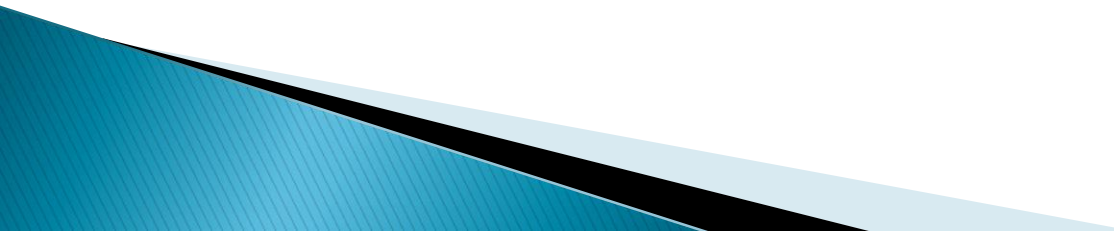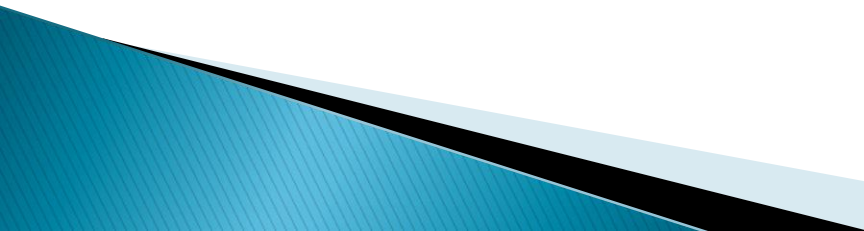# Psycholinguistics
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First Semester
Lecture 6

Speech Production

- **Introduction:**
- It is more difficult to study speech production than to investigate speech perception or comprehension because of the difficulty in constructing experimental tasks that can reveal complex steps in the process. Thus, psycholinguists interested in the speech production process must use less direct methods to gain insight into how this is accomplished.
- Psycholinguists are still far from understanding the process by which speakers put the message they wish to convey into linguistic form or how their words and phrases are selected, constructed, and ordered.

Sources of Data for Models of Speech Production

- ## 1. Speech Errors:
- All of us have experienced, either as speakers or hearers, utterances that seem to have gotten mixed up on their way out. (see the examples on page 312). These are called **speech errors** or **slips of the tongue.**
- Such errors provide indirect evidence for the units, stages, and cognitive computations involved in speech production.
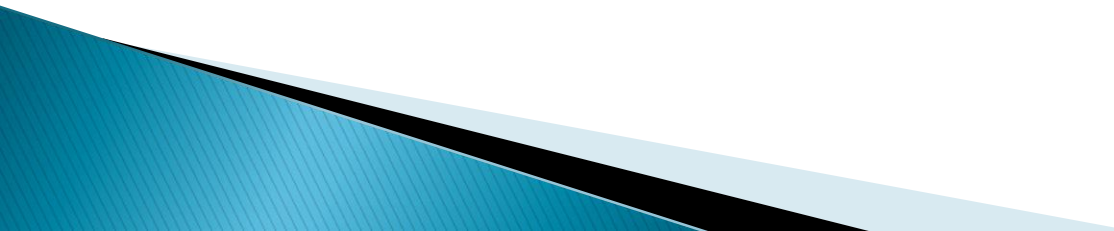- ## 2. Disfluencies:
- Utterances are characterized by hesitations, repetitions, false starts, and "filler" words such as *um,* or *you know* (sometimes called **filled pauses** and **unfilled pauses**). These occur roughly every five words when people describe pictures. However, their presence is rarely noted.

▸ Such lapses in fluent speech production provide us with valuable insights into the units of speech production and permit us to evaluate how much of speech is mentally planned in advance of its production.

Units of Speech Production

- We produce speech by stringing together, arranging, and rearranging a limited number of stored items. Even a long memorized passage must be mentally represented by its constituent parts including sentences, clauses, phrases, words, morphemes, syllables, phonemes, and even phonological features, because all of these units represent items that may be disordered or forgotten or remembered.

- These units which linguists use in describing the structure of language are those discrete units out of which the continuous physical speech signal is composed during the process of speech production.

- The speech signal is continuous, and locating the boundaries of any speech unit is difficult.
- However, when segments such as sounds or words are produced incorrectly or shift position within the utterance, they are identifiable as separable units.
- Errors also reveal that utterances are composed of units of differing sizes and classes; segments of varying sizes appear to be vulnerable to slips of the tongue.

- **Phonemic Segments:**
- 1. Anticipation errors: sounds which will come later in the utterance inappropriately appear earlier than intended.
- 2. Preservation errors: a sound produced early in the utterance reappears in an incorrect location later in the utterance.
- 3. Other types of errors: exchange errors, deleted phonemes, added phonemes.
- (Examine the examples on page 315).
- The speech errors illustrate an important point about basic units of speech production: at some level, they correspond to our notions of phonetic segments, such as consonants, vowels, and consonant clusters.
- **Phonetic Features:** (Discussed earlier in chapter 3)

The Syllable:

- Syllables also constitute units in the phonemic programming system. Errors do occur in which syllables that have no morphemic status (have no meaning by themselves) are disordered. (examine the examples on page 316).

- Exchanged syllables seem to obey a structural law with regard to syllable place; that is, initial segments replace initial segments, and final syllables exchange with final syllables.

The Stress:

- Because stress can be disordered like other phonemic features, it should be viewed as an independent production unit. (examine the examples bottom of page 317).
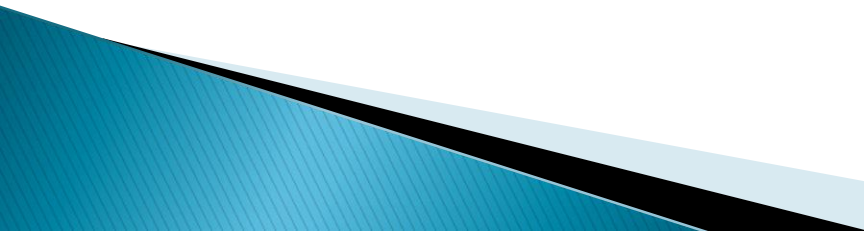
- **Word selection and placement errors**:
  - Words are discrete units in the production process. (examine the examples on page 318).
  - In other kinds of speech errors, words are also misselected, which provides interesting evidence for the nature of lexical retrieval and the representation and organization of our mental dictionaries (discussed in chapter 4).
- **Lexical search and pausal phenomena:**
  - Hesitations (unfilled pauses) are more likely to occur before content words. They are also longer before content words than function words.
  - This suggests that the speaker does not yet have his lexical target available for the next stage in the production process.
  - Hesitations are more likely to occur before less commonly used words in the language suggesting a more difficult process of lexical access than for more frequently used words.

- **Morphemes and Speech Errors:**
  - The basic unit of meaning in language is the morpheme, thus morphological units serve as building blocks. (examine the examples on page 319).
  - The separation of stem morphemes from affixes (inflectional or derivational prefixes or suffixes) shows that such affixes function as independent processing units.
  - The production of "possible" but nonoccurring derived forms show that, at least in some cases, complex words may be formed during speech in addition to being selected from the mental dictionary.

- **Grammatical Rules:**
  - Rules of inflectional and derivational morphology appear in speech errors through production of nonoccurring, morphologically complex words, and errors in morphological rule application. (examine the example on page 319).
  - Although the speaker produces an error, the "slip" reveals knowledge of grammatical morphology, including how grammatical morphemes are to be pronounced when they are affixed to differing stems.
- **The Phrase as a unite in slips of the tongue:**
  - Sentence constituents such as noun phrases, verb phrases, and prepositional phrases are in some way *marked off* as units when we speak. (examine the examples on page 320).
  - The noun phrases retain their internal organization, and two identical types of grammatical constituents are exchanged.

- **Self-Corrections and Re-tracings:**
    - When a speaker notices an error and proceeds to correct it (**self-correction** also called **re-tracing**), the correction is more apt to occur at the beginning of the syntactic constituent in which it occurs than at the actual error site. (examine the example on page 320).
    - The fact that most corrections take place at the beginnings of syntactic phrases supports such units as one type of building block in the speech production process.
- **Pausal Phenomena:**
    - Pausing is also a reflection of the language encoding process. Pauses are likely to occur at clause boundaries or other major structural breaks, as well as before certain lexical decision points.
    - Such positioning implies that speakers may be using the pause time to encode the following clause.

How Far Ahead Do We Plan?

- An examination of speech errors in which words are exchanged reveals that the largest percentage of such errors involves words in the same clause. This implies that speech is planned in clausal units.

- Another source of evidence shows that certain sequences of sounds often undergo rule-governed changes. (examine the example on page 322).

- However, such phonological processes apply less often across clause boundaries, indicating that the rules operate primarily within clausal units.

- *The chef fixed the soup and then MADE YOUR sandwich.*

- *The chef fixed the soup and the MAID YOUR sandwich.*

What Speech Error Data Suggest About the Process of Speech Production

- **1. Speech is planned in advance:**
- Speech is not produced one unit at a time. Prior to articulation the speaker must have access to a representation that includes more than one word, and in fact may include more than one clause. A viable model of production must posit all and only the necessary stages, showing which errors could occur at which level or stage, and predict the form of the utterance representation at that level.
- **2. The Lexicon is Organized Both Semantically and Phonologically:**
- Words involved in word substitution errors and word blends are semantically or phonologically similar or both. (examine the examples on page 323).

- The models of speech production assume that errors in lexical selection are accounted for by the nature of lexical organization. That is, the choice of inappropriate lexical items may occur because synonyms, antonyms, and similar sounding words are stored in close proximity to a given target word, and thus may be retrieved in error. Such erroneous selection, however, must occur at a stage after the syntactic form class of the target words has been determined, because word substitutions and blends do not create ungrammatical strings, as in the examples, which illustrate that nouns substitute for nouns, verbs for verbs, etc. Such behavior indicates that the speaker has already determined the grammatical form class of a target word.
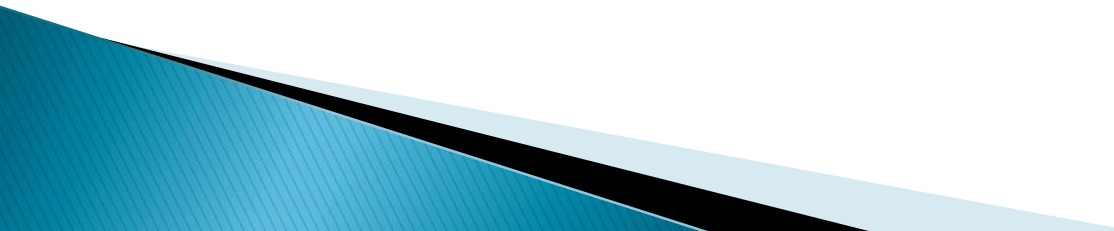
- **3. Morphologically Complex Words are Assembled:**
- Other errors in morphologically complex words, e.g. *A New Yorker → a New Yorkan (America/American)* **show that the morphological rules for word formation posited by linguists are actively engaged during speech production, and that they are compiled, even if they are stored as wholes (with morphological boundaries included).**
- Further, some word substitutions occur that appear to be influenced by previous words in the string, e.g. *Gave birth at midnight → gave birth at midwife*. The semantic relatedness between *birth* and *midwife* suggests that after *birth* was selected, as well as the intended *midnight, midwife* was incorrectly selected because of its phonological similarity and its active priming.
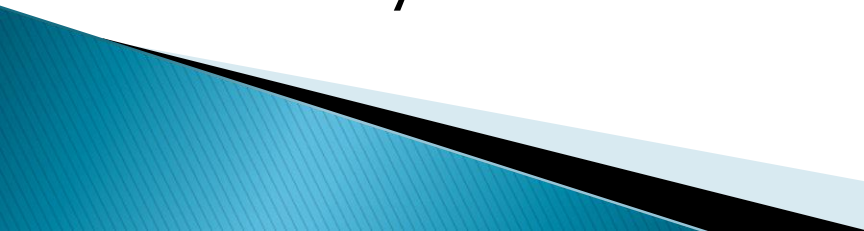
Speech errors involving affix placement suggest that inflectional and derivational morphemes are stored and processed differently from words and word stems in the speech production process.
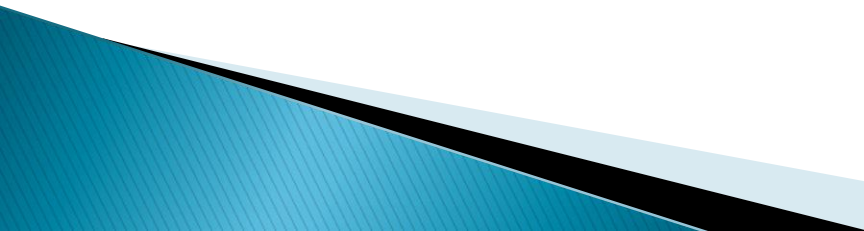
- *I don't know that I'd know one if I heard it → I don't know that I'd hear one if I knew it.*
- The verbs *know* and *hear* are shifted, but not in their inflected form; *heard* becomes *hear* and *know* becomes *knew*. That is, the verbs were exchanged (but the past tense marker meant to be applied to *hear* remained behind) before the past tense marker was applied to yield the final appropriate form of the new word *knew*. **This could only result from a discrete stage at which affixes are combined with their roots.**
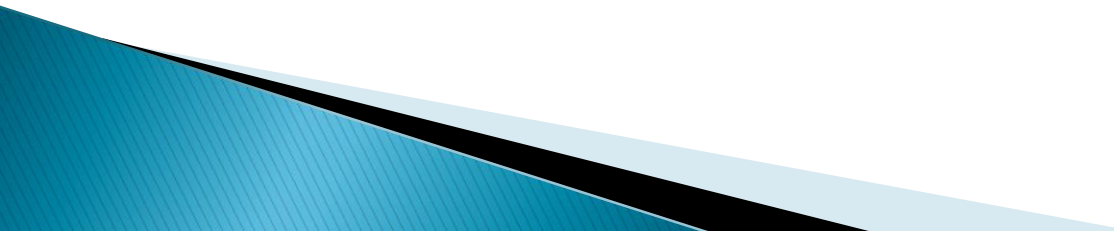
- **4. Speech errors reflect rule knowledge:**
  - *They seem to know where the problem is → They seem they know*
  - *It would be of interesting to see.*
  - These syntactically deviant sentences may arise from sentence blends, a combination of two sentence options into one. The first example may be a blend of *they seem to know/they know*, and the second example might be a blend of *it would be interesting/it would be of interest*. Such ill-formed syntax must arise at the level or stage in speech production when the syntactic structure of the utterance is being planned and constructed.

Speech Production Processing Models

▸ **1. The Utterance Generator Model of Speech Production:**

▸ This model is proposed by Fromkin (1971). It distinguishes six stages at which different representations of the utterance occur.

▸ The rectangular boxes stand for the representation at each level; the diamonds symbolize the processes that translate each level of representation into the one below.

▸ It is a top-down generator.

- I. Meaning to be conveyed is generated: An adequate model should account for competing plans at the conceptual level or at other levels which might allow the generation of more than one message at stage I that could be mapped onto one or more syntactic structures at stage II, resulting in speech errors such as syntactic blending mentioned earlier.

- II. The message is mapped onto a syntactic structure: A syntactic outline of the message is created. Semantic features (selecting words from the lexicon) will later be mapped onto these structures. Hence, the form and the grammatical category of the words that may be chosen is already determined.

- III. Intonation contours (sentence and phrasal stress) are generated on the basis of the syntactic representations. These are assigned before lexical selection because the syntactically determined primary stress and intonation contours and lexical stress are independent of one another and exist on different prosodic tiers.
- IV. Words are selected from the lexicon: Lexical items are now chosen on the basis of the semantic features and syntactic categories. However, these lexical items are not fully specified, in the sense that their morphological affixes are not "spelled out" phonologically.

- Speech-error data showed that the eventual phonological forms of grammatical morphemes are not yet determined; in slips of the tongue, accommodations match morphological affixes to their stems using morphophonemic rules. Thus, the model proposes that grammatical morphemes are entered in their phonological shape at a later stage.
- V. Phonological specification: At this level, phonological pronunciation rules apply and produce fully specified phonetic segments in syllables as the output.
- VI. Generation of the motor commands for speech:

- ## 2. Levelt's Model:
- In Levelt's (1989) model, message generation is initiated by the conceptualization of the utterance. During this early phase, an intention is conceived. The output of this stage is called the *preverbal message*, which is fed to the *formulator*. The formulator is divided into two sub-components.

- 1. The grammatical encoder: retrieves the lexical items with their syntactic and semantic properties, referred to as **lemmas.** A lemma (noun or verb) is used to generate appropriate phrase structures. Hence, the grammatical encoder produces an appropriately ordered string of lemmas.

- 2. The phonological encoder: takes the syntactic outline and generates a phonological plan for the utterance, which includes its eventual intonation and stress patterns.

- The *articulator* then executes the phonetic plan by conveying instructions to the neuromuscular system.
- The *speech-comprehension system* monitors the output for errors. Levelt (1983, 1989) notes that attempts at self-correction while speaking suggest that speakers actively attend to (**self-monitor**) both intermediate forms of their intended utterances during processing, as well as their output, e.g.
- *To the left side of the purple disk is a v–, a horizontal line.* (before full articulatory realization)
- *How long does that has to – have to simmer?* (fully realized utterance).

3. Dell's Model:

- Dell's spreading activation model of speech production is a connectionist model.

- In this model, words (and possibly rules) are organized into networks, with connections between units based on semantic and phonological relatedness. The activation of a concept spreads activation to those lexical items sharing semantic features with the thought to be conveyed. For example, the speaker's thought, "swimmer," activates, among other things, a class of nouns, a class of nominal affixes such as plural, and a class of verbs.

- Because of spreading activation among all nodes in the network, selection of *swimmer* also to some extent activates *drown* and *swim*, in addition to *sink*, and also activates aspects of their grammatical usage, as well as their phonological forms.

- Because activation is presumed to be bidirectional, it is theoretically possible to have interactions between semantic and phonological representations, leading to slips that share both phonological and semantic properties with the intended output.