# Lecture 16
# Understanding Word Meaning

Hello! And Welcome to the course, Introduction to the Psychology of Language. I am Dr. Ark Varma, from IIT Kanpur. And, we are in the fourth week of the course. We have talked about quite a few things in this course, already starting from you knows. Where language came from, language evolution, we've talked about, a little bit about speech. We've talked a little about, how children acquire language. Now, it

is our turn to move into how people negotiate different aspects of language, different levels of analysis of language and so on. So, what I'm trying to do here is and also going by the organization in you know the book we are referring for this course, that is tracts let's book. We will go in, in a sense, that we'll do a chapter on word processing. Then, we'll probably do something with, you know, reading before sentence processing, we've also already done something about speech processing that is.

So, this week is going to be focused on word processing. It will be focused on understanding, how people negotiate, interact and use words. How do we understand, when words are used around us, and what do we mean by these words that we pick up? Now, if you see you know for the most part, you know for at least a naive person, a word is the smallest meaningful unit of the language. And, what we will do in this week is to try and understand, how really meaning comes about to be attached to this unit. Okay? We will talk about some other levels of analysis as to how people look at words, and how did do they attach meaning to those words. How is meaning organized in our, you know mental framework. Say for example, in the semantic store. And, we also talk about, say for example, whenever it has more than one meaning, what kind of consequences does it take? We'll also spend a little bit of time talking about, say for example, how does the you know brain, you know organize these words and meanings and itself. So, we cover a range of these topics in the five lectures in this week.

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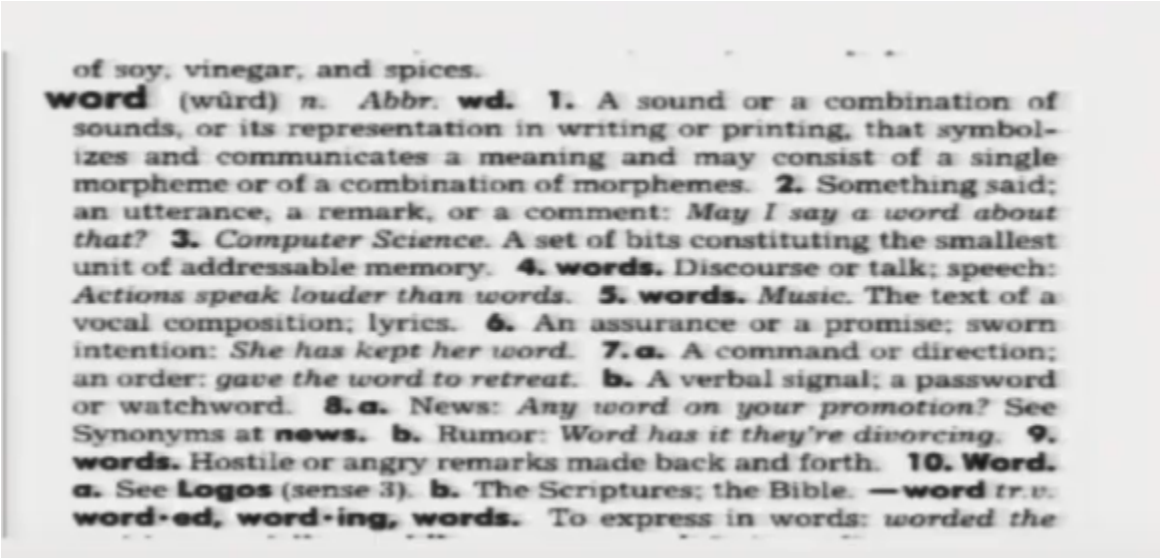
of soy, vinegar, and spices.

**word** (wûrd) *n.* *Abbr.* **wd.** **1.** A sound or a combination of sounds, or its representation in writing or printing, that symbolizes and communicates a meaning and may consist of a single morpheme or of a combination of morphemes. **2.** Something said; an utterance, a remark, or a comment: *May I say a word about that?* **3.** *Computer Science.* A set of bits constituting the smallest unit of addressable memory. **4. words.** Discourse or talk; speech: *Actions speak louder than words.* **5. words.** *Music.* The text of a vocal composition; lyrics. **6.** An assurance or a promise; sworn intention: *She has kept her word.* **7. a.** A command or direction; an order: *gave the word to retreat.* **b.** A verbal signal; a password or watchword. **8. a.** News: *Any word on your promotion?* See Synonyms at **news.** **b.** Rumor: *Word has it they're divorcing.* **9. words.** Hostile or angry remarks made back and forth. **10. Word.** **a.** See **Logos** (sense 3). **b.** The Scriptures; the Bible. **—word** *tr.v.* **word·ed, word·ing, words.** To express in words: *worded the*

Today, we start talking a little bit about words themselves. To let us begin we, we are going to talk about word meaning in today's lecture. Now, if you look at this is a dictionary entry, so, it's a figure of picked up out of Google. It's basically kind of telling us a little bit about, what a dictionary entry of the word suggests us. And, you look at there are almost seven, eight definitions, ten definitions I see. That, I here

which kind of describe what a word is in different ways. So, you can say for example begin with the simplest definition, that says it's a sound or a combination of sounds, or its representation in print or in speech. That symbolizes and communicates a meaning and may consist of a single or a combination of morphemes. So, we'll talk about what morphemes are when we move ahead. Okay? Also, say for example there are, you know particular kinds of uses of the word. Word, say for example you want to say you know, I want to have a word with you, you know I want to have a small conversation with you or say for example things like he had, there was no word in the room or something like. So, the pin drop silence in the word, there are there are quite a few, you know you have my word you have my promise that this will happen.

So, you can already see that the word, word or any other word for that matter, is used in a variety of ways, it can mean a variety of things depending upon, who is using them in what context. So, how do we really do it, how do we really kind of you know, it seems slightly complicated to me. If you, if I look at it now, Is I say for example, there is one word it might mean this, here what it mine might mean something else there, and it might mean something completely different in a different sense? For me, in order to you know acquire and remember what this word would mean makes, you know becomes very complicated, because the word could mean three things. Or a word just, just does not mean this, but it means so many other things as well. And, it you know carries and activate so, so much other kind of information as well. So, this is something that we will try, and you know get a grip of in this week and in different lectures during the week.

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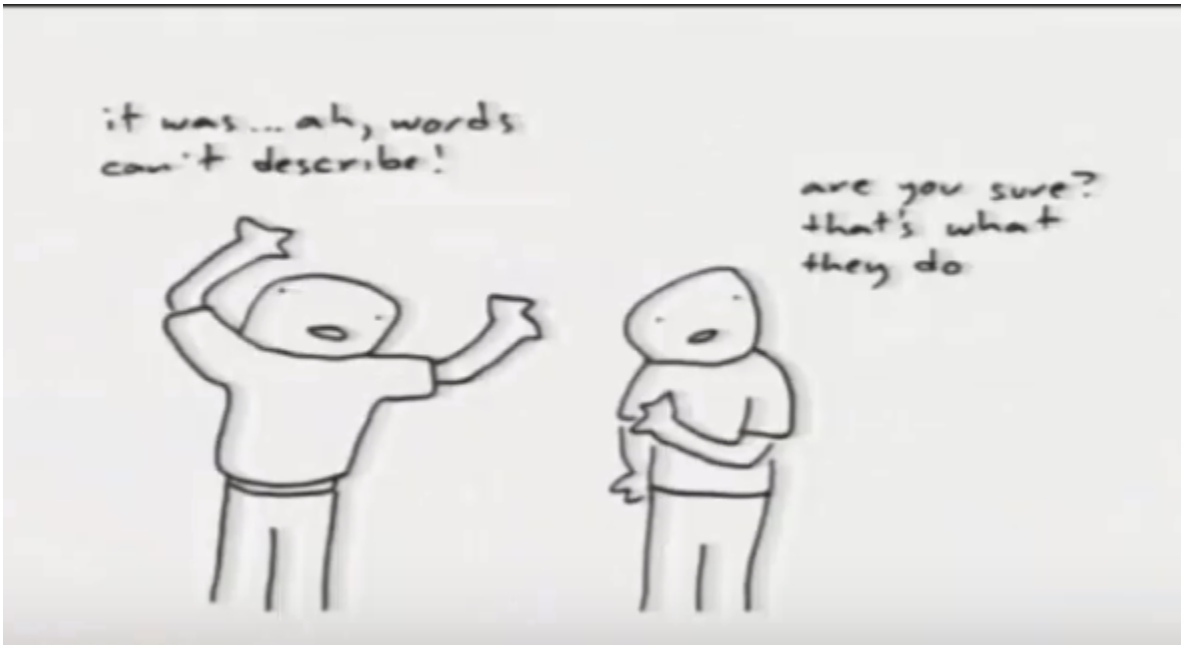

If I ask you what does a word do, and you will see basically tell me that, you know words basically have this function of describing the world to us. So, for example, this is a pen, as soon as I say a pen, your kind of in that 'pen' get an idea of many things. You know, you have a prototypical image of a pen in your head, you know that opinion is used for writing, you know therefore that it should have some kind of ink, some kind of a nib, stylus kind of thing there. And, it is say for example, should be slightly longish cylindrical object that, affords me a grip to use it in a particular way. All of that knowledge you will get, just when I say this is a pen. So, the word pen, per say includes so much of this knowledge, it includes so much of these things all of that you can instantiate, just by mentioning this word pen.

The other thing is, you know sometimes we come across people saying, I cannot describe this feeling in words, I cannot describe what I saw in words, or I have no words to express. And, this is interesting, because that's exactly what words are meant to do, you know? If you look at it more closely, isn't this what words do? Say for example you look at, some of these objects here.

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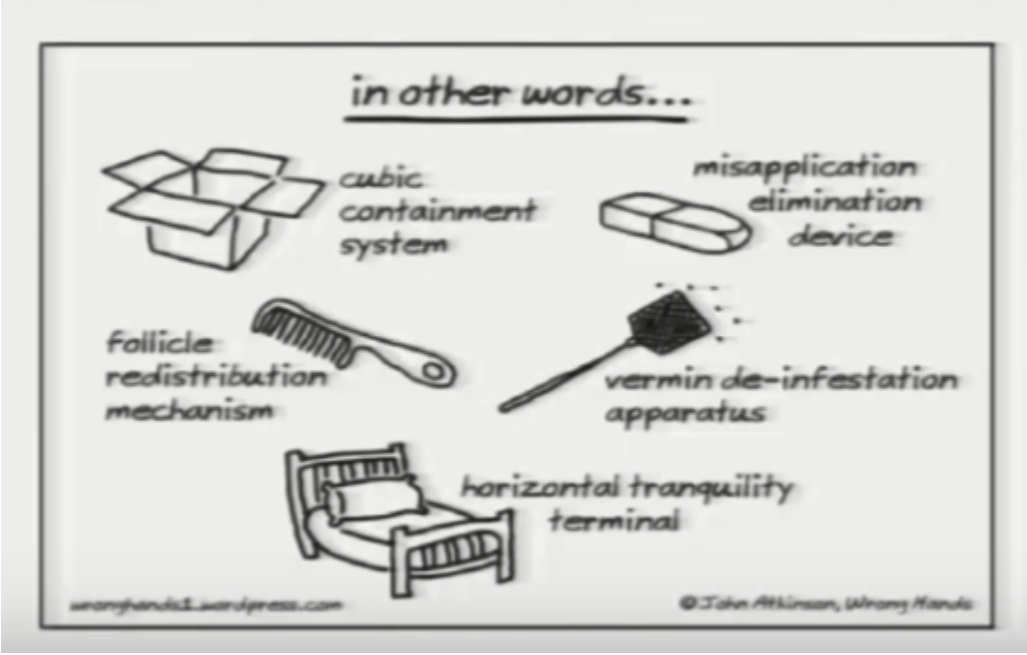


You know, this is a cartoon by John Atkinson, in his blog wrong hands, and I've picked it out you know Google for this a little bit of demonstration. So, if you really look at things here; you can look at a comb, and a comb is actually a follicle distribution system. So, a one word comb, kind of embeds in itself all of these three words. You know, it could also as I said, in itself also contain information about the form and everything. So, many different kinds of information. You see the erasers; eraser is referred to as a misapplication delay elimination device, or misapplication deletion device. Okay, and then you look at a

box, and it is called a cubic containment system. So, this is what words are supposed to do. So, what do words, do words describe our world to us. Words describe what you see around and that by using words your kind of capturing that entire set of concepts, and communicating them, in as many small numbers of sounds or say for example, as words to the other person. This is what, words are supposed to do. And, this is interesting. That how is it that so much of information can get bad into one little combination of sounds at once. This is what; we will be talking about in some detail.

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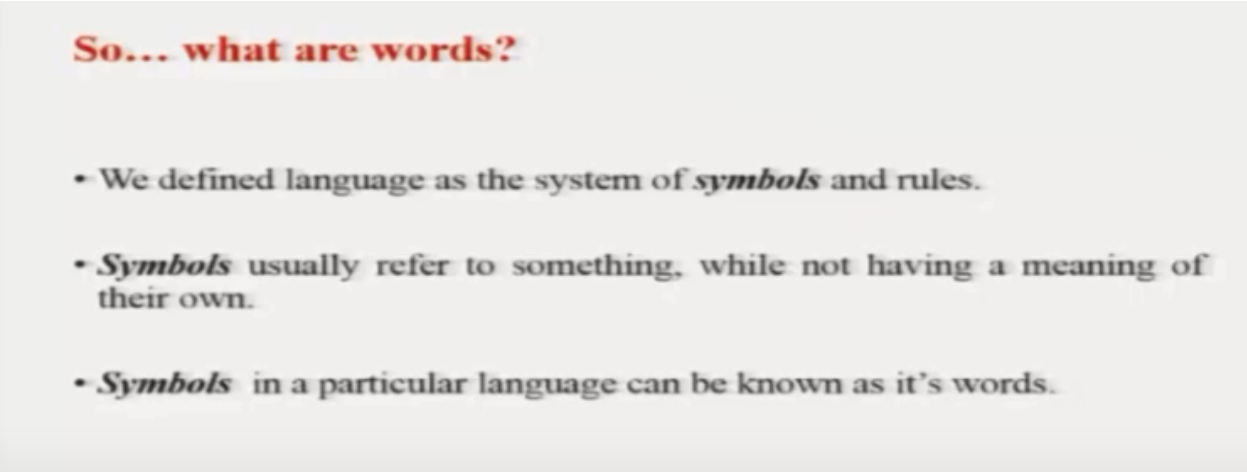


So, if you remember our definition of language, we talked about languages system of symbols and rules. We are, in this week going to talk about these Symbols. Okay? Symbols, obviously what are symbols, symbols are basically things that refer to something else, and they don't have a meaning of their own. in class 7/8 or in elementary mathematics once you start doing algebra the first thing is, that X is equals to 2.X per say does not have a value of its own. As soon as you assign it something a value, it has a value. So, a symbol is also something that it does not really have a value of its own, you assign the value to the symbol, and the symbol kind of keeps that value unless you assign a different value to it.

There are many examples that you can say, for example this particular sound, a combination of sound say for example cat, does not have anything in itself to be called, to be representing cat. You know, we had this concept of arbitrariness, when we are talking about hock it's design features of language. So, cat per say, tomorrow if you know, what the word cat, is made to mean dog and enough people start using, the word cats to refer to a dog. It the symbol will also change its meaning automatically. You know, then people will start, say for example referring to this as dog. And, there are so many ways in which usages of word change. And, we have seen if you kind of look back, in the words that were used in a particular way five years ago, are not using exact same way now, and you know, so on and so forth. So, this is, this is something very interesting. Okay?

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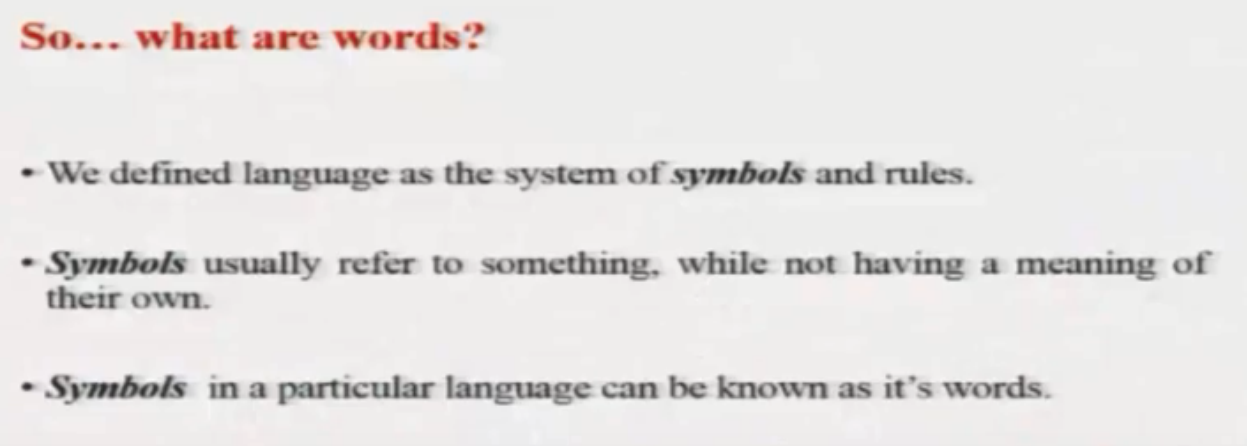


So, symbols in a particular language in some sense, you can call that these symbols are referred to as words. Okay? We have in our language, so many symbols, we create these symbols out of another setof symbols which are these sounds. And, when we create them, we also assign some sort of meaning to them that happen by consensus. You know, there always people are coining new words, things like Selfie. You know, there it was not really a word, but somebody started using it in one way, and it now becomes a valid word, you might already find it in a few dictionaries.

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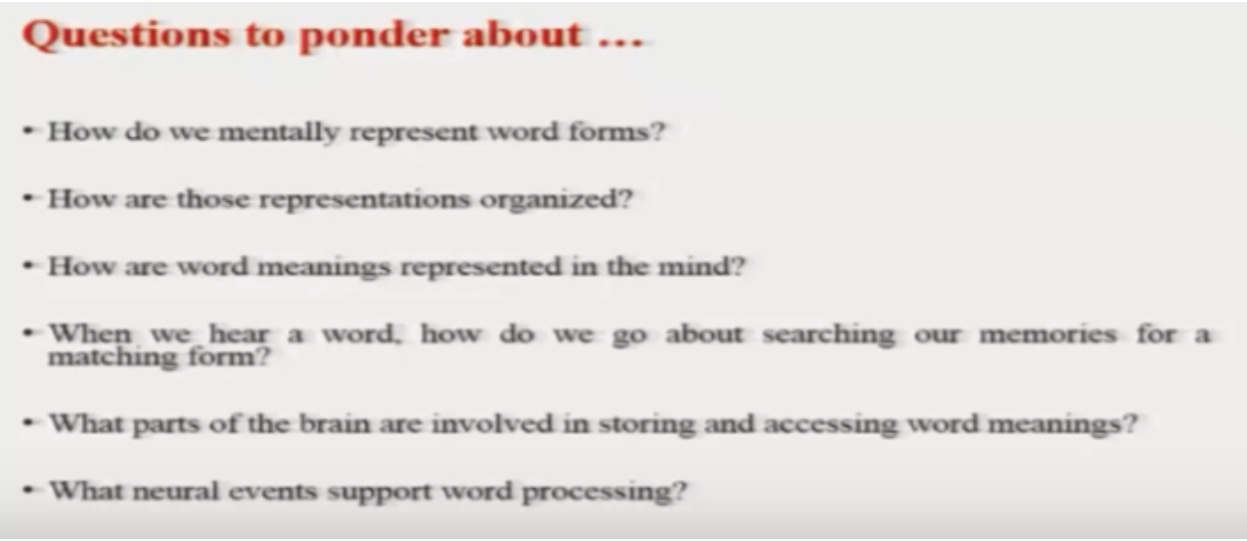


So, this is something which I would expect that you remember. And, then let us talk a little bit about say for and some questions, that are to be asked when you are, you know working or reading about words. So, what are these questions? So, how do we mentally represent word forms? Where in your head? You know a lot of students ask me. Okay? Do we store words at some point or some place in the brain? If we store

words at some place in the brain. Does, say for example things like, one neuron stand for one word, is it like that, say for example, I have more than a billion neurons in my head. But, I probably know of at least 50,000, 60,000maybe one lakh words, or one lakhneurons really dedicated to storing these one like words, and if I kind of, you know one or two of those neurons get damaged, do I lose one or two of those specific words that were attached to that neuron? You know, these kinds of questions can be asked. And, this is something which is very interesting, we probably talked a little bit about this, at some point in this chapter.

How are these representations organized, how do we represent words in our mind, and how are these representations organized? Are they linked to each other, are they completely independent? If you pick up one, are you going to pick up others as well? Or if you if you pick up one, you're just picking that one very specifically. How are word meanings represented? Now, okay, a word is one's you know form, but a word has so many meanings. You know? And, a word has, say for example, it's a meaning of so many other words. How is this organization coming about? Okay? These are some of the questions that we will answer and ask in this chapter.

Other things is, when we hear a word, how do we go about searching for, suppose there is I say that you know, in area X of your brain, all the words are stored that is alright? But, as soon as I say a word Y to you, how do you look for that word Yin that area X of your brain, how do you do it? Also, again because I'm talking of the brain so much. What parts of the brain are involved in storing the words, what parts of the brain are involved in accessing this words? This is also something that we will talk about. Okay? And, how in the brain these words are accessed, or attached to meaning, learn forgotten, relearned all of those processes, when, where are they happening. So, these are some of the very interesting questions, that, we will try an attempted answer in this week. And, this is basically what I hope that you would have probably understood or got, a little idea about by the end of this chapter.

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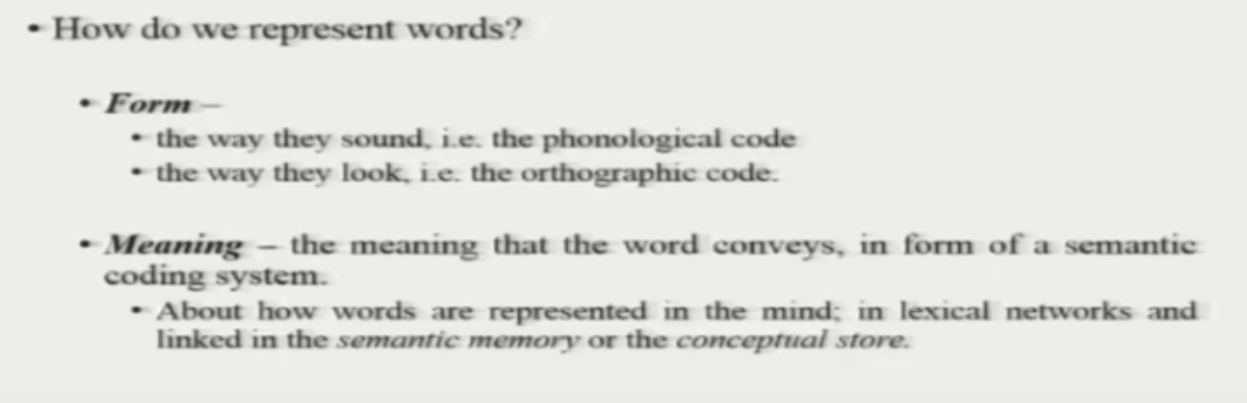

So, let us try and begin analyzing what words are; so, if somebody asks me, how do you represent words? I would say there are two things at least. One is, this concept of Form. A word looks like something, and a word appears like something, if you're talking of the rating modality. So, form is what? The Phonological code. How does the word sound? That is the phonological representation of a word. Looks like, what are the symbols that represent word, you know that's one more level here. This part is called the Orthographic code. When you write something, the way you write it, and the way those alphabets kind of stand for the sound and then the entire word, that is the orthographic code. So, the sound part is the phonological code, the written part is the orthographic code. Okay? This is about form, how do we store these forms in our head? That is one question. The other thing is, after the form is reached or access, there is this whole concept of meaning, how do you get the meaning of that word? That is what we want to be asked. So, the meaning that the word conveys, in form is basically represented in a form of a semantic coding system. A system that probably stores meaning, let's just keep it at that. Okay?

And, this coding system, probably is linked to a larger system which is the semantic memory or let us say the conceptual store. Okay? So, in if you've done any psychology you would know, that there is, a semantic memory, episodic memory, long term memory, short term memory all of those kinds of things. We are probably talking about the semantic memory here. Semantic memory must be the place where, these word meanings are organized and stored in a particular manner. Okay? So, this is two levels of looking at how words are represented, one is at the level of the form and the other is at the level of meaning. This is this is the two kinds of representation; I can think about.

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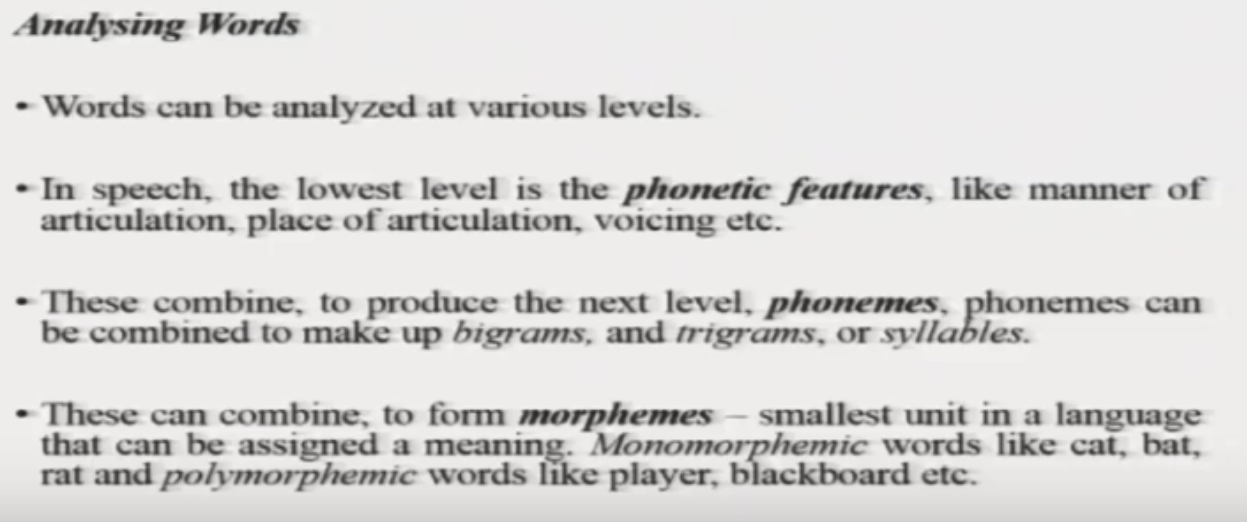


Now, obviously you have to analyze how words are there? So, let us look at it, the lowest level is at the level of phonetic features**.** You know, what are the phonetic features? Phonetic features if you remember

in the last week, we were talking about speech, I believe. In the last week, we talked about, manner of articulation, place of articulation. Whether something is voice or not voice? This is the lowest level. How are you going to eventually deliver the sounds? This is the phonetic feature level. So, the lowest level or phonetic feature, say for example, Hammond you know Hamster and hamburger, are slightly different in terms of the way the sound of 'am' is delivered, hamster is a shorter one hamster or hamburger is a different thing. So, this is phonetic features.

You combine the phonetic features, and you reach what is referred to as, the phonemes**.** Okay? The phonemes can be combined to form bigrams, trigrams. So, phonemes are those, the basic sounds of the language. Phonetic features are, how are you delivering those sounds, and articulating and creating those sounds. But, the sounds themselves are referred to as phonemes. If you remember I talked to you about it. That, English as a language has around 40 phonemes. So, any kind of versions, all kinds of phonetic features and a train says, that one might have can be mapped backwards to these 40phonemes that English has. Okay? So, that is thing, obviously there could be combination of sound. Say for example, you know in phonemes, you can have bigrams and trigrams. Bigrams as two phonemes put together, trigrams are three phonemes put together. Then, you can have these kinds of arrangements.

So, you have phonetic features you have phonemes. what else, once you start combining phonemes, you will be led to another level, which is the morpheme. What is the morpheme? Morpheme is the smallest unit in a language that can have a meaning, smallest meaningful unit of a language is called a morpheme. Okay? Now, morpheme can be an entire word, or there can be in a combination of morphemes, that make an entire word. So, we have examples of monomorphemic word, words having one morpheme; cat, dog, pat, bat all of these are just one morpheme. Because, this cannot be further broken down. As soon as it is broken down, it reduces into phonemes, which are meaningless.

Polymorphemic words, on the other hand can be broken down, at least one part or both parts will have meaning. Say for example, 'blackboard' is a polymorphic word. It has two morphemes; 'black' and 'board' both of them broken down have meanings. In the other hand, you can have word like 'player,' where in 'play' and 'er' at least one of them has a meaning. Play is itself one morpheme; it is called a free morpheme or a lexical morpheme. Whereas 'er' is a bound morpheme or a grammatical morpheme. I don't know, at what point I will discuss this again. But you need to remember this. So, you have mono morphemic words, you have polymorphic words. In the polymorphic words, you can have a free morpheme that can stand alone, has a meaning of its own. You have a bound morpheme that cannot stand alone and does not have a meaning of its own. Okay? So, just redoing this whole analysis part; you have phonetic features, you have phonemes, you have morphemes. This is how you organize this word. Okay?

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Now, this is a little bit about, how you start looking at words? Let us, this there's this very interesting conversation, again in image I've taken from Google. But the reference is coming from this very famous book called Alice in Wonderland a lot of you might have already read it. And, Alice in Wonderland there is this conversation probably between, Humpty and Alice. And, Humpty is basically you know, Humpty Dumpty sat on a wall that day. You know, that guy is sitting on the wall, and Alice is passing by the wall, and she says something, and you know there's this conversation that in shows. And, this is one of the interesting conversations, I always use this in class. And, Humpty says something he says, when I use a word 'Humpty' said in a rather scornful tone. It means, just what I choose it to mean, neither more nor less. Okay? And, the question is, says, Alice, whether you can make words mean, so many different things. I remember, I think is Alice probably refers to Humpty as an egg, and he probably takes offense, and that is where this conversation begins. So, Humpty is saying, when I use a word, it means exactly what I intend it to mean. You know, does that always happen with you as well, if you use a word, does it always exactly mean, what you, you know intended it to mean or people sometimes take it differently. Okay? So, Alice kind of recognizes the facts and says know, it is possible, so, it is the question is, whether you can, make words mean so many different things. Okay? And, then to that Humpty retorts the question actually is, which is to be master, what is the exact meaning of the word? Okay? Obviously, there are words with so many different meanings, and so many different strains references and so on.

And, those words can be kind of, you know, in that sense we used in a variety of ways. But what is it, that you intended the word to mean? Or what is it, that is going to be the dominant meaning of that entirety, that is the question. Okay? That is one of the basic debates or the basic and the most important questions

you need to understand, when you need to understand how word meanings actually function. Okay? So, we will talk about that, this is something we will explore in in this section. Okay?

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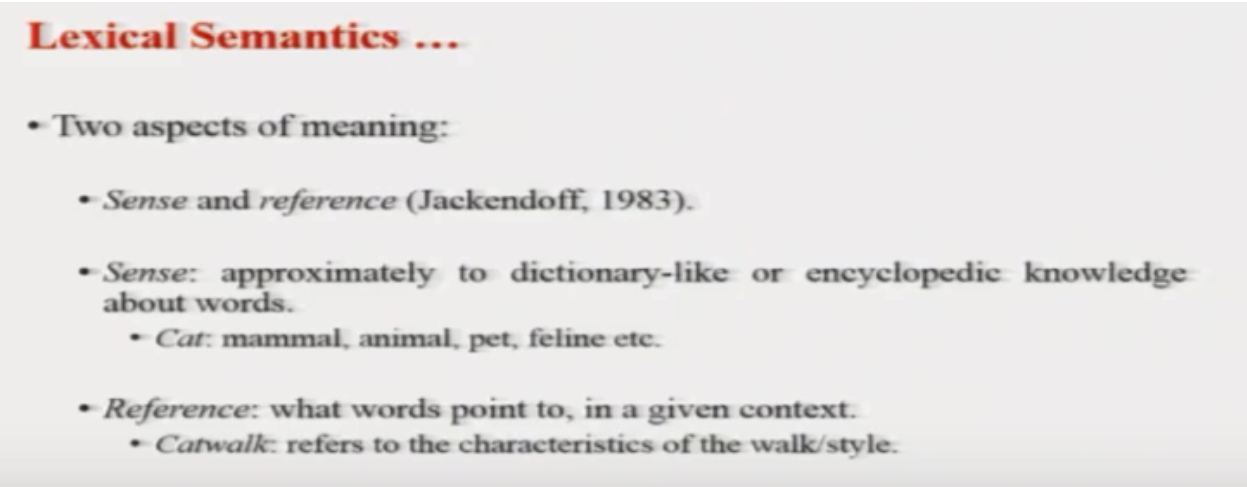


This section basically refers to what is if, what is called Lexical semantics**.** Lexical just meaning has to do with words in your mental, lexical semantics is how the meaning part of this words. So, Jack end off actually says that, there are two aspects to the meaning of a particular word, one is sense**,** one other is a reference. Okay? And, he distinguishes between them. And, he says, sense is the approximate dictionary like entry to a word. Suppose, I was showing you this dictionary like entry off the word, word in the beginning. So, if you look at the dictionary like entry of the word cat. Cat is mammal animal pet feline; those kinds of things will come in. You know, four legs, a tail and whiskers and two ears and all of that will come into the dictionary like entry.

However, there is also you can use a word to refer to something. The word exactly mayor may not mean that, but it is used to refer through something. So, you can have a word like, catwalk. Okay? What does cat work mean? It does not necessarily mean a cat's walk. Okay? Catwalk is used to refer to, when ladies walk on the ramp in a fashion show and stuff like that. What is it, that we are referring to? We are referring to this, style of walking, which resembled that of a cat. So, the reference is something there, you know it refers to the characteristics of the walk, it does not necessarily imply, that a cat is walking or that person who is walking there is a cat. It does not imply that. So, the sense part and the reference part, are two very important things. Which we need to have an understanding of, obviously you know in order to have better and more effective communication. Okay? So, that is small distinction that you should make.

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Now, another thing is, suppose you look at, you know this very interesting demonstration here. Words can refer to a lot of things. You know, a particular word can refer to so many different .Suppose, say for example, you see these two figures here. One is a darker green, one and the lighter green. Suppose, I want to refer to this darker to the square. I can call the square as a few things. I can say, give me the darker green object, give me the square, give me the object on the left, you know? You see, all these three expressions basically are referring to the same thing. Okay? And, that is what a reference typically means, the same thing can be referred to by different, so many different ways. Okay? And, also if you change the word, so this is this example of a two object universe. If there are only two things in this entire universe. One is the figure on the left, one is the figure on the right. I can't figure to this, I can refer to this figure on the left, by saying so many different things. Okay? And, you can kind of in a different universe by the way, if I say give me the one on the left, you will now give me the larger of the two. So, one of the ways I could, actually I have referred to this is given me the larger of the two shapes. Okay?

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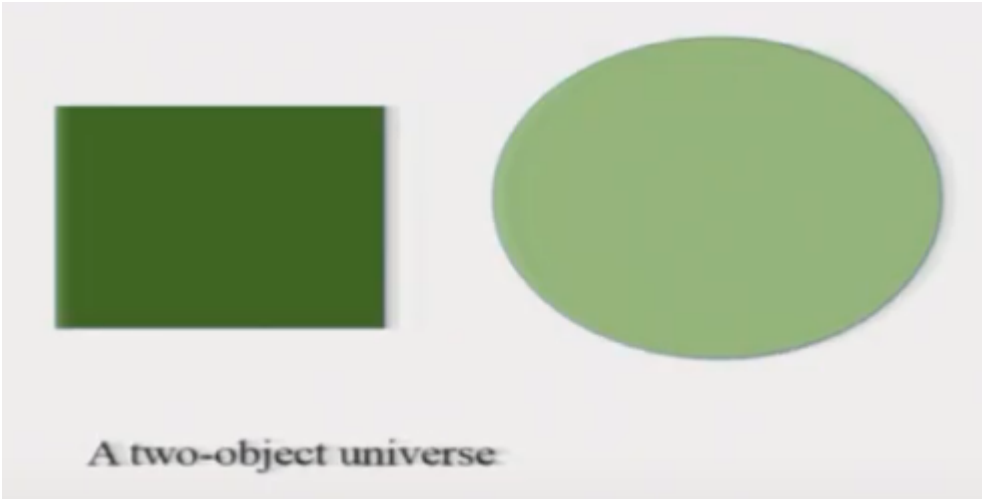

But if you move to the next slide and the world has changed. Now, the larger of the two is the circle .Now, that reference will not work here. So, for example, this is a good illustration to, try and understand, how the meaning or references of things change, when the world changes, when the speaker and the listener change, when the context where the speaker and listener are that changes. So, this is also I think something very important and you need to really you know remember that.

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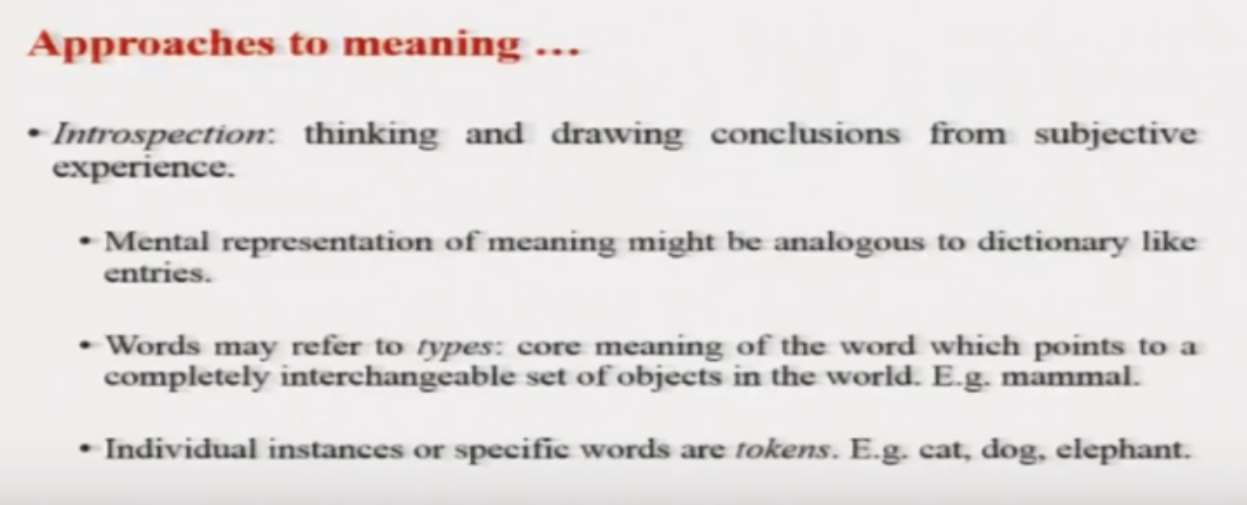


Now, moving to meaning. There are various ways in which meaning has been looked at. There are various approaches to meaning that are possible. Okay? One of the approaches to meaning is this whole concept of introspection. This is a very popular, very old concept in psychology. Which basically says, that you think, and you draw conclusions from subjective experience? So, when I talk to you about let us say, a watch, or a pen, or an apple, or a banana as soon as you listen to this, you have a subjective experience about this. You know that, in my subjective experience, this particular thing like a banana, you know refers with that particular fruit, and that particular fruit tastes in this way and all of that knowledge comes back. So, whatever you can infer think, analyze, after you've heard this word, can all be kind of summed up as being the meaning of this expression banana, that is one way.

So, mental representation of meaning might then bean analogous to a dictionary, to dictionary like into this. Because, It will say, say for example, if I am talking, I am you know analyzing my mental experience of the word banana. It refers to fruit, sweet, yellow in color, slightly yellowish, greenish in color so on and so forth. All of that kind of is your dictionary like entry, that is one way of doing this. However, words might refer to sometimes types, and sometimes tokens. And, what is the distinction? When I say animal, animalism a type, bird is a type. Okay? But, when I say cat, or I say Sparrow. Sparrow is a token of the type bird, cat is a token of the type animal, human being is also a token of the type animal. So, you

have to distinguish also between types and tokens. Types are core meanings of words, that point to a completely interchangeable set of objects in the world. Okay? Say for example, if you have, if you ask me what an animal is you? I can  give an example of a cat, tart, dog anything. But if you ask you me examples of what a dog is? I have to kind of talk to you about, any everything that just is dog. I can kind of go into breed sessile, but that's a different level altogether. Okay? So, individual instances or specific examples of a particular category, as referred to as tokens. And, that entire category depicted by a particular word, is referred to as a type.So, this is something that you have to kind of remember.

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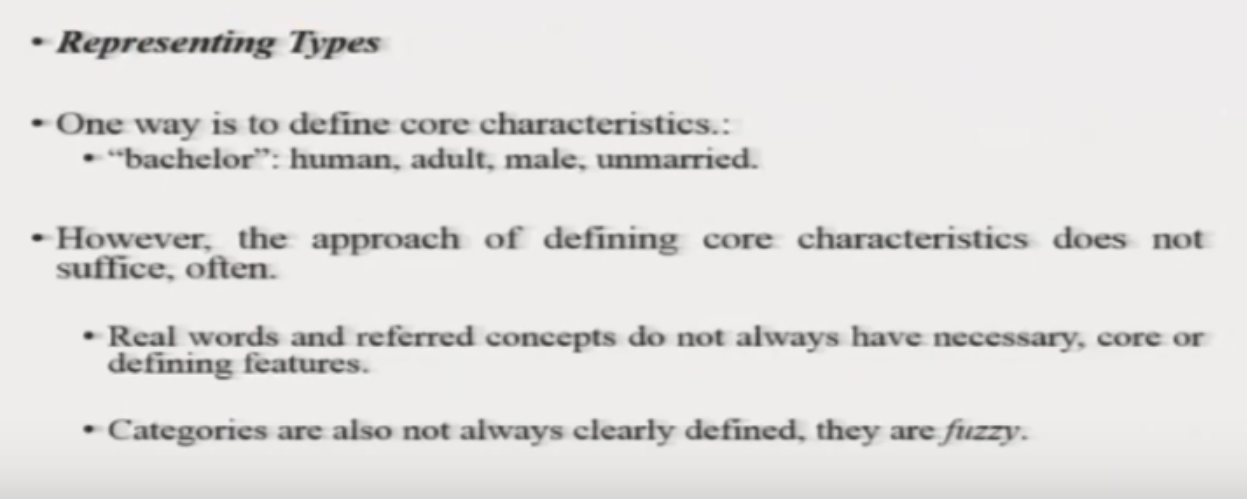


Now, how do you represent types in your head, how do you kind of store types in your head? So, for example, one of the ways could be that your kind of, you know distinct, you know represent them by the core categories. So, animal could have so many core categories, I'd look at could have so many categories, student could have so many categories. One of the examples, that actually takes is bachelor. So, bachelor is what? Human adult male unmarried, you know? Sometimes, what however happens is, that the core characteristics of each of these categories may not be so discrete from each other.

Suppose, we say for example, you know sometimes you already asked this question. I think the biologists will probably be able to give the best answer. But whether the carrot is a vegetable or a fruit, whether a tomato is a vegetable or a fruit, whether a bat is a bird or an animal those, those kinds of things. So, a Bachelor human adult male unmarried but, then Pope is also a human adult male unmarried. Is it try to refer to the Pope as bachelor or if that's a separate category if itself? Okay. Those kinds of things, so you will run into problems when you start using this approach of defining core characteristics, and that kind of creates a little bit of a difference. Real words and referred concepts do not always have necessary core or defining for that is another problem. Sometimes real world concepts or real world categories do not will

always have core defining features that separate them from everything else. That's also something that you know, it's not very cleared. And I said they are not always discreet. They are often fuzzy, fuzzy basically saying, that there might be so many overlapping features with other things. Any feature that you describe of animals and then of birds some features will kind of you know? overlap. That you have to kind of understand.

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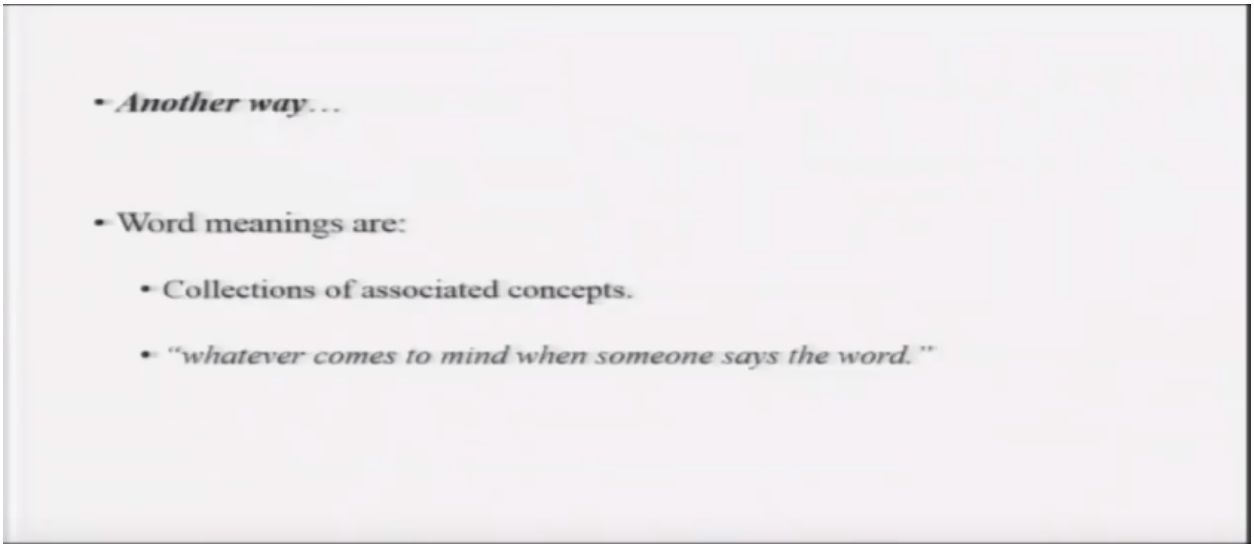


So, this is one way doesn't really you know completely work but then obviously there could be another way of looking at how this is there. How you make meaning? So, one of the ways is that you can look at meanings, as collection of associated concepts, so there but there might be for one word there might be so many associated concepts and all of those common associated concepts are if they are being tied by this word. This is how meaning is organized. Okay? So, what yeah you know very simply can be done is I give you a word, and I basically ask you to tell me everything that comes to mind, when I say that words. Suppose when I say cat, tell me everything that comes to mind. I have mapped it in a fusion.

Then I say dog and then I, you say everything that comes to mind, and I say you know Vale, and then I say bat, and then I say and then whatever features you've made, basically I can tabulate it and I can see which are common features among these things, Which are uncommon features among these things, and this is how it kind of can be done. So, this is one way of thinking about how meaning can be represented. Okay?

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- *Semantic network theory* (Collins & Loftus, 1975, Collins & Quillian, 1972):
  - Explains how word meanings are encoded in the mental lexicon and to explain certain patterns of behavior that people exhibit when responding to words.
  - Word meaning is represented by a set of *nodes* and *links* between them.

In a similar way semantics, in a similar way Collins and Loftus, and Collins and Quillan. Imagined, that we would be representing meaning, and they said there's this whole map that you will make can be referred to as the semantic network. Why semantic? Because this is capturing aspects of meaning and this aspect of meaning are being captured in this particular Network. Why network? Because meanings will have a lot of connected things. Okay? So, let us look at the figure a little bit and I'll come back to the description, so you see this semantic network this is an example of a semantic network.

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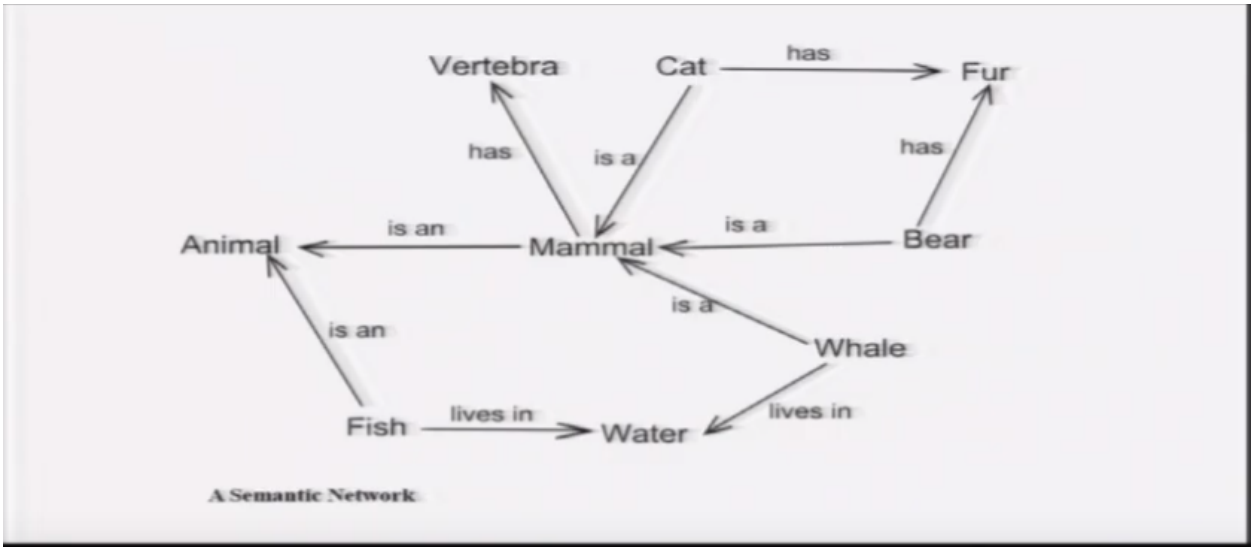


And, you can see say for example that there are so many of these words here. So, there is animal, there's fish, there's whatever mammal, vertebra, cat for, so you have types and tokens both kinds of things here. And, you say, say for example there are things that are common. So, cat and bear both are mammals, both have fur, similarly both are linked to mammal, and mammal are usually falling into the category of

vertebrate, so we have vertebra also that is there that has a vertebra you know? Has this smile cord. Okay? very sour as also a mammal. Okay? And but we live in water and fish also lives in water. But, fish is not connected to mammal directly. So, all of this is there. So, this is the representation of what is referred to as a semantic network.

This entire network is capturing meanings in some sense. Okay? And, the meanings are obviously shared between these different types, and also shared between different tokens. Okay? So, this is what the semantic network is you see now just looking at the anatomy of this, these each of these words are referred to as nodes. Nodes are particular characteristics and each of these nodes are linked by some of these arrows, which are called links. Links are functional features. So, for example mammal has a vertebra cat as fur. All of these are links. So, cat and fur what is the link between them? Cat has fur. Cat and mammal what is the link between them? Cat is a mammal. So, you see that this is a semantic network. It has nodes, it has links, the links basically are common you know, are things that connect between these types and their features or tokens and their features either ways. Okay?

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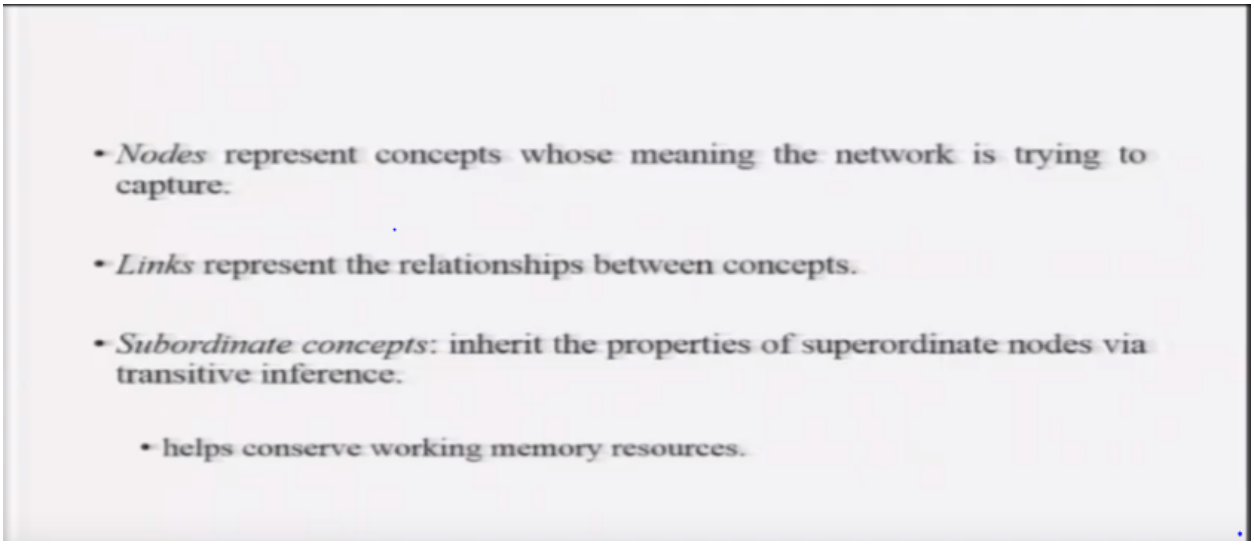


So, nodes represent concepts were meaning and then the meaning, you know, where the network is trying to capture meaning, links represent the relationship between these particular concepts, so far as a concept cat as a concept, mammal is a concept so on. And, then you can also have subordinate and super ordinate concepts. So, animal is a super ordinate concept of mammal. Where in mammal is a subordinate concept of animal. Similarly, you have instances, so cat is a subordinate category from mammal, and even smaller than animal. So, this is the connection there. This kind of organization helps you know conserve some memory resources because as soon as you are hitting or capturing one aspect you are already capturing the entire linkage or the entire network. That is something that is happening.

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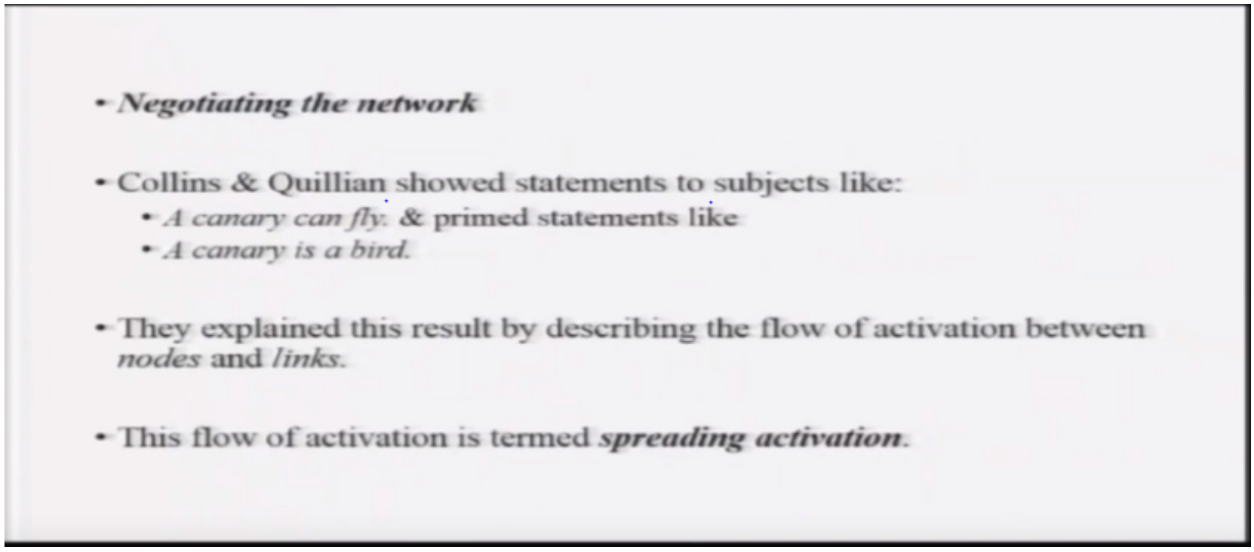


So, how do you negotiate the network, how does this really work out? If suppose this is the way you are storing meaning in your head. Collinson Quillen kind of wanted to test this and they kind of use something called the priming paradigm. So, priming is typically when you hear something and then you hear something later. The relationship between these two things, kind of affects you know, how you will react to the second thing. So, there is a prime and there's a target, and the prime and target may have a relationship.

Depending on the relationship between the prime and target, you can either be faster for the target or slower for the target. Okay? It could be a facilitative priming or it could inhibit something. So, what they did was they read out particular kinds of sentences and the sentences was something like a Canary can fly or a Canary  is a bird, so when they kind of use Canary can fly as a prime they found that people were faster than responding to cannery is a bird. You know, they had to simply say, yes or no two buttons. Yes, if it is correct. No, if it is wrong. Cannery can fly came out and when they didn't register it comes for a very small duration, then cannery is a bird comes and then because you already were primed for that. You know because, it can fly, It should be a bird kind of thing you were faster at deciding that canary simpler that is, how this has happened. They explain this result, by describing the flow of activation between the nodes and the links and they say, this is getting faster, or the priming is actually happening because of a concept called spreading activation.

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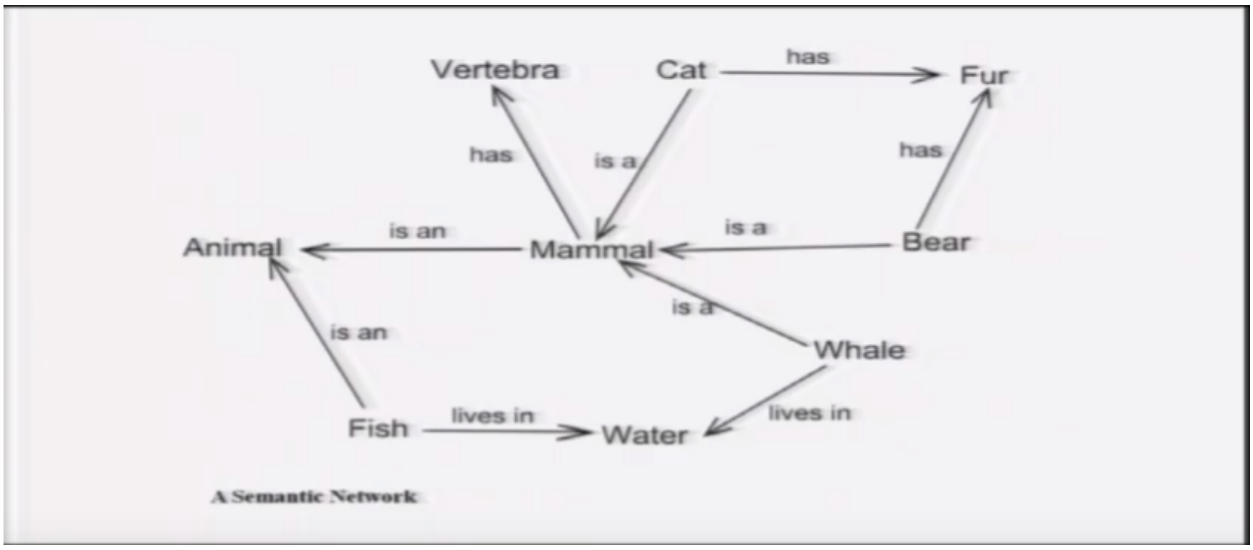


What is this concept of spreading activation? It basically says again if you look at this network here. If you are activating something like the cat. It also spreads activation whatever activation is there to cat. Activation basically means here, is just that it becomes readily available. so as soon as you see the picture of the cat. The cat concept come becomes readily available. Now, because the cat concept has become readily available what happens is activation from this concept this capability of being readily available this activation flows to everything that is linked to cat. So, it flows to fur and it flows to mammal both of them are close it probably would flow to you know, vertebra as well in a slightly indirect form of way, It will flow to animal as well in a slightly indirect form of way, and then they could cat could be attached to so many other things. And, everything that is a mammal and has vertebra will also be invariably linked to this. So, all of that kind of thing, so as soon as you listen to cat or read the word cat, or see the picture of a cat, or see a cat all of this gets activated. This is what spreading activation is like, okay? And, then you can ask questions like, okay?

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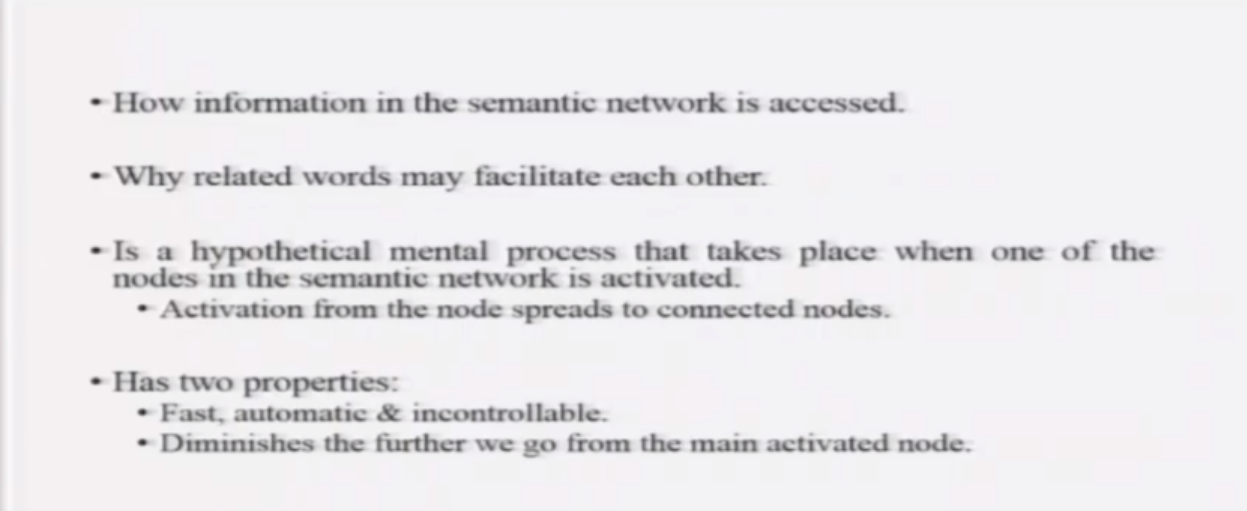


Why are these words facilitating each other because they are linked in one way, okay? So, these spreading activation, or this facilitation is a hypothetical mental process. That takes place when one of the nodes in the semantic network is activated, and that node shares its activity with the other nodes which are linked to this particular node. This spreading activation has two properties it is very fast as automatic this is not something that you can opt out of as soon as you read the word cat everything related to that cat in the network will get activated. Also, one of the properties is, it diminishes as we go farther away so cat might have a relative, and dog it might have a relative, and tiger and it might also by virtue of being animal has a relative in Ant eater or something like that but, the activations that will probably reach here will probably have diminished beyond being useful. So, as if their source of activation is this till here's a lot of activation, till here a lot of actuation, when you go much further, the activation has completely faded out. So, it is fast automatic, in controllable and it diminishes as you go further from this. So, things that are closer to this concept will get more benefit of this activation things that are farther off will receive lesser benefit that is this idea.

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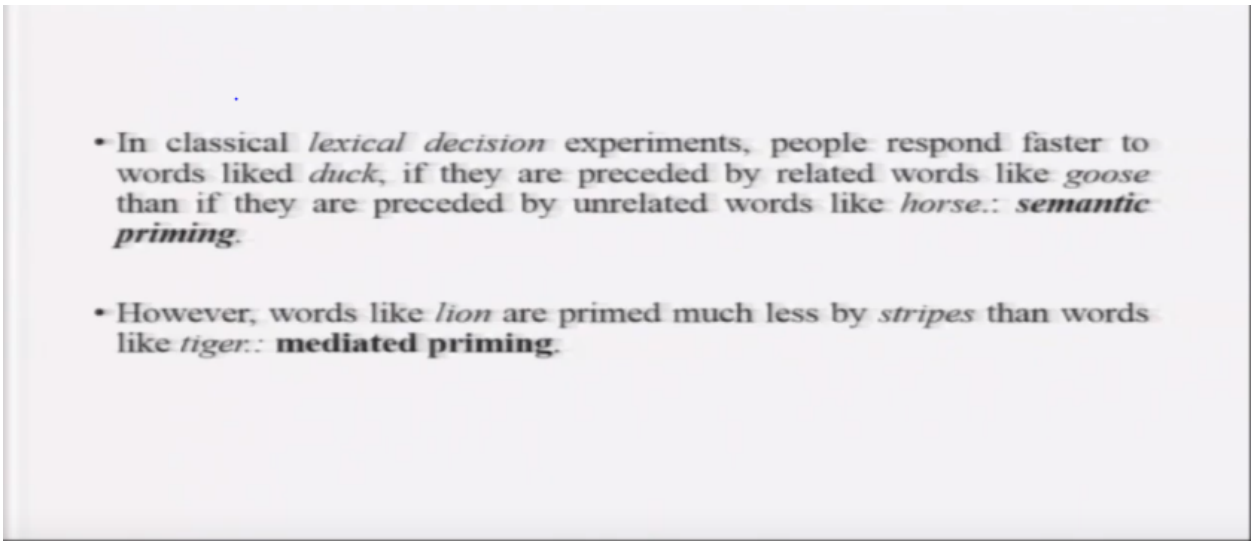


And, people have kind of, I talked to you about priming in that same day's reading kind of thing, but we will have used priming in the external decision tasks as well. A lexical decision task is very simply just you are shown a word in your ass whether it is a meaningful word or not. Okay? So, in classical lexical decision experiments people respond faster to words like duck. Is, they preceded by related words like goose and then if they are preceded by words like horse. So, Duck, as soon as you reduce the activation flows to duck and duck is facilitated but as soon as you reach horse the activation is not coming to duck it's probably going to somewhere else, and so you know reading duck after horse does not really get. you know, any benefit. This is called semantic priming by virtue of semantic relationships. There's also something called mediated priming, so if you read say for example lion if you read their stripes it prime's lion faster you know line much slower as compared to that it Prime's tiger. So, your stripes, Prime's, Tiger close relationship. Tiger is also any ways related to the lion because they are in the same family but because lion is a tiger is in the middle lion gets much lesser priming effect. This is called mediated priming. Even though it gets some priming anyways. Okay? So, one of the ways that the priming paradigm helps us. Is it helps us evaluate the relationship between objects in the semantic network at least that's how this particular theory really works? Okay. And, people have done a bunch of studies to show this.

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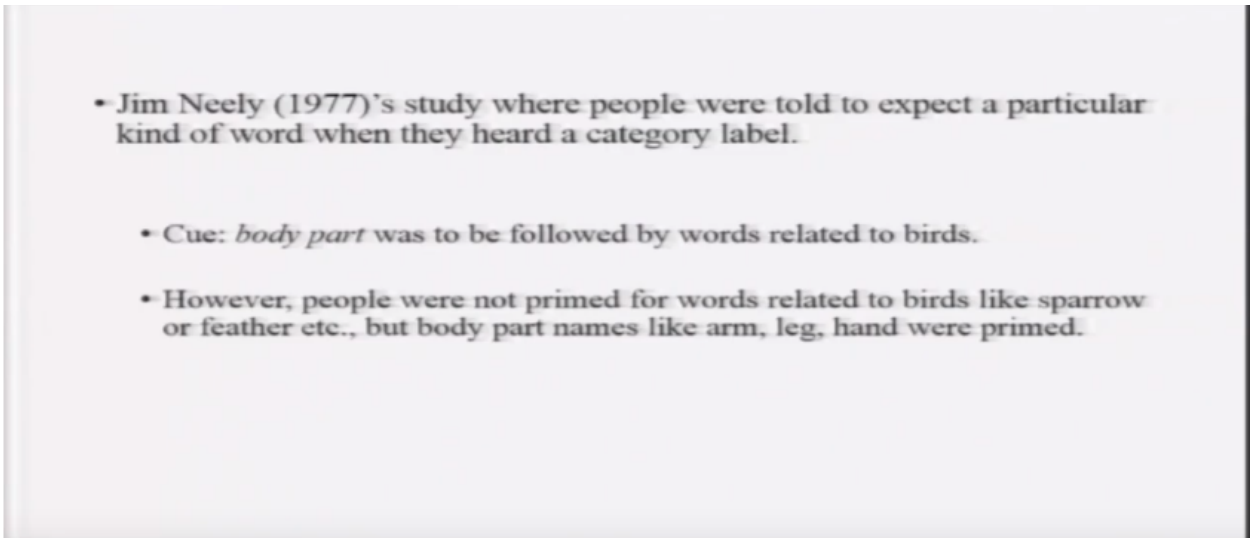


So, Jim Neely did this study1977.Where some people were told to expect a particular kind of word. When they heard a category label so you could hear body part and then you will hear certain kinds of words you could hear animal you could hear certain kind of words. Okay? However, so what happened was the cue was the word body part and the body part could be followed by actual names of body parts or by birds. Okay? By a name of birds. What did they find is, that people were not primed for words related to birds like sparrow or feather etc. but they were primed for words like arm leg and etc. So, because we're kind of more primed with respect to body parts our own body part and soon and so forth. Okay? That is one way that this whole priming thing really works.

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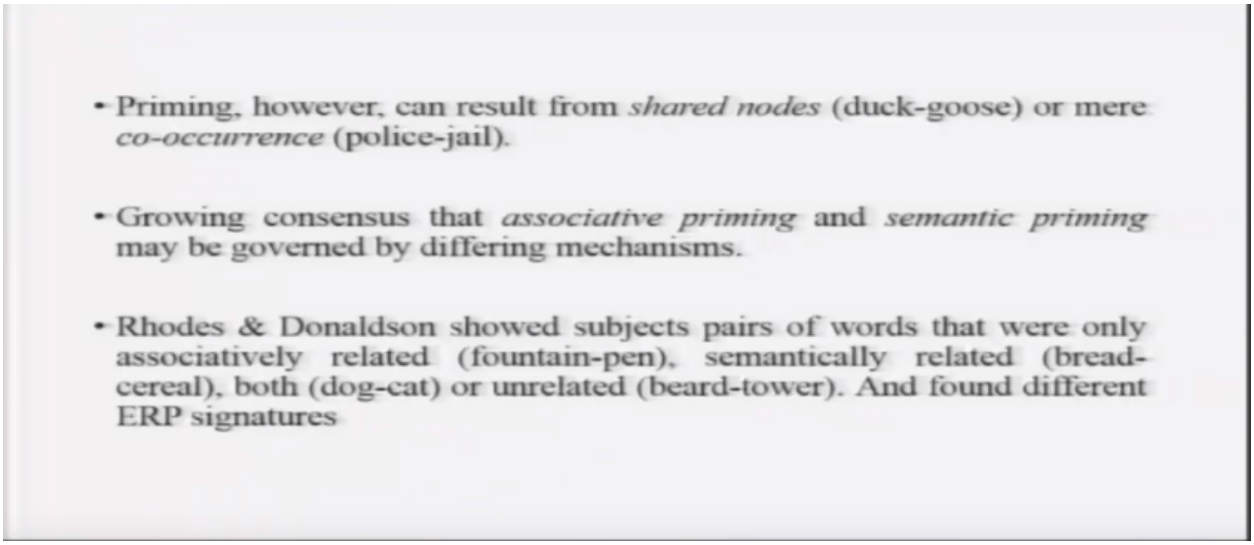


Priming however can also result from shared notes or mayor co occurrence say, for example fountain pen or police jail you know the police or jail for example is still slightly semantically related as well, but

fountain and pen are not semantically related at all, but because they are mentioned so many times together, because they co-occur so many times together, they are basically in that sense related to each other. Okay? They get linked the nodes get shared in the semantic network mainly by co occurrence. There's a growing consensus that, this kind of linkage can be referred to as a separate process as compared to the kind of linkage that was happening between stripes and tiger, and dragon and lion and those kinds of things. So, this is referred to as associative priming the priming that will happen when you say fountain and you say pen and the other kind will be referred to as semantic priming, and the idea is that semantic priming and associative priming should be different processes. Because they are kind of building upon different ways of making this connection.

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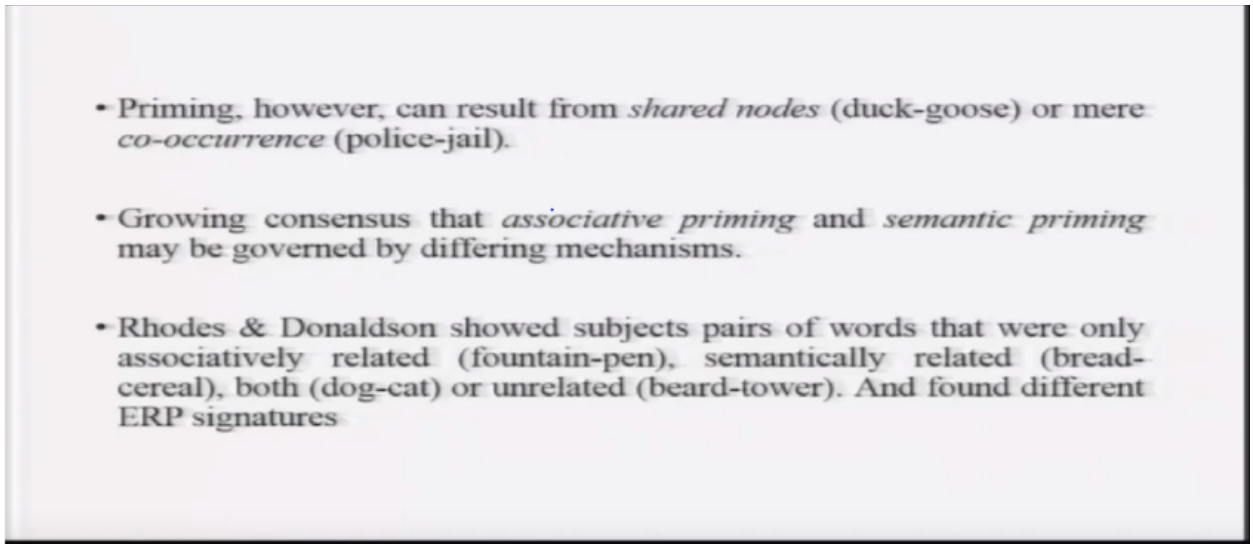


So, Rhodes and Donaldson they did this study they showed the subjects pairs of first there were only associatively related fountain pen, or semantically related bread and cereal, or related in both ways or dog and cat are both mentioned together, and they also have semantic relationships. So, semantically related or completely unrelated. And, they actually found different ERP signatures. ERP is basically you know the electrical activity that goes on in the brain when you hear something when you come across over it is Nobilis. And, they found that for each of these different kinds of relationships they were entirely different kinds of activity happening in the brain. Which at least confirmed to us that semantic priming and associative priming are actually different mental processes, alright? So, this is this.

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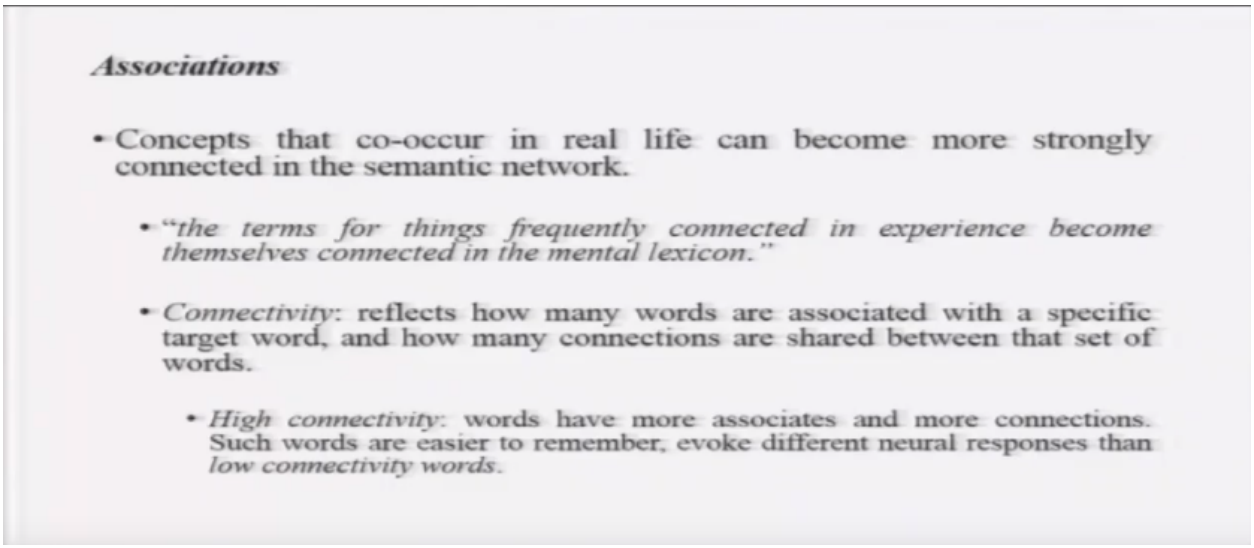


Now, I was talking about how things are related to each other and how things could get related just by co occurrence and people have kind of recognized this and they have kind of tried to build upon this, and what they have come up with is something similar to saying that in the terms for things that are frequently connected in experience. Will also get connected then you know themselves connected in the mental excellence of fountain and pen. They will also get connected in the mental accident in a similar manner. Okay? Connectivity basically, when we say connectivity it basically just reflects how words are associated within a specific network Say, for example how many words can get connected to this particular target word. Okay? This is connectivity. And how many connections are shared between a set of words? Say, for example fountain and pen and fountain as and water are obviously both all three of them connected. But what is the strength of connections, what is the manner of connections, what all connections are shared? all of that you also have to keep in mind.

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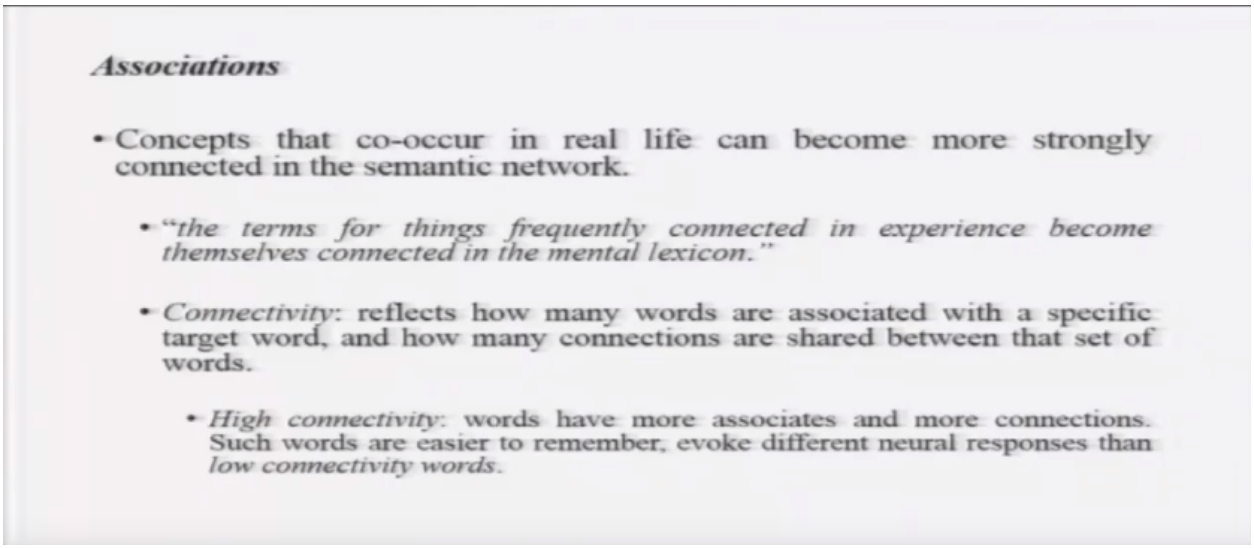


High connectivity basically means that a word has so many associates that are connected to each other. Low connectivity means that a word has only very few things connected to each other. And this basically also leads to different kinds of neural responses. So, it has been shown that say for example high connected connectivity words, words that have high connectivity are easier to remember because they are kind of you know? Linked to, so many things in any of those many things. That they are currently to can act as a cue to remembering them. Okay? that is one way the words with low connectivity are slightly more difficult to remember because they have, they will probably need a lot of evidence to buildup in order to you know, for you to remember them completely. Okay? So, the high connectivity low connectivity and also it has been shown that they kind of lead to different neural responses in the head. So, high connectivity words versus low connectivity words they will kind of you know lead to different kinds of new responses.

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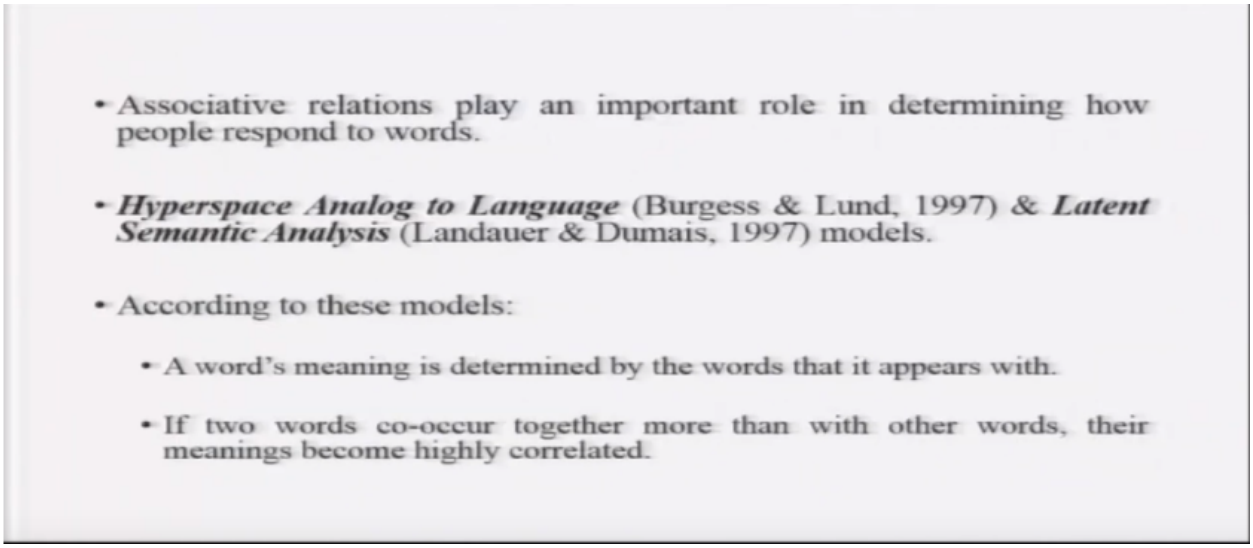


Counting on this say you see what happens in science is you come up with a concept in a particular field and that concept can is also available to everybody doing science. And, people use it in a very different way or indifferent using different methods to elaborate the same topic. So, this whole concept of associativity is also taken up in you know fields of machine learning, a digital intelligence, etcetera, natural language processing. And, people there came up with a couple of models of you know, really telling how other words could be arranged in a particular Network, and couple of those models we can talk about is the hyperspace in a hyperspace analog to language or the HAL model. I or the latent semantic analysis kind of one which is the, you know? Yeah! This is also another kind of model. Okay?

So, there are these two models and both of these models have some things in common so in both of these models a word's meaning is determined by the words it occurs with. So, for example if you don't know if you are, you know don't know the meaning of any word but, you see what words occur around it. You might be able to judge the meaning of this word that's the whole point. And, they say we are kind of counting on the fact that if words are co-occurring together more than more with each other than with other words then there should be in some sense a linkage between these two things. So, that is also something that you know this these models build upon.

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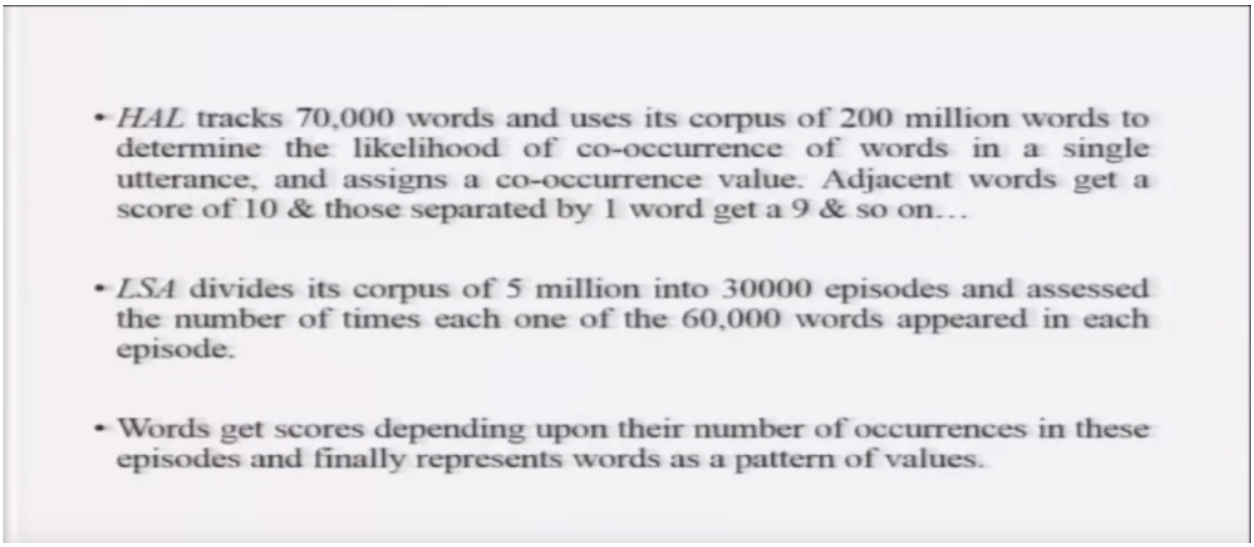


Now, HL has this you know it tracks around seventy thousand words it has a big corpus of 200 million words. From that kind of keeps track of 70,000 words. In order to determine the likelihood of co occurrence of these words in a single utterance. So, what is the probability that I have said rat, that I was going that I'm going to say cat as well. You know Cat and rat very, very high probability versus when I say rat and whether I will say parachute low probability of Corcoran's. Okay? That kind of thing.

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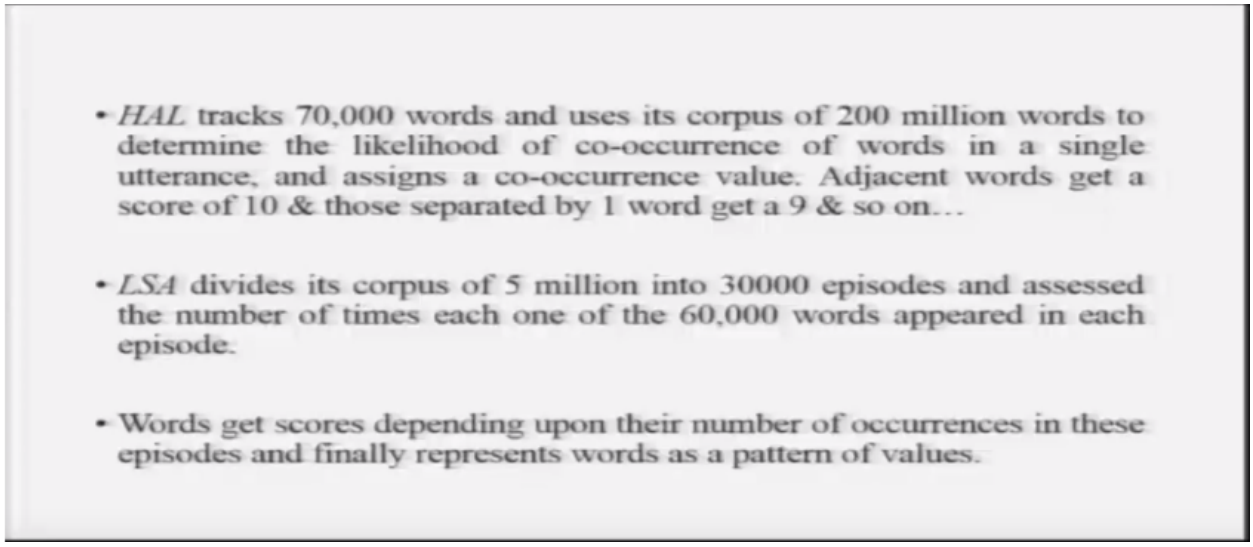


LSA the, LSA divides its corpus of five million words into 30,000 episodes, and they are basically assessed for the number of times, you know? Each of these 60,000 words appear to it. So, within that episode so you have five million words corpus you can divide this into 30,000 episodes, and each of these episodes you have 60,000 words foreach of those 60,000 words you have you can calculate a number into what is the probability that they would have come together within the episode basically. Basically, what

happens here is words gets course depending upon the number and kind of co-occurrences in these episodes, and they are finally represented with a pattern of values. So, in LSA you can say that within this episode these are the co-occurrence values of these words, so this word has some as such a high value this one has allowed Eloisa basically means so many words Coker with this or something like that. Okay?

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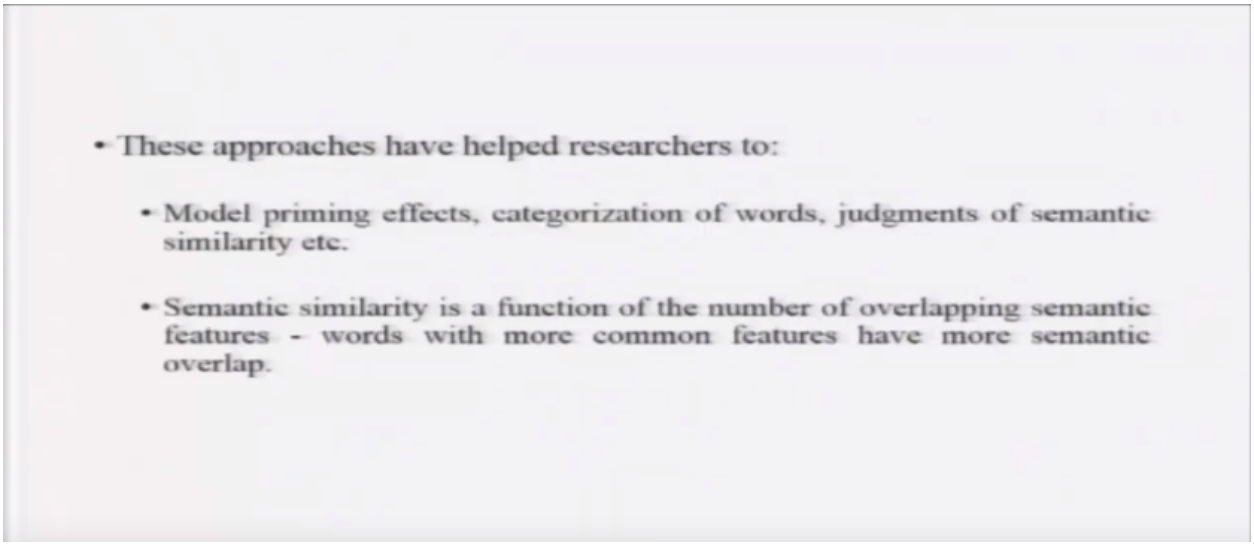


Now, these approaches basically have sort of they basically. You know, they help us to capture this concept of associativity, or association, or co-occurrence and they these kinds of models have helped explain some of the priming effects that happen. How do people categorize these words, and how do people judge things like semantic similarity, Okay? So, semantic similarity is a function of the number of you know overlapping semantic features basically you know, words with more common features will have more semantic overlap words, with less common features will have less semantic overlap, and obviously things that have more semantic overlap will be linked stronger together. So, it might be easier to prime either of them using the other. Okay? So, cat and rat have so many features cat and you know, fish have so less features, but they are associated because you know everybody knows that cats eat like to eat fish. Things like that. Okay?

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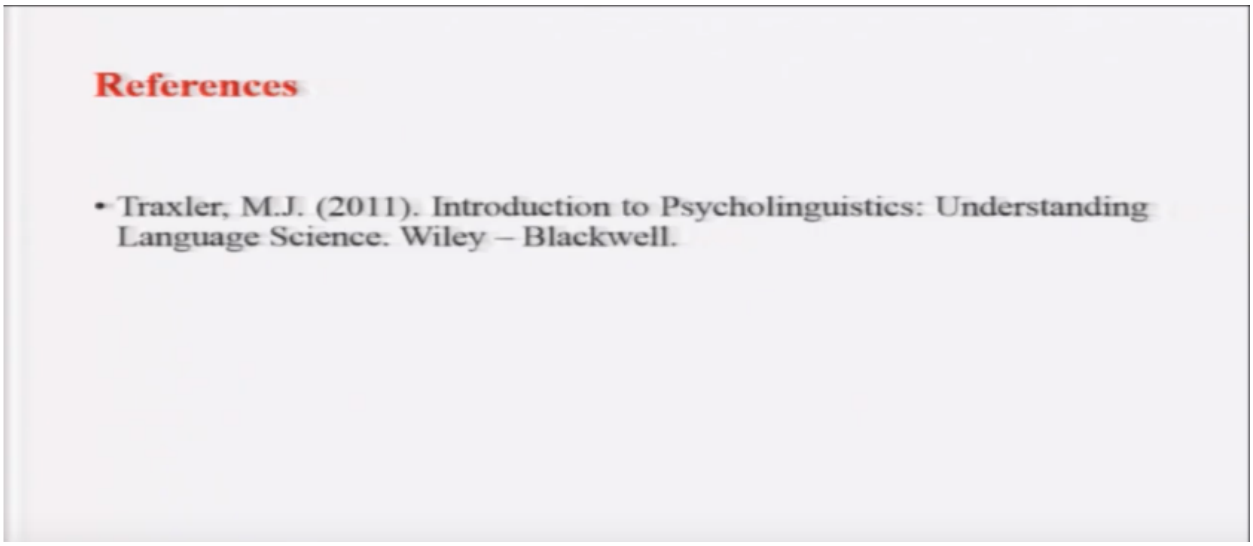


So, those, those kinds of things are there now this is basically all that I wanted to talk to you about I talked to you a little bit about in this lecture about how meaning could be captured. One was introspection, the other was the semantic networks theory and the other last one which we are discussing was Association. Association can also help in some you know in some sense explain some of these framing effects in the semantic networks theory as well as well as outside of it in these two theories the HAL and LSA. Which basically says that if you really need to figure out a meaning of the word and you don't know the meaning of the word independently you can just look at the words around this particular word. And, that will already help you, you know? Get a very good informed guess about the meaning of this word. So, this was a little bit about words and meanings we will talk to you in the next lecture about I think things lexical access and so on. Thank you.