Psycholinguistics
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Lecture 4

Words and Meanings
From Primitives to Complex Organization

- **Introduction:**
- In this lecture we ask the following questions:

1. How much can we know about real words?
2. Where do we store words?
3. How are they organized in our minds, and how do we recognize words that we see or hear?
4. What is meaning?
5. How do words relate to meanings?

- **How do we answer these questions?**
- We will address the first question by discussing the organization and processing of words and meanings using both psychological experiments and philosophical theorizing. First, we will consider words and meaning separately. At the end, we will link the two domains back together as we explore how listeners and readers process **lexical ambiguity**–words that have multiple meanings.

Words and Meanings: Separate but Linked Domains

- Three arguments make this point:

1. The translation argument suggest that any given language includes some words that do not depend on meaning for their existence and some meanings for which there are no single words, e.g. the Yiddish word *schlep,* the study of Heider (1972) on the language of the Danu (bottom of page 159), snow in English and in Eskimo.
2. The imperfect mapping illustration suggests that a given language can have many meanings for a specific word (ambiguity), e.g. *checked* and many different words for a given meaning (synonyms), e.g. *pail* and *bucket*.

3. The elasticity demonstration illustrates that a word meaning can change in different contexts, e.g. *tall tale* and *tall man*, *light class load* and *light child*. These examples show that word meanings sometimes hinge on the words that they appear with and are often context dependent.

The study of Words

- In this section we explore:
- 1. the form in which words are stored in our mental lexicon.
- 2. the factors that contribute to the access or retrieval of words.

First, we discuss the theoretical issues that underlie this research.

Word Primitives:

- We start by examining the sentence *The impartial judge ruled the defendants guilty* in terms of the morphological notions of morphemes, free morphemes, and bound morphemes. There are two hypotheses about word primitives:

- 1. One hypothesis about **word primitives** (the smallest form in which a word is stored in the mental lexicon) argues that each word (even a multimorphemic word) is a separate entry (or **lexeme**) in our lexicon, and is thus its own primitive. Therefore, each variant of a word (for example, *book, books, bookish, bookshelf,* and so on) has its own representation. When we produce multimorphemic words, such as *impartial* or *defendants*, we retrieve the plural form of the word directly. Likewise, when we hear or read a word, we access its lexeme as a whole.
- This seems an illogical and unnecessary use of space, yet it saves on processing time.

- 2. Another hypothesis about **word primitives** is that words are made up of constituent morphemes and that these morphemes serve as word primitives. When we listen to someone speaking, we **decompose** words into morphemes in order to comprehend spoken language. Thus, we "strip" a word of all affixes and then activate the root word *rule* plus the relevant bound morphemes (*-ed*). Likewise, when we speak, we access individual morphemes and combine them to make up complex words. This theory has the advantage of **cognitive economy**.

Evidence about word primitives:

- 1. the productivity and the ability of the users of the language to construct new words from their knowledge of morphology.
- 2. The results of the **lexical decision task** (see page 163, paragraphs 2, 3, and 4) in most studies were that it takes longer time to process multimorphemic words than words composed of a single morpheme. Further, pseudo-suffixed words take longer to process than actual prefixed words.
- 3. Speech errors in inflectional morphemes can be explained through a decompositional view of the lexicon.
- **Q.** What is the meaning of **lexical access, pseudo-suffixed,** and **reaction time**?

- 4. frequently encountered affixes, *disguise,* may be stored whole as lexemes. The same can be said about frequently encountered compound words, e.g. *impossible* versus *imperceptible.*
- 5. The results of **semantic priming tasks** (see page 165, paragraph 2) found faster response times to the second word when the first word was semantically related. Further, semantic associates have been found to prime **semantically transparent compound words**, but not **semantically opaque compounds.** These findings support the idea that the former are processed as two separate morphemes while the latter are processed as a single morpheme.

Factors influencing word access and organization:

- **Q.** If you were asked to sort out 150000 words in a computer program in a way that mimics their organization in the brain, what principles might you use?

- Models of lexical access need to account for this intuition and for various empirical findings that suggest that word recognition and retrieval are influenced by several key characteristics of words themselves.

- **1. Frequency:**
- The effect of frequency on lexical processing is a robust experimental finding: while reading or listening to someone speak, subjects tend to recognize high-frequency words more quickly and easily than low-frequency words. Further, subjects with aphasia are typically more accurate at reading high-frequency words than low-frequency words.
- **2. Imageability and Concreteness and Abstractness:**
- In memory tests, high-imagery words were more easily recalled than low-imagery words. Further, in lexical decision tasks, words primed other words only when both words were of the same type, for example, concrete-concrete or abstract-abstract, but not concrete-abstract or vice versa. From this, it was concluded that the lexicon is organized separately for concrete and abstract words.

- **3. Semantics**:
- In word association experiments (see page 168, paragraph 3) three major findings have occurred:

1. Subjects are most likely to respond with a semantically similar word, suggesting a stronger connection based on meaning than on, say, perceptual similarity, e.g. *needle*.
2. Subjects are most likely to associate the completion of a pair, e.g. *salt* triggers *pepper*.
3. Adults are most likely to respond with a word of the same grammatical class as the target.

Further evidence for the role of semantics within lexical access and organization of the lexicon comes from brain-damaged patients. In one study, an aphasic patient would often retrieve a semantic associate when reading, e.g. *sister* instead of *daughter, long* instead of *large*, and *mauve* instead of *purple*.

- **4. Grammatical Class:**
- Words also seem to be organized based on their grammatical class: nouns, verbs, and adjectives.
- Evidence comes from speech errors substituting nouns for nouns, etc. and from word association tasks where adults are most likely to respond with a word of the same grammatical class. Further, it has been found from lexical decision tasks that there is no frequency effects on **closed-class words,** and strong frequency effects for **open-class words.** Finally, Broca's aphasics are selectively impaired in their production of closed-class words.
- **5. Phonology:**
- Evidence indicates that words that sound alike might also be connected or stored close together in the lexicon, e.g. substitution for similar-sounding words.

- **Conclusion:**
- Some principles, such as frequency and meaning, seem to permeate all other principles, thus are more global aspects of the lexical system. However, we may use multiple principles of organization and access to accomplish all the jobs the lexicon is called on to perform.
- We will examine the ways different theoretical models account for how all these principles operate within a single cognitive system.

Models off Lexical access

- Our lexicon must be an extremely organized place in order for speech or comprehension to occur as flawlessly as it normally does, bearing in mind that the lexicon serves multiple purposes while reading, listening, and speaking or writing.
- A viable model of lexical access must explain this. Two major classes of models detail how words get accessed during reading or listening, and they implicitly provide us with some hypotheses to how the lexicon might be organized: **the serial search model** and **the parallel access (or direct access) model.**

- **Serial search models**:
- It claims that when we encounter a word, we look through a lexical list to determine the item is a word or not, and then retrieve the necessary information about the word (such as its meaning or grammatical class). Serial search means that the process takes place by scanning one lexical entry at a time, sequentially.
- The best known serial search model is **Forster's** (1976) **autonomous search model**.
- It is best described by comparing it to a library (see bottom of page 171and pages 172-173)

- **Parallel Access Models**:
- It proposes that perceptual input about a word can activate a lexical item directly, and that multiple lexical entries are activated in parallel. That is, a number of potential candidates are activated simultaneously, and the stored word that shares the most features with the perceived word wins. Most models then propose some kind of decision stage, during which the accessed word is checked against the input. Among the three major versions of direct- access models, the earliest version is John Morton's **logogen model.** Two other forms of direct-access model are **connectionist model** (McClelland and Rumelhart, 1981) and **cohort model** (Marslen-Wilson, 1987).

Separating words from meaning

- 1. We shall attempt to determine what features cause words, sentences, or larger linguistic units to mean what they do.
- 2. We shall describe psychological theories of how meaning is stored in our minds.

- To attempt to specify the features of meaning we'll take first about the following:
- The difficulty of defining the meaning and of simple words as *Bachelor*: unmarried male, the pope, a divorced man, men and women together as partners without being married.
- The meaning of a term is referred to as its **intension**, e.g. there are two intensions of the concept *chair.* Further, the set of that to which a word applies is known as its **extension**.
- Using evidence from extension to infer the intension of categories such as *kite* is easy, however, difficult for adjectival concepts such as *red*.

Philosophical Theories of Meaning

- **Reference Theory**:
- This theory postulates that the meaning of a term is the object to which that term refers or *denotes* in real world (that is, its **referent**).
- The theory thus draws a distinction between proper names that refer to a specific person or thing, category names that refer to a class of objects, and property names that refer to characteristics of objects or events.
- **Problems with the theory**:
- 1. Not all words *name* things, e.g. *and, not, or*.
- 2. There are things for which no real "objects" exist in the world, such as *freedom*.

- **Ideational Theory**:
- What words actually denote are *ideas rather* than objects. Thus, the terms *Hamlet* and *unicorn* have meaning by virtue of our mental ideas about them, even if the objects themselves do not exist.
- **Problems with the theory**:
- 1. We can never be entirely certain that other people correctly interpret our meanings, nor that we correctly interpret theirs.
- 2. Some meanings are found in the real world, not just in one's head.

Conceptual Primitives

- Three major issues address the study of meaning:
- 1. What are the smallest units (or primitives) of meaning? The study of the "building blocks" of concepts, i.e. **Conceptual primitives**, referred to as **features** parallels exploration of the primitives of words. The concept *even number* has the featural definition of "divisible by 2."
- 2. Whether concepts have clear boundaries or not, so that, for example, it is evident what counts as a *cup* and what does not.
- 3. Whether it is sufficient to represent a category as a list of features. Just as we have knowledge of individual morphemes, we also have knowledge of which morphemes can be combined and which cannot. Likewise, we can have knowledge of which features tend to co-occur within a concept.
- These issues will become clearer as we portray the differences between various feature theories.

Feature Theories

- They hold that concepts can be defined by the prevalent attributes within a category. As in the morpheme-as-word-primitive view, most researchers believe in a **decompositional view of meaning** such that concepts are composed of bundles of smaller units called features.
- Some characteristics that count as features can be designated as either *perceptual* (for example, "gray, large," like an elephant), *functional* ("used to transport people," as vehicles), *microstructural* ("composed of hydrogen and oxygen molecules," of water)

Variation of feature theories

- Although most philosophers and psychologists agree that concepts are themselves composites of features that serve to define each concept, there are disagreements about what features are necessary in defining each concept, and about the structure of meaning in mind. Among the multiple theories of concepts and categorization, two main approaches are **classical view** and **family resemblance theory.**

- **The Classical View:**
- It states that any concept has necessary and **jointly sufficient features** that all instances of that concept share. All triangles, for example, (1) are closed figures, (2) have three sides, and (3) have angles that add up to 180 degrees. They *must* have these three features to be triangles (thus these features are *necessary* for something to be a triangle*),* and all objects that have all three features must be triangles (thus the three features listed above are jointly *sufficient* for considering something to be a triangle). Thus, proponents of the classical view consider features the smallest units of meaning.
- It has, however, been challenged by the empirical data that seem to suggest that people do not use necessary and sufficient features in categorization tasks.

- **The Family Resemblance View:**
- See introductory example on page 188, paragraph 3.Many psychologists consider the world, at least as represented in our minds, less clear-cut than the classical view of meaning would have us believe. If you listed all the features of all the birds on your list, there would be no, or few, features common to all instances of the concept *bird*. This demonstrates the absence of necessary and sufficient conditions of *bird* and for any natural concept. In stead, the emphasis is on **characteristic features**- attributes common to many exemplars of a category. All attribute information would be stored within the meaning of a concept, but the features would be weighted according to their frequency within the category. The family resemblance view also emphasizes attributes easily accessible to people when they make category judgments. These most often are perceptual features (for example, “has feathers”) and readily available facts (for example, “lays eggs”).

- The second premise of the theory is that rather than share a set of necessary and sufficient conditions, instances of a concept may overlap in some traits but not in others. A single term, such as *game*, refers to objects that resemble each other in the same way that members of a family resemble each other. See figure 4.7 page 189.
- A third tenet of the family resemblance view is that some instances of a category or concept are more representative than others. Categories are said to have ***graded structure***– some birds would appear on most everyone's lists, others on few people's lists. The *best* example of a concept or category is known as the **prototype.**
- Another tenet of the family resemblance theory is that of **fuzzy boundaries.** Some instances of one category can overlap significantly with other categories, in the way that tomatoes, cucumbers, and olives are all *fruit* concepts that seem to be equally well qualified for *vegetable* status.

- To sum it up:
- There are three initial issues to discern how the prototype theory differs from the classical view:
- Both agree on the answer to the first question-that the primitive building blocks of concepts are features. However, the two disagree on the answer to the second question about whether concepts are structured based on rules and whether conceptual boundaries are well defined. Whereas the classical view argues for strict boundaries and concepts defined by necessary and sufficient features, the prototype view states that emphasis on characteristic features makes concept boundaries fuzzy. Concepts are graded as to typicality within a category. On the third issue, the family resemblance view claims that a list of the most characteristic features of a category is sufficient to represent the meaning of a concept.

Knowledge-Based approaches

- They emphasize that categorization and knowledge of concepts is based on something deeper than perceptual features. It seeks to explain *how* and *why* individual items get grouped together under a category label.
- Two types of knowledge-based theories are discussed in the literature: *psychological essentialism* and *psychological contextualism.*

- **Psychological Essentialism:**
- It advocates that people act as if things have essences or underlying natures that make them the thing that they are. It seems that people want to have a reason or an explanation for the ways they categorize the world. We want a reason why birds have wings, live in trees, and have beaks. For example, they are genetically endowed with a means for flying away from their predators.
- Thus, people have a way of making sense out of the collection of features that they see and of using these features when they encounter them again as signposts for the theory.
- To demonstrate the theory versus feature divide, Medin and Shoben (1988) conducted an experiment in which they asked subjects to judge which terms were more similar: white hair and gray hair, or white clouds and gray clouds. (for the results see page 194, paragraph 2,3).

- To illustrate the force of psychological essentialism see the experiment by Keil (1989) bottom of page 193 and top of page 194.
- **The Result**:
- Children develop a *theory* about a given domain (for example, animals). As a result, knowledge of the meaning of a concept shifts from knowing the most characteristic features of a category to having a general theory about why certain attributes occur. The theoretical reasons then predominate over features in making categorization judgments.
- A belief in biological essence may prove to be a guiding factor in defining what Keil called **natural kind terms,** things found naturally in the world, like animals. In contrast, with **nominal terms** (also known as **artifacts**), which refer to objects invented by humans (for example, vehicles, furniture), a different picture emerges. See the experiment on page 194 2nd paragraph.

- **Results:**
- Whereas the essence of biological categories will be genetic and anatomical; the essence of artifactual categories may be the function for which the object was designed-change the purpose or use, and you change the category.
- In summary, psychological essentialism is the modern extension of feature theories. The work on psychological essentialism is largely being conducted with special attention to natural kind terms: naïve theories of biology, and naïve theories of physics.

- One other class of theories is also gaining attention. These knowledge-based theories, what we have termed psychological contextualism, also go beyond individual feature analysis to ask how the context in which we find objects and events influences our meaning representations of those objects and events.

- **Psychological Contextualism:**
- It refers to the idea that certain contexts, either defined by goal or by culture, can provide the bond between features in a concept and concepts in a category. Several examples will illustrate this position.
- In the first, Labov (1973) presented subjects with pictures of cups (for example, teacups) and bowls, with some of the instances appearing to be part cup, part bowl-for example, wide like a bowl but with a handle. For the results see top of page 195.
- **Contextual knowledge influenced categorization.**
- A second example is Barsalou's previously mentioned "things to take out of a burning house".
- **Higher order knowledge constrains the features that we choose and yokes them together with underlying purpose.**

- Just as contextual goals and memory serve as the knowledge base upon which conceptual relations are formed, so too can cultural goal. In a now classically cited example by Lakoff (1987), the Dyirbal language spoken in parts of Australia treats *Women, fire,* and *dangerous things* as a coherent category, each preceded in the language by a unitary marker *balan*. Although this categorization makes little sense to the Western mind, Dixon (1986) demonstrates that underlying this classification system there is a principled, though culturally constructed, way to classify things.
- The three examples highlight the enormous flexibility and complexity inherent in the human conceptual system. They also demonstrate how our overall knowledge base interacts with conceptual features to create any number of viable categorization system, from biological to the sociological.

Conceptual Organization

- **How are our concept organized?**
- Most of the models that we'll look at use features as their building blocks, in part because they all preceded the more contemporary theory-and knowledge-based theories.
- The most common methods of study have been semantic verification and semantic priming tasks. The models of **semantic organization** we will discuss are largely based on the findings of such experiments.

Models of Semantic Representation

- **Hierarchical Network Model:**
- An illustration of its semantic representation is in figure 4.8, page 197.
- Individual concepts such as *animal* and *fish* are represented as "nodes", with the properties specific to each concept stored at the same level and connections between associated concepts. This model proposed that concepts are organized in our minds as "pyramids" of concepts, with broader, superordinate concepts (such as *animal*) at the top of the pyramid, and more specific, subordinate concepts (for example, *Chihuahua*) at the bottom. In the middle are basic level categories (such as *bird, dog, elephant,* and *fish*).

- One important aspect of the model is its emphasis on cognitive economy (see page 197, 2nd paragraph).
- A second important aspect was its explanation of semantic distance effects. (see pages 197, 198). As with category statement, the number of nodes that must be traversed to determine feature attributes will determine reaction times, i.e. the further the semantic distance between two concepts, the longer the reaction times in the semantic verification tasks.
- A third finding of interest in these experiments was the **category size effect.** (see page 198, 3rd paragraph).

- **Points of criticism:**
- 1. It is too hierarchical and may only work for **taxonomic categories** such as *animals* and *furniture*, but not for more abstract concepts such as *virtue, good, and emotion.*
- 2. The semantic distance effects were confounded by frequency effects of features. For example, subjects list the feature, “move”,” as a feature of animals more frequently than “has ear4s,” even though both are assumed to be stored at the *animals* node. Therefore, semantic distance effects need not be explained by semantic distance at all but by the strength of association between two concepts or between a concept and a feature. Another example, it seems clear that a German shepherd is a better instance of *dog* than is a Chihuahua; hence, more typical members of a category should be verified more quickly than less typical members in semantic verification tasks. A phenomenon referred to as **typicality effects.**

- **Feature Comparison Model:**
- Instead of nodes, concepts are represented as lists of features of two types:
- 1. *defining* features, which are critical for inclusion in a category.
- 2. *characteristic* features, which members of a category usually, but not necessarily have.
- For example, it is necessary for birds to have skin and bones but not that they fly.
- In contrast to the hierarchical network theory, all features are assumed to be stored under all relevant concepts. Although this violates the assumption of cognitive economy, it renders the **feature comparison model** better able to account for some of the empirical findings.

- **Spreading Activation Network Model:**
- Like the hierarchical model, the spreading activation model is still an associated network. However, the structure is not that of a strict hierarchy, but a more complex web of concepts and relations between concepts. Note its resemblance to connectionist models of cognition such as the connectionist model of lexical access discussed earlier. For example, the concept *flowers* is linked not only to *violets* and roses, but indirectly to *fire truck* via the *red* concept node. With regard to concepts, no distinction is made between defining and characteristic features; some connections simply appear stronger than others. The degree of association between nodes is represented by distance, with highly associated concepts, such as *canary* and *sings,* closer than more weekly associated concepts, such as *canary* and *skin*. Likewise, *cherry* would be confirmed more quickly than *fig* as *fruit* because *cherry* is closer to the subordinate category *(fruit),* because of its higher frequency and stronger association.

- The spreading Activation model is flexible enough to account for multiple access routes to concepts and their features and to explain many of the empirical findings related to lexical and conceptual research.

A special problem for the mental lexicon: Lexical ambiguity

- There is no strict one-to-one mapping between words and meaning. Multiple words can supply the same meaning-*pseudonym, alias, pen name.* Likewise, a single word can have multiple meanings: *bank.* Words such as *fox* are said to be *lexically ambiguous* because each word in isolation does not indicate the intended meaning. One meaning of an ambiguous word can be more common than the others: *bank* is most commonly used as a place where money is kept.
- In most cases, the multiple meanings of an ambiguous word share the same grammatical class, *fox*. Other times, the different meanings of a word are from different grammatical classes, *drill*.
- An obvious way in which the lexicon and meaning coalesce is in the study of how we process ambiguous words.

- Much of the research into the processing of ambiguous words has used a **phoneme monitoring task** (see page 203, 3rd paragraph).
- Sentence context usually constrain which interpretation an ambiguous word receive. In fact, there are two major theoretical camps about the role of context in influencing which of several meanings of lexically ambiguous words are activated:
- 1. One camp, **selective access view,** holds that context biases the interpretation of an ambiguous word, so that only the intended meaning is accessed. We consider only one interpretation of a word or a sentence at a time.
- 2. The second camp, **exhaustive access view,** holds that even with context provided, multiple meanings of a lexically ambiguous word are activated. Meanings do not necessarily achieve activation threshold simultaneously; more frequently used meanings of the word, or those influenced by context, may achieve threshold first, although all meanings are activated in parallel. Context simply resolves the conflict between meanings in post-access process. This theory has more empirical support.

The Reciprocal and Influential Relationships of Words and Meanings

- The relationship between words and meanings is a two-way street: words influence the kind of meanings we can convey; and meanings dictate the development of words.
- Work on the learning of object names suggests that the very use of words and language constrains or limits the possibilities for **word-meaning mapping.** The point of this research is that children come to favor certain meanings or mappings over others as they gain experience with language. Golinkoff (1994) have postulated several key principles that word learners rely on in learning novel words (see page 209).

- Taken together, this body of research suggests that something about language directs attention to some meanings over others. Language itself alters the efficiency with which we organize concepts and contributes to greater depth of conceptual understanding.
- The very makeup of our conceptual system works to influence the creation of words in language structures. Certain semantic properties are universally signaled by verbs. Verb systems of languages around the world specify *motion, manner, location,* and *cause* in various combinations. For example, some English verbs use a combination of motion and cause, as in the verbs *blew, pulled, kicked.* Others use motion and manner, or the way in which motion occurs, as in *slid, swung, swirled.* The conceptual structure embedded in the verb meaning serves to determine the propositional structure. This in turn, determines the required syntax, e.g. you can't think of *blowing* without thinking of an *agent* who does the blowing and an *object* that is blown. Given this semantic base, any sentence or syntactic representation is bound to have a *subject noun* (the blower), a *verb* (the act of blowing), and a *direct object* (the thing being blown).

- Psycholinguists are investigating these correlations between meaning and words and between meaning and syntax in an effort to see how young learners might use their early knowledge of meaning and semantic structure to support their way into knowledge of grammatical structure.
- The point is that just as language directs thought, properties of thought direct the composition of language.