?
- A) The evolution of language over time
- B) The sounds of language
- C) The grammar of modern languages
- D) Language teaching methods

27. What is an example of language change?
   - A) New words being created
   - B) Language remaining the same
   - C) Only written language evolving
   - D) Dialects disappearing

28. How do languages spread?
   - A) Through isolation
   - B) Through cultural contact and migration
   - C) By avoiding contact with others
   - D) By being imposed by authority

29. What is the significance of language families?
   - A) They show unrelated languages
   - B) They group languages with common origins
   - C) They have no relevance to linguistics
   - D) They only focus on dialects

30. Which factor does NOT contribute to language evolution?
   - A) Social changes
   - B) Cultural contact
   - C) Scientific advancements
   - D) Isolation from other cultures

Computational Linguistics

31. What does computational linguistics involve?
   - A) The study of spoken language only
   - B) The use of algorithms to process language
   - C) The analysis of written texts
   - D) Studying historical documents

32. How can artificial intelligence relate to linguistics?
   - A) It has no relation
   - B) AI can help model language processing

- C) AI only focuses on numbers
- D) AI ignores language complexities

33. What is a key application of computational linguistics?
- A) Learning to speak a language
- B) Creating dictionaries
- C) Developing language translation software
- D) Conducting language interviews

34. What type of analysis is NOT typically found in computational linguistics?
- A) Phonetic analysis
- B) Statistical analysis
- C) Emotional analysis
- D) Syntax analysis

35. How does computational linguistics help in language acquisition?
- A) It replaces human teachers
- B) It creates interactive learning tools
- C) It complicates the process
- D) It is irrelevant to language learning

Miscellaneous Linguistics
36. What is the primary goal of applied linguistics?
- A) To study language in isolation
- B) To apply linguistic theory to real-world issues
- C) To develop new languages
- D) To focus solely on grammar

37. What is the purpose of lexicography?
- A) To study sentence structure
- B) To compile dictionaries
- C) To analyze spoken language
- D) To teach language

38. How do linguists define "style" in language?
- A) As a set of grammar rules
- B) As a way to convey meaning and aesthetics
- C) As irrelevant to communication
- D) As limited to literature

39. What does "forensic linguistics" involve?
- A) Studying historical texts
- B) Analyzing language in legal contexts
- C) Teaching language to children
- D) Creating new languages

40. Which of the following is a characteristic of all languages?
- A) They remain static over time
- B) They are all written
- C) They change and evolve
- D) They are all spoken

Advanced Topics in Linguistics
41. What is the focus of critical discourse analysis?
- A) Understanding grammatical rules
- B) Examining language in relation to power and ideology
- C) Studying phonetic sounds
- D) Exploring vocabulary development

42. What is the role of neurolinguistics?
- A) To study the sounds of speech
- B) To examine language processing in the brain
- C) To analyze written texts
- D) To study language change

43. How do dialects reflect cultural identity?
- A) They do not reflect identity
- B) They show social status and group affiliation
- C) They are always considered inferior

- D) They erase cultural differences

44. What is the significance of ecolinguistics?
   - A) It studies animal sounds
   - B) It examines the relationship between language and the environment
   - C) It is unrelated to linguistics
   - D) It focuses only on written language

45. How does language influence our perception of reality?
   - A) It has no influence
   - B) It shapes our thoughts and interactions
   - C) It limits our understanding
   - D) It promotes uniformity

Language and Communication
46. What distinguishes human language from animal communication?
   - A) Complexity and creativity
   - B) Simplicity
   - C) Lack of rules
   - D) Non-verbal elements

47. How do humans use language to express abstract concepts?
   - A) They cannot express abstract ideas
   - B) Through symbols and grammar
   - C) Only through gestures
   - D) By limiting vocabulary

48. What does "conversational analysis" focus on?
   - A) The structure of sentences
   - B) The patterns in spoken conversation
   - C) The history of languages
   - D) The grammar of different languages

49. What is a primary focus of stylistics?
   - A) Syntax only

- B) The aesthetic quality of language
- C) Phonetic sounds
- D) Language acquisition

50. How can language documentation help preserve languages?
- A) By ignoring dialects
- B) By recording and analyzing endangered languages
- C) By promoting standard language only
- D) By eliminating variations

Language Myths and Misconceptions

51. What is a common myth about language?
- A) All languages are equally complex
- B) Some languages are superior to others
- C) Language is static
- D) Dialects are not real languages

52. How can attitudes towards language impact society?
- A) They promote understanding
- B) They can reinforce stereotypes and biases
- C) They have no impact
- D) They encourage linguistic diversity

53. What is the misconception about double negatives?
- A) They are always correct
- B) They are illogical in all languages
- C) They are accepted in some languages
- D) They enhance clarity

54. How do prescriptive rules differ from descriptive rules in linguistics?
- A) Prescriptive rules describe how language is used
- B) Descriptive rules enforce correctness
- C) Prescriptive rules dictate how language should be used
- D) Both terms mean the same

55. What is the impact of media on language perception?
- A) It has no effect
- B) It can create and reinforce language stereotypes
- C) It promotes linguistic equality
- D) It only promotes standard language

Language in Context
56. How does context influence language use?
- A) It has no influence
- B) It shapes meaning and interpretation
- C) It only affects written language
- D) It limits language options

57. What role does social status play in language?
- A) It has no relevance
- B) It influences language use and variation
- C) It promotes uniformity
- D) It only applies to formal settings

58. How does gender impact language use?
- A) It has no impact
- B) It influences communication styles and choices
- C) It only affects writing
- D) It promotes linguistic equality

59. How do linguistic attitudes shape language policy?
- A) They have no effect
- B) They can lead to discrimination against certain languages
- C) They promote all languages equally
- D) They only concern formal education

60. What is the significance of studying language and the environment?
- A) It is irrelevant
- B) It explores the impact of language on ecological issues
- C) It focuses only on written texts

- D) It limits language use

Final Topics in Linguistics

61. What is the focus of language documentation?
   - A) To create new languages
   - B) To record and preserve endangered languages
   - C) To promote standard languages
   - D) To analyze historical texts

62. How does language policy affect education?
   - A) It has no effect
   - B) It can determine which languages are taught in schools
   - C) It promotes all languages equally
   - D) It only applies to formal settings

63. What is the role of language in shaping identity?
   - A) It has no role
   - B) It reflects cultural and social identities
   - C) It limits personal expression
   - D) It promotes uniformity

64. How does multilingualism impact society?
   - A) It creates confusion
   - B) It enriches cultural diversity
   - C) It is irrelevant
   - D) It limits communication

65. What is a potential consequence of language discrimination?
   - A) Increased understanding
   - B) Social inequality
   - C) Enhanced communication
   - D) Language preservation

Advanced Concepts in Linguistics

66. What is the primary concern of critical discourse analysis?

- A) Analyzing grammar
- B) Exploring language in contexts of power
- C) Studying phonetics
- D) Examining vocabulary

67. How do linguists view the relationship between language and thought?
   - A) They are unrelated
   - B) Language shapes thought processes
   - C) Thought is always logical
   - D) Language limits thought

68. What is the significance of studying language variation?
   - A) It has no significance
   - B) It reveals social dynamics and cultural identities
   - C) It promotes uniformity
   - D) It focuses solely on grammar

69. How can language influence social change?
   - A) It has no influence
   - B) It can challenge existing power structures
   - C) It promotes conformity
   - D) It only affects personal interactions

70. What is the focus of stylistics in linguistics?
   - A) Analyzing grammar
   - B) Examining language aesthetics and choices
   - C) Studying vocabulary
   - D) Investigating phonetics

Language Use and Society
71. How does language use reflect social status?
   - A) It has no connection
   - B) Different social groups use language differently
   - C) All people use the same language
   - D) Language is always neutral

72. What is the role of language in cultural identity?
   - A) It is irrelevant
   - B) It helps express and shape cultural values
   - C) It limits cultural expression
   - D) It promotes uniformity

73. How do language attitudes affect communication?
   - A) They have no effect
   - B) They can create misunderstandings
   - C) They promote clarity
   - D) They limit language options

74. What is the impact of globalization on languages?
   - A) It has no impact
   - B) It can lead to language loss and homogenization
   - C) It promotes linguistic diversity
   - D) It only affects written languages

75. How does language shape our understanding of the world?
   - A) It has no role
   - B) It influences perceptions and interpretations
   - C) It limits understanding
   - D) It promotes uniformity

Final Questions
76. What is one characteristic that distinguishes human language from animal communication?
   - A) Use of sounds
   - B) Creativity and productivity
   - C) Simplicity
   - D) Lack of rules

77. How can language be both a tool for empowerment and oppression?
   - A) It is only a tool for empowerment

- B) It can reinforce social hierarchies
- C) It has no effect on power dynamics
- D) It promotes equality

78. What is the significance of studying language in relation to social justice?
- A) It has no significance
- B) It highlights inequalities and promotes understanding
- C) It focuses solely on grammar
- D) It is irrelevant to society

79. How does language reflect cultural values?
- A) It does not reflect values
- B) It embodies and expresses cultural beliefs
- C) It limits cultural expression
- D) It promotes uniformity

80. What does the study of phonetics focus on?
- A) Sentence structure
- B) The sounds of human speech
- C) Vocabulary development
- D) Language acquisition

81. What is the main concern of language policy?
- A) To promote one language only
- B) To manage language use in society
- C) To eliminate dialects
- D) To focus on written language

Chapter 3
The Lowdown on theScience of Speech **Sounds**

In This Chapter

- Spelling out what phonetics and phonology are
- Understanding how speech sounds are made
- Recognizing speech anatomy, up close and personal

Phonetics is centrally concerned with speech, a uniquely human behavior. Animals may bark, squeak, or meow to communicate. Parrots and mynah birds can imitate speech and even follow limited sets of human commands. However, only people naturally use speech to communicate. As the philosopher Bertrand Russell put it,"No matter how eloquently a dog may bark, he cannot tellyou that his parents were poor, but honest."

In this chapter, I introduce you to the basic way in which speech is produced. I explain the source-filter theory of speech production and the key parts of your anatomy responsible for carrying it out. I begin picking up key features that phoneticians use to describe speech sounds, such as voicing, place of articulation, and manner of articulation.

Phoneticians *transcribe* (write down) speech sounds of any language in the world using special symbols thatare part of the International Phonetic Alphabet (IPA).

Throughout this book, I walk you through more and more of these IPA symbols, until transcription becomes a cinch. For now, I am careful to indicate spelled words in quotes (such as "bee") and their IPA symbols in slash marks, meaning broad transcription,such as /bi/. (Refer to Chapter 3 for in-depth information on the IPA.)

Defining Phonetics andPhonology

Phonetics is the scientific study of the sounds of language. You may recognize the root *phon-* meaning sound (as in "telephone"). However, phonetics doesn't refer to just anysort of sound (such as a door slamming). Rather, it deals specifically with the sounds of spoken human language.

As such, it's part of the larger field of linguistics, the scientific study of language. (Check out *Linguistics For Dummies* by Rose-Marie Dechaine PhD, Strang Burton PhD, and Eric Vatikiotis-Bateson PhD [John Wiley & Sons, Inc.] for more information.)

Phonetics is closely related to *phonology*, the study of the sound systems and rules in language. The difference between phonetics and phonology can seem a bit tricky at first, but it's actually pretty straightforward. Phonetics deals with the sounds themselves. The more complicated part is the rules and systems (phonology). All languages have sound rules. They're not explicit (such as "Keep off the grass!"), but instead they're implicit or effortlessly understood.

To get a basic idea of phonological rules, try a simple exercise.

Fill in the opposite of these three English words. (I did the first one for you.) tolerant *in*tolerant

consistent ____________

possible_______________

You probably answered "*in*consistent" and "*im*possible," right? Here's the issue. The prefix "in" means "not" (or opposite) in English, so why does the "in" change to "im" for "*im*possible?" It does so because of a sound rule. In this case, the phonological rule is known as *assimilation* (one sound becoming more like another). In this example, a key consonant changes from one made with the tongue (the "n" sound) to one made at the lips (the "m" sound) in order to match the "p" sound of "possible," also produced at the lips. The effect of this phonological rule is to make speech easier to produce. To get a feel for this, try to say "*in*-possible" three times rapidly in succession. Now, try "*im*possible." You can see that saying "impossible" is easier.

Phoneticians specialize in describing and understanding speech sounds. A phonetician typically has a good ear for hearing languages and accents, is skilled in the use of computer programs for speech analysis, can analyze speech movement or physiology, and can transcribe usingthe IPA. Because phonetics and phonology are closely allied disciplines, a phonetician typically knows some phonology, and a phonologist is grounded in phonetics, even though their main objects of study are somewhat different. Phonetics can tell people about what language sounds are, how language sounds are produced, and how to transcribe these sounds for many purposes.

Phonetics is important for a wide variety of fields, including computer speech and language processing, speech and language pathology, language instruction, acting, voice-over coaching, dialectology, and forensics.

A big part of a person's identity is how you sound when you speak — phonetics lets you understand this in a wholenew way. And it's true what the experts say: Phonetics is definitely helpful for anyone learning a new language.

Sourcing and Filtering: How People Make Speech

Scientists have long wondered exactly how speech is produced. Our current best explanation is called the

source-filter theory, also known as the *acoustic theory of speech production*. The source-filter theory best explains how speech works.

The idea behind this theory is that speech begins with a breathy exhalation from the lungs, causing raw sound to be generated in the throat. This sound- generating activity is the *source*. The source may consist of buzzing of the *vocal folds* (also known as the*vocal cords*), which sounds like an ordinary voice. The source may also include hissing noise, which sounds like a whisper. The movement of the lips, tongue, and jaw (for oral sounds) and the use of the nose (for nasal sounds) shapes this raw sound and is the part of the system known as the *filter*.

The raw sound is filtered into something recognizable. A filter is anything that can selectively permit some things to pass through and block other things (kind of like what your coffee filter does). In this case, the filter allows some frequencies of sound to pass through, while blocking others.

After raw sound is created by a buzzing larynx and/or hissing noise, the sound is filtered by passing through differently shaped airway channels formed by the movement of the speech *articulators* (tongue, lips, jaw, and velum). This sound-shaping process results in fully formed speech (see Figure 2-1 for what this looks like).

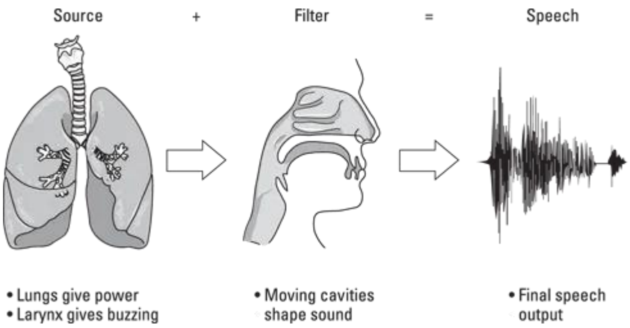


Illustration by Wiley, Composition Services Graphics

Figure 2-1: The source-filter theory of speech production in action.

Let me give you an analogy to help you understand. The first part of the speaking process is like the mouthpiece of a wind instrument, converting air pressure into sound. The filter is the main part of a wind instrument; no one simply plays a mouthpiece. Some kind of instrument body (such as a saxophone or flute) must form the musical sound. Similarly, you start talking with a vibrating source (your vocal folds). You then shape the sound with the instrument of your moving articulators, as the filter.

Here are a few other important points to rememberwith the source-filter theory:

- The source and filter are largely independent of each other. A talker can have problems with one part of thesystem, while the other part remains intact.
- The voicing source can be affected by laryngitis (as in a common cold), more serious disease (such as cancers), injuries, or paralysis.
- An alternative voicing source, such as an external artificial larynx, can provide voicing if the vocal folds areno longer able to function.
- The sources and filters of men and women differ. Overall, men have lower voices (different source characteristics) and different filter shapes (created by the mouth and throat passageways) than women.

Thankfully, people never have to really think about making these shapes. If so, imagine how people would ever be able to talk. Nevertheless, this theory explains howhumans do talk. It’s quite different than, say, rubbing a raspy limb across your body (like the katydid) or drumming your feet on the ground (like the prairie vole cricket) to communicate.

Gunnar Fant and the source-filtertheory

The source-filter theory of speech production was the brainchild of Gunnar Fant (1919–2009), a pioneering Swedish professor of speech communication. After earning a master's degree in engineering at Stockholm at the end of World War II, Fant began to apply this knowledge to analyze and synthesize speech sounds. His doctoral dissertation, the *Acoustic Theory of Speech*

Production, soon became an international standard. Fant's research led to the development of whole new technologies, including computer speech synthesis, and helped make phonetics more available to a variety of professions. At age 81, while still working actively on phonetics research, Fant wrote in "Half a Century in Phonetics and Speech Research,":

> "Mankind is making much progress in mapping the genetic code. We need some of the same patience and persistence in mapping the speech code."

Getting Acquainted with Your Speaking System

Although most people speak all their lives without really thinking about how they do it, phonetics begins with a close analysis of the speaking system. This part of phonetics, called *articulatory phonetics,* deals with the movement and physiology of speech. However, don't fear — you don't need to be a master phonetician to get this part of the field. In fact, the best way is to pay close attention to your own tongue, lips, jaw, and velum when you speak. As you get better acquainted with your speaking system, the basics of articulatory phonetics should become clear.

Figure 2-2 shows the broad divisions of the speaking system. Researchers divide the system into three levels, separated at the larynx. The lungs, responsible for the breathy source, are below the larynx. The next division is the larynx itself. Buzzing at this part of the body causes voiced sounds, such as in the vowel "ah"' of "h*o*t" (written in IPA characters as /ɑ/) or the sound /z/ of "*z*ip." Finally, the parts of the body that shape sound (the tongue, lips, jaw, and velum) are located above the larynx and are therefore called *supralaryngeal.*

In the following sections, I delve deeper into the different parts of the speech production system and what those parts do to help in the creation of sound. I also walk you through some exercises so you can see by doing — feeling the motion of the lungs, vocal folds, tongue, lips, jaw, and velum, through speech examples.

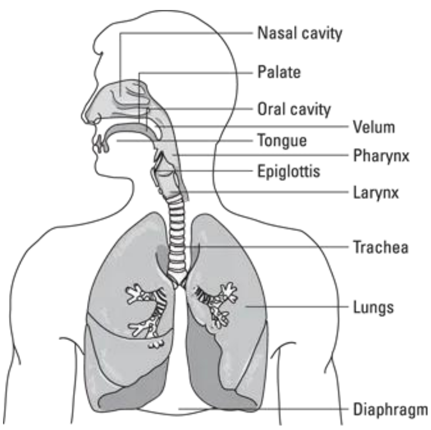


Illustration by Wiley, Composition Services Graphics

Figure 2-2: The main components of the speech production system.

If you're a shy person, you may want to close the door, because some of these exercises can sound, well, embarrassing. On the other hand, if you're a more outgoing type, you can probably enjoy this opportunity to release your inner phonetician.

Powering up your lungs

Speech begins with your lungs. For anyone who has been asked to speak just after an exhausting physical event (say, a marathon), it should come as no surprise that it can be difficult to get words out.

Lung power is important in terms of studying speech sounds for several reasons: Individuals with weakened lungs have characteristic speech difficulties, which is an important part of the study of speech language pathology.Furthermore, as I discuss in Chapter 10, an important feature of speech called *stress* is controlled in large part by how loud a sound is — this, in turn, relates to how much air is puffed out by the lungs.

The role of the lungs in breathing and speech

Your lungs clearly aren't designed to serve only speech.

They're part of the respiratory system, designed to bring in oxygen and remove carbon dioxide. Breathing typically begins with the nose, where air is filtered, warmed, and moistened. Air then moves to the *pharynx*, the part of the throat just behind the nose and into the *trachea*, the so- called *windpipe* that lies in front of the esophagus (or the *food tube*). From the trachea, the tubes split into two bronchi (left and right), then into many *bronchioles* (tiny bronchi), and finally ending up in tiny air sacs called *alveoli*. The gas exchange takes place in these sacs.

When you breathe for speaking, you go into a special mode that is very different than when you walk, run, or just sit around. Basically, speech breathing involves taking in a big breath, then holding back or checking the exhalation process so that enough pressure allows for buzzing at the larynx (also known as *voicing*). If you don't have a steady flow of pressure at the level of the larynx, you can't produce the voiced sounds, which include all the vowels and half of the consonants.

Young children take time to get the timing of this speech breathing right; think of how often you may have heard young kids say overly short breath-group phrases, such asthis example:

"so like Joey got a . . . got a candy and a . . . nice picture from his uncle"

Here the child talker quite literally runs out of breath before finishing his thought.

Some interesting bits about the lungs can give you some more insight into these powerhouse organs:

- They're light and spongy, and they can float on water.
- They contain about two liters (three quarts) of air, fully inflated.
- Your left and right lungs aren't exactly the same. The left lung is divided into two lobes, and the lung on yourright side is divided into three. The left lung is also slightly smaller, allowing room for your heart.

When resting, the average adult breathes around 12 to 20 times a minute, which adds up to a total of about11,000 liters (or 11,623 quarts) of air every day.

Testing your own lung power

You can test your lung power by producing a sustained vowel. To test your lung power, sit up, take a deep breath, and produce the vowel /ɑ/, as in the word "hot," holding itas long as you can. The vowel /ɑ/ is part of the IPA, which I discuss in Chapter 3.

How did you do? Most healthy men can sustain a vowel for around 25 to 35 seconds, and women for 15 to 25 seconds. Next, try the same vowel exercise while lying flaton your back (called being *supine*). You probably can't go on as long as you did when you were sitting up, and the task should be harder. Due to gravity and biomechanics, the lungs are simply more efficient in certain positions than others. The effect of body position on speech breathing is important to many medical fields, such as speech language pathology.

Buzzing with the vocal folds inthe larynx

The *larynx,* a cartilaginous structure sometimes called the

voice box, is the part of the body responsible for making all voiced sounds. The larynx is a series of cartilages held together by various ligaments and membranes, and also interwoven by a series of muscles. The most important muscles are the vocal folds, two muscular flaps that control the miraculous process of voicing.

Figure 2-3 shows a midsection image of the head. In this figure, you can see the positions of the nasal cavity, oral cavity, pharynx, and larynx. Look to see where the vocal folds and glottis are located. The vocal folds (also known as the *vocal cords*) are located in the larynx. You can find

the larynx in the figure at the upper part of the airpassage.

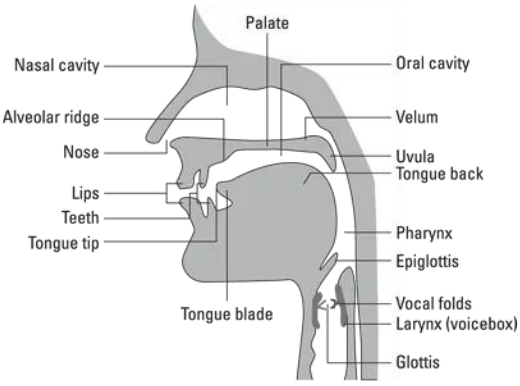


Illustration by Wiley, Composition Services Graphics

Figure 2-3: The midsagittal view of the vocal tract.

The following sections provide some examples you can doto help you get better acquainted with your larynx and glottis.

Getting a buzz from a different source

A common surgery used for the treatment of laryngeal cancer is *laryngectomy,* which is the complete or partial removal of the larynx and vocal folds. After such a surgery, several methods can be used to help a patient speak. One way is to train patients to use an *electrolarynx*, a mechanical (buzzing) device held againstthe throat to provide vibrations for speech. For laryngectomy patients, the electrolarynx has the advantage of being simple andaccessible pre- and post-operation. However, a disadvantage is the rather mechanical voice that results (see www.youtube.com/watch?v=v55NAjqltEI).

For phonetics students, trying out an electrolarynx is a fun way to really get the idea of the independence of source and filter. See if you can borrow one from a nearby communication disorders group or clinic. To see how it works, follow these steps:

1. **Place the vibrating membrane against the side of your Adam's apple (laryngeal prominence).**

2. **Turn on the device and silently count to 10.**

If you did it correctly, you'll feel a pleasant buzzing on your neck while the device *voices* (*phonates*) for you. You may need to try several times to get the coupling just right, so that others can hear you.

Locating your larynx

You can easily find your own larynx. Lightly place your thumb and forefinger on the front of your throat and holdout a vowel. You should feel a buzzing. If you have correctly done it, you're pressing down over the *thyroid cartilage* (refer to the larynx area shown in Figure 2-3) to sense the vibration of the vocal folds while you phonate. Ifyou're male, finding your vocal folds is even more obviousbecause of your *Adam's apple* (more technically called the *laryngeal prominence*), which is more pronounced in men than women.

Are you happy with your buzzing? Now try saying something else, but this time, whisper. When whispering, switch from a voiced (*phonated*) sound to voiceless. Doingthese exercises gives you a good idea of voicing, which is the first of three key features that phoneticians use to classify the speech sounds of the world. (Refer to Chapter 5 for these three key features.) Voicing is one of the most straightforward features for beginning phonetics students because you can always place your hand up to the throat to determine whether a sound is being produced with a voiced source or not.

Stopping with your glottis

Meanwhile, the *glottis* is the empty space between the two vocal folds when they're held open for breathing or for speech. That is, it's basically an empty hole. Your glottis isprobably the most important open space in your body because it regulates air coming in and out of the lungs.

Even if you're otherwise able to breathe just fine, if your glottis is clamped shut, air can't enter the lungs.

Clamping your glottis shut is a dangerous situation, so don't try it for long. Nevertheless, it's fun and instructive to try something called the *glottal stop,* /ʔ/, a temporary closing (also called an *adduction*) of the vocal folds that occurs commonly during speech. Are you ready? Stick to these steps as you try this exercise:

1. **Say "uh-oh," loudly and slowly several times.**

Young children like saying this expression as they are about to drop something expensive (say, your new cell phone) on a cement floor.

2. **Feel your vocal folds clamp shut at the end of "uh," and then open again (the technical term is *abduct*) when you begin saying "oh."**

3. **Try holding the closing gesture (the adduction) after the "uh."**

You should soon begin feeling uncomfortable and *anoxic* (which means without oxygen) because no air can get to your lungs.

4. **Breathe again, please!**

I need you alive and healthy to complete these exercises.

5. **Practice by saying other sounds, such as "oh-oh," "ah-ah," and "eeh-eeh," each time holding the glottal stop (at will) across the different vowels.**

This skill comes in handy when I discuss more about glottal stops used in American English and in differentEnglish dialects worldwide in Chapter 18.

Shaping the airflow

Parts of the body filter sound by creating airway shapes above the larynx. Air flowing through differently shaped vessels produces changing speech sounds. Imagine blowing into variously shaped bottles; they don't all sound the same, right? Or consider all the different sizes and shapes of instruments in an orchestra; different shapes lead to different sounds. For this reason, it's important to understand how the movement of your body can shape the air passages in your throat, mouth, and nasal passagesin order to produce understandable speech.

Air passages are shaped by the *speech organs*, also known as *articulators*. Phoneticians classify articulators as movable (such as the tongue, lips, jaw, and velum) and fixed (such as the teeth, alveolar ridge, and hard palate), according to their role in producing sound. Refer to Figures 2-2 and 2-3 to see where the articulators are located.

The movable articulators are as follows. Here you can find some helpful information to understand how each one works:

- **Tongue:** The tongue is the most important articulator, similar in structure to an elephant's trunk. The tongue is a *muscular hydrostat,* which means it's a muscle with a constant volume. (This characteristic is important in the science of making sound because muscular hydrostats are physiologically complex, requiring muscles to work *antagonistically*, against each other, in order to stretch or bend. Such complexity appears necessary for the motor tasks of speech.) The tongue elongates when it extends and bunches up when it contracts. You never directly see the main part of the tongue (the body and root). You can only view the thinner sections (tip/blade/dorsum) when it's extended for viewing.

  However, scientists can use imaging technologies such as ultrasound, videoflouroscopy, and magnetic resonance imaging to know what these tongue parts look like and how they behave.

- **Jaw:** Although classified as a movable speech articulator, the jaw isn't as important as the tongue. The jaw basically serves as a platform to position the tongue.

- **Lips:** The lips are used mostly to lower vowel sounds through extension. The *lip extension* is also known as *protrusion* or *rounding*. The lips protrude approximately a quarter inch when rounded. English has two rounded vowels, /u/ (as in "b*oo*t"), and /ʊ/ (as in "b*oo*k"). Other languages have more rounded sounds, such as Swedish, French, and German . These languages require more precise lip rounding than English.

  Lips can also flare and spread (widen). This acts like the bell of a brass instrument to brighten up certain sounds (like /i/ in "b*ea*d").

- **Velum:** The *velum,* also known as the *soft palate,* is fleshy, moveable, and made of muscle. The velum regulates the nasality of speech sounds (for example, /d/ versus /n/, as in the words "dice" and "nice"). The velum makes up the rear third of the roof of the mouth and ends with a hanging body called the uvula, which means "bundle of grapes," just in front of the throat.

Some parts of the body are more passive or static during sound production. These so-called fixed articulators are as follows:

- **Teeth:** Your teeth are used to produce the "th" sounds in English, including the voiced consonant /ð/ (as in "*th*ose") and the voiceless consonant /θ/ (as in "*th*ick"). The consonants made here are called *dental*. Your teethare helpful in making *fricatives,* hissy sounds in which air is forced through a narrow groove, especially /s/,

  /z/, /f/, and /v/ — like in the words "*s*o," "*z*ip", "*f*eel," and "*v*ote". Tooth loss can affect other speech sounds, including the affricates /tʃ/ (as in "*ch*op") and /dʒ/ (as in "*J*oe").

- **Alveolar ridge:** This is a pronounced body ridge located about a quarter of an inch behind your top teeth. Consonants made here are called *alveolar*.

  You can easily feel the alveolar ridge with your tongue. Say "na-na" or "da-da," and feel where your tongue touches on the roof of your mouth.

- The alveolar ridge is particularly important for producing consonants, including /t/, /d/, /s/, /z/, /n/,

  /l/, and /ɹ/, as in the words "*t*ime," "*d*ime," "*s*ick," "*z*oo," "*n*ice, "*l*ice," and "*r*ice." Many scientists think an exaggerated alveolar ridge has evolved in modern humans to support speech.

- **Hard palate:** It continues just behind the alveolar ridge and makes up the first two-thirds of the roof ofyour mouth. It's fixed and immovable because it's backed by bone. Consonants made here are called *palatal*. The English consonant /j/ (as in "*y*ellow") isproduced at the hard palate.

Producing Consonants

A *consonant* is a sound made by partially or totally blocking the vocal tract during speech production. Consonants are classified based on *where* they're made in the articulatory system (place of articulation), *how* they are produced (manner of articulation), and whether they're *voiced* (made with buzzing of the larynx) or not.

These sections discuss the different ways English

consonants are made. Remember, each language has its own set of consonants. So English, for example, doesn't have the "rolled r" found in Spanish, and Spanish doesn't have the consonant /dʒ/ as in "ju*dg*e".

Getting to the right place

Basically consonant sounds use different parts of the tongue and the lips. Figure 2-4 shows a midsagittal view of the head, including the lips, tongue, and the consonantal places of articulation.

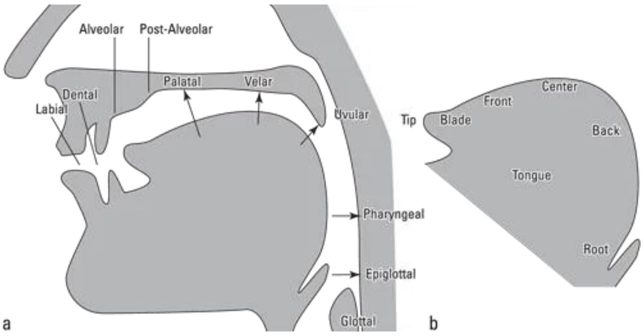


Illustration by Wiley, Composition Services Graphics

Figure 2-4: The consonantal places of articulation (a) and divisions of the tongue (b).

Notice that these regions are relative; there is clearly no "dotted line" separating the front from the back or marking off the tip from the blade (unless you happen to have a disturbing tattoo there, which I doubt). However, these regions play different functional roles in speech. The tip and blade are the most flexible tongue regions. The different parts of the tongue control the sound in the following ways:

- **Coronal:** Speech sounds made using either the tip or blade are called *coronal* (crown-like) sounds.
- **Dorsal:** Speech sounds made using the rear of the tongue are called *dorsal* (back) articulations.

To get an overall feel of what happens when you speak with your lips, tongue, and jaw, slowly say the

word "*batik,*" paying attention to where your articulators are as you do so. At the beginning of the word you should sense the separation of the lips for the

/b/ (a labial gesture), then the lowering of the tongue and jaw as you pronounce the first syllable. Next, the front of your tongue will rise to make (coronal) contact for the /t/ of "*t*ik." When you reach the end of "ti<u>k</u>," you should be able to detect the back (dorsum) of your tongue making (velar) contact with the roof of your mouth for the final /k/ sound.

However, phoneticians typically need to know more detail about where sounds are made than just which parts of the tongue are involved. The following list details the English places of articulation for consonants:

- **Bilabial:** Also called *labial,* sounds made with a constriction at the lips are very common in the languages of the world. Say "*p*at," "*b*at," and "*m*at" to get a good feel for these sounds. Because the lips are a visible part of a person's body, young children usually use these bilabial sounds in some of their first spoken words ("Momma" or "Poppa"). Think of the baby word terms for mother and father in other languages you may know; they probably contain bilabial consonants.
- **Labiodental:** Your top teeth touch your bottom lip to form these sounds. Say "*f*at" and "*v*at" to sample a voiceless and voiced pair produced at the labiodental place. A person could logically flip things around and tryto make a consonant by touching the bottom teeth to the top lip. I can't take any legal responsibility for any spluttering behavior from such an ill-advised anatomical experiment.
- **Dental:** A closure produced at the teeth with contact of the tongue tip and/or blade makes these consonants.

  For American English, this refers to the "th" sounds, as in "*th*ick" and "*th*is." The first sound is voiceless and is transcribed with the IPA symbol /θ/, *theta*. The second is voiced and is transcribed with the IPA symbol /ð/, *ethe*. Beginning phonetics students frequently mix up /θ/ and /ð/, probably due to the dreadful problem of fixating about spelling. Remember to use your ear and the IPA, and you'll be fine.

  Phonetics is a discipline where (for once) you really don't have to worry about how to spell. In fact, an overreliance on spelling can trip you up in many ways.

  When you hear a word and wish to transcribe it, concentrate on the sounds and don't worry about how it's spelled. Instead, go directly to the IPA characters. If you remain hung up on spelling, a good way to break this habit is to transcribe *nonsense words* also known as *nonce words* because you can't possibly know how they're spelled correctly.
- **Alveolar:** As I discuss in the earlier section, "Shaping the airflow," this important bony ridge on your hard palate makes the sounds /t/, /d/, /s/, /z/, /n/, /l/, and /ɹ/. The tongue tip makes some of these sounds, while the tongue blade makes others.
- **Retroflex:** This name literally means *flexed backwards*. Placing the tongue tip to the rear of the alveolar ridge makes these sounds. Although (as I show you in Chapter 16) such sounds are common in the English accents of India and

Pakistan, they're less common in American or British English.

- **Palato-alveolar:** This region is also known as the *post-alveolar*. You make these sounds when you placethe tongue blade just behind the alveolar ridge.

  Constriction is made at the palatal region, as in the sound "sh" of "*sh*ip," transcribed with the IPA character

  /ʃ/, known as "esh." The voiced equivalent, "zh," as in "plea*s*ure" or "lei*s*ure," is transcribed in the IPA as /ʒ/, "long z" or "yogh." English has many /ʃ/ sounds, but farfewer /ʒ/ sounds (especially because many /ʒ/-containing words are of French or Hungarian origin,thank you, Zsa Zsa Gabor).

- **Palatal:** You make this sound by placing the front of the tongue on the hard palate. It's the loneliest place of articulation in English. Although some languages have many consonants produced here, English has only the gliding sound "y" of "*y*es," transcribed incidentally, with

  /j/. Repeat "you young yappy yodelers" if you reallywant a palatal workout.

- **Velar:** For these sounds, you're placing the back of your tongue on the soft palate. That's the pliant, yucky part of the back of your mouth with no underlying boneto make it hard, just cartilage. Try saying "kick" and "gag" to get a mouthful of stop consonants made here. You can also make nasal consonants here, such as the sound at the end of the words "si*ng*, sa*ng*, su*ng*" — transcribed with the IPA symbol /ŋ/, "eng" or "long n."

  Note that /ŋ/ isn't the same nasal consonant as the alveolar /n/, such as in "si*n*." Velar nasals have a muchmore "back of the mouth" sound than alveolars. Also, people speaking English can't start a word with velar nasals — they occur only at the end of syllables. So, if someone says to you "have a gnice /ŋɑɪs/ day!," you should suspect something has gone terribly, terribly wrong.

Beginning transcribers may sometimes be confused by "ing" words, such as "thing" (/ɪŋ/ in IPA) or "sang" (/sæŋ/ in IPA). A typical question is "where is the "g"?

This is a spelling illusion. Although some speakers may possibly be able to produce a "hard g" (made with a full occlusion) for these examples (for example, "sin*g*"), most talkers don't realize a final stop. They simply end with a velar nasal. Try it and see what you do. On the other hand, if you listen carefully to words, such as "singular," "linguistics," or "wrangle," there indeed should probably be a /g/ placed in the IPA transcription because this sound is produced. I provide more help on problem areas for beginning transcribers in later Chapters.

Nosing around when you needto

Although it may sound disturbing, people actually talk

through their noses at times. The oral airway is connected to the nasal passages — you may have unfortunately discovered this connection if you've unluckily burst out laughing at a funny joke while trying to swallow a sip of soda.

Air usually passes from the lungs through the mouth during speech because during most speech the soft palateraises to close off the passage of air through the nose.

However, in the case of nasal consonants, the velum lowers roughly at the same time as the consonantal obstruction in the mouth, resulting in air also flowing out through the nose. People do this miraculous process of shunting air from the oral cavity to the nasal cavity (and back again) automatically, thousands of times each day.

Here is a nifty way to detect nasal airflow duringspeech. Ladies, get your makeup mirrors! Guys, borrow one from a friend. If the mirror is cool to the touch, you're good to go. If not, place it in a refrigerator for an hour or so, and you'll be ready to try a classic phonetician's trick. Hold the mirror directly under your nose and say "dice" three times. Because the beginning of "*d*ice" has an oral consonant, you should observe, well, *nothing* on the mirror. That is, most air escapes through your mouth for this sound. Next, try saying "nice" three times. This time, you should notice some clear fog marks under each nostril where your outgoing air during nasal release for /n/ made contact with the mirror. You may now try this with other placesof (nasal) articulation, such as the words "mime" and "hang."

Minding your manners

Blocking the vocal tract forms consonants. Forming consonants can happen in different ways: by making a complete closure for a short or long time, by letting air escape in different fashions, or by having the articulators approach each other for a while, resulting in vocal tract shapes that modify airflow. The following list includes some of the main manners of articulation in English. I discuss more details on manner of articulator, including examples for other languages, in Chapters 5 and 16.

- **Stop:** When air is completely blocked during speech, this is called a *stop* consonant. English stops include voiceless consonants /p/, /t/, and /k/ and voiced consonants /b/, /d/, and /g/, as in the words "*p*at," "*t*at," and "*c*at" and "*b*all," "*d*oll," and "*g*all." You make these consonants by blocking airflow in different regions of the mouth. *Nasal stops* (sometimes called just *nasals,*for short) also involve blocking air in the oral cavity, but they're coordinated with a lowering of the velum toallow air to escape through the nose.
- **Fricative:** These consonants all involve producing *friction,* or hissing sound, by bringing two articulators very close to each other and blowing air through. When air passes through a narrow groove or slit, a hiss results (think of opening your car window just a crack while driving down the freeway at a high speed). You hiss withyour articulators when you make sounds, such as /f/,

  /v/, /s/, or /ð/ (as in "*f*at," "*v*at," "*s*at," and "*th*at"). Chapter 6 provides more information on English fricatives.
- **Affricate:** This type of consonant may be thought of asa combination of stop and fricative. That is, an *affricate* starts off sharply with a complete blockage of sound and then transitions into a hiss. As such, the symbols for affricates tend to involve double letters, such as the two affricates found in English, the voiceless /tʃ/ for "*ch*ip" or "whi*ch*," and the voiced affricate /dʒ/, as in "we*dge*" or "*J*eff." Note that some authors tie the affricate

  symbols together with a tie or bar, such as /ʧ̑ /, /ʧ̮/, or /ʧ̄/. I use more recent conventions and don't do so.
- **Approximant:** In these consonants, two articulators approach or *approximate* each other. As a result, the vocal tract briefly assumes an interesting shape that forms sound without creating any hissing or complete blockage. These sounds tend to have a fluid or "wa-wa"- like quality, and include the English consonants /ɹ/, /l/,

  /j/, and /w/, as in the words "*r*ake," "*l*ake," "*y*ell," and "*w*ell."

A good way to remember the English approximants is to think of the phrase "your whirlies," because it contains them all: /j/, /ɹ/, /w/, and /l/.

Note that the American English "r" is properly transcribed upside down, /ɹ/, in IPA. Many varieties of "r" sounds exist in the world, and the IPA has reserved the "right side up" symbol, /r/, for the rolling (trilled) "r," for instance in Spanish. I go over more information on IPA characters in Chapter 3.

- **Tap:** For this consonant, sometimes called a *flap,* the tongue makes a single hit against the alveolar ridge. It's a brief voiced event, common in the middle of words such as "city" in American English. A tap is transcribed as /ɾ/ in the IPA.

Producing Vowels

Vowels are produced with relatively little obstruction of air in the vocal tract, which is different than consonants. Phoneticians describe the way in which people produce vowels in different terms than for consonants. Because vowels are made by the tongue being held in rather complicated shapes in various positions, phoneticians settle for rather general expressions such as "high, mid, low" and "front, center, back" to describe vowel place of articulation. Thus, a sound made with the tongue held with the main point of constriction toward the top front of the mouth is called a *high-front vowel,* while a vowel produced with the tongue pretty much in the center of the mouth is called a *mid-central vowel.* The positions of the lips (rounded or not) are also important. As I describe in Chapters 12 and 13, many phoneticians believe a better description of vowels can be given acoustically, such as what a sound spectrograph measures. Nevertheless, the best way to understand howvowels are formed is to produce them, from the front to the back, and from top to the bottom.

To the front

The *front* vowels are produced with the tongue tip just a bit behind your teeth. Start with the sound "ee" as in "h*ee*d," transcribed in the IPA as /i/. Say this sound threetimes. This is a high-front vowel because you make it at the very front of your mouth with the tongue pulled as high up as possible. Next, try the words “hid,” “hayed,” “head,” and “had” — in this order. You’ve just made the front vowel series of American English. In IPA symbols, you transcribe these vowels as /ɪ/, /e/, /ɛ/, and /æ/.

As you speak this series, notice your tongue stays at the front of your mouth, but your tongue and jaw drop because the vowels become progressively lower. By the time you get to “had,” you’re making a low-front vowel.

To the back

You form the back vowels at, where else, the back of your mouth (big surprise!). Start with “boot” to make /u/, a high-back vowel. Next, please say “book” and “boat.” Youshould feel your tongue lowering in the mouth, with the major constriction still being located at the back.

Phoneticians transcribe these vowels of American English

as /ʊ/ and /o/.

The next two (low-back) sounds are some of the most difficult to tell apart, so don’t panic if you can’t immediately decipher them. Say “l*aw*” and “f*a*ther.” In most dialects of American English, these words contain the vowels “open-o” (/ɔ/) and /ɑ/, respectively. Most students (and even many phoneticians) have difficulty differentiating between them. These vowels also are merging in many English dialects, making consistent examples difficult to list. For example, some American talkers contrast /ɔ/ and /ɑ/ for “caught-cot”, although most don’t. Nonetheless, with practice you can get better at sorting out these notorious two vowel sounds at the low-back region of the vowel space!

In the middle: Mid-central vowels

A time-honored method of many phonetics teachers is to

save teaching the English central vowels for last because the basics of mid-central vowels are easy, but processing all the details can get a bit involved. For now, let me break them into these two classifications.

“Uh” vowels

The “uh” vowels include the symbols /ə/ “schwa” and /ʌ/ “wedge”, as in the words “th*e*” and “m*u*d.” Don’t be surprised if these two vowels (/ə/ and /ʌ/) sound pretty much the same to you (they do to me) — the difference here has to do with linguistic stress — because words with linguistic content such as nouns, verbs, and adjectives (forexample, “mud” and “cut”) are produced with greater *linguistic stress* (see Chapter 7 for more details). They’re produced with a slightly more open quality and are assigned the symbol /ʌ/. Refer to the later section, “Putting Sounds Together (Suprasegmentals)” for more about linguistic stress. In contrast, English *articles,* such as “the” and “a” (as well as weak syllables in polysyllabic words, such as the “re” in “*re*ply”) tend to be produced quietly, that is with less stress. This results in a relatively more closed mouth position for the “uh” sounds, transcribed as the vowel /ə/.

I dislike the names “schwa” and “wedge” because these character names don’t represent their intended

sounds well. Therefore, I suggest you secretly do what my students do and rename them something like “schwuh” and “wudge.” Doing so can help you remember that these symbols represent an “uh” quality.

“Er” vowels

English has /ɚ/ (“r-colored schwa”) and /ɝ/ (right-hook reversed epsilon) for “er” mid-central vowels. Notice that both of these characters have a small part on the right (a right hook, not to be confused with the prizefighting gesture) that indicates *rhoticization,* also referred to as *r- coloring*. For most North American accents, you can find the vowels /ɚ/ and /ɝ/ in the words “her” and “shirt.”

The good news is that similar stress principles apply with the “er” series as the “uh” series. Pronouns such as “her” or endings such as the “er” in “father” typically don’t attract stress and thus are written with an r-colored schwa, /ɚ/. On the other hand, you transcribe a verb, suchas “hurt” or an adjective such as “first,” with the vowel /ɝ/(right-hook reversed epsilon).

Embarrassing ‘Diphthongs’?

The vowels in the preceding section are called

monophthongs, literally “single sound” (in Greek). These vowels have only one sound quality. Try saying “the fat caton the flat mat.” The main words here contain a monophthongal vowel called “ash,” written in the IPA as /æ/. Notice how /æ/

vowels have one basic quality — they are, if you will, flat.

Next, try saying the famous phrase "How now brown cow?" Pronounce the phrases slowly and notice that each vowel will seem to slide from an "ah" to an "oo" (or in the IPA, from an /a/ to an /ʊ/). For this reason, these words are each said to each contain a *diphthong,* or a vowel containing two qualities. For /aʊ/, English speakers transition from a low-front to a high-back vowel quality. In addition to /aʊ/, English has two other diphthongs, /aɪ/ (as in "wh*i*te" or "s*i*ze") and /ɔɪ/(as in "b*oy*" or "l*oi*ter").

Are diphthongs really embarrassing? They shouldn't be, unless you produce them in an exaggerated manner (such as in the previous exercise). However, if you feel shy about producing diphthongs, you may wish to think twice about studying a language, such as the Bern dialect of Swiss German, which has diphthongs and even triphthongs aplenty. Yes, you guessed correctly — in a *triphthong,* one would swing through three different vowel qualities within one vowel-like sound. Check it out with the locals the next time you are in Bern (and don't really worry about being embarrassed).

Putting sounds together(suprasegmentals)

Consonants and vowels are called *segmental* units of

speech. When people refer to the consonants and vowelsof a language, they're dealing with individual (and logically separable) divisions of speech. This part is an important aspect of phonetics, but surely not the only part. To start with, consonants and vowels combine into *syllables*, an absolutely essentially part of language.

Without syllables, you couldn't even speak your own name (and would, I suppose, be left only with your initials).

Therefore, you need to consider larger chunks of language, called *suprasegmentals*, or sections larger thanthe segment.

Suprasegmentals refer to those features that apply to syllables and larger chunks of language, such as the phrase or sentence. They include changes in *stress* (the relative degree of prominence that a syllable has) and *pitch* (how high or low the sound is), which the followingsections explain in greater detail.

Emphasizing a syllable:Linguistic stress

When phoneticians refer to stress, they don't mean

emotional stress. For English, l*inguistic stress* deals with making a syllable louder, longer, and higher in pitch (that is, making it stand out) compared to others. Stress can serve two different functions in language:

- *Lexical* (or word level)
- *Focus* (or contrastive emphasis)

Part of knowing English is realizing when stress is placed on the correct *syll*able (here at the beginning of the word), and not on a wrong syl*lab*le (such as here, in the middle of the word). Words that are *polysyllabic* (containing more than one syllable) have a correct spot for main stress (also called *primary stress*). Therefore, getting the stress right is an important part of our wordlearning.

In addition, some English word pairs show regular contrast between nouns and verbs with respect to stress placement. Say these words to yourself:

Noun	***Verb***
record	(to) record (his)
conduct	(to) conduct (the)
permit	(to) permit

You can tell that stress falls on the first syllable of the nouns, and the last syllable of the verbs, right? For some English word pairs stress assignment serves a grammatical role, helping indicate which words are nounsand which are verbs.

Stress can also be used to draw attention (focus) to a certain aspect of an utterance, while downplaying others. Repeat these three sentences, stressing the bolded word ineach case:

Sonya plays piano.
Sonya *plays* piano.Sonya
plays *piano*.

Does your stressing these italicized words differently change the meaning of any of these sentences? Each sentence contains the same words — thus, logically, they should all mean the same thing, right? As you probably guessed, they don't. When people stress a certain word in a phrase or sentence, they do shift the emphasis or meaning. These three sentences all seem to answer three different questions:

Who plays piano? (*Sonya* does!)

Does Sonya listen to piano or play piano?	(She *plays!*)
Does Sonya play the bagpipes?	(No, she plays *piano*.)

Using stress allows people to convey very different emphasis even when using the same words. Correctly using stress in this way is quite a challenge for computers, by the way. Think of how computer speech often sounds or how the stress in your speech may be misunderstood by computerized telephone answering systems.

A good way to practice finding the primary stress of a word is to say it while rapping out the rhythm with

your knuckles on a table. For instance, try this with "refrigerator." You should get something like:

knock *knock* knock knock knock

That is, the stress falls on the second syllable ("fridge"). Next, try the word "tendency." You should have:

knock knock knock

Here, stress falls on the first (or initial) syllable.

This method seems to work well for most beginning phonetics students. I think the only time students have difficulty with stress assignment is if they overthink it. Remember, it is a sound thing and really quite simple after you get the hang of it.

Changing how low or high the sound is

Pitch is a suprasegmental feature that results from

changes in the rate of buzzing of the larynx. The faster the buzzing, the higher pitched the sound; the slower the buzzing, the lower the sound.

Men and women buzz the larynx at generally differentrates. If you're an adult male, on average your larynx buzzes about 120 times per second when you speak.

Women and children (having higher voices) buzz at typically about twice that rate, around 220 times per second. This difference is due to the fact that men have larger laryngeal cartilages (Adam's apple) and vocal folds.

Phoneticians call the rate of this buzzing *frequency*, the number of times something completes a cycle over time.In this case, it's the number of times that air pulses from the larynx (resulting from the opening and closing of thevocal folds) per second.

Pitch refers to the way in which frequency is heard.

When phoneticians talk about pitch, they aren't referring to the physical means of producing a speech sound, but the way in which a listener is able to place that sound as being higher or lower than another. For example, when people listen to music, they can usually tell when one note is higher or lower than another, although they may not know much else about the music (such as what those notes are or what instruments produced them). Detecting this auditory property of high and low is very important in speech and language.

English uses pitch patterns known as *sentence-level intonation, which means the way in which pitch changes over a phrase- or sentence-length utterance to affect meaning. Try these two sentences, and listen carefully to the melody as you say each one:*

- "I am at the supermarket." This type of simple factual statement is usually produced with a *falling intonation contour*. This means the pitch drops over the course of the sentence, with the word "I" being higher than the word "supermarket." Many phoneticians think this basic type of pitch pattern may be universal (found across the world's languages). People blow off air when they exhale for speech, providing less energy for increased pitch by the end of an utterance, compared to the beginning.
- "Are you eating that egg roll?" In this question, you probably noticed your melody going in the opposite direction, that is — from low to high. In English, people usually form this kind of "yes/no question" (a question that can be answered with a yes or no answer) with a rising intonation pattern. Indeed, if you were to restate the factual sentence "I am eating an egg roll" and change your intonation so that the pitch went from low to high, it would turn into a question or expression of astonishment.

These examples show how a simple switch in intonation contour can change the meaning of words from a statement to a question. In Chapter 10, I discuss more about the power of intonation in English speech.

Chapter 4
Meeting the IPA:Your New SecretCode

In This Chapter

- Taking a closer look at the symbols
- Zipping around the chart
- Recognizing the sounds
- Seeing why the IPA is better than spelling

The *International Phonetic Alphabet* (IPA) is a comprehensive symbol set that lets you transcribe the sounds of any language in the world. The *International Phonetic Association*, a group of phoneticians who meet regularly to adjust features and symbols, revises and maintains the IPA, making sure that all world languages are covered. Many IPA symbols come from Latin characters and resemble English (such as, /b/), so you'll probably feel fairly comfortable with them. However, other symbols may seem foreign to you, such as /ʃ/ or /ŋ/.

In this chapter, I show you how to write, understand, and pronounce these IPA characters.

Although most alphabets are designed to represent only one language (or a small set of languages), the IPA represents the sounds of any of the languages in the world. An *alphabet* is any set of letters or symbols in which a language is written. When people speak more specifically of the alphabet, they usually refer to today's system of writing (the ABCs) that has been handed down from the ancient Near East. The word "alphabet" comes from the Greek letters *alpha beta*, and from the Hebrew letters *aleph* and *bet*.

The history of the IPA (not a beer or a terrorist organization)

In 1886, a group of language teachers met in Paris to help school children learn to read and to better pronounce foreign languages. The group eventually became known l' Association Phonétique Internationale (or in English, The International Phonetic Association). The group soon made it its goal to create a universal alphabet to describe the sounds of any language in the world. After 125 years of work and numerous revisions, it came up with today's sophisticated version of the IPA.

Eyeballing the Symbols

When you examine the full IPA chart (see Figure 3-1 or check out www.langsci.ucl.ac.uk/ipa/IPA_chart_%28C%292005.pdf), you can see a few hundred different symbols. However, please don't panic! You only need a fraction of them to transcribe English. In these sections, I introduce them to you first. Like the Periodic Table you may have studied inchemistry class, you can also master the basic principles of the IPA chart without getting hung up in all the details.After you master the basics, you can later focus on any other symbols you need.

Each IPA symbol represents unique *voicing* (whetherthe vocal folds are active during sound production), *place of articulation* (where in the vocal tract a sound is made), and *manner of articulation* (how a sound is produced) for consonants. For vowels, each IPA symbol represents *height* (tongue vertical positioning), *advancement* (tongue horizontal positioning), and *lip- rounding* specifications (whether the lips are protruded for sound production). Refer to Chapter 6 for more information on English consonant features, and Chapter 7 for English vowel features.

Latin alphabet symbols

See if you can begin by spotting the Latin alphabet symbols. They're among the group of symbols labeled with a No. 1 in Figure 3-1, called *pulmonic consonants*. The Latin alphabet symbols include these lower-case characters (/p/, /b/, /m/, /f/, /v/, /t/, /d/, /n/, /s/, /z/,/l/, /c/, /j/, /k/, /g/, /x/, /q/, and /h/), and upper-case

characters (/B/, /R/, /G/, /L/, and /N/).

The IPA isn't spelling. Although some of the IPA lower-case Latin symbols may match up pretty wellwith sounds represented by English letters (for instance, IPA /p/ and the letter "p" in "pit"), other IPA Latin symbols (/c/, /j/, /x/, /q/, /B/, /R/, /G/, /L/, and /N/) don't. For instance, IPA /q/ has nothing to dowith the letter "q" in *qu*ick or *qu*iet. Rather, /q/ is a throat sound not even found in English but present in Arabic and Sephardic Hebrew.

1 CONSONANTS (PULMONIC) © 2005 IPA

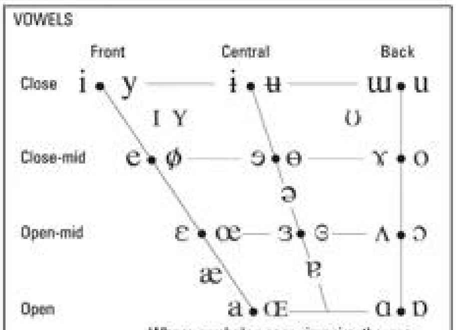
	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Retroflex	Palatal	Velar	Uvular	Pharyngeal	Glottal
Plosive	p b			t d		ʈ ɖ	c ɟ	k ɡ	q ɢ		ʔ
Nasal	m	ɱ		n		ɳ	ɲ	ŋ	ɴ		
Trill	ʙ			r					ʀ		
Tap or Flap		ⱱ		ɾ		ɽ					
Fricative	ɸ β	f v	θ ð	s z	ʃ ʒ	ʂ ʐ	ç ʝ	x ɣ	χ ʁ	ħ ʕ	h ɦ
Lateral fricative				ɬ ɮ							
Approximant		ʋ		ɹ		ɻ	j	ɰ			
Lateral approximant				l		ɭ	ʎ	ʟ			

Where symbols appear in pairs, the one to the right represents a voiced consonant. Shaded areas denote articulations judged impossible.

2 CONSONANTS (NON-PULMONIC)

Clicks		Voiced implosives		Ejectives	
ʘ	Bilabial	ɓ	Bilabial	ʼ	Examples:
ǀ	Dental	ɗ	Dental/alveolar	pʼ	Bilabial
ǃ	(Post)alveolar	ʄ	Palatal	tʼ	Dental/alveolar
ǂ	Palatoalveolar	ɠ	Velar	kʼ	Velar
ǁ	Alveolar lateral	ʛ	Uvular	sʼ	Alveolar fricative

3 VOWELS



Where symbols appear in pairs, the one to the right represents a rounded vowel.

OTHER SYMBOLS

- ʍ Voiceless labial-velar fricative
- w Voiced labial-velar approximant
- ɥ Voiced labial-palatal approximant
- ʜ Voiceless epiglottal fricative
- ʢ Voiced epiglottal fricative
- ʡ Epiglottal plosive
- ɕ ʑ Alveolo-palatal fricatives
- ɺ Voiced alveolar lateral flap
- ɧ Simultaneous ʃ and x

Affricates and double articulations can be represented by two symbols joined by a tie bar if necessary. k͡p t͜s

5 SUPRASEGMENTALS

- ˈ Primary stress
- ˌ Secondary stress ˌfoʊnəˈtɪʃən
- ː Long eː
- ˑ Half-long eˑ
- ̆ Extra-short ĕ
- | Minor (foot) group
- ‖ Major (intonation) group
- . Syllable break ɹi.ækt
- ‿ Linking (absence of a break)

4 DIACRITICS Diacritics may be placed above a symbol with a descender, e.g. ŋ̊

Voiceless	n̥ d̥	Breathy voiced	b̤ a̤	Dental	t̪ d̪
Voiced	s̬ t̬	Creaky voiced	b̰ a̰	Apical	t̺ d̺
Aspirated	tʰ dʰ	Linguolabial	t̼ d̼	Laminal	t̻ d̻
More rounded	ɔ̹	Labialized	tʷ dʷ	Nasalized	ẽ
Less rounded	ɔ̜	Palatalized	tʲ dʲ	Nasal release	dⁿ
Advanced	u̟	Velarized	tˠ dˠ	Lateral release	dˡ
Retracted	e̠	Pharyngealized	tˤ dˤ	No audible release	d̚
Centralized	ë	Velarized or pharyngealized	ɫ		
Mid-centralized	e̽	Raised	e̝ (ɹ̝ = voiced alveolar fricative)		
Syllabic	n̩	Lowered	e̞ (β̞ = voiced bilabial approximant)		
Non-syllabic	e̯	Advanced Tongue Root	e̘		
Rhoticity	ɚ a˞	Retracted Tongue Root	e̙		

6 TONES AND WORD ACCENTS

LEVEL			CONTOUR		
e̋ or	˥	Extra high	ě or	˩˥	Rising
é	˦	High	ê	˥˩	Falling
ē	˧	Mid	e᷄	˦˥	High rising
è	˨	Low	e᷅	˩˨	Low rising
ȅ	˩	Extra low	e᷈	˧˦˧	Rising-falling
ꜜ		Downstep	↗		Global rise
ꜛ		Upstep	↘		Global fall

Figure 3-1: The International Phonetic Alphabet (revised to 2005).

You can also find Latin symbols in the Vowel chart in Figure 3-1 in section No. 3 (/i/, /y/, /e/, /o/, /a/). Like the consonant IPA symbols, most have very different sounds than when these symbols are used as letters to spell. For example, the IPA symbol /i/ is the "ee" sound of the word "ch*ee*se," and the IPA symbol /e/ is the "ay" sound of the word "b*ai*t." Because English spelling doesn't reliably indicate speech sounds, the best way to master the IPA is to go directly to flash cards and match word sound with IPA symbol. (Refer to the later section "Why the IPA Trumps Spelling" for more information.)

Greek alphabet symbols

The IPA also contains some Greek alphabet symbols. If you're familiar with Greek campus organizations, you may recognize some of them. For instance, consonant symbols include *phi* /ɸ/, *beta* /β/, *theta* /θ/, and gamma /ɣ/. Of these symbols, you find /θ/ in the English words "*th*ing," "au*th*or," and "wor*th*." Among the vowels, you can find *upsilon* /ʊ/ and *epsilon* /ɛ/. You find these sounds in the words "p*u*t" and "b*e*t."

Made-up symbols

The majority of the IPA symbols are made-up characters. They're symbols that have been flipped upside-down or sideways, or they have had hooks or curlicues stuck on their tops, bottoms, or sides. For example, the velar nasal stop consonant, "eng" (IPA character /ŋ/), consists of a long, curled right arm stuck onto a Latin "n." Don't you

wish you could have been around when some of these characters were created?

The IPA also has some made-up vowel characters, at least for English speakers. For instance, the IPA mid-front rounded vowel is transcribed /ø/. This is a (lip) rounded version of the vowel /e/, found in Swedish. It sounds like saying the word "bait" while sticking your lips out, causing a lowered sound quality. This symbol resembles an "o" with a line slashed through it.

Another famous made-up vowel is the IPA mid-central vowel, /ə/, *schwa*. This character represents the unstressed sound "uh," as in "th*e*" and "*a*nother."

Tuning In to the IPA

The IPA is broken down into six different parts, which I refer to as charts. Each chart represents different aspects of speech sound classification. Refer to Figure 3-1 to see the different charts. In the following sections, I take a closer look and describe them in greater detail.

Featuring the consonants

The top two charts of the IPA in Figure 3-1 represent the consonants of the world's languages. *Consonants* are sounds made by partially or wholly blocking the oral airway during speech. The large chart (section No. 1) shows 59 different symbols listed in columns by place of articulation and in rows by manner of articulation.

Wherever applicable, voiceless and voiced pairs of sounds (such as /f/ and /v/) are listed side by side, with the voiceless symbol on the left and the voiced symbol on the right.

Because every IPA symbol is uniquely defined by its voicing, place, and manner (see Chapters 2 and 5 for more information), you're now ready to have some fun (and of course impress your friends and family!) by reading off the features for each symbol from the chart. Let me start you off. In the top left box, you can see that /p/ is a voiceless, bilabial plosive. Looking down the next column to the right, you see that /v/ is a voiced, labiodental fricative.

Are you confused and not sure how I came up with these descriptions? Just follow these steps to get them:

1. **Look up to the top of the column to get the consonant's place of articulation.**
2. **Look to the left side of the row to get the consonant's manner of articulation.**

   If the character is on the left side of the cell, it's voiceless, otherwise it's voiced. If a character is in the middle (by itself), it's voiced.
3. **Put it all together and you have the consonant's voicing, place, and manner of articulation.**

Now it's your turn. Name the voicing, place, and manner of the /h/ symbol in the column at the far right. Yes, /h/ is a voiceless, glottal fricative. Congratulations, you can now cruise to any part of the consonant chart and extract this kind of information. You need this important skill as you work on phonological rules (see Chapters 8 and 9).

Accounting for clicks

The second chart in Figure 3-1 (labeled No. 2) is for sounds produced very differently than in English. When these sounds are produced, air doesn't flow outward fromthe lungs, as is the case for most language sounds.

Instead, air may be briefly moved from the larynx or the mouth. This chart covers the fascinating consonants of Zulu, the sucking-in sounds of Sindhi, and the popping sounds of Quechua, to name a few. Chapter 12 and the multimedia material (located at www.dummies.com/go/phoneticsfd) give you some more exposure to these sounds.

Going round the vowel chart

The third chart in Figure 3-1 (labeled No. 3) is called a *vowel quadrilateral,* a physical layout of vowels as produced in the mouth (refer to Figure 3-2 for a better idea what this looks like). In this chart, vowels are represented by how close the tongue is held to the top ofthe mouth, also known as being *high*. In contrast, the vowel may be produced with an open vocal tract, also known as placing the tongue *low*. In terms of horizontal

direction, the tongue can be described as positioned at the *front, central,* or *back* part of the mouth. Where the symbols are paired, the rightmost symbol is produced with the lips rounded (or protruded). Lip rounding has the effect of giving the vowel a lowered, rather hollow sound.

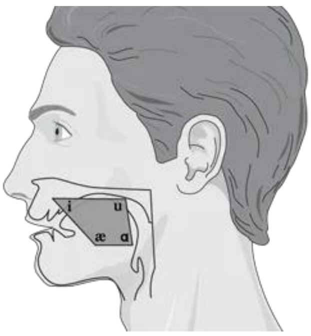


Illustration by Wiley, Composition Services Graphics

Figure 3-2: Vowel quadrilateral superimposed on a person's vocal tract.

Marking details with diacritics

The next chart I focus on in Figure 3-1 addresses the diacritics. (I skip over the chart called "Other symbols," which is a very specialized section.) *Diacritics* (in Chart 4,labeled No. 4) are small helper marks made through or near a phonetic character to critically alter its value. For instance, if you look at the top-left box of this chart, you can see that a small circle, [̥], placed under any IPA character, indicates that the sound is produced with a voiceless quality. In other words, if you need to transcribe a normally voiced sound, such as /n/ or /d/ that was produced as voiceless, you can use the diacritic [̥].

Stressing and breaking up with suprasegmentals

The fifth chart in Figure 3-1 (labeled No. 5), called

suprasegmentals, lists the IPA symbols used to describe syllables and words, that is, chunks of speech larger than individual consonants and vowels. This chart includes ways of marking stress, length, intonation, and syllable breaks. For example, the IPA indicates primary stress by placing a small

vertical mark in front of the syllable, like this for the word "syllable" /ˈsɪləbəl/. Here, the IPA is different than some books and dictionaries that underline or bold the stressed syllable (like this: **syll**able or *syll*able). I describe this level of phonetics in more detail in Chapter 10.

What are those other symbols?

The IPA section called "other symbols" is designed to cover sounds that don't quite fit in elsewhere. Some of the sounds are produced with two simultaneous constrictions in the vocal tract and thus can't be easily placed in the first section of the IPA. These double-articulations include /w/, /ʍ/, /ɥ/, and /ɧ/. Other sounds have special combinations of manner features that require them being singled out for special designation (/ɕ/, /ʑ/, and /ɺ/). Three sounds in this group (/ʜ/, /ʢ/, and /ʡ/) are produced at the lowest section of the vocal tract, the epiglottis. I provide more information on all of these other sounds in Chapter16.

Beginning phonetics students are sometimes mortified by the fact that the chart has so many diacritics. You don't have to panic because you only need a small subset to transcribe English. After you begin to see how the diacritic system works, figuring out new characters becomes easier.

Touching on tone languages

The sixth part of Figure 3-1 (labeled No. 6) details special symbols needed for languages known as *tone languages* (such as Vietnamese, Mandarin, Yoruba, or Igbo) in which the *pitch* (high versus low sound) of different syllables and words alter the meaning. This concept may seem odd to monolingual English speakers, because English doesn't have such a system. For example, saying a word in a high squeaky voice versus saying the same word in a much lower voice doesn't change the meaning. However, English-speakers are in the minority, because most of the people of the world speak tone languages. The IPA has a uniform system to mark these tones in terms of their height *level* (from extra low to extra high) and their *contour* (rising, falling, rising-falling, and so forth). Chapter 15 describes tone languages in greater detail.

Sounding Out Englishin the IPA

The best way to familiarize yourself with the IPA is to practice the different sounds. Practicing can help you understand how these sounds differ and why the IPA chart is organized as it is. Speaking and hearing the sounds can also help you remember them. These sections explain how to make the sounds for the different English IPA sounds.

Cruising the Englishconsonants

Consonants are the first place to start when sounding out the English symbols using the IPA. Figure 3-3 shows the consonants of English.

Manner	Voicing		Place of articulation							
	Voiced (+)	Voiceless (–)	Bilabial	Labio-Dental	Dental	Alveolar	Palato-Alveolar	Palatal	Velar	Glottal
Stop (nasal)	+		m			n			ŋ	
Stop (oral)		–	p			t			k	
Stop (oral)	+		b			d			g	
Fricative		–		f	θ	s	ʃ			h
Fricative	+			v	ð	z	ʒ			
Affricate		–					tʃ			
Affricate	+						dʒ			
Approximant		–	ʍ						ʍ	
Approximant	+		w			ɹ		j	w	
(lateral)	+					l			ɫ	

Figure 3-3: The consonants of English.

To know how to identify one IPA symbol from another, focus on working with a minimal pair. A *minimal pair* is when two words differ by only one meaningful sound. For example, /bæt/ and /bit/ ("bat" and "beet"), or /bæt/ and /bæd/ ("bat" and "bad").

Minimal pairs help people identify *phonemes*, the smallest unit of sound that changes meaning in language. If you become stuck in hearing a particular sound (such as /ŋ/), you may form minimal pair contrasts (such as /sɪn/ and /sɪŋ/ ("sin" and "sing"), tomake things clearer.

Here I work through Figure 3-3, column by column. The first column, /m/, /p/, and /b/ are a cinch — they sound like they're spelled in English, as in "*m*at," "*p*at," and "*b*at." All three of these consonants are *stops* (sounds made by blocking air in the oral cavity), the first being nasal, and the last two being oral. Notice at the bottom of the bilabial column you also find symbols /w/ and /ʍ/ — that are also placed in the velar columns. The sounds /w/ and /ʍ/ (voiced and voiceless) are considered *labiovelar*, that is articulations made simultaneously at the labial and velar places of articulation. Such articulations are called *double articulations* and are relatively complex (notice, for example, that young children acquire /w/ sounds relatively late in acquisition).

You make the /w/ sounds with your lips puckered and the tongue held toward the back of your mouth, as in "*w*et" or "*W*illiam." To get a better sense, try to say "wet" without letting your lips go forward — or while holding your tongue tip against your teeth to keep your tongue forward in your mouth. (Doing so is darn near impossible.)

Because these double articulated sounds are awkward tofit into the consonant place of articulation chart, they're more typically listed in the Other Sounds section of the IPA. (Refer to Chapter 16 for more information.)

The sound /ʍ/ is like a /w/, but without voicing.

Instead of "*w*itch," sounds with /ʍ/ rather sound like "*hw*itch." In fact, at one point the IPA used the symbol "hw" instead of /ʍ/. (I still don't know why they switched!) Some speakers of American English alternate between /w/ and /ʍ/ in expressions such as "*Wh*ich *w*itch is *wh*ich?" (with the middle "witch" being voiced and the others not). If these examples work for you, super! If not, listen to the examples listed in the bonus multimedia material at www.dummies.com/go/phoneticsfd.

Moving to the next column, the labiodentals /f/ and /v/ should also be easy to transcribe. You can find the voiceless consonant /f/ in words such as "*f*ree," "*f*ire," "*ph*one," and "enou*gh*." You can find the voiced labiodentals fricative in "*v*ibe," "ri*v*er," and "Da*v*e."

Students often mix up the dental fricatives /θ/ and /ð/. You can find the voiceless /θ/ in words, such as "*th*igh," "*th*ick," "me*th*od," and "ba*th*." Meanwhile, you can find the voiced fricative /ð/ in words, such as "*th*ose," "*th*is," "la*th*er," "bro*th*er," "la*th*e," and "brea*th*e." You can always sneak your hand up over your larynx (to the Adam's apple), and if you feel a buzz, it's the voiced /ð/.

When you're discovering and mastering new IPA sounds and symbols, I suggest you try them out in all

contexts (positions in a word) — that is, the beginning, middle, and end. These positions are called word

initial, *medial*, and *final*. Here are a couple examples:

IPA Symbol	*Initial*	*Medial*	*Final*
/p/	*p*at	a*pp*ear	ri*p*
/f/	*f*in	a*f*raid	shea*f*

Some sounds can't appear in all three positions. For example, the velar nasal consonant /ŋ/ can't begin a word in English. Also, /t/ and /d/ sometimes become a tap in medial position. A *tap* is a very rapid stop sound made by touching one articulator against another, such as the very short "t" sound in "Be*tt*y." Refer to Chapter 9 for more information on these rules.

Acing the alveolar symbols

Many consonant sounds are made at that handy-dandy bump at the roof of your mouth, the *alveolar ridge*. These sounds include /t/, /d/, /n/, /s/, /z/, /ɹ/, and /l/. I describe these sounds in the following list.

- **/t/ and /d/:** The case of /t/ and /d/ is interesting. These sounds are pretty straightforward in most positions of American English. Thus, you can find /t/ in"*t*ick," "s*t*eel," and "pi*t*," and you can find /d/ in words, such as "*d*ome," "ca*d*," "*d*rip," and "love*d*." However, in *medial* position (the middle of a word), American English has a tendency to change a regular /t/ or /d/ into something called a *tap* or *flap*, which means an articulator rapidly moves against another under the force of the airstream, without enough time to build up any kind of burst, such that it sounds like a fully formed stop consonant. For example, notice that the /t/ in "Be*tt*y" isn't the same /t/ as in "be*t*" — it sounds something like a cross between a /t/ and a /d/ — a short, voiced event. Chapter 9 discusses in great depththe cases when this sound happens.
- **/n/:** Some sounds, such as /n/, are easy for beginning transcribers to work with because their sounds are easy to spot. You find /n/ in the words "*n*ice," "pa*n*," and "ho*n*or."
- **/s/ and /z/:** The fricatives are also relatively straightforward, as in /s/ found in "*s*ail," "ri*c*e," "re*c*eipt," and "fit*s*," and /z/ found in "*z*ipper," "fi*zz*," and "run*s*." But did you notice you can be fooled by spelling, as in "runs" which is spelled with an "s" butactually has a /z/ sound?
- **/ɹ/ and /l/:** These are two additional consonants made at the alveolar place of articulation. *Approximants* are sounds made by bringing the articulators together close enough to shape airflow but not so close that air is stopped or that friction is caused (check out Chapter 6).You can find the consonant /ɹ/ in the words "*r*ice," "ca*r*een," and "c*r*oak." Notice that this IPA symbol is like the letter "r," except turned upside down, because the right-side up IPA symbol, /r/, indicates a trilled (rolled) "r", as in the Spanish word "burro." Some phonetics textbooks incorrectly let you get away with transcribing English using /r/ instead of /ɹ/, but I recommend forming good habits and using /ɹ/ whenever possible!

Saying, "I'm chilling with phonetics" isn't completely inaccurate, because sucking in cool air while

holding the mouth position for any given consonant is an effective way to feel where your articulators are. Try it with the lateral alveolar consonant, /l/. Make the /l/ of the syllable "la," and hold the /l/ while sucking in air through your mouth. You should feel cool air around thesides of your tongue, showing that this is a *lateral* (made with the sides) sound. You may also notice a kind of Daffy Duck-like slurpy sound quality when you attempt it.

In the same column, under /ɹ/ you can see the symbol

/l/. You can make a lateral sound by passing air around the sides of the tongue, which is different than most sounds, which are *central,* with airflow passing through the middle of the vocal tract. The consonant /l/ is another interesting case that occupies two columns in the consonant chart for English — you can also find it inthe velar column.

There are actually two slightly different flavors of /l/:

- **Light /l/:** This one is produced at the alveolar ridge. You can always find the light l at the beginning of a syllable. It has a higher sounding pitch. Some examples include "*l*ight," "*l*eaf," and "*l*oad."
- **Dark /ɫ/:** This one is produced at the back of the tongue. The dark l, also called *velarized,* is marked with a tilde diacritic / ˜/ through its middle. The dark l occurs at the end of a syllable and sounds lower in pitch. Some examples include "waff*le*," "ful*l*," and "cal*l*."

Pulling back to the palate: Alveolars and palatals

The English *palato-alveolar* (or *post-alveolar*)

consonants consist of two manners of articulation:

- **Fricatives:** The *fricatives* are represented by the voiceless character "*esh"* or "long s." Words with this sound include "*sh*eep," "na*t*ion," "mi*ss*ion," "wa*sh*," and "*s*ure." The voiced counterpart, "*ezh"* or "long z," /ʒ/ is rarer in English, including words, such as "mea*s*ure," "lei*s*ure," "rou*g*e," and "deri*si*on." There are almost no cases of word-initial /ʒ/ sounds (except Zsa Zsa Gabor).
- **Affricates:** The *affricates* /ʧ/ and /ʤ/ are sounds that begin abruptly and then continue on a bit in hissy frication. Some examples of the voiceless /ʧ/ include "*ch*ip," "*ch*ocolate," "fea*t*ure," and "wa*tch*." When a person voices this sound, it's /ʤ/, as in "*G*eorge," "re*g*ion," "mi*dg*et," and "ju*dg*e." Again, if you have any problems knowing which is

voiced and which is voiceless, reach up and feel your Adam's apple to see whether you're buzzing or not.

The palatal consonant /j/ is interesting. You can find this sound in words, such as "*y*es," "*y*outh," and "*y*ellow." However, it also occurs in the words "*f*ew," "*cu*te," and "*mu*te." To see why, here's a minimal pair: /mut/ versus

/mjut/, "moot" versus "mute." You can see that "mute" begins with a palatalized /m/, having a palatal glide /j/ right after it. Slavic languages (like Russian and Polish) use palatalized consonants much more than English; in fact, when teaching English as a second language (ESL) to these speakers, breaking them of this habit can be quite a challenge.

Reaching way back to the velars and the glottis

Three additional stop consonants are in the velar column, the oral stops /k/ and /ɡ/, and the nasal stop /ŋ/.

Examples of /k/ include "*C*arl," "s*k*in," "e*x*cess," and "ra*ck*." Examples of /ɡ/ include "*g*irl," "a*gg*ravate," and "fo*g*." Notice that /ɡ/ corresponds with what some call "hard g," not a "soft g."

The last sound in the chart is what one might call "way down there." That is, the glottal fricative, /h/. Your *glottis* is simply a hole or space between your vocal folds in your throat. When you cause air to hiss there, you get an "h" sound, as in "*h*ello," "*h*ot," "*wh*o," and "a*h*a!" In Chapter 2,I discuss making a stop with your glottis (a *glottal stop*, / ʔ/) — however, you don't freely use this sound to make words in English; instead, it alternates and only appears under certain conditions. As such, glottal stop and flap are special sounds (called *allophones*) that aren't included in the main chart.

Visualizing the GAE vowels

English vowels are more difficult to describe than English consonants because they're produced with less precision of tongue positioning. Vowels differ systematically across major forms of English (such as American and British).

Between these two major dialects, one major difference is the presence or absence of *rhotacized* (r-colored) vowels. Whereas most GAE speakers would pronounce "brother" as /ˈbɹʌðɚ/, most British speakers pronounce it as / ˈbɹʌðə/. The difference is whether the final vowel has an r-like quality (such as /ɚ/) or not (/ə/). Refer to Chapters 7 and 18 for more information about American and British vowel differences. Vowels typically differ across the dialects within any given type of English. For example, within American English think of the difference between a talker from New York City and one from Atlanta, Georgia. In British English, one would expect differences between speakers from London (in the south) and Liverpool (in thenorth).

Figure 3-4 is a chart of the vowels most commonly foundin General American English (GAE).

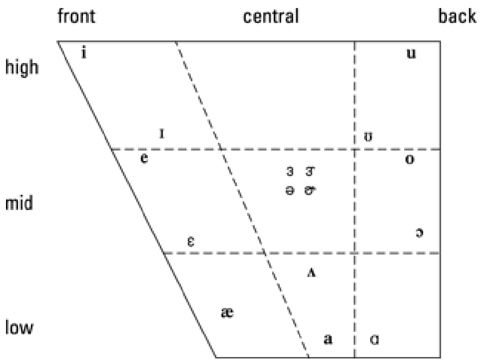


Figure 3-4: Vowels of General American English.

In Figure 3-4, I use the terms *high* and *low* in place of IPA *close* and *open*. To keep things simple, I also use "h_d" words, as examples to capture the typical vowels producedby speakers of General American English.

Starting with the front vowels, say "heed," "hid," "hayed," "head," and "had." These five words include examples of the front vowel series, from high to low. You can find the symbol /i/, lower case "i," in the words "fl*ee*ce," "p*ea*," and "k*ey*." A vowel slightly lower and more central is /ɪ/, "small capital I", as in the words "th*i*ck," "t*i*p," "*i*llustrate,"and "r*i*d."

Say that you're a speaker of English as a second language (ESL) and come from a language like Spanish that has

/a/, /i/, /u/, /e/, and /o/ vowels (but not /æ/, /ɪ/, /ʊ/, / ɛ/, and /ɔ/ vowels). I discuss more about these vowel differences in Chapter 7. For now, you may need to work a bit extra to be able to identify these English sounds. Using minimal pairs is a good way to sharpen up your ears!

My Fair Lady: Famous phonetics story with an important message

A world-famous story dealing with phonetics is the musical *My Fair Lady,* based on the play, *Pygmalion*, by George Bernard Shaw. In this drama, a British phonetician, Henry Higgins, teaches a lower-class flower girl, Eliza Doolittle, to switch from her Cockney accent to proper English. This saga is a satire of theBritish class system, a love story, and a taste of phonetics, all in one.

The goal of changing someone's accent is called *prescription* (judging what is correct). Today, linguists and phoneticians spend much less time *prescribing* how people should sound and more time *describing* how different languages and dialects do sound. There is still a market for foreign accent reduction, although a bit different than at the time of Eliza Doolittle. Also, as wonderful as the song is, clients aren't necessarily required to sing "The rain in Spain stays mainly in the plain." Refer to Chapter 1 for more information on prescribing and describing.

The symbol /e/ is a mid-front vowel, as in "s*ai*l," "*a*pe," and "l*a*zy. "You can find the symbol /ɛ/, *epsilon*, in the words "l*e*t," "sw*ea*ter," "t*e*ll," and "t*e*n." The low-front vowel, /æ/ is called *ash*. Phoneticians introduced this Old English Latin character into the IPA. To write an ash, follow the instructions in Figure 3-5.

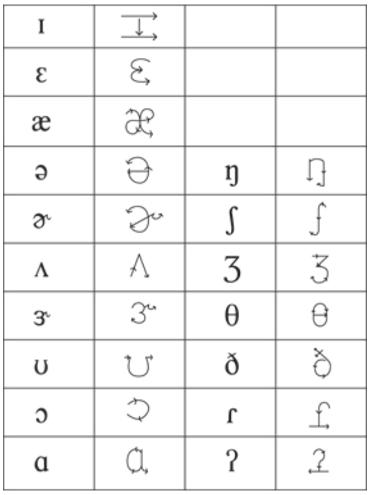


Figure 3-5: How to draw some of the common made-up IPA symbols.

To master the symbols for the GAE back vowels, say "who'd," "hood," "hoed," "hawed" (as in "hemmed and hawed"), and "hospital." (You can also say "hod," but few people know what a hod [coal scuttle] is anymore.) These words represent the back vowel series /u/, /ʊ/, /o/, /ɔ/, and /ɑ/, which I discuss here with some examples:

- **/u/:** You can find this high back vowel in the words "bl*ue*," "c*oo*l," and "ref*u*sal."
- **/ʊ/:** This symbol has a Greek name, *upsilon,* and you form it by taking a lower case u and placing small handles on it. You can find this sound in "p*u*ll," "b*oo*k,"and "w*ou*ld."
- **/o/:** The mid-back vowel can sometimes sound pretty much like it's spelled. You can find it in words, such as "t*oe*," "g*o*," "*ow*n," and "mel*o*dious."
- **/ɔ/:** This mid-low vowel is called *open-o* and is written like drawing a "c" backwards. You can find this vowel in the words "s*aw*," "b*a*ll," "*awe*," and "l*aw*," like most Americans pronounce.
- **/ɑ/:** You can find this low-back vowel, referred to as *script a,* in the words "f*a*ther," "psych*o*logy," and "h*o*nor."

You may have noticed a different flavor of the vowel "a,"in Figure 3-4, found slightly fronted to script a. This IPA

/a/, "lower case a," is used to indicate the beginning of the English diphthongs /aɪ/ and /aʊ/, as in "m*i*le" and "l*ou*d."

Why the IPA Trumps Spelling

When it comes to explaining language sounds, English spelling doesn't have the power or the precision to deal with the challenge because there is a loose relationship between English letters and language sounds. Therefore, a given sound can be spelled many different ways. Here are some famous examples:

- The word "ghoti" could logically be pronounced like "fish." That would be the "gh" of "enou*gh*," the "o" of "w*o*men," and the "ti" of "na*ti*on." Playwright and phonetician George Bernard Shaw pointed out this example.
- The vowel sound in the word "*ei*ght" (transcribed with the symbol /e/ in IPA) can be spelled "ay," "ea," "au," "ai," "ey," and "a (consonant) e" in English. If you don't believe this, say the words "day," "break," "gauge," "jail,""they," and "date."
- Many languages have sounds that can't be easily spelled. For instance, Zulu and Xhosa have a consonant that sounds like the clicking noise you make when encouraging a horse ("tsk-tsk") and another consonant that sounds like a quick kiss. Most world languages convey meaning by having some syllables sound higher in pitch than other syllables.

Chapter 5
Producing Speech: The How-To

In This Chapter

- Knowing how your body shapes sounds
- Getting a grounding in speech physiology
- Looking closer at speech production problems
- Seeing how scientists solve speech challenges

Understanding not only what parts of your body are involved in making speech is important, but also which mechanical and physiological processes are involved. That is, how do you produce speech? This chapter gives more information about the source of speech, addressing how high and low voices are produced, and how people shout, sing, and whisper. I provide many more details about how sounds are shaped, so that you can better understand the acoustics of speech (which I discuss more in Chapter 12). At the end of the chapter, you can compare your own experience of producing speech with current models of speech production, including those based on speech gestures and neural simulations.

Focusing on the Source: The VocalFolds

To have a better understanding of the source of the buzz for voiced sounds, you need to take a closer look at the vocal folds and the larynx. The *vocal folds* (also known as *vocal cords*) are small, muscular flaps located in your throat that allow you to speak, while the *larynx* (also known as the *voice box*) is the structure that houses the vocal folds. Refer to Chapter 2 for more background about general speech anatomy. For this discussion, Figure 4-1 gives you some details about the vocal folds and larynx.

The following sections explain some characteristics of vocal folds and how they work, including what they do during regular speech, whispering, loud speech, and singing.

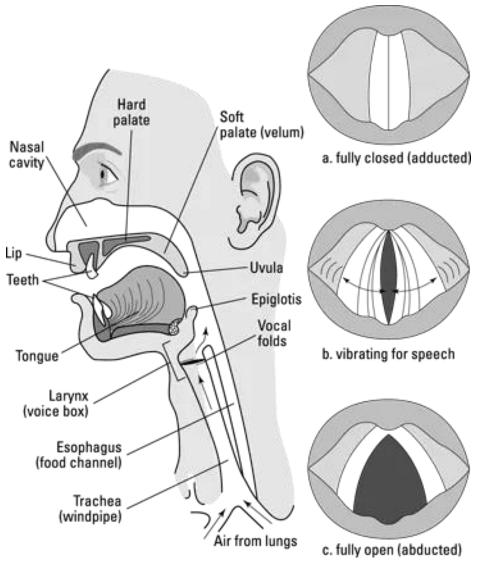


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Figure 4-1: A diagram of the vocal folds in the larynx: fully closed (adducted) (a), vibrating for speech (b), and fully opened (abducted) (c).

Examining the Bernoulli principle

Daniel Bernoulli (1700–1782) was a prolific scientist and member of the famous Bernoulli family (originally of Antwerp, then in the Spanish Netherlands), many of whom were scientists, mathematicians, and artists. Bernoulli is perhaps most known for his principle, which states that fluids in an area moving faster than the surrounding area possess less pressure. That is, the faster moving the fluid is, the lower the pressure. *Fluid* generally includes gases, such as air.

The Bernoulli principle can explain why if you're walking along the side of a road and a giant truck goes roaring past, you may feel sucked into the middle of the road in its wake. The truck creates a high-speed blast of fluid (air) pressure next to you, lowering the pressure. You're then pulled into that low-pressureminimum.

You can test this principle by taking two very light, aluminum cola cans and placing them about one to two inches apart on a bed of soda straws. If you then blow sharply between the cans using a straw (imitating the force of the giant truck), you can watch the cans be sucked inward into the low-pressure gradient.

The Bernoulli principle regulates vocal fold adduction by creatinga low-pressure zone that draws in the vocal folds. The forces drawtogether the vocal folds and the tracheal pressure pushes them apart. In this manner, the pulse chain of vocalization is sustained.

Identifying the attributes offolds

The vocal folds are an important part of your body that

can't be seen without a special instrument. Located deepin your throat, these small muscular flaps provide the buzzing source needed for voiced speech. Check out these important characteristics about vocal folds:

- The male vocal folds are between 17 and 25 millimeters long.
- The female vocal folds are between 12.5 and 17.5 millimeters long.
- The vocal folds are pearly white (because of scant blood circulation).
- The vocal folds are muscle (called the *thyroartyenoid* or *vocalis*), surrounded by a protective layer of mucous membrane.
- When the vocal fold muscles tighten, their vibratory properties change, raising the pitch.
- A person can possibly speak with just one vocal fold; however, people sound different than before. For example, Jack Klugman (who played Oscar in *The OddCouple*) had his right vocal fold surgically removed due to laryngeal cancer. To hear samples of his speech before and after, go to: minnesota.publicradio.org/display/web/2005/10/07_klugman/ and www.npr.org/templates/story/story.php?storyId=5226119.

Pulsating: Vocal folds at work

In order for the vocal folds to create speech, several steps must take place in the right order. Follow along with thesesteps and refer to Figure 4-2:

1. The vocal folds *adduct* (come together) enough that air pressure builds up beneath the larynx, creating tracheal pressure.The force of the ongoing airstream *abducts*

(brings away from each other) the vocal folds.

To keep straight the directions of abducting and adducting, remember that the glottis is basically a hole

(or an absence). Thus, abducting the glottis creates a space, where as adducting means bringing the vocal foldstogether.

2. The ongoing airstream also keeps the vocal folds partially adducted (closed) because of the Bernoulli principle.

The Bernoulli principle states that fast moving fluids (gases) create a sort of vacuum that may draw objectsinto its wake. Refer to the nearby sidebar for more information about this property.

3. The vocal folds flutter, with the bottom part of each fold leading the top part.

4. Under the right conditions, this rhythmic pattern continues, creating glottal *pulses* of air, a series of steady puffs of sound waves.

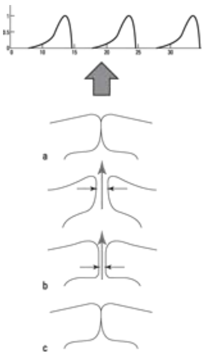

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Figure 4-2: How the vocal folds produce voicing for speech.

The faster the pulses come means the higher the *fundamental frequency* (rate of pulses per second). Fundamental frequency is heard as *pitch* (how high or low a sound appears to be). The way your body regulates fundamental frequency is to adjust the lengthand tension of the vocal folds. A muscle called the *cricothyroid* raises pitch by rocking the thyroid cartilage against the *cricoid* cartilage (which is ringlike), elongating the vocal folds. When the vocal folds are stretched thin, they vibrate more rapidly. For instance, strong contraction of the cricothyroid muscle gives voice a falsetto register (like the singer Tiny Tim).

If you wish to try your own cricothyroid rocking experiment, put your thumb and forefinger over your

cricothyroid region (see Figure 4-3) and sustain the vowel /i/. If you jiggle your fingers in and out (not toohard), you can cause rocking on the cricothyroid jointand create a slight pitch flutter.

The vibrating vocal folds are commonly viewed using an instrument called an *endoscope*, a device that uses fiber optics to take video images during speech and breathing. Endoscopy images can either be taken using a rigid wand placed through the mouth at the back of the throat (*rigid endoscopy*) or via a thin, flexible light-pipe fed through the nostril down just over the larynx (*flexible endoscopy*). Strobe light can be pulsed at different speeds to freeze- frame the beating vocal folds, resulting in stunning images. To see videos of the vocal folds during speech taken at different fundamental frequencies of phonation, see http://voicedoctor.net/videos/stroboscopy-rigid-normal- female-vocal-cords-glide and www.youtube.com/watch?v=M9FEVUa5YXI.

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Figure 4-3: Two fingers placed over cricothyroid region for rocking experiment.

Here are some important facts about the buzzing you do for speech:

- During speech, roughly half of the consonants you produce and all of the vowels are voiced.
- The vocal folds are drawn tight.
- There is more of an opening at the posterior portion than the front.
- Men's vocal folds vibrate on average 120 times per second.
- Women and children's vocal folds vibrate at a higher frequency than those of men (due to smaller size). On average, women's vocal folds beat 220 times per second, while children's beat around 270 cycles per second.

Figure 4-4 shows the vocal folds during voiced speech (Figure 4-4a) and whispered speech (Figure 4-4b). These sections also examine what your vocal folds specifically do when you yell and sing.

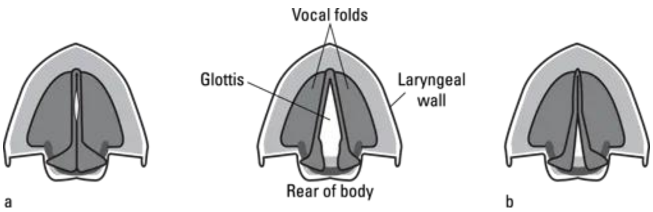

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Figure 4-4: What a glottis does during voiced speech and whispering.

Whispering

Opening the glottis somewhat, which allows air to flow out while creating friction, creates whispered speech (refer to Figure 4-4b). This process is similar to what creates the voiceless fricative consonant "h" as in "*h*ello" (/h/ in IPA).

There is no language where people whisper instead of talking because whispered speech isn't as understandable as spoken language; it's simply not as loud or clear.

However some languages mix whispering with regular voiced speech in a special way to produce a distinctive feature called *breathiness* that can change meaning. For instance, if you're visiting Gujurat, India, and wish to visit a "palace" (a word pronounced in Gujurati with breathy voice), you don't want to use the word for "dirt," which is the same word pronounced without breathiness. Refer to Chapter 15 for more information.

Talking loudly

Your breathing system (including your lungs and trachea), your larynx, and the neck, nose, and throat regulate speech volume. The more air is passed through the glottis (for instance, at higher tracheal pressures), the higher the air pressure of the voice. Raising the resistance of the upper airway, by reducing the size of the glottis and not letting air escape needlessly, can also increase the pressure. In addition, opening the pharynx and oral cavityto greater air volumes increases resonance and allows sound to flow less impeded. This opening of the pharynx and oral cavity can include elevating the velum, lowering the jaw/tongue, and opening the mouth.

Being loud and proud

Who is the loudest person in the world? When scientists chart how loud someone is, they usually measure the lowest and highest sound pressure that can be registered at a certain fundamental frequency. Researchers have converted this sound to a likely heard (perceptible) value with a formula. They chart these sounds with sound pressure levels in decibels (dB) on the vertical axis and fundamental frequency on the horizontal axis. In general, people tend to produce lower sound pressure levels with lower frequency sounds and higher pressures with higher frequency sounds. The cutoff for the highest sounds appears to bearound 109 dB.

However, some reports of various contests worldwide claim individuals have topped the norm. For years, the record belonged to Simon Robinson, who reached an epic 128 dBs at a distance of 8 feet, 2 inches during a competition in Adelaide, Australia. More recently, Jill Drake, a 52-year-old teaching assistant in Kent, England, broke the record with a 129 dB shout, approximately the same level as a jackhammer.

Children may take time to develop the *sensorimotor* (body-sensing) systems necessary to regulate voice volume during speech. For instance, child language researchers report (anecdotally) that young children can have difficulty in adjusting their volume in speaking tasks;they tend to be quiet or loud without gradations in between, which may also explain why children have trouble speaking with their "inside" voice.

Too much loud speech can damage the vocal folds; voice clinicians work on a daily basis by assigning warm-up exercises, periods of rest, hydration, and other relaxation tips to help reduce stress and strain on the professionalvoice.

Singing

Singing is a part of musical traditions throughout the world. When you listen to other languages, they can sometimes sound melodic or a bit like singing. However, in other ways the sounds of a foreign language are clearly different from the sounds of someone singing. Although speech and singing research show the two are closely linked, they do have interesting differences in terms of vocal production.

English speakers make more voiced sounds during singing (around 90 percent) than during speech (around 40 percent). People usually sing from a pre-defined score or memorized body of material, with the goal of more than just the communication of words but also to convey emotion, intent, and a certain sound quality. As such, sung *articulatory gestures* (lip, jaw, and tongue movements) are generally exaggerated, compared to everyday speech.

An interesting clue about the kind of information people can include in the sung voice comes from studying the voices of opera singers. Johan Sundberg, a professor at the University of London, has conducted extensive research into the acoustics of singing. In a number of famous studies, he developed the idea of the *singing*

formant, an additional resonant peak (at around 4 to 5 kHz), which results from lowering the larynx. This peak has the effect of making the sung voice stand out from a background of orchestral music. See Chapter 12 for more information on formants and resonant peaks.Other kinds of sung voice exist besides opera, including gravelly or rough voices, used in genres such as folk, blues, and rock. In ongoing studies, researchers are investigating what is at the core of these types of sung voices, even going so far as to study ugly voice (that maymake bad singers *not* sound good).

The quest to replace vocal folds

The precious half-inch to three-quarters inch strips of muscular tissue in your throat that allow you to make voiced sounds usually last a lifetime. But what if something goes wrong?

Cancers, infections, and surgical complications, as well as stomach acids, reflux, and general wear and tear (especially in professional singers) can cause these tissues to malfunction.

Doctors usually noninvasively treat minor problems, whereas in cases of paralysis from surgical complications or for individuals with *laryngectomies* (whole or partial vocal fold removal) scientists are looking at the following ways of replacement and repair.

Vibrating gels: One exciting avenue focuses on developing gels that vibrate with approximately the same characteristics as the vocal folds. For instance, Dr. Robert Langer and colleagues at Harvard University and MIT are working on gel-like materials that vibrate at around 200 Hz (similar to a female voice) when stimulated with the same amount of air pressure that would normally be exerted at a human glottis. Individuals missing vocal fold function would receive gel injections to boost vibrations.

Vocal fold augmentations: In cases of individuals with unilateral paralysis or vocal fold atrophy, surgeons are perfecting vocal fold *augmentation* (increasing, enhancing, or enlarging) techniques. For many years, doctors have preferred injecting Teflon into shrunken or missing parts of vocal folds. However, more recently surgeons are using living tissue because it leads to regeneration of vocal fold tissue. In this procedure, surgeons harvest a small amount of fat cells and connective tissue from the patient's own thigh and inject theminto the affected vocal fold.

Human larynx transplants: A third exciting avenue is to transplant an entire human larynx for individuals with total laryngectomies. A first transplant was attempted in 1998 at the Cleveland Clinic, restoring the voice of Timothy Hediler after a motorcycle accident. He spoke normally for the first eight years after the transplant, but later he experienced some swelling in his vocal cords that made his voice sound a bit breathy and froggy. Despite that, doctors said his quality of life improved.

In 2011, surgeons at UC Davis, headed by Dr. Peter Belafsky, transplanted a larynx into 52-year-old Brenda Jensen, who had damaged her vocal cords after repeatedly pulling out a breathing tube while under sedation in the hospital. The operation lasted 18 hours over two days, performed by doctors who had trained two years for the procedure. Surgeons replaced her larynx, windpipe, and thyroid gland with that of a donor who died in an accident. In numerous appearances after the operation, she reported being able to speak with "her own voice."

Recognizing the FixedArticulators

The bedrock of your speech anatomy is your skull. This includes your teeth, the bony (alveolar) ridge that contains the teeth, and the hard palate, just behind the teeth. Before examining the moving organs that shape speech (most notably, the tongue), I focus on the key regions where speech sounds are made. This section givesspecial attention to *compensatory* (or counterbalancing) effects that these fixed structures may have on other partsof your speaking anatomy.

Chomping at the bit: The teeth

You're born with no visible teeth, just tiny indentations. You grow 20 baby teeth by about age 2½ and then shed them and grow a set of about 32 permanent teeth by about 14 to 18 years of age. Besides providing employment for the Tooth Fairy (and your dentist), research shows that your teeth (officially known as *dentition*) may have mixed effects on speech.

A couple ways that teeth can affect speech include the following:

- **Compensatory articulation:** People show compensatory articulation when they speak.

  Compensatory articulation means that a talker can produce a sound in more than one way. If one way of producing a sound isn't possible, another way can be used. Shedding *deciduous teeth* (also referred to as *baby teeth* or *milk teeth*) can cause speech errors, particularly with front vowels and fricatives. However, such complications are usually temporary and people normally overcome them.

  For instance, you ordinarily produce the fricative /s/ by creating a hissing against the alveolar ridge and having the escaping air shaped by your front teeth. However, if you shed your front teeth at age 8, you may hiss with air compressed slightly behind the alveolar ridge, while using a somewhat more lateral escape. This "s" may sound rather funny, but most listeners would get the general idea of what you're saying. Chapter 14 provides more information on compensatory articulation.
- **Jaw position:** A more serious type of effect that the teeth may have on speech is through their indirect effect on jaw position. The teeth and jaw form a relationship called *occlusion*, more commonly known as the *bite type*. In other words, occlusion is the relation between your upper jaw (the *maxilla*) and your lower jaw (the *mandible*). See the section "Clenching and releasing: The jaw" later in this chapter.

Sounds made at the teeth in English include the interdental fricative consonants (voiceless /θ/ and voiced /ð/), as well as the labiodental fricative consonants (voiceless /f/ and voiced /v/). British, South African, Australian, and other varieties of English produce many dental "t" and "d" sounds (see Chapter 18), whereas General American and Canadian English accents use glottal stop /ʔ/, alveolar flap /ɾ/, and alveolar /t/ or /d/.

Imaging the palate: Then and now

Phoneticians have long used the hard palate as a region to take interesting images of speech articulation. Daniel Jones (a key British phonetician who inspired *Pygmalion* and *My Fair Lady*) observed the place of articulation for lingual consonants. First, he had the patient open his mouth. Next, he would blow out a (short) candle and quickly place this in the patient's mouth, blackening the palate with candle soot. He then had the patient articulate, for instance with /ɑsɑ/. Finally, he inserted a mirror and observed. He identified a mark where the patient's wet tongue had touched the candle soot, revealing an image of the place of articulation on the palatal surface.

The technologies of electropalatography (EPG) and electro- optical palatography use a similar approach today. Such patients are taught to read a visual display and then to emulate contact patterns produced by a therapist. In EPG, the speaker wears a custom-made artificial palate (like a dentist's retainer). The artificial palate contains numerous contact-sensitive electrodes that are activated when touched by the tongue. In this manner, phoneticians can use EPG to record patterns of tongue contact during speech, which can be useful for recording consonant production. Scientists have used this technology to learn about speech motor planning and control. For instance, coarticulation of the tongue in different vowel environments has been described with the help of EPG. Clinicians have used EPG to provide real- time speech feedback to a variety of populations, including children with cleft palate, children with Down syndrome, children who are deaf, children with cochlear implants, children with cerebral palsy, adults with Parkinson's disease, and adults with speech apraxia.

Electro-optical palatography is a less common technique where a patient wears an artificial palate that contains optical reflective sensors. These sensors act like tiny video cameras that track the tongue, not by sensing, but by imaging. Electro-optical palatography systems can track not only consonants, but also vowels. Although these systems are still in early stages of development, one day a speech scientist or speech language pathologist may simply ask the patient to pop in a retainer and an image of the tongue, shot from the roof of the patient's mouth, will appear on screen.

Making consonants: Thealveolar ridge

Phoneticians are concerned with the upper alveolar ridge, the bump on the roof of your mouth between the upper teeth and the hard palate, because it's where many consonants are made. Examples of alveolar consonants in English are, for instance, /t/, /d/, /s/, /z/, /n/, /ɹ/, and

/l/ like in the words "*t*oday," "*d*ime," "*s*oap," "*z*oo," "*n*ice," "*r*ose," and "*l*augh." Refer to Chapter 6 for more details.

Aiding eating and talking: Thehard palate

The *hard palate* is the front part of the top of your mouth,

covering the region in between the arch formed by the upper teeth. It's referred to as hard because of its underlying bones, the skull's *palatine bones*. Take a moment to feel your hard palate — run your tongue alongit. It should feel, well, hard. You should also feel ridges onit, called *rugae*. These ridges help move food backwards toward the throat.

The hard palate is an essential part of your body for eating and talking (although not at the same time).

English sounds made at the hard palate include /j/, /

ʃ/, and /ʒ/, as in "*y*ou," "*sh*ale," and "mea*s*ure."

Palate shape can have an effect on speech. Recent work by Professor Yana Yunusova and colleagues at the University of Toronto have shown that individuals with very high (domed) palates produce very different articulatory patterns for vowels and consonants than individuals with flat and wide palate shapes. Nevertheless, both sets of talkers can produce understandable vowels.

Some individuals have birth defects called *cleft palate*. These disorders result in extreme changes in hard (and soft) palate shape caused by an opening between the mouth and nasal passage. The effect on speech is called *velopharyngeal-nasal dysfunction*, a problem between making oral and nasal closures for speech (refer to the later section, "Eyeing the soft palate and uvula: Velum" for more information).

Locating the hidden hyoid

The *hyoid,* named after the letter *upsilon* because it is u-shaped, is the only bone in the body not connected directly to other bones. It sits right below your tongue and jaw, above the thyroid cartilage and the larynx. Your hyoid isn't really a speech articulator; instead it's an important point of attachment (an anchoring) for the speech muscles of the tongue, larynx, and pharynx to hold onto.

On a somewhat grisly note, the hyoid bone is a telltale sign of strangling used in forensics. When a person is strangled, the hyoid becomes highly compressed and changes shape. This distortion indicates strangling.

Until recently, no ancient hyoid bones were found of human ancestors or related homonids. However, in 1989 archeologists found a Neanderthal specimen in a cave in Kebara, Israel, that had a remarkably modern-looking hyoid. This discovery led some archeologists to conclude that Neanderthal was capable of modern speech and language because this modern hyoid suggested a descended larynx, while other scientists countered that hyoid shape doesn't determine larynx position.

Eyeing the Movable Articulators

A great deal of speech lies in the movement of your articulators. For this reason, I like to refer to the "dance of speech." Speech movements are quick, precise, and fluid

— like a good dancer. To speak, you need a plan, but you can't follow it too tightly; instead, the movements are flowing, overlapped, and coordinated. Everything comes together by sticking to a rhythm. These sections focus on those parts of the body that accomplish this amazing speech dance.

Wagging: The tongue

The tongue is the primary moving articulator. In fact, it's quite active in a wide range of activities. The tongue can stick out, pull in, move to the sides and middle, curl, point, lick, flick up and down, bulge, groove, flatten, and do many other things. You use it for eating, drinking, tasting, cleaning the teeth, speaking, and singing (and even kissing).

It's a large mass or muscle tissue; the average length of the human tongue from the *oropharynx* (top part of the throat) to the tip is 10 centimeters (4 inches). The average weight of the adult male tongue is 70 grams, whereas a female's is 60 grams.

The size of a newborn's tongue pretty much fills the oral cavity, with the tongue descending into the pharyngeal cavity with maturation. The tongue develops, along with the rest of the vocal tract, through childhood and reaches its adult size at around age 16.

Although the tongue may look like it's moving really fast, typical speech movements actually aren't as fast as, say a human running. They're on the order of centimeters per second, or around a mile per hour. However, it's the astounding coordination of these tongue movements as sound segments are planned and blended that is hard to fathom.

Researchers continue to study how such movements are planned and produced. Direct study of tongue

movement in a number of languages has suggested that much of the variance in tongue shapes falls into two main categories:

- **Front raising:** The tongue moves along a high-front to a low-back axis.
- **Back raising:** The tongue bunches along a high-back to low-front axis.

However, this basic explanation doesn't fit all sounds in all contexts, and researchers are continuing to search for better models to describe the complexity of tongue movement during speech.

Many people make the mistake of underestimating the tongue's size and shape, based on observing their own tongue in a mirror. Doing so is a mistake because the image of one's own tongue only shows the tip (or *apex*) and blade, just a small part of the entire tongue itself. In fact, most of the tongue is humped, which you can't see in a mirror. The tongue, except for a thin covering, is almost entirely muscle. Figure 4-5 shows its structure.

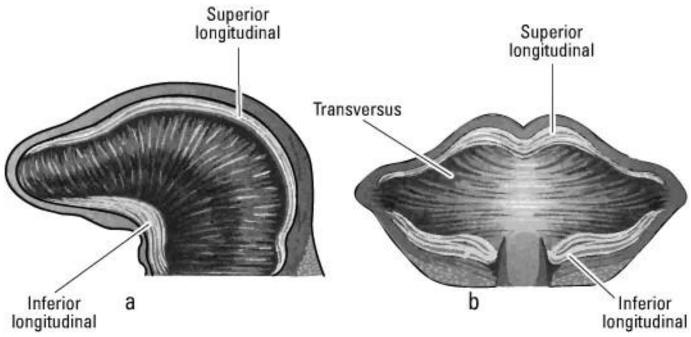

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Figure 4-5: A tongue's intrinsic muscles from a side view (a) and front (b) view.

Figure 4-5 shows that the tongue consists of four muscles, called *intrinsic* muscles (inside muscles) that run in different directions. These four muscles are the *superior longitudinal, inferior longitudinal, verticalis,* and *transversus*. When these muscles contract in different combinations, the tongue is capable of numerous shapes.

Extrinsic muscles, which are outside muscles, connect the tongue to other parts of the body. These muscles (refer to Figure 4-6) position the tongue. The extrinsic muscles are the *genioglossus, hyoglossus, styloglossus,* and *palatoglossus*. The names of these muscles can help you understand their functions. For instance, the hyoglossus (which literally means "hyoid to tongue") when contracted pulls the tongue down toward the hyoid bone in the neck, lowering and backing the tongue body.

Your tongue is the one part of your body most like an elephant because the tongue is a *muscular hydrostat*, like an elephant's trunk. A hydrostat is a muscular structure (without bones) that is incompressible and can be used for various purposes. When the tongue extends, it gets skinnier. When it withdraws, it gets fatter. Think elephant trunk, snake tongue, or squid tentacles.

By the way, creating a tongue from scratch isn't easy. To see some of the latest attempts in silicon modeling of the tongue conducted by researchers in Japan, refer to the bonus online Part of Tens chapter at www.dummies.com/extras/phonetics.

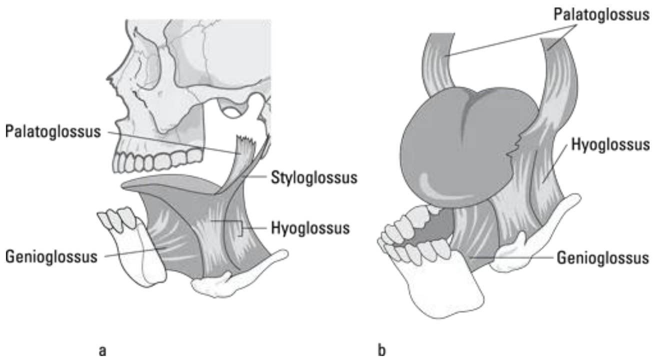

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Figure 4-6: The tongue's extrinsic muscles from a side view (a) and an oblique view (b).

More than just for licking: Thelips

The lips comprise the *orbicularis oris* muscle, a complex

of muscles that originate on the surface of the jaws and insert into the margin of the lip membrane and chin muscles. The lips act to narrow the mouth opening, purse the opening, and pucker the edges. This muscle is also responsible for closing the mouth. The lips act like a sphincter but the lips comprise four different muscle groups, therefore the lips aren't a true sphincter muscle.

In English, the lips are an important place of articulation for the bilabial stop consonants /p/, /b/, and /m/, for the labiodental fricatives /f/ and /v/, and for the labiovelar approximants /w/ and /ʍ/.

Your lips are important in contributing to the characteristics of many vowels in English, for instance

— /u/, /ʊ/, /o/, and /ɔ/. When you form these vowels, lip rounding serves as a *descriptive*, but not a *distinctive* feature. That is, when your lips form the features of these four vowels in English, this lip rounding doesn't distinguish these four from any otherset that doesn't have lip rounding. Another descriptive feature example is the English vowel /i/, made with lips spread. Acoustically, spread lips have the effect of acting like a horn on the end of a brass instrument, brightening up the sound. In this case, lip spread, not lip rounding, is a descriptive feature for /i/.

In languages with phonemic lip rounding, the planning processes for lip protrusion are generally more extensive and precise than those in English (check out Chapter 6 for more information).

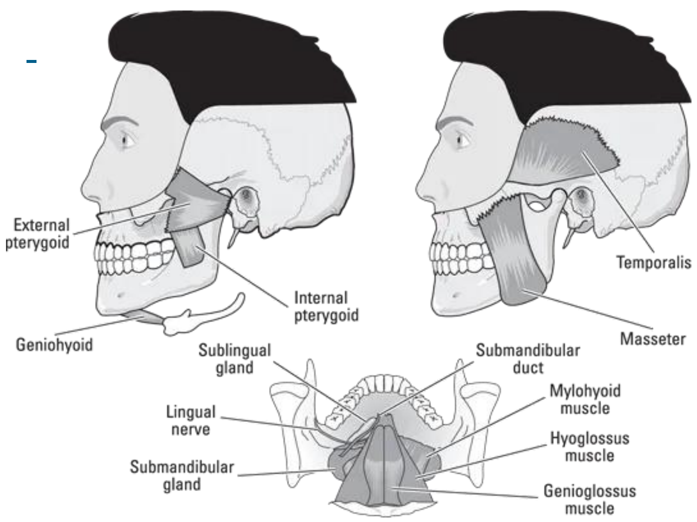
Clenching and releasing: Thejaw

The jaw, also known as the mandible, is a part of your body that seems to drive scientists crazy. It is distinct shape-wise from the rest of your body both in terms of its proportions and specific anatomical features.

The jaw keeps its shape as it grows with the body throughout maturation. In fact, it's the only bone in the body to do so. The jaw is a moving articulator that is involved in speech, primarily as a platform for the tongue. Recent studies have also suggested that people can voluntarily control jaw stiffness, which can be useful when producing fine-tuned sounds, such as fricatives, where the tongue must be precisely heldagainst the palate.

Jaw movement for speech is rather different than jaw movement for other functions, such as chewing or swallowing. Researchers see somewhat different patterns in the movement of the jaw if a subject reads or eats, with speech showing less rhythmic, low-amplitude movements.

The jaw consists of a large curved bone with two perpendicular processes (called *rami*, or branches) that rise up to meet the skull. The lower section contains the chin (or *mental protuberance*) and holds the teeth. Figure4-7 shows the anatomical view of a jaw.



Wiley, Composition Services Graphics

Figure 4-7: A jaw and its muscles.

The rami meet the skull at the *temporomandibular joint (TMJ)*. The jaw has two TMJ (one on each side of the skull) that work in unison. These complex joints allow a hinge-like motion, a sliding motion, and a sideways motion of the jaw. You may have heard of TMJ because of *TMJ disorder*, a condition in which the TMJ joint can be painful and audibly pop or click during certain movements.

A series of muscles, known as the *muscles of mastication,* move the jaw. These muscles include the *masseter, temporalis, and internal pterygoid* (all of which raise the jaw), and the *external pterygoid, anterior belly of digastric* (not shown in the figure)*, mylohyoid,* and *geniohoid* (all of which lower the jaw). Look at Figure 4-7to see these muscles.

Eyeing the soft palate and uvula: The velum

You find the velum, which consists of the soft palate and

uvula, behind your hard palate (see Figure 4-1). *Velum* means *curtain* and is a hanging flap in the back of the roofof the mouth. The soft palate is called "soft" because it has cartilage underlying it, instead of bone, and the *uvula* (the structure at the back of the velum that hangs down in the throat; refer to the next section for more details). You can feel this difference if you probe this part of your palate with your tongue. The uvula is a structure used for consonant articulations (such as trills) in some languages.

The velum is an important place of articulation for many English speech sounds, including /k/, /ɡ/, /ŋ/, /ɫ/, and /w/, as in the words "*k*ick," "*g*host," "ri*ng*,"

"pi*ll*," and "*w*et".

Like the tongue, the velum is highly coordinated and capable of quick and fine-tuned movements. An important velar function is to open and close the

velopharyngeal port (also known as the *nasal port*), the airway passage to the nasal cavity. This function is necessary because most speech sounds are non-nasal, so it's important that most air not flow out the nose duringspeech.

Both passive and active forces move the velum:

Passive: The velum is acted on by gravity and airflow. **Active:** A series of five muscles move the velum in different directions. The five muscles are *palatal levator, palatal tenser, uvulus, glossopalatine,* and *pharyngopalatine.*

The path of the velum moving up and down during speech is fascinating to watch (look at www.utdallas.edu/~wkatz/PFD/phon_movies.html). The moving velum has a hooked shape with a dimple in the bottom as it lifts to close the nasal port. Every time you make a non-nasal oral sound, you subconsciously move your velum in this way. When a nasal is made, however, as in /ɑnɑ/, your velum moves forward and down, allowing air passage into the nasal cavity.

The velum actually doesn't act alone. Typically, the sides and the back wall of the *pharnyx* (the back of your throat) participate with the closure to form a flap-like sphincter motion. Different people seem to make this closure in slightly different ways.

Going for the grapes: The uvula

The uvula (which means "bunch of grapes") hangs down in the back of the throat. It's that part that cartoonists love to draw! This region of the velum has a rather rich blood supply, leading anatomists to suspect that it may have some cooling function. In terms of speech, some languages use this part of the body to make trills or fricatives (flip to Chapter 16 for additional information).However, English doesn't have uvular sounds.

Pondering Speech Production with Models

Ordinary conversational speech involves relaying about 12 to 18 meaningful bits of sound (technically referred to as *phonemes*) per second. In fast speech, this rate is easily doubled. Such rates are much faster than anyone can type on a keyboard or tap out on a cell phone.

In order for you to produce speech, your mind sends ideas to your mouth at lightning speed. According to Professor Joseph Perkell of MIT, approximately 50 muscles governing vocal tract movement are typically coordinated to permit speaking, so that you can be understood. And this estimate of 50 muscles, by the way, doesn't even include the muscles of the respiratory system that are alsoinvolved.

You must coordinate all these muscles for speech without requiring too much effort or concentration so that you can complete other everyday tasks, such as tracking your conversation, walking around, and so on.

Being able to understand healthy speech production is important so that clinicians can better assist individuals with disordered or delayed speech processes. To grasp how people can accomplish this feat of talking, scientists make observations and build models. The following sections examine some of these different models.

Models are essential to science

A *model* is a visual representation, whether physical or mathematical, that helps scientists study something in more depth. In particular, it allows scientists to test *hypotheses* about *theories*. A *theory* is a general set of underlying principles and assumptions concerning the natural world that has arisen from repeated observations and testing. A *hypothesis* is a specific, testable prediction about what you would expect to happen, given a certain theory.

For example, a phonetician wishes to test the hypothesis that children boost vowel intelligibility by varying their fundamental frequency to a greater extent than adults. This hypothesis follows from the source-filter theory of speech production. Phoneticians can generate a statistical model of the vocal tract and compare findings for children and adults.

Ordering sounds, from mind tomouth

Speech is the predominant channel people use to relay

language. Other channels include reading/writing, and sign language. Because speech sounds don't hang around for anyone to see like written communication, the order in which sounds are produced is critical.

Speech sounds aren't strung together like beads on a string; the planned sounds blend and interweave by the time they reach the final output stage by a principle called *coarticulation*. Two main types of coarticulation, which are as follows, affect sound production:

- **Anticipatory:** Also referred to as *look-ahead* or *right-to-left coarticulation,* it measures how a talker prepares for an upcoming sound during the production of a current sound. It's considered a measure of speech planning and shows many language-specific properties.
- **Perseverative:** Also referred to as *carry-over* or *left-to-right coarticulation,* it describes the effects of a previously made sound that continue onto the present sound. Think of a nagging mother-in-law who is still sticking around when she shouldn't be there any more. *Perseverative coarticulation* measures the physical properties of the articulators, or in other words how quickly they can be set to move or stop after being set into motion. For example, if you say "I said *he* again," the breathiness of the /h/ will carry over into the vowel

  /i/. Such breathiness doesn't carry over from a preceding sound that isn't breathy, such as the /b/ in the word "*b*ee" (/bi/ in IPA).

All people coarticulate naturally while they speak, in both anticipatory and perseverative directions. Refer to Chapter 6 for more on coarticulation.

Speech is also redundant, meaning that information is relayed based on more than one type of clue. For example, when you make the consonant /p/ in the word "*p*et," you're letting the listener know it's a /p/ (and not a /b/) by encoding many types of acoustic clues, based on frequency and timing (refer to Chapters 15 and 16 for more specifics). In this way, humans are quite different than computers. Humans usually include many types of information in speech and language codes before letting a listener get the idea that a distinction has been made.

Controlling degrees of freedom

To understand how speech is produced, researchers have long tried to build speech systems and have often been humbled by the ways in which these approaches have come up lacking. The *degrees of freedom* problem, which is that many muscles fire in a complex order to produce speech, is so difficult that scientists have tried to make some sense of it.

Because speech science researchers have known for quite some time about basic speech anatomy, they have searched for muscle-by-muscle coordination of speech.

Scientists first hoped that by studying a single muscle (or small group of muscles) they could explain in a simple fashion how speech was organized. Electrodes were available for recording muscle activity, and scientists hoped that by charting the time course of muscle activation, they could get a better idea of how speech was planned and regulated. For instance, they searched for the pulse trains involved in stimulating the *orbicularis oris,* the facial muscles, the respiratory muscles, the intrinsic lingual muscles, the extrinsic lingual muscles, and so on in a certain order. They presumed that the brain's neural structures coordinated all the steps.

However, the data instead suggested that speech is much more complex. There are too many processes for the brain to regulate centrally, and the brain doesn't trigger muscles in a sequential, one-by-one fashion.

This degrees of freedom problem is ongoing in speech science. For this reason, scientists have abandoned the view that individual muscle actions are programmed in running speech on a one-by-one basis. Instead, researchers have taken other steps, building models that are organized more functionally, along coordinative structures or gestures. Researchers have tried to re-createhow these processes happen, either in a mathematical model, in a graphic simulation (such as an avatar), in a mechanical robot, or in a computerized neural model.

In models, scientists describe trade-offs between sets of muscles to achieve a common function such as lip closure.These muscles are hierarchically related such that a speech-planning mechanism only need trigger a function such as *elevate lip*, which would trigger a whole complex of muscles in the face, lips, and jaw. Scientists have found much evidence for this type of *synergistic* (working together for an enhanced effect) model. For instance, lip- closing muscles do work in synergy with the muscles of the face and jaw; if some muscles are interrupted in function, others take over. Thinking the body has some type of central executive that needs to plan each muscle's activity (on an individual basis) just doesn't make sense.

Trying to map speech

At some level, researchers hope to connect the lofty world of language (say, thinking of the lines of a Shakespeare play) and actually *saying* some of these words in the messy reality of speech, motor control, acoustics, and perception. This problem clearly isn't easy to solve. If it were, society would already have convincing talking robots or computers without keyboards that people could chat with like any other person.

In early work on this problem, linguists assumed that the same divisions used to describe language (words, syllables, morphemes, consonants and vowels, and features) naturally mapped to speech goals. As a starting point, researchers thought the process was basically linear, from start to finish. According to this view, speech would be accomplished with a left to right readout, having a short-term buffer that allowed for syllables.

Mounting evidence shows that speech isn't produced in such a linear fashion and that linguistic concepts aren't generally adequate for describing the complexity of speaking. For instance, the /dʒ/ in "*J*erry" is realized by placing the tongue against the alveolar ridge and releasing into a post-alveolar fricative while voicing. This physical action requires dozens of muscle sets in the vocal tract, plus respiratory muscles. Somehow, labeling this sound as another linguistic feature doesn't seem to satisfy many researchers that the process is really being explained.

Feeding forward, feeding back

Scientists assume that people speak by mapping information from higher to lower processing levels, which is called *feed-forward processing*. You start with a concept, find the word (*lexical selection*), map the word into its speech sounds (phonemes), and finally output a string of spoken speech. In feed-forward processing, information flows without needing to loop back. In terms of speech production, feed-forward mechanisms include your knowledge of English, your years of practice speaking and moving your articulators, and the automatic processes used to produce speech. This overlearned aspectof speech makes its production effortless under ordinary conditions. Feed-forward processing is rapid because it doesn't require a time delay such as feed-back processing.

However, you also need feedback processes; you don't talk in a vacuum. You hear yourself talk and use this information to adjust your volume and rate. You also sense the position of lips, tongue, jaw, and velum. You, along with nearly everyone else, use this type of feedback to adjust your ongoing speech.

People can rely on auditory feedback to make adjustments. For example, if you're at a party where the background sound is loud, you'll probably start speaking louder automatically. If suddenly the sound drops, you can lower your volume. You also hear the sound of your voice through the bones of your skull, which is called *boneconduction*. For this reason, when you hear your voice audio-recorded, you sound different, often tinnier.

In terms of articulatory feedback, a visit to the dentist can provide some insight. Numbing the tongue with anesthetic reduces articulatory feedback and compromises the production of certain sounds.

A good way to visualize the process is to imagine a house thermostat. A simple, old-fashioned version will wait until your room gets too cold in the winter before kicking on the heat. When the room gets too hot, the thermostat kicks it off. This is feedback — accurate, but time consuming, clunky (and not really smart). Some people have smarter thermostats that incorporate feed-forward information. You can set such a thermostat, for example to turn down the heat when you're away during the day or asleep at night (ahead of time) and then adjust it back to comfortable levels when you're home or active again.

Coming Up with Solutions and Explanations

Understanding speech production is one of the great scientific challenges of this century. Scientists are using a variety of approaches to understand how speech is produced, including systems that allow for precise timing of speech gestures and computational models that incorporate brain bases for speech production. This section gives you a taste of these recent approaches.

Keeping a gestural score

Figuring out how speech can be controlled is important, but it still doesn't solve the problem of degrees of freedom, or basically how 50 or so odd sets of muscles coordinate during fluent speech.

In 1986, researchers at Haskins Laboratory proposed to track speech according to a gestural score, which other researchers have modeled. With a *gestural score,* for a word in the mind to be finally realized as speech, you begin with a series of articulatory gestures. They include adjustments to your speech anatomy such as lip protrusion, velar lowering, tongue tip and body positioning, and adjustment of glottal width. Each gesture is then considered a sequence within an articulatory score (much like different measures might be thought to be parts of a musical composition). However, in this model the articulatory gestures have time frames expressed as

sliding windows within which the gestures are expressed. By lining up the sliding windows of the various articulatory gestures over time, one can read out an action score for the articulation of a spoken word.

You can find more information on gestural scores, including an example for the word "pan" at www.haskins.yale.edu/research/gestural.html.

This type of model can capture the graded, articulatory properties of speech. Scientists can combine such models with linguistic explanations and computer and anatomical models of speech production.

Connecting with a DIVA

Frank Guenther, a professor at Boston University, developed the Directions Into Velocities of Articulators (DIVA) model to study speech production. DIVA incorporates auditory and *somatosensory* (body-based) feedback in a distributed neural network.

Neural network models are very basic simulations of the brain, set up in computers. A *neural network* consists of many artificial neurons, each of which gets stimulated and fires (electronically), acting in the computer as if it were somehow a human neuron. These neurons are linked together in nets that feed their information to each other. For instance, in a feed-forward network, neurons in one layer feed their output forward to a next layer until one gets a final output from the neural network. In many systems an intermediate layer (called a *hidden layer*) helps process the input and output layers.

These nets are capable of some surprising properties. For instance, they can be shown a pattern (called a *training* *set*) and undergo supervised learning that will eventually allow them to complete complex tasks, such as speech production and perception.

Components of the DIVA model are based on brain-imaging data from studies of children and adults producing speech and language, thus relating speech- processing activity with what scientists know about the brain. DIVA *learns* to control a vocal tract model and thensends this information to a speech synthesizer.

Researchers can also use DIVA to simulate MRI images of

brain activation during speech, against which the patterns of real talkers can be compared.

The first DIVA models were only able to simulate single speech sounds, one by one. However, a more recent model, called gradient order DIVA (GODIVA) can capturesequences of sounds. As models of this type are elaborated, they may offer new insights into how healthy and disordered people produce and control speech sounds.

Chapter 6

Classifying SpeechSounds: Your Gateway to Phonology

In This Chapter

- Taking a closer look at features
- Noting odd things with markedness
- Keying in on consonant and vowel classification
- Grasping the important concepts of phonemes and allophones

Naming is knowledge. If you classify a speech sound, you know what its voicing source is, where it is produced in the vocal tract, and how the sound was physically made. This chapter introduces you to how speech sounds are described in phonetics. I discuss some of the traditional ways that phoneticians use to classify vowels and consonants — ways that are used somewhat differently across these two sound classes. I dedicate a major part ofthis chapter to the concepts of phoneme and allophone, important building blocks needed to understand the *phonology* (sound systems and rules) of any language.

Focusing on Features

A *phonetic feature* is a property used to define classes of sounds. More specifically, a feature is the smallest part of sound that can affect meaning in a language. In early workon feature theory, phoneticians defined features as the smallest units that people listened to when telling meaningful words apart, such as "dog" versus "bog." As work in this area progressed, phoneticians also defined features by the role they played in *phonological rules,* which are broader sound patterns in language (refer to

Binary: You're in or out!

You may be familiar with the term *binary* from computers, meaning having two values, 0 or 1. Think of flipping a light switch either on or off. Because binary values are so (blessedly) straightforward, engineers andlogicians all over the world love them. Phonologists use binary features because of their simplicity and because they can be easily used in computers and telephone andcommunication systems.

An example of a binary feature is *voicing*. A sound is either *voiced* (coded as + in binary features) or *voiceless*(coded as –). Another example is *aspiration*, whether a stop consonant is produced with a puff of air after its release. Using binary features, phoneticians classify stop consonants as being "+/– aspiration."

To see how binary features are typically used for consonants and vowels, Figure 5-1 shows a binary feature matrix for the sounds in the word "needs," written in IPA as /nidz/.

	/n/	/i/	/d/	/z/
Syllabic	–	+	–	–
Consonantal	+	–	+	+
High	–	+	–	–
Back	–	–	–	–
Low	–	–	–	–
Anterior	+	–	+	+
Coronal	+	–	+	+
Round	n/a	–	n/a	n/a
Tense	n/a	+	n/a	n/a
Voice	+	(+)	+	+
Continuant	+	(+)	–	+
Nasal	+	(–)	–	–
Strident	–	n/a	–	+
Lateral	–	n/a	–	–

Illustration by Wiley, Composition Services Graphics

Figure 5-1: The word "needs" represented in a binary feature matrix.

In this figure, the sound features of each phoneme (/n/, /i/, /d/, and /z/) are listed as binary (+/–) values of features, detailed in the left-most column. For example, /n/ is a consonant (+ consonantal) that doesn't make up the nucleus of a syllable (– syllabic). The next three features refer to positions of the tongue body relative to a neutral position, such as in production of the vowel /ə/ for "the". The consonant /n/ is negative for these three features. Because /n/ is produced at the alveolar ridge, it's considered + *anterior* and + *coronal* (sounds made with tongue tip or blade). Because /n/ isn't a vowel, the features "round" and "tense" don't apply. /n/ is produced with an ongoing flow of air and is thus + *continuant*. It's + *nasal* (produced with airflow in the nasal passage), not made with noisy hissiness (– strident) nor with airflow around the sides of the tongue (– lateral).

If you're an engineer, you can immediately see the usefulness of this kind of information. Binary features, which are necessary for many kinds of speech and communication technologies, break the speech signal into the smallest bits of information needed, and then discard and eliminate the less useful information.

Phoneticians only want to work with the most needed features. For instance, because most stop consonants are *oral stops* (sounds made by blocking airflow in the mouth, refer to Chapter 6 for more information), you don't usually need to state the oral features for /p/, /t/, /k/, /b/, /d/, and /ɡ/. However, the *nasal feature* (describing sounds made with airflow through the nasal passage) is added to the description of the (less common) English nasal stop consonants /m/, /n/, and /ŋ/. Here are some examples of reducing this feature *redundancy* (repetition) to make phonetic description more streamlined and complete:

/b/: This sound is typically described as a voiced bilabial stop. You don't need to further specify "oral" because it's understood by default.

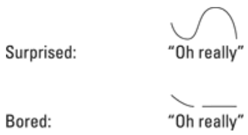
/m/: This sound is typically described as a *voiced bilabial nasal* or a *voiced bilabial nasal stop*. Because nasals are less common sounds and are distinguished from the more typical oral stops by their nasality, it's important to note "nasal" in their description.

Here is another example. In Figure 5-1, the last 5 features (voice, continuant, nasal, strident, lateral) apply chiefly to consonants. Thus, the vowel /i/ (as in "eat"), doesn't needto be marked with these (+ voice, + continuant, and so on). For this reason, I've placed the values in parentheses or marked them as "n/a" (not applicable).

Graded: All levels can apply

Other properties of spoken language don't divide up as neatly as the cases of voicing and aspiration, as the previous section shows. Phoneticians typically use *graded* (categorized) representations for showing various melodic patterns across different intended meanings or emotions. *Suprasegmental* (larger than the individual sound segment) properties (such as stress, length, and intonation) indicate gradual change over the course of an utterance.

For example, try saying "Oh, really?" several times, first in a surprised, then in a bored voice. You probably produced rather different melodic patterns across the two intended emotions. Marking these changes with any kind of simple binary feature would be difficult. That's why using graded representations is better. Here is this graded example:



To represent the melody of these utterances, you have a couple of different options. You can draw one of the following two:

- **Pitch contour:** A *pitch contour* is a line that represents the fundamental frequency of the utterance. Figure 5-2 provides an example.

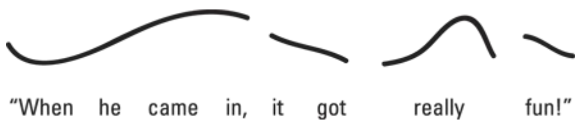
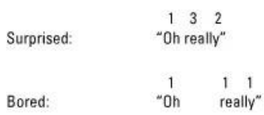


Illustration by Wiley, Composition Services Graphics

Figure 5-2: A pitch contour example.

- **Numeric categorization scheme:** In such a representation (as this), numeric levels of pitch (where 1is low, 2 is mid, and 3 is high) and thespacing between numbers representing *juncture* (the space between words) provide a graded representation of the information.



There is no one correct method for transcribing suprasegmental information described in the IPA. However, refer to Chapters 10 and 11 for some recommendations.

Articulatory: What your body does

Articulatory features refer to the positions of the moving

speech *articulators* (the tongue, lips, jaw, and velum). In the old days, articulatory features also referred to the muscular settings of the vocal tract (tense and lax). The old phoneticians got a lot right; the positions of the speech articulators are a pretty good way of classifying consonant sounds. However, this muscular setting hypothesis for vowels was wrong. Phoneticians now know the following:

- **For consonant sounds:** Articulatory features can point to the tongue itself, such as *apical* (made by the tip), *coronal* (made by the blade), as well as the regionson the lips, teeth, and vocal tract where consonantal constrictions take place (bilabial, labiodental, dental, alveolar, post-alveolar, retroflex, palatal, uvular, pharyngeal, and glottal).
- **For vowels:** Articulatory descriptions of vowels consider the height and backness of the tongue. Tongue position refers to high, mid, or low (also known as having the mouth move from close to open) and back, central, or front in the horizontal direction. Figure 5-3 shows this common expression in a diagram known as a vowel chart, or vowel quadrilateral.

  Vowel charts also account for the articulatory feature of *rounding* (lip protrusion), listing unrounded and rounded versions of vowels side by side. For instance, the high front rounded vowel /y/, as found in the French word "tu" (meaning *you* informal), would appear next to the high front vowel /i/. English doesn't have rounded and unrounded vowel pairs. Instead, the four vowels with some lip rounding are circled in Figure 5-3. The arrows show movement for *diphthongs* (vowelswith more than one quality). Chapter 7 provides further information about vowels, diphthongs, and the vowel quadrilateral.

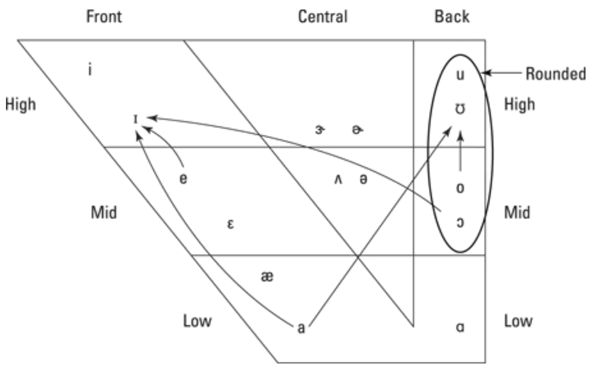


Illustration by Wiley, Composition Services Graphics

Figure 5-3: Vowel quadrilateral showing rounded vowels anddiphthongs.

Acoustic: The soundsthemselves

Although specifying more or less where the tongue is

during vowel production is okay for a basic classification of vowels, doing so doesn't cover everything. Phoneticians agree that *acoustic* (sound-based) features give a more precise definition, especially for vowels. These acoustic features have to do with specific issues, such as how high or low the frequencies of the sounds are in different parts of the sound spectrum, and the duration (length) of the sounds.

Vowels in the past: Getting tense about lax

Phoneticians used to think that vowels called *tense* were produced with more muscular tension than the vowels called *lax*. In the 1960s, instrumentation became available for investigating muscle activation during speech, and experiments in the 1970s checked out the tense versus lax question. By the way, some of these experiments were probably not a whole lot of fun for the subjects because “hook-wire” electrodes were used (fish-hook likeelectrodes that are injected into the muscles of the tongue, cheeks, and throat). Ouch!

The results provided no evidence that the tense vowels are produced with any more muscle activation than lax vowels. Today, phoneticians consider the English vowel tense/lax difference to be a phonological one. The English tense vowels are those that can be produced in stressed *open syllables,* that is, without any consonant at the end. Thus, you can say “bee” (/bi/ in IPA) or “shoe” (/ʃu/ in IPA), but you can’t say /bɪ/ or /ʃʊ/ andhave them be English words. People can use lax vowels in *closed syllables,* syllables ending with a consonant (such as “bit” /bɪt/ and “shook” /ʃʊk/).

The tongue makes many different shapes when you say vowels, and a more critical determining factor in what creates a vowel sound is the shape of the tube in your throat. Refer to the top part of Figure 5-4 for a sample ofthese tube shapes.

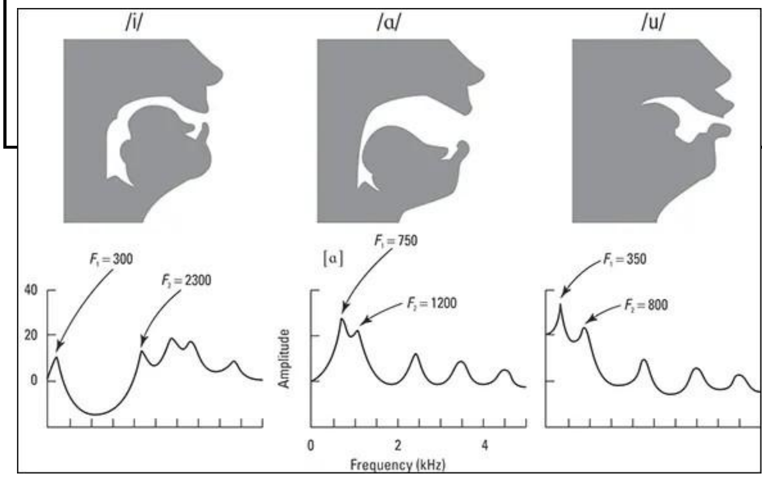


Illustration by Wiley, Composition Services Graphics

Figure 5-4: Three cross-sectional heads showing different tube shapesand the corresponding vowel spectra.

To work with acoustic features, phoneticians analyze speech by computer and look for landmarks. One such important landmark for vowels is called *formant frequencies,* which are peaks in the spectrum which determine vowel sound quality. Chapter 12 explains more about acoustic features and formant frequencies.

Marking StrangeSounds

The number of possible features for any given speech sound can become, well, many! As a phonetician considers the numerous sounds in language, it becomes important to keep track of which are the more common sounds, those likely to be universal across the world's languages, and which sounds are rare — that is, the oddballs of the phonetics world.

To do so, the unusual sound or process is considered *marked,* whereas the rather common one is *unmarked.* Here are some examples:

- Stop consonants made at the lips (such as /p/ and /b/) are relatively common across the world's languages, and are thus rather unmarked. However, the first sound in the Japanese word "Fuji" is a voiceless bilabial fricative made by blowing air sharply through the two lips. This fricative (classified with the Greek character "*phi,*" /ɸ/ in IPA) is relatively rare in the world's languages, and is thus considered marked.
- The vowels /i/, /u/, and /a/ are highly unmarked, because they're some of the most likely vowels to be found in any languages in the world. In contrast, the rounded vowels /y/, /ø/, and /œ/ are more marked, because they only tend to appear if a language also has a corresponding unrounded series /i/, /e/, and /a/.

How a phonetician determines whether a sound is marked or unmarked is a pretty sophisticated way of viewing language. Saying that a sound or process is marked means that it's less commonly distributed among the world's languages, perhaps because a certain sound is relatively difficult to hear or is effortfulto produce (or both).

However, remember that a phonetician talking about markedness is quite different than people saying that a certain language is difficult. The idea of a language being difficult is usually a value judgment: It depends on where you're coming from. When deciding whether a language is simple or complex, be careful about making value judgments about other languages. For example, Japanese may seem like a "difficult" language for an English speaker, but perhaps not so much for a native speaker of Korean because Japanese and Korean share many phonological, syntactic, and writing similarities that English doesn't share.

Also, before making a judgment of difficulty, think about what part of the language is supposed to be difficult.

Linguists talk about languages in terms of their phonology, *morphology* (way of representing chunks of meaning), *syntax* (way of marking who did what to whom), *semantics* (phrase and sentence level meaning), and writing systems, assuming the language has a written form (most languages in the world don't have a written form). It's very typical for languages to be complex in some areas and not in others. For instance, Japanese has a rather simple sound inventory, a relatively straightforward syntax, but a very complicated writing system. In contrast, Turkish has a fairly simple writing system but a rather complex phonology and syntax.

Introducing the BigThree

In order to grasp a basic tenet of phonetics, you need to know about the Big Three — the three types of articulatory features that allow you to classify consonants. For phonetics, the three are voicing, place, and manner, which create the acronym VPM. Here is a bit more about these three and what you need to know:

- **Voicing:** This term refers to whether or not the vocal folds are buzzing during speech. If there is voicing, buzzing occurs and speech is heard as voiced, such as the consonants in "*b*ee" (/bi/) and "*z*oo" (/zu/). If there is no buzzing, a sound is voiceless, such as the consonants in "*pit*" (/pɪt/) or "*sh*y" (/ʃaɪ/). All vowels and about half of the consonants are normally producedvoiced, unless you're whispering.
- **Places of articulation:** This term relates to the location of consonant production. They're the regions of

the vocal tract where consonant constriction takes place. Refer to Table 5-1 for the different places.

Table 5-1 Where English Consonants Are Produced

Feature	***Location***	***IPA***
Bilabial	At the two lips	/p/, /b/, /m/
Labiodental	Lower lip to teeth	/f/, /v/
Dental	Teeth	/θ/, /ð/
Alveolar	Ridge on palatebehind teeth	/s/, /z/, /t/, /d/, /ɹ/, /l/, /n/
Post-alveolar (also known aspalato-alveolar)	Behind the alveolarridge	/ʧ/, /ʤ/, /ʃ/, /ʒ/
Palatal	At the hard palate	/j/
Velar	At the soft palate	/k/, /g/, /ŋ/
Labio-velar	With lips and soft palate	/w/
Glottal	Space between vocalfolds	/ʔ/, /h/

Manner of Articulation: This term refers to the howof consonant production, specifically, the nature of the consonantal constriction. Table 5-2 lists the major manner types for English.

Table 5-2 How English Consonants Are Produced

Name	***Construction Type***	***IPA***
Stop oral	Complete blockage – by default,	/p/, /t/, /k/, /b/, /d/, /g/,
Nasal	Nasal stop – oral cavity stopped, air flows out nasal cavity	/m/, /n/, /ŋ/

Fricative	Groove or narrow slit to producehissing	/θ/, /ð/, /ʃ/, /ʒ/, /s/, /z/, /h/, /f/, /v/
Affricate	Combo of stop and fricative	/ʧ/, /ʤ/
Approximant	Articulators approximate each other, come together for a "wa-wa" effect	/w/, /ɹ/, /l/, /j/
Tap	Brief complete blockage	/ɾ/
Glottal stop	Complete blockage at the glottal source	/ʔ/

Every time you encounter a consonant, think of VPM and be prepared to determine its voicing, place, and manner features.

Making flashcards is a great way to master consonants and vowels, with a word or sound on one side, and the features on the other.

Moving to the Middle, Moving to the Sides

Most speech sounds are made with *central airflow,* through the middle of the oral cavity, which is the default or unmarked case. However for some sounds, like the "l" sound, a *lateral* (sideways) *airflow* mechanism is used, which involves air flowing around the sides of the tongue.

In English, you can find an important central versus lateral distinction for the voiced alveolar approximants /ɹ/and /l/. You can hear these two sounds in the minimal pair "*l*eap" and "*r*eap" (/lip/ and /ɹip/). For /l/, air is produced with lateral movement around the tongue.

To test it, try the phonetician's cool air trick. To usethis test, produce a speech sound you wish to investigate, freeze the position, and suck in air. Your articulators can sense the cool incoming air, and you should be able to get a better sensation of where yourtongue, lips, and jaw are during the production of the sound. For this example, to do this test, follow along:

1. **Say "reap," holding the initial consonant (/ɹ/).**
2. **Suck in some cool air to help feel where your tongue is and where the air flows.**
3. **Say "leap," doing the same thing while sensing tongue position and airflow for the initial /l/.**

You should be able to feel airflow around the sides of the tongue for /l/. You may also notice a bit of a duck-like, slurpy quality to the air as it flows around the sides of thetongue. This is a well-known quality, also found as a feature in some of the languages that have slightly different lateral sounds than are found in English.

Sounding Out Vowels and Keeping Things Cardinal

Knowing what phoneticians generally think about when classifying vowels is important. In fact, phonetics has a strong tradition, dating back to 19th century British phonetician Daniel Jones, of using the ear to determine vowel quality. An important technique for relying on the ear depends on using *cardinal vowels,* vowels produced at well-defined positions in articulatory space and used as a reference against which other vowels can be heard.

Figure 5-5 shows how cardinal vowels work. Plotted are the cardinal vowels, as originally defined by Jones and still used by many phoneticians today. These vowels aren't necessarily the vowels of any given language, although many lie close to vowels found in many languages (for instance, cardinal vowel /i/ is quite close to the high front unrounded vowel of German). The relative tongue position for each vowel is shown on the sides of the figure.

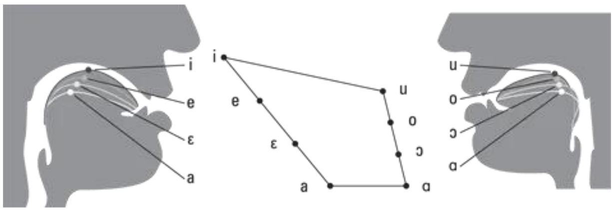


Illustration by Wiley, Composition Services Graphics

Figure 5-5: English cardinal vowels and associated tongue positions.

To make cardinal vowel /i/, make a regular English /i/ and then push your tongue higher and more front — that is, make the most extreme /i/ possible for you to make.

This *point vowel,* or extreme articulatory case, is a very pure /i/ against which other types of "/i/-like" vowels may be judged. With such an extremely /i/-sounding reference handy, a phonetician can describe how the high front sounds of, say, English, Swedish, and Japanese differ.

The same type of logic holds true for the other vowels in this figure, such as the low front vowel /a/ or the high back vowel /u/. Just like with the regular IPA

chart (see Chapter 3), this set of cardinal vowels also has *rounded* and *unrounded* (either produced with the lips protruded or not) vowels. Jones called the rounded series the *secondary cardinal vowels.*

To hear Daniel Jones producing 18 cardinal vowels (from an original 1956 Linguaphone recording), go to www.youtube.com/watch?v=haJm2QoRNKo.

Tackling Phonemes

A *phoneme* is the smallest unit of sound that contributes to a meaning in a language. Knowing about phonemes is important and frequently overlooked by beginning students of phonetics because they can seem so obvious and, well, boring. However, phonemes aren't boring. In fact, they're essential to many fields, such as speech language pathology, psycholinguistics, and child language acquisition.

In simple terms, a *phoneme* is psychological. If you want to talk about a speech sound in general, it's a

phone, not a phoneme. A sound becomes a phoneme when it's considered a meaningful sound in a language. Phoneticians talk about phonemes of English or Russian or Tagalog. That is, to be a phoneme means to be a crucial part of a particular language, not language in general.

Furthermore, one person's phoneme isn't necessarily another person's phoneme. If I were to suddenly drop you among speakers of a very different-sounding language, and these people tried to teach you their language's sound system, you would probably have a difficult time telling certain sounds apart. This is because the sound boundaries in your mind (based on the phonemes of your native language) wouldn't work well for the new languageI have dumped you in.

If you're a native English speaker, you'd be in this plight if you were trying to hear the sound of the Thai consonant

/t/ at the beginning of a syllable. For example, the clear spicy Thai soup "*t*om yum" may sound to you as if it were pronounced "*d*om yum," instead of having an unaspirated

/t/ at the beginning. Native Thai speakers may be surprised and even amused at your inability to hear this word pronounced correctly.

Determining whether speech breaks down at the phonemic level is important in understanding languagedisorders such as *aphasia*, the language loss in adults after brain damage, and in studying child language acquisition. The following sections take a closer look at phonemes.

Defining phonemes

To investigate the sound system of a language, you search for a phoneme. To be a phoneme, a sound must pass two tests:

- **It must be able to form a minimal pair.** A *minimal pair* is formed whenever two words differ byone sound, such as "bat" versus "bag" (/bæt/ and

  /bæg/), or "eat" versus "it" (/it/ and/ɪt/). In the first pair, consonant voicing (/t/ versus /g/) makes the difference. In the second pair, vowel quality (/i/ versus / ɪ/) makes the difference. However, in both cases a single phoneme causes a meaningful distinction between two words. Phoneticians consider minimal pairs a test for a distinctive feature because the feature contributes to animportant, sound-based meaning in a language.
- **It should be in free (or contrastive) distribution.** The term *free distribution* means a sound can be found in the same environment with a change in meaning. For example, the minimal pair "bay"versus "pay" (/be/ and /pe/) show that English /b/ and

  /p/ are in free distribution.

Notice that phonemes in a language (such as the English consonants /s/, /t/, /g/, and the vowels /i/, /ɑ/, and /u/) can appear basically anywhere in a word and change meaning in pretty much the same fashion. The same kind of sound-meaning relationships hold true even when these sounds are in different syllabic positions, such as "*t*oe" versus "*g*o" (initial position) or"sea*t*" versus "see*d*" (final position).

Complementary distribution:Eyeing allophones

Complementary distribution is when sounds don't

distribute freely, but seem to vary systematically (suggesting some kind of interesting, underlying reason). Complementary distribution is the opposite of free distribution, a property of phonemes. The systematically varying sounds that result from complimentary distribution are called *allophones,* a group of possible stand-ins for a phoneme. It's kind of like Clark Kent and Superman — they're really the same guy, but the two are never seen in the same place together. One can stand in for the other.

The prefix *allo-* means a systematic variant of something, and *-phone* is a language sound. Therefore, an allophone is a systematic variant of a phoneme in language. In this case, a language has one phoneme of something (such as a "t" in English), but this phoneme is realized in several different ways, depending on the context.

Sticking to the rules of phonology

Part of speaking a language is internalizing its *phonology*, the systematic sound rules. A speaker of American English would know the rules that govern which "t" to use and when, and would be able to use them automatically. When faced with a new (made-up) word, such as "*t*elps," she would pronounce the initial "t" with aspiration, whereas she wouldn't do the same to the "t" at the end of "kra*t*".

Put your hand under your mouth and try for yourself. You should feel a puff of air on the first "t" of "*t*elps" and none on the "t" of "kra*t*". You probably used two different allophones of the phoneme /t/ (that is, [t^h] and [t]) because you know General American English.

Phonologists love figuring out which sounds in a language *corpus* (body or sample of a language) represent *phonemes* (meaningful sounds of the language) and which are allophones of a single, underlying phoneme. To search for phonemes, people look for minimal pairs and free or contrastive distribution. To search for allophones, phonologists hunt for sounds that are similar phonetically (for example, like /s/ and /ʃ/ or /t/ and /ʧ/) and which also show complementary distribution.

English has just one meaningful "t". At the level of meaning, the "t" in "*T*ed" is the same as the "t" in "ba*t*," in "Be*tt*y," and in "mi*tt*en." They all represent some kind of basic "t" in your mind. However, what may surprise you is that each of the "t" sounds for these four words is pronounced quite differently, as in the following:

Word	***IPA Transcription (narrow)***	***The "t" Used (Allophone)***
Ted	[tʰɛd]	aspirated t
bat	[bæt]	unaspirated t
Betty	[ˈbɛɾɪ]	alveolar tap
mitten	[ˈmɪʔn̩]	glottal stop

Test Yourself

Essay Questions

1. Explain the differences between phonetics and phonology.
2. Describe the source-filter theory of speech production.
3. Discuss the role of the vocal folds in producing voiced sounds.
4. Analyze how the articulatory phonetics contributes to speech understanding.
5. Explain the concept of assimilation in phonology with examples.
6. Discuss the importance of the International Phonetic Alphabet (IPA) in linguistics.
7. Describe the process of speech breathing and its significance.
8. Analyze the impact of speech sound disorders on communication.
9. Discuss the anatomical structures involved in speech production.
10. Explain the concept of voicing and its relevance in phonetics.
11. Compare and contrast the articulation of vowels and consonants.
12. Discuss the historical development of phonetics as a discipline.
13. Explain how different languages utilize phonological rules.
14. Analyze the role of the tongue in shaping speech sounds.
15. Discuss the implications of laryngectomy on speech production.
16. Describe the importance of articulators in phonetic transcription.
17. Explain the concept of nasal consonants and their production.
18. Discuss how phonetics aids in language learning.
19. Analyze the influence of regional accents on phonetics.
20. Describe the methods used in articulatory phonetics research.
21. Explain the role of the hard palate in consonant production.
22. Discuss the differences between bilabial and labiodental sounds.
23. Analyze how technology has advanced the study of phonetics.
24. Explain the significance of understanding speech anatomy for speech therapists.
25. Discuss the challenges faced by phoneticians in transcription.
26. Describe the process of sound filtering in speech.
27. Analyze the impact of stress on speech intelligibility.
28. Discuss the role of the uvula in speech production.
29. Explain the concept of glottal stops and their occurrence in English.
30. Discuss the relationship between phonetics and sociolinguistics.
31. Explain how children acquire phonetic skills.
32. Analyze the role of the velum in producing oral and nasal sounds.
33. Discuss the importance of pitch and intonation in speech.
34. Explain how dialectology intersects with phonetics.
35. Describe the articulatory features that distinguish different languages.
36. Discuss the effects of aging on speech production.
37. Analyze how speech therapy utilizes phonetics.
38. Explain the concept of supralaryngeal articulators.
39. Discuss the challenges of transcribing non-native speech sounds.
40. Describe the role of technology in speech synthesis.
41. Analyze the concept of phonetic variation across different languages.
42. Discuss how cultural factors influence phonological rules.
43. Explain the process of sound change in historical linguistics.

44. Analyze the differences between American and British phonetics.
45. Discuss the effects of hearing loss on speech production.
46. Explain the significance of fricatives in phonetic analysis.
47. Discuss the role of speech perception in phonetics.
48. Analyze the importance of phonetics in forensic linguistics.
49. Explain the process of voicing contrasts in languages.
50. Discuss the implications of phonetic research for language teaching.

51. Explain the concept of place of articulation with examples.
52. Discuss how the respiratory system contributes to speech production.
53. Analyze the role of emotional expression in phonetics.
54. Discuss the relationship between phonetics and language identity.
55. Explain how accents can change over time within a community.
56. Discuss the significance of stress patterns in English.
57. Analyze how different cultures perceive speech sounds.
58. Explain the differences between oral and nasal vowels.
59. Discuss the role of feedback in speech production.
60. Analyze the effects of bilingualism on phonetic development.
61. Discuss the use of phonetics in artificial intelligence and speech recognition.
62. Explain how sociophonetics examines the relationship between speech and society.
63. Analyze the role of the pharynx in speech production.
64. Discuss the importance of auditory feedback in speech.
65. Explain how speech sounds can convey emotion.
66. Analyze the effects of environmental factors on speech clarity.
67. Discuss the role of phonetic training for singers and actors.
68. Explain the concept of phonological processes in child language acquisition.
69. Analyze the relationship between articulation and intelligibility.
70. Discuss how speech disorders can affect social interaction.
71. Explain the concept of phonological awareness in literacy.
72. Analyze the significance of voice quality in phonetics.
73. Discuss the impact of technology on phonetic research methodologies.
74. Explain the differences between voiced and voiceless consonants.
75. Analyze how rhythm and timing contribute to speech patterns.
76. Discuss the role of the auditory system in speech understanding.
77. Explain the significance of vowel length in different languages.
78. Analyze the concept of dialectal variation in phonetics.
79. Discuss how speech perception varies among different age groups.
80. Explain the role of suprasegmental features in phonetics.
81. Analyze how cultural narratives shape phonological patterns.
82. Discuss the impact of globalization on regional accents.
83. Explain the concept of phoneme vs. allophone.
84. Analyze the role of gender in speech sound production.
85. Discuss the significance of tongue positioning in vowel production.
86. Explain how articulation differs in fast vs. slow speech.
87. Analyze the effects of stress and intonation on meaning.
88. Discuss the role of language contact in phonetic change.
89. Explain the significance of phonetic transcription in language documentation.

90. Analyze how social media influences speech patterns.
91. Discuss the role of feedback loops in speech production.
92. Explain the influence of phonetics on poetry and song.
93. Analyze the concept of minimal pairs in phonetics.
94. Discuss the importance of phonetic diversity in language preservation.
95. Explain how different languages express similar sounds.
96. Analyze the relationship between phonetics and cognitive processing.
97. Discuss the role of cultural identity in speech production.
98. Explain the significance of articulation in public speaking.
99. Analyze how phonetic features can influence language evolution.
100. Discuss the implications of phonetic research for speech technology.

Multiple-Choice Questions (MCQs)

1. What does phonetics primarily study?
   - A) Grammar
   - B) Speech sounds
   - C) Vocabulary
   - D) Syntax

2. The International Phonetic Alphabet (IPA) is used for:
   - A) Writing poetry
   - B) Transcribing speech sounds
   - C) Teaching grammar
   - D) Learning vocabulary

3. Which part of the anatomy is responsible for voicing?
   - A) Tongue
   - B) Larynx
   - C) Nasal cavity
   - D) Teeth

4. What is the term for sounds produced with a complete closure of the vocal tract?
   - A) Fricatives
   - B) Stops
   - C) Nasals
   - D) Glides

5. Which of the following is a bilabial sound?
   - A) /t/
   - B) /b/
   - C) /s/
   - D) /ʃ/

6. The term "articulators" refers to:

- A) Speech therapy techniques
- B) Parts of the body that produce speech sounds
- C) Written phonetic symbols
- D) Types of speech disorders

7. Voicing refers to:
- A) The pitch of a sound
- B) Whether the vocal folds vibrate during sound production
- C) The volume of speech
- D) The speed of speech

8. The process of changing a sound to make it easier to pronounce is called:
- A) Assimilation
- B) Dissimilation
- C) Elision
- D) Fusion

9. Which sound is produced using the alveolar ridge?
- A) /p/
- B) /k/
- C) /d/
- D) /m/

10. Nasal consonants are produced when:
- A) The lips are closed
- B) The velum is lowered
- C) The vocal folds are apart
- D) The jaw is raised

11. The soft palate is also known as the:
- A) Uvula
- B) Larynx
- C) Velum
- D) Alveolar ridge

12. Which of the following is NOT a feature of consonants?
- A) Voicing
- B) Place of articulation
- C) Length
- D) Manner of articulation

13. The sound /ʃ/ as in "ship" is categorized as a:
- A) Bilabial
- B) Labiodental
- C) Palato-alveolar
- D) Dental

14. Which of the following describes the tongue's role in articulation?
- ***A) It is fixed***
- ***B) It is a movable articulator***
- ***C) It does not affect sound***
- ***D) It only produces vowels***

15. The term "phonological rules" refers to:
- ***A) Spelling patterns***
- ***B) Sound patterns in a language***
- ***C) Grammatical structures***
- ***D) Vocabulary lists***

16. Which of the following is a fixed articulator?
- ***A) Tongue***
- ***B) Lips***
- ***C) Hard palate***
- ***D) Jaw***

17. The term "fricative" refers to:
- ***A) A sound produced with a complete closure***
- ***B) A sound produced with a continuous airflow***
- ***C) A vowel sound***
- ***D) A sound produced at the lips***

18. A glottal stop is represented in IPA as:
- ***A) /h/***
- ***B) /ʔ/***
- ***C) /ʃ/***
- ***D) /t/***

19. Which of the following sounds is considered a nasal?
- ***A) /b/***
- ***B) /n/***
- ***C) /s/***
- ***D) /p/***

20. The process by which speech sounds are influenced by adjacent sounds is called:
- ***A) Assimilation***
- ***B) Dissimilation***
- ***C) Flapping***
- ***D) Elision***

21. Which of the following is a voiced consonant?
- ***A) /f/***
- ***B) /s/***
- ***C) /z/***
- ***D) /p/***

22. The articulation of the sound /k/ involves:
- *A) The lips*
- *B) The alveolar ridge*
- *C) The soft palate*
- *D) The teeth*

23. Stress in speech primarily affects:
- *A) Vowel length*
- *B) Word meaning*
- *C) Sentence structure*
- *D) Phonetic transcription*

24. The sound /θ/ as in "think" is classified as:
- *A) Voiced*
- *B) Voiceless*
- *C) Nasal*
- *D) Fricative*

25. The study of how speech sounds are perceived is known as:
- *A) Articulatory phonetics*
- *B) Acoustic phonetics*
- *C) Auditory phonetics*
- *D) Phonology*

26. The sound /dʒ/ as in "judge" is a:
- *A) Bilabial*
- *B) Alveolar*
- *C) Palato-alveolar*
- *D) Velar*

27. Which of the following is a characteristic of a vowel?
- *A) It involves a complete closure of the vocal tract.*
- *B) It can be nasal or oral.*
- *C) It is always voiced.*
- *D) It is produced at the alveolar ridge.*

28. The term "syllable" refers to:
- *A) A single sound*
- *B) A unit of organization for a sequence of speech sounds*
- *C) A type of phoneme*
- *D) A written word*

29. The sound /ŋ/ as in "sing" is classified as:
- *A) Voiced*
- *B) Voiceless*
- *C) Alveolar*

- D) Velar nasal

30. A language with more vowel sounds than English is:
- A) French
- B) Spanish
- C) Japanese
- D) Mandarin

True/False Statements

1. Phonetics is the study of speech sounds.
2. The larynx is responsible for producing all speech sounds.
3. The IPA stands for the International Phonetic Alphabet.
4. Voiced sounds are produced without vibrating vocal folds.
5. Assimilation is a type of phonological rule.
6. Bilabial sounds are produced using the tongue.
7. Nasal consonants allow airflow through the mouth only.
8. The soft palate is also known as the velum.
9. All languages have the same phonetic inventory.
10. The tongue is a fixed articulator.
11. Fricatives are produced with a complete closure of the vocal tract.
12. The sound /ʃ/ is a voiced consonant.
13. The alveolar ridge is located behind the upper front teeth.
14. Vowels can be nasalized in some languages.
15. Phonetics has no relevance to language teaching.
16. The glottal stop is represented as /ʔ/ in IPA.
17. Speech sounds can influence each other in connected speech.
18. The sound /z/ is a voiceless consonant.
19. The hard palate is a movable articulator.
20. Stressed syllables are usually louder and longer.
21. The sound /θ/ is an example of a labiodental consonant.
22. Auditory phonetics studies how speech sounds are produced.
23. The vocal folds are located in the pharynx.
24. Phonological rules are always explicit.
25. The term "phoneme" refers to the smallest unit of sound in a language.
26. Consonants can be classified by their place and manner of articulation.
27. The uvula plays no role in speech production.
28. Children learn speech sounds in a predictable order.
29. Phonetics is only concerned with spoken language.
30. All speech sounds are produced with the same amount of airflow.

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