Determining the distribution of segments in a language

In phonological analysis, we often want to determine whether two sounds:

1. belong to two separate **phonemes**
2. are **allophones** of a single phoneme

We can gather evidence about segments' status with respect to the phonemes of a language by examining their **distribution** in that language. That is, what are the **environments** in which each sound appears? Are these environments **predictable** or **unpredictable**?

We begin by making a list of the environments for each sound and then examining the lists for patterns.

1. Contrastive distribution

We can prove that two sounds belong to **two separate phonemes** if we can show that they are in **contrastive distribution**.

Two sounds are in contrastive distribution, also known as overlapping distribution, when they **appear in (at least some of) the same environments**. In other words, given information about the phonological environment, it is **unpredictable** which of the sounds under investigation will appear in that environment. Unpredictable information can't be assigned by the phonological grammar — it must be stored in the underlying representations (URs) of morphemes in the mental lexicon. On the other hand, when a phoneme has multiple allophones, they are assigned by the phonological grammar. Therefore, two sounds that are in contrastive distribution can't possibly be allophones of the same phoneme (although see below on the distribution pattern known as *neutralization*).

There are two ways to show that sounds are in contrastive distribution.

- Find at least one **minimal pair** of words distinguished only by the sounds in question. A minimal pair is quick and easy proof that the two sounds are contrastive — after all, the two sounds are used in the language to make contrasting words.
- Even if you can't find a minimal pair, you may be able to demonstrate that the two sounds appear in **overlapping environments**; that is, that nothing about their environments can be used to predict which sound will appear. This requires more careful discussion, showing that neither the preceding environment, nor the following environment, nor both taken together, can be used to predict which sound will appear.

2. Complementary distribution

If two sounds are in **complementary distribution**, we can show that they are **allophones of the same phoneme**. (To think about: When *multiple* pairs of sounds are in complementary distribution with each other at the same time, how do we decide which of them to pair up?)

Two sounds are in complementary distribution when they **never appear in the same environment**. That is, one sound appears in a certain set of environments, and the other sound appears in the **complement** of that set of environments — so that between the two sounds, they cover all of the possible environments of the language. (Extending this, if a phoneme has *more than two* allophones, we may find three, four, or more sounds that all appear in distinct environments, dividing up the labor of covering all the environments in the language.)

When two sounds are in complementary distribution, it is **predictable** which of the two will appear in any given phonological environment. Thus, we will be able to model a phonological process (for example, write a phonological rule) to determine which allophone appears where. Some examples:

- Sound A appears only at the ends of words. Sound B appears elsewhere (i.e., in all other environments that we know of).
- Sound A appears only when it precedes a fricative. Sound B appears elsewhere, including before stops, vowels, liquids, nasals, glides, etc.
- Sound A appears only when it follows a sonorant and precedes a vowel. Sound B appears elsewhere — whenever those conditions are not met.

These made-up examples illustrate some of the things that need to be considered when we look for crucial environmental factors. Sometimes we need to look at word boundaries. Sometimes we need to look at just the preceding sound, or just the following sound. Sometimes both the preceding and following sounds are relevant. Also, sometimes the crucial natural class in the environment is a very general one, like "vowels" or "fricatives," while other times we will need to be more specific, as in "high vowels" or "voiced coronal obstruents".

Very often, the environment for one allophone can be stated in terms of natural classes, but the other environment cannot. In such cases, we can refer to the uncharacterizable, "left-over" collection of environments as "**elsewhere**" (a concept that is important in phonological analysis).

- A note about **long-distance environments**:

  As we saw in the Turkish problem, we can't always look only at the immediately adjacent segments to determine what phonological environments are relevant. **Vowels**, in particular, can be affected by nearby vowels even if consonants intervene. But don't try too hard to find long-distance environments for **consonants**; such cases are comparatively rare and almost always involve *assimilation or dissimilation* of a **specific feature** (well-known cases include [±nasal], [±lateral], [±anterior]). We would not expect to find, say, a language where the voicing of a word-final consonant depends on whether or not the word-initial consonant is a labial fricative.

As always, be as general as possible when stating an environment. Don't refer to "high front tense vowels" when "high vowels" would be sufficient. And remember that the word *or* is a red flag when you are trying to characterize an environment — it warns you that you may not have

correctly identified the appropriate natural class. Finally, be sure to formalize your analysis (using the tools of our model) by stating the natural class in terms of **features**.

3. Neutralization

Neutralization is a situation in which two sounds belong to separate phonemes — their distribution is demonstrably contrastive — but, **in some particular environment (context)**, phoneme #1 has an allophone that is identical to phoneme #2 (or more accurately, to phoneme #2's allophone in that environment).

An example of neutralization would be a language in which /p/ and /b/ are in contrastive distribution in most environments, but /p/ has a [b] allophone when it follows a liquid. Thus, following a liquid, both /p/ and /b/ surface as [b]: the /p/-/b/ contrast is **neutralized** following a liquid.

Neutralization is most clearly seen in cases of **morpheme alternations**, where we can *directly observe* two different phonemes "turning into" identical-looking allophones in a particular context.

4. Free variation

In a case of **free variation**, two sounds belong to the same phoneme, but their distribution is not determined by their environment. Instead, either one of the two sounds may be freely used in any environment (although the meaning does not change when one of the sounds is exchanged for the other — this is why we know the sounds are *not* distinct phonemes).

Often, free variation is not truly "free," because the choice between the two options may be determined by non-phonological factors like sociolinguistic context or speech rate. In any case, because the focus of this course is on *phonological* factors, we will probably not discuss many cases of free variation.