Phonemes, Speech, and Reading

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READING MEETINGS
with Mark and Molly
Conversations Bridging Science & Practice

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Plan

Three content discussions

Phonemes, speech, and reading	Today
Weighing the evidence	Very Soon
Learning: how does it happen?	Soon

Roundtable discussion:

Implications for instruction	TBA

What are phonemes?

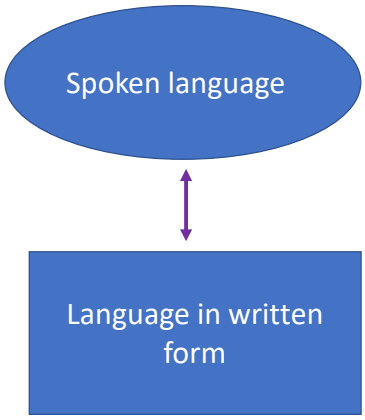
Well, that is the issue to be decided.

Everyone *sort of* knows what they are.

So let's start with: why are we talking about phonemes?

Phonemes are the solution to a problem

The starting point:

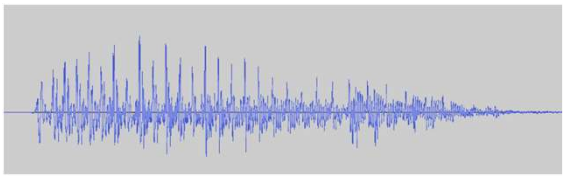


Pre-reader knows a first language (at the level of a 5 year old). Grammar, vocabulary, pronunciations, sounds, uses.

This is new, has to be learned.

Simple View of Reading: beginning reader doesn't re-learn the language. They learn how print maps onto existing knowledge.
(How? They didn't say.)

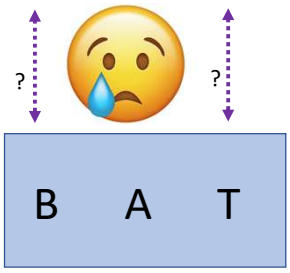
The problem:
Speech and print have different properties



What you hear: sound wave
Continuous
Changing
No breaks between units

NOT Beads-on-a-string

MISMATCH

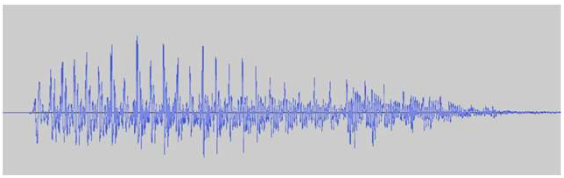


What you see: letters
Discrete
Static
Clear breaks between units

Beads-on-a-string

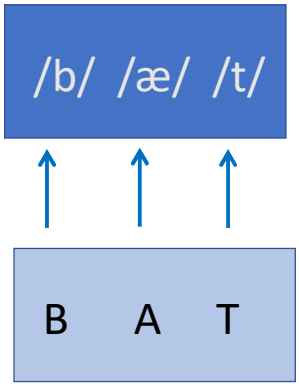
How do we connect
two such different things?

The solution:
Phonemes!



Convenient Fiction!

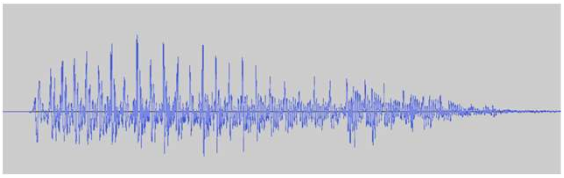
Treat speech *as though*
it consists of beads on a string



PHONEMES
Not sounds
Not letters

Abstract
Letter/sound mashup

These mappings can then
be learned, taught.



Convenient Fiction!

/b/ /æ/ /t/

Achieving this convenient fiction
= "Phonemic awareness"
Not a great term [later].

B A T

Main point: becoming phonemic depends on speech and print.

Let's pause a moment to take this in.

Everyone has been told "phonemes are the minimal units of speech"
BAT is different from PAT: initial phonemes differ.

Makes it sound like we talk in phonemes.

We don't? Maryellen?

If you can tell that BAT and PAT are different, does that mean you know the phonemes /b/ and /p/?

No. Infants can do that. Requires sensitivity to features of the sounds, not treating them as distinct phonemes that can be moved around.

Concept of phoneme relevant to reading goes much further.

The BIG question:

How do we get from what is needed for spoken language to the phonemes that are needed for reading?

A Developmental Account of Becoming Phonemic

What is learned from experience with spoken language

What is learned from experience with print.

How they overlap and influence each other.

What happens over time.

If we know this, then we can figure out what to DO.

Basic ideas:

Phonemes develop.
They're abstract.
They emerge from conjunction of print and speech.

Spoken language experience gets the learner part way.

But print knowledge is necessary to get the whole phonemic enchilada.
A particular kind of print: an alphabet.

Development of Phonemic Abstraction

Starts with language acquisition

Continues through and is influenced by learning to read.

Learning spoken language:

Hearing

Comprehension

Acoustic

The first mismatch

How do you know the spoken form of a word and the sound of a word are *the same word*?

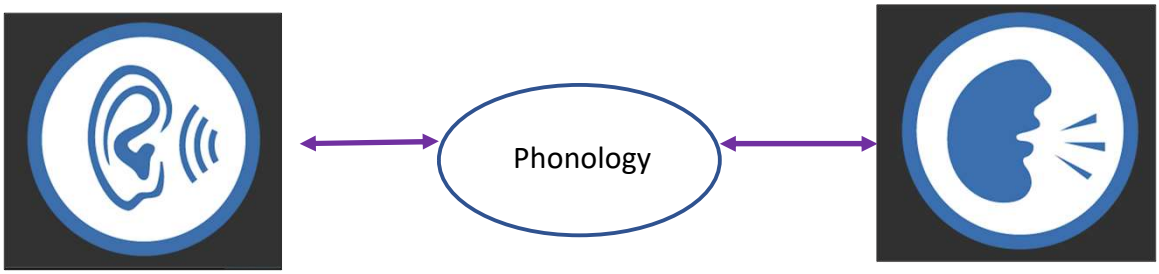
They're made of different stuff.

Speaking

Production

Articulatory

Solution? We develop a mental/neural representation that mediates between hearing and speaking. Call this *phonology*. It connects articulatory (spoken) and acoustic (heard) forms of language.



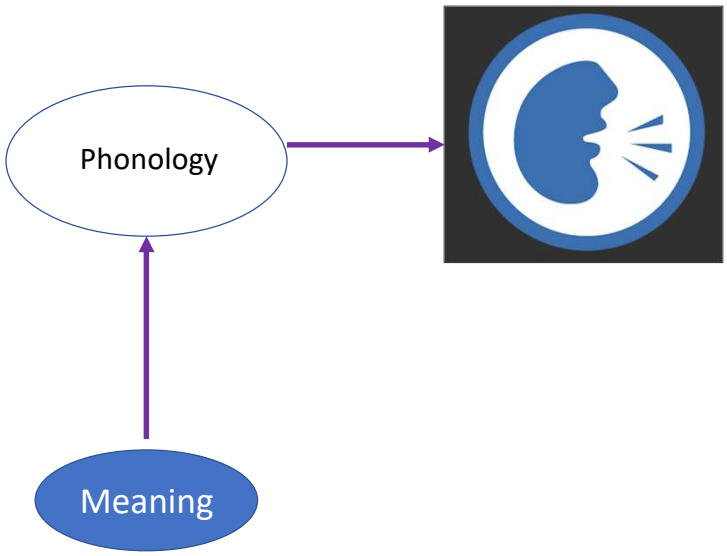
Hearing

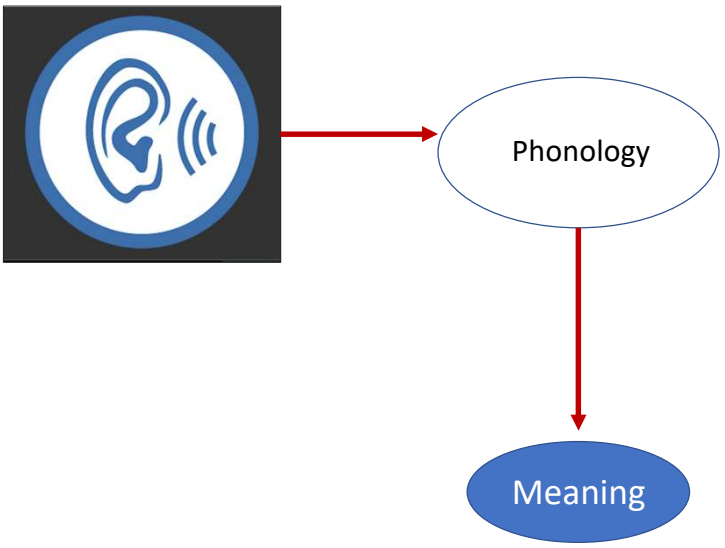
Comprehension

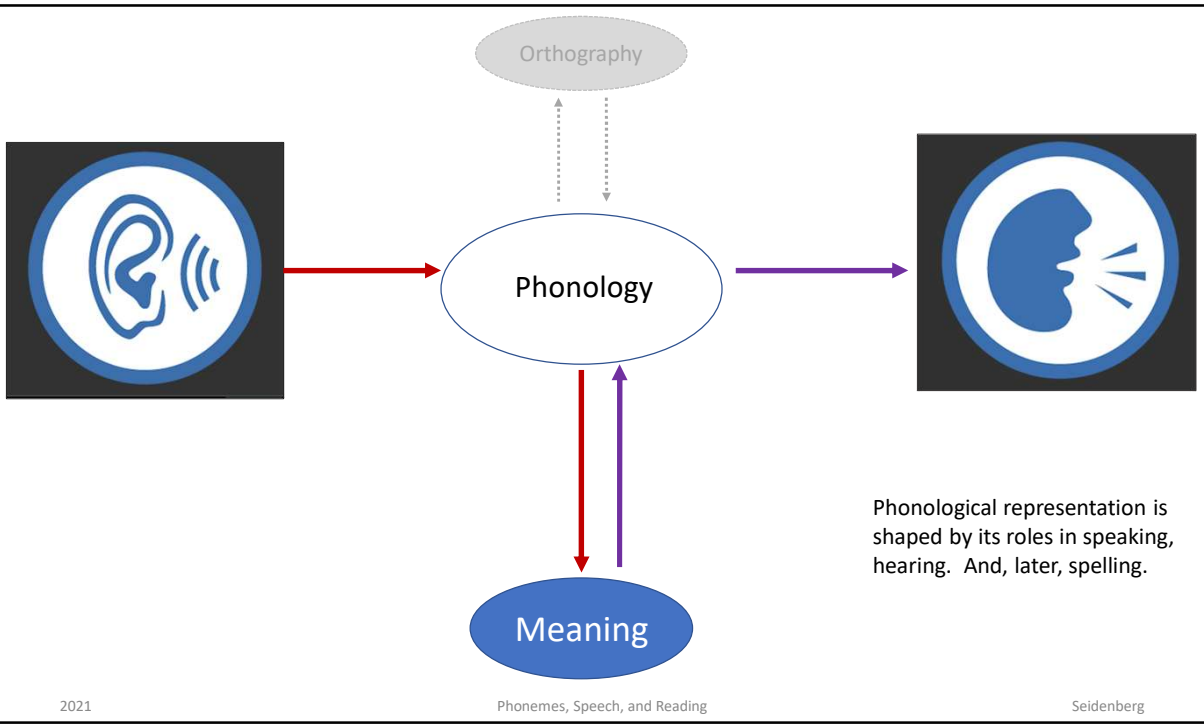
Speaking

Production

What we can do with this.







Phonological representation is shaped by its roles in speaking, hearing. And, later, spelling.

How is all this learned?

The infant/toddler is learning to comprehend and produce language. No print yet.

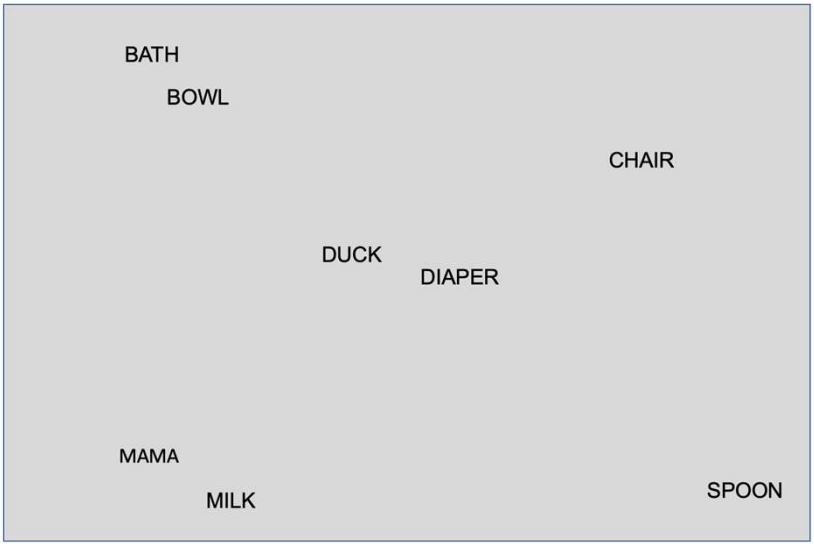
They have to discover the relevant properties of speech.

They do this by detecting patterns.

A lot of them.

The first words that infants understand are BLOBS. Don't overlap very much in sound.

One child's first words. Spread out. Same holds for other groups of first words.



As vocabulary increases, children discover parts where words overlap.

Picking up patterns across words = "statistical learning". Which means:

The patterns in speech vary in how often they occur, which parts occur with each other, which sequences of sounds are common or uncommon, etc.

This growing knowledge of properties of words and components of words results in emergence of "phonological awareness".

The toddler isn't *consciously aware* that words have units such as syllables.
But their behavior shows they've begun to learn and use this knowledge.

Discovery of the parts doesn't occur in a strict sequence.

Child is picking up on patterns in speech wherever they occur.

Words are one kind of pattern.
MAMA, BOTTLE are frequent and stand out against surrounding sounds.
Also very salient to babies!

But also other patterns. Parts of words.

Statistical learning is opportunistic: finds patterns wherever they are lurking.

Children learn about words, syllables. Morphemes start showing up too:

WALKING
TALKING
POOPING
CRYING

Language learner starts to isolate ING, which is an inflectional morpheme.
(if ING were a word, it would be the 6th most common in English)

Because of the structure of English syllables, the onset and rime units are salient.

Rhyming words: (remember: these are all spoken, not written!)
BOAT COAT NOTE GOAT

Ending (rime) is the same across words.
Beginning (onset) sound varies.
Contrast helps child discover initial sounds.
Important! An ingredient in the recipe for phonemes.

Summary about language acquisition part

Child discovers words, parts of words, many other aspects of language.
By detecting patterns across words.

Learning does not follow a strict sequence.
And it's messy: some information about many things.

Given the statistical properties of spoken language,
general tendency for larger units to be discovered before smaller ones.

But, some patterns that involve smaller bits can be discovered.
Such as: learning that words begin with some sounds and not with others.
Because this statistical evidence is very strong!

Now to the onset of reading.

We've said:

Phonemes are for reading, not for speaking/listening
They can't be learned from speech because they literally aren't there.

They build on knowledge of spoken language but require exposure to print.

We've provided evidence for one part (speech doesn't consist of phonemes) but not the other (phonemic abstraction depends on print)

So, some evidence:

1. Studies of illiterates
2. Studies of reading non-alphabetic writing systems.
3. Brain evidence (not today)

1. How do illiterates—people who do not read—represent spoken language?

Classic studies.
This was the first.

Cognition, 7 (1979) 323–331

1

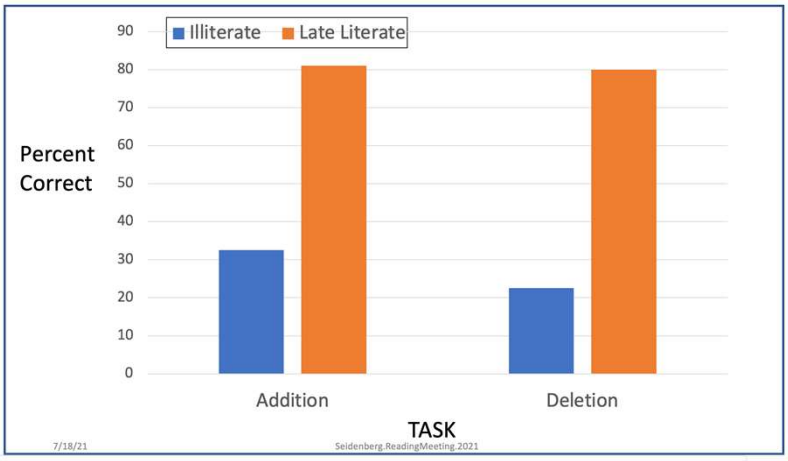
Does awareness of speech as a sequence of phones arise spontaneously? *

JOSÉ MORAIS
LUZ CARY
JÉSUS ALEGRIA
and PAUL BERTELSON

Université libre de Bruxelles

Abstract

It was found that illiterate adults could neither delete nor add a phone at the beginning of a non-word; but these tasks were rather easily performed by people with similar environment and childhood experiences, who learned to read rudimentarily as adults. Awareness of speech as a sequence of phones is thus not attained spontaneously in the course of general cognitive growth, but demands some specific training, which, for most persons, is probably provided by learning to read in the alphabetic system.



This figure shows percent correct collapsing across word, nonword conditions for simplicity. Literates perform better than illiterates on both words and nonwords, but the difference is larger for nonwords, which are harder because they haven't been heard before.

Literate participants performed "phoneme deletion/addition" tasks much better than illiterates.

The groups differed in literacy levels, but not age, culture, SES, etc.

Conclusion: the differences are due to literacy. Phonemes depend on exposure to print.

This study launched many follow-ups.

By these researchers and others.
In multiple languages.

Picture is remarkably consistent.

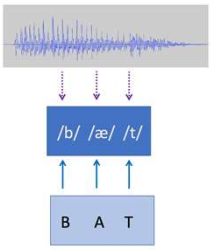
Literacy has a big impact on tasks involving segments (phoneme-like slices).
Less impact on syllables and almost none on non-linguistic sounds (e.g., music)

Phoneme-related instruction improves illiterates' performance.

Conclusions do not depend on results from one study.
Or results using only one method.

This is solid and convincing beyond reasonable doubt.

2. Studies of other types of writing



Claim: Phonemic abstraction is relevant to reading in an alphabetic writing system.
Not in languages that employ other writing systems.

How to test? Repeat "phonemic" tasks (addition, deletion, etc.) with people who speak/read languages such as Chinese (Mandarin, Cantonese, or other language in this group).

Organization of these spoken languages is very different from English.
Writing is not alphabetic.

If phonemes are "minimal units of spoken language", then performance on phonemic tasks should be comparable to speakers of English, other languages.

If phonemes depend on exposure to alphabet, Chinese should perform more poorly on these tasks.

Instead, they should show superior performance on tasks that depend on units that are relevant in THOSE languages, such as tone.

Findings?

Again, many studies over many years in many languages and several types of writing. Examples:

Monolingual Mandarin, bilingual Mandarin-English
Monolingual Mandarin, with and without exposure to Pinyin (alphabet)
Cantonese-English bilinguals
English only
Parallel studies in Japanese, Hebrew, Spanish, other languages/writing systems

An early study:

ELSEVIER

Cognition
Volume 24, Issues 1–2, November 1986, Pages 31-44

The ability to manipulate speech sounds depends on knowing alphabetic writing ☆

Charles Read, Zhang Yun-Fei, Nie Hong-Yin, Ding Bao-Qing

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Abstract

Chinese adults literate only in Chinese characters could not add or delete individual consonants in spoken Chinese words. A comparable group of adults, literate in alphabetic spelling as well as characters, could perform the same tasks readily and accurately. The two groups were similar in education and experience but differed in age and consequently in whether they had learned an alphabetic writing system in school. Even adults who had once learned alphabetic writing but were no longer able to use it were able to manipulate speech sounds in this way. This "segmentation" skill, which has been shown to contribute to skilled reading and writing, does not develop with cognitive maturation, non-alphabetic literacy, or exposure to a language rich in rhymes

Also a large body of work by Catherine McBride (CUHK), Charles Perfetti (Pitt), Shu Hua (Beijing Normal), and others.

Available online at www.sciencedirect.com
SCIENCE DIRECT®
J. Experimental Child Psychology 89 (2004) 93–111
Journal of Experimental Child Psychology
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Levels of phonological awareness in three cultures

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Some findings:
Chinese speakers perform more poorly on phoneme-related tasks than English speakers.

Groups are similar on syllable-related tasks.

Chinese speakers excel at tone-related tasks.

For Chinese speakers, exposure to pinyin (instructional alphabet) increases phonemic-level performance.

Many other findings about skilled reading, learning to read, roles of different types of information in different writing systems.

Results from many such studies synthesized here:

Psychological Bulletin
2005, Vol. 131, No. 1, 3–29

0033-2909/05/$12.00 DOI: 10.1037/0033-2909.131.1.3

Reading Acquisition, Developmental Dyslexia, and Skilled Reading Across Languages: A Psycholinguistic Grain Size Theory

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Centre National de la Recherché Scientifique and Université de Provence

Usha Goswami
University of Cambridge

The development of reading depends on phonological awareness across all languages so far studied. Languages vary in the consistency with which phonology is represented in orthography. This results in developmental differences in the grain size of lexical representations and accompanying differences in developmental reading strategies and the manifestation of dyslexia across orthographies. Differences in lexical representations and reading across languages leave developmental "footprints" in the adult lexicon. The lexical organization and processing strategies that are characteristic of skilled reading in different orthographies are affected by different developmental constraints in different writing systems. The authors develop a novel theoretical framework to explain these cross-language data, which they label a *psycholinguistic grain size* theory of reading and its development.

In general, readers represent phonology using units that are relevant to their language/writing system.

When we say “phonemes are minimal units of speech” as in BAT vs. PAT:

They’re not units of speech.

They don’t function this way in other languages such as Chinese.

Take home message:

The “phonemic illusion” is important for learning to read English and other alphabetic writing.

Essential to consider how it develops.

Origins are in spoken language experience.

But people do not speak in phonemes.

We learn to treat speech as if it has phonemes.

As a result of learning—and being taught about — alphabetic writing.

We don't speak in letters or phonemes but it may seem that way.

What Next?

You probably want some evidence that is closer to classroom experience than studies of illiterates and Chinese reading.

So: we'll look at evidence from research examining impact of different experiences, conditions on gaining phonemic knowledge in English.

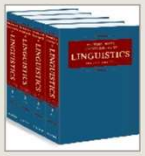
What the NRP said.
What we've learned since.

And then?

Learning. Roles of explicit instruction, implicit learning. How reading and speech change each other. Awareness? Meaning what?

Instruction: What are the implications?

Bye for now.



International Encyclopedia of Linguistics (2 ed.)
William J. Frawley

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Print ISBN-13: 9780195139778
Current Online Version: 2003
Print Publication Date: 2003
Published online: 2003
eISBN: 9780195307450

A great surprise awaits anyone who turns for the first time to examine the physical record of speech: the segments are not there. One common intuition about talking is that we proceed by emitting a sequence of discrete articulations, rather like the letters of an alphabet. But this finds little obvious support in phonetic reality, where the cues to consonant identity may be carried entirely on vowels, and where the diverse articulators move almost continuously and with considerable independence. The segmental intuition can be at least partly redeemed by analysis of the physical record, working from steady states and notable transitions, observing and factoring out contextual effects, so as to reconstruct a vocabulary of identifiable units. Strikingly, though, no simple slicing-up of the course of events can yield a reliable map of the units that play a role in the patterning of sound systems—the segments that linguistic theory posits as fundamental to phonological representation.

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Some phonological theories recognize an element called the phoneme, defined as the smallest sound unit that can distinguish words. For example, /d/ and /ð/ are different phonemes of English because they distinguish between the words *breed* and *breathe*. (These words are called a *minimal pair*; identifying minimal pairs is an essential part of analyzing the phonemic system of a language.) Speech sounds that are audibly different but are not used to distinguish between words are called *allophones*. For example, Spanish [d] and [ð] are allophones of the phoneme /d/ because no pair of Spanish words is ever distinguished by them. Allophones cannot distinguish words because they always occur in different contexts; they are therefore said to be in *complementary distribution*. For example, Spanish [d] occurs initially and after [n] or [l], with [ð] occurring everywhere else.

Since about 1950, it has been known that there are various problems with the concept of the phoneme (Halle 1959, Joos 1957). In some dialects of American English, for instance, the phonemic distinction between /ɪ/ and /ɛ/ (e.g. cf. *pit/pet*) is neutralized before a nasal, so *pin* and *pen* or *Jim* and *gem* are homophonous. The vowel occurring in these words, approximately [ɛ̃], must be an allophone of /ɪ/ or /ɛ/, because it is in complementary distribution with both—but which one is it an allophone of? Generative Phonology regards this and other paradoxes as definitive evidence against positing a phonemic level of representation (Chomsky 1964, 1966, Chomsky and Halle 1965). These arguments against the phoneme were widely accepted, leading to near-universal rejection of the phoneme as an element of linguistic theory. Still, the word “phoneme” continues to be used as a convenient way of talking about speech sounds, and the theory of Lexical Phonology includes a level of representation that harks back to the phoneme.