LEXICAL DECOMPOSITION
COMPONENTIAL ANALYSIS
PROTOTYPES
NETWORK THEORIES

Lexical decomposition is an old idea. Most dictionary definitions demonstrate this:
Stallion = Male Horse.
In the 1950s L. Hjemslev decided that meaning could be broken down into smaller units just as sound
was broken down into Phonemes or Features. So the idea of what was to become sememes was
born. Philosophers such as G A Moore in England (founder of ordinary language philosophy) also
suggested the idea of conceptual analysis as a method of doing semantics. Hjemslev believed that the
ultimate content of the basic units would be specific to a particular language but other linguists (such
as Wierzbicka today) are intent on finding a universal set just as Leibniz wanted. Anthropologists
interested in kinship terms were developing a similar system (independently) in the U.S.
The style of Componential Analysis that is of interest to us was developed in 1963 in an article called
“The structure of a semantic theory”. In this article the authors argued for a distinction between
Pragmatics and Semantics and a style of semantics that depended on a conceptual analysis as well as a
distinction between semantic and encyclopaedic knowledge (such knowledge obviously being a matter
of psychology).
For Katz and Fodor (1963), Semantics was the part of the grammar that assigned meaning to a string
of words on the basis of its lexical content and its syntactic structure. The pragmatics dealt with the
real world knowledge that is used in the interpretation of a sentence which is outside the domain of
semantics:

The shop sells alligator shoes
The shop sells horse shoes

In an interpretative katz-Fodor model the words exist in a lexicon that contains all the information,
syntactic/phonological and semantic. After the words are joined, Projection Rules worked on trees
(basically the TG trees) to determine how adjacent words would be interpreted in the phrases they
were part of. The Lexicon also contained the selectional restrictions that are still part of syntactic
theory. The system also led to decompositionality (semantic markers are in brackets):

◊ chair: (Object), (Physical), (Inanimate), (Artifact), (Furniture), (Portable), (Has
legs), (Has a back), (Has a seat), (Seat for one).

The items in brackets are ‘semantic markers’ and they represent the semantic information involved in
the meaning of the word. Another type of information would be distinguishers.
A set up for the various meanings of Bachelor would be as follows:

bachelor {Noun}:
  a. (human) (male) [one who has never been married]
  b. (human) (male) [young knight serving under the standard of another]
  c. (human) [one who has the first or lowest academic degree]
  d. (animal) (male) [young fur seal without a mate in mating season]

Thus the analysis combines the shared basic information plus the particular information that
identifies the word.

Further information could be included:

colourful {Adj}:
  a. (colour) [abounding in contrast or variety of bright colours] <(physical object) or
     (social activity)>
The material in angle brackets being selection restrictions.

**ball** {Noun}
- (social activity) (large) (assembly) [for the purpose of social dancing]
- (physical object) [having globular shape]
- (physical object) [solid missile for projection by engine of war]

So, we can see that an expression such as a colourful ball can mean an distinctive, unusual OR variously coloured social occasion as well as possibly meaning a physical object that is multi-coloured but not a distinctive, unusual physical ball as the evaluative meaning is not applicable to a physical object that is not aesthetic.

As the system developed, it became more a system of features so that man was +MALE, +ADULT, +HUMAN; while a woman was [-MALE] [+ADULT], [+HUMAN]; and a boy would be [+MALE], [-ADULT], [+HUMAN]; and a girl [-MALE], [-ADULT], [+HUMAN] etc. The elements in brackets were known as semantic primitive or features.

Structuralist School:

• Componential Analysis - CA (Also ‘Lexical Decomposition’):
The sense components of words are listed as semantic features that go to make up the meaning of a word. This is attractive in that it provides an analysis that looks like analyses in other areas of Linguistics (eg. Phonology):

<table>
<thead>
<tr>
<th></th>
<th>man</th>
<th>woman</th>
<th>boy</th>
<th>girl</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+ human</td>
<td>+ human</td>
<td>+ human</td>
<td>+ human</td>
</tr>
<tr>
<td></td>
<td>+ male</td>
<td>- male</td>
<td>+ male</td>
<td>- male</td>
</tr>
<tr>
<td></td>
<td>+ adult</td>
<td>+ adult</td>
<td>- adult</td>
<td>- adult</td>
</tr>
</tbody>
</table>

Here universal features underlying meaning in all language are listed. This captures the idea that all languages seem to utilise the same kind of meanings. These features are meant to be primitive concepts. Note that these concepts need not actually be the same as the english words human, male, female etc. The point here is not to explain everything in terms of English but to capture the basic concepts underlying all languages. This also helps us capture the idea that words seem to exist in certain sets; so we can have the set of words for young animals: calf, lamb, foal as a set or the females as a set: cow, doe, mare, ewe etc. The sets are just groups of words that share a certain semantic feature. Such a system captures the sense relations between words. Synonyms have the same features, antonyms have opposite features. Hyponyms share all the features with their hyponyms but the hyponyms have some more. However note that man and boy are not opposites, so we can see a weakness in the theory. The different values of ADULT do not lead to opposition whereas the difference in Gender in Man - Woman does. The notion of ‘incompatibility’ is captured however. Woman is incompatible with man and boy, as well as girl but more weakly so.

There is also the problem of determining the list of features from which meaning is drawn. And what features can be used to capture the meaning of the word ‘lemon’ or ‘orange’ that avoid hopelessly detailed analyses.

The system also fails to capture the metaphoric use of words, and the use of idiomatic expressions. A further problem is the lack of psychological reality of the features. An expression using the features overtly is no easier to process than a word that bundles the features up. So ‘cause to die’ is no easier to process than the bundled form ‘kill’.
On the continental side with this kind of development, we have Baldinger who would analyse chair as follows:

<table>
<thead>
<tr>
<th></th>
<th>with a back</th>
<th>raised above ground</th>
<th>for one person</th>
<th>to sit on</th>
<th>with arms</th>
<th>of solid material</th>
</tr>
</thead>
<tbody>
<tr>
<td>chair</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>armchair</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>stool</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>sofa</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>pouffe</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Here all the markers are intended to be exhaustive in their analysis.
The question that always arises in dealing with features is the set of features that we should use. We could just use an infinite set but then we are not getting very far in our analysis. No-one has ever been able to determine a full set of features that people could agree on. Others have argued that many words in language (words for types of living creatures for example) are not analysable any further. There is also the dispute as to whether the features have to be words in the language itself or something so abstract as to have no lexical instantiation.

Further attempts at lexical decomposition have fallen apart for a number of reasons; the analysis of ‘KILL’ as “cause to be not alive” as failed because tests show that it is not slower to process to a sentence with ‘kill’ it than the same clause containing ‘cause to die’ or ‘cause to become not alive’. Furthermore a sentence like
Reginald killed Assumpta on Thursday

does not mean the same as
Reginald caused Assumpta to become not alive/to die on Thursday

Still the notion of features or lexical decomposition is attempting to capture the facts of entailment, synonymy, near synonymy, hyponymy, hypernymy, antonymy, ambiguity.

The notion we have looked at in terms of meanings as features still persists in Chomsky’s and Jackendoff’s works. There is no exposition of the features in Chomsky’s work but Jackendoff does list some features. These types of theories are called by Aitchison “Atomic or Globule” theories. Other types of theory of meaning influenced by psychology would be a prototypical type of theory and a network type of theory.

Prototypes address the question that some things seem to be ‘better’ members of a group than others (chairs are better furniture than radios). The central insight involves categorisation and prototypicality - Eleanor Rosch, (university of California, Berkeley) 1975,

The test involved a list of categories (fruit, vegetable, bird, furniture) with a list of 50 examples (orange, apple, pear, lemon etc.) and the subjects were asked to rate on a scale of 1 to 7 the ‘perfectness’ of the words on the list as examples of the category.
The results were surprisingly consistent. In 1983 psychologists on the other side of America got surprisingly similar results. People seem to match a potential member of a category against a
“prototype”. The idea of prototype is further supported by the notion of colours. one red being a better example of red than some other.

But note that bat made it on to some people’s “bird” list.

Three problems with prototypes:

• diversity of characteristics which make up the prototype.
• the difficulty of arranging them in order of priority.
• the problem of knowing where to stop.

A further problem results from the fact that typicality effects of compound concepts do not follow from the individual component concepts:

There is a Standard Objection to the idea that concepts might be prototypes (or exemplars, or stereotypes): Because they are productive, concepts must be compositional. Prototypes aren't compositional, so concepts can't be prototypes (see, e.g., Margolis, 1994). A prototypical pet fish is neither a prototypical pet nor a prototypical fish.

What prototype would one associate with “forget”? Why is 3 a more prototypical odd number than 247?

Part of cognitive psychology explores the concept of concepts. What cognitive events happen when you think about a chair? How is the concept of chair represented in the cognitive system? This is a subtle issue. For example, surely a seat at a formal dining table is chair, but what about a recliner, a stool, a couch, or a tree stump? The issue is important because the representation of concepts is the basis of everything else we can mentally do with concepts. In a very real sense how we think and what we can learn is largely determined by how we represent concepts.

An efficient way to represent concepts would be to keep only the critical properties of a concept. This set of critical properties is sometimes called a prototype or schema. The idea of prototypes is that a person has a mental construct that identifies typical characteristics of various categories. When a person encounters a new object he compares it to the prototypes in memory. If it matches the prototype for a chair well enough the new object will be classified and treated as a chair. This approach allows new objects to be interpreted on the basis of previously learned information. It is a powerful approach because one does not need to store all previously seen chairs in long term memory. Instead, only the prototype needs to be kept.

This demonstration allows you to participate in a type of experiment that is often used to investigate the creation and storage of concepts. It is a variation of a method used by Posner and Keele (1968), which is one of the earliest studies to systematically explore concept representation in a controlled way. Rather than using an already well-known concept like a chair, Posner and Keele had participants learn patterns of dots. The patterns were variations of a few prototypes, but the prototypes themselves were not seen during a training phase. During the training phase participants learned to classify the variations, with the underlying prototype being the basis for correct classifications.

After learning to classify the variants, participants were shown a variety of dot patterns. In particular, they were shown patterns were shown during the testing phase, new variant patterns, and the patterns corresponding to the prototypes. Classification and reaction time performance were nearly equal for the previously seen variants and the prototypes. Performance was slightly worse for the new variants. This is significant because both the new variants and the prototypes were never seen during testing. To classify dot patterns that were not previously seen, the participants must be using a mental concept of what corresponds to the different categories. That performance is better for the prototype patterns than for the new variants indicates that the mental concept is similar to the prototype patterns. The conclusion seemed to be that people created a mental representation that was a mixture of the variant patterns used during training, that is, a prototype.

Posner and Keele's experiment led to an intense investigation on concept formation and representation. Much of that research is consistent with prototype theories. However, there are aspects
of the experimental data (even in Fosner and Keele's experiment) that suggest that the prototype theories cannot be the sole basis for concept representation. For example, our behavior is often influenced by the properties of individual experiences, and some theories of concept formation suggest that this alone can account for the data purported to imply prototypes.

In word association tests (what is the first word you think of when I say X), patterns emerge: Collocation Co-ordination, Superordination and synonymy (antonymy in adjectives). These patterns also emerge in the 'first 10 words that come to mind when I say X'. Some Psychologists and Linguists have proposed that the mental lexicon is like a network of meanings, some links constant and some temporary, that organise our mental lexicon.

I. Organisation of Nouns:
1. There has been a lot of study into the organisation of nouns as these are what most investigators look at first. It is usually assumed that nouns are stored hierarchically into levels from the specific to the general. The topmost level is the most vacuous semantically: {action}, {animal}, {artefact}, {attribute}, {body}, {cognition, idea}, {communication}, {event}, {feeling}, {food}, {group}, {location}, { motive}, {natural object}, {path} {person}, {plant}, {possession, property} {Process}, {quantity, amount}, {relation}, {shape}, {society}, {state}, {substance}, {time}.
2. The seem to seldom go deeper than 10 levels deep. eg: fiesta — car — motor vehicle — wheeled vehicle — vehicle — conveyance — artefact.
3. The hyponymy relation seems to result from this arrangement. The meronymy relation is then seen as the deeper level inheriting properties of the hyponym, meronymic relation information as well with more precise information stored in the hyponym. eg: canary inherits 'flies', has wings and beak' from the hyponym but contains the extra information 'small', 'yellow' as well as inheriting 'sings' from the hyponym SONGBIRD.
4. Three types of information can be distinguished:
   4.1. PARTS: BEAK, WINGS
   4.2. ATTRIBUTES: SMALL, YELLOW
   4.3. FUNCTIONS: SINGS, FLIES

   I. Parts: Meronyms serve as features that hyponyms can inherit.
   II. Attributes: Canary has a one way — {People will list small as a property of canaries but would not necessarily give canaries in a list of small things} — pointer to small, but the property of small must be interpreted in terms of the head word / hyponym "bird" or "songbird". The canary is small for a bird it is not small in relation to atoms or ants. The noun must contain information about the expected attributes and deeper levels can modify this information. Buildings are expected to be of a certain approximate size, small buildings are smaller than this, tall buildings taller.
   III. Functions: the function of a nominal is a description of something that instances of the concept normally has associated with them. Instruments: knife - cut, Materials: wallpaper - attach; wool - knit, products: hole - dig; picture - paint, containers: box -hold. ORNAMENT - DECORATION: an ornament can be any size, shape or composition so parts and attributes will not capture the meaning but FUNCTION will capture the notion of what an ornament is about. It is hard to see how prototype theories can capture the functional features.

ADJECTIVES:
1. Predicative Vs Non-Predicative Adjectives:
2. Predicative and non-predicative adjectives cannot be conjoined: "the young and three friends. The tall and corporate surgeon.
3. Non-predicative adjectives are not gradable: "The extremely former professor" is odd
4. Non-predicative adjectives cannot be nominalised: The predicative use of the nervous Person allows "The person's nervousness" but the non-predicative use does not: ""the disorder's nervousness."
5. The basic relationship between adjectives is ANTONYM. Witness that in word tests, one adjective causes the opposite adjective as a response. The antonym effect is English is confused because the words are often borrowed in pairs or as single units from romance language or extant from Germanic or a Germanic pair may be half lost. Synsets are groups of words seemingly the same in meaning, they should be regarded as adjectives clustered around a focal adjective, that relates to a contrasting cluster at the opposite pole of the attributes.

I. Gradation: Gradable adjectives can be recognised as those that can take adverbs of degree such as very, rather, quite, somewhat, extremely etc. Some gradation can be lexicalised: Frigid — cold — cool — tepid — warm — hot — scalding. But very few in English are.
II. Markedness: adjectives seem to show the notion of Markedness. This can be seen in
expressions "How old is he" "How long is it". Old and Long are the unmarked forms: he is 5 years old, It is 12 inches long. We can also see that the unmarked form can usually be formed in to a nominal form; long — length. Nearly always one member of an antonym set is the unmarked form. Usually the unmarked form also forms the stem to which the affix is added.

**Colour adjectives:** These seem to be organised differently And in English can also be nominals ... the bipolar pattern of direct and indirect antonymy do not hold for these as adjectives. The work of Berlin and Kay on colour shows that the basic distinction is one of lightness and more colour terms are added as they are need but always following a set pattern determined by our perceptual process.


**VERBS:** The most complex lexical category, the fact that verbs with complex decompositions can be processed as fast as verbs with simple decompositions seems to argue against a componential analysis of verbs/words.

I. **Troponymy** (tropos greek for manner, fashion) the relationship seems to be one of manner — to X is to Y in some manner. Walk — strut, Talk — mumble. hit — tap/whack/slap/rap/chop ....

A. The hierarchical arrangement of verbs is unlike that of nouns in that it is shallower. Also it is difficult to get unique headwords: verbs of motion have two top nodes: {move, make a movement} and {move, travel, displace}. Thirdly, there seems to be a 'bulge' where most verbs cluster, that is a level where we find most of the verbs (called level0). walk is 'to move in some manner' and to slouch, traipse, amble, strut, mosey is 'to walk in some manner'. slouch etc. are level0 walk is level+1 and move is level+2. move — walk — strut, slouch, traipse, shuffle, saunter etc. As one descends in the verb hierarchy so the number of possible subjects decreases. Almost anything can move, people and animals can walk, but only people can really traipse, saunter etc. and certainly only humans can goose-step sleep-walk(?)

II. **Entailment:** Succeed/Try, Snore/Sleep, Mumble/Talk. The three types of entailment we can see are: 1: no temporal inclusion: Succeed/Try — backwards Presupposition. 2: V2 entails V1 and is contained in it temporally: snore entails sleep and is contained in it, buy entails pay and includes it 3: the first verb entails the second and they are temporally co-extensive: Mumble/Talk. Type 3 verbs can be related by troponymy but not type 1 or 2: to mumble is to talk in a certain manner to strut is to walk in a certain manner.

III. **Causal relation:** Feed is to cause to eat so feed causes eat. Show causes see. frighten/fear, raise/rise, give/own give entails own

IV. **Opposition:** win/lose (do not tolerate degree words as they are direct antonyms), lengthen/shorten (deadjectival). Damage/repair, rise/fall. Approve/disapprove are antonyms but allow gradation by quite, rather, extremely. Converses: buy/sell, loan/borrow, teach/learn