Ten Lectures on Cognitive Linguistics

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Ten Lectures on Cognitive Linguistics

By

George Lakoff

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Preface

The present text, *Ten Lectures on Cognitive Linguistics*, is a transcribed version of lectures given by George Lakoff in Beijing in April, 2004. These lectures were part of a lecture series hosted by the Department of foreign languages and the Research Institute of Foreign Languages at Beihang University. This text also belongs to the *Beihang Linguistics Lecture Series*. It is our hope that the publication of this text—accompanied by its video-disc counterpart—will encourage cognitive linguistic studies in the Chinese mainland.

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George Lakoff is Professor of Linguistics at the University of California, Berkeley. He previously taught at Harvard University and the University of Michigan. Dr. Lakoff earned his PhD in 1966 from Indiana University. His more than 40 years of research has contributed greatly to the establishment of Cognitive Linguistics as a new academic paradigm. His co-authored book *Metaphors We Live By* (1980) [with Mark Johnson] is seminal and path-breaking. His works *Women, Fire, and Dangerous Things: What Categories Reveal About The Mind* (1987), and *Philosophy in the Flesh: The Embodied Mind and Its Challenge To The Western Tradition* (1999) [with Mark Johnson] laid the foundation for Cognitive Linguistics. He has published a multitude of articles in major scholarly journals and has edited volumes on the subject. He is the author of numerous influential books including *Moral Politics: How Liberals and Conservatives Think*, (2002); and *More Than Cool Reason* (1989) [with Mark Turner]; *Where Mathematics Comes From: How the Embodied Mind Brings Mathematics Into Being* (2000) [with Rafael Nunez] and, most recently, *Don't Think of an Elephant: Know Your Values, Frame the Debate* (2004).

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LECTURE 1

Generative Semantics: The Background to Cognitive Linguistics

I'd like to thank you all for coming again. I'm honored to be here. I hope to live up to your expectations. What I am going to do in the next few lectures is go over a lot of work that I've done.

I can't believe my work has spanned over the last 41 years. I can hardly believe I have been doing linguistics for 41 years. But let me try to give you some sense of the difference between linguistics today and linguistics 41 years ago. What has happened since then and why? There is an enormous change that has come about in linguistics and the reason is that people simply have become linguists as they study things and discover more things about language, and the other reason is that with the development of cognitive science, that is, the study of the mind and the study of the brain, we've learned a lot about what is it to be human being and language makes up a great deal of what it is to be human. So what we will see as we go along is that we are discovering not merely technical things about language but rather a great deal about what it means to be a person. That's really what these lectures are about.

Why is it that you study linguistics? My first linguistics teacher was a great linguist named Roman Jakobson. My second linguistics teacher was another great linguist named Noam Chomsky. They had two opposite views: Roman Jakobson viewed language as central to all human activities. What he said was this: that when you study language you study everything, that to study language is to study thought, to study language is to study interpersonal communication, to study anthropology, to study the way people interact with one another and requires fitting language into the web of science, fitting it into how science works, how physics works in, let's say, acoustics, how the brain works, and so on. It is a lesson I've never forgotten. And I think it is extremely important one that we will see. The view from my other teacher professor Chomsky is that language is the opposite, completely autonomous, independent of all communication, independent of thought, independent of the body, independent of interpersonal relationships, and so on. I've never believed that. I've been more a follower of Dr. Jakobson. And you will see as we go along, that I think the evidence shows that Dr. Jakobson had the better idea, but we will see as we go along what the evidence is.

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Let me begin with a view of linguistics from 1963 when I first started in the field. In 1963, the study of meaning was the study of formal logic. My own training and background was at MIT, the Massachusetts Institute of Technology, a technical university where I studied mathematics and English literature. And one of the things that I learned there was that I learned to do both: the study of meaning from the perspective of literature, but also the study of logic, mathematical logic. And mathematical logic has certain properties that we inherited from Aristotle. That is mathematical logic as it developed, and was a philosophical endeavor and it assumed certain very interesting things, things which are not necessarily true, but interesting. These came from 2,500 years ago in Greece, as Aristotle constructed logic. Aristotle assumed that meaning was out there in the world, that the meanings of words were the essences of things out there in the world, that the mind could directly grasp the world. Logic was logic not of the human mind necessarily. It could be of the human mind but it was the logic of the world, and if you are smart, you could grasp the logic of the world with your mind. That was the assumption. And that assumption carried through up until 1963. It was assumed that the study of logic was the study of all rational structures in the universe, and mathematical logic was supposed to be the mathematics of that structure and that rational thought limited the structure of the universe. That was an assumption, just taken for granted about the nature of reasoning and logic. Now, logic of course, could also be a purely mathematical endeavor. There are all sorts of logics that are made up by mathematicians that have nothing to do with the world. So if you are a mathematician and you look at pure mathematical logic, it doesn't matter. You can make up all sorts of logics and there are tens of thousands of logics that logicians have made up. But the general philosophical assumption when I came into linguistics was that the study of meaning was the study of the way words fit the world. That was the assumption how language fit onto the structure of the world and that the structure of the world will be characterized in terms of logic.

Now there was another assumption that came from the modern theory of logic and that was that logic was formal. There was a formal structure to logic and that formal structure has certain properties. I will go through them in a minute and I'll check and see how they work. At the same time, Noam Chomsky came along, and in 1957 he wrote a book called Syntactic Structures. And in that book he introduced a metaphor into the study of linguistics, a very powerful metaphor. He said that a sentence is a string of symbols. Now when he said that he was referring to formal mathematics, which was the theory of simple manipulation. It is called recursive function theory. Sometimes it is called the theory of formal languages. It is a theory of how symbols get moved

around without regard to their meaning and what regularities you could find by studying systems of symbols. This theory is the basis for computer science.

In addition, Chomsky said that a language was a set of such sequences of symbols and that grammar was a system for generating that set. When he said that, he was referring to again the mathematical recursive function theory. In short, he was claiming that a language was a purely mechanical system for manipulating symbols in some regular fashion by rules and that they had nothing to do with meaning, nothing to do with communication. As a mathematical system, it didn't even have anything necessarily to do with the fact that you have a brain, a body, or anything else. It was a disembodied mathematical system, so that generative grammar, as was characterized back in 1963, was a symbol system had nothing to do with meaning and that you could then hook it up to meaning by relating it to the structure of the world and to logic. As a student of Chomsky's, I did a lot of work on this theory. I did many investigations of phenomena from the point of view of this theory, and got to know it very well. And I soon began to suspect that it didn't work very well. The part that didn't work very well has to do with the claim that the structure of language has nothing to do with meaning, that the structure of language has nothing to do with social interaction or contact or communication, because it seems to me as I started looking at examples, it has everything to do with meaning, communication, social interaction, relationships between people, and so on.

So let me try to give you some examples of what I began to find. As I did this, I tried to take the theory of meaning in logic and apply it to meaning in linguistics. During the first 12 years of my career as a linguist, I did what was called generative semantics; that is, I was trying to apply logic to the study of meaning in language and account for syntax in terms of properties of meaning. So that is what I am going to talk about. Let me give you a few examples. Many of you likely know the game of baseball. In baseball, you hit the ball, and there are certain verbs you use to describe "hit," like single, double, triple, so you can say he doubled to left field or he doubled off the wall in left field. Now the expressions "off the wall" or "to left field." Those are two prepositional phrases very familiar to you. And they are directional prepositional phrases. They describe the direction in which something moves.

Now in Chomskyan theory, with pure symbols, if you have a sentence like "John doubled off the wall," the only way you could ask how "off the wall" fits with "double" is to have "off the wall" just fit with this verb, the symbol. But if you ask what is the general principle, where, by which you can account for where the phrase "off the wall" occurs, is there any generalization about it? It appears that it has to do with meaning. When you say "he doubled off the wall," the "off the wall" refers to the ball moving off the wall. If you say "he doubled to

left field," it means the ball went to left field. That is "to left field" describes the direction of the movement of the ball. And if you had a verb with no movement of an object, you could not get "off the wall" or "to left field." You can't say "he slept to left field" or "he slept off the wall." There is no movement of an object. If I say "he fell," I mean "he fell" is his movement. But if you say something like "he sat," you can't say he sat to left field. The generalization is in the meaning. It's not in the grammar. But for Chomsky everything that puts phrases together has to do with the symbols of the grammar, not with the meaning. And when you find a generalization about how things fit together it is about meaning, then that violates the theory. It violates the theory that grammar has only to do with the symbols that fit together, and not their meaning.

Let me give you many other examples of this. I want to give you a sense of how broad this is. Suppose that you look at certain expressions in English that occur only with negatives, but not with positive sentences. So there are sentences like, take a word "ever," e-v-e-r, "ever." You can say "I didn't ever see him" but you can't say "I ever saw him." "Ever" only goes with negatives, "not ever" but not simply "I ever saw him," that is impossible in normal sentences. Now there are some cases, some kinds of sentences where you have a negative meaning and a positive grammar and a negative grammar with a positive meaning. It is special constructions in English. For example, if I say to you "why paint your house purple?" There is no subject, there is no auxiliary, and what I'm saying is "I'm suggesting that perhaps you should not paint your house purple unless you have a good reason." Right? And if I say "why not paint your house purple?" I'm suggesting you should paint your house purple unless you have a good reason not to. OK? So "why not" is a positive suggestion and "why" is a negative suggestion in this construction only, that is, when there is no subject and no auxiliary. So "why not paint your house purple?" and "why paint your house purple?" Now the question is this if you have a negative grammar with a positive meaning, there's "ever." Do words like this, these negative polarity items, do they go with the grammar or with the meaning? The theory that says grammar is about simple manipulations says it should go with the grammar. The theory that says it is about meaning says it should go with the meaning. So we test it. You can say, "why not ever help him?" It doesn't work. But "Why ever give him any money?" is OK. If you say there are expressions like "give a dime." Why can't you say "I don't give a dime" not "I give a dime." Furthermore, you can say "why give a dime" but not "why not give a dime." You can say things like "he doesn't have a red cent." It's an idiom that can only occur with negatives, not "he has a red cent." You can say "why give him a red cent" but not "why not give him a red cent." That is impossible. These negative polarity items go with the negative meaning, not with the negative grammar. And that is profound. Because it says

the combination of words that is what syntax is about is dependent upon the meaning of the sentence. It is not merely dependent upon the other words and the surface forms in a sentence. It is a very deep and an important property.

There are many cases like this and let me give you some more. Take the English distinction between the words "who" and "which." Now, "who" usually refers to a person and "which" usually refers to something that's not a person. So I can say something like "the man who I saw" or "the bicycle which I saw," but not "the bicycle who I saw" and not "the man which I saw." OK? So "who" is with people and "which" is with non people. But what do you say about a cat? If you have a pet cat, what do you say about your pet cat? It depends on how you think about your pet cat. So you can say "my cat who always tries to fool me," but "my cat which weighs ten pounds." Now if you say "my cat who weighs ten pounds," you're talking about how much he eats, that he may be over eating a bit, may have a personality like that. That is, when you use "who" you are metaphorically attributing personhood to the cat. If you just look at a cat as a thing, then you use "which." In short, the distribution between "which" and "who" is just part of the grammar of English, and it depends upon the meaning, not just grammar. It depends upon how you understand what the cat is. And it doesn't just depend upon the fixed meaning of the word. It depends on how you understand the meaning of the word in context. That is the crucial thing, how you understand it in context. Now that is an extremely important part of language: the way context works. This is the study of what is called pragmatics. Context has to do with how you fit things into your understanding of the world. One of the arguments that we have found, one of the results of generative semantics is that the study of context is not separate from the study of meaning. Context is the semantics of the world, of your understanding of situations. The semantics of situations is the semantics of communication, of interpersonal communication. There are generalizations about just that.

Now let me give you some examples of such generalizations. Suppose I have a sentence like "can you give me a cup of tea?" Now in English there are expressions like "can you give me a cup of tea?" which is literally a question about your ability, but it's actually a request to give you tea. Right? These are indirect speech acts. I wrote a paper about this back in 1971 called *Conversational Postulates*. The idea here is that there is a systematic relationship between what you say and what you mean. There is a system behind it. When you say "can you," there is a reason why that is a request rather than a statement. There is a reason why it's a request and not a promise. Let me explain why. If you look at requests such as John L. Austin's or John Searle's, who have both written books on speech acts, they observed that requests have certain conditions. When you make a directive or a request or give directions to someone to do

something, an imperative sentence, what you are doing is this: you are assuming that you have the right to make the request first, that is, you are in a social position to do that. Second, you are assuming that the other person is willing to undertake this. That is at least possible, and the other person is able to do it. You generally don't make requests of the things that you know are impossible in a normal situations. Now you might for certain reasons want to do this, for certain rhetorical reasons you might want to request something impossible of your parents, for example. But those are special cases, and with normal requests, you assume someone can do it, that they would be willing to do it, that they would want to do it, and moreover, if you are making your request, it is assumed between you and the other person that you really want the request to be carried out. So look at the ways that you can use other sentences to make requests. You can say "I would like you to give me a cup of tea" or "I want a cup of tea." That is, you can express a desire. This is one of the conditions of a request. You can request by giving the condition of the request. You can make a request by asking if someone is able to carry it out. That is, being able to carry it out is a condition for the request. And so they say "yes," they are able to carry it out, it is like saying "yes, I will fulfill the request." So I say "can you pour me a cup of tea?" You say "yes." You don't just sit there. "Can you pour me a cup of tea?" You say "yes!" and do nothing. It's socially not right, because when you said "yes," you actually said yes to "I will give you a cup of tea." I can say "will you give me a cup of tea?" That is, this will happen in the future. That is a future question about what will happen. It's one of the questions about one of the conditions. So if you say "yes, will you?" then you're saying in the future you will, and that means you'll do it. So the conditions on requests can be stated or questioned in such a way that it can be used to evoke the rest of the request. In cognitive linguistics this is called metonymy, where a part stands for the whole. And the name for this phenomenon is "indirect speech acts."

Now indirect speech acts are particularly interesting because of the phenomena I just mentioned about "why paint your house purple?" If I ask you something like "why aren't you doing your homework?" I come and ask you this negative question "why aren't you doing your homework?" That is a suggestion that you should be doing your homework unless you have a good reason. That is an indirect speech act. And "why paint your house purple" is an indirect speech act construction. It is a combination of the indirect speech act with "why" and the imperative "paint your house purple." It's thinking two constructions and parts of them and putting them together. And this is called an amalgam. It is fitting two parts of a sentence together. And you fit them together under pragmatic conditions, conditions of communication, of

successful communication. What that means is that you cannot just by looking at the symbols themselves, fit them together. You have to know what they mean in a context.

And this is the same as with "can you." Let me give you some examples of the differences of this. With "can you," "can you open the door?" the relationship between "can you" and the request is part of the conventional part of the language. It's a fixed construction of English. It is something you learn, you learn to do it by saying "can you." Now there are other indirect ways of speaking, that are not just part of language, but that are still understood in the context. Let me give you an example. Suppose I would say to someone sitting next to the window "it's very, very hot in here," and you jump up and open the window under these social situations. You would feel impelled to open the window if you could. But that's not part of the grammar of English. We may say "it's hot in here" does not mean open the window, but in this social situation, it would mean just that. Now notice that there is a grammatical difference between these. Suppose you take the word "please" in English. The word "please," is used in a polite request, but you can put "please" in different parts of the sentence. You can say "Please, can you open the window?" or "Can you please open the window?" and you might think that they are the same, but they are not. Right? So here is a subtle difference in English that native speakers of English know. It's the difference between internal "please" and external "please." And I will give you the examples. I can say "please can you open the window" or I can say "please it's hot in here," and you open the window. I can say "can you please open the window?" but I cannot say "it's please hot in here," because "internal please" goes exactly before what I am telling you to do, before the directive, so when it's inside it goes before what I'm telling you to do. When it is outside, it just says I'm making a polite request. But it's not necessarily right before. So that's a special constraint on "please."

What does that mean for a theory of linguistics, for a theory of grammar? The combination of "please," which is part of the grammar of English with other words, is part of syntax, it's part of grammar, how you put words together. But you cannot put "please" in the middle of a declarative sentence like "it's hot in here." You cannot say "it's please hot in here." What is the principle? The principle is that when you put "please" in the middle of a sentence, it must go right before a directive that the sentence is grammatically giving. And that is conditioned on speech acts. It's a condition on meaning in context. It is not just how you put the words together. So here you have another example of something in the grammar of English that does not just depend upon a formal system of simple manipulation. It depends upon what you mean, how you are

communicating with something else and what are the principles of communication. So this says that pragmatics, the understanding of communication, is entering into the grammar of English.

Now these are very important results. Let me pause for a minute to just go over them. What they show is that the fundamental assumption made by Chomsky in his basic metaphor. Remember the basic metaphor? A sentence is a string of symbols, where a symbol is independent of the meaning, it's a meaningless symbol, just a bunch of symbols. A grammar is a set, in the sense of set theory, a mathematically precise notion, a set of such strings, and notice what it is a set and what is not a set, it's independent of context. Sets don't change with context. Sets are defined by their members, strictly in mathematics. So you can't say here is a set, but over there it is not a set. You can't say in this auditorium something is a set, but in the other auditorium it is not. So you said this is the set and rules of English generate that set without looking at meaning. It's false. It does not apply to real English.

All these examples we've just given you are cases where meaning matters, where context matters, and where communication matters, for when things can fit together. So this is crucial to the understanding of what is going on.

Now, what was the response to these examples? Why didn't Chomsky just give up? The response was to say grammaticality is not something that you just know. A sentence like "it's please cold in here" could be grammatical. We can call it grammatical and just call it semantically anomalous. What you do is just redefine what you mean by grammar or with something like constructions like "why paint your house purple?" They can say that's not a core construction of English, that it is a peripheral construction of English, and that we're only interested in the core constructions. And what he did over the years was to shrink those core constructions until there are only thirty or forty of them out of hundreds of constructions in English so that the result is a theory of grammar that does not apply very much. It doesn't apply to all of language. It just applies to just a small amount of language. But you only know this if you are inside the theory, if you know it very, very well.

Most people who read Chomsky can't understand him very well. If you try to read Chomsky, it's difficult sometimes to understand what he's saying. But if you know the inside of the theory, then you know that this is what he's doing. He is shrinking the notional grammar, or he is changing it in some way so that the theory will stay the same, and your understanding of what grammar is will not fit your normal understanding.

So one of the commitments that I undertook was to say I'm going to study all of language, not just the core constructions, and I'm going to study language as it is used in context among people, not just language independent

of context and people. Now that is a commitment as a scientist. I could have done something else, I could have said "I'm only going to study those things that work according to the theory. I'm only going to study these thirty constructions, and that's all I will do." People could do that, but I refused to do it. That's a commitment that I made personally. So, as a result, what I had to do was give a theory of how meaning could affect grammar, and that was what generative semantics was about.

Now, in transformational grammar, generative grammar just has to do with having some means of characterizing. "Generating" just means characterizing a set by some principles. There are two very different ways in which you can characterize an infinite set. You can try to have principles that go step by step and generate them by a sequence of steps. These are called transformations, or you could have your principles simply be static and give constraints so that you can have what is called a constraint satisfaction system. And generative semantics was a constraint satisfaction system. It says there are certain constraints that fit in the language, and so it's cognitive linguistics. It's a constraint satisfaction system. It gives certain principles, and then in a given sentence, ten of these principles may work at once. In transformational grammar, the principles work one at a time in sequence, and they require a derivation, and that requires a first step of derivation that is called the underlying structure. Now in Chomsky's early work, he used the term deep structure, but he gave that up by 1967 because I gave proofs that such things couldn't exist. It turned out that a deep structure in Chomsky's sense had to also fit meaning, and when he saw that meaning was entering the paradigm, he gave up that condition that deep structure determined the meaning, and he called these initial structures D structures. D, but that does not mean deep. It's just D, so a continuation. He dropped out one of the conditions. Now so he has that initial structure from which the others can be derived.

I tried working with this system for many years, and I tried adapting it to generative semantics. I tried to say the underlying structure was its logical form, and that from its logical form you could derive in various steps the surface form. And in 1974, I came upon a set of sentences that could not be done this way. These are sentences that cannot have any deep structure or D structure or underlying structure with transformations.

Let me give you an example of such a sentence. Let's take a simple case, say, "I invited you'll never guess who to the party." (1) Now compare that to "you'll never guess who I invited to the party." (2) So "you'll never guess who"…. this part occurs. This (sentence 2) is the normal way to say the sentence in simple constructions of English. "You'll never guess who I invited to the party" is a simple indirect question, here. This occurs here (after "I invited"). Compare that

with "I invited John to the party." Instead of John, I can say "you'll never guess who." Now this (sentence 2) is the normal form of the sentence, and this sentence (sentence 1) basically means that (sentence 2). And in this sentence (sentence 2), this piece ("I invited to the party") is embedded after the verb "guess," so this is an embedded clause. But here (sentence 1), "you'll never guess," which is the top clause, is embedded. It is sort of embedded here and then you have the "who" which forms this noun phrase, and this is the top clause.

This sentence was first noticed by a linguist at MIT named Avery Andrews, who had been an undergraduate student of mine at Harvard and went to study with Chomsky. I got a call from Haj Ross one day telling me this sentence. And he said "There must be a very strange transformation that takes this top clause, drops off the 'who' and sticks this part in there." That's an impossible transformation. In the theory of transformational grammar, that could not happen. It was very odd.

I said, "Look, the first thing you do if you are a grammarian and you find a phenomenon that iterates it, see if you can do two of them, three of them, four of them. Check if you can embed one in terms of the other, see how they iterate, see if there are not two but three, four, five, etc." So I constructed some more examples. You can say "John invited you'll never guess who to you can imagine what kind of a party for God knows what reason on wasn't it last Tuesday." Now, "John invited you'll never guess who to you can't imagine what kind of a party for God knows what reason on wasn't it last Tuesday." What is the deep structure of this sentence, or the D structure, or the underlying structure? It has none. Notice that here this is an underlying structure "you'll never guess who John invited"; but so is this, "you can't imagine what kind of a party John invited someone to." That is also an underlying semantic structure or deep structure, but so is this, "God knows for what reason John invited someone to a party"; and so is this "wasn't it last Tuesday that John invited someone to a party for some reason."

That is, if you try to give a single underlying structure for that sentence within a theory of transformational grammar, you will fail. Try it. Go home for homework if you are taking a course in transformational grammar and just try it. Each of these pieces underlined is part of the highest sentence from a deep structure point of view, an underlying structure point of view, but they don't fit together in any way. It's like you have four sentences coming together, lots of different clauses fitting together in a way that makes sense. That is, grammar has to do with it, and this construction has to do with fitting pieces together under certain conditions. Now what are the conditions? Notice what you cannot say. You cannot say "John invited Harry guessed who to the party." You can only say "you'll never guess who." Right? So take this, "John invited Harry guessed who to the party," no good. You say "Harry guessed who John invited to

the party," but you can't put it in here (after "invite"). You can say "John invited God knows who to the party," but you can't say "John invited God doesn't know who to the party." The constraint on what can go here is that it must be an exclamation. You must be exclaiming on how extreme this is, and only certain constructions express exclamations. So you can say "God knows when the sun will shine again," but not "God doesn't know when the sun will shine again." You can say "you'll never guess when spring will come." You know, that's an exclamation, but if you say "Bill guessed when spring would come," that's not an exclamation. Only expressions that express exclamations fit here, regardless of the grammar used to express them. The condition is a pragmatic condition on the grammar. It's the condition on what you are expressing. That should never happen in a generative grammar where meaning is ignored, where exclamation should not be part of how things fit together, but it happens in English. It does not fit any Chomskyan account of grammar.

Now let me give you another example like this. There are certain kinds of constructions that are supposed to only occur as main clauses. So, for example, you all know [...] who the basketball player Yao Ming is. What team does he play for? (Answer: Rockets) So consider the following sentence "Who could stop Yao?" It is an exclamation, and it is a question that isn't really a question. It is expressing a negative statement that no one can stop Yao Ming. I say "Who could stop Yao Ming?" it means no one could stop him. As opposed to "Who stopped Yao Ming yesterday?" ... "Shaqille O'Neill!" "Who stopped Yao Ming yesterday" is not an exclamation, does not express a negative, but "who could stop Yao Ming" expresses a negative. You can say "John believes that no one can stop Yao Ming," but not "John believes who could stop Yao." You cannot make it into a relative clause. You cannot say "Yao Ming is the person that John believes who could stop." Impossible. It can't be a relative clause. It can't be a complement of something like "believe" or "say."

Now there is, however, one place in English where it can be embedded, and it's in a sentence like this. "The Rockets [...] are going to win because who could stop Yao Ming!" It occurs in this "because" clause. Notice it does not occur in every embedded clause. You cannot say "The Rockets are going to win if who could stop Yao Ming." You can say "The Rockets are going to win if no one can stop Yao," but not "if who could stop Yao." That is, English has a very interesting construction with the "because" clause at the end of a sentence where you can have an exclamation that expresses a meaning that can fit in the "because" clause. The meaning is a negative meaning. So under those conditions, you can have that sentence, but you can't do it with "if," only "because."

Now think about what this means for a theory of grammar. It means that this exclamation means something else—it means a negative statement. That is, if you understand the meaning of "because" and the meaning of that negative

statement, you can express it with this. In a theory of grammar, could you tell exactly where "who could stop Yao Ming!" can occur without looking at what it meant? The answer is no. That is, this construction depends upon knowing that only exclamations expressing negative statements can occur here, and that means you have to use the concept "exclamation" which is a pragmatic concept and you have to use the concept "express" which has to do with meaning. That's the only way you can account for this phenomenon in the grammar of English. So now think about what we have. We have cases where you have to look at indirect speech acts, that in the grammar of English, like "who could stop Yao!" to understand the grammar. You have cases like "John invited you'll never guess who to you can't imagine what kind of a party for God knows what reason on wasn't it last Tuesday" that we just saw where there can be no deep structure. You have cases where the semantics is determining the choice of grammatical expressions. That is, in short, the basic claim behind generative linguistics is false, massively false. These are not rare examples. There are hundreds of examples like this. They are not rare, and they were published all by 1974, so they are in the literature, and anyone who believes in generative grammar ignored them. They decided they're going to do it anyway and just ignore these sentences and only look at core grammar.

Now let's look at another part of Chomsky's more recent theories. By more recent I mean after 1966. Having started studying with Chomsky in 1962, that seems more recent to me. In 1966, there was a proposal made by one of Chomsky's students Ray Jackendoff to claim that the sentence structure was based on heads and modifiers. This is the so-called X-bar theory. And in the X-bar theory, the assumption was that nouns were N zeros (N^0) and verbs were V zeros (V^0), and then there were N bars (N) and V bars (V) and so on, and N double bars (N"), and there were certain kind of rules that allowed one to look like this. Look at it. The sentence looked like a V double bar, and that in particular, if you look at this part of the system, it was claimed that the lowest N bar could take a complement. Sorry, this is N^0 and takes a complement and becomes N bar. And then there comes the N bar, then you could have a modifier like an adjective modifying this N bar over here, so this is a complement and this is an adjective (see Figure 1). Jackendoff's original argument for this had to do with the word "one" in English. "One" can be either a number or it can be a pronoun, and as a pronoun, that's indefinite. So you could say "I bought a car and Bill bought one, too," "I bought a large car and Bill bought a small one," or "Bill bought one, too." You say "one" means a large car. And the idea here is you can say "I bought a car with a V-6 engine," here's the complement "car with a V-6 engine," "I bought a large car with a V-6 engine and Bill bought a small one, a car with a V-6 engine" [...] or you can say "I bought a large car with a

V-6 engine and Bill bought one, too." So Jackendoff's hypothesis was that "one" could refer back to any N bar. That was the hypothesis.

Now within a few days after that, Haj Ross and I constructed counter examples to this, which have been ignored up to today. Actually, it's still ignored. And the counter examples go as follows: John bought a large expensive portrait of the queen by Smith and Bill bought a small cheap portrait of the princess by Jones. That's one sentence. Now where can you put "one" and what does "one" refer to? You can say "portrait." No problem. And "Bill bought a small cheap one of the princess by Jones," so "one" could be an N bar in this account; but also you can have "and Bill bought a small one of the princess by Jones." And if you say "small one," here it doesn't mean cheap portrait, it means expensive portrait; or you can say "and Bill bought a small cheap one by Jones." A small cheap one by Jones, and that means a cheap one of the queen; or you could say "and Bill bought a cheap, …" that's a small cheap one of the queen, "and Bill bought a cheap one by Smith," and that means a small one of the princess. So basically any combination can be used. And if you put a "one" there and you drop out one of these modifiers, then it takes the meaning from the previous sentence. Is that all clear? Now the question is: can "one" refer back to any particular node in the tree? And the answer is no, because, for example, you have something like "cheap portrait of the queen" (Figure 1) versus "cheap portrait" (Figure 2), you can use one for either of those with the single node, but in fact you could have it refer to either one of these, and there is no tree that will have a single node in it. So even if you had "cheap portrait of the queen" (Figure 3), there would be no node that this "one" would refer back to. So in short, there can be no rule for the meaning of "one" that refers back to just a single node with the meaning of that node. That is, it is not a possible rule of transformational grammar.

Now that does not mean there is no rule for it. And in fact, in the Neural theory of grammar, there is a perfectly good rule for it and it is a very simple rule. In the Neural theory of grammar, what you are doing here, if you have "one," is the following: notice first that in these sentences, you have opposites, "large" and "small," and "expensive" and "cheap," as well as things that are mutually exclusive that can not both hold—that is "of the queen" and "of the princess," "by Smith" and "by Jones." These are mutually exclusive meanings. In a Neural theory of language, how do you express something that is mutually exclusive? The answer is mutual neural inhibition. Neural inhibition is when a neuron fires and it stops another one from firing and there are certain circuits where you have two neurons and they are connected, and so any one or if either one fires, it stops the other. So mutual inhibition is the way you characterize, you know, things that are semantically incompatible in a Neural theory. So if you

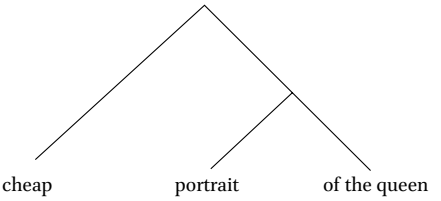

FIGURE 1

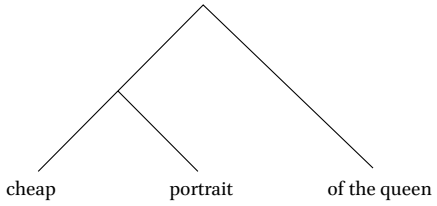

FIGURE 2

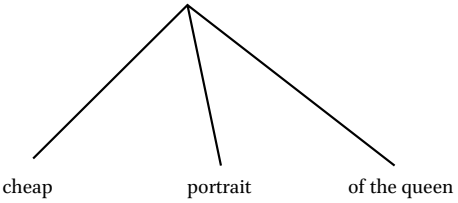

FIGURE 3

have a Neural theory and you have a sentence like "John bought a large expensive portrait of the queen by Smith and Bill bought a cheap one by Jones," this "one," will refer back and activate the meaning of everything in this previous noun phrase except what is inhibited by what's in the noun phrase. So "cheap" will inhibit "expensive" if you have "cheap," and "by Jones" will inhibit "Smith," and then the rest will just work. That is, this will refer back to "large" and "of the queen," and they will be fitted together in a neural theory. This should not be obvious. It's something we haven't discussed in Neural theory yet and we are going to discuss it a bit, but this is how that will be done in the contemporary cognitive theory of construction grammar based on a Neural system. That is, these sentences work this way because we are human beings that have brains where mutual inhibition is possible. They cannot work in any transformational theory where you have to look at the syntax of "one."

Let's look more generally at X-bar theory. Now, we'll show that there are sentences where X-bar theory is not possible. There are sentences where you cannot have X-bar theory. So let me give you an example like that. Here "The Rockets are going to win because who could stop Yao Ming." First you have to understand the claims of X-bar theory. If you have an X-bar theory, it says that a verb agrees—in English you have verb agreement—with the head of the noun phrase. The verbs agree with the heads. In terms of selection, the verb selects the meaning of the head, it selects the head that will go with it. So for example, if you have a verb like "believe." "Believe" requires a human being.

You could say "the tall man who I saw yesterday believes so and so," and "man" is what it selected. If I say "the large car that I saw yesterday believes so and so," that is no good. So it's the head that determines the selection. And that's not just true of subjects, it's also true of objects. Secondly the modifier, like the adjective, modifies the head, if I have something like "a large car," "large" is the modifier, "car" is the head, "large" modifies "car." All X-bar theories follow these principles. If they don't follow these principles, they are not an X-bar theory. So those are the basic principles.

Now consider a sentence like "I picked up and drank a large delicious cup of tea," and the question is: what is the head of "cup of tea"? Is "cup" the head or is "tea" the head? There are two possible X-bar structures here. In one of them, you have "cup of tea," where this phrase is the head. So here you have an N zero and then you have some other structures here, whatever it is (See Figure 2). In the other theory, in the other analysis, "cup" is the head, an N zero, and then a prepositional phrase "of tea," and this is a complement and this is an N bar (see Figure 3). So those are two possible analyses, and under X-bar theory, one of these must be right. And since there's only one of these in the sentence, and one must be right, the other must be wrong because you can't have two analyses at the same time. But you do. In this sentence, neither of these could work. Why? Notice "pick up" is a verb, the verb selects the head. What does "pick up" select? I picked up the cup. So that says "cup" should be the head. But I also drank the tea, so that says "tea" should be the head. You can't have both at once, but you do. And look at "large." "Large" is a modifier. What does it modify? It modifies the head, "cup." "Delicious" is a modifier. What does it modify, the head "tea." X-bar theory can't work for that sentence or any sentence like it. It is a true counter example to X-bar theory. Now this is not a problem in construction grammar at all, because in construction grammar, you don't have constraints as there is no X-bar theory. You can say what things mean and you can have a construction like "a cup of tea." "A cup of tea" is a measure construction, and there're two parts, a physical object that measures something and the entity that it measures. Period. A modifier can modify the object or what's measured, no problem, either one, depending on the semantics. So in the construction grammar, this is no problem but in X-bar grammar it's impossible.

These are some of the reasons why I gave up being a transformational grammarian, and there are hundreds of more like these. But these are some of the reasons why by 1974, I gave it up completely. All of these examples were known by 1974, that is, thirty years ago. I knew all of these and I said "this cannot work," and I ought to do something else, and that something else is called cognitive linguistics for reasons that we will get to in the next lecture.

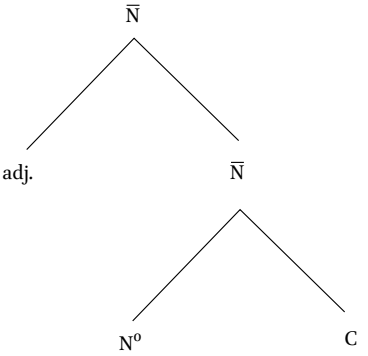

FIGURE 4

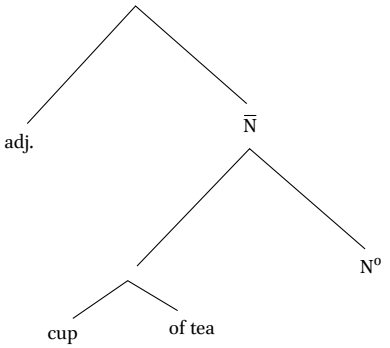

FIGURE 5

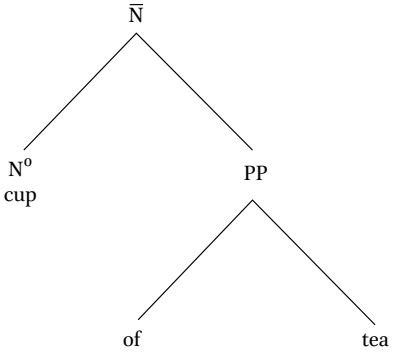

FIGURE 6

All original audio-recordings and other supplementary material, such as any hand-outs and powerpoint presentations for the lecture series, have been made available online and are referenced via unique DOI numbers on the website www.figshare.com. They may be accessed via this QR code and the following dynamic link: https://doi.org/10.6084/m9.figshare.5425561.

LECTURE 2

Cognitive Semantics: The Basic Mechanisms of Thought

I want to start out by talking about the theory of meaning that comes out of Anglo-American philosophy and logic. This theory of meaning defined what semantics was in early linguistics. In 1963, I mentioned that I was one of the people bringing the study of logic into linguistics in order to study meaning. Let me tell you what that meant exactly. It meant that if you had a formula such as, you know, f(a, b): something like John hit Bill, something of that sort, and its predicate with two arguments, that formula was taken to be a formal set of symbols that could only be evaluated in the world. And there was an assumption, a philosophical assumption, holding since the time of Aristotle, and to many logicians in the present time, that the world itself at any given moment is made up of entities, things like you, you, and you, each entity.

This chalk is an entity, with properties—this is white, it is made of chalk—those are properties, and relations holding between them. This chalk is in my hand—"being in" is a relation, being in my hand, the relation between the chalk and my hand. The idea was that at any point in time, the entire world could be seen in terms of entities with properties and relations, and that any predicate, like "the chalk is white," "white" is the predicate, any predicational statement like "is white" could be understood in terms of what Aristotle called a category, a classical category, that is, a category of things in the world defined by an essence—the idea of 'whiteness' out there in the world, and that every predication in language could be understood as a category statement about the world. So that "is white" means … is in the category of white things. And that it is in my hand is the relationship between my hand and anything in the world that happens to be in my hand, like this water bottle.

The assumption that the world could be understood this way has held from within the theory of logic from the time of Aristotle up to present day. It is a theory about what the world is like, and the assumption is that the world is structured according to logic. So, for example, if the water is in the bottle, and the bottle is in the room, then the water is in the room and that is seen as a fact about the world. And that logical statement is true, that is, if it's true of the world that the water is in the bottle, and it is true of the world that the bottle is in the room, and it is true of the world that the water is in the room. So the idea in classical logic was that logic consisted of the logical structure of

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the world, and that reasoning was something that human beings could do to reflect the logical structure of the world, and that language got its meaning by fitting the logical structure of the world. That is the assumption behind classical semantics.

Now, in formal semantics, you take what is called set theoretical models. That is, you assume that there is a set of abstract entities, like letters A, B, C, D, E, or something like that, some abstract entities, and you form sets, and the model of the world, the model of the property, is a set. So for example, the property of white things in the world would be represented in a set theoretical model by the set and you'd understand that as the set of all white things. And a relation like "is in my hand …", the relation like "is in" for the chalk and "my hand" would be given by an ordered pair of sets A and B, where this is the set. This ordered pair would be all the things that were in something else. For example, "this chalk" and "my hand" would be in the set IN = (A, B) or this water in the bottle, "water bottle" would be in the set IN. The idea was that set theory could mirror and model the structure of the world. And if you could do that, then you could understand semantics in purely mathematical terms. You have a set theoretical model. You have formulas in logic, and you could map them from the formulas in logic to the set theoretical models, where the models were taken as models of the world. That is what the classical theory of semantics is about, and it's completely disembodied. It has nothing to do with human beings. All it has to do is just about abstract formulas and abstract set theoretical models. It's a purely mathematical construction.

And what makes it semantics is that if you can attribute these formulas to language, and you can attribute the model to language. You can say that the bottle models the world with entities, properties and relations, and then that is supposed to give it meaning. So the idea was that formulas were given meaning right by being mapped onto the world. That is the classical theory of meaning, and many people still believe it. In addition to that, this goes along with the classical theory of truth. The idea that there is truth is the relationship between symbols and the world. And that a sentence is true: like "the chalk is in my hand" is true just in case the entity representing the chalk and the entity representing the hand, and that ordered pair of entities is in the entity set of ordered pairs representing IN. Or, "the chalk is white" is true just in case this piece of chalk is in the set of white things in the world. That's the classical theory of meaning completely disembodied, has nothing to do with the mind, the brain, the body, anything else—a purely mathematical theory.

Now, in addition to that, in order to handle certain other problems, again brought up by Aristotle, like necessity and possibility, logicians made up an extension of this, in which they talked not only about the actual world, but about

possible worlds. So, for example, it could be the case that the chalk in my hand is yellow, but it happens to be white. But you could imagine another possible world just like this one, with everything else the same except that this piece of chalk is yellow, that is, in the set of yellow things in that world and not in the set of white things. That's what a possible world is just like this one, but the other one, but it's yellow instead of white. That's a kind of possible world. And the study of possible world semantics came about because of sentences like "it could be possible for this chalk to be yellow. Right? It isn't yellow, but it could have been yellow." It is a possibility. So, that kind of sentence was handled by possible world semantics at that time, and it still is. Current possible world semantics assumes the following thing: possible world semantics is not a cognitive theory, not a psychological theory, not a biological theory. It has nothing to do with that—it is purely and abstractly disembodied mathematical theory.

Now, when I was working in generative semantics, that was the only theory of semantics that existed. There wasn't anything else. And I tried to make it work. I spent 12 years developing different kinds of logic, different kinds of models, and so on. Let me try to give you a sense of the difficulties. In 1968, my friend, the late James McCawley, one of the greatest linguists of all time, was giving a lecture. We were giving a class together at a linguistic institute. And McCawley at the time had a favorite actress, Brigitte Bardot (BB) in 1968, a long time ago. And he made up a sentence and the sentence went like this: "I dreamt that I was Brigitte Bardot and that I kissed me," not … "I kissed myself." Impossible.

Now, normally, the sentence I kissed me would make no sense, because there is no reflexive. Even if you kissed your arm or something, you wouldn't say "you kissed me." You need a reflexive. But in this sentence it works because you are dreaming. In the dream you are Brigitte Bardot, you are experiencing the world as Brigitte Bardot, you see this handsome guy McCawley, and you go and you kiss him. Right? I dreamt I was Brigitte Bardot and I kissed me.

Now, there are two possible worlds: the world, the real world and the world of the dream. But they are related in an interesting way. Because if you look at the real world (R) and the world of the dream (D), here you have [R] Brigitte Bardot, McCawley, and [D] Brigitte Bardot, McCawley. But McCawley has two parts. His center of consciousness called his mind and the rest—his body and everything else about him. And here in the world of the dream, you have Brigitte Bardot, who has a body and a mind, and McCawley's mind is mapped on to Brigitte Bardot's mind. When you say I dreamt I was Brigitte Bardot, it doesn't mean that Brigitte Bardot looks like Jim McCawley. She looks like Brigitte Bardot. You know she is very sexy. She is a woman. She is not Jim McCawley at all, right? So, his mind is being mapped on to that.

Now, classical model theory with possible world semantics cannot do this. It is a technical limitation. In particular, if you think about it, it's very strange how one person's mind could be another person's mind. This is not something that is true of the world or even relations between possible worlds. This has to do with the way you understand something. It's about a dream. It's about your cognition.

Now, at the time I tried to deal with this, with what was called Counterpart Theory in model logic—this was a theory made up by a logician David Lewis, but even that didn't work. We tried and it didn't work. There was really no way to do this, but we knew that you had to be able to break a person up into mind and the rest of them to be able to do these projections across possible situations. So, here was a case where classical possible world theory broke down, and this is the beginning of mental space theory. At that time, Gilles Fauconnier was a beginning graduate student in linguistics and wrote a paper about this sentence, and his career since then has been about talking about how you need mental spaces, a cognitive theory of possible situations rather than a theory of situations out there in the world, and possible worlds are taken as being somewhat real, not parts of people's minds, but out there.

These are very strange things. This was a very difficult case. Let me give you another case like this. Take the sentence "If I were you, I'd hate me." Now, you can't say "I hate me." You have to reflexivize. You can say "I hate myself." You could say "if I were you, I'd hate myself." But "if I were you, I'd hate me" means one thing and "if I were you, I'd hate myself" means something completely different. Let me explain. In the first one, it says imagine the situation: you are really a nasty person, you do mean things to other people, then "if I were you, I hate myself." Right? So that's the case where you say "if I were you, I hate myself."

Now, consider a situation where I'm a mean person, I do nasty things, I've done nasty things to you, and I can say "if I were you, I'd hate me." This has a totally different meaning. And again, you have to have a situation like this: only it's not a dream, you have a situation where my center of consciousness of mind is projected onto yours, and then you say "I hate me" versus "I hate myself." Now, these are the interesting hard problems that are never discussed in model theory. Now, since the days of the 1970s, model theory has advanced. Richard Montague's student Hans Kopf has invented what he calls Discourse Representation Theory, which does a lot more interesting things with model theory than before and allows you to do things in sequence and so on. But Discourse Representation Theory cannot handle these sentences. They cannot do correspondences and they cannot break something up into mind and body. They just can't do either of those. These are impossibilities in those theories of

semantics that are not cognitive theories. Discourse Representation Theory is not a cognitive theory. It's a formal theory just like theoretical models where you have sets in sequences, forming what they call "discourse is a sequence of these models." Now, it was because of cases like this that problems first began to arise with the theory of model theoretical semantics. I saw these cases in 1968, and I said I don't know how to do these, these are problematic, and I talked about them, I talked to Fauconnier and I talked to many other people. And then I just kept working. I kept working within that paradigm.

Now, in 1975, there was a very interesting institute at Berkeley. It was an unannounced underground institute. I got a small grant from the National Science Foundation to invite eight people to a seminar at Berkeley, and I got some very famous logicians, computer scientists, linguists, and so on to attend. A rumor got out that we were going to have something interesting happening in Berkeley and 188 people showed up. So we formed communes. It was 1975. There were no communes in Berkeley yet. Lots of us rented out houses together. We formed an institute that went for six weeks, and the rules were these: we had two classrooms and a sign-up sheet. And any one could lecture with three days notice and sign up on the sign-up sheet, on any topic, and that went for 6 weeks with 188 linguists. These were all interesting people, and they all came out and did whatever they were doing. During those lectures I went to probably about a third to a half of them. I heard a series of lectures that completely changed everything I believed.

The first one was a lecture by Paul Kay, my colleague at Berkeley. Like most of the linguists who were my colleagues at Berkeley, Paul Kay at that time was an anthropologist. He has since moved over to linguistics. He and Brent Berlin had written a famous book about color and color terms. When they were graduate students, they were taught that the languages of the world could have any number of colors and they could just break up the color spectrum anyway at all. They didn't believe this, so they decided to do an experiment. They went to a paint company, a company that sold paints and had little chips of paint. And the paint company had these chips with a hundred and forty-four chips of paint, 12 by 12, various colors, the whole spectrum out there, all the colors. And they got a hundred of these paint samples and they sent them to one hundred anthropological field workers, people studying various languages and cultures around the world. And they asked the people there to find out what the color terms were and pure color terms, not color terms that meant grass or blood or something like that, but just things like blue or green that were colors, but not other things. So they went and they went out and they found, they got people to do that. And they asked them two questions. First, find out the range of the colors, what the range was. You know, you have a bunch of color chips, here,

and the range here, and the range here, and the range there, and so on. Here is blue, here is green, and here is maybe purple, here is red, and so on. Then they asked another question. They said "Ask each person what is the best example of each color." They sent these around the world to people, some of which have just two colors in their language. There are some languages with only two color terms, one for the warm colors: red, yellow, and orange; another for the cool colors: blue, green, black, and so on. Others have three colors, four colors, six colors, eight colors, and so on. English has eleven, Russian twelve. And so they sent these out and they got them back and they discovered that everybody had the same central colors, the same best examples—the ranges were different, but they had the same best examples. So if you had a language with no word distinguishing blue and green, that's one language for both blue and green. They said the best example would be central blue or central green, not something in the middle. This is a very striking example.

In this lecture, Paul Kay put that research together with a study by Russell Diveley, a famous neural scientist who recently died, about three months ago, who was then at Berkeley. And he had worked out the neural physiology of color vision. He had figured out how the brain processes color vision, again working with monkeys, with macaque monkeys, so you can do operations on the brain, and had figured out that in general, color vision works by your three color cones in your eye, three types of color receptor. They form circuits of very complex kinds so that there are six types of color circuits. The circuits form pairs like red/green, blue/yellow, white, black, and then they form. They have response curves so that when you see light reflected off something, like the blue chairs that you are sitting on, you see light reflected off that, that will activate a certain set of wave lengths, and that will activate the color cones in your eye, that will, in turn, activate the neural circuitry, and there will be certain responses. So, for pure blue, you get a high response curve for central blue, and for something like purple, it might be between red and blue. Partially, here is a response curve for red, a response curve for blue, where it meets in the middle is purple; and likewise for a response curve for yellow, response curve for red, where it meets in the middle is orange. The best example is when you have the highest response with nothing else, no other color. It turns out that everybody, with a few exceptions due perhaps to certain other difficulties which we discovered later, has pretty much the same range of colors and the same best examples because of their physiology—because of their color cones and their brains. Now there are variations, there are people who are color blind, and then there are interesting variations discovered later that men and women differ slightly. Apparently, there are the color cones, the chemicals there have to do with the genetic material with chromosomes, the white chromosomes.

It turns out that there are two types of men in terms of color but they are very close. The central greenness is like two nanometers apart, but there are sixteen types of women in terms of color. Color sensitivity is, it's not that women are more sensitive, it is that there are more differences among women, many more differences. Now that means that the color you see is different from someone else if you are one type of person versus another type.

Now, I don't know if this happens in China, but in America, it is very common for men and women to disagree about color. For a husband to say, "that's brown," and the wife says, "it is not brown, that's orange." What's interesting is that they can both be right because they can have slightly different color cones. The point of this for Paul Kay was that they showed that there was a physiology, a physiological reason for the universals of color. For color, there have been certain central colors, not only a certain limited range of possible color terms and so on. There are not five thousand pure color terms. There are up to twelve or so. His idea there was that you could explain something about language, language universals in terms of neural physiology, but for me, this meant really something really much more interesting. I remembered the classical theory of semantics. Remember, it says "the chalk is white" just in case it is in the set of white things in the world. The chalk is yellow if it is in the set of yellow things in the world. The chair is blue if it is in the set of blue things in the world. There is no set of blue things in the world. Blue and all other colors have to do with the interaction between you and the world. The idea is color is not in the world. Color is an interactive property. Color is not just a matter of wavelengths that are reflected. Colors have to do with many wavelengths. In fact, in color television they put together different wavelengths to get a million different colors. The idea here is that color is not wavelengths. Color has to do with the way that the wavelengths hitting your color cones and the neural circuitry in your eyes give rise to an experience that you have internally. For example, it is not true that grass is green in itself. The greenness has to do with the relation between you and the grass. It is not true that blood is red in itself. It is not true that the sky is blue in itself. All colors have to do with the interaction between you and the world.

Now to me that was a shock. And it was a shock not merely to discover that about the world, but I looked at the world, and it looked colored, and that isn't the way the world actually looks. There's no red in there, right? Objects reflect the wavelengths, but the red has to do with how my brain and my body is structured, and we were all close enough so that we pretty much see it in the same way with the exception of some husbands and wives. Now what's interesting about this for semantics is that the traditional theory of meaning and truth was based on the assumption that symbols are related to the world,

that the sentence like "the chalk is yellow" is true in the case that the chalk is in the set of yellow things in the world, but if there isn't the set of yellow things in the world, then the classical theory of semantics must be wrong. This is also important because of what was called the Correspondence Theory of Truth. All the Anglo-American philosophy is based on the Correspondence Theory of Truth. It says that if you take a sentence, the sentence is true, like, "the chalk is white" just in case you map the objects onto the world, the properties onto the world, and if the sentence fits the world, then it is true; if it doesn't, it isn't. But if it fits the world independent of you and independent of any people, right? That cannot be true. Just from what we know about color, it cannot be true in general. That is, your brains, your bodies take part in meaning, take part in understanding, in ideas.

Now, if you step back from the point of view of today, we are now thirty years later, a lot of neural science has happened, we've learned a huge amount. If you are a neural scientist today, that seems completely obvious. After all, anything you can understand, you can only understand through your brain. Brains are highly structured, and you are only able to understand what the structure of the brain will permit you to understand. So it makes sense from the point of view of current neural science. But in 1975, this was revolutionary. It said that the theory of meaning that we've had for two thousand five hundred years did not work—that it fundamentally did not work, and that the theory of what truth is, the theory of truth was false. It's difficult to say that the theory, the very theory, the very understanding of what truth is isn't true. That is a major, major thing to understand. Since then, what we've found is that this is normal, that everything works like color in this regard, and we'll go through some more examples. So that was the first of the interesting lectures I heard in the summer of 1975.

Now the second one was just as revolutionary, and so revolutionary in a similar way. That was a lecture given by Eleanor Rosch. Eleanor Rosch was the person who first discovered prototype theory, and I'll talk about that in a little while. But in that summer of 1975, she gave her first lecture on what she called basic level objects. Now basic level objects are things like bottles, chairs, tables, pieces of chalk, very simple objects. But, a given object can be described in many ways. I can describe this chair as furniture; I can describe it as a physical object; I can describe it as a chair with a back and no arms. You know there are certain kinds of chairs and I could describe them in all kinds of ways. What she found was that there was a certain level of description, a level of categorization. That was cognitively more basic than other cases.

For example, if you close your eyes, you can get a mental image of a chair. Now, close your eyes and try to get a mental image of a generalized piece of

furniture, not a chair, not a table, not a desk, no particular kind, just a general piece of furniture, and you can't do it. There is no mental images above the level of chair. Chair is the highest level of categorization, at which you can get a mental image. It turns out also it's the highest level of categorization, in which you do something with your body in interacting with the chair. You have motor programs for sitting in the chair, motor programs for interacting with the table or you're sitting in the chair, motor programs for turning on lamps, but no motor programs for dealing with all and only the furniture. Nothing that you do with your body for all and only furniture. That doesn't happen.

So what she pointed out was, this is is a very special kind of categorization, and it was a basic level category. Notice the same is true for something like a "car." You can get a mental image of a car, you do certain things with the car, you drive it, you shift, etc, or you press the pedals. There are certain things that you do with your body with the car, but not with respective vehicles which include cars, buses, trains, and boats. There is no general mental image of all vehicles. It's like furniture—its too high a level. So the basic level is the level defined by mental imagery, gestalt perception where you could see something at a distance and see its general shape, motor programs, and also it turns out most of your information about categories comes at the basic level. It's very information rich. You know a lot about chairs and cars, much less about vehicles in general. That isn't true about the rest. So in general, what Rosch concluded from this was something important. Basic level categories are defined by your bodily interactions with the world. That is the ability to have gestalt perception, form a mental image, and interact physically with your body. They are interactive categories and as such, the basic level which is cognitively real and part of your mental structure, is not out there in the world by itself. It's in your interactions with the world, with your body. That means that semantics has to be embodied, just as we saw in the case of color. Color semantics has to be embodied. Basic level semantics has to be embodied. You have to take your body into account. You can't have a purely abstract mathematical theory of it.

Now the third lecture that was important to me that summer was given by Leonard Talmy. Leonard Talmy was just finishing his PhD at Berkeley, and he had been studying spatial relations in languages around the world. By spatial relations in English, I mean, things like prepositions in, through, under, by, across, above, below, etc, all of those, and Chinese has other verbs for spatial relations. Different languages have different ways of expressing spatial relations. For example, in Mixtec, which is an Oto Manguean language of central Mexico. In Mixtec, all spatial relations are given by body part metaphors. So if you want to say something like the cow is standing on the hill, they have no word for "on." You would say "the cow is standing the hill's head." You project the head

onto the hill, the body onto the hill, you see the head, and the cow's standing on the hill's head. Now for each body part, like the head or the arm, there's a corresponding space, for the head is above, for the face is here, and for the arm is here.

And we now know from neural science something very important. It's been discovered that these associated spaces are represented physically in the brain. There is what is called a peripersonal space. When we get to the third day of lectures, I will show you some power points and slides of all of the data on this. But there are, let's say if you take this portion of the face, there're certain neurons that fire when you touch this portion of the face and the same neurons fire when you see something close to the face over here. So you see something there, certain neurons fire; and if you touch that, the same neurons fire. That is, the body is set up to identify spaces close to body parts, and this is reflected in Mixtec. So if you say something like the plane, the airplane is flying over the hill, it's the airplane is flying the hill's head, with the head but it's the space associated above here. So it's a metonymy of the head for the space associated with the head, the peripersonal space. That's how Mixtec comes into work. Now let me give you other examples in Mixtec. If you want to say something like "the cat is sitting on top of the house," what you say is the cat is sitting the house's animal back, animal back is like the back of a horse or a cow. They have a word for animal back which is horizontal. So there is no word for "on" and you say the cat is sitting the house's animal back. Suppose you want to say the cat is sitting under the tree, you say the cat is sitting the tree's foot, right in the area near where you'll put, project your body onto the tree and you project the foot. So Mixtec works by body part projections and English has some of these. We have things like "in back of me," "in front of me," and so on. You have a back and a front that you project. So we have part of this in English, too.

Now in other languages, you also have many others, I won't go into that for another minute. What Leonard Talmy discovered was this. First, when you look across many languages and all the spatial terms, they do not line up. They are just different. They combine and they just take different aspects of space. They look strangely and wildly different. Why? You can decompose those terms into spatial primitives that are the same across languages. So one of the primitives, that is, has to do with containment, being inside a certain bounded region, for the word like "in" or "inside" versus "outside." Another primitive has to do with contact. A word like "on," if I say the chalk is on the desk, here is the chalk, it's in contact with the desk, if I remove it from contact, it's no longer "on" the desk. "On" requires contact, and it also requires in the central sense being above and it has to be supported by the desk. Now you get the painting on the wall, and there is not above, but it is supported by the wall and in contact with the wall.

So support and contact are crucial for the central senses of "on" and usually in the most practicable cases, it's "above," like this sort of "on."

Now all languages appear to have primitives like contact, support, verticality, above and below, in and out. That is containment. They also have a source, a path, and a goal for from, along, to, and so on. Talmy started to break down these primitives. He broke them down into dozens of them. He found that there were three classes of primitives. Some were topological. So containment is a topological property which means that you can take a container and make it any shape at all, stretch it, do anything you want to, it stays a container. It doesn't matter how big it is, it doesn't matter where it's located, it's still a container. The same is true for a path. If I have a start here, I have a source, I have a goal, and I have a path. It doesn't matter if the path is wiggly, if it's long, if it's short, it's still a path. Those are topological cases. Then there are orientational cases like "up," "down," "front," and "back." Those are the orientations given by the body, and then some orientations are outside. There are languages where you identify things as being north of something else or west of something else. So there are external orientations and there are bodily orientations, but they are orientational cases.

And finally there are what he called force dynamic cases. These are cases like "against" where you are pushing against and there is a resistance. He identified language sixteen types of force dynamic interactions. So support is one, and being against, pushing against with resistance is another, and pushing with no resistance is the third, and you know there are cases where you start, where you block something, you come in and then you create the resistance. He went through all these cases and showed that all of the spatial relations could be given in terms of one of the three classes. Sometimes there are two classes at once. So for example, if something is in a bank vault, it is both protected from the outside, there are force dynamics, and it's also contained spatially, so you can have two at once. Now we call those image schemas or force dynamics schemas, and every preposition or spatial relation term is a combination, a binding together of these various schemas. So for example, if I have something like "through," "through" means you start outside, you go inside and you go outside again. So "through" has a sort of scenario where you begin outside and go inside and then outside. There is a source, a path and a goal, and you put them together. It's complex, but it is made of two schemas, a source path goal schema and a container schema which are two image schemas (Figure 1). "Into" is made up of two schemas like that (Figure 2), "out of" is made up of schemas like that (Figure 3) where you start in and you go out. The idea is that these things can be combined, and different languages combine them in different ways, and then there can be variations on them, which are very interesting.

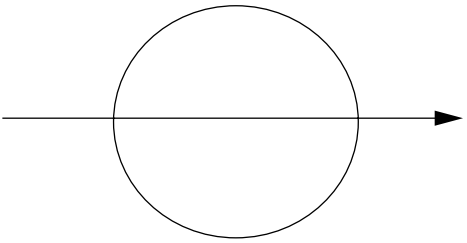

FIGURE 1 *THROUGH image schema.*

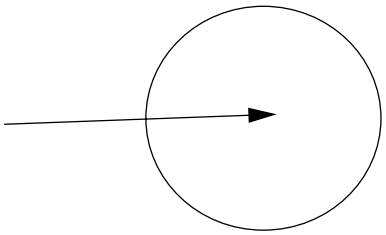

FIGURE 2 *INTO image schema.*

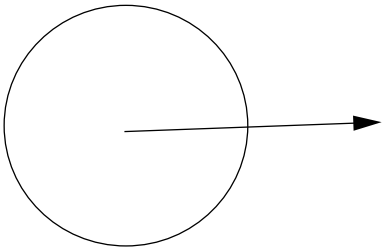

FIGURE 3 *OUT image schema.*

There are what I call radial categories of these complex schemas, so something like "over." This is the central sense of "over," where let's say you have a hill or maybe a bridge, or something like that—where this goes over that. It can be flying above it. It can be in contact with it. You could drive over the hill, fly over the hill. It's above and across. So it goes across something, across the middle line. You have a path like that, and it's above it. It's putting together several image schemas at once to get that "over" (Figure 4). But there's another "over" where there's nothing moving, you just have that (Figure 5). So the helicopter is over the hill, but if the helicopter lands, it's no longer "over," and it's "on" the hill. But if it's moving, it can still be going over the hill, but it has to go from one side to the other. Now you can have another version. So this is another path of "over." Now suppose that you are standing here, and there is a building over here, and this is a possible path over the hill to that building. Then you can say the house is over the hill from me, from where I am. There is a possible path, so that's another variation on this "over" (Figure 6), at the end of the possible path to something. Now this is a very productive variation. It's a general rule of English at least, where, for example, you can say "he walked across the street," it's a path, "he walked across the street" or "he lives across the street." You actually have to walk a potential path to where he lives. So you have a street. You can walk across the street or you are here, he's there, and there is a potential path

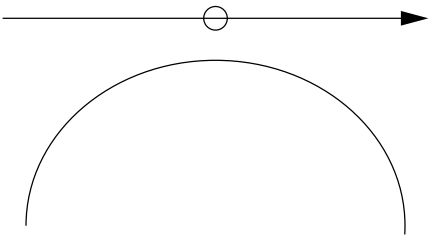

FIGURE 4 *OVER image schema 1.*

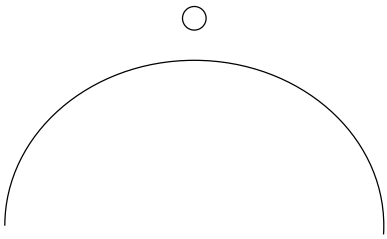

FIGURE 5 *OVER image schema 2.*

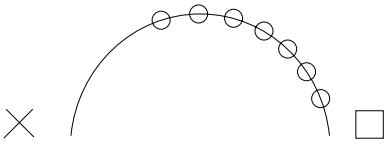

FIGURE 6 *OVER image schema 3.*

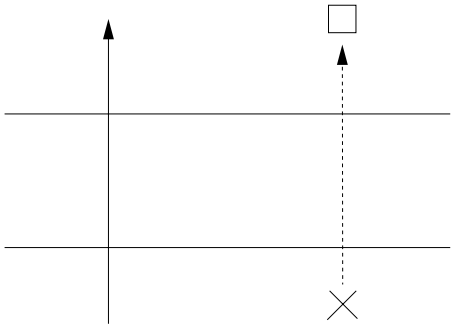

FIGURE 7 *OVER image schema 4.*

to go across the street (Figure 7), and he lives at the end of that path, you say "he lives across the street." So the word "across" can attach itself to something that means like this or something systematically related. Similarly the word "through." You could say "the main office," "he walked through the doorway" or "the main office is through that [door], at the end of the path through the door way." So basically, there are systematical relationships that link central senses of prepositions to non-central senses, to other senses. And "over" is interesting because there are over one hundred senses of "over." In *Women, Fire, and Dangerous Things,* which I happened to bring here. You see, just this book. It's a case study at the end of case study two, and in there you have, a diagram of sixty senses of "over" and how they are related to each other, with examples of, various types of "over" and so on. Now, I won't go through all of them, but the point is this: spatial relations differ from language to language, and they are very complicated, and so you might say how does anyone ever learn them. The idea is you learn primitives. You have primitives like source, path, goal, containers, contact, support, etc. You have maybe fifty to a hundred primitives like these, and you can put them together in lots of different ways in different languages, and then given that, there is a word that expresses some complex of

primitives. If there is word that expresses a bunch of primitives put together in a certain way, then that word can be extended to a related set of primitives in some systematic way. There is a system behind this.

Now why is that interesting? Many of these primitives have to do with the body. They are bodily orientations. They have to do with force which has to do with the way your muscles work. They have to do with a cognitive topology which has something to do with the human mind constructs. So if I say, "there are bees, a bunch of bees, swarming in the garden," there needn't be any fence around the bees there. The "IN, the container" is in your mind. You're understanding the container around the bees. We once had a bunch of bees swarming in our garden and we understood this very well. Ten thousand bees once descended upon our garden and sat in the tree for a while. You could see the bees buzzing around in a contained area: the garden. Now this is important first because the primitives are embodied, and that is how it is possible for you to learn them. Now we'll talk in a little while about how they are embodied. We won't say how, we just say they happen to be somewhere. There is a theory about how they are embodied, but right now we know that they are embodied in some way and that all these complex terms can be decomposed into simple primitives. Now this is extremely striking in certain languages of Northwest Mexico. Eugene Casad is a linguist has worked on Cora. Cora is a language of Northwest Mexico. Cora is a very interesting language. Cora has a system of 137 spatial relations, but none of them are prepositions, none of them are postpositions, none are body part metaphors, and none are cases. Where are they? How does Cora do spatial relations? Cora uses deictic locative pronouns. English has two, "here" and "there." Cora has 137 deictic locative pronouns. Now Gene Casad who did the field work on it worked on this language for thirteen years before he found out anything about the system, and when he found it out, he understood it in terms of this decomposition.

Let me give you some feel for how Cora works. There is a system in Cora. Something like this (Figure 8). A system of morphemes where there are three parts to a morpheme and the first part of the morpheme indicates how close something is. Is it very close to you? Is it at medium distance or is it far away? So you are here and it is there or here, wherever. The question is how close is it. You are here. So if it is, for example, the medium distance, you use "m." The second part has to do with whether it is in your line of sight, in your field of vision, inside versus outside. Here you have "u" and here you have "a." The third part of the morpheme has to do with whether the object is on a slope, on the top or on the bottom of a slope. So if it is on the slope, you say "h," so "muh" means "over there at medium distance, inside of the line of sight on the slope," "muh." "Mah" means over there outside the field of vision, medium distance. If

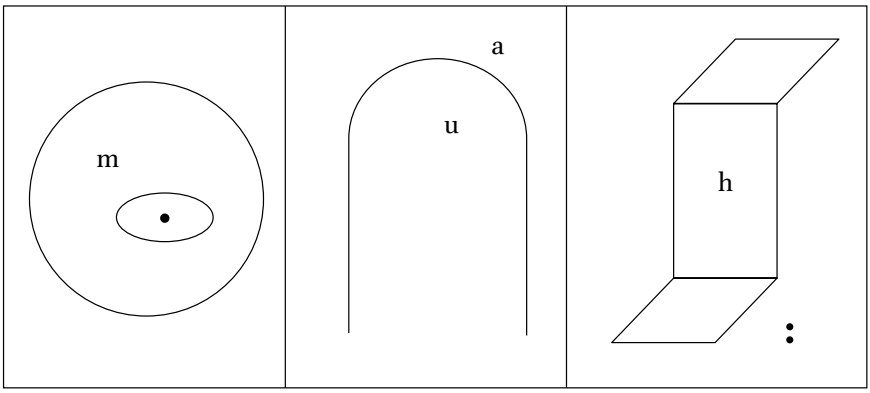

FIGURE 8

it is, if I remember correctly, if it is down here, it is a long vowel. So if you say [ma:h] with a long vowel, then it is medium distance outside the field of vision on the bottom of the slope and so on. You get the general idea and the rest of this fills in. I don't remember exactly which one is where.

Now, this is a real language and has just morphemes, muh, mah, mu, mi, ya. And it has a system. And the system is phoneme by phoneme with these image schemas. The image schemas are part of the universal system. The way they are put together is not part of the universal system. Now this says first with respect to spatial relations, if you look at the words they all look different. If you look, if you can break it down to the image schemas, then you see the universal. Then you see what is in common of the people's minds. I won't talk about them now. Then you have metaphors based on this system. Now this is again something embodied. It is not something you can do in formal set theory semantics. You think about the system. You say how would you do any of this in terms of set theory. It is hopeless. This is why you need cognitive linguistics. You need something that has to do with the way you are embodied, the way your mind is embodied, the way you interact with the world. That is part of what cognitive linguistics is about. And when you see this, you begin again to see the systematicity in language that you just don't see in standard semantics.

Now why should this exist? Where do image schemas come from? We have only the beginning of an answer but it is a very interesting beginning of an answer. There is a book by Terry Regier called *The Human Semantic Potential*, and in this book Regier goes over the results of his doctoral dissertation. Regier is a cognitive scientist trained in computer science, cognitive psychology, cognitive linguistics, and neural computation. He has done all of that work. He was the first cognitive science graduate from Berkeley. He did all of those things. He

discovered that there are certain parts of the brain that have the right neural structure, so that applying principles of neural computations to them, they will compute the image schemas. So for example, there is part of the brain back here, which has topographic maps.

What is a topographic map? Let me give you an example of how topographic maps were discovered. We know, for example, there was an experiment done also at Berkeley in the same laboratory where the color work was done, in which they took monkeys and removed the back of the skull. They knew exactly what was firing and where and so on. And they had a target set up. The target looked like a couple of circles and then an axis through the target. These are black and white. They gave the monkey curari, which paralyzes the eyes, so there were no eye movements, so that the monkey looking at the target would see this target. It was still and his eyes were still and the brain would be firing and where there was something dark, certain neurons would fire, and where there was light, the neurons would not be firing.

What does firing mean? It means that certain chemicals pass out of the neuron. They injected a radioactive version of the chemicals that passed out of the neuron so that as the neuron was fired, they got refilled with the radioactive version. So wherever this was firing after about half an hour, it was all radioactive. Then they [quote] "sacrificed the monkey," they killed the monkey, took that part of the brain out that was radioactive and put it onto a photographic plate and put it in a refrigerator for three months to develop the photographic plate. That could be predictable systematically, that you could see the extra lines but they were sort of twisted around because the brain isn't flat and it was twisted, folded and what you have in the brain is a copy of what is on the retina in V one, the primary visual cortex. That is a topographic map.

There are other topographic maps for your body that appear for your motor system. So there is a part of your brain that fires when you speak or move your mouth. There is another part over here when you move your arms and there is another part when you move your legs, and they are laid out in some systematic linear order so that the part that fires when you move this finger is next to the part that fires when you move that finger. So you have topographic organizations in the brain. Now what Regier did was the following. He said somehow the brain has to compute, let's say, an inside and outside. How could the brain compute inside and outside for any arbitrary figure? That is I gave the figure like that, it has inside and outside. I give it a triangle, I give it a five-sided figure. They can be any side, in any place. It has to be able to tell this is the inside and that's the outside. How could a brain do that? And he said, "Look. Let's put together some things we know about the visual system of the brain." So here are the some things.

We know that in the primary visual cortex, the brain comes in layers, and inside a layer you have neurons that are connected to each other. Lots of neuron connections. These are connected all over these places. Now we also know that the connections can be excitatory, that they can stimulate the other neurons to fire or inhibit—that they could stop them from firing. So this fires the other inhibitory connection and the next one will be stopped. We also know that there are layers of neurons. Let's assume this is another layer underneath that one and that there are connections across the corresponding parts of the layers. So this is connected to here and this is connected to here. This one in the corner is connected to here. And I think this is underneath that. That is, it's connected. Here is one layer. Here is another layer, lots of connections to whatever is .... sort of in the area, not one to one but little connections come in group of connections, but very close across this.

Some of these are inhibitory, going from one layer to another, and these can be excitatory or inhibitory within. We also know that there are some layers with their spreading of activation or inhibition from the outside to the inside. How do we know this? There is a great experiment done by Professor Roman Candron at UCSD, which shows this in an interesting way. In the back of the eye, the nerve that connects the eye comes in and every one of us has a little blind spot in the back of our retina. We have a tiny blind spot where the nerves come in. Now we don't see the blind spot. Our brains fill in the blind spot, and the question is how do they fill it in? What is the mechanism? So what he did was this. He got a little target where this is green on the outside and yellow on the inside. And he set it up so that when you flash this, you would, you could sort of monitor people's eye movements. And just as it was going right, your eyes were going right by it, this would flash on, so the yellow part would just go inside the blind spot of the optic nerve. The outside would be green. And the question was what did you see when that happened. Did you see green with a black hole or something else? And the fact is people only saw green. They saw nothing but green. That is, this part of the brain connected to that part of the eye, the retina, is filling in from outside to inside. It's the green, the detectors from where we experience as green are moving from outside to inside, filling in that inner part in our brains. We know they are spreading in that direction.

So Regier put this information together, and he said there is another piece he put. He said "look, if you see a shape, you see an object with an interesting shape like this bottle." I hold up this bottle. See it, it is a shape. The way that you tell it is a shape is that your brain computes the differences in shading between this and the background, and computes the outline of this. So there is a part of the brain that computes this in a lower level of vision at the very beginning of the visual system. So he said let us suppose, since we have that, that we have

a topographic map that picks out the shape. Let's say, the shape is this. And suppose we want to ask the question "Is the circle inside the triangle or is the circle outside the triangle?" Right? For the triangle we know that this shape is picked out. Now let's assume then that this map with this shape is picked out, and this, either or all, this means that all along here there are active neurons. These are highly active neurons. Let's assume that there is another connection between here and here. Every neuron here to here, with this neuron in this map inhibits the neuron in this map, so there are inhibitory connections. This inhibits this. So firing tends to make this not fire. Now let's suppose here you have activation flowing from one side, from outside to inside. Well, if these are firing and then inhibit, what you will get is an inhibited triangle over here. And if these fire from outside to inside, then you get activity here and then it hits the inhabited part and stops, and you will get no activity inside the triangle. That is, this mechanism, neural mechanism will distinguish inside, interiors from exteriors for any shape at all, any size at all and any location at all. That is, this is the way to compute the image schema for a container.

So what he said was this. The human brain has the right structure. Think of it this way: if I were God, I created people, I created people with all this apparatus, and I wanted to make image schemas. How would I wire up the brain to do it? If I wire up the brain in this way, I will get a container schema computed in this fashion. Now we don't know that this is true. This is a computational model. We do not know that this really happens. We do know that every piece of it happens and we know that somehow the brain has to do it and it has to do it in a place where this is possible, and the place that has the topographic map structure is back here. And this is the kind of computational structure that would work this out. Now that is part of Regier's book. He then did the same sort of thing for orientational structures and so on. And what he did then was he did a computational model where he asked the computer to try to learn new cases from old. That is, he trained the computer. Let's see. This is above the triangle. This is below, you know. That's next to the triangle and so on. For different trainings of figures, he takes squares, and so on, and he would give them extra cases when he trained them, and say this is, when you see this, this is above and another one is not, but not for many cases and on different figures. And then he gave it a new figure, and he said, "Is this in or out?" And in virtually a hundred percent of the cases, it would predict the correct answer. So we know that if the brain works this way, and it has that possibility and has to work somehow sort of like this, you can get image schemas. What is very interesting about this is this is an embodied mechanism and has to be a mechanism. That is, it gives you some idea of how it is possible to have a spatial relation, a primitive spatial relation. Now I can go through the cases for how we

get over and under and through and so on. But for "through" you put together a source and a path and goal, and there you're putting two of them together. So what is done is something quite remarkable. He's allowed us to take the first step in understanding how a physical brain can give rise to a concept, an idea, and how that concept—like containment—will allow us to get image schemas for the various languages. So they can be then fit together and when they are simultaneously activated, with something like through, you will have a path through a container or into or you have a path that starts outside and moves into the container. So what he did in his thesis was show how you could put these things together and get results of this sort.

Now let's stop for a moment and consider where we are. We have come very far from the idea that meaning is in the relationship between symbols and sets in the world. Meaning is in your brain. Meaning has to do with things like this. Meaning components arise because your brain has a certain structure. If it didn't have that structure, we would not have the image schema that we have. That is very important. All of a sudden, we see an enormous shift in the understanding of what meaning is. It is no longer outside of us. It is no longer in the relationship between words and some structure in the world. It has to do with our bodies, our brains. That is with the locus of meaning and how we interact with the world. Meaning comes out of our interactions with our bodies. So, that is the fundamental theory of meaning within cognitive linguistics, and that's how that arises. We'll go to other kinds of examples in a while, but what I would like to do at this point is go through one more phenomenon, and then I will let you take a break, because you need one. We have blown your mind fairly well so far, but let me go one step further.

Back in 1975, during that summer, I heard a fourth lecture that was very important. And that was the first lecture by Charles Fillmore on Frame Semantics. What Fillmore did was ask a very deep question. Fillmore had been reading the literature on semantic fields in European linguistics. A semantic field is a set of related words. So I give you the words "knife," "fork," and "spoon." They are a set of related words, you know, or I give you words like "Monday," "Tuesday," and "Wednesday." Those are related words. You can tell when words are not related. For example, if I give you the words "Monday," "Tuesday," "apple," and "Thursday." Which one doesn't fit? Now, Fillmore asked how can you characterize the meaning relationships among sets of related words. And what he showed was that there is such a theory. It's a theory of what he called semantic frames. And in a frame, there are a couple of things. There are what he called semantic roles. These are elements of a frame, and there are relationships at a time, and there might be sequences, which he called scenarios. So for example, suppose we take the set of words "buy," "sell," "cost," "price," and "goods," we

say what is the frame for that. Well, we have four roles "buyer," "seller," "goods," and "money." The scenario has three parts. In the first part, the buyer has the money, the seller has the goods, the buyer wants the goods, the seller wants the money. In the second part, they exchange the money for the goods, that is, the seller gives the goods to the buyer and the buyer gives the money to the seller. And in the third part, the buyer has the goods and the seller has the money. Every commercial event works like that. That is called a commercial event frame, and words like "buy," "sell," "goods," "price," "cost," and so on, all those commercial event words are defined relative to this frame. So the frame has roles. It has scenarios over time and it has relationships at each point in the scenario. Some frames have slightly different structures, but that's a very common frame structure. Now notice that a word like "sell" or "buy" uses other ideas. It uses the idea of possession. Perhaps they use the idea of desire. Those are more primitive ideas. And as you go through the system of frames, you get more and more primitive ideas and where did they end. In the body, in possession, in desire and in things of that sort. That is, the system of frames is based on the body. Now also you will find that there are image schemas here. For example, if I say these are transferred, that the buyer transfers the goods, the buyer transfers the money to the seller, what does that mean? There is a source, a path, and a goal. It means there is a force, the buyer is exerting the force on the money, moving it to the seller. So there is a force dynamic schema and a source-path-goal schema as part of this. Frames use image schema structure inside the frame so that the frames get built up in terms of embodied elements and the systems of frames start with embodied elements, put them together in this way and build up more and more complicated ones. You can't account for this in logic. There are no frames of semantics and no embodied frames of semantics in the theories of logic. They do not exist. So this is the fourth example that I encountered in the summer of 1975.

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LECTURE 3

Cognitive Semantics: The Basic Mechanisms of Thought

There is a classical theory of categories that again comes from Aristotle and it says that a category is defined by a set of features, a set of necessary and sufficient conditions—that is, a list of properties and that everything is either in a category or out of a category. And that the defining features are what are called the essence of this category. This is a classical theory. It has been around for over 2500 years and it doesn't work. Unfortunately, it would be nice if it worked, but it is not true.

First, there are many concepts that are graded that have degrees like "tall." You can be tall, I am short, other people are tall. There are words called hedges that change the degree of tallness, so you can say "he is pretty tall, somewhat tall, very tall, not very tall, and so on." And these hedges depend upon the category being defined by gradations. So when a category is defined by gradations, it is not something that you can either in or out. You can be tall to some degree or rich to some degree. What that means is that the classical theory just doesn't work for any category like that. You need some theory of graded categories. And in these cases, there are categories, for example, if you take something like tall, there are some people who are just obviously tall. Yao Ming is tall. So it is not the case that everything is between zero and one. Somethings are very tall and some people are not tall. Now the one problem is if you need to extend the theory of categories to include graded categories.

But, in addition, phenomena called prototypes were discovered in the 1970's by a woman named Eleanor Rosch, a very famous professor and one of my colleagues at Berkeley. She discovered that there are cases where there are gradations of membership in a category even if the category does have straight boundaries, there are better and worse examples of the category. She did some famous experiments. Let me give you an example of one. She said, look, if you have a notion of a bird, some birds are more birdlike than other birds. So a penguin is not a very birdlike bird. And so what she did was this. She set up an experiment where she would test time reactions. In the reaction time experiment, you flash on the sentence. And you are supposed to push the button "true" or "false." So the first sentence comes on. It says "a cow is a bird," you press "false." No problem. It comes on and says "a sparrow is a bird." "True." It comes on "a chicken is a bird," you go "true." You know, "a pelican is a bird." You

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go "true," and so on. They measured the time and what they find is that there is a gradation of times, and this gradation of times fits the judgment of how close something is to a typical bird. So a typical bird might be a little song bird like a sparrow. In America we have robins that are song birds. It seems a small song bird is more of a typical bird. A vulture is not a typical bird. It is further down the scale. A pelican is less of a typical bird. A penguin is a way down, not a very typical bird. A bat is not a bird at all, but it is sort of like a bird. And what you find is that even though there is birds and non-birds, there is a boundary of the category that really isn't a bird but it's like a bird in some ways. Even though there is a boundary, there is a degree of membership, a degree to which something is like a typical case. So you have a notion of a typical case of a bird and degrees to which something is like a typical case. So gradedness can combine with typicality.

Now typicality is actually used in reasoning. There is a famous experiment in which, let me give you an example. A duck is not quite a typical bird. Right? It is atypical, sort of in the middle. The experiment went like this. They had given subjects a bunch of questions, and one question said there is a certain island where all of the sparrows got an illness. Would you expect the ducks to get that illness? Most people said "yes." Then there is another set of subjects who got the question there is a certain island where all the ducks got a certain illness, would you expect the sparrows to get that illness? Many fewer people said "yes." Right? That is the influence goes from the typical to the non-typical but not from the non-typical to the typical. So you reason, based on the scales of typicality that reasoning goes from typical to non-typical and that is one of the functions of typical cases.

Now, further study by linguists showed that there are more kinds of prototypes. For example, there is an ideal case prototype that is different from a typical case prototype. It is easy to see; think of the difference between all the women and the audience. What is the difference between a typical husband and an ideal husband? Are they the same? Very different. You have different prototypes and you reason about them differently. For example, if you are looking for a husband, you might rate people based on your ideal, not on the typical case. That is, you are looking for some ideal and you rate them on an ideal case. However, what do you think about typical cases? If you meet somebody who has just married someone, would you expect about their husbands to be more like a typical husband? Given no other information, it's like that.

And the same thing applies for buying a car. Suppose you want to buy a used car, an old car. There is a typical old car, an ideal old car, and a terrible old car. The terrible old car has a special name in English. There are two names: one name is a "lemon," there is another that is a "junker." Either are nightmare

cases. You have, four categories that are important, typical prototypes, ideal prototypes, and nightmare prototypes. There is actually a word in English for the nightmare cases, the expression "from hell"—the used car from hell, the boyfriend from hell. These are the nightmare cases. And you judge people, when you go to buy a car, you want to avoid the nightmare case, look for the ideal case and expect the typical case. Try to judge this.

So what happens is that when you are learning an important category, you learn a very complicated structure in that category. You learn typical cases, ideal cases, nightmare cases, and you use them for different kinds of reasoning. You think about them and reason about them for different purposes. This is normal for just about every important category we have. Now this fact contradicts Aristotle's view of categories. Aristotle said in a category, all members of the category are equal. They are all the same: they either have the essence or they don't have the essence; they have the defining properties or they don't. That is the end of the story. It is a false story. Most categories are characterized in this way. Now it turns out that there are other categories. There are categories that can be defined instantaneously. I can make up a category and you will be able to think, given your knowledge about all of these things, you will be able to impose a structure like this. For example, suppose I make up a category—things you take on a picnic, right? You don't take a bear on a picnic or an elephant on a picnic. You might take a little dog on a picnic, probably not a cat, and so on. There are things you will take on a picnic. You will take a bottle of tea on a picnic. You are given certain examples. You know what you will take on a picnic: what would be typical or what would be ideal for a picnic or what would be disastrous for a picnic. You could make this up immediately for a new category if you have the right knowledge.[…]

Now there are other kinds of prototypes that are very important. These are very special case prototypes. There are cases that are called salient exemplars. Salient exemplars, a terrible technical term that only a psychologist could make up. Take the category "terrorist attack." The salient exemplar would be "9/11." Right? It is the most famous one that would come to mind immediately and what happens with salient exemplars is very interesting. People judge probabilities based on salient exemplars. So we had a terrorist attack in America on 9/11 and now that has become a salient exemplar of terrorist attack. As a result, all of the people in America worry about 9/11 type attacks. In the middle of cornfields in Iowa, people worry about terrorist crashing airplanes into their houses. It's completely irrational. There is no probability that this will happen. In the middle of Ohio, in the Midwest, thousands of miles from any interesting big city, any important city, people want to have a mask to protect them from biological warfare. Right? So what happens is that the

salient exemplar increases the probability that people will understand their lives in terms of that exemplar. People reason and use probability judgments based on that. And this has been studied a great deal. So those are some of the cases of prototypes.

Now there is another really, really important case of prototypes, and that is what we call radial categories—central cases and non-central cases. Take the simple category "mother." Now a "mother" is defined by many frames. We talked yesterday about frame semantics and the notion that mother is defined by many frames. One frame is the birth frame. The person here is the mother, the other person is the child, the baby, so mother and child. That is one frame, but there are other frames. For example, the marriage frame. The wife of your father is your mother. There is another frame. There is a frame of genetic inheritance—the female who you got half of your genes from is your mother. There is a nurturance frame—the woman who raised you is your mother. We call that a nurturance frame. Now normally all of these frames come together. So if you say "my mother is coming to visit me," you expect it to be the person who gave birth to you, the person who you get genetic traits from, the person who raised you, and the wife of your father. But the world is more complicated than that. There are stepmothers because of divorce, and deaths, and so on. So there are stepmothers, and stepmothers didn't give birth to you, you don't get genetic traits from them, but they raised you. Now that we have the possibility of egg implantation and so on, there can be a notion of a birth mother that is not the genetic mother. So you can have a genetic mother, the person you get the egg from and the birth mother, the person who gives birth to you who may not be the person who raises you. You may hire someone to be a birth mother, then she hands over the child and then, you know, then you have a nurturant mother. So there are different kinds if you separate these things out. And we now have this in English because of the technology—expressions not only like stepmother, but birth mother, genetic mother, and surrogate mother. A surrogate mother is somebody who is paid to give birth to the child even though she may not contribute the egg and may not raise the child. She just gives birth.

Now what is interesting about this is the following. Normally when you apply an adjective to a category, all the properties of the category hold, plus the properties of the adjective. So if you say "he is a rich man," he is a man and he is also rich or "she is an intelligent woman," she is a woman and she is also intelligent. But if you say "she is a birth mother," she doesn't have all the properties of a mother, she only gives birth. Right? That is, you have fewer of the frame's whole—not all of the frames. So this is what we call a radial category. In the central case, think about a wheel with spokes. In the central case all of the frame's hold, you know, you have birth, genetics, nurturance, and

so on. And then with certain modifiers, you can pick up one of these properties, one of these frames or two or three and they can go out from the center. And you could have various concepts of mothers, a lot of them generated from the center with various possibilities and with words, special words like birth and surrogate to tell you which of the possibilities they are. This does not fit the ordinary theory of modification. The ordinary theory of adjective modification says that adjectives just add a property to the noun whereas in these cases they in fact subtract models. They pick out some models and ignore others. So it is a very important thing to notice how that works and to notice that the category mother is not an Aristotelian category, it is a radial category.

Now we will talk about other radial categories in a while, but I wanted to get it started to give you the idea there are such things. They are extremely important. Now there is another kind of prototype, a last one I will talk about. And this is a frame-based prototype. So, for example, think of the prototype of the word bachelor. What is the frame for the word bachelor? Now normally a word like bachelor in English refers to a male of marriageable age, who is not married and is eligible to be married. So a male eligible to be married, who is not married, is the usual case. Now those properties form a frame for bachelor. But now there are tricky cases. Suppose you think of an Arab sheikh, who has only three wives but can have four. Is he an eligible bachelor? He is eligible to be married. It's not so clear. That is, this is a variant on the frame. You know in some respect he is a bachelor and in some ways, he is not. He is not clearly a bachelor but he is a variant on the frame because the frame was not made up for Arab sheikhs.

We have another example: the pope. Is the pope a bachelor? Well, he has never been married. He is in a way eligible to be married, but not really. Possibly, you know, he could quit the church to get married, but it is sort of odd to call the pope a bachelor. But in some ways he is a bachelor, so there is another in-between case. So what you have are gradations based on the variations on the frame. The reason is the frames don't always fit reality. Frames are cases that are made up of what we call idealized cognitive models. They are made up, they are mental models, but they don't always fit reality. And we have words and we can ask questions: Is he a bachelor or is he not a bachelor? And that question presupposes a strict division. But the strict division is false in terms of reality. The strict division may be defined by fitting the frame completely or not fitting it completely. But when you try to fit a frame to reality, it may only hold partially. That gives you another kind of prototype. Every frame defines a prototypical case whatever it is. Non-prototypical cases are cases that only partly fit the frame.

So, that is the story of prototypes. There are many types; there is not just one. You use them in reasoning, in categorization and so on. And they are very important for many, many things. Why is this so philosphically important? It is philosophically important because classical semantics, formal semantics, it will assume that the category, the property of a category is defined by a set, a set of things, but a set is defined. It is something that is, we remember, in a set or out of a set but there is no prototype properties. Sets do not have prototypes. Sets do not have any of the properties we just discussed, so a set theoretical semantics which is what most of the books on semantics are in a generative tradition and in generative tradition they use formal semantics. They can't account for any of the phenomena we just discussed. None of them. They are not discussed in textbooks on formal semantics because they cannot be handled by formal semantics. So this is an extremely important thing. If you go out and you look at many linguistics departments, they all have courses on semantics and they will be formal semantics, logical semantics, and they will miss all of the cognitive phenomena we just discussed. One of the reasons why I became a cognitive linguist was in order to discuss this phenomenon.

I want to tell you a little about how I started working on conceptual metaphor. This is a true story. In 1978, I was teaching an undergraduate seminar with five students. At the time I was interested in what was called in America performance art, and I was giving the undergraduates a seminar in performance art and linguistics and in there, we went through various topics, reading papers on those topics. And on the day that we were to read paper on metaphor. It was a very cold rainy day, we all sat around a little table and there were five students. And one woman in the class came in a little bit late. She was all wet and she was crying. We tried not to notice that she was crying, which was difficult because she was sitting at the table right there. You know, so we went on with the class, and I said "well, OK, on page so and so, professor so and so claims the following. What do you think of this?" I go to look around the room and then looked at her and she says,"I can't do this today. I have got a metaphor problem with my boyfriend." And she looks around and she says, "Maybe you can help."

This was in Berkeley in 1970s. We said, "Of course." And we formed a group for some group therapy, and we said, "Ok, tell us your problem." She said, "Well, on the way to class, I was walking with my boyfriend, and he said something that upset me. He said that our relationship had hit a dead-end street, a dead-end street." Right? And she said, "I don't really understand this very well. You know maybe you can help me understand it." So we said, "Look, if it's hit a dead-end street, you can't keep going the way you have been going. You may have to turn back." And then we realized that English has a lot of expressions in which love was seen as a kind of journey. So for example, you could say of a

romantic relationship "It has been a long bumpy road." You could say things like "We are going in different directions. We are at the cross roads in the relationship." You could say "The marriage is on the rocks. It is off the track. We are spinning our wheels." Even an airplane image, "We may have to bail out." You know, take a parachute. Now, as you know, by the way, being a linguistics professor, I dutifully wrote down all of these expressions and made a list. I said, "Gee, this is an interesting list, you know. Is there a generalization about this list?" I mean that's a question a linguist would ask: what is the generalization here? We looked at this list and we see that "well, in every case, love is seen as a journey. The lovers are the travelers." What is the love relationship? The love relationship is the vehicle. Sometimes it is a car, sometimes a boat when you are on the rocks, a train when you are off the track, a plane when you are bailing out, you know, but some kind of vehicle. So love relationship is a vehicle. Write down: love relationship—vehicle. What about this journey where you are going? Well, there is, you have common life goals and the common life goals are the destinations that you are trying to reach in this journey—common destinations. So common life goals—destinations. And what about this? Why do you keep "hitting dead-end street and spinning your wheels"? Well, these are difficulties in the journey. So it turns out that difficulties in the love relationship are difficulties in a journey. That is, they are impediments to travelling, things that keep you from getting where you want to go, so "you are spinning your wheels and you go on the rocks, etc…." So you write these down and they are completely systematic. They look like almost a mathematical mapping. She said, "Gee, that is very interesting." We have this generalization that looks like a mathematical mapping about these different expressions. And the woman says, "I don't care about your generalization. My boyfriend is breaking up with me." She said, "He is thinking in terms of this metaphor." So I said, "That is interesting. How can you think in terms of the metaphor?" I mean the classical theory of metaphor doesn't talk about thinking in terms of metaphor. How does this work? So we looked at a case. We said, "Ok, let's suppose you take something like "we are spinning our wheels in this relationship." What we know about "spinning the wheels" is that it is an image. This image is that there is a car and wheels are turning and the car is not moving. It is stuck. In America the term "spin your wheels" applies to a case when your car is not moving. It stuck in ice or sand or snow or something like that. The wheels digging in and the more you turn them, the more they dig in. So in this case, what you have is … the vehicle is not moving. You put a lot of energy into getting it moving. You try to rock the car, move it or somehow try to get the wheels going and so on. And you feel frustrated. Now, what about in the love relationship? When you say "we are spinning our wheels in this relationship," it means the

relationship is not going anywhere. There is no progress towards common life goals. Secondly, it means you put in a lot of energy, you want to go to somewhere. You are putting energy into it and you feel frustrated. That is the reasoning that you do about travel is being mapped onto the reasoning you do about love, via this mathematical mapping THE LOVERS ARE TRAVELLERS, THE VEHICLE IS THE RELATIONSHIP, and so on. So the idea here is that to understand the use of dead-end street, which means that you can't keep going the way you have been going. You have to so something else, either give up the relationship or turn and go in some other direction. You have to do something else. That is the inference. There is an inference. It is said for a reason. It is said for that reason. By the way, she did not make up with her boyfriend. But she found somebody else later on. She got a job, she got a PhD, she got married to a very nice man and she is fine. In fact, she is the chairman of the department.

Now, what is interesting about this is the following. First, when I went to high school, I learned a definition of metaphor, and it came from Aristotle. Aristotle, back to 2500 years ago, said that metaphor is a matter of words; it is a word used not in its normal sense but in an unusual abnormal sense. Secondly, that it is based on similarity that it's used mainly in poetry or rhetoric, in special rhetorical situations, and you know that it is not the usual kind of language, it is not typical language at all. But it is useful to see similarities. It turns out that he was wrong. First of all, all of these expressions we saw are cases where a metaphor is not in the words. There are a lot of different words: spinning your wheels, off the track, going in different directions—lots of different words. The metaphorical generalization is the mapping—the relationship between love and travel, which is that travelers map onto lovers, that vehicles map onto relationships, that destinations map onto common life goals, that impediments to travel map onto difficulties. That is the generalization of all the expressions and that is what the conceptual metaphor is. It is that mapping that allows you to reason about love, using reasoning about travel. It allows you to reason about one domain "love" in terms of another familiar domain where you understand the reasoning patterns. Notice that love and travel are not similar in themselves. The metaphor is not based on similarity. It is very important that it is not based on similarity. It is not in the words. It is in the concepts. And notice, in each case you have a frame, a frame of traveling being mapped onto love. In each case you have two domains, a complex structure given by a frame and mapping of more than one element onto another point. That's what conceptual metaphor is.

Now you may ask how does this work on poetry and so on. We will get to that in a while. For now, notice why Aristotle gave the definition he gave. He had to—Aristotle was the inventor of logic. His logic assumed that the

logic of the mind was the logic of the world and the categories were defined by essences and that if you had a word, and that word fits categories, and that if the word did not fit its usual category, the only explanation he could give is in terms of similarities of properties. That's all he had, so he was forced to give that definition. That's false—he gave an incorrect theory. Now notice the issue of definition. Definitions are not the issue here. Aristotle actually gave a theory of a phenomenon. He observed that people used things he called metaphors. What he did was give a theory. He said, "It occurs in this kind of language. It is about words. It is based on similarity." That is a theory. That theory came to be taken as a definition. But it wasn't. It was a theory, and it was an incorrect theory. It appears now that we have looked at not just the data on love but thousands of other metaphors, that they all work, that they involve mappings from one domain to another. It is a different theory. And we will go through more of that today. But it's important that if someone says "I learned the definition of the term metaphor when I was in high school and this does not fit it." That is wrong. You didn't learn the definition. You learned the theory, and it was a false theory.

Now, why is this important? First, in terms of philosophy and semantics, it's vitally important. If meaning is taken as the relationship that you find in formal semantics between symbols and the world, there is no room for metaphor, because metaphors are in your mind. Where are those, where are those mappings? They are not just out there in the world. You know, it's not in the world independent of people that love is a journey. It is the way people understand it. The metaphors, those mappings are in your mind. They are not in the world. And that means to understand the meaning of expressions like "we are spinning our wheels in this relationship" or "we are going in different directions" or "it's been a long bumpy road." If you want to understand those, you cannot do it in the classical theory of formal semantics. You just can not. It doesn't work, because the classical theory is disembodied. It is just in the relationship between the words and the world. It has nothing to do with cognition. Now Aristotle also claimed that metaphor was special and poetic. That was not ordinary everyday language. But the expressions I just give you are ordinary everyday English. It is a common English expression to say something like "we are going in different directions," "it's been a long bumpy road." That's not poetic. You don't have to be a poet to say this. It is not political rhetoric or anything like that. It's normal discourse. So metaphor is a normal mode of thought, as we will see, completely normal, in some cases, even universal.

Next, it is important because of what is called the distinction between literal meaning and non-literal meaning. There is a tradition in semantics of what is called literal meaning. Literal meaning is based on the old theory of

meaning where the words are supposed to fit the world literally. That literal meaning has to do with the way words in your language are conventionally taken to fit the world. Now and anything else who is a matter of rhetoric, indirect speech and so on. So if you use an indirect speech act, if I say something like "it is cold in here," to mean "close the window," I am not just being literal about it, I mean close the window. So there, that's taken as non-normal, not quite literal meaning.

However, the distinction between literal meaning and non-literal meaning breaks down in the case of metaphor, conceptual metaphor. That is, and the reason is this. The other part of the notion of literal meaning besides fitting the world is that of ordinary everyday language. So the idea is that ordinary everyday language fits the world. Here we have ordinary everyday language, which is metaphorical. It just doesn't fit to the objective world; it has to do with your mind. But then there is a further question. Can a metaphor be appropriate? Is it appropriate? And this is the question in fact that that student brought up. One of the reactions when we figured all these things out was about the "dead-end street," was "Gee, I really wanted to go into the relationship, to go into another dimension, like the fifth dimension" That is, she didn't want that metaphor to hold. She thought the metaphor was inappropriate. But there are people for whom a relationship is a matter of finding common life goals and reaching them and then this metaphor might be appropriate for them. It might not be appropriate for someone else. So metaphors can be appropriate or not. When they are appropriate, then we can say that certain sentences are true or false. That is, "it can be a long bumpy road." It could be true that you are going in different directions if you both understand the relationship in that way. So what we are going to see is that metaphors are, can be appropriate or inappropriate, that they may be true in certain cases and completely inappropriate in other cases, either true or false, or false in other cases. They may just not fit the world. You know there are sort of false metaphors. This is a whole new domain of semantics: the notion of literal meaning. If you ask "Is this literally true? Is it literal to say it's being a long bumpy road in this relationship?" Well, it is an ordinary everyday expression. It may be true, but it doesn't quite fit an objective world. It does fit the world and the world the way the lovers understand it and that is perfectly reasonable and may be sufficient for it to be appropriate. So the issues brought up by the theory of conceptual metaphor are way beyond the issues brought up in formal semantics. They are different questions that are brought up. You have to think about meaning in a different way. You can't accept the old philosophy. You can't accept the correspondence theory of truth that says truth is the relationship between

the words and the world, because it doesn't work that way for metaphor. It can be true, but you got to think very carefully of what it means for metaphor to be true or not true or inactive or not appropriate and so on. So our semantics become much more interesting, and much more complicated, but entirely different than it was before.

After I discovered this, I started looking for other cases. I asked, "How many of these are there?" And we now have one. You know, there can't just be ten. There has got to be a lot of them. How many? So far we have found hundreds. We suspect there are thousands. They are just all over. As soon as you start noticing them, they are everywhere. So what I would like to do now is try to give you some sense of how common these are and then some sense of their properties. For example, there is a general metaphor that "more is up" and "less is down." Prices rise. They fall. They skyrocket and so on. So "more is up" and "less is down." And if you take a copy of *Metaphors We Live By*, and you go through it, in any one of these early chapters, there is a long list of up and down metaphors. So here we go. Lots of up and down metaphors. "Happy is up"; "sad is down." So "I am feeling up today." "My spirits rose." "I am depressed." "I am feeling down." "Happy is up." "Sad is down." "He is really low." "He fell into a depression." "That boosted my spirits." "So happy is up"; "sad is down." Why is happy up and sad down? Because there is a physical basis of this. When you feel happy, you are smiling and you feel erect, your muscles are up and so on.

That is true around the world. When you feel depressed—drooping. And there is a reason for this. It has been observed by Paul Agmen, who studies the physiology of emotions that this is true in all cultures around the world: the human universal about the emotions and the body. And when you have this correlation, you will learn "happy is up" and "sad is down." Conscious is up; unconscious is down. You say "get up," "wake up," or "I am up already." "He rises early in the morning" or "he fell asleep." "He dropped off to sleep." "He is under hypnosis." "He sank into a coma." So conscious is up; unconscious is down. Health and life are up; sickness and death are down. "He is at the peak of health." "Lazarus rose from the dead." "He is in top shape." "He fell ill." "He is sinking fast." "He came down with the flu." "He is declining." "He dropped dead." "He may not have fallen," or "he dropped dead." Physical, being under control, notice having control is up; under control is down. So, "I am on top of the situation." "He is in a superior position." "He is at the height of his power." "He is in the high command." "He is in the upper echelon." "His power rose." "He is under my control." "He fell from power." "His power is on the decline." "He is my social inferior." "He is a low man on the totem pole" and so on. So you get lots and lots of these. I won't go through all of them in here, but like "good is

up" and "bad is down." "Things are looking up." "We hit a peak last year, but it has been downhill ever since." "Things are at an all-time low" and so on. Good is up; bad is down.

Now one of the things that you learn from this right away is that there are many metaphors and metaphors are in the conceptual system, and a single word like "up" can be used for different metaphors, and that the word can be metaphorically ambiguous. So let me give you an example. If I say I have a sentence like "It is all downhill from here" in English. "It is all downhill from here," is ambiguous. It could mean things are just going to get worse and worse and worse. Or this is another metaphor. I will go over in a while. And that is one in which actions are motions and ease of action is ease of motion and going down. So you could say, for example, "how is your dissertation going?" You say, "well, it is an up-hill climb" meaning "it is hard." Or you could say "it is all downhill from here" meaning "it is easy." So "it is all downhill from here" could either use the idea that action is motion and downhill motion is easier than uphill motion or it could mean "good is up," "bad is down,"—so they could have almost opposite meanings. So the metaphor is not in the words. The metaphor is not in the sentence. The metaphor is in the conceptual mapping on which the sentence is based. That is a very important thing to learn. The metaphor is not in the words. People are thinking of the thing. That's a metaphorical sentence as if the sense of metaphor is in the words of the sentence. The words of the sentence evoke an understanding, evoke a conceptual understanding. That conceptual understanding itself can be metaphorical. And a metaphorical sentence evokes a metaphorical understanding. Now these are totally different ideas from the Aristotelian notion. They are completely different from what you have learned in the course of formal semantics. There is nothing like this in formal semantics. In order to think about metaphorical semantics you have to change your brain. You have to think very differently and you have to forget lots of things you were taught. Right? Like, for example, metaphor is in the words.

So let that sink in for a minute, and then I will talk about some other cases. First, there are lots and lots of examples. And some of the most profound examples are very deep. They have to do with the most basic concepts that we have. Take the notion of time. It turns out that there are various metaphors for time, not just in English, but in many languages. Some of them appear to be universal. Some are not universal. But let me give you an example of this. There is a metaphor for time in which times are moving objects that are coming towards me. The observer who is here and the times are going this way. The future is ahead; the past is behind. Now in Chinese, sometimes it is up and down. We will talk about that in a minute. In English, it is not. In English, it is

"the future is ahead; the past is behind." And you don't think about the past as being up, which you might in Chinese. So languages differ with respect to this.

Not only that, there are languages where the future is behind, and the past is ahead. It is very interesting. My colleague Rafael Núnez has been studying languages in the Andes mountains in Peru and Chile. There he finds languages in which the past is ahead because you can see what has happened and the future is behind because you can't see it. When they say things like "it happened long ago," they point ahead. There are lots of video tapes of people talking about "this happened two years ago, and this happened long ago." They go further into the further ahead. But in English, the future is ahead; the past is behind. So we have expressions like "let's put that all behind this. Look what is ahead of us." It is forward looking. Now, given that "the future is ahead and the past is behind," you then have further metaphors: times and events. Events are associated with times. Times can be coming toward you. So you could say things like "Christmas is coming! It's coming up on me. Christmas is here. Christmas has past. Christmas is behind us now." So you can see this is going this way. Not only that. Relative times can work the same way. Think of two times coming towards one. Which one precedes the other? Thanksgiving precedes Christmas. Thanksgiving comes first. Christmas follows. So you can see that, as you go along, as times go along, the language fits it, but the reasoning fits it too. Now in this case, there is a figure-ground distinction. I am the ground. Right? I am the observer. The times are the figures. They are moving relative to the ground—they are moving relative to me. Now there is another metaphor for time where figure and ground are reversed. It is called figure-ground reversals or duals. There is one in which time is a landscape. It's a path on the ground, you are moving along time. Times are points on the ground. I am moving and the points on the ground are the figures—they are the ground. I am the figure. So you can talk about things like "being on time, being within a certain amount of time as if there is an area." You could also say "not only is Christmas coming up on us, but we are coming up on Christmas, or we are approaching Christmas." So there are two different metaphors either the Christmas is approaching us or we are approaching Christmas depending upon which metaphor you use. The same words "approach" and "come up on" are used, and its the same words with the opposite subject and object, so they are different metaphors. Not only that. You can have metaphorical ambiguity with these two metaphors. Let me give you an example. Suppose we have scheduled a meeting on Wednesday. We will have a meeting on Wednesday. We can say "let's move the meeting ahead two days." When is the meeting? How many people say Monday? How many people say Friday? It turns out it

is ambiguous. One of my colleagues observed metaphor quite extensively. She did a set of experiments to show that this metaphor is psychologically real. The first thing she did was in the laboratory. She had little movies in which she would show either things coming towards you or had a camera showing you moving ahead with you holding the camera and see what happen when you are moving ahead. She would show you little film clips and then she would ask the question. She would say "Is there a meeting scheduled on Wednesday, you know, the meeting has been moved ahead." When is the meeting? And if you have time moving, things moving towards you visually, spatially in this field, you get one answer. If you have you moving forward, you get another answer. So if you are moving forward, the answer is Friday. This is moving forward, the answer is Monday.

Then she did a clever experiment. She went to San Francisco Airport, where there were planes coming in and people waiting for the planes. She asked the people on the planes and the people waiting for the planes these questions. So for the people waiting for the planes, you say "OK, there is a meeting scheduled for Wednesday, we're gonna move it ahead. You know, when is the meeting?" As for the people coming on the planes, they just came off the planes and she asked them at the moment they came off the planes the same question. People coming off the planes said "Friday" and the other people said "Monday."

This is a real effect. It really happens. Metaphors are part of cognition, the part of the way you think and the part of the way you reason. You reason in terms of metaphors. And the words are guides of metaphors and imperfect guides, because they can be ambiguous. So that's the next lesson we will learn. They are real. They guide your reasoning. We think in terms of them and the words lead you to this mode of thought. But the mode of thought isn't in the words. The meaning is not in the words.

Now what I'd like to do next is give you a sense of the complexity of the system. And the way it is embodied. So what I would like to do is take some examples from *Women, Fire, and Dangerous Things*, a monstrous book. And this is from a study of "anger." Zoltan Kövecses, a great Hungarian linguist and a wonderful person. He decided about 20 years ago that he wanted to study emotions. But he got on to it in an interesting way. During the communist period in Hungary, when the Russians were controlling Hungary, it was very hard to earn a living. So as a professor, professors' salaries were very, very low, so he had to do other work. Now luckily he had other skills. One skill he had was that he was a championship water polo player. He is a huge man and very strong. He was on the European Championship water polo team, and he was a hero, a national hero in Hungary for water polo. I would walk around Budapest with

him and all the women would throw themselves at his feet. He was recognized everywhere. He also knew English very well, so he would dub movies that were translated into Hungarian. But even then he couldn't earn much of a living there, so he had another profession, which was to make up idiom dictionaries. He tried to make an idiom dictionary of English and while he was on the letter "A," he got to the word "Anger." And he came upon a long, long list of idioms and they look like this, see, "He lost his cool. She was looking daggers at me. I almost burst a blood vessel." These all mean that you got angry. "He was foaming at the mouth." "You are making my blood boil." "He is wrestling with his anger." "He is on a short fuse." "He is just letting off steam." "Don't get a hernia." "Keep a grip on yourself." "Don't fly off the handle." "When I told him, he blew up." "He channeled his anger into something constructive." "He was red with anger." "He was blue in the face." "He appeased his anger." "He was doing a slow burn." "She kept bugging me" and so on. He came up with 300 of these in English and decided to apply for a grant to do research on these with me, because he had read *Metaphors We Live By.* He didn't tell me. He just showed up in my office one day and said. "I want to study 'anger.'" I looked up, "OK."

Now, Zoltán, being a professional athlete, was very disciplined. He wanted to account for every single idiom. He would show up in my house early in the morning—his time to study idioms. This article took us 9 months to do, to figure out the system. It is not easy to do this research. When you get to the system and you finally feel beginning to see it, what you discovered is that it is embodied. It turns out that at the same time I happened to be reading the work of Paul Agmen, who is a friend of mine, who is the world's leading expert on the physiology of emotions. He had done some studies the previous year on the physiology of "anger" as well as "fear" and some other metaphors. When you get angry, your actual skin temperature rises 4/10 of a degree Fahrenheit. When you get angry, your blood pressure goes up. Your heartrate increases. When you get angry, you don't see as clearly as you otherwise would. Your perception is made less good. And when you get angry, it is likely harder to control your body in fine order movements. Those are the acts of the physiology of anger. When you get, for example, when you get afraid, your temperature goes down about half a degree. That is why you are frozen with fear. The metaphors are based on the body. The way it works is this. By the way, there is also a system of metonymies, so let me stop and talk a little about metonymy and then come to metonymies and metaphor cases.

If you go to frame semantics, we look at a frame. Think of the frame semantics for a restaurant. You go into a restaurant, and they seat you at a table. The waitress or waiter comes over and gives you a menu, and you order some food. And there is the food you have, and then, you know, you eat the food, you

pay at the end, and so on. The roles are customer, waiter or waitress, the dish you ordered, that is your food, the money you pay, and so on. And there is a scenario for doing this. Now in America one waitress can say to another waitress, "The hamburger left without paying." Or here the "Baozi left without paying" or "Table six left without paying" because the table is part of this. That is one part of the frame that can stand for another part of a frame for reference. Well, given what you know, it is implicit unconscious knowledge that you have about your own physiology of "anger." You can have metonymies for being angry like "don't get hot under the collar," which means "don't get angry." Or "he is a hothead" means "he gets angry easily" and so on. Or the thing about "don't burst a blood vessel" means the blood pressure is going up, so the increase of blood pressure stands for the anger. So there are a whole lot of cases like that. "She is red with anger, scarlet with rage." Or agitation, "she is shaking with anger." "He is hopping mad." In English we have an expression "hopping mad"—he is so agitated that he is hopping. "He was quivering with rage. He is all worked up" and so on. These are metonymies of the body—they represent a bodily state for the anger state. There are other things like "she was blind with rage" because she can't see well. "He was so mad that he couldn't see straight." Right? That is to say he couldn't see accurately. So you have a metonymy there.

Now in addition to this, there are metaphors. There is a whole system of metaphors for anger. There is one metaphor that "anger is heat" in general, and this metaphor has two special cases, two framings for "heat." That is, in one framing for heat, the heat is like a fluid in a container. Think of the soup in a pot or, you know, something in a furnace, oil in a furnace or something, in which you have a closed container and fluid and the container is being heated and the fluid is being heated. And that's why you can say "He made my blood boil." OK? Or "he is letting off steam." So "let off steam" means the steam is coming out and it is less likely to explode. If you keep it in, it will explode. And explode, and that means "releasing," it means "getting very angry with someone, losing control." So "exploding" is losing control. Now when you look at this, you have stages of, in heating containers You heat a liquid and you can say you can let it simmer and use slow [heat] if you wish to cook soup. You put it on low heat and it simmers. So "he has been simmering for a long time." So it is a low level of anger for a long time. Or if someone is very angry, you can say, "simmer down, get less angry." You can "let him stew," which is low simmer for a long time. If somebody is angry, you can "let him stew," or let him cook for a long time." Now when the intensity of the heat builds, you have more and more heat, it starts to get boiling. And when it boils, the liquid goes up. So you get things like "his anger welled up inside of him. He could feel his gorge rising. We got a rise out of him. His anger kept building up inside him. He was in

a towering rage." Right?" There is something going up. When you heat liquid intensely, it produces steam, so "he got all steamed up. He was fuming, letting off steam." Now if you close the container, you close the pot, you heat it up, you can have things like "he could start to burst." So you can be bursting with anger. You could say "I could barely contain my rage. I couldn't keep it in any longer." Then if you try to keep this pot closed, and it's boiling and boiling and boiling, it can explode. You can say "he exploded with anger. He blew up. He had an outburst." And then there are special cases. So one special case is from a car, from a piston. "He blew a gasket." A gasket is the little ring around the top of the piston, so if it gets too much pressure, the ring bursts. So "he blew a gasket." Volcano—"she erupted." Electricity—"I blew a fuse." Explosives—"She is on a short fuse." Bomb—"That really set me off." These are kinds of explosions. Then you can have an explosion of this sort of pot with liquid in it, and the liquid comes out, so "his anger finally came out" and things like "smoke was pouring out of the ears." So what you have is a very rich understanding of the heating of the fluid in a container. That maps onto being angry, and there are stages of heating and reasoning about it that maps onto reasoning about anger. Now that's one case just of "anger is heat." But there is another case of "anger is heat," and that's fire. And it is a different metaphor. It has a different language and there's different frames for fire. So think about the frames for fire. You have a thing that is burning—wood, let's say. And as the wood burns, it gets consumed, the wood disappears: consumed as it burns. So someone can be "consumed with anger." The cause of the fire is the cause of the anger. So those can be inflammatory remarks. Things that are inflammatory, meaning causing fire. You can inflame the situation, and make people more angry. "His insincere apology added fuel to the fire," or made the other person more angry. And you could say "Boy, am I burned up," or "He has been smoldering for days," and so on. So here you have a general metaphor, metaphors occurring at certain levels. A general metaphor "anger is heat." This metaphor is motivated by the physiology.

Then you have two special cases, two frames about heat. One frame for heat is the liquid in the container being heated; the other is fire. Two different frames they map from. Both map anger but they are different metaphors because they are different mappings. Each of them gives rise to language. One has things like "You made my blood boil," the other is "I am burned up." These are different metaphors. "I am consumed with anger," on the "fire" one. "He is letting off steam," in the other one. Different conceptual mappings. The language is assorted by each of them and then you reason differently, depending on them. In one you get you explode, and the other one you can set people on fire—you can spread the fire. Both are dangerous, but in different ways. Now those are

not the only metaphors for anger. There are others. So let me try to give you a sense of the range. Anger can also be seen as insanity. "He is mad." The word mad means insane. "When I touched them, he went crazy." "One more complaint and I'll go berserk." "He went out of his mind." "He's gone bonkers." "He is in an insane rage." Insane rage. "If anything else goes wrong, I will get hysterical." Anger is insanity. "When my mother finds out, she will have a fit." "He is fit to be tied." "He is going to throw a tantrum." And then you get violent with frustrated behavior. You know, insane behavior standing for anger. "He is tearing his hair out." "He is heading against the wall." "Climbing the walls." Insane behavior standing for anger. Then you have another one. Anger can be an opponent that you struggle against, because people try to control their anger. So in that case, you can be "struggling with your anger, battling your anger, fighting back your anger, wrestling with your anger, you can be seized by anger, you can take control of your anger, surrender to your anger, yield to your anger, be overcome by anger, appease your anger" and so on.

Then there is "Anger is a dangerous animal." "He has a ferocious temper, a fierce temper." "It is dangerous to arouse … wake up his anger." "He has a monstrous temper." My favorite is "he unleashed his anger." He took the leash off, and let it go. "He unleashed his anger." "His anger is insatiable." "He beats up people." And for China—it is a dragon image. "He was breathing fire." In general also you get things like that "he was bristling with anger," "he's got his hackles up." That is, when you have a dangerous, their hair stands on end. So you get "bristling with anger, baring his teeth, ruffling his feathers, snapping, growling, snarling." These are all animal behaviors.

Now what do we learn from this? First, for an important concept like anger, you don't just have one metaphor, you have a system of metaphors. Within that system, you have levels. You can have a level of "anger as heat," with the two special cases, which are different mappings and therefore different metaphors. "Anger is heat" is based directly on the physiology, but the frame of heating something in a container is not. That is a special frame, a special kind of use of heat. So given something that is based on the physiology, you can extend that to something that isn't directly based on the physiology. What about "anger as insanity"? Why? Because what marks insanity is loss of control and that's part of being angry—a loss of control. What are other cases of a loss of control? Wild animals, animals going wild and so on. So what you find and also if you're trying to, people are supposed to stay in control, so they try to stay in control, and that is, in "wrestling with your anger," it is like fighting someone. So what you find is that the metaphor system is therefore purpose. One of the metaphors that we found in *Metaphors We Live By* was the theories of buildings. So

you have things like "he laid the foundation for that theory." Or that theory has weak foundations. Or the theory is built on solid facts. What is the ground for that theory? Is it built on solid ground? The theory can crumble. You can prop up your theory and so on. Now when you actually look at this in detail, it turns out that certain parts of the building are mapped on the theories: the ground, the foundation, the walls, anything that holds up the wall, the buttresses, you can buttress your theory—a buttress holds up the walls and that is all. There is no paint in the theory. You don't have electricity, electric lights of your theory. You don't have the plumbing of your theory, the floor of your theory. Look around the building, most of the things aren't there. The air-conditioning of your theory, nothing.

Now why is it that it is so small? Why is there only a part of this mapped and not all of it? It's the fact that works this way. What do the theories have to do with buildings? Why should theories have anything to do at all with buildings? These are the questions asked by a student of mine named Joe Grady, who wrote a very interesting dissertation based on observations like this. He discovered that there really are other more basic metaphors than theories of buildings that the theory of building metaphor is made up of. He discovered that there are what we called primary or primitive metaphors, and that the primitive metaphors and the primary ones are all based in the physical realm—in actual experience—and that they can be put together in various ways. When you put them together, it becomes less obvious what the experience is. Let me explain. When you looked at theories of buildings, you looked at the words used like 'crumble' and 'foundation' and so on. He found the same words we used in other metaphors. There is a metaphor that "a society is a building" and the society has to have a strong foundation or weak foundation. It can crumble. You can try to prop up the society or fix the foundation of the society. Same words for society. Why should you have the same words for societies and theories? It seems strange. He got the idea for the answer from a speech by the first President George Bush during the Gulf War in 1991. In that speech, Bush got up there and spoke of Saddam Hussein's invasion. He said, "This will not stand." He used the word "stand." "This will not stand" means "this will not persist." This is a metaphor that says that "persisting over time" is standing erect. Can you see why? It is like flowers come out of the ground, they persist over time and they stand erect and they die and they go into the ground or trees or buildings themselves and so on. Things that are persisting over time typically stand erect. When they cease to persist over time, they go down. Now, so that is one part. There is another metaphor he noticed, which is that an organizational structure is a physical structure. You understand an organization

in terms of its physical structure, and that makes sense because if you look at an object and you examine it, you see the way it is organized by looking at the physical structure. So the physical structure is the organizational structure if revealed by the physical structure. Now given those two metaphors, what happens when you put them together. You bind them together and you get an organizational structure that persists over time as a physical structure that remains erect, remains tall. He stands up. Now what is an organizational structure that persists over time? One, a society; two, a theory. A physical structure that remains erect is a building. So what you have is a whole structure of basic metaphors that have been fit together as pieces like building blocks to make other metaphors. You have an organizational structure that persists over time that is a physical structure that remains erect, and then special cases of societies and buildings.

What that means is that the conceptual structure of metaphor is being put together in blocks just as all other conceptual structures are being put together. Conceptual structure means taking pieces and putting them together, combining them, and combining the frames. So similarly, you can have primitive metaphors and you can combine them into bigger metaphors. Now this work was done in 1997 by Grady. By coincidence, there were two other dissertations done by students at Berkeley in 1997 on metaphor. One was by Grady's best friend Christopher Johnson, and he studied metaphor acquisition by children. He found that it is hard to study this but he said "we have a vast number of computer archives of all the records of child language acquisition that have been done by researchers." Let's take a metaphor like "knowing is seeing." I see what you are getting at, it is clear to me and so on. Let's take that metaphor "knowing is seeing" and then do something interesting. Let us look up the word "see" for all children at each age and find out what they would say at each age with the word "see," what the sentences were. Then they discovered a generalization. The first sentences are all non-metaphorical—literal. "See, daddy!" "See, doggy!" Then there is a stage in which "knowing" and "seeing" come together and the grammar of "seeing" and of "knowing," fits the word "see." So you can say, "See Daddy come in. See what I spilled." So knowing and seeing come together. Then there is a further stage of metaphor. "See what I mean." So what he says is that there exists premised condition where knowing the target domain and the source domain of the metaphor occur together in the child's experience. And that is necessary for later metaphor.

Now the third dissertation explains the first two. The third one was a dissertation by Sri Narayanan. He did much more than this, but part of the dissertation had to do with a neural theory of metaphor. He was working on neural computation and he was working on a very difficult problem. I will tell

you later what his problem was. Part of his study required the setting up of a computational model of how metaphor works. In this, he observed first that the source and target domains for basic metaphors that we have like "more is up" are in different parts of the brain. Quantity is computed in one part of the brain where you compute number. Verticality is computed in another part of the brain which has to do with both balance and vision, with those brought together. So the idea is that verticality and number are in different parts of the brain. How would you get metaphor linking them? Well, "more is up" persists because every time you pour water into a glass, the level goes up; every time you put books down, the level goes up. That is, in general, more things means higher level. Everyday of your life, it's a correlation. You pour water into the glass, you see there is more water and it is higher. Two parts of your brain are activated together over and over again. When that happens, neural connections are formed between them. The way the mechanism works has to do with strengthening the synapses between those two parts of the brain. So the connections get formed, the slogan that neuroscientists have is "neurons that fire together, wire together." They form connections, they form strong connections. Those connections are the metaphorical mappings. So that when one part of the brain is activated, the corresponding part of the other one is activated. You know, verticality, quantity. They are the metaphors. The metaphors are physically there in your brain according to Narayanan.

Now how does this explain Christopher Johnson's results about acquisition? He says "When knowing and seeing occur together, where this seeing is activated and knowing is activated, then you learn connections and then you get the metaphor. How does this explain Grady's observation about primitive metaphors, about primaries? Grady studied over a hundred different primaries. What he found was, in every case when you had two experiences that came together in the life of a child, the life of everybody, what happened was that they formed primitive metaphors. So, for example, take the metaphors for "time," where time is a moving object or you move over time and in general what is time in your brain? Time has to do with the firing of neurons. Every second, there is a pulse that goes through your brain, from the brain stem throughout to the rest of the brain. It times the rest of your brain. It arouses you like a clock to your brain. Everything else is timed relative to that. Time has to do with the relationship between an event and other regular events. For example, the sun going around regularly or water dripping regularly or a watch ticking regularly—that is, one event relative to another event gives you time. Then when that happens in the brain and you see someone moving towards you. You notice the passing of time or when you are moving relatively to something else. So what's going on there is everybody is going to understand time as a moving

object or time as you move, relative to someone else because everyone has the same experiences.

What about anger? Anger is heat or anger is activation around the world or anger is an increase of pressure inside. You have, for example, a Chinese expression of "having too much *Qi*" for anger. That is, too much internal energy. So what happens is that no people noticed from the physiology, that the physiology corresponds to the state of anger and you get metaphors linking them. You get neural connections linking them. So the idea here is that the universal metaphors are the metaphors that arise mostly in childhood, maybe not all in childhood, but mostly in childhood just by living in the world. They don't require language. They are pre-linguistic. That the experiences are bringing together the source and target domains of the primitives, of the primitive metaphors only, of those primitives give rise to neural connections for those metaphors and create them and then a language like "can come along", like "see what I mean", now, or "he is boiling mad." What's interesting about this is that this sets up a system of hundreds of primitive metaphors that you learn automatically just by living, just by going around the world everyday, living your life as a child, happily doing whatever children do, you are going to learn hundreds of metaphors. We will go through more of them this afternoon.

Those are only the simple primitive ones, and they fit together into larger ones like "theories are buildings." "Theories are buildings" is not taught—that's not learned in that way. That's a more complicated, elaborate one and what is learned is things that persist over time stand erect because all the children go around seeing flowers and trees and people persisting over time and standing erect. Right? What is learned is that organizational structure is physical structure because all kids are always looking at them, examining them and looking at the way they are organized. As a child goes around in his or her everyday life, different parts of the brain are regularly activated together. When they are regularly activated together, they are going to learn the neural connections between them, which are the metaphors. That is how metaphor systems get established. But only systems of the primaries and then a culture on top of that allows you to put the primaries together to form larger and larger more complicated metaphors, which we will discuss in very great detail in the net segment.

All original audio-recordings and other supplementary material, such as any hand-outs and powerpoint presentations for the lecture series, have been made available online and are referenced via unique DOI numbers on the website www.figshare.com. They may be accessed via this QR code and the following dynamic link: https://doi.org/10.6084/m9.figshare.5425642.

LECTURE 4

Cognitive Semantics: The Basic Mechanism of Thought

I'd like to pick up where we left off this morning with the idea of primary metaphor and how primary metaphors fit together into larger complex metaphors. Before I do that, I should mention one metaphor that I didn't talk about this morning—a very common one. We mentioned two of the metaphors for time. One of them is that time is a moving object and the other one is that time is a landscape we move over. But there is a third very common metaphor for time, and it is that time is a resource like money, that is, the "time is money" metaphor. So, for example, we have the idea of "wasting time," or "spending time." We can say "I don't have enough time for that," "I can't budget my time," "budget my time very carefully," "I can't use too much time." Time is understood as a resource for doing something else, and in special cases, like money, money as a resource. This is not a universal metaphor. It may seem strange to you in China, but this is not a universal metaphor. There are many parts of the world where time is not like a resource. In particular, aboriginal cultures often do not have this metaphor. They don't understand time as something that you have to budget, that you have to not waste, and so on. Rather, they view time as something that will flow. People just live. In cultures like that, it's very different—it's difficult to set up a factory, because to set up a factory you have to have the idea of doing something in a certain amount of time, paying people by the hour, by the day, or something of this sort, and that is not necessarily a possible thing in every culture. So it's important to understand that some metaphors are universal, and some are very culturally specific, and they may differ in all sorts of ways.

Now what I'd like to do now is to go on from metaphors for time to metaphors for events. There you have something very interesting happening. There are a lot of different ways to understand what an event is metaphorically and they are systemically related to each other. So for example, I mentioned this morning the idea of state as a location, a bounded region in space, and that is one of the primary metaphors. I mean wherever you go around the world, state is a bounded region in space. Why? Why should that be? Now think for a minute. You go outside. It's a sunny day. You want to be in a shade and get away from the heat, and you have to go under the tree in a bounded region in space. That is, there you're cool. So being in a cooler state corresponds to being in a

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certain bounded region. This happens all the time. Constantly being in a certain state may correlate with being in a certain place. Similarly, if you want to change your state, suppose you're hot and you want to become cool, you may want to walk under the tree—that is, you may want to move from where you are to somewhere else. Change is understood in terms of movement, in terms of motion, from one bounded region to another bounded region. So a change of state is understood as motion from one bounded region to another bounded region. Again, this is a very common metaphor around the world.

Then there is a metaphor for causation, an extremely common one, which is again a universal. Causes are forces. You push or pull or something like this. Causation is seen as a force, and causation is commonly understood in terms of forced motion. So if change is movement from one location to another, causation is movement, is a forced movement from one place to another. So let me give you an example. Take a word like "bring." I bring this, I give it to you, that is, I am applying force to this, and it moves to a new location. Now I can use the word "bring," which is a verb for forced motion to mean a cause. How? Take examples like "the summer brought winds from the ocean" or "Roosevelt brought America out of the Depression." That is, you can understand general causation in terms of a forced movement from one place to another. Now what is interesting about this is that there are different kinds of forces and different kinds of movements. And for each type of force and movement, you have a different kind of causation. For example, take something like "throw." I throw a ball. You can say, for example, that "seeing … hearing that lecture threw me into confusion." Think about that. "Hearing that lecture threw me into confusion," where the lecture is causing you to go from one state into the state of confusion. So a verb like "throw" can be a causal verb. Now similarly, a verb like "pull." You can pull on something. You can take a verb like "pull" and use it to mean general causation. For example, "his psychiatrist pulled him out of his depression." There was no literal pulling, but you understand causation in terms of pulling, that is, getting someone to come in a certain direction, from one location to another location. Pull him out of his depression. So any verb in English, any verb at all of forced motion can be a verb of causation. What is interesting is that the type of causation is different with different types of verbs. There is no one type of causation because there is no one kind of forced motion. For example, if I bring you something, then I am coming with the thing. I am also going from one place to another. So you can have a sentence like when you say "Roosevelt brought the United States out of the Depression." Roosevelt was there, applying, you know, he's the causal force the whole time. The causal force occurred all the time. But if the lecture throws you into confusion, you can be in confusion after the lecture, not just during it. Or I can have a sentence like "the

homerun threw the crowd into a frenzy." After the homerun, the crowd went into a frenzy, but the homerun didn't continue the whole time. So for a word like throw, when you throw, you apply force, the ball then goes by itself. That is a different kind of force.

If I pull you to some place, then you come to the same place I come to. So if the psychiatrist pulls someone out of his depression, then the psychiatrist who is pulling is not depressed, and is taking the same person to a non-depressed state where he is—the same location. You would not say the psychiatrist pushed someone out of the depression or threw someone out of the depression. So the idea is that they're going to the same place. Each different verb of force, for different kinds of force, is a different kind of causal logic. Each has a different meaning and therefore a different type of causation. Now why does this matter? The reason is that philosophers and most people who used to study semantics thought that there was only one kind of causation. They thought that there was just a concept cause and it was to find it in one way. What we find here is that there are many types of causation, as many types of causation as there are types of force and forced motion. And the reason is that causation is understood metaphorically as forced motion. Causation is fundamentally a metaphorical concept, and all the different types depend on the types of forces.

I've just given you three different metaphors that fit together. States are locations, changes are movements, causes are forces, causation is forced motion for you to fit them all together. That is how you get a complex metaphor. It's called the event's structural metaphor. It's the location version of the event structure metaphor. It's complicated because you're taking primary metaphors and putting them together. When you do that, you get even further metaphors. Take, for example, actions. What is an action in this metaphor? An action is a self-propelled motion. It's a movement for you to provide with your own force. We can see this in looking at the types of actions, the metaphors for them. So for example, if you help somebody, it's an act—it's like helping them move. So you can say it's smooth sailing, it's downhill from here or he gives me a boost, that is, he helps me move. Manner of action is like manner of motion. We're slogging through it. We're out of step or in step. Careful action is like careful motion. What is an example of a careful motion? "Walking on egg shells." So when you say he's walking on egg shells, it means he's acting very carefully. "Treading on thin ice" is another example of acting very carefully. "Walking a fine line" is another example. So each of these kinds of careful motion can be a metaphor for careful action. Similarly, freedom of action means freedom of movement. So if you have freedom of movement, you can say things like "workers, throw off your chains." That is, you move freely, and that means it's

not just that you can move freely, it's that you can act freely. Or you can say things like "I'm trapped in this job." Trap is physical lack of movement. That means it's a physically constrained on action. So constraint on movement is the metaphorical basis for understanding, mapping a constraint on action. Right? It's the same event structure metaphor, where action is movement and freedom of action is understood in terms of freedom of movement.

So what you see in these cases is something very profound, that the simple metaphors fit together to perform a very large complex model for thinking about causation, action, events, changes, and so on—all in one metaphorical framework, and this metaphorical framework is universal. Now in this metaphorical framework, what is a purpose? What does it mean to achieve a purpose? If action is movement, achieving a purpose is going to a location, a destination that you want to go to. So doing something, to get something that you want is moving to be in the place you want to be at. So you understand this in terms of achieving a purpose as reaching a destination. That's why you can say when you talk about goals, "the goal that you want to get to" or "we reach the end," "we see the light of the end of the tunnel," "we have a short way to go." And what does it mean to have a lack of purpose? We don't have any purposes at all. That means you don't know what direction you are going in, so you say "you are just floating around, drifting aimlessly." The phrase "he needs direction" means he has no purpose. So reaching a purpose is getting to a destination. In this, what is the means for achieving a purpose? A means for achieving a purpose is a path that you take, and in English the word for that path is "way." So you do it this way, or another way—anyway you can. The word for way is the path that you take to reach a destination, and it's also a purpose. It's a means for achieving a purpose. So starting out on a purpose for action is like starting out on a path. "He's just starting his thesis," "he's taking the first step," "we're moving ahead," "let's forge ahead," "we've come a long way," "cover a lot of ground"—all these are understandings in terms of purpose for action, in terms of moving to a destination. If you look at the expressions in English for purpose, for action, and for events, you'll find there are hundreds of expressions in terms of this complex metaphor—the event structure metaphor. This is something that occurs around the world.

Now as part of this metaphor, there is another very important case, which is external events can affect you. That is, something that happens outside can cause you to do something else, and can make a change in your life. So if achieving a purpose is reaching a destination, what does that mean for external events to have a causal effect on your life? That means it's like a force that moves you off course, that moves you away. So you have lots of examples like that. Notice you say "how are things going," the words for these events are

things. You can say "things are going with me," means they are helping me achieving my purpose. "Things are going against me," they are keeping me from reaching my destination, from achieving my purpose. "Things took the turn for the worse." "Things are going my way," means they're helping me, going forth in the direction I want to go in.

Now there's a second special case of this, and that is water or wind—fluid entities. So you can say "you have to go with the flow." That is the external flow of events that exerts force on you, and you can't do anything, you just have to go with the flow as much as you can. When you have something like "I'm trying to keep my head above water," that means you are in the ocean, you are about to drown, which is death—failure is death, and you are trying to achieve something, and the water keeps forcing you in one way or another, keeps you from going in your direction, makes it hard to achieve a goal. You can talk about "the flow of history" or "the winds of change," that is, these are forces that act on you that affect where you are going to wind up in your life. So again all of these ideas about events and purposes for action have to do with force that applies to space and movement in space.

Now my favorite example of a special case of this has to do with horses. In English, there is an interesting set of metaphors. If you are riding a horse or if you are in a carriage drawn by a horse, the horse can move you independently and may not take you where you want to go. So you say "keep a tight rein on the situation" as if the situation were a horse. You want to make sure things don't go in the wrong direction. So you say "keep a tight rein on it" or "wild horses couldn't make me do that." "Wild horses" is a very important metaphor in English. Suppose that you want to do something and someone else comes and he is very, very pushy. He talks to you a lot and you say "hold your horses" as if the horses were pushing you in a certain direction where you don't want to go. Then suppose you are doing something and the situation makes it very hard to do what you want to do, you may say "whoa" as though the situation were a horse trying to take you somewhere. You say "whoa"—slow down. So these metaphors, this system is a single whole system, in which states are locations, changes are motions, causes are forces, actions are self-propelled motions, and purposes are destinations you are trying to reach. It's a remarkable system. It's something that people use all the time.

Now one of the most interesting parts of the system is that it has a variant. Remember on the time metaphors we had a figure-ground difference? We had "time is coming toward me." Time is the figure, I am the ground or the time is on the ground and I am the figure. There's something like that here with event as well. Consider a sentence like "I have a headache." It's a property I have. Now it's also a state you are in, but a state can be understood as something that you

have or a location that you are in. In English, there are some cases where you have both. You can have trouble or you can be in trouble. "In trouble" is in a state; "having trouble" is like it's a property of yours. So if you are in trouble, the trouble is the ground and you are the figure—you're in trouble or out of trouble. If you are the ground, the trouble can come to you. Troubles are coming my way or my troubles went away or I have troubles. So notice it's the same duality. A property is a possession you have, like a headache. Now change again is motion to a new location. So I got a headache. I got it. It came to me or my headache went away, gone or the noise gave me a headache. Causation is like giving. When you give something, you are using force and having it move from one place to another. So it's like the headache. It's like the noise is giving you this headache and the aspirin can take it away—it removes the headache. So here properties are what you are like. Are you sick? Do you have a headache? whatever. You know if you are sick, that is a property of you, the pills can take your illness away. Or, you know, going out in cold weather can give you a cold, make it come to you. Again this is a dual version of event structure, and these two metaphors are like figure ground reversals of each other.

What about purpose? In purpose, you have the other metaphor. You have "reaching a destination." Here achieving a purpose is getting an object that you want. How do you think about failure? If you don't get something, you can say "it fell through my hands." That is, you want to get it and it fell through your hands. "It's within my grasp," I can almost get it, almost achieve this purpose, within my grasp. "He has it," "he got his job," right? "he got it."

Now this is a special case of this. That's really interesting. That is achieving a purpose is not just getting any object. It's getting something to eat. So you talk about "the fruits of his labor." You got "fruits." You got something to eat. "He savored victory"—that is, the winning, victory is something that tastes good to him. He tasted … you can say "he almost tasted it." You can say "the opportunity has me drooling," "he's mouth-watering," so achieving a purpose is getting something to eat and seeing that you can almost achieve a purpose is like having the juices in your mouth flowing. What is it "to try"? Trying is attempting to achieve a purpose. It's trying to get something to eat. How do you do it? The traditional methods are hunting, fishing, and agriculture. So in English you have cases like "he's hunting for a job," "he bagged it," that is, put into the hunter's bag, a promotion, "he's shooting for a promotion," "he's aiming at a career in the movies," and so on. Then there's fishing. "He's fishing for compliments," he's trying to get people to compliment him. Or "he landed a good job" or "he landed a promotion" as if you've taken the fish and pulled it onto land, it's landed. "He netted a good job" as if you are fishing with a net. "Netted." You have cases like "I have got a line out" like you are fishing with a fishing line.

"I have got a line out on a good used car," I am trying to get a good used car, say, I'm fishing for it. You put out the line. And then there is agriculture. "He reaped rewards." "Reap" is taking in the crops. The job is a plum, like fruits. "The fruits of his labor," "It's ripe for the picking," and so on. So what you see here is a system of metaphors that fit together. A dual system, an event structure system in which causes are forces in both case, changes are motion. But there're two different ways of understanding states. States are bounded regions in space or they are properties or possessions, things that you have. Depending on which of those you use, you have different versions of these metaphors.

What it shows is that you can have a very, very rich metaphor system by putting together the primary metaphors. Then once you do that, you have lots of special cases of knowledge that you have about the world, knowledge about hunting, fishing, and agriculture that fit into these cases, and they are what allow you to use metaphorical language. Metaphorical language is when you put lots of different pieces of the system together and you get something like "that job is a plum" or "he landed a promotion." You can see the system only because you have noticed that the whole system is there. If you just look at one example, you wouldn't see the entire system, but it's systematic. What is remarkable about this is everyone in the world learns this system, because they learn the primary metaphors just by living. They learn that states are locations, bounded regions, causes are forces, and purposes are destinations. Why are purposes destinations? You want to achieve a purpose. You've got a goal to a given place. If you want to get a cup of tea, you have to go to the stove and heat the water. You want to, you know, read a book, you have to go to the library and get the book. So purposes regularly correlate with going to destinations where you can do something or getting an object that you want. You want to eat a banana, so you've got to go and get the banana. So this is how primary metaphors work. You learn this primary system and then you fit them together in this complex way of understanding the world and then the language fits on to that.

Now there are lots of other variations of these, and I just want to give you a sense of how rich a metaphor system can be. For example, activities can be seen as things that move. So for example, suppose they're building a new highway, you can say "the highway is moving along." It's progressing towards its conclusion and reaching the purposes or destinations again. So when you're near to it, it's near the object. Suppose you are doing your dissertation or writing a paper, you say "it's coming along." "How is your paper doing?" "Well, we are reaching the end." That is, any project or activity can be seen as something that moves, and when it reaches the end, then the purposes are fulfilled.

Another one is that an action can be seen as a bounded region in space. So for example, you can say "they pushed him into running for president." Now

think about that. The activity is "running for president." Causes are forces. That means they caused him, they exerted a pressure on him. Causal pressure, so they pushed him into. Why "into"? It's a bounded region, he's moving into a activity—a region where he's running for president. Let me give you another example, "He was drawn into the bank robbery." That is, someone put pressure on him and pulled him into the activity of robbing a bank. Or "I've taken steps toward canceling my insurance policy," that is, you take some steps in the direction of this activity which is seen as a location. Or "she came near to resigning from her job"—her job is seen as a location and she can come near from it and then back away from it. She backed away from resigning her job. So again this is another variant on event structure where actions are seen as bounded regions.

There is version of this having to do with existence. Existence is location here, and birth is arrival. We had a birth in our family yesterday; we had a new grandchild. Birth is arrival, "the baby has arrived, eight pounds and four ounces." The baby is coming. Death is departure, "he's left us," "he's gone away." But being alive, existing is being here. That's why you "come into existence" and things "go out of existence," because existence is here.

So I want to just go through this a bit, to give you a sense of the richness of this system. We always think in terms of this system everyday. You can't think about purposes, about actions, about achieving something without thinking about goals you want to reach or things you want to get. That's how you think everyday. You can't think about states without thinking about whether you're going to go in them, or out of them, or come near them or be deep in them or not. There's no way to think about these things any other way. Metaphor is crucial. It is normal, it is there everyday and it is in the way that you think and language attaches itself to this mode of thought. So the general point to summarize is the most common things that you do—time and events and causes—everyday you understand these by metaphor. The metaphors are natural. They are primary metaphors. You learn them just by living in the world. They are conceptual. You have language that attaches to those metaphors, usually to the source domain and then you use them to the target domain. You can see the metaphorical language, but the metaphors are in thoughts. Then you can put metaphors together. That's called binding the metaphors together to form complex metaphors.

Now I'd like to give you a sense of another very complicated system, and this is the system of metaphors for the mind, that is, how do you think about thinking. This is something you do everyday. You constantly have to think about reasoning and think about thinking, and it's very, very common to do that. For example, there is a general metaphor about thinking, a single general

high level metaphor. Here's how it goes. The mind is a body, thinking is a bodily action of some sort, and ideas are the things you act with respect to. Thinking is moving. The mind is a body, and when you are thinking, you are moving, and the ideas are the locations, so when you go from one idea to another, you are moving from one idea to another. So you can reason "step by step," you can "reach conclusions." That's why they are called "conclusions." You reach the end point of a chain of reasoning that goes through space. Your mind can "race"—you can go fast. Your mind can "wander around," not going straight in the direction but all over the place. You let your mind wander from idea to idea to idea. You can have "a flight of fancy" where you just fly off and think about random things, flights of fancy. You can say, suppose you are trying to prove something, you are in the middle of a long, difficult argument, you say "I'm stuck," or "I can't go any further," or you can be "thinking in circles." You can have "circular reasoning"—it doesn't go anywhere. You get the general idea that a topic is an area, and ideas on that topic are locations in that area. That's why you "talk about something." "About" means "around" in the area or something, so you "talk about it." Suppose you are talking to someone and you are having a conversation, and they think very fast, you can say "you slow down, you are thinking too fast for me" as if they were moving or running too fast. Or you can say "I can't follow you"—"following" is "being taken along some path of reasoning." Communicating something is guiding someone along the path, so the question is "do you follow them," and rethinking it again is "going over it again." To rethink is to go over something again. So here you have "thinking is moving" where the ideas are locations on the ground and the mind is a body.

Now there is another variation on this metaphor of "mind is body," and that is thinking is perceiving, knowing is seeing, as we saw before. Knowing is seeing and ideas are things that are perceived. Now what is communicating? Communicating an idea is showing it to someone. Attempting to get knowledge is searching. So let me give you some examples of all of these. You can say "I see what you are saying." Now "a cover-up in the government is an attempt to hide something from the public." That's why it's a cover-up, so the public will not know it. So you cover it up to hide it, so it won't be seen, therefore known. So knowing is seeing. If you're writing a paper, you want to write it clearly, you want your writing to be clear, so the other person can see it and therefore understand it. Understanding is seeing clearly. If you're writing a paper that is opaque, where no light can come through, then readers can't see the ideas in the paper. Communication is therefore showing something. "You've seen the paper," let me "show you" how this works. Let me "point it out" to you. I "point out this." I "point out" that. "Notice" this. Seeing is perceiving. "Notice this," "pay attention to that," "do I have to draw you a picture?" or "let me draw you

a picture" so you can see it. You can talk about having a perspective on something, seeing something from one position and then seeing it from another position and it might be different. So the idea of having different understandings has to do with different perspectives that you can take, different "points of view." The notion "point of view" uses this metaphor. That's the point from which you "view" something. So in general, this also extends to other kinds of perception like hearing. You can be "deaf" to what your father tells you, that is, you don't do what he tells you, you don't pay attention, and so on. But in general, most of these are about seeing. It's a major metaphor. It is used all over the place. Think about what it means for someone to be a brilliant student. Why brilliant? Because that person can shed light on topics and allow other people to see them and understand them clearly. So when you see all these examples. They are almost overwhelming. That is, the system is so rich and consistent. It's a single consistent system.

Now there is another variant on this metaphor of "the mind is body," and the thinking is object manipulation and ideas are objects. Thinking is doing this, so you can be "tossing ideas around," right? "playing with ideas." When ideas are objects, what is communication? Communication is giving the object of an idea to someone else, so it's like "sending a message." This is the basis for what is called the conduit metaphor for communication. The conduit metaphor says ideas are objects, communication is sending an object to someone else and language is the container you send it in. So you "put it in language" and then you "send" it to someone else. Now this is only a metaphor, but this is one of the major metaphors that we have. It's a metaphor that is used all the time. What is memory? Memory is like a warehouse where you store away your memories, and then you can go to get them. The memories can be stored in various ways, you can retrieve memories or recall them, that is, get them to come to you. So recall versus retrieve, you go to get them. So there are two various ways of understanding memories. This carries over to analyzing an object, another very important thing. For analysis, what is analyzing an idea? It's like taking an object to part, to look at its structure. What is an analysis? It uses this metaphor. The idea is an object that has a structure, and you can take it apart to see its structure. That's what an analysis is.

So in this, you have these very important metaphors. But let me stop for a minute to speak of the metaphor of communication—the conduit metaphor. In the conduit metaphor, language is something that contains ideas. You put the ideas, the objects into language, and you send that to someone else. Now, that has an entailment. It follows from that that the meaning is in the words and that you should be able to just take the meaning in the language and take

the meaning out, extract it. It's false. It's not really true. The meaning isn't in the words. Notice we saw before that there are ambiguous metaphors. We have words and have lots of different meanings in them depending on the context, the situation or both meanings at once. But the reason we think that the meaning is in the words is that we use this metaphor. This metaphor is the basis of a lot of semiotics. The basic metaphor for communication in semiotics is the conduit metaphor. And there it is assumed that every word has an idea associated with it, but may not. Words are sort of prompts for thinking about things and there might be normal ways for thinking about things but other ways as well. Right? The conduit metaphor is not to be taken as literally true, or any of these—these are metaphors. It's important to understand them. Notice communication in the first metaphor where thinking is moving is guiding someone. Communication in the second one is showing something and only here it is sending objects. There are different metaphors for communication, and we understand them differently.

Now one of the richest metaphors, one that is in this group of "mind is body" is that ideas of food and thinking involves food preparation and eating. So in this, a well functioning mind is like a healthy body. That's why they give you exercises to do. Have you ever worried about being given exercises as your homework? Why are they called exercises? They are to build your mind. A well functioning mind is like a healthy strong body. So they give you exercises. Ideas are food. Acquiring ideas is like eating, and interest in ideas is an appetite for food, and so on. So for example, you can have a thirst for knowledge, a thirst, that is, an appetite for getting ideas. You can have an insatiable curiosity. You are curious and you eat, and you think about more and more and more things. You want to know more and more. It's insatiable. There are some ideas that you don't want to swallow, that you just can't swallow, you just can't get them down. That is, unsavory ideas, ideas that don't taste good. Now suppose you are just talking to someone over the dinner table with someone about something not very serious. That in American English is called "chewing the fat." It's called "the fat" because it is not nutritious, as opposed to "the meat of the argument," which is nutritious. You want to get to the meat of the argument, not just chew the fat and so on. An idea may be so complicated that you can't digest it all, like this lecture. There is so much here that you can't digest all of it. But there is plenty of food for thought here. And then you have your exams. What you do on the exam? You regurgitate the facts. That's like spitting them up, spitting them out, that you have food and you put them out. So regurgitating the facts in an exam is having the kind of exam where you just barely take it in and you give it back. It's not fully digested.

So I should say one thing. English has a lot of metaphors for ideas of food. But there is another language that has hundreds more. Does Chinese have a huge one? I'm not surprised. The language I knew of was French. Cultures that have a great cuisine, have a very extensive use of this metaphor. So I don't know about it and I'd love to find out examples from Chinese. Maybe you can tell me some later. French has some wonderful ones. My favorite one in French is that's an idea "aux petits oignons" which means "with little onions." It is particular for ideas. It tastes very good with little onions. So you know little French onions.

Now let me give you a few more of the metaphors for thoughts. There is one metaphor for thought that is extremely important, and that confuses people a lot, especially in linguistics and philosophy. It's the metaphor that thought is language, and here thinking is some sort of linguistic activity, either speaking or writing. Simple ideas are words, complex ideas are sentences, and fully communicating a sequence of thought is spelling, and memorization is writing. So for example, you say "let me make a mental note of that," as if you are writing it on a pad. Let me make a mental note. You can say things like "she's an open book to me" as if you can read her mind. So thought is language. "I misread his intentions." Thought is language, "misread." "He has a whole catalog of great ideas" and so on.

Now some of these cases, in some of these cases, the language is spoken language, not written language. So you can say "I can barely hear myself think" as if you are pronouncing the words. "He's an articulate thinker." Articulation is carefully articulating the words with your mouth. "An articulate thinker." "She doesn't listen to her conscience." "Listen" is used as if she's hearing the words. "Her conscience told her not to do it"—"tell" in language. "I don't like the sound of his ideas"—sound. "That sounds like a good idea." So what you have are cases where thought is understood as either written or spoken language, and there are other cases as well. For example, it's a very common expression in English to say "that's Greek to me," means I don't understand that, I don't speak Greek. Or "liberals and conservatives don't speak the same language," which means that they don't think in the same way. We can say "she cannot translate her ideas into well-defined plans." "Translate" ideas into plans as if they were words. "His thoughts are eloquent." "Eloquence" has to do with speaking and pronouncing. "What is the vocabulary of philosophical ideas?" as though ideas were words and there were a vocabulary of them. "The argument is abbreviated," as if there is an abbreviation, a short version, it cuts short. "He's reading between the lines," as if he's being seen to understand something that is not said. He understands an idea that isn't communicated. My favorite is "he is computer literate," "literate" as if he can read the writing. So in general, we have

a very rich metaphor of thought as language, and it's very common when you are studying linguistics, to misunderstand it, to take that metaphor literally, and when you are speaking about thought, to act as if it is language, and it isn't. You have got to keep language and thought separate; language has just to do with the phonological expression of the thoughts.

Another metaphor that is very common for thinking is that thinking is a mathematical calculation like addition, so you put two and two together. Reasoning is adding. You say "what does all this add up to." I can say at the end of my lecture "let me summarize"—"sum" like an addition. Let me summarize, let me tell you what this adds up to. I can say "let me give you an account of the history of metaphor." Account is like accounting. You put down all these numbers and see what they add up to and how they fit together, how they add up. That's what an account is. So here you see my favorite one is "that doesn't count." I'm not going to count it in there, and I'm not going to put it in my accounting and in the sum to see what this adds up to. "We won't let that count," it can't come into the argument. Very importantly we have a little metaphor and it says thought is mathematical calculation.

The last one I'll give you is that the mind is a machine. The mind is a machine and ideas are the products of that machine, and thinking is an automated process step by step, putting the ideas together to get a complex idea. Normal thought is the normal operation of the machine, and inability to think is the failure of the machine to function. So you say things like "I'm a little rusty today." "Rusty" means that you have rust on your machine and it doesn't work very well. So when you say "I'm a little rusty," it means I'm thinking slowly. The machine is rusted. Or you can say "Boy! The wheels are turning now"—I have ideas coming out really fast. The wheels are turning. Or you can talk about a "mental breakdown" as if the machine were breaking down. So those are part of the system of metaphors for thought, and again what you find is that if you have an important area of your life, there is not just one metaphor for it. There are lots of different ones. And they are all different. They all have different modes of reasoning. They are about different subject matter. They mean different things.

I would like to point out at this point is something very deep. If you take those metaphors that I just gave you for thinking, and you put them together and you make a list of them, there're certain parts of them that constitute a philosophy. It is Anglo-American philosophy. That's part of this metaphor. That idea is the basis of all analytic philosophy, that thoughts are independent of any thinkers, that they're really things out there in the world, in the universe. It's part of the philosophy. You can talk about thoughts and analyze

them without worrying about the person who's thinking, without worrying about the mind, the brain or anything else. Similarly, in this metaphor that the mind is body, thoughts correspond to things in the world. That's like the correspondence theory of truth that the thoughts can fit the world. Take thought as motion when you are moving. Rational thought is direct, deliberate, step by step motion, and that's in the analytic philosophy—that's what a rational thought is. It's direct, deliberate step by step motion. Go to the metaphor of thought as object manipulation. In that, the thoughts are objectively existing; therefore, they are the same for everyone. It says that ideas are universal. That is part of analytic philosophy. Since the ideas are things that are objective out there in the world, they are the same for everybody. That's one of the assumptions of Anglo-American philosophy. Communication is sending ideas. That's part of Anglo-American philosophy. The structure of a thought is like the structure of an object, and analyzing thoughts is taking apart objects. That is why it is called analytic philosophy. You are analyzing language by taking it into its parts, and that's what analytic philosophers are trying to do, to do language analysis, breaking a language down into parts, giving necessary and sufficient conditions for concepts, for example.

Now take the metaphor for thought as mathematical calculation. Just as numbers can be accurately represented by sequences of written symbols, thoughts can also be adequately represented by sequences of written symbols. That means that you can have a symbolic logic or you can write down the thought as in symbolic logic. Just as mathematical calculation is a mechanical process like an algorithm, thought is an automatic process, and in logic you have rules of thought that apply automatically, from one formula to the next formula. Just as there are some systematic universal principles of mathematical calculations that work step by step, there are also systematic universal principles of reason that work step by step. This is what a logic is. A logic is a set of principles of reasoning. They work step by step. Just as numbers and mathematics are seen as universal, thoughts and reason are seen as universal. So all of that is part of analytic philosophy. Finally the mind is a machine. Each complex thought, according to this metaphor, has a structure imposed by mechanically putting together simple thoughts in a regular, describable, step by step fashion. That is what analytic philosophy says. It's called compositionality, that you put together thoughts in a step by step fashion, you put together ideas. So what's interesting about this is that analytic philosophy denies the existence of conceptual metaphor, but all of it is based on conceptual metaphor. So it's an ironic position, but it's interesting. All of these metaphors are common metaphors, and when you put them together in this odd way, they are all different; but you put them together, you get a philosophy that seems

natural to many people. Analytic philosophy seems like a natural chronic thing to believe. Why? Because you already have the metaphors in your mind. What that means is that if you are going to challenge analytic philosophy as you must if you are doing cognitive linguistics. Cognitive linguistics is inconsistent with analytic philosophy, as analytic philosophy says there is no metaphor, the meaning is just the relationship between words and the world. In that case, you have to notice when you are using metaphors and when philosophers are using metaphors. Very important thing to do. So if you are reading around in linguistics or philosophy of language, philosophy of language is mainly analytic philosophy and it assumes that language works in this way. So what you are going to get are a lot of statements that are inconsistent with most of the facts of cognitive linguistics. It is important to know that.

I can go through more. We have a large book, but I won't. I just want to give you that sense at least of this. I want to talk about a few more things. One of the things that I want to talk about is to give you examples of how metaphor interacts with image schemas, how it interacts with prepositions and uses of prepositions. To do that, I'll give you some examples out of this book, but I can make it up—you can make it up anyway you like. There is a difference between looking over something and overlooking something. How does that work? Well, when you look over something, it's that you use your eyes. It is a metaphor that seeing is touching, where your eyes sort of go out and touch something. So you can say "he ran his eyes over the wall" or "his eyes picked out every detail." It's your eyes that are being used and you can say of two lovers that "their eyes met," or their eyes came together. When you are looking over a paper, here is a paper, we have a frame. Here is an eye. You have an eye, and you have eyebeams that are going over this in detail. It's looking it over. It's covering it. It's like walking over the bridge or something like that. You are going over this. Now to overlook something is when the eyebeams go over them with no contact, and you don't see it. Now there is a difference between overlook and oversee. To oversee something is to watch all of the actions of somebody to make sure that they are doing it correctly, so you are covering the actions going over. And what you find in use after use of this in language is that each particular word takes a particular metaphor for "over," and a metaphor for "look" and "see" and put those metaphors together to get a meaning of that word. You can't predict what the word will mean from "over" and "look," but you do know that one of the senses of "over" is going to be used, one of the metaphorical senses of "look" will be used or literal sense of "look," and that they will be put together. So the meaning is motivated by the system of metaphors but not predictable. You have to learn it, but it's not learning something random. "Overlook" cannot mean to eat. "Overlook" cannot mean to step on something.

There are certain possibilities for "overlook." When you work on English and you look at prepositions to go together with verbs, you get incredible complexity. It must drive language learners crazy to look at prepositions and verbs together in English. They are one of the hardest things to teach. But what's happening is that they are using the system, they are using the metaphor system, and they are using the metaphor system for both the prepositions and for the verbs. Once you see how that system works, you can explain it a lot better, but it's not easy to see—it's a very big, complicated system. So I would like to just give you a sense of this. We could go through other examples as well.

Let's talk just a bit about poetry. I want to give you a little bit of sense of how poetic metaphors work. One of my lectures is just on poetic metaphor but I want to give a few examples so that you see how complicated poetic metaphor is. The thing to remember about poetic metaphor is that for the most part, it uses this system. It uses all the basic primary metaphors that we have, all the conventional metaphors that we already have, and it extends them and puts them together in interesting ways. Poetic metaphors are not original. They are original combinations of things already known.

There is a great Shakespeare poem called sonnet 73. It's about death. But it doesn't say it's about death. The question is how do you know it's about death. It says:

> That time of year thou mayst in me behold,
> (Lakoff: That is that time of year when you can see in me.)
> When yellow leaves, or none, or few (Lakoff: That is, yellow leaves, or none, or few) do hang
> Upon those boughs which shake against the cold,
> Bare ruined choirs where late the sweet birds sang.
> (Lakoff: Then it goes on.)
> In me thou seest the twilight of such day,
> As after sunset fadeth in the west,
> Which by and by black night doth take away,
> Death's second self, which seals up all in rest."
> (Lakoff: The third part.)
> In me thou seest the glowing of such fire
> That on the ashes of his youth doth lie,
> As the deathbed whereon it must expire,
> Consumed with that which it was nourished by.
> This thou perceiv'st, which makes thy love more strong,
> To love that well which thou must leave ere long.

Now that is a lot of complicated English. This would take days to unpack all those metaphors. But let's take a couple. The first: "That time of year thou mayst in me behold when yellow leaves" What time of year when leaves turn yellow? Autumn. There is a metaphor "a life time is a year," and winter is death, and autumn is old age. Notice "When yellow leaves, or none, or few do hang upon those boughs which shake against the cold" Right? Shivering old man. But a life time is a year, and autumn is old age, winter is death. "In me thou seest the twilight of such day, as after sunset fadeth in the west." The twilight of a day, a life time is a day. What part of life time is twilight? Old age, near death, after sunset. It's not quite night yet, but night is death. Sunset is a period of old age before death. Third. "In me thou seest the glowing of such fire that on the ashes of his youth doth lie." Youth is when you pile up the wood in a fire and there is still fresh wood, when it becomes ashes, it's going to the old age; even if there are some coals burning, it's old age. Now let's just take that. Here you have a life time as a fire, youth is when the fire is burning brightly, old age is when you get ashes and you have maybe a few coals still burning. So you have three different metaphors for a life time: a life time is a day, is a year, a life time is a day, and a life time is a fire. Why those three and why do they make sense? What are the primary metaphors here? Are those primary metaphors or not? Notice and why not something else? Why not a lifetime is a week? It doesn't work, right? You know some of them just don't work, you know. A life time is an apple? No. You just can have any of them, fireworks, year works, day works. A life time, you know, is a bottle cap. No. So which ones work, which ones don't? Now think about a year, a day, and a fire, and how they are in parallel. In each case, there is heat and then cold. Death is cold, life is heat in all of them. That metaphor that "death is cold" and "life is heat" is an experiential metaphor. Dead people turn cold, people alive are warm. So what you have is a correlation in experience that gives rise to a primary metaphor. Life is heat. Death is cold. First. What else happens? In a day, you have death as night, or night can be cold. It's colder than day, and also night is dark. In winter, things get dark early, it's dark early. So you have life as light and death as dark. The same thing with a fire, the fire is glowing, it's light. Ashes are dark. Life is light, death is dark in all three of these. All of them have a cycle—a waxing and waning cycle. That is, during the day, it sort of gets bigger, it gets more of the day until noon and until then it sort of goes away. That's what is called waxing and waning. That is, getting more intense and less intense. During the year, it goes up to summer and then to autumn and winter; it gets more intense, and then less intense. And the fire burns—it gets more intense, and then burns down and gets less intense. So you have cycles of intensity in all three. A lifetime is a

cycle of intensity. In the prime of life, you have the most intensity. As you get older, you have less intensity.

All three of those have these three metaphors put together. You put them together in an understanding of a year, an understanding of "life is a year, life is a day, and life is a fire." Right? That is, those three metaphors, "life is a day, life is a year, life is a fire," are like complex metaphors, derived from the composition of "life is light, death is dark, life is warm, death is cold, life is a cycle of intensity." All those structures … all those three metaphors structure the other metaphors. That's why this poem has exactly those three metaphors. That's poetry. That is why this poem makes sense as a beautiful poem in addition to all the other metaphors that you used to see. What you see in this is that the metaphors are not obvious in the words. It's not just going to the words, it's not just saying "Oh, this is a metaphorical sentence: That time of year thou mayst in me behold, when yellow leaves, or none, or few do hang." They are metaphorical. The words are used metaphorically in this, but the idea is to evoke a metaphorical idea, and not just one idea, but complex metaphorical ideas that use the basic system of metaphors, primary metaphors and call them up and evoke them. That's why this poem works. That's what a poet is doing. Poets are not just using single metaphorical words. There is not just a literal meaning and a single metaphorical meaning. So words are prompts to deep metaphorical understandings. Try to digest some of this, and I hope that we don't have too much regurgitation afterwards.

All original audio-recordings and other supplementary material, such as any hand-outs and powerpoint presentations for the lecture series, have been made available online and are referenced via unique DOI numbers on the website www.figshare.com. They may be accessed via this QR code and the following dynamic link: https://doi.org/10.6084/m9.figshare.5425555.

LECTURE 5

Constructions: The Structure of Grammar

Consider a very simple sentence: There's John. The earliest construction that children learn is this construction. It's called deictic locative construction. Deictic means you're pointing like there or here, locative to a place, to a location there. Children learn this construction very early. You have in English for "there" they learn Da, and for "father" they would say Da-Da. So, Da, Da-Da is a very early sentence. Now, it turns out that this is actually an extremely complicated construction. It is so complicated that from a certain point of view, from the point of view of generative linguistics, it is virtually impossible to describe this construction and, in fact, Chomsky's theory leaves this out. It is not described in Chomsky's theory because it cannot be.

Let me explain why. Take a sentence like "There's John." Now you can say a variant "There goes John." So you can have the verb Be, "There's John," the verb Go, "There goes John," or you can say "Here comes John." So there are three possibilities, three verbs: Go, Come, and Be. You can also have a phrase in the end. "There goes John with his jacket on." "There is John sitting on the porch." So these are the final phrases like "with his jacket on," "sitting on the porch, drinking tea," whatever. Now, how do you negate that sentence? What's the negative form of "There's John"? You cannot negate it. You cannot say "There isn't John." Impossible. No negative. How do you question it? How do you say? What do you say? "Is there John?" Impossible. You can't form a question. How do you do what is called a tag construction on it? The tag construction is something like "John is sick, isn't he?" You cannot say "There is John, isn't there?" Impossible. Or not even "There's John, isn't he?" Impossible. So that can't be done. Now, these sentences like "Here comes the bus," "There's John," "There goes Professor Li," all of these sentences also cannot be embedded. So you cannot say something like "Bill believes that there's John" or "Bill believes that here comes the bus." Right? You say "Bill believes that the bus is coming," "Bill believes that John is there," but not "Bill believes that here comes the bus." You can't embed it. You can't embed it anywhere, not in a relative clause. You can't say "I know the man who there goes." Impossible. So, in general, this doesn't occur embedded except with the right verb. You can say things like "I'd like to point out to you that here comes the bus you are waiting for," "I'd like to let you know that there is the man that you wanted to see." So, with a couple of verbs like "point out," it is possible, but with other verbs, impossible.

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Now, from the point of view of just syntax which is the combination of symbols, it is extremely complicated to describe this distribution. But this distribution is actually very simple from the point of view of semantics. Think of what this sentence means and think of why it is that the child, a very young child can learn this sentence as one of the very first sentences he learns. What are you doing when you say "There's John?" Are you are pointing something out—you are pointing at something and you are talking to someone who's seeing the same thing that you can see. That someone is present, right here, like you are. "There's John." And pointing to a location, "There" or "Here comes the bus." I point to some location, "There goes Henry." And I name the person who is at that location. And what I'm doing is saying either that person is stationary "There's John" or moving "Here comes the bus," or "There goes the bus." Either away or from. Those are the conditions of the sentences. They are fairly simple conditions, because we are constantly pointing to things that we see, pointing to locations, saying the name of what is in that location—it's very simple. Pointing out whether something is moving or stationary—very simple conditions. So you can see why a child could learn this very, very easily.

Now why does this have the very strange syntax that it does? Think for a minute. Why can't you negate it? You say "There's John." Why can't you have a negative? Because you can't point out something that is not there. You point out something that is present, already here. You can't negate it if you say it isn't there, if that's the condition for the construction, so there is no negative. Why not a question? Because you point it out it's there, it's a positive thing, there's no question about it. Why not a tag like "isn't there?"—because the tag is expressing doubt, uncertainty, and there's no uncertainty and it's right there. "There's John." No uncertainty. Why can't you embed it, things like believe or expect? Because the meaning of pointing out is incompatible with the meaning of belief. That is, they don't quite fit together. It's not just believing that what you are saying is really there. However, you can embed it with the verb "point out," because that's what you are doing, you are pointing it out. So it's actually very simple. This construction has a situational meaning, or a pragmatic meaning. It tells you what you are doing with this construction. And that is normal. Constructions have a meaning. What you are doing then determines what other things can combine with the construction. So this is a very important thing to understand that there are constructions, not just sequences of syntactic categories or something like that. They are not just symbolic. They have meanings. What they are doing is pairing that meaning with a certain form. You are saying that the location you are pointing to comes first. Why would the location come first? Because that's what you are pointing to, you are

trying to get their attention to that location. Right? There is a reason why "it is there" is first.

So this is something that you learn, which is very important. From the earliest stages of childhood, constructions normally have semantic and pragmatic conditions associated with them. What we want to say in cognitive linguistics is that construction is actually a pairing of the meaning, that is, the pragmatic or semantic meaning of the construction with the form, the surface words or the surface, you know, categories of objects or whatever. So the claim here is that if you are going to specify a construction, you have two parts: a semantic part and a form part. The semantic part says I'm pointing something out, I'm pointing out that there are certain elements of a construction. The elements are the speech act, pointing out, the thing you are pointing to, the thing or person located there, and whether it is stationary or moving and whether it is going or coming. That's it. Then the surface form says first position—the location, second position—the predicate, third position—the entity you are pointing to, fourth position—how you are describing it. That's it. But there's correspondence between them, a pairing of the form with the meaning.

So construction, from the point of view of cognitive linguistics, is such a pairing. Now one of the questions we had this morning becomes relevant here. When you pair a form with a meaning in the neural system, you have that neural connections going in both ways. So you need to have something that goes in one direction and the other direction, and then you need a little circuit, a neural circuit that controls the flow of activation one way or the other. And you need that for each element. For the "there" part, for the "go" part, for the "John" part, for the description part. For each element you are going to need some pairing. Then you need another element that makes them all into one construction that unifies them. That is something that says if it is activated, the whole construction is activated, and if the part of the construction is activated, it is activated. So it's something that a little neural circuit tells you are connected to each other. Again, our connected forms are a unit. That's the kind of structure that you need, and in our group we model those structures and we can do neural complication over those structures and then describe them quite precisely.

So what it says is that syntax lies in those little parts in the middle, the circuits that control the flow and the circuits that tell you what and how these are unified, that syntax is not autonomous, it doesn't occur by itself. Syntax is secondary. It's a pairing of meaning and form, and meaning is grounded in the body, and form is grounded in the body. That is, phonological form has to do with what you say and what you hear, which is part of what is embodied. So

form is embodied, meaning is embodied and syntax depends upon these two embodied things. What you are doing is syntax, the secondary construction of these pairings. So in a cognitive grammar, that is how we understand what syntax is and how we fit it into a neural theory.

Now one of the most interesting things about the deictic *there* construction is that it has a great many variations. Let me try to give you some sense of all the variations that it has. Suppose I say a sentence, suppose a little sound goes off. Thank you. I can say, "There is the beep." Now suppose I know that that sound is going to come off in a second, just before I can say "Here comes the beep." So you can do this with sounds. Now notice what you cannot do. With John you can say "John is there," with the beep you can't say "The beep is there." You say "There's the beep," but not "The beep is there." Why not? What is going on that allows this to happen? In a simple sentence like "John is there," you are just talking about location, but sounds are not just in the location. Sounds are things you hear but not the physical things in space. You can't say "the beep is there." Now why could you say "here comes the beep," "there's the beep," or "there goes the beep?" This is the variant on the construction, on the deictic *there* construction, and it's a variant. That is a very minor variant. In this variant, you are understanding perceptual space as physical space, and percepts as entities, things you hear as entities. You are understanding that something that is about to come into existence, about to be realized is distal. "There comes the beep" and so on. Something realized is distal, something soon to be realized is proximal, meaning here.

There is a general metaphor that activation is motion. Activation is motion. This occurs in many, many cases, a very common metaphor. What happens is that these metaphors allow you to extend the construction from "Here comes Harry" to "Here comes the beep." But that's a special construction. That is a different construction than "Harry is there." Totally different constructions. Harry is there, is or isn't Harry there, is Harry there? Totally different constraints. This deictic locative for you pointing something out is extended via metaphors that the simple construction does not get extended by, and that's an interesting fact—it can be extended. That one can be extended and the other cannot be. Notice what this means. It means constructions have an existence as separate entities. Some people might say this construction is just a version of the other one with the rules that move "there" to the front or something, but that can't be. It's got to be a separate entity, because this construction gets extended, but the other one does not.

In a traditional generative grammar, there are no constructions as entities. There are rules and they just generate lots of examples of constructions, but

the constructions are not separate things, they are just whatever is generated by the rules. So for Chomsky, constructions are what he calls epiphenomenon. The real thing, the rules, they just generate constructions freely, and the constructions are not units of their own. But here we see that the construction must be an entity on its own. Right? You must be able to distinguish one from another. They don't extend in the same way.

Now there are other examples of this perceptual deictic. Take something like "There goes the alarm clock." There goes the alarm clock. Or suppose you regularly get a pain in your knee. Your knee starts to hurt and you say "Oh, there goes the pain in my knee." You are perceiving the pain. Now notice that you can say things like "Here comes the beep with sound." But if the alarm clock is about to go off, you cannot say "Here comes the alarm clock." If it goes off, you say "There goes the alarm clock," but you can't say "Here comes the alarm clock" and you cannot say "Here comes the pain in my knee" as you bend and begin to feel it. Why can't you do this? There is a special condition on this that has to do with metonymy. When I say the alarm clock, here comes, you know, "there goes the alarm clock," I'm using a metonymy of the clock sending for the sound of the clock. The beep is the sound, but the alarm clock isn't the sound, it's an object. When I say "There goes the alarm clock," what I mean is that "There goes the sound of the alarm clock," the alarm. When I say "There goes my knee," I mean "There goes the pain in my knee." That's when I am perceiving the pain, not the knee. So you can say "Here comes the pain in my knee." But you know, you cannot say "Here comes my knee." You cannot use this construction with a metonymy, and that's a special constraint on this construction. Now notice in the normal constructions, you couldn't say it at all. You can't say "My knee goes there," "The pain in my knee goes there." Impossible! You can't say any of those at all. So what we find is that variations on this construction can have special constraints that are unique to that construction.

What is a variation on a construction? What does it mean? In transformational grammar, people used to try to do variations on constructions by taking one construction and then trying to transform it into the other, but that's not what is happening here. The syntax is pretty much the same, but the constraints on the meaning are different. What are you doing with this variant is inheriting as much as you can from the central construction as in "There is Harry." With special constraints, at the metaphor that a percept, something perceived is an object, which we saw in the other metaphors for the mind, or you are perceiving things that are objects and things with them and so on add to that metaphor and allow the metonymy only under certain conditions, but don't allow the metonymy with "here," coming in this direction. You have

those conditions, and then you activate everything else. How do you do that? That's a little strange, but it's not strange in a neural theory of grammar and here's why.

When you say activate everything else, you mean activate everything that is consistent with the condition you just stated and don't activate anything inconsistent with it. But what is inconsistency? Inconsistency, from the neural perspective, is mutual inhibition, that is, neurally the activation of one inhibits the activation of the other. So what it says is that you can specify the variants on the constructions by saying here are the special conditions on this construction and otherwise take everything else from the central construction. When you do that, you activate as much as possible in the central construction except the parts that are inconsistent with the special case, because they are mutually exclusive. If this is activated, the other can't be. Everything else is allowed to be activated. So what you have now is a maximally simple theory of what constructional variation is. It says when you have a variant of a construction, you have a construction, you have conditions that differ and you have something neurally activating the construction that allows you to activate as much as possible and the differences are mutually inhibitory. That says this is the natural thing to happen. But why? You have a construction if you want to extend it. All you need to do is add two or three extra conditions, and you can extend it completely naturally.

Well, it turns out that for the deictic construction, there are ten extensions. There are ten different variants on this construction. It is widely extended. Let me try to give you some sense of the kinds of extensions that there are. So, there is one in discourse. We are listening to a lecture. And I say to you, "Now there is a good point." That was a good example. There is a good example. I can be pointing to something in language, not an object, not a percept, but something in the discourse. And I can say, if I know, if I anticipate the lecture, I can say "Now here comes the best part. Here comes the best part, listen carefully." Then the lecture says it. At this point I can not say "there goes a nice point" or "there goes the best part." Impossible. Why? What you have in the metaphor in discourse is your understanding of discourse. Think about how we understand discourse. We understand discourse that is about to happen in terms of objects that are coming to us. I'm speaking, in the future I'm going to say some other things and you understand that as objects coming toward us while the metaphor of time is a moving object. As it moves, and it is being formulated as it goes, you say it, and that is gone. It's not in the past, it's not over there, it is gone. That's why you can't say "there goes a nice point," because it does not exist anymore. But with "Here it comes," you are anticipating that the speaker has already formulated it. So it is existing, it's coming, but

after it's here, it doesn't exist. That's something you know about discourse. So therefore, you can't say "There goes a nice point." So you need to extend the construction as the metaphor that discourse—elements of discourse are objects moving towards you. Elements that you hear are objects that are present here. There is a nice point. And then they go out of existence. Notice the metaphor coming into and going out of existence.

Now there are other deictics. One of them that's important is what I call the activity-started deictic. That is, this is something you can say when somebody who does some regular activity, starts doing it again. So "there he goes doing Tai Ji again." So notice "There he goes, doing it." He is not moving or "There he goes meditating again." He is sitting there, no motion. Right? But go "he's in activity." Remember how metaphor activities are motions. "There he goes," that's where he is going. So this metaphor can extend the construction again in the new direction. You can also get sentences like "Here we go again." Again, it is extending the construction. Now let's see, one of my favorites is this: Imagine that you go to get some soup and you ordered soup and they come and they say, "Here's your soup, piping hot." This is what we call the delivery deictic. They used to be in TV show with Johnny Carson. Other guys used to say "Here is Johnny" when he brought him on. And you can say in English "Here is your soup" with a long [i:]. Now that is the only place you get that long [i:]. H e r e. You can't say "John is h-e-r-e." Impossible. You can't say "H e r e comes the bus." Impossible. But "H-e-r-e is your pizza." Fine. When you are delivering something, you can say that.

Now what's interesting about this is the following. Suppose they take your pizza away; you can't say "there goes your pizza," but "here is the pizza" upon delivery is fine. There is a delivery frame when someone is delivering something to you. "Here is your package." When it is delivered, and you fit that frame, then you get this long vowel and it only works with "here" because you present it here, so that the conditions of the frame, when added to the central construction, change the construction in a minimal way, use the rest of it and then add it to the conditions. It's very simple to describe the conditions in which that long vowel occurs. You are delivering something.

Now, there are other cases as well. I won't go through the exact details of them. Let me give you some examples. You can say something like "now there." Suppose you are talking about your favorite baseball player who is now retired. You talk about the old days when you went to see this baseball player. You can say "Now there was the great shortstop" and you say it with a special use of the vowel, "there," with awe, t-h-e-r-e, breathy, now t-h-e-r-e was the shortstop. You can't say T-h-e-r-e's John. Or H-e-r-e comes the bus. Impossible! But when you are expressing awe, you go "Oh!" You have this breathy voice, you can add the

breathiness to there. Then "there" refers back in time because you are talking about something previous. Now let's say something, so you have a very, very special condition. You can say now "H-e-r-e is a great cup of coffee." "H-e-r-e." So I noticed, I mean you just can't use it in other constructions. For example, suppose you see a movie of your favorite shortstop making a great play. You can't say "Now there went a great shortstop." Right? There was, it only goes with "be," it doesn't go with go, because you are expressing awe at this person's existence. It's a different constraint. There is another one that has to do with annoyance. You say "There they go making fools of themselves again." "There they go," "There they go," timing it. You are exasperating it, "There they go making fools of themselves again," certain rhythm that goes with this. Now, and you can say of us "here we go making fools of ourselves again," but not "here they go making fools of themselves."

There are special conditions having to do with phonology and semantics that go with this construction. They use the rest of it and they go on. I can continue, there is a lot more in this book of variations on the construction, but one of the general points is simple. First, constructions are pairings of semantics and phonology. Those pairings have to have neural elements linking circuits that allow governing the flow between semantics and phonology and then something unifying all of those elements in the middle. The grammar is that pairing and that structure. And then you can get variations on it. In neural theory, you just need to specify what the variations are and then activate the construction and everything works. Now let's consider a different construction of English when it is generally discussed. It's a different *there* construction. This is the existential *there* construction and that is the one that is usually discussed. "There is a fly on the wall." "There is a car in the backyard." Something like that. Now notice the differences. The first deictic *there* construction has stress on "there." "There is Harry." "There goes Harry" and you can have "here." "Here comes Harry." You can have "here" in this construction and it has no stress. "There is a fly on the wall." In the other construction, you have something definite, something specific, "There is Harry." You know, "There is the beep." It's definite and specific. Here you have something that is indefinite and non-specific. Namely, "There is a bird on the roof," "there is a boy on the porch." It doesn't say which it is. It's unspecified and indefinite. So that's those of the constraints and then you can have descriptive phrases like "There is a boy on the porch wearing a red hat." You know, that's the same kind of thing at the end.

Now how are these constructions learned? What is the difference in the learning of the deictic construction and the existential construction and are they related? Christopher Johnson, who did the work on the learning of

metaphor in his dissertation, also studied the learning of these constructions and he discovered something extremely interesting. In everyone of the protocols of child language he looked at, the constructions were learned in a very interesting way. They were learned in cases where they came together, where there were cases when you couldn't tell one from the other and that is the case when you are both pointing something out and saying it exists. You can do both at once. So you both point it out. You can use an indefinite article like *a* and you don't know if it's specific or not. It's vague. So you know, "There is a fly on your nose." It could be "**There** is a fly on your nose." or "There is a **fly** on your nose." You could both point it out and say it exists at the same time, but they mean different things. But there are two interpretations of the words. If you slur it, so you can't tell the difference whether it is stressed or unstressed in between, then you have something that can be interpreted either way. It seems that these are learned in those situations. When you are both pointing something out and saying it exists, which is common enough, especially with children. With children, your saying its existence and pointing it out are commonly going together. So what it's saying is that we base the existential on the deictic. Now if that is the case, something interesting is happening. With the existential, you are just saying it exists, but you are not pointing it out. You point it out in the other construction but with the existential you just say it exists and it, therefore, doesn't have a stressed vowel on "there," because you are not pointing it to anything. So you have a sentence like "There is a fly on your nose." What are the syntactic constraints? None. You can say negated, "There isn't a fly on your nose." You can question it, "Is there a fly on your nose?" You can put a tag on, "There is a fly on your nose, isn't there?" You can embed it, "Bill believes that there is a fly on your nose" and so on. No constraints at all. Why? Because the pragmatic constraint of pointing something out is not on this construction. Or you are doing and saying it exists. Its meaning has no constraints to rule out negatives, questions, tags, and so on. So you can do anything with them.

Now what it says is, in terms of grammar, that you can understand the structure of the existential as a variant of the deictic, that it has dropped the conditions on pointing out and added the condition on existence. When you add the condition on existence, you only get the verb *be*. If you only get the verb *be*, you only get the pronoun, the deictic locatic, you only get the deictic locative *there*. You don't get *here*, because *here* goes with *come*. So you only get *there*. So what it says is that if you think about this in terms of acquisition and you think about the way it will be organized relative to your brain because of the way it is acquired, then you can see the existential construction as a variant of the deictic construction, with which it just says "change the conditions, don't

have this condition, have this other condition." Now this is quite remarkable because the older construction, the one you learn first, is very constrained and is based on conditions having fewer constraints. It doesn't just add conditions. It changes conditions by removing pragmatic constraints. So it is relatively unconstrained—it is free. The other one has word conditions and syntax conditions because it has pragmatic conditions. So you get a very different theory about the organization of a grammar. It says a grammar can be organized with variants on constructions. This is a very different theory of how grammars can be structured. One of the interesting things about the existential *there* constructions is that they also have variants. There are four variants on them.

Let me try to give you some sense of those variants. One variant has to do with presentation—beginning something when you are starting off. In that case, you can have the following kind of sentences. "Once upon a time, there lived in a kingdom far away an old man." "Lived," there you can get a different word, not "was," but "lived." "Once upon a time, there was living on the top of the mountain an old woman." You get "was living" and a locational and then the subject at the end. So when you are beginning a discourse, you can get that variation on *there* constructions, on the existential *there*. It's the discourse starting case. There is a different variation that's kind of interesting. That is when you are reminding people of things or reminding yourself, you can say "who can we get to go to the movies with us." "Well, there is Harry" or "There is always Harry." Then you can have with reminders something specific like Harry as opposed to something unspecific like a dog or a man. So in those cases, you can have specifics. You can have specifics in lists, as well. What would I have to do today? "Well, there is a cat to feed," "There is dinner to buy," "There's …" etc. There is a whole long list of things to do. That is the variant on the existential *there* construction, but it's a special case. It has the framework of sort of reminding yourself of what you have to do or what there is. When you are doing that, you have specific things, definites, "the cat to feed," "the cat" and it overrides the condition on indefinites. So again you can have variations to keep everything except these special conditions. Now there is another really interesting one which is what I call the strange existential. The normal existential says something like "There is a man outside." "There's been a man shot," where the "a man" goes after the form *be*. "There's been a man shot." But the strange existential is "There's a man been shot."

So let me write those down. Normal. "There's been a man shot." Strange. "There's a man been shot." Now what's interesting about this is usually a man goes after the verb *to be*, the subject always follows the verb *to be*, but here it's following something that looks like the verb *to be* reduced, but it isn't. It's the

verb *has*. "There's a man been shot, hasn't there?" Not "There's a man been shot, isn't there?" The tag shows you that this apostrophe s comes from has, not from is. You can't say "There is a man been shot." In the strange existential, the second element is the *have* of the perfect, and the phonological condition is that it must be reduced to look like the form of *be*, like what *is* would do. That's the phonological condition; otherwise, it is just like the other. But it has two different conditions and then it pairs the rest of the structure. So here you have a set of four or five different existential constructions, minimally different from the central case. But you can't derive them by grammatical transformation or anything like that. What you have are different pairings of semantics and phonology, and you get a new pairing of form and meaning that tells you this is the variation and then it points to a construction, activates that construction, and says take everything there that is consistent with these conditions. That's how grammars are really organized. They are not organized around transformation or anything like that. They are organized around constructions, pairings of forms and meanings and variations on constructions.

So we can now go to constructions after constructions, and so on, but I want to give you a rich example that indicates, first of all, how grammars are constructed but also now that we know something about the neural theory of grammar, how the neural system works. Why they should be constructed this way? Because given the neural system, it's easy to form variations of this sort. I'm going to stop there on syntax. We could do lots more with syntax, but the general idea in syntax is that syntax is secondary, not primary. What is primary in grammar is the embodied parts, embodied semantics, and embodied phonology. Syntax has to do with the pairing of the semantics and the phonology, and the structure, the neural structure that permits that pairing, that permits the flow between the semantics and the phonology. That's where the construction is in the syntax—it is in what can permit that flow. Once you have that, you can form variations on it by having other pairings. Minimal pairings of other conditions that activate the central construction and then therefore take everything consistent with what is left. That's how grammars get constructed. That's how they get built up and that's the structure that they have in your brain, and it's very different from anything like a generative theory.

Let's stop grammar for a while and take up the topic of blending and mental spaces. Now, the subject of mental spaces came about because of a number of classic problems in logic. They were problems like the following. You could say something like "In 1947 the president was a baby." That's ambiguous. It could mean we elected a two year old president or the person who is now president was two years old at that time. How do we make sense of that? We have a

simple sentence "The president was a baby." But that sentence "The president is a baby" is not true at any point in time. What you are doing is saying that this previous point in time in which the predicate "is a baby" holds of someone, and that is someone today can be described as the president. So you are looking at the world at two different stages, in the past and in the present—what Fauconnier called mental spaces.

There is a place where the mayor and the police chief are the same person. There are two roles, the mayor and the police chief, and they point to the same person. What Fauconnier did in his book *Mental Spaces* was give a general theory of how these cases worked. That is, he said, "Look, you have certain things we call mental spaces." Whatever they are, he didn't say what they are, just represented them by circles. You have entities and in the mental space you can have an entity. Let's call this X and you can have a predicate "is a baby," and we chose it in this space. You can have an entity X prime over here, or this X prime is president, and you can have a connector between them. When you say what constructs this is "In 1947" that tells you the difference between this and "the president." So what Fauconnier said was something very minimal. He didn't tell you what mental spaces are. He didn't say here's a theory of what they are. He said any theory of what they are has to meet these conditions.

Here are the basic conditions on the theory of mental spaces, and if you want to go further, whatever they are, they have to meet these conditions. They have to have at least this kind of information. That's what you've seen in that book. And then it goes through chapter after chapter with more and more complicated examples. So you can have a movie. In the movie, you know, Elizabeth Taylor plays Cleopatra and in the movie, Cleopatra marries Richard Burton. Well, Cleopatra and Richard Burton don't exist in the same world. But it's Cleopatra in the world of the movie and Richard Burton playing Mark Anthony in the other world. You get the idea. Now, so that's the basic idea behind mental spaces. What is the neural theory of mental spaces? Think about first the neural theory of a single mental space. It has to do with a neural simulation. We went through that before. We said, look, we have something like "Harry grasps the bottle." You have a simulation of Harry, a simulation of grasping and a simulation of the bottle where the patient of grasping is bound to the bottle and the agent is bound to Harry. You can do a neural simulation of that. What does that mean? It means that a bunch of neurons distribute in some various parts of the brain that are simulating the imagination of this. Now what about mental spaces? It's something similar. It says there are two groups of neurons in different places which can simulate these different things and the relations between them. So the theory of neural simulation says look,

if you have different spaces, what you are doing is using neurons in somewhat different parts of the brain, somewhat related to those parts of the brain, to then activate notions like "is president" or "is a baby" and the relations between them, between these different places. Now, that is now being programmed. We are now working out the actual neural modeling of the theory of mental spaces. It's not finished yet, but that's the general idea behind this.

Now what about conceptual blends? Conceptual blends are bindings. We talked about bindings. I gave you one example. Let me give you a number of examples of bindings. I give you an example of the blue chair. We can bind the blueness to the chair to get a single object. Binding also occurs in pronominalization. "John came into the room and he took off his coat." You are binding "he" to "John," the referent of "he" to the referent of "John," so they are the same person. That's another kind of binding. We saw binding when you put metaphors together. So we had before the metaphor of persisting over time is standing erect and organizational structure is physical structure and then we bound together organizational structure and persisting over time and physical structure and standing erect. We got the metaphor, the complex metaphor, an organizational structure that persists over time is physical structure. It's the physical structure that stands erect which can be either a society or a theory is a building. Now, when you do that, you are forming a blend of two metaphors. It's binding together two metaphors to form a blended metaphor. You can bind together metonymies and metaphors of all sorts, especially in mythology or fiction or poetry you can get very, very complex blends. For example, in Western mythology, European mythology, there is a figure called the Grim Reaper. Now the Grim Reaper is a guy, who is a skeleton. The skeleton comes dressed in a monk's hood and a black cowl. He has a scythe that is used to cut down wheat. He comes to the door, you open the door, and you say "Oho, I'm gone. I'm out of here. I have to go with this guy" and he takes you away. That's usually before you are ready to die. It's not when you are on your death bed, about to die. It's when you are perfectly healthy, perfectly nice, this guy shows up, and you say "I've got to go, bye!" Now what is going on with the Grim Reaper? Why does this Grim Reaper look like that? Why does he have a scythe? Why does he go away? Why does he have this cowl on? Why is he a skeleton? What is going on?

Here is why. First, there are two metonymies. What is a skeleton? A skeleton is what you become after you die. So the skeleton stands for death. So it's the metonymy of what you become after you die for death. The skeleton is taking you away. Why the monk's cowl? [It] disappeared in the Middle Ages, and at that time monks dressed in black presided over funerals. So the guy presiding

over the funeral has come to the door for you. Why this scythe? Why has he got this big blade in his hand? What is it used for? It is used for cutting down wheat. There is a metaphor that people are plants and that they sprout out when they are young, and when they are vigorous young people, they are full-blown and then they decline. Now when do you harvest the wheat? When it's fully developed, full-blown, you cut it down. This guy is cutting you down in the prime of your life. Right? People are plants. You are being cut down. Death. Why do you have to go? Because death is departure. We say he is gone, we've lost him, he's gone away, he's departed, and so on. You are binding together two metonymies and two metaphors into one figure in mythology. This is very common. It happens all the time, in poetry, novels, you know, myths, and so on. So what you are doing is binding and the result is called a blend.

What other kinds of blends are there? All sorts. Mark Turner gives a very nice example from Dante. There is a figure in Dante, Bertrand de Born, who goes around. His head is cut off. He is holding his bloody head by it's hair and the head speaks to you. The head is in hell. And forever, he's got to go around holding his head and his head speaks to you and explains to you why he has this horrible punishment. Here's why. Bertrand de Born did some bad things. What did he do that was so bad? Well, he was a British nobleman, and he convinced the son of the king to overthrow the king and kill the king. Now, in England, this was bad in Medieval England. Today we might say Hurray! But then he was bad. And why? And why does he have his head cut off? Because the king is the head of state metaphorically, and he was responsible for removing the head of state. The father is the head of the family and he was responsible for removing the head of the family. So his punishment is that his head should be removed. It's only fair, balanced. There's moral accounting to balance things. We'll talk about moral accounting later. So, that, what is going on there? You have a figure of Bertrand de Born in which two metaphors are coming together with the idea of moral accounting, that is morality—having done to you for what you did to something or somebody else. But what you did to somebody else was metaphorical. So it's via these two metaphors that you get the figure of Bertrand de Born. That's a blend. You are putting them together.

There are also other sorts of blends and they occur all over the place. They occur in advertising. One of my favorite ads is a public service ad in America to support education. You have a guy who is in the operating room of a hospital. He is lying there under the sheet. He is looking up. There are three children who are about eight years old dressed as doctors. They say little Mark, little Jenny, and little Mary will be your surgeons today." Think if you don't

educate them, you'd better watch out, because soon they will operate on you. They'd better be educated well. This is a picture that would not happen. It's a blend that doesn't happen. You have the children at a young age before they become doctors, being doctors. That is, you are combining a future mental space and a present mental space, and you are blending them. Ads like this are extremely, extremely common. They are blends. We find this basic idea everywhere. I mean there are Fauconnier and Turner that have a big thick five hundred-page book with blend after blend after blend. Shawnacle has another hundred-page book with hundreds of blends. They are constantly there. The point of them is that given a notion of binding, neural binding, given metaphors, given frames, given metonymies, you can blend them together. You can do bindings and we do them all the time easily. We understand them regularly, and we reason with them. So, that's how blends work, that's how blends fit in. Blends are normal. We read fairy tales, we don't even notice that there are blends.

Now in mathematics, there are blends. We have a metaphor mentioned this morning in mathematics of the number line. Here's the number line. This point is zero. This point is one. This point is two. This point is three and so on. In these numbers metaphorically are points on the line. They could be just numbers, but there is a metaphor, numbers of points on the line. With that metaphor, we blend the source and the target domain. Then it is both a point and a number simultaneously, both a point and a number in the number line. We have lots and lots of blends. Mathematics gives us many, many, many blends. I could give you more examples.

There's a nice example from trigonometry. It's a basic metaphor for trigonometry that's based on the blend. In case you never understood trigonometry, in five minutes you will. In geometry, there is a concept of a circle. The circle has a circumference, a center, and radius. That's in geometry (Figure 1). We also have number lines made of 0, 1, 2, 3, and so on, which is a blend (Figure 2). Given the number line, we can form a plane, the Cartesian plane that has a point here—0, 0. This is 0, 1, 2, 3, etc. And this is –1, –2. Here we have –1. Here we have 1 and so on. Let's make it a little bigger. Let's say 1 is over here, –1 is over here. 1 is over here and –1 is here. So that's the number line. That is the Cartesian plane and geometry (Figure 3). Now what we can do is we can put these together. We can draw a unit form of blend that goes like this. We put a circle right here where this goes through the 1. It says the radius is length 1. That's why it is a unit circle. Now we have a circle with the center at 0, 0 and circumference here and this is Distance 1. That's a blend of the circle and the Cartesian plane (Figure 4). Now we'll take another blend.

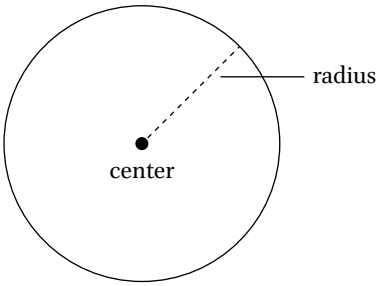

FIGURE 1

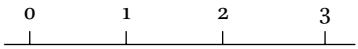

FIGURE 2

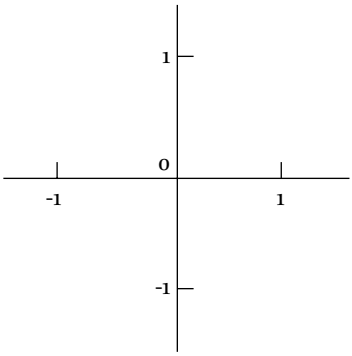

FIGURE 3

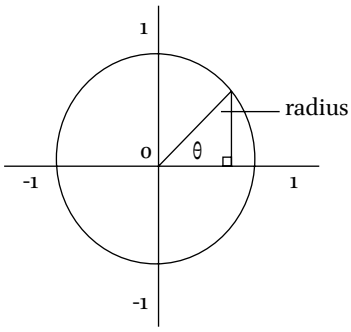

FIGURE 4

Let's take an angle. We call this angle θ and let's put that angle right there. This is now θ. Now let's take a right triangle like this. Let's put this right triangle right here that forms another blend. We now have a blend of four elements. The circle, the Cartesian plane, the angle, and the right triangle. That's a blend. We just put them together. Now what is trigonometry about? Trigonometry is the study of how to do arithmetic with angles. For example, you might want to add angles. You have two angles, here is an angle, here is an angle, you want to add them, you would like to do that and get a new angle. But what if you want to subtract angles or multiply angles or divide angles or raise angles to powers? How could you do that? Because angles occur in plane geometry with these known numbers. If you are going to add them, they have to be numbers. If you are going to subtract them, angles have to be numbers, but angles in geometry are not numbers. So somehow you've got to get them to be numbers and that's the job for metaphor. So you construct the basic metaphor of trigonometry and you do this by taking this blend and noticing certain things. You notice

that as this angle gets bigger, this line gets longer, gets bigger and gets longer and when this angle hits 90 degrees, this line has a length of π over 2 (π/2). When it is a hundred and eighty degrees, it has a length π, comes around to 360, it has a length of 2π and so on because this circumference is two π. So given that, we know that let's say a 45 degree angle. Here is π over 4. It has a number. It's a correlation between angles and numbers, then makes the length of this line. So we construct a metaphor, and the metaphor says the angle is the length of the line. It is the length of this arc and that makes the angle into a number and then you can add angles, subtract angles, raise them to powers, multiply them, do whatever you want, and that's called trigonometry. You now understand what trigonometry is. It took less than five minutes to explain. Now how to do it is another matter. But you understand now what it is about and the mechanism is blending plus metaphor. You form this blend and then on the basis of this blend you construct a metaphor. The blending is just binding these structures together. Let me give you a feel of what the blending is. It's a very powerful device, that we use all the time.

Now what I would like to do to finish up is talk about something that will be talked about in Beijing University later this week and that is politics. But here I want to talk just about one part of that, and that has to do with what I will call deep metaphor. Now deep metaphor is what you expect—not obvious, and what a deep metaphor does is structure an entire world of view, structures how you understand the world. And it's not obvious and then other metaphors fit the deep metaphors. Let me give you examples of this.

In the book Moral Politics I ask the following question: What is the difference in American politics, which might be very, very different from Chinese politics? I don't pretend to know anything about Chinese politics. But in American politics, there are differences between liberals and conservatives. Right now, it's a very tricky difference because about half the country is liberal and the other half is conservative. In the current projections for the elections coming up, it's about forty five or forty six percent on each side. It's very, very close. In the last election, Gore got the most votes but the Supreme Court chose Bush on certain strange constitutional grounds. But Bush was supposed to have won by five hundred votes out of a hundred million casts. That's how close the division in America is. In America, liberals and conservatives cannot even talk to each other. They can't understand each other. They have TV programs where they just yell at each other and neither understands the other. There's just lots of yelling, back and forth, but no contact made. So the question I ask myself is what is the difference in terms of cognition. How does this work? And I asked it in a particular way. I said, "OK, if you are going to ask this question, you have

to have certain problems that you have to solve." So let's think of, you know, the primes of the problems that you will have to solve. What sort of data matters here? And what I found was this.

Let's start this back in 1992, about ten years ago. There was a major election when the conservatives took over the government. And in that election, the conservatives made a pledge to do ten things, which was called the Contract with America. The ten things were the conservatives were going to outlaw all abortions. No more abortion anywhere allowed. Even if you wanted to do it or not, no abortion. They were also going to change the tax rate so that rich people paid a lot less, and it was called the flat tax. They used to be a progressive tax where very rich people pay more taxes than poor people, but now they were going to say they pay the same rate, which meant a lot less taxes. So they were going to have a flat tax. I ask myself what does abortion have to do with the flat tax? Now the other thing that they pledged was that they would guarantee that every American could own any kind of guns they wanted including machine guns. That is, they would get rid of laws against gun control, controlling the ownership of guns. What does the flat tax and abortion have to do with the ownership of guns? And then they said, we are going to have tort reform. Let me explain what that means. It means in America, if a corporation does something irresponsible, like, suppose that it makes a car with a gas tank that will blow up under certain conditions, and it knows this and it doesn't care. And the gas tanks blew up and a certain number of people were killed. In America, it's possible for the relatives of those people to sue. They want to say that let's not allow that or at least allow not to have very high payments. That means very low payments for any suits of this sort. That's called the tort reform. That is to limit it to a very small amount of the payment for injury from irresponsible or evil corporations in law suits. What does that have to do with the flat tax, abortion, guns and so on, and so on? They had lots and lots of these different proposals. Now I couldn't figure out what they had to do with each other. So I said to myself that I believe exactly the opposite of each of these things. What do my beliefs have to do with each other? And I couldn't figure that out either. So then I said, "OK, I'm not going to worry about this."

I looked at another mystery. One of the big things going on in the electoral campaigns in 1992 and 1994 in America. The conservatives were arguing about what they called family values and they were talking about what traditional American families of a certain sort would believe and that was what the election was supposed to be about. I said why would family values matter in national elections with their issues of war and peace and atom bombs, pollution and global warming? Why family values? I discovered as I was looking at this. I remembered an old paper that one of my students had written about

metaphor. And the metaphor was that the nation is a family. After you understand large social groups in terms of smaller social groups, especially families and communities and so on. This is the metaphor that all Americans have. We speak of our founding fathers. When we have a war, we send our sons and daughters to wars and so on. Now and I assumed this is probably here in China as well. The nation is understood, at least in America, as a family. Now, if you have two different understandings of the nation, I reason, maybe you have two different kinds of families that are being understood. So what I did was that I took the politics, I set up the metaphor as a mapping and I mapped backwards. I'll claim two different models of the family. I'll call them the strict father family and nurturant parent. The strict father family goes with conservatism and the nurturant parent family goes with liberalism in politics. Most conservatives feel this is the ideal kind of family and most liberals claim the nurturants as the ideal kind of family.

So what I then did was work out the details, and in this book there are five hundred pages of details showing that every single proposal of the conservative or liberal kind is a consequence of these metaphors. Now we won't get a chance to go through it all today, but I want to give you a feel for this. In a strict father family, the father is the leader of the family, and it is assumed that the world is a difficult and dangerous place, that the world is competitive and always will be, that there is evil out there in the world and that children are born bad and have to be made good. You need a strict father to protect the family, to support the family, to compete with other people in the world successfully and to teach his children right from wrong. It is assumed that this is absolutely right and absolutely wrong and the strict father knows what's right and what's wrong. Furthermore, the only way that the strict father can teach his children what's right is to punish them when they do wrong and the punishment must be painful—it must hurt. The idea is that if you give them physical discipline when they are young, then they will get mental discipline, they will learn to do what's right and wrong, they will control themselves, discipline themselves and that's the only way they will become moral people, so that physical punishment is an act of love. So if you love your child, if you punish them physically when they do wrong, and there's a name for this, the word is tough love, which is an expression used by conservatives. Tough love.

Now here's another part of this: that discipline that you get from being punished physically when you do wrong, actually there are certain books which tell you how hard you should hit and what kind of sticks you can use and so on. That discipline is supposed to do something else for you, that is, if you are a disciplined person, and you pursue yourself interest, you can become wealthy and self-reliant, so there is a connection between prosperity and morality. If

you are disciplined enough, the assumption is that in America there is so much opportunity, you can make money, that all you need is to be disciplined to do it and then you will be able to become self-reliant and make enough money to take care of yourself. If you are not disciplined, then you won't be able to be moral and you won't be able to follow the rules and do what's right, and if you are not disciplined, you won't be able to make a living and you will be dependent on other people. So lack of discipline is seen therefore as immorality, and there's a link between poverty and immorality as there is a link between prosperity and morality. Now it's the further part of this model that by the time a child has reached the age of eighteen to twenty one, when they are adults, then the effect of the strict father is over and presumably the child can take care of themselves or not, and then they are out of the family. They have to go off on their own, take care of themselves, and if they can't take care of themselves, too bad. They are subject to the discipline of the world. That's tough love, too bad. And after that, the father cannot meddle in the life of the child. The father can no longer tell the child what to do. But if the child is on his own and has his own sense of morality and has it right, he doesn't need to be told by the father, so the father is just meddling in his life. Otherwise, the father can't do much good anyway. So the shouldn't meddle in the life of the child. That's the strict father model.

Now there is an interesting part of this model. It has a metaphorical version of capitalism built into it and it's a very interesting thing. It's a fundamental metaphor of capitalism that goes like this. If every body pursues their own profit, if everybody tries to make as much money as possible, then the profit of everybody will be maximized as a law of nature. That is the best for everybody if everybody just makes as much money as they can. That is Adam Smith's Law of the Invisible Hand. It says by this invisible hand, which means nature, everybody will make the maximum amount of money they can. Next is the basis for enterprise. Now this metaphor has a version in the strict father model of the family. It is if everybody seeks their own self interest, then the self-interest of everyone will be maximized by the invisible hand, by nature. That's why it's moral to pursue your self-interest. It says if you are disciplined and you act morally, pursuing your self-interest, you can become wealthy and self-reliant. Conservative theoreticians write about this. People who are writing about child raising talk about the world of capitalism in the strict father family. It is a major thing. This notion of free enterprise enters into the family in this way. So think about the politics that come out when you map this onto a nation. In America, during the period of Roosevelt, after the Great Depression, Roosevelt brought the country out of the depression by instituting what we call social programs. So for example, they had a national program to build parks or make

public buildings, to put people to work for the public good. They instated a program called social security where when you get paid, you put a certain amount of money aside into a government account and when you retire, you get at least that much back. That means when you are old, you won't be impoverished and you'll have money back. That's called social security. There is also medicare, where if you pay a certain amount dependent on your income, then when you are old or you retire, you can get all the free medical care you need. Those are social programs. Now there are also programs for people who are injured. So for example, suppose that you are in a wheelchair. There are social programs paid for by the government to teach you how to get around, use artificial limbs, maybe learn a trade, and get a job. These are social programs or there might be social programs to give medical help to poor children who can't afford doctors—that's what a social program is.

Now according to the strict father model as applied to politics, social programs are immoral because they give people things they have not earned. They give people things they have not earned and make them dependent. They take away discipline—that's what makes them immoral. So it is the goal of conservative politics to get rid of all government social programs, all of them. It turns out that the tax rate for the wealthy sort of goes up. If you are really, really wealthy, then they used to pay at a high tax rate. I mean if you were something like a billionaire, and you made a billion dollars a year, you might have to pay five hundred million dollars to the government to pay for social programs and keep five hundred million dollars. Now, that has been changed so that the billionaires now pay less—much less—and that has made America go into a deficit. America now has a deficit, and the reason is that George Bush cuts the taxes on very wealthy people. One reason he did that is that his friends and he himself are very wealthy persons, but also what you get is no money from social programs and you get rid of them all at once. So America is now in the midst of having the conservatives slowly get rid of social programs, lots and lots of them and the liberals are trying to stop that. Now what does the strict father model say about foreign policy? It says, well, America is like the father of the world, the most powerful nation, it is the moral authority of the family of nations and the third world countries are like children and they should just obey. Does the strict father ask their children what he should do? No, he tells them what to do. Should the US go to the United Nations and consult with all the nations of the world who are less powerful? No, that would be given up sovereignty, giving up the moral authority of the strict father. America should just decide what it's going to do and do it. Right? Decide what is right and do it and impose its moral vision on other people. That's what the conservatives want to do and that's where you get the war in Iraq and so on. So

that's a couple of things. There are hundreds of other consequences for politics for this.

Now what about the liberals? The nurturant … the nurturant parent family is a very different kind of family. It assumes children are born good and should be made better. And it assumes that the world can be made better and people should act to make the world better. It also assumes both parents are equal. They have equal responsibility. In addition, it assumes that the job of the parents is to nurture their children and to raise their children to nurture others. Nurturance means two things: empathy—you care about someone else, you feel what other people feel, you connect to them, so a parent has to hear those cries and know what those cries mean—and responsibility. A parent cannot be responsible if they cannot take care of themselves. They have to take care of themselves and also take care of their children. To be responsible, you have to be strong. It's not easy to raise a child and if you've raised children, you will know this. Those of you who haven't may soon find out; it is very hard to raise children. It requires responsibility. From empathy and responsibility, many things follow.

First, if you empathize with the child, you want to protect the child, so protection is a moral value. You are morally obligated to protect that child. Secondly, fulfillment in life is a concern. In America, you want your children to have a happy, fulfilled life, and if you are going to do that, you yourself should have a happy, fulfilled life, because people who are unhappy don't want other people to be happier than they are. So it is part of the strict father family that everybody in the family should have happy fulfilled lives. That should be a goal of the family.

Next, if you empathize with someone, a child, you want the child to be treated fairly. So fairness becomes a value. If you want the child to have a fulfilled life, the child must have enough freedom to do this. So freedom becomes a value. Now there is not much freedom if there is no opportunity to make a living. So allowing opportunity for as many people as possible becomes a value. There is no opportunity if you don't have prosperity. So building prosperity, living in a good economy for everyone can prosper, no matter who they are, becomes a value. You can't do that unless you build community unless people are cooperating in that community, so building communities and cooperation are a value. You are not going to get cooperation in America unless people trust you. America works on trust. The entire country works on trust—it is the only thing that makes American business go, and when there isn't trust, the whole thing collapses. But trust is required and that's one of these values. You don't trust someone unless they are honest. So honesty becomes a value. And you don't trust someone unless you can communicate with them. And if

you can talk back and forth, open communication is a value. Those are the liberal values and every liberal program that is proposed politically is an instance of one or more of those values. So in foreign policy, you would allow America to care about other people in the world if you are liberal and that calls for global cooperation and consultation with people. It requires treaties and the use of diplomacy rather than war. In social policy, you want to help people who need help. Liberals want to help people who are poor, who are impoverished, people who are injured, who are quadriplegic, people who can't afford an education, and so on—those who want social programs.

So you have two completely opposite views of politics in America that come out of these metaphors. Now these are very deep, and they are usually unconscious. I've written a book to try to make them conscious, but they are unconscious. Once you have these deep metaphors, they structure metaphors for every other area of life, for every other policy, for education, for how you should conduct foreign policy, for how you should run an economy, and so on. There are lots of other metaphors that go with this. For example, there is a metaphor about what I call free markets. It says a market is a force of nature. And that under nature, people should freely just sell goods in any way they can. That's a conservative metaphor. It fits the strict father model. It doesn't fit the nurturant parent model because it can hurt people. It isn't fair because what happens in the free market is the richer you are, the more you can control the market, and therefore you don't have a fair market. So liberals want fair markets in which wealthy corporations are limited in their ability to control the market. And conservatives want free markets allowing rich people to get as rich as they can be, because being wealthy is like being a good person and so on. So, for example, I give you one nice linguistic example. What does it have to do with linguistics? On the day that George Bush took office, certain press releases started coming out of the White House. There is a writer named Kerry Hughes. He started using the term tax relief. He had a tax relief proposal which was to cut taxes for the rich. He called this tax relief.

Now, think about this from the point of view of metaphor and frame semantics. If you have the word relief, you are a cognitive linguist, you see the word relief, What does that tell you? There is a frame. In that frame, there is some affliction, something that hurts somebody. There is an afflicted party. Somebody is harmed by that affliction, so that somebody is hurt and somebody is being hurt by it. There is a reliever who takes the harm of this affliction away, and he is a hero. If someone else comes to try to stop him, they are villains, they are bad guys, because they are trying keeping somebody from being relieved of this affliction. So that's what the word relief says. You add the word tax and you get a metaphor—taxation is an affliction. It harms people. You can see

taxation in a different way as an investment in society, as helping people who need help and so on. But in this metaphor, taxation is an affliction. One of the things that Bush constantly talks about is tax relief, because that fits the strict father model. So tax relief is a metaphor and it's a kind of surface metaphor, but the deep metaphor is that the nation is a family, a strict father family. That's the deep metaphor that governs all of the surface metaphors. So the point of this is that politics and morality can be governed by deep metaphors that determine how you understand the world, how you understand every part of it. And then the surface metaphors fit onto the deep metaphors. The deep metaphors allow you to make sense of the others. And that's what is important. And in American politics, that's why liberals and conservatives can't understand each other when they talk. They talk past each other, because they have two other utterly different deep metaphors.

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LECTURE 6

The Neural Theory of Language

This is going to be a very difficult lecture. I usually never use PowerPoint, but this is necessary, as you will see. So I apologize for the PowerPoint. I've talked a little bit about neural science as we go along. I want to give you some ideas of what it means for language to be embodied from the point of view of the brain. We've also talked about embodiment from another point of view, the point of view of interactions in the world, social interactions, and so on.

So, one of the questions we had earlier had to do with Mark Johnson's discussion of embodiment of image schemas in terms of functioning in the world with your body, and that's correct, that is part of that embodiment. We also talked about Terry Regier's study of image schemas and its embodiment in the brain. These are not two different notions of embodiment. They are the same, but that is not obvious.

So what I'm going to do today is tell you why they are the same in detail. I want to do a few more things. I want to talk about what it means to have a concept. What mental simulation is, what it means to have a theory of mental simulation and how this gives rise to a theory of meaning, and how a theory of meaning that is embodied could also be about the world. Those are important questions that I want to go through. I also want to talk about the semantics of grammar, kinds of conceptual grammar, and how one can get a theory of what those concepts are.

So, this is a paper done jointly with Vittorio Gallese of the University of Parma in Italy. He is one of the discoverers of mirror neurons, which I'll discuss in a while, and all the neural science data is from his research group, along with professor Rizzolatti in Parma. So I did not do neural science, I'm a linguist. I have worked with him and we've worked on this together. What we found in going through his data is that there are a lot of phenomena that were never written up in the scientific journals because they did not know what they meant. What we are going to do is go through them here and show what some of these things mean for linguistics.

This is the Neural Theory of Language Group at Berkeley, by Jerry Feldman, Srini Narayanan, Lokendra Shastri, and Nancy Chang. There are certain assumptions about concepts that just about everyone accepts, maybe one or two people don't, but most people accept them. One is that concepts are the elements of reason, that if you are reasoning, reasoning is a complex process and concepts are the elements of reason.

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Also, concepts agree to constitute the meanings of words and linguistic expressions. Now, there is a traditional theory of concepts, and that traditional theory we will see doesn't work, but here it is. The traditional theory says that reason and language are what distinguish human beings from other animals, and concepts, which are the elements of reason, therefore only use human-specific brain mechanisms, that is the brain mechanisms that people have that other animals do not. That reason therefore is separate from perception and action, since animals have perception and action, and reason does not make direct use of the sensory-motor system, since animals have a sensory-motor system, they can see and hear and move and so on. So, concepts are disembodied in this sense, that is, they do not have to do with perception and action in the world in the traditional theory. That's what that says.

Now, we claim something very different—that human concepts are embodied, that many concepts make direct use of the sensory-motor capacities of our body-brain system. We will say exactly what that means in a while, that many of these capacities are also represented in human primates, that is, in monkeys. One example, the concept of grasping, will be discussed in detail. We will take that example because it has been studied extensively. This has been studied extensively in monkeys.

We are going to talk about what we call amodality. The traditional theory implicitly claims that even action concepts like grasp did not make use of the sensory-motor system. As a concept, according to the traditional theory, "grasp" must be disembodied. Thus the traditional theory claims that the concept grasp is amodal. Modality requires something like vision or action or hearing or smell, those are modalities. The claim is that concepts have nothing to do with the bodily modalities: vision, action, smell, moving your body, and so on—they are amodal. Since the concept 'grasp' is a concept, it therefore must be modality free even if the concept designates an action doing this, even if it designates an action in a specific modality, namely, using the hand. That is the traditional claim. Now, there are certain properties that concepts are generally agreed to have. Not everyone agrees on this but almost everyone does.

One, they are universal in the following sense. They characterize all particular instances. So, for example, the concept of "grasping" is the same no matter who the agent is, what the patient is, or how the grasping is done. That is what it means by universal. It is a general concept for "grasping" that works for all the kinds of grasping. No matter who the agent is or what the patient is or how it is done, that's what universality means.

Secondly, the concept is stable. It means that it doesn't change from day to day. The concepts are stable, all concepts are stable, they don't change. The

concept of grasping is not going to be different tomorrow than it is today. Secondly, concepts are internally structured. So, we know, for example, that grasping has a structure to it. You start out by opening your hand, reaching for something, closing your hand, and so on. So, concepts are internally structured. They are compositional. Compositional means you can fit them together. For example, take the concept of "a bottle" and the concept of "grasping," you can fit them together to get a concept of "grasping a bottle." This gives rise to inferences. For example, if I've grasped, the bottle, then I've reached for the bottle; if I haven't reached for the bottle, then I haven't grasped the bottle. Ok? Simple inferences. There are relations among concepts. They may be related by hyponymy, antonymy, etc. So, for example, the concept of grasping is more general than the concept of grasping with a full hand or grasping with the finger or grasping with the mouth. There is a hierarchy. That is what hyponyms are about. Concepts are meaningful, that is, they have meaning. They are not just random symbols or something like that. Concepts have to mean something and concepts are independent of the words used to express them, and that's very important. Why? Because different languages can express the same concepts in different words, and the words can change over time. So, those are the general properties. Now, concepts can be either concrete, that is, a sensory-motor concept like "grasp" or "abstract" non-sensory-motor concept like "grasping an idea" which means understanding an idea. That is an abstract, not concrete use—not a sensory-motor concept. So you have both kinds.

What we are going to do in this talk is introduce some basic ideas for making sense of concepts from the neural science. Instead of perception—hearing or use of the body—we are going to talk about multimodality, where you have multiple uses of your sensory-motor system, of grasping, using the body and perceiving and hearing and yelling feedback from touch and so on. We are going to talk about the idea of functional clusters. These are high level notions and they function as conceptual units. I'll explain later what each of these are. We'll talk about the idea of simulation—this is going to be necessary for meaningfulness and contextual inference. Then we are going to talk about the idea of parameters, that is, the parameters that govern semantic simulations, simulations of what you doing, and how you are understanding it. They characterize inference and they link to language. So, those are the ideas that we are going to be going through shortly.

Lets begin with multimodality first. The action of grasping is not amodal. That is, it's not that the action as opposed to the concept. The action is multimodal because I can both do it and see it. So I'm using both the motor modality and the visual modality. So it is multi-modal. And we are going to argue that that allows for universality. We don't know it yet, but you'll see it.

We also have functional clusters; these form higher-level units. We'll talk about what they are and what they mean. They are clusters of neurons. They have an internal relational structure required by concepts, so we are going to show that. I'm going to show that there are two types: local clusters and network clusters. You will see what those mean as we go along. Multi-modality is realized in the brain through network clusters, and these are in the brain's parallel networks between the parietal and premotor cortexes. There are connections between them and we will see that leads to multimodality. Network clusters are formed by interconnected local clusters of neurons and these are canonical and mirror neurons, and we will see what they are momentarily.

To understand this simulation, to get the meaning of grasp, we must at least be able to imagine ourselves or someone else grasping an object. Now this is very important. Let's stop for a minute and think about the theory of meaning. What does it take to understand the meaning of the word grasp? You have to at least be able to imagine yourself or someone else grasping something. If you can not even imagine anyone grasping anything, if you can't imagine it, you do not understand the concept of "grasp." So that's the point. We are going to base the theory of meaning on the theory of imagination and we are going to claim that imagination is done by neural simulation, and I'll explain exactly what that is. The conceptualization of grasping, that grasping is an action and we make it into a concept that we can reason it out and have a language. The conceptualization of grasping via simulation therefore requires the use of the same functional clusters in the action and perception of grasping, and we will see this momentarily.

Now, all of this is based on a set of results in neural science. We know that there are visual imagination uses in the same neural substrate as vision. Let me explain what that means. There is a part of the brain that is active when you actually see something. If I see, I'm looking at this bottle, part of my primary visual cortex is active, other parts of the visual system are active, too. Now, if you say, imagine that you can see that bottle, imagine that you're looking at that bottle, some of the same neural system is active, that is, imagining seeing uses the same neural system as actually seeing. The same is true for movement. If I go to pick up the bottle, a certain part of my brain in the motor system is active. If I then imagine picking up the bottle, some of the same parts are active. How do we know this? We know this via FMRI research, that is, we study what is actually going on in the brain. Now, since you can understand a concrete concept like grasping, only if you can imagine doing it or observing it, the capacity for mental simulation, or the capacity for imagining it, for carrying it out in your head, is taken as the basis for meaningfulness. So, we're going

to say that a concept is meaningful only if you could actually imagine doing it—simulating it. Thus action and observation together provide the basis for meaningfulness in the neural theory of language. So this is where we are going.

Now, in order to do this at all, we need a very important concept, the concept of a neural parameter, which is very different from the concept of the grammatical parameter. All actions, perceptions, and simulations make use of parameters and their values, and neural parameterization is pervasive, and I'll tell you what they are. The action of reaching for an object, suppose I'm reaching for this bottle, making use of the parameter of direction, so one part of reaching is direction. Parameters like a part of dimension—a feature. One parameter is direction. It also makes use of the parameter of force. If I'm reaching for something, I can do it very gently or I can do it forcefully or with medium force. Those are parameters, and they are governed in actions by certain clusters of neurons in the neural system, and that has been discovered—it is part of what we know about neural science.

The same parameter values that characterize the internal structure of actions and simulations of actions also characterize the internal structure of action concepts. That's the crucial part of this. We are going to claim that if we look at the parameters that characterize acting and perceiving, we are going to see that those same parameters—the same clusters of neurons are characterizing the internal structure of the concept as well as the action and the perception. That is the basic claim that we are going to be making.

Now, let me stop for a minute and talk about the neural theory of language. That is going to be crucial in all of this. That theory uses computational modeling mechanisms. It uses what is called structural connectionism, not PDP connectionism. Let me explain the difference very briefly. PDP connectionism, parallel distributed processing connectionism, is a model in which you have various layers of neurons which are connected to each other in all kinds of ways. Then you put constraints on it, that is, you give it an input and if it makes a mistake, one of the things it does is they categorize something as being, let's say, grasping or not grasping; or a word, if it is a word "bat" or not the word "bat." Now, you put in something like the word "bat" and you say it is bat or not, it may make a mistake. You put in the word "cat" and you may say is it "cat" or "bat" or not, and well, you'd get it right or make a mistake, and you can feedback the equivalent of the answer through the system, the neural system, it's the way mathematically to do this. What that does is you could learn all kinds of information in this bunch of neurons. Because everything is connected to everything else, you get lots of interference between the concepts and circuits like this cannot control motor action, cannot do vision, cannot do

language, and so on—for most linguistic tasks. There are some tasks where people claim they might be able to do something in language, but for most they cannot.

Structural connectionism has to do with the actual kinds of structures that you find in your brains. The PDP structures are very rarely found in brains. There are some parts of the brain where you have things like this but most parts you do not. Structural connectionism takes the neural structures and what it does is make mathematical models of them. So, it says if you have a neuron and it fires, let's call that firing value the amount of, let's say, chemicals going down the axon. Let's give that a number. You have maybe a thousand inputs to that neuron, each with a certain amount of chemical, let's give them numbers, and there are multiplier effects in the synapses, so let's multiply those by other numbers, add them up, and if you get enough, it fires and goes down and it goes to the next neuron. So with models like that, you can make mathematical models of neural firing: neuron by neuron by neuron, spreading out in spreading activation for each neuron spreads to a thousand others and gets a thousand inputs, and models like that have been constructed, and one of the things that people do in our group, is then model how such systems work.

Now, that doesn't mean that we have made a full model of the brain or anything like that. What we tend to do is to make higher-level models of clusters of neurons and we will talk about those. These are called localist models, and in them the units are not individual neurons but whole clusters. We will talk about clusters momentarily.

Now, localism allows the neural theory to characterize precise computations, that is to say exactly what each neuron is doing as they did in actions and inferences, not what each neuron but what each cluster is doing. Because it uses functional clusters, it is not subject to a certain objection called the grandmother cell objection. So let me tell you about the grandmother cell objection. There was an earlier theory in which you have structured connectionism one neuron at a time, and people said that's ridiculous for language, because neurons die. Imagine the neuron for your grandmother: if the neuron for your grandmother would die, you would no longer know who you grandmother was. That just doesn't happen. Right? So that's silly. But however, if you have clusters of neurons between ten and a hundred and fifty neurons for each concept and those have been discovered, then if one dies, you still got a hundred and forty nine left. They do the same job. So that's not a problem with this kind of system.

Now, the advantages of structure connectionism are these. Structure connectionism operates on structures of the sort found in real brains. From the structure connectionism perspective, the inferential structure of concepts is

the consequence of the network structure of the brain and is organizational in terms of functional clusters. Let me say that again. The inferential structure of a concept, the way we can reason with concepts, the possible forms of reasoning, follow from the network structure of the brain, the way that the neurons are set up in clusters. That's what we will be arguing. That's what the theory says.

Now, structured connectionism comes with various mechanisms. One is a dynamic, that is, it operates over time, a dynamic simulation mechanism that adapts parameter values to situations. So in a given situation you might be picking up this bottle with a small force or a large force or you might be doing it in this direction or in that direction. So it allows you to adapt the situations. It is a neural binding theory. What is neural binding? Neural binding, in the traditional sense, has to do with, when two things occur in different parts of the brain, there is a mechanism for identifying them and having them be understood as the same entity. For example, suppose you look at a blue chair, now there is part of the brain that computes color, and a completely different part of the brain that computes the structure of a chair, the image of a chair. So, somehow when you see a blue chair, you have something in one part your brain doing the color blue, and another part of the brain saying this is a metal image of a chair and it fits that. You have to be able to link them up, so there is a single object of blue chair. It's not blueness separated from chairness, it's a single thing. The name for this process is neural binding, and there are certain theories of how it works. Right now the most prominent theory is that when the blueness and the chairness are firing in sequencing together, then you understand that as being the same object. We do not know that this is true. It is the best current theory we know that such things do occur, but we don't know that it is the right theory. It could be a different way. There could be some other mechanism, but there are some mechanisms for binding. We know the properties for binding, but we are not sure of the exact mechanism.

So what we have is a model for binding that assumes that you have simultaneous firing. If that's wrong, we could construct a different model to try to fit those other facts. We also have spreading activation throughout the network with what is called a probabilistic inference mechanism. Here is how that works. Probabilistic means that the values are between one and zero. It's not just firing and not firing. If you have a cluster of neurons, let's suppose you have a hundred clusters, a hundred neurons in there, maybe only eighty of them are firing and twenty of them are not. So that's the case we have them, say, firing 0.8 out of 1. So if 85% are firing, is 0.85. But the amount of firing is probabilistic in that the values between 0 and 1, and the model has a probabilistic computational mechanism for putting probabilities together to get new ones.

So together, all of these mechanisms equate to a lot of work. That's what these guys are doing at the Computer Science Institute. These jointly allow for the modeling of both sensory-motor simulations and inference. Ok, those are the mechanisms that are used.

In the neural theory of, now by the way, you don't have to worry about this because there are other people doing this work. At least I don't have to worry about this, because there are very smart people working on it. There are also fixed structures we call schemas, or sometimes frames. Image schemas and frames are both schemas. A schema that structures an action has an internal structure that consists, just as frames do, of roles, parameters, and phases. A role, the agent—me, the patient —the bottle, the action—grasping, or maybe other sub-actions like reaching, opening the hand, closing the hand, tightening the hand, lifting the arm, moving it—those are roles. Phases: in the first phase, you open the hand and reach out; in the second phase, you grasp, which means you close your hand around and tighten it, then you might, third phase, lift it and use it in some way. Those are phases. The parameters are force, direction, and various other parameters. Now, that's what a schema is. That's how we characterize the structure of frames.

The ideas of Multimodality, Functional Clusters, Simulations, and Parameters are going to allow us to link the neural theory of structural connectionism to neuroscience. We are trying to link the actual neural modeling of the computation to what the neural scientists are found—and I will show you how to do it.

Let's look at the neuroscience evidence. In the sensory-motor system, the neuroscience evidence allows us to characterize these aspects of concepts: universality; semantic role structure; aspectual structure, what is called aspectual linguistics. It is the phases of an action and parameter structure. Here is how it works in grasping. We are going to say that universality is achieved by multimodality. That is when multimodal functional clusters are in action, like grasping, fire, when grasping is performed, observed, imagined, inferred, or heard, any of those things, when that happens, we are going to say that there are certain neural clusters that are firing. The grasping can be of any type, done by any agent, on any object, in any manner, and in any location. When this happens, you get universality. So, if you can show that there is multimodality for some functional cluster, then we are also showing that that functional cluster can play the conceptual role of universality for the given concept.

So, in addition, there is multimodal integration. There is also the premotor cortex as a whole. If I perform an action, like lifting up this bottle and grasping it, two different parts of the brain are active, at least. One is the motor cortex

up here, where neurons that fire control individual movements, for example, this and this, opening and closing the elbow, opening and closing the hand, turning individual movements, moving the arm forward, moving the arm up, moving the arm down. These are the kinds of movements controlled by the motor cortex. Very simple. The motor cortex does not allow for the integrated movement for a choreography. Think of the brain as a choreographer telling each of the individual neurons here how to perform a dance. First you've got to move your hand out, you got to do this, and you got to do that. The choreographer is the premotor cortex. It has connections to the motor cortex, and what it does is, say, first do this and then do this, then do this, then do this, and so on. It tells you what to do and when, and how much force they have and the parameters they have. The way it does it is as follows. There is a circuit with neurons connected to each other that fires in sequence, connecting all of these neurons in the motor cortex, and if one fires it says "move your arm like that"; the next one fires and it says "move it forward"; the next one fires and says "go like that"; the next one fires and says "tighten it"; the next one fires and says "lift this." Now, how does it say it? It says it because the neurons have connections to the part of brain here that do all of these things. So when the first one fires, there's a connection to the motor cortex that says, "Ah, it is connected to this thing, go do that"; the next one fires, "It's connected to this thing, go do that"; the next one fires, "it's connected to another thing that activates the part that does that. That's the mechanism. This mechanism was first modeled by Srini Narayanan, the same guy who did the neural theory of metaphor in his thesis. They are related work.

It turns out that the circuits that do this characterize the phases of actions. What comes first, second, third, and they also characterize aspect in natural language. That is, what is aspect about. It says some actions iterate. It's a loop. So you can type and type and type; other actions like walking, go on and on and on … there is no final state. Things that have a final state, like jumping, you jump and it's over, and so on. That is, these circuits may have end points and they may not have end points, they may have loops. And then they indicate purpose. How does a circuit indicate purpose? It has a test for whether the purpose has been carried out. For example, here the purpose is having this thing in your hand and being able to control it. That is your purpose. So at each point you check, do I have it in my hand? No. Do I have it in my hand? No. Do I have it in my hand? Well, yes, but I can't control it. Do I have it in my hand and can I control it? Yes. When that condition is met, then the purpose is met. So, that is the idea behind this whole system, and it's completely worked out. It's not only been programmed, it's been programmed in thorough detail

and there's a new programming system that has been invented to do it and so on.

Ok, now, so that's the modeling part of this. The premotor cortex that choreographs these things is not a uniform field, meaning it is not the case that every neuron in there does the same kind of thing. There are functionally distinct areas that do different things, and each of the premotor areas is reciprocally connected, that means, connected both ways, with distinct regions of the posterior, back here, parietal cortex. So this is connected to this in three different ways. The premotor cortex is part of a series of parallel functional networks.

Now, let's go on to multimotor integration. The cortical premotor areas are endowed with sensory properties, and that's very interesting. Because you have connections between the parietal cortex, the parietal cortex gets sensory information—information from the eyes, from the ears, from touch, and so on, has sensory information, right? If there are connections both ways between the motor, premotor cortex, and the parietal cortex, then, neurons in the premotor cortex are going to get information from the parietal cortex. They are going to have sensory properties and respond to visual somatosensory and auditory stimuli as well as choreographing actions. So, these parietal areas which are traditionally considered to process presensory information also get information from the motor areas because the connections are going both ways. So, if you are doing something, there is also information going to what you can see, what you can hear, and so on, what you can touch, the information about touch. So, you get information going both ways. What that means is you are integrating various modalities, you are integrating movement with seeing, hearing, and touching. Therefore, look at the various parts of the premotor cortex and isolate all its different functional regions. They work somewhat differently.

Now, here are the various parietal networks from various points of view. These are networks that go like this, and so on, because you could see with these neurons what they are and where they are. And now, we're going to go through them one by one. In area F5, there are three classes of neurons that have been found in monkeys. With the monkeys, they actually take off the monkey's skull and they probe and they find these things. There are general purpose motor neurons, and then there are visual motor neurons which are called canonical and mirror neurons.

So, let's start with the general purpose neurons. There are three types that that group has found for the monkey: grasping neurons, holding neurons, and manipulating neurons. The kind of task they gave the monkey is grasping an

object. You know whatever kind of object it is—a banana, a ring, something like that. Manipulating the object, getting a peanut and twisting it, and holding an object, getting something like this and holding onto it. And they train the monkey to do each of these three things and then they feed it if it does it right and so on, and train it for a long time and then they get it to do this. Now, in F5, let's look what's going on here. These drawings are what are called histograms. They show the firing of individual neurons. So, you have a neuron and you can see that it is firing right here. This line in the middle is where it's doing the thing that you are interested in. So, here is one firing pattern, and here is another firing pattern and so on. Here is a firing pattern when the monkey, for this particular neuron, here is one particular neuron, grasps something with its mouth, goes and picks it up with its mouth. The neuron fires in the premotor cortex. Here is where it grasps with the controlateral hand, that is the left hand. The same neuron is firing. The amount of firing and whether it's exactly the same doesn't matter much. It's the sort of regular, it's the approximate amount that matters. Here is the ipsilateral hand, the same hand, namely the right hand, and it's firing there. That is, this neuron fires only when the monkey grasps and it doesn't matter how. It can do it with its mouth or either hand. This is for a general grasping of any kind, at the level of individual neurons, and there's a group of neurons, maybe fifty to a hundred or something like that, I don't have the actual numbers here, but there is a whole bunch of them that work just like this.

Now, think about it. That is kind of interesting, because it's firing for grasping any kind at all, but what it is actually doing is something different with its mouth and with its arms. So, what do we know from general purpose neurons; what do they achieve in theories of concepts; partially universality, their firing correlates with a goal-oriented action of a general type, regardless of effectors, that is arm or mouth or manner, that's how you do it. That's whether you do it like this or like that.

Now, in regards to goal-oriented movements, it turns out that this firing only occurs if the animal actually gets the object. If it just moves its hands like this, nothing happens with the neuron. The neuron doesn't fire just for moving like this or movements with the mouth, it actually has to get the object—it says it has achieved the goal.

Now, let's look at another part of F5, F5c, and its connection to the PF part of the parietal cortex. There you have circuits that contain what are called mirror neurons. Now, mirror neurons are extremely important. This is a big deal for many reasons. Here's where we have to pay attention! If you don't remember any thing from this lecture about mirror neurons, remember mirror neurons.

Mirror neurons fire, discharge, they fire, when either the monkey performs one of the number of actions like grasping or holding or twisting the peanut or when the monkey sees another individual, another monkey or the experimenter doing the same action. Monkey see, monkey do. It is because there is a connection between the motor parts, the premotor part that controls action, and the parietal cortex that controls vision, because the connections go both ways. Over the monkey's lifetime, these neurons have been tuned, the connections have been tuned in such a way that they fire when either the monkey sees someone else do the action or the monkey does the action.

Now this has also been found in human beings. So, let me stop for a minute with this story and tell a little story why this is incredibly important. This is the basis for us for imitation, for learning how to do something by seeing something. You go and study marshal arts and the master says, "look at me do this" and you go and do this. Right? The master says "do this" and you go and do this. Not so easy the first time, but you have to practice.

Now, the idea is, because of the mirror neurons this is possible. Secondly, it has to do with being able to tell what someone else is emotionally feeling. When you have a certain emotion, it can show in you body, so if you are angry, you can see it in people's faces. People are happy, right? People are depressed, right? In many cases, you can see that because the muscles in the face and body reflect what someone is feeling. So, if you can see what someone else's muscles are doing, and if that connects to your muscles, to the neurons that control your muscles, you don't have to be doing the same thing—although little children often do. You don't have to be doing the same thing, but that is going to be connected to your emotional system. That is the physiology of emotions, so you will be able to feel what someone else feels, sort of do a kind of mind reading, and this makes that possible. The name for this is empathy. The mirror neurons provide for empathy and they exist in both monkeys and people, which means we evolved to have empathy with other beings. Evolution allowed us to connect with other people and to have empathy for them, and that is an extremely important thing to know, because traditional theories of evolution said we only evolve to pursue our own goals, to achieve our own purposes for self interest, and that's not true. We evolved naturally to connect with other people and to have empathy. That is a very important part of human nature. So that's where this eventually will go in terms of moral theory. This changes all of moral theory.

Now, let's get back to the circuit, which gives rise to these mirror neurons. Here is where the mirror neurons are, and let me show you how they work and the evidence for them. We have the firing when the monkey sees the

experimenter picking up something, grasping something and then, over here you have the firing when the monkey does it himself, and you see the same firing. Now, if you see the same neuron firing in the monkey grasping something, but if the experimenter takes an instrument like a pair of pliers, not his hands and grasps the entity, there is no firing, because it is not the same action even though the same effect has been carried out. So you got to really do it with your hand. This is very important. Here is what happens in the dark. The monkey can't see anything but when it does it in the dark, the same neuron fires. So what you have here. These are other similar cases where the monkey is doing something else. If the monkey is doing another action, some other thing, not just picking something up, but doing some totally different action, no firing.

Now, that is an over simplified story. Here is the complicated story. 30% of the neurons work like that. That is, the neurons fire only when you have exactly the same actions going on. But there is what is called category loosening and that is really interesting. And let me escape for a minute and get exactly what's here. In A and B, you have observed grasping. The monkey is seeing, here is the neuron, there the monkey is seeing some grasping, and here is the grasping with a precision grip like that; here is the grasping with the whole hand. Here in C, you get the precision grip. The monkey … you get a firing with the precision grip when he sees or observe somebody else doing this. But when the monkey sees somebody else doing this grip, nothing happens. Right? Over here, the monkey does either grip, it fires. Monkey sees this one, it fires; he sees the other one, nothing happens. Now, this is wild and interesting. Why?

This is a special case of grasping. These are two special cases. That neuron fires when the monkey does any kind of grasping, but when he sees only one kind of grasping; there is another set of neurons that do the reverse. When the monkey sees one kind of grasping, while it's the prototypical grasping from the monkey, this is the prototype for the monkeys, but when he does, only one. So, what that means is that the sub-case, the sub-category of precision grasping, is linked in these neurons to the general notion of grasping, that is—the same hierarchical structure in semantics. Linking the general kind of grasping to the special case is present at the single neuron level. That is pretty wild. If you think about it, we have a hierarchy of concepts, right? More general, more specific. That is replicated at the single neuron level, neuron by neuron. It's the set of neurons that just do that. To me, this is astonishing. When they first found that they didn't publish it because they had no idea what it meant. They needed to talk to a linguist.

With the precision grip, PG is for this grip here. Look, when the experimenter grasps the object. This is at the grasping. You also get a firing when

you release the object. Right? That is, there is a neuron that fires in phases. It computes the aspect of grasping, the central part and the final part. There is other neurons which fire in the beginning parts where you are going to. That is, there are neurons that fire, controlling the phases of the action, and you can find them one by one.

Here, the experimenter grasps and releases the objects with the right hand. This is the left hand, same thing. Now, this is an interesting case. Here the experimenter grasps with a whole hand (WH), and releases it with the left hand, and notice that you are getting firing at the end, but not much. This is mainly for the right hand. Here you get the monkey grasping the object with the right hand—in this neuron and you get nothing there. That is, you can both fire with releasing the object, so if here is a neuron that fires when the experimenter is going through a phase, but only when the monkey is doing the central action. So, it's linking my central action with all your phases.

Here the experimenter presents the object with the left hand. Nothing happens when the experimenter just presents the object. It's not grasping, so no firing. Here, when the monkey grasps with the whole hand. This is with this grip. This is the whole hand. So when the monkey is grasping, this is for any kind of grasping you will get firing here. But, with observation, with either of the graspings, you get aspect. You will get at two stages: here and release. So, there is a link between the central concept of grasping and the whole structure, the phases of grasping. This is kind of nice in this experiment. What you see in A is a full vision. The monkey can see the experimenter grasping the block and you see the firing. Over here, in B, the monkey is grasping, I'm sorry, the experimenter is reaching over here. The monkey, let's see what's going on there. It's hidden, but the experimenter has begun the action and then goes and grasps it, and during the phase in which it would be carried out, it's done.

This is the monkey, the monkey is going and going like this, and you get firing over here, and you get the firing when this is carried out, When the purpose is done. So, this is for purposeful grasping, that is, when the purpose is carried out. Even if the monkey can't seize it with its own hand, if it is carried out, done, firing. If it is just this, no firing in either case. So, you have to get the purpose.

So, like humans, monkeys can infer the goal of an action even when the visual is missing—you can infer the action. Now, these are the cases where there is sound. What you'll find here is that there are certain things like when you break a peanut, you can hear it, or you grasp a certain kind of ring, you can hear the metal, and so on. And here you have the firing. Here are two different neurons—three and four. Here is the firing. Let's first look at Three: vision and

sound. The monkey can both see and hear, no problem. Here the monkey can see, but no sound, so you get firing again.

Here the monkey can't see it, but can hear the sound, so as soon as the sound comes, as soon as it hears the sound and the action, then you get this neuron firing, but not because you can see it and so on. So, what's interesting here is the firing anticipates the action. It's anticipatory when he sees it. He says that he is going to break that peanut, so it's going to start the fire. But with sound you can't see it, there is no anticipation, no firing. So, that says anticipation of an action is built into its neurons. And this is what the actual motor neuron does. This is when you are actually doing it. That's what's happening.

The same sort of thing goes on here. This thing is with peanut breaking and paper ripping and so on. Vision and sound, you get this with peanut breaking. If you only have vision and no sound, this neuron is not firing. If you have just sound, it's firing, and you have motor neurons. So this neuron is tuned to both, doing and hearing, but not seeing. So to give you some sense of the richness of what's in the brain, this is an interesting case. Here you have in the blue: food action, hand action, mouth action. This is with a human being, and it turns out that there are two cases. One where some body's in the FMRI, and they are asked to either perform an action with mimicking, that is, they pretend that they are kicking an object, but there is no object there—do this but there is no object. Assume that you are grasping, here in the yellow, but have no object. So you see that happening. Assume that you are grasping something with your mouth, you are biting, here, but no apple. Here they give him an object, and what you see is that a region in the parietal cortex parallel to where the activation is for foot, hand, and mouth is done. And this could be done with the same object like the apple. So the activity for understanding and representing an object in the brain depends upon what you're doing with it. This is a very interesting part.

Now, how do mirror neurons work? Is this magic? No, it's not magic. They work by simulation. When the subject—the monkey or you, observes another individual doing an action, like grasping, the subject, we claim, is simulating the same action, that is, the subject's brain is carrying out what he sees. I see you going to lift that and I'm carrying out automatically because my parietal cortex is getting the visual information. It's connected to the motor cortex, which can imagine using the same neurons, carrying this out. I see this. I'm imagining what you are doing unconsciously. I may not know it, but my brain is imagining what you are doing and what you are going to do. That is why you get the idea of starting to see the peanut twisted and you see the activation, but if it is just hearing, you can't see it, there is no activation. So, the

idea is that when you see something happening, normally, you understand it. If I see someone picking this up, I can understand it because I can do it, and when I see it because the connections in my brain simulating doing it. That is what the understanding is, and that's the basis of the theory of meaning. That is the basis of what is called simulation semantics. That is why we've gone through all of this, to show you what a neural theory of meaning is. What is going on here is: since the subject observes another individual doing action, the subject is simulating the same action, and since action and simulation use the same neural substrate, that would explain why the same neurons are firing during action observation and during action execution.

Now, what do we know from mirror neurons? We get partial universality because they code an action regardless of agent, patient, modality, that is, you get partial role structure. They code an agent and a purpose role. If you think about it, these neurons, when they see something, when you see something, they have someone else, some other agent doing something. They also fire when you do it. The same neurons are therefore identifying you with the other agent, right? What they do, in order to do that, is they are picking out an agent role—a grasper role. So, these neurons have the function of picking out a grasper—of separating. Think of it this way. They separate the dancer from the dance. You know the line from Yeats, how can you tell the dancer from the dance? You have a brain and mirror neurons and that's how. That is because you can feel yourself dance and you can identify yourself with the dancer, you are separating out the dancer from the dance, and the grasper from the grasping. Also, they distinguish purposeful action where you actually get the object from just moving your hands. So they distinguish a role of purpose from nonpurposeful action.

Now, so they also achieve category tightening and loosening, that is, hierarchical structure, and some limited prototype structures. This is a prototype of "grasping." You find out that this occurs as a prototype in some of these neurons. Now, here is where that circuitry is. Here is the next group. We are going to F5ab, the next circuit. This links the premotor area at F5ab to the parietal area AIP. These are interesting things. These are called canonical neurons. Let me try to give you a feel for what these neurons do. These neurons fire when you are either performing an action on an object or you see the object you could perform it on. I can do it if I see the bottle or I grasp the bottle, the same neurons are firing. Now, that's fairly wild. It transforms intrinsic physical features of objects, shapes and size, the things that you can grasp, into hand motor programs requiring us to act on them. The things that are looked at are manipulating objects, grasping, holding, and tearing apart. So these are canonical neurons. They are located along this ridge.

Here is how this works. You have the monkey grasping a ring, and this neuron fires, but it's grasping a plate, a cube, a cone, a sphere, a cylinder, nothing. Here you may get a little bit firing because of the similarity of shape with a ring, but not much. Here, you have a similar case, again, firing with the ring, but not all of these things. This has to do with what happens in the dark.

So, how do the canonical neurons work? Again, by simulation. The sight of a graspable object triggers the simulation of grasping. The reason for that is that you have connections between the parietal cortex and F5, but they are different connections. You are linking the patient of an action to the action. That's what this does. It links the patient of the action to the action. So they achieve partial universality. They code regardless of patient, manner, or action. They code a patient role and a purpose role. They only fire when you actually get the purpose, and they fire in the presence of the appropriate patient for a given action. So, what you get so far is the coding of a whole lot of conceptual structure.

Now, let's go to the third circuit. This one links area of F4 and VIP in the parietal. Let me explain briefly about this. There is a notion called peri-personal space. Let me explain what that is. Take my cheek—if I touch my cheek, there will be certain neurons firing. If I see something coming towards my cheek and doesn't touch it, the same neurons will fire. The same thing, my arm, you got to grasp my arm, you haven't touched it yet, the same neurons are going to fire as if you are touching it. Here is the places where it works, and the actions are head turning for looking at what's going on versus reaching with the arm and controlling it. Here is the monkey, here is the monkey's face and its peripersonal space, so, any enter into, any entry into, any of this again has firing in this area. The same as touching any of this area. If you put something into this region around it, it is the same as if you touch the corresponding place.

Here is the neural firing. You have the monkey in this region and here is showing what happens when you put something into space at various angles, and you see the amount of firing varying. The maximum firing is right next to the cheek. In an ENG, the neurons respond to an object approaching the chin. The sensory-motor cortex of the receptive field is located here. So, this is the neuron for the chin. This responds when you touch the chin. Something is coming towards the chin. The monkey is looking at it. It responds. If it is coming towards the eye, the one for the chin doesn't respond. Here this is coming towards the chin. The monkey is looking down, so you can see it and you get a response.

This is a neuron that fires when you touch here. If you have a probe like this going toward here, neuron fires. But, if I move over a bit, over the central line, I go towards here, not toward here, no firing. Here again, even if the monkey is looking away, I go towards here, firing. if I go over a little bit, no firing.

So, how does that work? Again, by simulation. The sight or sound of a possible target. You see something coming towards your chin, and there is a connection between the touching of the chin and seeing the area that allows you to see it. It's going to be the same as if you actually touched it because you are anticipating it. You are simulating this action and you are simulating that it's going to hit the chin.

So, these achieve partial universality. It doesn't matter who the patient is—and they also code the location of an action because your location is where you've been touched or where something is moving. These are the experiments. All right, then, what does this mean? The premotor and the parietal areas, rather than having separate and independent functions, are neurally integrated, not only to control action, but to serve the function of constructing an integrated representation of actions, together with objects acted on and locations toward which the actions are directed. In these circuits, sensory inputs are transformed in order to accomplish not only motor but also cognitive tasks, like space perception and action understanding.

They have phases and there are other experiments that go through more examples of how phases work. Jointly, they characterize stability. The same neurons where functions do the same things day after day. They can cover all the particular cases, and they have an internal structure. They get semantic roles: agent, patient, purpose, and location. They have aspectual structure phases. They are meaningful, because you can simulate and understand them; and of course, with the monkeys that are independent of linguistic expression.

Now, let's go to the neural theory of language. Remember what Narayanan did about coordinating actions. You have in the premotor cortex connections to the motor cortex. I'm going to grasp this thing: first the neuron fires, I do this; the second neuron fires, I open my hand; the third one, I go like that; the fourth one, I go like that, and so on because of the connections. Notice that all of these things are in different places. You have to have another circuit connecting them, which is what Narayanan is modeling. You have to have another circuit, putting all these things together on top of it, and that's what Narayanan circuitry does in part. It pulls all of these together. That's the model. It's not discovered in neuroscience. It tells you what to do and when to do it. So it integrates things, and that allows you not only to do things in sequence but also to infer. That is, if you are understanding this, if you are simulating this, you can say "Oh, he is doing this and this, he is about to grasp." That is, you can make predications, you can infer actions, you can do reasoning about this. Because you can link up the patient with the action and the agent with the action, it does some compositionality. So basically, if you put Narayanan's work together with this work, what you get is a theory of the concept of grasping as

a meaningful concept. You get a theory of the meaning of the word grasp. Not just the action, the meaning.

Now, notice what we've done. For at least one concept—grasp, a physical concept—functional clusters, as characterized in the sensory-motor system and as models using structured connectionist binding and inference mechanisms, have all the necessary properties for concepts, not just actions, and not just perceptions, but concepts.

Now, we have a neural version of Occam's Razor. Occam's Razor says, "Don't postulate anything more than you have to." Under the traditional theory, action concepts have to be disembodied, that is, characterized neurally entirely outside the sensory-motor system. That is, in the traditional theory there would have to be another set of circuits to do all of this stuff for the concepts in addition to what is being done for the actions and the perceptions. But here we show that if you have just what they are for the actions on the perceptions, you get everything you need for the concepts, because the same neural substructure is giving you imagination. It allows you to simulate in your imagination. Because of that, you would have to duplicate all these apparatus in the traditional theory to get concepts. In this theory, you don't have to do that. It just follows from what is going on in the sensory-motor system.

Now we start moving faster. We are getting into the linguistics. For each type of action, you have a fixed schema, consisting of certain parameters: role parameters, like agent and patient; phase parameters, like initial, middle, and final state; manner parameters, like degree of force and direction. These are all represented down to the neural level. A grasping from the point of view of linguistics, if you are doing linguistic semantics and you are doing what a frame semantics would do. Here is what you would need. The roles: agent, action, patient, location; the manners: force, type of grip, effect of use; the initial state: the object is located in peri-personal space, if your grasp is close enough to the field of reach. It doesn't mean we can grasp it if it's over there. Starting transition, you reach with a direction toward the object, you know, toward the object location, opening your hand. Central transition: you close your hand with force, function, how much forces of the function of fragility and how much the patient is with; the goal condition is that the effector, the hand, encloses the object with the manner, a grip determined by parameter values, situated conditions; a final state: the agent doesn't control the object. That's what a linguistic description of grasping has to have, and that's what the concept of grasping is. To do reasoning about grasping, that's what you need; and that is what you get in the sensory motor system, without any special other parts. That is, it says the concept of grasping—it's a concept, not just an action is embodied.

So, what this does is fit the grasp schema to the neuroscience of grasping in each way. That is, each schema parameter is a functional cluster, each parameter value is either a firing pattern over a functional cluster or some neuron binding to a functional cluster as when the agent is bound to an actor in context. Then there is what Narayanan calls an executing schema or an x-schema. This is the chin that fires for this one and this one and this one. It executes an action. It's a neural circuit connecting the parameters of the fixed schema so that they can dynamically coordinate the firing over time and adapt the values to inputs from context. Note the same neurons that are defining the fixed schema are neurons subject to dynamic, that is, defining the fixed schema for grasp. We have a set of neurons that define once and for all what it means to grasp, but because there is a dynamic circuit connecting them. Right? They can be activated by the executing schema during performance, observation, and imagination. Schemas are not like logical conditions. They run bodies and that's what's interesting about this. Schemas are not abstract things here. They run bodies, and they do it as well as they can in the real time adjusting to real conditions.

Now, how does this view of concepts differ from the traditional one? One, there are no necessary and sufficient conditions. That is, they are probabilistic. Things can fire or not. They can do it this way, they can do it and just do it a little bit differently the next time and so on. That is the way they are probabilistic. There isn't an abstract representation. This is how you do it. It's just in your body. There isn't another representation of concept outside of the body. There is nothing, no symbols. It is not symbolic. There's no symbols for the concept. It is just the neurons running in your body. So, here is why it is not a necessary condition. There are degrees; there are variations, extensions, and so on.

Here is why it is not representational—because you conceptualize the world on the basis of how you experience it. We saw color is not in the world, nor its heat. It's not a representation of the world. It's what's going on in your body. Since our experience is a function of our body and brain and physical and social environment, so are our concepts and so on. So that's important. These are all directly physical; they are not representations of something else.

There are no symbols. We can write down a symbol, like final state if we are writing it down, but that's our way of writing or symbolizing what is going on in the brain. There is no symbols in the brain. So in the theory of meaning, there is nothing symbolic. Meaningfulness and meaningfulness of concepts does not require symbols in the brain. The brain does not symbolize things. Now, when we write down symbols like purpose or agent, that means we are representing a functional cluster of neurons.

This says language is not modular. The modules are the premotor module and the parietal module. Here they are working together, constantly. They are multi-modal, they are not modular. Many concepts which are part of language are inherently multi-modal, and they exploit the pre-existing multi-modal character of the sensory-motor system. Concepts are exploiting the system of doing and observing the sensory-motor system, and they use the same system for conceptualizing.

What about abstract concepts? Right? Some are about motion; some are less concrete, like freedom. Conceptual metaphor accounts for some of this. That is, virtually all abstract concepts have conventional metaphorical conceptualizations like grasping an idea. And so we have metaphorical mappings from concrete to abstract domains, that is neural connections, to characterizing the meanings of a vast number of so called abstract concepts. A vast number of abstract concepts are characterized metaphorically—not all, but a lot of them.

Now, what are conceptual metaphors? They are, as we said yesterday, connectionist maps. They are direct connections, and therefore, we claim that the sensory-motor system is directly engaged in abstract reasoning. When you are talking about grasping an idea, you are understanding your mind as grasping, you are activating the grasp schema in simulating it.

Remember the difference between imagining grasping, which can be done unconsciously or consciously, and actually doing it or seeing it. When you do it, there is a connection from the brain and the motor-cortex to your body, but when you imagine doing it, that connection is inhibited in the brain stem, so your body doesn't do it, you just imagine it. Here is the understanding of grasping and notice the reasoning patterns about ordinary grasping work for metaphorical grasping. So, you can begin to grasp an idea but not quite get a hold of it just like you can begin to grasp an object but not quite get a hold of it. If you fail to grasp an idea, it can go right by you or over your head just like a moving object. If you grasp some idea, you can turn it over in your mind like you can turn over an object. You can't hold onto an idea before you grasp it. So the inferences are the same. They are the same inferential structure just mapped over by metaphor. Inferences are going on in the sensory-motor system. They are going on with physical grasping, when you imagine that and then you map onto ideas. That's how the invariance principle works. It is because you are actually using the sensory-motor system, that the sensory-motor system structure is used for in metaphor.

Now, I want to finish up with some new work. I want to introduce the concept of a Cog. Let me try to explain what a Cog is. It's crucial for abstract reasoning and for grammar and for many other things.

Let's go back to the premotor versus the motor cortex. Whenever we perform a complex motor movement like picking up a glass and taking a drink, two parts of the brain are activated: premotor and motor. The motor cortex, as neuron ensembles that control motor synergies. The synergy is a simple action like this or that, right? Like opening or closing the hand, flexing or extending the elbow, turning the wrist, and so on. Complex motor schemas are carried out in the premotor cortex. Now let us call the motor cortex the primary motor cortex right here because it's directly connected to the body. What we called primary is directly connected to the body. Let's call the premotor cortex secondary because it has connections to the primary cortex that controls the action. So let's call that primary and that secondary.

Now, what about the schema that controls actions. This is what the executing schema, what the Narayanan called the Controller X-schema, which controls action: it first does this, then does this. What he discovered is that that characterizes aspect in the languages of the world. In his dissertation he also showed that this can compute the logic of aspect abstractly. That is we just look at this schema, it computes the logic of aspects. How does it show this, by what miracle would this be done?

Here is how it works. He took the notion of aspect, which is when you have the beginning of an action, then the middle of it, it might reiterate, it might extend a long time, a short time; it might be a purpose satisfied in the final state, and so on. And what it showed was that for about sixty different actions, the same structure appeared. So, you have lots of different actions, but all of them: start, a middle part, reiteration or continuation, it may have a purpose or not, may have a final state or not. If they have a final state, then they are perfective. If they have none, they are imperfective. So when you look at it, it basically computes aspect. He then said how could you show that the same circuitry that can move your body or can recognize other people's movements can do reasoning. How could you show that? And that's why he set up his neural theory of metaphor. He said let us take a set of metaphors about an abstract domain, international economics. He then went to the business section of the New York Times and the Wall Street Journal and the Economist, and collected sentences that used physical verbs, like push and pull and fall and run and so on, and he got thousands of the examples, in about three seconds on the computer. Then, he took about thirty of these examples and worked them out in this. Let me give you some of these examples. France fell into a recession and Germany pulled it out. Another one. India is stumbling toward the liberalization of its economy. So, what he did was then figure out what metaphors they were linking the physical actions to the economics. We worked that out like a linguist with a little help from his friends. Then he asked could the

same circuitry that could move the body do the reasoning about economics correctly, using the part about falling into a recession, pulling out, stumbling, and so on. He showed that it could for thirty cases, enough to make it look real. That is the same circuitry that can move your body, can do reasoning, which is just what we would expect, if concepts we defined in the way we have just suggested.

This is the controller x-schema and the initial phase, starting phase, etc, pre-central, central phase, and so on. This is how aspect works. Right? So this is what you had for actions and it's also for aspect in natural language. This is what he used to call Petri Nets. Here are the properties of them, but we've already talked about them.

Now, what's interesting about this is that aspect shows up in the grammar of every language in the world. Every language has ways to indicate that an action is about to start, that it is in the starting phase, that is in the middle, that it's iterating, that it's either long or short, that, you know, has duration or it's instantaneous, that it's finished or not. Every language can say those things in its grammar. The semantics of aspect, which could carries this out, is part of the semantics of grammar in every language of the world. So, this controller x-schema that Narayanan made up is part of the semantics of grammar. It is located in the premotor cortex in the secondary structure. Aspect by itself can fit any action. They fit an action and how it is connected to the motor cortex to carry out the action so that if you don't have any connections, if you inhabit all the connections in the motor cortex and just run the controller schema itself, not seeing what it controls, you get the logic of aspect, pure aspect. What this says is that the concept of aspects, all the aspectual concepts, come out of Narayanan's model of the controller x-schema in the secondary structure—the premotor cortex.

So, here we have one case in which a secondary structure is showing up as the meaning of something in grammar—in universal grammar. Let us call that a Cog. Are there other Cogs? Are there other cases where something that's in grammar has to be computed in the brain by a secondary structure with connections to primary structures? The answer appears to be "yes," grammatical meaning appears to work this way. Think of the primitive image schemas—containers, source-path-goal, contact, rotation, front-back, up-and-down, all of the force. These are Talmy's force dynamic schemas. Take for example the container schema, which presumably is computed in the visual cortex according to Regier in certain ways. It computes a generalized container but can fit any shape at all, as we saw. Where does it get the shapes? By connection to the parietal cortex where information about shape is registered. So it is a secondary structure that can fit any shape. It can fit the bottle, the room, the

building—any shape at all, any size at all. But that information about shape and size is given elsewhere in the parietal cortex. So, that means that the part of the brain that computes the container schema is also secondary. That is true for anything, something that computes generalized source, path, and goal for any particular one is going to be linked to, as going to be in the secondary structure in the brain linked to the primary ones: particular sources, particular paths, particular goals. Think about number for a minute. There is part of the brain that computes numbers. It can tell one from two, from three, and so on. That part of the brain can also tell one bell and the sound from two bells, from three bells, or one tree from two trees, from three trees—either vision or sound. That is, it is in the secondary structure that can be linked either vision or sound which are primary. A number shows up in the grammar of every language. Here is a cog hypothesis, that the meaning of grammatical concepts, the concepts that show up in grammar, are the concepts computed by secondary structures in the brain. That's the hypothesis. The concepts that show up in grammar around the world are exactly the concepts computed by the secondary structures in the brain. I do not know if this is true. It is a hypothesis, and it is a plausible one, but it is the hypothesis to direct future research.

I've done two more studies with respect to Cog. I have a book on the cognitive structure of mathematics called *Where Mathematics Comes From*. The book was written with Narayanan. It's a nine hundred page book going through everything from addition to subtraction up through higher mathematics, calculus, you know, imaginary numbers, transcendental numbers, you know, it has all kinds of stuff from higher mathematics, showing that mathematics is metaphorical in full detail. Let me give you an example of those metaphors in mathematics. Think about the number line. You have a line, and you have a longer line—zero, one, two, three, etc. In the number line, there is a metaphor: numbers are points on the line. Numbers don't have to be the points on the line. It is only a metaphor. In set theory, numbers are sets: zero is the empty set, one is the set containing the empty set and so on. That is a different metaphor. Mathematics is based on metaphors going from one branch of mathematics to another. Very, very common. That's how mathematics is built up. When you look at the details of these metaphors, they are all Cog to Cog metaphors, like lines and numbers, and that's why mathematics can apply to anything. A concept built into grammar can apply to any concept at all, any particular concept that is in the grammar of the sentence, any special case they can apply to, via links from the secondary to primary structures. The same is true of mathematics. Mathematics is abstract. What makes it abstract is that it is defined over secondary structures that can then be linked to any corresponding primary structures. That's why it fits—it can be used to fit all kinds of special cases.

I have another paper as long as this one about art and form in art. I looked at art criticism, and it turns out that in art criticism, as done by certain art critics in the seventies who looked at things of this sort, the structure of a painting is basically an image schema structure. You can show this is the center, this is the contained region, here you have motion from here to here. Here you have a force applied in this direction and so on. So, it looks like image schemas are structuring art, and image schemas are all Cogs, they are all secondary structures. So, it looks like structure in general, in human cognition, is coming out of secondary structures in the brain, which then apply to abstract reasoning.

Now, the very last thing in this lecture is the nature of Cog. Let's think about language acquisition, because that is the major place where Cogs are important. We know from the work at the Max Plank Institute that when children learn grammar, they learn it one verb at a time. They learn the construction for a verb like "give" where, you know, "I give him a book" or something like that. They learn a different grammar for a verb like "fall" or a verb like "hit." So they learn these grammatical constructions one verb at a time and then they generalize the new cases. The question is: what is generalization? It used to be thought that generalization is a kind of induction, you get a new structure that is somehow by magic imposed.

The theory of cogs says something different about generalization. It says that the secondary structure is already there in the primary structure. That is if I'm giving you something, I have in the secondary structure a source, a path and a goal, and I have a force dynamics and an agent, a patient, and an object that I move in. Then I have the particular thing, if I'm handing you the bottle, I have connections to the fact that this looks like a bottle, has a shape like a bottle, that I'm doing it, that you are the patient, you are the indirect object, you are the recipient. So it is already in the structure of giving an abstract structure in the secondary part of the brain, in the premotor cortex controlling the action. The generalization is already there in this special case, and what you learn is to inhibit the special case, the connections to the special case, so that you can then have connections to new cases. So generalization is not learning something new. It is inhibiting connections to the old special cases. When you do that, you can make connections to new special cases, but you already know the generalizations, because they are part of the special cases. That something that's true of the neural system of the human brain. It's not something that is abstractly true of a mathematical system. It's certainly not true in a mathematical system. So if you try to understand language acquisition in terms of an abstract mathematical system, you will never reach this conclusion. But if you do it in terms of the neural system, you do.

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LECTURE 7

The Poetic Metaphor

I first began working on metaphor when I was teaching an undergraduate seminar at Berkeley in the year 1978, and there were five students in the class, and on the day we were to discuss a paper on metaphor, one of the women in the class came in late. It was raining, and she was very wet, and she was crying. We sat around a little table and we all tried to ignore the fact that she was crying. As I started to go over the paper, saying "on page ten, professor so and so said so and so, what do you think about this," she turned and said, "I'm sorry. I can't do this today. I have a metaphor problem with my boyfriend." She looked around, she said, "Maybe you can help." So we said, "Sure, we can help. We will try." So she then said, "On the way here, my boyfriend said that our relationship had hit a dead end street.", and she didn't know what this meant. So we said, "Look, if it hit a dead end street, you can't keep going the way you have been going. You have to turn back."

Then we realized that English had many expressions for understanding love as a journey, and so we started to write them down. I'm a linguist, I started writing all these down. "Dead end street," "going the way you have been going," "turn back," and lots more like "the marriage is on the rocks," "it's off the tracks," "we are spinning the wheels," "we are going in different directions," "it's been a long bumpy road," "we are at the cross roads in the relationship." All these words like "cross roads," "long bumpy road," and so on are different, ordinary words in English. They are all about journeys, and here they apply to love. Even when they are about airplanes, we may have to "bale out," that is, have the parachute. Now we made this long list and then I asked the question "Is there any generalization about this list? Is there anything general about it?" And we noticed that there were some generalizations and we could write them down too that in every case, the lovers were travelers. So write down "lovers—travelers." In every case, the relationship was some kind of vehicle. Either a plane, a train, a car, or a boat, but in every case, it was a vehicle. So I wrote down "love relationship—vehicle." Then we said "What about the goals, the traveling, the path?" and we noticed that the common life goals of the lovers corresponded to the common destinations that you were going to in this vehicle. Finally we noticed that in every case, there were some difficulties, that is, in every case, there was either a "long bumpy road" or "on the rocks," "off the track." Something was going wrong, that is, there was a difficulty in getting to the end point. There was some impediment. Impediment is something that

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stops you, an impediment to travel, and that was the difficulty in the relationship. The difficulties were impediments to travel. Now we wrote down this generalization. You could write it down almost like the mathematical mapping. We were very happy, said, "Look, there was the generalization here. Isn't that interesting!" The woman said, "I don't care about your generalization. My boyfriend is breaking up with me." She's thinking in terms of this metaphor, thinking in terms of this metaphor. So I said, "How is it possible to think in terms of metaphor? What does that mean?" So we took examples. For example, we went and looked at the expression "we are spinning our wheels in this relationship." Now in English, the expression "spinning your wheels" in literal language applies to a car. It's a car that is stopped, usually in the mud or the sand or the ice or the snow, and you try to get it out by putting on the accelerator and your wheels start spinning and it goes in deeper. Then you push it, you try to get it out, and it's very hard. That's the image that you have. So if you are spinning your wheels in this relationship, what do we know about that image? In the image, the car is not moving. In the image, you are trying to get the car to move. You want it to be moving, but it is not moving. In the image, you are making an effort to get it moving, and you are frustrated, because it is not. So when you say "we are spinning our wheels in this relationship," what does it mean? It means the relationship is not moving, it's not going forward, you are not making progress toward common life goals. It means you are putting effort into getting it to make progress, and it means you are frustrated. That is, everything you know about the domain of travel in this expression is being mapped on to the domain of love via the mapping that "lovers are travelers," "the relationship is a vehicle," and so on. The mapping maps your knowledge and influences your reasoning about travel onto reasoning about love, and that is how it is possible to think in terms of metaphor.

Now several things follow from this. First, the young lady did not make up with her boyfriend. They did not get back together. But she eventually got a PhD and married to someone else. She was very happy and she's the chairman of a major linguistic department. So she is fine. Now there are many things that follow from this example. First, the metaphor is the mapping. You have lots of different words here, lots of words, you know, "dead end street" and "cross roads" and "long bumpy road." Different words but one metaphor, and that is "love is a journey," and the way you specify it precisely is via a mapping. "Travelers" maps to "lovers," "vehicle" maps to "relationship," "the impediment to travel" maps to "difficulties," and so on. Those mappings map the way you think about journeys and reason about journeys onto the way you think about love, and they give you a way to think about love metaphorically. Now this is inconsistent with the traditional theory of metaphor. The traditional theory

is from Aristotle. Aristotle looked at the examples of metaphor in literature and he said, "Metaphor is in the words. It's an unusual use of words that is not normal." So first of all, it is not normal. Notice all of these expressions in English that I gave you "the relationship is on the rocks," "it has been a long bumpy road," these are normal everyday expressions. They are not especially poetic.

So, for one, they are normal. So Aristotle was wrong about that. Two, he said that they were in the words. But we saw you have different words with the same metaphor. The metaphor is how you think about love in terms of journeys. The metaphor is in the mapping from travel to love. So Aristotle was wrong about that, too. Aristotle then said that metaphor was based on similarity. There is no similarity between love and journeys outside that metaphor. So Aristotle was wrong about that too. So basically, the theory that Aristotle came up with 2500 years ago, which has been passed on generation after generation after generation, doesn't work. It's an incorrect theory. Moreover, according to the Aristotelian account, metaphor is supposed to be unusual, poetic, rhetorical, but here we find it in the most ordinary everyday thought and language, and that's what all the research on metaphor has shown in the past 25 years. So what we've found in the past 25 years is that metaphor is an ordinary everyday phenomenon, and we've found that it is in thought. It is primarily a way in which you understand the world in terms of other domains that you have. We've also discovered that there is a difference between what we call "primary metaphor" and "complex metaphor." Primary metaphors are cases of relatively simple metaphors that arise from your everyday experience. For example, we have here some metaphors. By the way, most primary metaphors are universal, not quite all, but most of them, occur around the world. For example, "more is up, less is down." Prices rise, prices fall. Right? That is, the temperature rises, the temperature falls. More is up, less is down. Now why is it that "more is up" and "less is down?" If I pour water into a glass, the level will rise. If I pile books on the desk, the level will rise. You put more things in, everyday there is a correlation between verticality and quantity. Now in your brain, verticality and quantity are represented in two different parts of the brain. This is the part of the brain that computes number, and it's in a different place that the part of the brain that computes space and orientation to balance. So what happens is that there is a linkage between these when they occur together in the world. When they occur together, then you learn neural connections between them.

Let me give you other examples—affection is warmth. Your mother or father holds you affectionately and you correlate it to warmth and therefore you get metaphors like "a warm person," "a cool person," "he is cool to me," and so on. Now the idea is you learn hundreds of such basic primary metaphors, and then they fit together to form bigger and bigger ones and more complicated

ones. So, the simple ones arise just by functioning in the world. As a person, while you're a child mostly, you learn this conceptually, and then they come into language and you learn them linguistically, and then they combine and that's where you get cultural differences in metaphor. And what poets do is they use the ordinary everyday primary metaphors and put them together in interesting and complicated ways. So what I want to do today is give you examples of this, lots of examples to show how poetry uses ordinary everyday metaphors and puts them together in very complex ways to give you a poem. There is not just metaphor in poems. There's lots and lots of other things as well. But what we are going to do is just give examples from poetry. Now there is a famous poem by Robert Frost, and it says

> ……
> Two roads diverged in a wood, […] and I —
> I took the one less traveled by,
> And that has made all the difference …
> ……

Now two roads diverged in a wood. There is a metaphor that life is a journey. Now let's think about this metaphor. We'll analyze it in very great detail. It is based on what is called the event structure metaphor. The event structure metaphor goes like this. It is a composite of a number of other primary metaphors. It says states are locations, that is, the state you are in, are you happy, sad, is understood as a bounded region in space. So you can be in love or in a depression, and so on. Now changes are movements from one state to another, from one location to another, and then a purpose, you know, your final destination is where you'll arrive at, and purposes are destinations you are trying to go to, and means to get there are paths. So means are paths and actions are motions. So then you have an extension of this metaphor for life. It says there are life goals—life has purposes, destinations, and you can choose them. That gives you a metaphor for life that is a journey where you go from purposes for destinations to purposes for destinations and so on. Then when he says "two roads diverged in a wood," these are two different ways of life, two different ways to live your life, two different courses of life, going to different destinations. "And I took the one less traveled by" means I took the path that other people do not take; I chose to live my life differently. He says "And that has made all the difference." So he's saying it is a good thing not to do what everyone else does, but to take the life that is appropriate to you and to your unique characteristics, that is different from other people's lives. That is what that's about when he talks about "two roads diverged in a wood."

Now why in a wood? Because when you are in the woods, you can not see ahead. We have a metaphor that the future is ahead and the past is behind. And that says in the woods, you cannot see the future. So when the roads diverged, he could not see where they were going. He didn't know where he would wind up, but he took the one that other people didn't take. That was a good thing. So there's a reason for "in the woods," that uses another primary metaphor, and that is "seeing is knowing" and "the future is ahead." So notice all the metaphors that we have, conceptual metaphors in just those lines: states are locations, changes are motions, actions are self-propelled movements, purposes are destinations, and means are paths. Then you have the future as ahead, knowing is seeing. If you don't see, you don't know. All of those conceptual metaphors are needed to understand those three simple lines. And you don't even notice that you are doing it. What is interesting about this, I read that poem hundreds of times before I studied the theory of metaphor and I never knew that I was thinking in terms of all of those conceptual metaphors. So when a poet uses a metaphor, he's evoking a whole system of conceptual metaphors that we use everyday. Poetic metaphor is not all original. It uses the ordinary things and what is original is the way it puts the metaphors together.

All right, let's take a look at some other cases. Shakespeare in King Lear says:

> "Thou must be patient; we came crying hither; (Lakoff: That is "to here.")
> Thou know'st, the first time that we smell the air, we wawl and cry."

Now notice a simple thing: we came crying hither, we came hither. "Came" literally is moving, but there is a general metaphor that existence is location here, birth is coming into existence, that birth is arrival, death is departure. So a dead person is seen as going away, leaving us, a baby is seen as arriving. So "we came crying," babies are crying when they are born. Hither, here. So he is using the ordinary metaphor of existence as location here, birth is arrival.

Now we see these so commonly that we often don't notice them. What I would like to do is go through a whole poem and give you some idea of all the richness of metaphor in that poem. Now this is a book called *More Than Cool Reason* by myself and Mark Turner. We wrote it in 1987, it was published in 89, and it goes through all the types of poetic metaphor. What we did to start this book is we sat down, we said, "How should we start?" and I said, "Look, there is only one clear way to start. We take a large collection of poetry and we open to a random page and we put our finger down. So we opened to a random page and this was the poem my finger came down on. Because it didn't matter, we didn't take the poem because it has a lot of metaphors. We picked the poem

because every poem does. It didn't matter which poem we picked, so we happened to pick this one, and this is by Emily Dickinson. It says:

> Because I could not stop for Death
> He kindly stopped for me—(Lakoff: I'll read it twice.)
> The carriage held but just Ourselves
> And Immortality.
>
> We slowly drove—He knew no haste
> And I had put away
> My labor and my leisure too,
> For His Civility—
>
> We passed the School, where Children strove
> At Recess—in the Ring—
> We passed the Fields of Gazing Grain—
> We passed the setting Sun —
>
> Or rather—He passed Us
> The Dews drew quivering and chill —
> For only Gossamer, my Gown —
> My Tippet—only Tulle—
>
> We paused before a House that seemed
> A swelling of the Ground—
> The Roof was scarcely visible—
> The Cornice—in the Ground—
>
> Since then—'tis Centuries—and yet
> Feels shorter than the Day
> I first surmised the Horses' Heads
> Were toward Eternity—

Now let's go through this bit by bit. "Because I could not stop for death, he kindly stopped for me, the carriage held but just ourselves, and immortality." Ok, let's just do that. First, you have "because I could not stop for death." That means I'm leaving and there is a general metaphor that activity is movement, action is moving around. She could not stop; she's doing so much stuff. She's running around doing so many things that she's not even thinking about death. "Because I could not stop for death"—she could not even think that

death might be there. He kindly stopped for me—she died. But she is viewing death as now a person. What kind of person? "The carriage held but just Ourselves"—that is, Death is a coachman that is driving her away in a coach, in a carriage. Now why is Death a coachman? Why should Death be a coachman? Because death is departure, birth is arrival, existence is being here, as in the location of here, death is departure. So the process of death, the phenomenon of death is understood as what causes death, and death is going away. What causes you to go away is the coachman who drives you away. So that's what that's about. "And immortality," she is a Christian, she believes that when you die, your immortal soul lives on. She is going away. What is interesting about this is that death is departure, if life is a journey, death, too, is a kind of journey. You have a continuous journey of life and then into death. So the poem continues. "We slowly drove—He knew no haste," that is, this coachman Death was not in any hurry. When you die, there's no hurry. "And I had put away. My labor and my leisure too"—stop working, stop doing visual activities. "For His Civility." Death here is seen as civil, that is not rushed, not in any hurry, but just calm. "We passed the School, where Children strove At Recess"—recess is when you take off from school for a period, "—in the ring" where children were playing in the playground. So, first the coach is going past the stages of life. We passed children, we're going past the young part of life. "We passed the Fields of Gazing Grain, We passed the setting Sun." All right, why the fields of gazing grain? First, why grain? There is a general metaphor, very common, that people are plants with respect to the life cycle. That is, they are seedlings. They sprout, they grow up, they reach maturity, they die. You can think people as trees or other kinds of plants, and here it is grain. Why gazing grain? If you see a field of wheat in the sunshine, during the day, the wheat moves toward the sun. It shifts. So when the wheat is mature at its peak, it will look like that it's looking at the sun, hence the gazing grain. This means that the grain was being passed is people at the prime of life. So first they go past the stage of childhood, and you have a metonymy of the children for the child, then you have the metaphor—the field of gazing grain, of the grain for people at their prime of life. Then "we drove past the setting sun." Why the setting sun? There is a metaphor that lifetime … a lifetime is a date, and the sunset is death. That is, when it is night, it is death. Sunset is the approach of death, old age. So you are going past youth, maturity, old age in this journey. So it's a journey reviewing the stages of life after you die.

"The Dews were quivering and chill—For only Gossamer, my Gown." Gossamer is very, very flimsy, fine cloth. "My Tippet—only Tulle," another very fine cloth. That is what corpses were dressed in. She just had the dress of the corpse. "We passed before a House that seemed a swelling of the Ground." A

swelling of ground. Why? A grave. "The Roof was scarcely visible"—that's the stone coming out. "The Cornice," that is, the peak of a roof in the ground. That is the cemetery stone. So "We paused before a House that seemed A swelling of the Ground—The Roof was scarcely visible—The Cornice—in the Ground," a grave. "Since then," now the journey continues—and yet Feels shorter than the Day I first surmised the Horses' Heads Were toward Eternity." That is, death is a continuous journey also, continuing life's journey, but it goes on forever—"the Horses' Heads Were toward Eternity." That's how metaphor is used in a complex poem. One metaphor after another of the ordinary ones you see everyday are used to put together to form this complexity.

Now let me give some other examples of how metaphors like these are used, metaphors for life and death. Take the "a life is a journey" metaphor. Dante began his *Devine Comedy* by writing "in the middle of life's road, I found myself in a dark wood." "In the middle of life's road, I found myself in a dark wood," very similar to what we saw before. "Life is a road" is "life is a journey," and in the middle of it, halfway through my life, "I found myself in a dark wood." Why dark? You can't see where you are going. Knowing is seeing. You do not know what direction your life is going to take. If in the middle of a dark wood, you don't know where the road is going to take you, where it's going to continue. So this is about confusion in the middle of life. Or Shakespeare writes in Macbeth "and all are yesterday's hath lighted fools the way to dusty death." Again, life is a journey to death.

We can go on, there are lots and lots of examples. Let me give you a couple of famous ones. T. S. Eliot in the Love Song of J. Alfred Prufrock writes "I have seen the moment of my greatness flicker." Why flicker? Because life is seen as a fire, and the greatness, that is, the high point of life is the highest flame, and when a flame flickers, it has a chance of going out. And then if life is a fire and the flame goes out, you die. So I've seen the premonition of death, "the moment of my greatness flicker." "And I have seen the eternal Footman hold my coat and snicker, And in short, I was afraid." Why the eternal Footman? Again he is the person who's in the carriage taking you away with death. So he sees his death coming. Again similar metaphors.

Now what I would like to do at this point is take a complicated case with some more examples and look at some details. Here this is Shakespeare's sonnet 73. It goes like this:

> That time of year thou mayst in me behold
> When yellow leaves, or none, or few, do hang
> Upon those boughs which shake against the cold,
> Bare ruined choirs, where late the sweet birds sang.

In me thou seest the twilight of such day
As after sunset fadeth in the west,
Which by and by black night doth take away,
Death's second self, that seals up all in rest.
In me thou seest the glowing of such fire
That on the ashes of his youth doth lie,
As the deathbed whereon it must expire,
Consumed with that which it was nourished by.
This thou perceiv'st, which makes thy love more strong,
To love that well which thou must leave ere long.

What we'll do is just go through that bit by bit and we'll go through it several times so as to look into the metaphorical structure of this poem. First, "That time of year thou mayst in me behold When yellow leaves, or none, or few do hang Upon those boughs which shake against the cold Bare ruined choirs where late the sweet birds sang." What time of year is it? Autumn. What is the metaphor? The overall metaphor of these four lines is that a lifetime is a year, and for lifetime is a year, youth is spring, maturity is summer, autumn is old age, winter is death. This is about old age and the approach of death.

Now the next one. "In me thou seest the twilight of such day As after sunset fadeth in the west, Which by and by black night doth take away, Death's second self, that seals up all in rest." Now here you have another metaphor, the one we saw before of "a lifetime is a day," where twilight is old age and night is death. So first, life time is a year, autumn is old age, life time is a day, twilight is old age. Finally, "In me thou seest the glowing of such fire That on the ashes of his youth doth lie, As the deathbed whereon it must expire, Consumed with that which it was nourished by." A lifetime is a fire, and the beginning of the fire is when it's lit, and when the fire is brightest, it's maturity, and the ashes, when you're down to the ashes in the cold, it's old age, and when the fire is out, it's death.

Now what we have in each case is the metaphor we saw before. These are not unique metaphors, of "a life time is a day," "a lifetime is a year," "a lifetime is a fire." They show up over and over again. But now why these three? For example, why isn't a lifetime a week? Why isn't the lifetime a bottle or an apple or a couch or something else? Why is these three, day, year, fire? The answer is that there are primary metaphors that structure these. In every case, there is another metaphor, another three metaphors and they go like this: that life is light and death is dark; that life is warm and death is cold; that lifetime is a cycle of increasing and then decreasing intensity. Those are primary metaphors because what you know about death, you know that someone dies, he can't

see anymore. The light goes out. Right? So if someone dies, the body gets cold. So death is cold, life is warm. And you know that as someone matures, he gets more and more active until he gets older and he gets less and less active and then dies. So you have this cycle. Each of these cases has all three at once. A day has a part that is warmest—noon and the afternoon. It has a part that is coldest—night, it has a part that has the most light—the afternoon, a part that is dark—night. It has increasing activity, more and more people do things toward the afternoon and then decreasing activity at night until it's dark. So that you have those three primary metaphors, all of them come together in each of the other three metaphors of a day, a year, and a fire. This is an extremely highly structured poem. It is structured by the primary metaphors about light, about heat and about activity and then the secondary metaphors about a day, a year and the cycle. Then that poem is organized in terms of those three.

There is another kind of metaphor besides the conceptual metaphor, and that is the image metaphor. And you see that here in the first stanza, "That time of year thou mayst in me behold When yellow leaves, or none, or few do hang Upon those boughs which shake against the cold." Now boughs of a tree are like arms of a person. It is image mapping there, and the image is of an old man being cold and shaking against the cold. So given that people are plants, again the conceptual metaphor, you have an image of a tree mapped onto an image of a person with the arms of boughs and the shaking boughs and the shaking of a man's arms. So what you find in this poem is metaphor upon metaphor upon metaphor. To understand them, you have to factor them out, one at a time, and see which one is there and you factor them out by knowing the collection of basic metaphors overall.

Let's consider another poem. This is a poem by William Carlos Williams. It's called *To A Solitary Disciple*. Now William Carlos Williams is a very famous American poet. He wrote in the 1920s and 30s. He was a doctor. He lived near the New York City, in New Jersey, just across the river from the New York City, and he was a member of the New York poetic circles. At that time, he was part of a literary movement that hated metaphor. Metaphor there was seen in the Aristotelian sense of lots of ornamentation of additional words that didn't matter and so on. What he tried to do was strip his poetry bare and to say "I'm writing without metaphor." Now what is interesting about this is that when you actually read his poems, you see there's metaphors everywhere, but not the overburdened kind, very subtle metaphor. So the reason that we chose this poem was that Turner and I were running a seminar while we were writing the book and we asked students to bring a poem in that had examples of metaphor, and a student brought in this poem and said, "I found one metaphor

in this poem." We'll see these metaphors in almost every word of this poem. We'll try to see which one the student was talking about and will be obvious in some ways. So let me go over the poem and then go through the metaphorical structure of the poem, and then we'll see once we do that, that there is a difference between what I'll call deep metaphor and surface metaphor. So first we're going to read it and then go through the surface metaphors and then talk about the deep metaphor. The poem goes like this: "To a Solitary Disciple," and here the word "disciple" is being used in a religious sense as someone entering the church, as you'll see, becoming a monk. [...]

Rather notice, mon cher,
that the moon is
tilted above
the point of the steeple
than that its color
is shell-pink.

Rather observe
that it is early morning
than that the sky
is smooth
as a turquoise.

Rather grasp
how the dark
converging lines
of the steeple
meet at a pinnacle—
perceive how
its little ornament
tries to stop them—

See how it fails!
See how the converging lines
of the hexagonal spire
escape upward—
receding, dividing!
— Sepals
that guard and contain
the flower!

Observe
how motionless
the eaten moon
lies in the protecting lines.
It is true:
in the light colors
of the morning

brown-stone and slate
shine orange and dark blue

But observe
the oppressive weight
of the squat edifice!
Observe
the jasmine lightness
of the moon.

It is certainly a very beautiful poem. Let's look at the details of this. He's pointing out a scene. The scene is a scene of a church building. He's talking to a solitary disciple, solitary because this person is becoming a monk, disciple because he is studying under other people in the church. "Rather notice, mon cher," that is "mon cher," my dear one, "cher" from French. "That the moon is tilted," the moon is tilted here, "above the point of the steeple." Here we have a scene first of the moon tilted above the point, right above the point of the steeple. That the color of the moon is shell-pink, like the pink of some sort of sea shell. "Rather observe" and notice each one of us observes this instead of that. That is rather notice the tiltedness of the moon than the color of the moon. First, "rather observe that it is early morning." "Observe" this instead of, right? "than that the sky is smooth as a turquoise."

"Rather grasp how the dark converging lines of the steeple meet at a pinnacle—perceive how its little ornament tries to stop them." So you have these guys. Here are the lines converging at the pinnacle. This is an ornament of the top, and you image the lines, the ornament is trying to stop the lines from going into the sky. See how it tries to stop them. "See how it fails," that means the lines go into the sky. The lines that define the steeple are going up into the sky. Sepals—that is, the petals of a flower, right? the petals on the inside of the flower, and these are little sepals. "Sepals that guard and contain the flower," so you have this image of these lines going up into the sky, they become sepals and inside them is a flower. That the sepals, the outside of the

flower, those green parts that keep the leaves in, guard and protect the flower. That's the image.

"Observe how motionless the eaten moon," so we have the moon and the moon is a crescent; it has a bite taken out of it. That was the metaphor that the student noticed. The eaten moon has a little bite taken out of it. It is like a crescent. It is tilted, for to be tiled it means the crescent is tilted. And it says "Observe" … let's see … "Observe how motionless the eaten moon lies in the protective lines", so the moon is now in the protective lines where the flower is. "It is true: in the light colors of the morning brown-stone and slate." That is, this brown color and slate which is a dark grayish black, "shine orange and dark blue." The color looks brighter, bright orange instead of brown, dark blue instead of gray slate. "But observe the oppressive weight," the heaviness of the squat, squat is like this; edifice, it's a low building, "Observe the jasmine lightness (which we'll talk about) of the moon," above this steeple. It says rather notice that the moon is tilted. That is, it's not perfectly symmetrical. It's an angle. It's tilted. It's imperfect if it's tilted. It's not perfectly round. It's an imperfect vision. If it were a perfectly round vision, you have the moon round right above the steeple, but it's not that. It's, you know, an crescent moon, tilted. Notice that instead of noticing this beautiful color of the moon at dawn, the moon looks a little bit pink. It's a very beautiful color. Notice the imperfection of the moon rather than its beautiful color. So this is about what he's saying and what you should notice and what you shouldn't.

"Rather observed that it is early morning," why morning? We have a day, and this is the beginning of a life or career. He's going into the Church. So this is a beginning, early morning. The rest of the day is the following out of either a life or a career. He is going to have a life in the church and this is its beginning. So we have again a lifetime is a day. Rather notice it is early morning. Pay attention to the earliness. "rather than the sky is smooth as a turquoise," now what could it mean for the sky to be smooth as a turquoise? A turquoise is a nice blue, sort of precious stone. Why smooth? We have a general metaphor that seeing is touching, where your eyes can pick out every detail of the pattern, where you can run your eyes over the wall and so on. Here you are running your eyes over the sky. It is smooth means there is nothing else in the sky. You know, the stars are gone, completely clear sky. The sky is smooth as you run your eyes over it. So here you have a metaphor, shaping the image. This is a poet who cares about creating images and he's using a metaphor to shape that image.

Now, "rather grasp." Grasp, understanding is grasping. "Rather grasp how the dark converging lines of the steeple," now the steeple is dark, and remember this darkness will be important in a while. "how the dark converging lines of the steeple meet at a pinnacle." Now there is a very important metaphor here,

discovered by Leonard Talmy, who writes about what he calls "fictive motion." Fictive motion is when you understand a shape in terms of something moving, tracing that shape. Here you see the lines as if they are stationary just as the steeple, but see how they meet that that is moving. So this is the fictive motion metaphor that a shape is the motion tracing that shape. See how they meet at the pinnacle. Then given that metaphor is extended, see how he tries to stop them. He is creating an image, but he is using the fictive motion metaphor to create the image.

Then he says you're looking at this church and the steeple. Now what is a steeple for a Christian church? A steeple is pointing to God in heaven. That's what it's about. It points to heaven where God lives. It is supposed to make you look up to God, think about God. That is why they have steeples. So see how the lines of the church go beyond the top of the steeple into heaven, into the sky. Heaven is going from the earthly to the divine above the top of the steeple. So it's above it. It's the divine. Then we have, see "how the dark converging lines of the steeple meet at a pinnacle—perceive how its little ornament tries to stop them—See how it fails!" That is, the physical church can not stop you from thinking about the divine. If you go and trace the lines, the lines of the church will make you think of the divine. The physical church can't allow you to stop there. That's what steeples are all about. They take your eye up, and therefore, to seeing is knowing, they make you think about what's up there.

"See how it fails! See how the converging lines of the hexagonal spire escape upward—" This is trying to stop them. We will come back to that. "Receding, dividing!" Lines are receding and dividing in the sky. See then you have another image metaphor. These lines for image metaphor are like the sepals, the green part outside the flower that guards and protects the flower. Now what is the flower? The flower is the most delicate and important part. The sepals are the hard stuff on the outside, but it's the flower that allows for later creativity and so on. So that's the delicate and important and beautiful part. He says look at that, look at that beautiful delicate part with these other things, these other lines guarding it and protecting it. Then he says "Observe how motionless the eaten moon." What's the eaten moon? We have this round thing with a bite taken out of it. What is the image metaphor? It is the wafer that you take a bite out of it in communion, mapped down to the moon, so this is about the body of Christ, the body of God up there. You are looking at the sacred, the moon, and that is the flower. Notice it is in the same place. So he says "notice how motionless the eaten moon lies in the protective lines." It is exactly where the flower is. So the flower of the church is Christ—it is God. That's what you should be thinking about if you are going to become a monk.

Now "It is true: in the light colors of the morning brown-stone and slate shine orange and dark blue." He's saying if you look at the colors of this building, the colors of this building are really ugly. They are brown and there, you know they are slate, they're black, they are sort of yucky, but at the beautiful time in the morning when you're starting out, and the day is just starting, the light changes the colors into something beautiful, orange and dark blue. That is metaphorically now: this is the beginning of becoming a monk and going into the church is really great. That is, the light at the beginning makes the sort of ugliness of the church look beautiful.

He says "But observe (Let's, on the contrary, observe) the oppressive weight of the squat edifice!" Why oppressive and then weight? He's saying this building is heavy, and in doing this, he's not just talking about the building. There is a general metaphor that institutions are buildings. For example, in America, we speak of the White House as meaning the presidency. He's saying the church as an institution is represented by this building, and yet it's heavy—it has duties. That is the metaphor, that difficulties are burdens that weigh you down. He says this is going to be hard, going in and becoming a monk is hard. It's going to be difficult. It is a burden to go into the Church, and it's oppressive. It's going to weigh you down. It's not going to be a nice experience. It's going to be a difficult experience. So he says "observe the oppressive weight of the squat edifice!" That is the institution of the Church. It's going to be hard on you.

Then he says "Observe the jasmine lightness of the moon." He says when you are becoming a monk, don't pay attention to the oppressiveness of the institution, look at God, the moon which is God up there. "The jasmine lightness"—what is the metaphor for light? Light is moral, light is good, light is enlightening. It teaches you things. That is, knowing is seeing, and light enlightens you. Observe and then light is not heavy, so where it's difficult, what makes it easy, what makes it worthwhile is the lightness of the moon and its jasmine lightness, because it smells beautiful, it's sensual. Observe the sensuality of being religious.

So this is the poem. Let's go back through it again and you will see more of it. "Rather notice, mon cher, that the moon is tilted above," that is, God is not perfect. "Tilted"—once you see that in the poem. But he says notice this, this imperfect God above, the color of the moon. "Rather observe that it is early morning," pay attention that this is the beginning. "Rather than that the sky is smooth as a turquoise." Don't just look at the beauty of the sky. Notice where you are in your life. "Rather grasp how the dark converging lines of the steeple." "Dark"—the physical building is dark and darkness has a meaning. The metaphor is that bad is dark. You know, immoral is dark. There is immorality all

through the church. There are bad things in the church. It's the dark side of the church. This is a dark steeple. "The dark converging lines of the steeple meet at a pinnacle—" How the very top of the church, the physical buildings were trying to keep them in, but they point to God and they escape. So what you're doing is allowing them to escape and pay attention to what's up there, the flower and the moon and then there they fit together, they become God with lightness and so on. So you can see what he's talking about in this poem is someone who is describing, is doing the description of the building, but in describing the building, he is giving a lesson about what it means to go into the institution. That's the structure of the poem.

Now, Williams is also a poet, and a master poet, and in doing this and talking to someone who is going into the Church. Becoming a poet is like becoming a novelist in the church. There's another reading of this that says when you become a poet, there's an institution of poetry and it's not a nice institution. You know if you actually know the institution of poetry, you start experiencing it. It's like the institution of religion. There's all the bad things of religion that you find in the institution of being a poet. Pay attention to really why you become a poet, because it's beautiful. That's the metaphorical structure of that poem. It is a metaphor upon metaphor upon metaphor upon metaphor and then the whole meaning of the poem is another metaphor. The image metaphor like the eaten moon is a very surface metaphor. The metaphor of the whole poem is about understanding the description of the physical church as the description of the process of entering the institution, and then there is a higher order reading about becoming a poet. So when you read a poem like this, if you understand the basic metaphorical structure of the mind, if you know that the mind is structured with all of these metaphors, it is possible to unpack all the metaphors and see the extraordinary way in which a great poet puts them together into something of great beauty.

Now I'd like to finish up with a description of some poems from the Asian poetic tradition, and in this book we go through a number of them, and we'll just go through some here. There is a very interesting poet in America—William S. Mervin or W. S. Mervin—who is also a translator, a very, very excellent translator, especially of Asian poetry. He has a book called *Asian Figures,* where he takes poems from various traditions, from the Chinese tradition, from Japanese, Burmese, Korean sources and so on. A number of his poems throughout the book. They are very short poems, extremely short poems, like epigraphs. What he does is translate them into English, usually in a very beautiful way. So what I'd like to do is go through this with a few of these I've taken out of *Asian Figures* from various traditions, and then talk about how they are understood metaphorically. The first one. I'll read a number. I'll just go through

them, read them and pick some to do. "Charcoal writes everybody's name black." "Blind blames the ditch." "Big thunder, little rain." "Jelly in a vise." "Not big, but a pepper." "Cows run with the wind, horses against it." "Cow, parched by the sun, pants at the moon." "Burnt lips on broth now blows on cold water." "Frog forgets he had a tail." "Cow in the stream eating from both banks." "Knife can't whittle its own handle." "Any weather, chickens' pens are rolled up." "The rats decide the cat ought to be belled." and "Ants on a mill stone, whichever way they walk, they go around with it." I assume that these kinds of poems are familiar to most of you, and if they're not, they should be. They're traditional poems of your tradition. What I'd like to do is go through them bit by bit. We discovered as we did this, that we were interpreting them from a Western perspective, and in the middle of doing so, we spoke to someone from a Chinese tradition and they said, "Oh no, you've interpreted it completely backwards." So what I'll do is give you both interpretations and explain why we interpret them backwards.

Now, "Charcoal writes everybody's name black." Now first, it has a simple metaphorical interpretation. What do we know about charcoal? It's piece of burnt wood and it has one property basically: if you touch it, you get black. You know that's what it is. So the only thing the charcoal can do is write black, and one way to understand this is to say that being able to be black and giving off blackness is the essential property of what defines charcoal. It's the essence of charcoal. He thinks of a person as having a single essence. That is the only thing that they can do. Then, that's all they can do. So if you know a person who only can do one thing, don't expect him to do anything else. That's a simple interpretation. But it is not really enough, because why "name"? We have a metaphor that a reputation is a name. You give someone a bad name. You want to protect your name. There is a metaphor that moral is white and immoral is black. "Write" is a form of communication, so you can understand writing as communicating. So it says "writes someone's name black." It says it communicates the reputation as immoral, that is, it says bad things about people. Now if black is immorality, it says that that an immoral person will make everybody else sound immoral and will say bad things about other people. So that's another interpretation, and there may be more.

"Blind blames the ditch." Now the idea here is that you have a blind person. When you say "blames the ditch," it says you have somebody who is going out walking that falls into a ditch, and he doesn't blame himself, he blames the ditch for being there. If you are blind, you shouldn't just go out walking without feeling where you are going and seeing if there might be ditches around, because you could get hurt. You should take precautions if you are blind and you should blame yourself instead of the ditch. Now this is not just about a

blind person, because the metaphor is knowing is seeing. If I take that metaphor, it says not blind, but ignorant. If some one is ignorant and doesn't know things, they should know that they're ignorant. If you are an ignorant person, and if you don't know things, you should know you don't know things and take precautions about that. Because if you are an ignorant person, bad things can happen to you, because you don't know things. Falling into the ditch, falling metaphorically is failing. Failure is falling, and it's one of our major metaphors. So it says you can fail at something, because you're ignorant, and you shouldn't be blaming the external things. You should be blaming your own ignorance. So you have "blind blames the ditch." You can see a number of metaphors structuring that interpretation.

"Not big, but a pepper." What do we know about a pepper? It's small, but very strong. It can have a great effect. So it says that some one who isn't big can have a great effect. There's a general metaphor that important is big and unimportant is small, so it says that an unimportant person who has the right personality, that is, the internal structure—qualities like a pepper—can have a still have a big effect. This is speaking of someone who may not be impressive and important, but has a major effect on people. "Not big, but a pepper." The metaphors are ordinary everyday metaphors. Important is big, for example.

"Frog forgets he had a tail." Now we know about frogs that they develop from tadpoles and tadpoles have tails, and animals with tails are on a lower point in the hierarchy of animals, in relation to animals without tails. So there is a hierarchy in the world of animals. Now, where is the tail on a tadpole? It's behind. The future is ahead, and the past is behind. So "frog forgets he had a tail" is talking about someone who is higher in the social order than a tadpole, than a lower animal, a higher person. This is based on the great chain of being in which you have higher animals above lower animals and higher people above lower people. So it's a hierarchal view of nature. It says that you have a frog who is higher on the chain than the tadpole, that is, a person who is higher than someone who is at a lower rank. It says he had a tail in the past, he was at the lower rank. So this is said about someone who forgets that he started out, who is at a higher rank, forgetting that he's started out at a lower rank. And why is that important? Because someone who's started out at a lower rank should have empathy for other people at lower ranks. It says this is an arrogant person. "Frog forgets he had a tail." Notice all the metaphors. "Frog forgets he had a tail." Six words, more than six metaphors. The metaphors are not in the words. They're in your mind.

"Knife can't whittle its own handle." Now a knife is an important tool and instrument and can be a weapon. It can be something powerful and important. But you know obviously it cannot whittle its own handle. Is that interesting?

No. This is about people, and notice it's about shaping, that people don't shape themselves. It takes other knifes to whittle the handle of a knife, so it takes other people to shape you. So no matter how effective you are as a person, you are a sharp person, you are a knife, no matter how effective you are, you did not create yourself. Other people make you into a knife. It has a moral lesson associated with it. Don't forget the other people who make you what you are. A knife can not whittle its own handle.

"The rats decide the cat ought to be belled." First, we know that the cat eats mice. The cat is a threat to mice. It's the predator—higher on the rank of animals than the lower mice and it preys on the mice. Now that is the fact of nature. Mice can't change cats. But if someone puts the bell on the cat, that would protect the mice, because when the cat comes, they can get away. So it says that the people who are threatened by more powerful people decide there should be a check on the more powerful people. But they can't impose that check. You know that you may fool yourself into thinking that you can change the more powerful people, but you can't. Very confusing.

"Ants on a millstone." A millstone is a huge round stone—a very big, enormous stone. Ants are tiny in respect to the millstone. The millstone goes around, reasonably fast, grinding the grain. It's moving around fast, and the ants are in this tiny portion of the millstone, and there they are just walking relative to the local part of the millstone. They can go a little bit, so that's what the image "ants on the millstone" is. It says, "Whichever way they walk, they go around with it." It says you are ants, and the world is this millstone, and it is moving—there are actions and events in the world that you can't control and can't even see or comprehend, and you are going to be affected by them. It's going to make you move. It's going to change your state. You're going to go around with it and never know why. We are all ants on a millstone.

Let me finish with the example that we first misinterpreted and you can judge the misinterpretation by yourself. It is this one. "Cows run with the wind, horses against it." "Cows run with the wind, horses against it." Now when we first looked at this, we interpreted it from a Western perspective. In American mythology, horses are noble animals and cows are not. Horses are really great things. They like to give you freedom—they go out on the range and explore. They are about breaking with tradition. Pioneers rode horses, you know. They did not have cows. Cows are domesticated. They're boring. They're uninteresting. So the idea here is, in American tradition, it's important to go against the tradition. It's important to stop, you know, to do something new, to find a frontier and break through it, to make changes. That's what's respected in the western tradition. So when a westerner hears cows run with the wind—that is—what is the wind? If you look at the event structure metaphor, in which

states are locations and action is motion, a wind is an excess of forces and causes, and causes are forces. A wind is an external force like an external cause and they help you move in a certain direction. So the wind is something like going with the wind, as opposed to going against it, meaning the wind is all the external things that are happening in the world, and going with it means going along with what everybody else is doing. Going against it is not going on with what people are doing, and it slows you down, it makes it hard to do things, it's difficult, but when you say horses against it, it means it's noble, it's good to go against the prevailing forces. That was our interpretation. This is not the Chinese interpretation. As we're told, in Chinese culture, it is good to go along with tradition. It is good to do what other people have done. It is good to have cows because cows sustain you. Cows give you milk, meat, and all the good things of a family life. Horses don't do any of those things. So this says that cows are the good things, and horses are the useless guys, and the guys that go against tradition don't sustain you, don't help you, and don't do the good things towards building a family.

All original audio-recordings and other supplementary material, such as any hand-outs and powerpoint presentations for the lecture series, have been made available online and are referenced via unique DOI numbers on the website www.figshare.com. They may be accessed via this QR code and the following dynamic link: https://doi.org/10.6084/m9.figshare.5426938.

LECTURE 8

The Implications for Philosophy: How Cognitive Linguistics Changes the Idea of What Philosophy Is

In the previous lectures I have gone through the basic mechanisms of the mind, that is, image schemas, prototypes, metaphors, frames, blends, and so on. I just completed the lecture on poetry and poetic metaphor. What I would like to do today is point out the implications of cognitive linguistics for philosophy.

This study of philosophy began with my own work and the work of Mark Johnson, who is a philosopher, on conceptual metaphor. What we discovered together was that conceptual metaphor is not in the words, it's in the way you think, it's in the way you understand one kind of thing in terms of another kind of thing. For example, when we understand time, we understand time around the world in terms of motion, so you have a location in terms of space. So, for example, in English, in speaking on time, the future is understood as ahead, the past is behind. There are some languages in the world where the past is ahead and the future is behind. Very, very different way of understanding time. In addition to that, we have two general metaphors in motion, one of which is that time is a moving object you can move towards or can move towards you, so that the time for action may come, the time can be here, the time can be past. You can have one time following another. This is the preceding time—the following time—and as they come towards you, you can speak of the following day or the preceding day. So, each of these as they go, you know, each moving object, each time, each entity can be seen as time relative to you or you can be seen as moving over a time landscape where you do things within a certain amount of time, so that either Christmas can come up on you or you can come up on Christmas.

Now that is just one of hundreds, maybe thousands, of metaphors we think with every day. They are also the ways you reason. They are very complex metaphor systems, while some of them are just a set of primitive metaphors that I've talked about that you learn simply by functioning in the world. For example, affection is warmth. When you hold a child, the affection you feel from your parents corresponds with the warmth of being held. There are two parts of your brain that are active, the emotional part and the part of registered temperature. They are in different parts of the brain, and when they activate together over and over, they form connections, and those neural connections constitute the metaphor. They allow you to understand the emotional part, the

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emotion of affection in terms of warmth. So the language follows, that he is a warm person, a cold person, and so on. So these metaphors occur all over. They are normal. There are thousands of them. You probably have learned hundreds of them by the time you were 6 or 7 years old. And the conceptual metaphors precede the linguistic, I mean linguistic expression of them. It's important to understand that the metaphors are not in the language. They are not in the words. They are in your mind. They are in the way you reason.

Now why does this matter for philosophy? Let us begin and we will come back to it, begin with Anglo-American philosophy. In Anglo-American philosophy, there is an assumption that truth is the basis of meaning, meaning is based on truth, and that truth is the relationship between words and the world. Now let us consider a common metaphor for time. It's a metaphor that time is a resource, like money—you can waste time, spend time, invest your time, budget your time, you go on thanking people for their valuable time, you can measure how much time you use to do something, and so on, as if it were some sort of resource like money. So this "time is money" metaphor is very common both in China and in America. It's not true in all cultures. Some cultures do not consider time as a resource. People just live their lives. They don't worry about measuring it out in terms of amounts. But in other parts of the world, we think of time in terms of resources and possibly money.

Now, can a metaphor be true? The answer is yes. For example, it is possible for someone to waste an hour of your time. Suppose you have to do something, you have a busy day, someone comes in and starts to talk to you and talk to you, and then you could say, "you are wasting my time." That is, if you understand time as a resource, as money, if that's the way you live your life, then it is possible for someone to waste a certain amount of your time. But objectively, outside of your understanding, you know, in the universe in general, time is not a resource. If you think it's about the universe before people existed, time was not a resource for doing anything because there was no one to do anything. Time existed, but it was just time, or maybe time didn't exist, and that's an interesting question, and we will get to that. Did time exist before there were people to understand time? Now physicists assume that it does, but we will talk about that too. So there are a number of fairly deep questions that we will be getting at. But in terms of wasting time, certainly before there were people, there was no wasting time, spending time, no time as a resource. So time as a resource, wasting time is a metaphor that only requires your understanding. It is not outside of you. So the theory of truth that says that truth is in the relationship between the words and the external world—that is a false theory of truth. That is called the correspondence theory of truth and it is false. It cannot handle metaphorical truth, truths that are true by virtue of you living your life

through some metaphor, because you are living a life through and you have to go through time being chopped up as resources. That's what students do.

Now, that is profound for a number of reasons. If the correspondence theory of truth is false, then Anglo-American philosophy all goes out the window, because that is the central principle behind all of it. It all depends on the correspondence theory of truth. If there is no correspondence theory of truth, there is no theory of meaning that is based on truth. Therefore there is no account of meaningfulness in any part of philosophy, and that philosophy can't work. Now this is also true of the version of Anglo American philosophy that uses logic. There is a version called 'formal philosophy' in which a language is understood as a system of symbols, just meaningless formal symbols as you would have in a formal logic. And then these symbols are mapped onto some understanding, some model of the world—usually it sets the theoretical model. In order to do that, there is more philosophy needed. You need to understand the world in terms of being made up of entities—you are an entity, the microphone is an entity, the book is an entity, and so on, entities with properties and relations out there in the world at any time. Then the idea is to model that in set theory, with sets of theoretical entities, abstract entities, standing for you and the book and the chair, the table for the entities. A property is the set of things that has that property. So, for example, the blue chairs. There is a set of blue things assumed in the world out there and so on. Now, we saw in Lecture Two there is no such thing as the set of blue things in the world because color is computed by the human body and brain. There is no color in the world itself. We know color arises because objects reflect wavelengths, but wavelengths are not color. Wavelengths are combined by the eye through the color cones and neural circuitry. The eye and the brain produce color given the wavelengths that are reflected. So there is no color in the world and sentences like "the chair is blue" cannot be true on the basis of the relationship between symbols and the world because there is nothing blue in the world in itself outside of us. So the correspondence theory of truth which says that truth is independent of people, that theory can't work for color, it can't work for metaphor, it can't work for many, many other cases that we have found. That's important. It does not work for frame semantics, and there are no prototypes. When I, when we talk about prototypes we know prototypes are outside human beings. If you think about the types of prototypes that there are, there are typical cases of prototypes. For example, take the category "husband." There are typical husbands—ideal husbands. There is a category of horrible husbands.

Now, we understand these prototypes in terms of forms of reasoning. If you have a typical case, it's what you can normally expect. If you have an ideal case, then you use it to measure as a standard to measure other people. If you have

a nightmare case, you use it as a standard for something to be avoided. We do this with any category. You can have a typical used car, an ideal used car, and a nightmare used car—any category at all. But those categories are not out in the world independent of us. So we understand, and in turn construct our conceptual system. Conceptual systems arise, systems of concept, meaningful systems arise by our interactions with the world and our interactions with each other. They are not just out in the world independent of us. What that says is that Anglo-American philosophy doesn't work. If a metaphorical sentence can be true, then Anglo-American philosophy doesn't work. This is a major point.

Now I will tell you a true story. When I first met the philosopher Mark Johnson, we started talking about metaphor. He happened to come through Berkeley to teach for a while. We went out for a cup of coffee. We came to some similar conclusions about metaphors being mappings from one domain to another and really being in the mind and not just being in words. Now we then asked, "Could we write a philosophical paper about this?" There it had just been at the time two major papers written in America, by two of the major philosophers there, Donald Davison and John Searle, who were both at my university. And we asked, "Could we write a paper saying that, you know, that criticizing their work and we thought about this for a while and we came back and we said "No, we both agreed we could not write such a paper." Why? Because what we were claiming contradicted the presupposition of all of their philosophy. All of their philosophy assumed that the correspondence theory of truth and we were denying what they presupposed and you can't just write a paper in a journal denying a presupposition. You could argue within the presupposition, but you can't just say to the journal, "Everything the journal is based on is false" You just can't do that.

So what we did was write a book instead, *Metaphors We Live By* saying just that about philosophy. So at this point I said to Mark Johnson, "Is there any philosophy in the West that fits with what we have discovered?" And he said, "Well, maybe a little bit." There are two philosophers Merleau-Ponty and John Dewey. They say some of these things but they are not very clear, they are kind of vague, you can't get very far with them, but they do accept and they do understand some of these things. But virtually, all other philosophies in the history of western philosophy go against this. I didn't believe it, and I said, "Do you mean that since the time of the Greeks, 2500 years ago, there have been no well-known philosophers who had said this besides Dewey and Merrill Ponte, who were in the 20th century?" He is an expert of the history of philosophy. He said no. That's it. So I said to him, "Well, you are a philosopher, make up a philosophy." He laughed. He said, "Philosophers don't make up philosophy. They only comment on other people's philosophies."

Now, since then we took up the challenge. We wrote a book called *Philosophy in the Flesh*. We sat down to write this book in 1991 and finished in 1998. It took seven years. It's a big book. When we sat down to write this book, we made a list of everything that needed to be said. Mark looked at this list, and he said, "that is impossible, no one can write this book." But we did, after only seven years—it is a big book and there is a reason for that. The first thing you have to do, if you ask this question of what is the implication of cognitive linguistics for philosophy, is that you have to ask what is philosophy. Moreover, if you are saying that existing philosophies don't work, you have to provide a new one. But what does it mean to provide a new philosophy? I mean we are just two people, we sit down and we say, well, you know, there are always really smart philosophers who have written over these last 2500 years, it's a little daunting to make one up. What did they have to do to make up a philosophy?

So we sat down and analyzed the structure of philosophies. I mean, linguists can do things like this. We analyze, you know, discourse. So we say what is a philosophy, what do you have to do? Well, the first thing you have to do is have a method, a method of analysis. Every major philosopher has some sort of philosophical method. And we've had a method, cognitive linguistics. It is a method of analysis. So OK, that is the easy part, we have done the method.

Now what about the rest? What else do you have to do to construct a philosophy? Well, you have to give an answer to the question, questions like what is truth, what is meaning. So we looked at these cases like "he wasted an hour of my time this morning"—a metaphorical truth. We said "what makes that true?" We said it certainly wouldn't be true for someone who didn't have this metaphor. But if you have the metaphor and you understand the world in terms of that metaphor, then truth can be based on that understanding. That is, if you understand your life and if you understand the world so that you believe that time is a resource, and if you act as if that time is a resource like money, then something like "he wasted an hour of my time" can be true.

So what we said was that the theory of truth requires that truth be based on understanding, and then we needed a theory of understanding. Now that comes out of the work being done on neural science and language which I talked about in Lecture Five.

The idea there is that meaning is based on mental simulation, through neural stimulation. It is a theory of simulation semantics. It says that given a result in neural science that shows that when you do something, either make a movement or perceive something, the same part of the brain is active as when you imagine, doing a movement or seeing something and when you understand a sentence or a word that expresses that concept. These results from neural science are very profound—consider the following example. Suppose I have

the example "John took a drink of water." Now, unless you can at least imagine what it is to take a drink of water, you can't understand the sentence. If you can understand the sentence, then you can at least imagine what it is. Now you can imagine things that can't exist. You can imagine "pigs that fly." You can imagine all kinds of non-existent things by putting concepts together. And that's something that you can do with your brain, so we have a theory of how you can imagine non-existent things because you have concepts in your brain that you can put together and then activate those parts of the brain. So the idea is that simulation semantics gives you a theory of meaning not only for existing things but for imagined things, and that's what a theory of meaning requires.

The theory of meaning is based on understanding which is based on neural simulation. The theory of truth is based on understanding. So if you understand something as metaphor, then metaphor can be true. Now, how does this fit the world? How is it possible for a theory of meaning based on neural understanding to be able to say something true or false about something in the world like lifting up a bottle? The way that works is again given by neural science. As is mentioned in Lecture Five, there are things called canonical neurons. These are neurons that fire when you either perform an action or you see something you can perform it on. These neurons connect you to things in the world that you act on. That is, there is a biological mechanism that connects you to things that you act on. Similarly, when you perceive something, there are mirror neurons. If you see someone else doing something, those neurons fire, the same neurons fire when you do the same thing that someone else is doing. That connects you to them, so we have in our brains and in our bodies neuron mechanisms that connect us to the world and to other people. It is that that allows our concepts to fit the world and to fit what other people are doing and to have the same concepts across people. Very important. That you can get a neural explanation, a scientific explanation for something as deep as that. So the first part of the book is an account of the theory of truth and its meaning and understanding and situation semantics in terms of a neural theory of mind and language. Then, and then metaphor fits perfectly into that because you can understand things via metaphors.

Now a further thing that we need to do is ask how do we understand scientific truth. For example, how do we get evidence for a theory of metaphor? That comes from what we call convergent evidence. There are ten different sources of evidence for the theory of metaphor. They come from different areas. One might say, look, you have only one source of evidence, and that doesn't prove anything. If there is only one source of evidence, how do you know that you're not just making it up with the theory? However, if you have ten independent sources of evidence and they converge, then you know you are on the right track.

Some of the evidence comes from the study of polysemy, how corresponding words in the source domain map onto the target domain. For example, in the case of 'time is a resource,' we have words like waste, spend, budget, invest, and so on, which are words for money and then they map consistently onto time so that we know that there is evidence from the words. When you reason about the inferences about money and resources, then those inferences also map onto time for reasoning about time. So we get a second source of evidence, which is evidence from inference.

There is a third source of evidence from novel metaphor like poetry and poetic metaphor. And this morning, at another university, I gave a lecture going through all the evidence from poetic metaphor that ordinary metaphor works on the way we have. There is a book called *More than Cool Reasons* by myself and Mark Turner that goes through this and a whole book's worth of examples.

The fourth source of evidence is historical change. Eve Sweetser has written a book on how the same metaphors apply from the Indio-European all the way up to the present and how they govern the change of meaning in words. So if you have a metaphor like "Knowing is seeing," whenever a new word for seeing comes into existence in a very short time, 50 or 100 years, that word comes to mean knowing.

So over and over and over again, you have evidence of metaphor from historical change. There is evidence from sign language. There is evidence from gesture. There is evidence from language learning. There is evidence from discourse analysis and so on. So what we outline in this book is the idea that there is converging evidence for this and that's how you know something in science. In science, you have that evidence from many different areas that converge before you have an acceptable scientific theory. That's a very important thing for understanding the nature of scientific knowledge.

So the beginning of this book, the first seven chapters is about those parts of constructing a philosophy. Then there is a very, very deep part of any philosophy. Every philosopher, if he has a method, must apply the method to the most basic ideas in philosophy. What are the most basic ideas of philosophy? If you apply part of your method, what are they? Well, every philosopher has to give an account of time and space, space and causes, and events. Ideas and understanding of the mind, an understanding of the self, who are you, what does it mean to have the self, an understanding of morality, and finally an understanding of being, what do you do are addressed—what is it to exist? So all of these must be addressed by anybody pretending to be a philosopher.

So we made a list of all of these concepts and we said, OK, we are cognitive linguists, let's go and do an analysis of these concepts. Well, it turns out that the major way of understanding space is through image schemes, which we discussed in Lecture Two, that is things like sources, paths, and goals and

containers, and rotations and things of this sort—contact that had already been done in cognitive linguistics.

But what about time, events, causation, morality, and so on? Well, it turns out that they are all metaphorical for the most part—we have metaphors not only for time, but there is a whole series of metaphors for events and for causes. For example, in Lecture Six, I went over the metaphors for events and causes in great detail. In this book, there is a whole chapter on that. The basic metaphor is that a state is a little bounded region in space, changes are movements into or out of that region, causes are forces, purposes are destinations and so on. And those metaphors are universal. They occur around the world and there are other metaphors like that and they are variations on those, and we discussed them at very great length. When we were done, discussing them, we noticed something amazing. If you look at causation, the usual account of causation in every philosophy is that there is one thing that is the causation. But what we find is that there are many types of causation, each coming about via a different combination of frames and metaphors. Therefore, causation is not just something out there in the world, but something that we understand. For example, take the idea that "causes are forces" that can move something from one state to another, that is, from one place to another.

What is a causal verb? Something like bring, carry, throw, push, pull, propel, any thing where you will exert force with the result that something moves from one place to another. Each of those verbs works differently. They have different inferences. If I bring something to you, then I am coming along with it and I am exerting force the whole time. If I throw it to you, then I only exert force at the beginning and it is going to you by itself. If I am pulling it, it's going, the thing I'm pulling is going towards where I am. If I am pushing it, it is moving away from where I am and so on. Each word works differently. When you apply them to causation, the same differences occur. So take a sentence like "President Roosevelt brought America out of the Depression." "Brought" means he was applying causal force the entire time he was president, he was doing things that had the results the whole time. Suppose you go to a baseball game and some one gets a home run, you can say the home run threw everyone into a frenzy. Threw. That is, first home-run occurs, then you go into a frenzy. That is like first you propel a force on the ball, then it goes somewhere. You can't say the home-run brought everyone into a frenzy. You don't say it carried everyone into a frenzy. If you thought about looking at which verbs you could use in which sentences and with what meanings, it turns out there are lots and lots of different kinds of logics of causation. This says that causation is not a unitary phenomenon. There are lots of them out there in the world and in this chapter, we've discussed at least 22 types. There are a lot, almost two dozen

types of causations with different logics. That is new to philosophers. It says causation as a single unitary thing is not just out there in the world—the way we think metaphorically and the forms of force that we understand provide us with an understanding of the world in terms of causes that make sense to us and lots of kinds of them. It is a very different kind of philosophy, it says there is one kind of cause out there in the world. What we do is go through all the different types of causations.

Now, there is another very important part of this book that has to do with morality. It's a whole section on the metaphors for morality. In there, we discovered a number of kinds of metaphors. In America, and maybe as in many other parts of the world, the major metaphor for morality is what we call the moral accounting metaphor. In fact, a student who came to me discovered this. He was taking my class and he was in the business school. He was taking Metaphor, and he was taking Introduction to Philosophy and he was taking business accounting. He said, "Professor Lakoff, I would like to write a paper about morality." I said, "that's fine." He said, "what I've discovered is that when I take my philosophy courses and I go to my business accounting courses, all the philosophers talk about is accounting." I said, "Gee, that is interesting, tell me more." Then he wrote a paper, a very nice paper about this.

There is a metaphor that well-being is wealth, that is, if I do something good for you, then at least in English, you can say you do something good for me, I can say I owe you one, I am in your debt, how can I repay you. It is as if you give me money. So metaphorically helping someone, doing something good for them, for their well-being is like giving you money metaphorically. You say I owe you for that, and I need to repay you.

Now, if I do something bad to you, suppose I harm you in someway, then how do the books get balanced? Well, I then do a favor back for you, I do something kind for you. In the second case, if I harm you, there are at least three different ways for the books to get balanced. That is, if I harm you, then I could do something good to make up for it. That's one possibility. That's called restitution. Restitution is a word in English for doing something good to make up for the harm you've done. A second way is retribution. You can harm me back. And the third way uses what is called moral arithmetic. It is revenge. Revenge is your taking something good away from me. It is like a form of arithmetic, where giving bad is taking good. That's a sort of arithmetic accounting.

This moral accounting system occurs in cultures around the world. In Christianity, you have the notion of turning the other cheek. How does that work? Well, the idea in Christianity—idealistic Christianity—real Christians usually don't turn the other cheek. In the ideal case, if someone does you harm, notice what that means? It means that they owe you, like they have taken

something good away from you, and therefore they owe you. So if they do you harm, then if you turn the other cheek, that means do me more harm, then they owe you more, and then you have guilt. Guilt is moral debt. It is an understanding of debt for harm done. So, basically turning the other cheek works like guilt.

In Buddhism, you have the notion of karma. That is, you do good things to people in the world, and in the long run, maybe in the next life, good things will come to you. They will be balanced. The accounts will be balanced. If you have good karma, that means you have done good things and you could expect good things back. So this idea of moral accounting is one of the most basic ideas in all morality. It is a metaphorical idea. Now there are other important metaphors. For example, there is the idea of what is called moral strength. Moral strength assumes that there is evil out there in the world. In order to stand up to evil, you have to be strong or you will fall. Now, that says there can be such a thing as moral strength and it has an inference. What if you are morally weak? Suppose you are not morally strong. Suppose you can't stand up to evil. Then you are evil waiting to happen, you are going to fall—falling is becoming evil. Good is up and bad is down. So, what that says is that if you are not morally strong, you're going to be either immoral or you'll become immoral. You are immorality waiting to happen. Very important metaphor.

There are others that are common. One is that is the metaphor of moral authority, that is, it's possible for some one to have a physical authority over you, someone like your parents when you are a child. Your parents can tell you what to do, and if you don't want to, they can move you out, they have physical authority, they are bigger than you are. Now, similarly, you can have a notion of someone having moral authority, someone who is better than you are, who knows what's right and what's wrong, and they can tell you what's right and wrong. What follows from that is that you should therefore respect their moral authority when they tell you what's right or wrong.

There is another important metaphor for morality, what I call the moral order. The idea is that morality and power should go together, that the powerful people in the world should be the moral people. This says if you want to find out about morality, you look at traditional forms of power. So in this moral order you have God in a religious case, God above man, then you have man above nature, above animals. You have adults above children.

Then in the American, Western version, you have Western culture over non-Western culture, America over other countries. Then you have other versions of this in the moral order: men above women, Christians above non-Christians, strict people above homosexuals, white people above non-white people, this is a metaphor that is well known in Western culture. It's a metaphor

of discrimination. It says that it is right to discriminate against people if you are higher in the moral order, and it is used to justify discrimination. Very evil metaphor for morality.

There is another, that's very important. Morality can be understood as traveling along a path, that is, there is a path of right action. And you are moral if you stand on the path and immoral if you go off the path. Or there is an idea of an area of right action, and you are moral if you stay in the area and immoral if you go out of the area. So that is another metaphor of moral boundaries. The word for going out of the area in English is "to transgress," to go across a boundary. So "transgress" means. The word for going off the path is called "deviate," so deviant behavior is something that deviates from the path. It is based on that metaphor.

Then there is a metaphor of what I call moral essence. The idea here is that everybody has a character, some essence that makes them who they are and you can be of good character or bad character. That is, you can have something in you that is good, being inherently a good person or inherently a bad person. That is the metaphor of moral essence. Good people will do good things and bad people will do bad things. That's what follows from that. Then there is a metaphor of moral purity. Morality is purity and immorality is disgusting, awful, yucky things. In that metaphor, to be moral is to be pure. If there is something that is disgusting, you say that's disgusting behavior and so on. It's immoral.

Then there is metaphor of "morality is health," in which you think of immorality as a kind of disease that can spread. Now this is a very important metaphor in the West because it is the basis of things like imprisonment. What you do with immoral people, you get them away from moral people by putting them in prison. So they don't have contact and their immorality can't spread. So, that's one part. It's also the basis for, in some cases, moving people, moving in the West from the cities to the suburbs. They assume that people in the cities are bad people and that if you move to the suburbs to get away from the bad people because you could catch bad morality by being opposed to them. That is, the disease can't spread. And this is again widely used in America as justifying movements from the city to the suburbs and so on. Those are some of the major metaphors for morality.

There are two kinds of family-based metaphors which give you totally different views of morality. These are extremely important metaphors in American culture and they may not occur in Chinese culture at all. But they do occur in American culture and they form the basis for the difference between political liberals and political conservatives and liberal and conservative morality. So let me give you a sense of how that works.

There is a general metaphor that the nation is a family in America. So we have founding fathers, for example, of the nation. We send their sons to war. Given this idea that the nation is as a family, there are two distinctive kinds of families giving rise to two distinctive views of national morality. One of them is what is called a strict father family. In a strict father family, it is assumed that the world is a dangerous place that is difficult, that there is always competition, and there always will be losers and winners and the children are born bad and have to be made good. The reason you need a strict father is to protect the family in the dangerous world, to support the family in the difficult world and to make the bad children into good children.

How does a strict father make bad children into good children? Punishment—usually physically painful punishment. The name for this in America is called tough love. The idea is that a strict father who loves his children will beat them when they do something bad and that is good for the children. How is it good for the children? The theory in this model of the family is that applying physical discipline will make the children get internal mental discipline so that in the future they will do only the good things and avoid doing the bad things. The way they become moral is that there is a strict absolute morality, there are rules to follow and they will only follow the rules if they are mentally disciplined and they get their true physical discipline. That is the idea.

Now another part of this family model, is that if you are a disciplined person, then you can become prosperous and wealthy and take care of yourself, and become a self-reliant person. It is moral to follow your self-interest—let me go into that for a minute. There is another metaphor for morality. It is called the metaphor of the morality of self-interest. Why is it moral to follow your self-interest in this metaphor? What is very wildly interesting about this metaphor, it is based on another metaphor. It is based on Adam Smith's basic metaphor for capitalism. Adam Smith was the guy who invented capitalism. He had a metaphor called the metaphor of the invisible hand. And it goes like this. If everybody pursues their own profit, everybody just tries to make as much money as they can, then he says the profit of all will be maximized by the invisible hand. The invisible hand is nature. It is a law of nature that if everybody pursues their own profit, the profit of all will be maximized. That is Adam Smith's metaphor. There is a version of this in American culture and American family life, that is, if everybody pursues their own self-interest, the self-interest of all will be maximized.

Now the other model, what I call the progressive model, the one behind progressive politics, is a very different model of the family and morality. In the family, it is assumed that both parents are equally responsible for raising their

children. This is called the nurturant parent model of the family. In that family, the job of the parent is to nurture the children and to teach the children to nurture others. They turn the children into nurturers of other people. That is the job of a nurturant family. What is nurturance? Two things. The first is empathy. You care about someone else, you feel what they feel. If a baby cries, and if you are good parents, you learn what those cries mean. Empathy and responsibility. To be responsible for a child, you have to be responsible first for yourself, but then you have to do a whole lot of things to raise the child. And a responsible parent is a strong parent. Responsibility requires strength and a lot of other things. It is not easy to be responsible.

Now from those values in the nurturant parent family, there are other values that follow. That is a part of the family. If you empathize with a child, you want to protect the child. If you empathize with a child, you want the child to be fulfilled in life. You want the child to be treated fairly, not unfairly. If the child is to be fulfilled in life, the child must be free enough to be able to seek his own fulfillment. In order to have freedom, there has to be opportunity, economic opportunity, opportunity for fulfillment, for free action, and if there is none, there is no freedom. For there to be opportunity, there has to be prosperity. So you have to seek prosperity. For there to be prosperity, you have to work with other people in your community. So community building is a moral part of this family life. It's an important part of a nurturant family. You can't raise a child alone. The morality, the moral values of the community are important. You have to work for them.

In addition, if you are going to work and build up a community, you must cooperate. So cooperation becomes a family value. To cooperate, you have to have trust, so trust is a value. If you are going to be trustful, you have to be honest. So honesty is a value. In a nurturant parent family, you have the idea that you are going to nurture your child and protect your child and allow your child to be fulfilled in life and to be treated fairly and with freedom and so on. And you want do things for other people too.

That is the basis for progressive politics in America. So you have in America right now a fifty-fifty split between two totally different moral systems. And tomorrow I will show how this works in politics. But those are two kinds of family models in the West. It's probably different in China, but I don't know. Now I went through this because metaphor plays a crucial rule in morality. To understand what morality is at all, you have to use at least some of these metaphors. If you don't use any of these metaphors at all, if you don't think of any of these terms, there is no morality, there is no such concept. The very concept requires things like accounting. I have left out uprightness, that is, you know moral people are upright and so on. What we did in going through this

metaphor analysis is give a theory of morality and that's one of the things that has to be done if you are going to construct a philosophy.

This is just to give you some sense of why it's important to do cognitive linguistics if you are going to understand philosophy. There is no philosophy out there now that talks about all of these different considerations in morality. There is no philosophy that says, as this says, that morality is first constituted by metaphor and second that metaphors are not arbitrary. They come about in a universal way. Let me try to give you a sense of how they are not arbitrary.

Think about metaphors like "moral strength or well-being is wealth or moral health." Why should we have metaphors like this? Morality is about well-being—your well-being and the well-being of other people. Morality is about how you affect the well-being of other people as well as your own. That's the subject matter of morality. If you look at the way children live around the world, the way they grow up, you will ask, "What is it that affects well-being?" Well, around the world, you are better-off if you are strong than if you are weak; you are better-off if you are healthy than if you are sick; you are better off if you can stand upright than if you have to crawl around on the ground, you are better off if you are taken care of than if you are not taken care of. If you go through each of these metaphors, then what you'll find is that they all arise from the conditions of well-being in the world. What about the strict father in nurturant parent models? They arise from two very basic facts about what it is to be a human being.

We know from the study of mirror neurons in neural science that there are neurons that fire away either when you perform an action or you see someone else perform the same one. We know that the same neurons are there in monkeys. That means we evolved to have mirror neurons. Why is that important for morality? The mirror neuron system is in what is called the pre-frontal cortex. That is the cortex, the part of the brain that choreographs your complex actions, they put together complex actions. It has connections from that part of the brain to the emotional system.

Now there is a physiology of emotions. When people feel happy, their faces go up, their bodes go up; when they feel depressed, their mouths go down and their bodies goes droop; you can tell by the expressions on people's faces and what their bodies are doing, how they feel. How is that possible? The reason is that you have mirror neurons that allow you to loog at someone else and know what it will be like to have that happening in your body. Those mirror neurons that are firing would say their muscles should be like your muscles and they are connected to your emotional system and that allows you to tell how someone else could feel. It is the neural basis of empathy.

Now we also know from the study of neural science that purposes and purposeful actions are indicated down to the single neural level. We went through this in Lecture Five, going through the evidence showing that, for example, if a monkey is grasping something like a banana, if they succeed in achieving their purpose, certain neurons will fire, but if they just move their hand, the neurons don't fire. That is, there are other neurons that will fire when they just move their hand. The importance of this is that purpose is coded neurally—and empathy is coded neurally.

The strict father model seems to be a reflex of people wanting to have authority and power over other people to achieve their purposes. The nurturant model has to do with empathy and acting upon that empathy. So these are two very different parts of what is to be a human. We have both of them. Chances are that variations on these models of one sort or another are going to occur in various parts of the world. I don't know how Chinese moral systems work, but chances are you are going to get variations on each of these in this system.

Now why is this important? It says that morality comes out of experience in the world and have a human body and brain, that morality is embodied. That says there isn't a universal morality, but there is a limited range of moral concepts. We can describe what they are. So what you have is a very different moral system that says there isn't one morality, there are a number of them, there are a number of different metaphors. But they are not infinite. It is not that anything goes. There are certain ranges and, moreover, you may have one particular version of morality or another, but again it is not just anything at all.

Let me stop with the discussion of concepts and then tell you a few other things about what we had to do in this book. Remember where we were. We were asking what it is to take to construct a philosophy. One thing we saw was that we had to go through all the basic concepts: time, events, causation, morality, the mind, and show how they are understood and we went through all of the metaphors for all these concepts and showed that all of them were metaphorical. But then we have to do something more, that is required of every philosophy. Every philosophy, as they use its motor analysis to describe other philosophies, previous philosophies. You find, starting with Aristotle, Aristotle describes the Presocratics and so on. You go up through history, philosophers always comment on the previous philosophers, using their own understanding of those philosophers.

Bertrand Russell, for example, one of the creators of analytic philosophy, has a big book called *The History of Western Philosophy,* where he tries to explain Western philosophy in terms of analytic philosophy. He takes analytic

philosophy for granted and then tries to explain it all that way. What does that mean for our attempt? It means that what we need to do is take cognitive linguistics and apply it to philosophies as a subject matter. So we started with Presocratics, and we looked at the metaphors of the Presocratic philosophers, then we went through Plato's metaphors, Aristotle's metaphors, Descartes's metaphors, Kant's metaphors, and finally the analytic philosophers'metaphors.

Now I can't do all of that today, but that's the second half of the book. It's a long description to go through all the metaphors of all these philosophers. But let me tell you briefly the kind of things we found. What we found is that each philosopher has a set of metaphors taken as absolute truth. They have some metaphors and they just take them as truth and then they reason on the basis of those metaphors and all their reasoning uses just those metaphors. They never go outside those metaphors. That's why you get a distinctive type of reasoning in Plato and a very different kind of reasoning in Aristotle and a very different kind of reasoning in Descartes or Kant or Donald Davidson or contemporary philosophers.

So what we did was we worked out what their metaphorical system was for the Presocratics, Plato, Aristotle, Descartes, Kant's moral theory, and analytic philosophy. Now I can't go through them all, but let me give you a few of the things that we found. What is the minimal difference between Plato and Aristotle? Plato had the basic metaphor. First of all, you need to know something about Western philosophy. All of the Presocratic philosophers, the ones before Plato, before Socrates, all of those philosophers had certain things in common. They all assumed that the world was rational, that there was a rational structure to the world. They were reacting against the view of the Greek gods. With the Greek gods, the idea was the world was made up because there were these gods up there and they are completely crazy irrational beings, very selfish and self-centered and they would be fighting with one another and what happened in your life depended upon what the gods were doing and how they happened to pinch on you.

This was a rebellion against the idea of the Greek gods. It said, no, the world works in a sort of rational way. It is not just the matter of the whims of the gods. So that part of Greek philosophy says that. It says moreover that every entity in the world, let's see, this one, is a member of the category, so this object is a member of the category "bottle." Every entity, you are a member of the category "person." That's a member of the category "chair." Every entity is a member of a category.

Secondly, it says that every category itself is an entity in the world, that categories are things in the world, and it says that every category is defined by essence. What is essence? It is a list of properties of necessary and sufficient

conditions for something to be a member of the category. So, for example, if you look at a tree, what is the essence of a tree? The essence of a tree is that it is made of wood, that it has a certain shape. That's called the substantive essence—subtance. It has a formal essence, that is, it has a trunk, roots, branches, and leaves. That's its form—that's its formal essence. It has an essence with respect to change. It starts from a seed, and it sprouts out, and then it gets bigger, and it grows bark, it grows branches, and then it starts to decline and then it dies. That is its cycle of change.

So the idea is every essence has either substantive formal or changed dynamic aspects to it. That is what essences are. Essences do one more thing—because something has an essence, it explains the behavior of that thing in the world. So if you ask why is it that the tree can burn? Because it is made of wood. Why can you climb a tree? Because it has limbs and so on. Why can forests regenerate? Because it's a pattern of growth, a pattern of change. That is, the essences determine the behavior of things, that is all part of Presocratic philosophy. Then there is one more thing. If each entity is a member of a category, and the category itself exists in the world as an entity, then that category must be a member of a bigger category. And the bigger category has to be a thing in the world and that must be a member of a bigger category, and so on. You keep on getting a hierarchy of categories, and then there is a further assumption. There is a highest category, a category in which everything contains everything in the world. And the name for that category is called being. Being is the category that contains everything that exists. This comes from Presocratic philosophy. That's what being is.

Now if every category is defined by essence, they told you what everything in that category is like. Chairs have an essence, they have backs, they have seats, they are off the ground, and so on. Trees have an essence, bottles have an essence, and so on. What about the category of being? If you know something's essence and if its behavior follows from logically—if it follows from it as a consequence of it's essence, then what you should be doing is going around, figuring out what the essences are. That's how you make predications about the world. Moreover, if you can get essences about a higher category, you could make better predications about more things. If you could figure out the essence of the highest category—being, then you could figure out how everything behaves.

So the main question of philosophy determined by the Presocratics was what is the essence of being. Being is given by the sequence of hierarchy of categories. It's the highest category. It has everything in it. All categories are defined by an essence that determines behavior. You ask what is the essence of being. And then you have various Presocratic philosophers, you know,

making claims about the essence of being. So there was somebody who said the essence of being is water. Everything is made up of water. Someone else comes on and says "Hey! Wait a minute. Fire is not made up of water." There are four things: earth, fire, wood, and water—fire isn't water. And moreover, these things come in opposites, fire puts out water, and so on. So given that, you know, the essence of being must be an indeterminate matter, for it can't be anyone of those, and so on. Then you get one philosopher after another saying "what is the essence of being?" You have a philosopher coming on and saying, "you can't step in the same stream twice." The essence of being is change. That is the dynamic pattern of change. That's the real essence of being and so on. Each Presocratic philosopher tries to give a different answer to the essence of being. You get another philosopher coming on, saying the essence of being is number. Well, the assumption was if the essence of being is number, what is the rational structure of the world? It's given by arithmetic, by addition, subtraction, multiplication, and division. Then when they discovered that therefore everything could be done by giving numbers to things and doing arithemetic on them. Then it was discovered that the square root of 2 couldn't be given by addition, subtraction, multiplication, or division—that the square root of 2 is irrational. People commit suicide because the world ceases to be a rational place. So this was taken very, very seriously.

What about Plato? Plato comes along and he says that essences are ideas that you have. The ideas don't have to be the things that you have, they can be ideas that are floating in the universe. He says moreover that essences are ideal things, the best of things, so they are both ideas and ideals. Now there is a part of Plato where if you start reading Plato where things get a little mysterious. Plato had some points, talking about "the good," and he says something that sounds very mysterious indeed. He says the sentence "the good is the causal source of all that is." The good is the causal source of all that is. Now what sense can you make of this? I remember when I was a college freshman, I read this and I said that this doesn't make any sense at all—nothing. But in writing this book, it began to make sense; let me try to explain how. Plato had the idea that essences, the essence of categories of things, that essences were abstract, they were ideas, they weren't out there physically in the world, that the world was a sort of shadow of the essences, that the real things were the ideas, the Platonic ideas, and that these were not only ideas but these were the best examples of things. So the Platonic idea of the bottle was also the Platonic ideal of the bottle, it was the best bottle, the best possible bottle as well as being the essence of the bottle. That ideals and ideas came together in essences.

Moreover he then said, "Let us look at the hierarchy of categories." Each category has an essence, you have a higher category, a higher category, a higher

category. Let's go up to the top, we have the essence of being at the top. That essence is both an idea, as an abstract, and it's an ideal, it's the best, it's the good. It's good, it is the best thing there is. Well, not exactly the best thing there is, because if you look at the essence of being and all the other essences, they form the category of essences. So if the essences form a category, there must be an essence of essence. It follows metaphorically. There must be the essence of essence and it must be an idea and an ideal, and it must not only be the ideal, it must be the highest ideal, the most ideal thing there is, and we give that a name. We call it "the good." When Plato talks about the good, that is what he means. The essence of essence. Now what is the property of the essence of essence? Essences are the causal source of behavior. And if this is not only the essence of being but the essence of all essences, it is the causal source of the behavior of essence. The good is the causal source of all that is. If you put these metaphors together, they make sense. It means Platonic sense—Plato's sense. So when you start to read a philosopher like Plato, if you figured out what these metaphors are, it starts to make sense. The reasoning actually follows. And what we did, when we did this, we go through these arguments which when we first read made no sense at all. We did not see why from here you reach that conclusion. If you understand them as metaphors, they actually do follow from a metaphorical logic.

Now what is the difference between Plato and Aristotle? Plato says that essences are ideas. Aristotle says that ideas are essences. Exactly the reverse. He says that the ideas you have in your mind are the essences of things in the world. He says the world is made up of objects, the categories are out there in the world and the essences of the categories are in the world. He says your ideas, if you really can understand something, your ideas are those essences, the mind he says from understanding is grasping, can grasp the essences of the world and take them into your mind to form ideas. That your ideas are the essences of things in the world and that he says is how you can do science. He is the first scientist. He says you can do science by having the essences of things in the world because from the essences you can predicate behavior. Then you went out trying to do biology, physics, and so on, trying to characterize what the essences of biological categories were and so on. Now you see from this that when you do metaphorical analysis of different philosophers, you begin to understand what the enterprise of philosophy is. These are people trying to understand how the world rationally works in this way.

Now let's keep ahead a little. I don't want to go too much into this, but I do want to talk about two things. I want to talk a little about Descartes and a little about analytic philosophy and then stop. Descartes made a major break.

Descartes asked, "How do I know that I exist?" And he concluded, "I think therefore I exist. I exist because I am a thinking being." Moreover he said, "What makes me a being is that I exist, that I am rational." He said, "I know that … how do I know that I am thinking? Because I have clear and distinct ideas and I can pick out my clear and distinct ideas."

Let's stop right there and look at the metaphor involved. It is an important central metaphor and it goes like this. Knowing is seeing, understanding is seeing clearly, and in order to have knowledge, you have to be able to have mental vision, that is, you have … and notice you have all things like … that's a clear argument, that's an opaque argument, and so on. Now in this, that metaphor is elaborated very, very greatly, and it's there all over the place in Descartes. The notion of clear and distinctive ideas is in the metaphor of mental vision. Let me give you some idea about how rich this is. An idea is an object that you see. Knowing an idea is seeing an object clearly. A person who knows is a person who sees. The life of reason is ordinary life. Visual focusing is mental attention. Mental intellectual acuity is visual acuity. A mental view point on something is a physical view point. An impediment to knowing is a visible obstruction like pulling the wool over your eyes or being blind, that something may keep you from seeing. Now it turns out that Descartes uses this all over the place. In the same way we assert that when we see objects clearly when being present to the regarding eye. They operate on it with sufficient strength. But distinct is that which is so precise and different from all of the other objects that it contains within it nothing but what is clear. That is, he is reasoning entirely in terms of the metaphor of "knowing is seeing." You will find this throughout Descartes.

Now there are other metaphors as well. I won't go through them, there is a lot of stuff on Descartes's philosophy here, and there are other metaphors that he uses. Now what about Kant's moral theory? If you start to read Kant's moral theory, it is very turgid, it's not so obvious, but it turns out that in Kant's moral theory there is a central metaphor. It's that reason is a strict father, a strict father, a strict father model of the family, that the mind is a family, that the strict father is reason, that the child is will, and that external evil in the world is passion and the idea is that the reason should govern the will and overcome the passions, that the evil you have to stand up to is the passions and that what the strict father has to do in terms of teaching is show right and wrong, the will is what carries out actions, the strict father must tell the will what to do, what not to do, and discipline it. That is the central role of metaphor in accounting morality. There are three other basic metaphors that Kant used together with that. So what is interesting is that Kant uses the strict father morality with reason as the strict father.

Finally I'd like to talk a bit about analytic philosophy. There is a set of metaphors that I discussed in one of the previous lectures for the mind. And in the section of the book on the mind, we go through the basic metaphors for mind. There is the basic one that the mind is the body that functions in space and ideas are the things that functions in this respect too. Special cases are that thinking is moving, and the ideas are locations you move through, so you think step by step and you reach conclusions or you can be going in circles. Another one is that knowing is seeing, so you can say it's clear, it's unclear, I see what you are saying, and so on. Another one is that thinking is manipulating objects, it's playing with ideas, communication is sending ideas to someone else, ideas are objects, and thinking is manipulating the objects, putting the ideas together and so on. Those are important metaphors. Another one is that thinking is mathematical calculation. You put two and two together, you form an account of something by doing accounting. You can say, "let me sum it up for you," which is like adding up the sum." You have a metaphor that thought is language, which is a very basic metaphor, in which you talk about the vocabulary of philosophical ideas, and so on. "Thought is language" is a very important metaphor when you say things like I can hear myself think, as if you can—the thoughts can be all expressed in words. Then there is a very important one which is the mind is a machine which turns out thoughts in a step by step fashion.

Now if you put these metaphors together, what you get is a set of consequences that are basically analytic philosophy. So, for example, take the notion of analyzing through linguistic analysis, which is the center of analytic philosophy. It says that ideas are objects and therefore analysis is looking at the structure of those objects and breaking down their structure. So that's one of these metaphors. It says that if ideas are objects or locations in space, they are independent of the thinker. That is, if you are seeing something, the thing you are seeing is independent of you; if you are moving into a place, the place exists independent of you; if you are manipulating an object, the object exists independent of you; if those are ideas, it says ideas exist independent of the thinker thinking the ideas. This is one of the central tenets of analytic philosophy, that ideas have nothing to do with the mind, they exist independent of minds. Very strange thing, but it requires that if truth is the relation between symbols and things in the world, then ideas and meanings have to be independent of minds. It is a very strange thing but that's what analytic philosophy says, among other things. In each case, in this metaphor, the idea is a thing in the world. Analytic philosophy, the correspondence theory of truth says that the sentence is true if the words fit the state of affairs in the world, that is, the ideas are the states of affairs and affairs in the world.

So what you have here, and I can go through the rest, for example, in analytic philosophy, a branch of that, the formal philosophy, where you use logic and formal logic. What does a formal logic say? It says that you have a formal language, thought is language. The language is made up of symbols—the symbols are objects, so you are manipulating the symbols and symbol manipulation is thinking. That's what formal logic is. Moreover, it's a branch of mathematics. It's like thinking is mathematical manipulation putting two and two together in a mechanical way, the mind is a machine, you think in a mechanical way and you put ideas together. Basically, the metaphors for mind structure analytic philosophy. Our normal metaphors for mind provide this structure to what Western analytic philosophy is. What's interesting about that is analytic philosophy says there can't be any conceptual metaphors, so that the very philosophy that says there can't be conceptual metaphors is made up of about twenty different metaphors. That's what we do all through here.

So what we've done in this book is outline what philosophy is about. What we try to do is say, first, there are results from cognitive linguistics that don't fit any of these existing philosophies and therefore we have to construct a new one. We have a couple of names for this—one is experientialism and the other is embodied realism. But basically it comes out of the idea that the mind is embodied. Previous philosophies all assumed that the mind is disembodied. Whether it is Plato that has ideas that are abstract, Aristotle that has them out in the world, or Descartes where it's a strict separation between mind and body, the mind is not part of the body, and so on, the idea and the same thing in analytic philosophy. Meaning and ideas are disembodied. They are in the relationship between symbols and the world. So when you go to an embodied theory of meaning and an embodied theory of ideas as we have, you have to have a new philosophy. We give examples of what meaning is, what truth is, and what understanding is in terms of neural science and mental simulation. Then we have to say we have a method. The method is doing cognitive linguistics. Then we ask what are the basic ideas. You have to analyze them—they are time, events, causation, the mind itself, morality, and being. We do that to show they are all metaphorical. Then you have to say what is about previous philosophies—what they are like. We make a discovery, the discovery is that every philosophy is defined by a set of metaphors that are taken as truth, and not even noticed as being metaphors, and that all the reasoning is done within them. That is what this book *Philosophy in the Flesh* is about.

All original audio-recordings and other supplementary material, such as any hand-outs and powerpoint presentations for the lecture series, have been made available online and are referenced via unique DOI numbers on the website www.figshare.com. They may be accessed via this QR code and the following dynamic link: https://doi.org/10.6084/m9.figshare.5426989.

LECTURE 9

Political Linguistics: The Application of Cognitive Linguistics to Political Analysis in America

It is a great privilege to be at this well-known, world famous university, and an especially great privilege to be at the cradle of the democracy movement in China. I come from the University of California at Berkeley, which started the free speech movement in America back in 1964, very much like the democracy movement in China, somewhat more successful in some ways, but still very much in the same spirit. What I'd like to do today is talk about the relationship between academic pursuits like cognitive linguistics and politics.

What is happening in America right now is probably very confusing to Chinese students. The reason is this: Right now, America is politically divided right down the middle—almost fifty-fifty. George Bush did not get the most votes in the last election. Al Gore got the most votes by 500, 000, but Bush won in a critical state where his brother was governor. There was a contested election about whether the vote was legal. He won because the Supreme Court, with justices appointed by his father, chose him in a decision which it said was unique and could not be used as precedent for any other decision. In short, there was a lot of political corruption in the choice of this unilateral election. It is remarkable that there was no protests in the streets and so on in America. I think the reason for that is that America tries to be peaceful even under the worse conditions.

Right now America is divided almost fifty-fifty between two utterly different views of politics and with them utterly different views of what morality is. This is something that is not widely known around the world, and it is not widely understood. What I'd like to do is give you some understanding of what politics in America is like today and what kinds of issues are at stake there and why it is that a minority party has been running the country. The conservatives are a very wealthy organization. They are the Republicans there. They have become radical conservatives and they are running America right now. They have all the branches of government—minority, majority, and the Supreme Court, and both the Congress and the Senate, and the White House. It's a very slim majority, barely a majority, very close, even though the majority of voters are on the other side. The question is how have they done this. Moreover, the form of conservatism has become more and more right wing. It is more and more radical as time has gone on.

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One question I want to ask is "How has that happened?" The history of this is very interesting. In 1964, Lyndon Johnson won the election by a huge majority over a man named Barry Goldwater who was a conservative candidate. At that time, conservatism was of no interest in America. No one wanted to be a conservative. Between 1964 and 2000, the conservatives took over America, and the way they did it was use a lot of intellectuals. What they did was they invested a huge amount of money, two billion dollars over forty years, to build think tanks, that is, politically oriented research institutions to promote conservative values and to get them into the public domain, and also to spend a lot of money on media to use the media to their political advantage. At the same time, the progressives, the Democrats in America, did nothing of that sort. Nothing. And during these years the conservatives succeeded. What they succeeded in doing was figuring out exactly how they thought. Originally conservatives were in great disarray, they had lots of factions and so on. They came together around a single political ideology that they could understand, and they instituted a language apparatus in the society, that is, a means of producing effective language for the media and training their politicians at all levels in the use of this language. At the same time the democrats did nothing. What happened over those years was that their language became the language of American politics and their ideas defined the issues of American politics. The way we say this within cognitive linguistics is, they came to frame every issue. Now what I've been involved in recently is the development of the politics institute, separate from the university—a private politics institute to try to reframe American politics from a more progressive perspective, one more democratic, because the conservative movement is actually a very antidemocratic movement as we will see. What is happening in terms of their domination of American politics is actually quite dangerous, and we will talk about why. What I would like to do is try to give you some examples of why cognitive linguistics in particular matters for understanding all of this politics. Let me give you a very common metaphor used in thinking. In morality around the world, one of the common metaphors for morality is "morality is accounting." It's like adding up debts. So if I say to you, if you do me a favor and you do something good for me, I can say I'm in your debt, I owe you one, and how can I repay you? So doing someone a favor, doing something that increases their well-being is metaphorically like giving them money. Therefore, to balance it out, you owe them something, you have to repay, you are expected to repay it in some way.

Now if I do something to harm you, then moral accounting can occur in several ways. If I harm you, it's like … almost like taking money away from you.

It is hurting you in some way and therefore, I can make up for it by doing something good for you. That is called restitution. If I harm you in some way I can say "I am sorry. I will make up for it." That's restitution. That's one way of settling the moral books. That's another metaphor being used. But another variant of that in moral accounting is what is called retribution. If I do something to harm you, then you may feel the only way you can balance the moral books is by harming me back. That is called retribution, or punishment. Another form is called revenge. If I do something to harm you, you can do something to take something good away from me—to harm me by taking something good away and that is called revenge. In Buddhism, you have the notion of karma, which says that if you do good deeds to the world eventually in this life or the next, good will come to you, that there is moral balance eventually.

Now this is a metaphor and it's one of the central metaphors for morality. It's something very important in American life, as you will see as we go along. In general, what I discovered in looking at the American situation was that morality was central to it. I discovered this in the following way. So let me tell you by the way how I got into this particular branch of research.

Back in 1992, I watched the Republican national nomination convention for the presidency. This is the other side of conservative convention on TV. I watched the candidate for vice president give an acceptance speech and I mainly wanted to see it because although he wasn't a very interesting person, his speech writer was—his speech writer was a major conservative theorist. I wanted to see what his speech writer said. As I listened to the speech, I found myself embarassed because I could not understand the speech. This was not a very smart politician, but everyone in the audience there on TV could understand it. I understood every sentence. That was not the problem, sentence by sentence. I just had no idea how the sentences fit together.

So I decided to try to remember one argument and it was an argument about taxation. The argument was about what is called the progressive income tax. In America, a progressive income tax is a tax where very wealthy people pay higher taxes than poor people because the idea is that the wealthy people have gotten more from the society and owe more back and that they are more able to pay. Now conservatives are against the progressive income tax. This candidate was giving one argument against it. The argument was in one sentence. The argument against the progressive income tax was "Why should the best people be punished?" That was his argument. Everybody cheered in the hall on TV and I didn't understand why this was an argument against the progressive income tax and everybody who were Republicans understood this. I realized at that point that although I was a professor of semantics, and although

I had studied American politics all my life, I fundamentally did not understand American politics because I couldn't understand what people who believe something else understood.

Then two years later, in the year that the conservatives took over the American Congress in 1994, during the election there was a very radical conservative movement. They filled the election with ten promises they called the contract with America. They said "we promise to do the following ten things and if you elect us." And the ten things were a list. I looked at this list, and they were familiar things, but I didn't understand how the things on the list fit together.

So the list consisted of these things. If you elect us, we will promise to end all abortions for women. No women will be able to get any abortion. If you elect us, everybody will be able to own guns. Guns for everyone. If you elect us, we will have a lower income tax for wealthy people. If you elect us, we will get rid of all environmental regulations—nothing to stop pollution, nothing to stop the degradation of environment. We will get rid of all of these regulations. If you elect us, we will have what they call tort reform. Tort reform means the following. In America right now, it is possible to sue a corporation if it does something to harm people. For example, if they build a car where they know the gas tank will blow up, and somebody drives one and there is a crash and the gas tanks blow up and somebody dies, the family can sue the company. They said "we will not allow this. We will not allow law suits that will allow for very large settlements against corporations that do immoral things" and so on. There is a long list of these things. In foreign policy, we want to build up the army to be as strong as possible. These were among the ten things. I looked at these ten things and I said these are very strange people. The other thing was they promised was to institute the death penalty everywhere for murder, and have as much death penalty use in as many places as possible. So I looked at this list and I said what do these positions have to do with each other. What does being against abortion have to do with lowering the taxes of wealthy people? What does lowering the taxes of wealthy people have to do with allowing everyone to own guns? What does allowing people to own guns have to do with tort reform or building up, you know, the military and so on? What are all these things? How do they fit together?

Then I said to myself, I am against all of these things. I have the opposite views. I asked myself how do my views fit together. I couldn't answer the question. Now again I have written a classic book called *Women, Fire and Dangerous Things* about categorization. As an expert on categorization, I didn't even understand my own categories. That was very embarrassing. So I started wondering about how all these things worked. That was the mystery to

me. I started to interview both liberals and conservatives. As I did, I found that each thought the other was irrational. So if you ask a liberal about conservatives, as I did, they will say "How could you be what they call Pro-life that is anti-abortion and still promote the death penalty? How can you be in favor of life and in favor of the death penalty?"

If you ask conservatives about this, they will say liberals are irrational. How could they not want to put a murderer to death but allow the killing of babies, for an abortion? Each side thought the other was crazy. Now when you see something like this, you understand that there is a different world view involved. One thing we learn from cognitive science and cognitive linguistics is that our understanding of the world comes in terms of frames and metaphors and most of these are unconscious. Most of these are not things that we know about, or that we understand about ourselves. They are very deep. They are in our brains, in the synapses of our brains. We understand the world without being able to understand the mechanism for understanding. What cognitive linguistics is about is showing people what that mechanism for understanding is like. So I thought: Aha! This is an ideal problem for cognitive linguistics, and I set about studying it. Now that turned out to be a very difficult thing, but one of the questions I asked was the following.

I had been doing research on metaphors for morality, like moral accounting. Mark Johnson and I had discovered a set of about twenty or so metaphors that seemed to be universal. When I started listening to the speeches of liberals and conservatives, I found that they use different metaphors for morality. So I started writing down a list of who used which metaphors for morality. When I got this list done, I didn't understand them.

Let me try to give you a sense of the metaphors for morality that I discovered and then in a while you will see how they work in politics. There is a metaphor of what I will call moral strength. It says there is evil in the world that there is an absolute right and wrong. Morality is uprightness. It's moral to be upright and to be strong. You need moral strength. If you are morally weak, what happens? You need moral strength to stand up to evil. If you are morally weak, you will fall. That means you will become evil. So moral weakness is evil waiting to happen. It is immoral even to be morally weak. That is the metaphor of moral strength. This occurs in many places around the world. Interestingly, it was one of the main metaphors used in conservative politics.

Let's take some other examples. There is a metaphor that immorality is a disease, a contagion and it can spread, that you can catch immorality by being in contact with immoral people. What follows from this is that when you raise children you have to keep them away from bad people because they'll become immoral if they are in contact with bad people. In America this has to do with

races a lot. In the inner cities of America, you have a lot of people who are not white, and they are seen by conservatives very often as being immoral. The idea is to get rid of public schools where every one can go and have what are called vouchers for private schools, namely to privatize education so that the children of the wealthy and the children of moral people will not have to be in contact with these children of immoral people. What they do is they will move to the suburbs or they will try to send their children to different schools. They will be against the government funding education for everyone because that means everyone will have to go to the same schools. Instead, they want the government to give the educational money in the form of what is called vouchers, that is, slips of paper worth a certain amount of money, so that you can go to private schools and then the private schools can choose what students they want. And you can segregate the society in terms of what conservatives see as morality. The result, of course, will be that the wealthy people will go to better schools and the poor people will go to worse schools. But that is, you know, this is the idea behind what is called school vouchers. So one of the ten things they promised to do was introduce a school voucher program. This would have the effect of eliminating public education because as more and more people pull their children out of public schools, the public school system collapses because it doesn't have enough finances behind it to support it. So, that is one of the programs of conservatives.

So I started looking at more of these things. Let me give you other metaphors for morality. There is a metaphor of what I will call moral essence or character. The idea is that you have some sort of virtue inside of you that you learn when you are young or perhaps are born with some sort of internal character. What you do depends on your character. That is, your behavior comes from your essence or your character. If you put the metaphor of moral essence and moral strength together, you have an expression like "backbone." That says what kind of backbone does he have means 'is he morally strong?' and what kind of character does he have. Conservatives like to talk about that issue, about backbone and character because of moral strength for reasons we will see in a while.

There is a metaphor that morality is purity and immorality is to be disgusting or impure in someway. That's a very wide metaphor in the world. There is another metaphor that morality is nurturance—to take care of people—and that immorality is not to care about someone. There are many more we could go through this list but I want to give you a sense of them and they are not a random list. All of these metaphors come from one place and that is the following. In general, morality concerns well-being. It has to do with the well-being of others and your own well-being. Therefore, the metaphors for morality

that occur around the world, what are called the primary metaphors, arise because of your experience in the world of two things coming together. Two different types of experiences come together forming a metaphor because they activate different parts of your brain and you learn neural connections between those different parts and those neural connections are the physical instantiations of metaphorical thought.

So for example, it is better to be strong than to be weak. You just function in the world better. Therefore you have more well-being. Therefore, morality is strength. It's better to be healthy than to be sick. So morality is healthy and immorality is disease. It is better to eat pure food than to have impure food, so morality is purity. It is better to be able to stand upright than to have to crawl on the ground. Morality is uprightness. It is better to be able to function in the light than in the dark, so morality is light and immorality is dark, and so on. There are about twenty-five examples like this with the basic metaphors from morality arise from the conditions of well-being. Now what I found was some of them were attractive to conservatives and some of them to liberals, but I didn't know why. It was a mystery.

So I then continued working, and I found another mystery. One of the major conservative political theorists had written a big book, which was his most famous best selling book and it was a book of children's stories. And I said why should a major political theorist be writing a book of children's stories?

Moreover, most of the conservative candidates for office in America were talking about what they called family values. I wondered why when the issues of atomic war were at stake, why when the issues of starvation and poverty were at stake and so on, were people talking about traditional family values. When I went into this, I thought of reading that literature—it occurred to me that one of my students had noticed a very deep metaphor in American life. It's the metaphor that the nation is a family. In America, we understand that there are many places in the world, we understand large social groups in terms of smaller social groups like families and communities. And so we have expressions in America like the founding fathers of America, as if America were a family and the people who found it were fathers. We have the descendents of the founding fathers that are called the sons and daughters of the American Revolution. When we have a war, we speak of sending our sons to war as if the country had children. So the idea that the nation is a family is a very common metaphor.

I reasoned that if it was the case that the nation is understood as a family, that you map families onto the nation and reason about the nation as a family and if we have two different ways of understanding what the nation should be, conservative and progressive politics, then maybe there were two different

kinds of families behind us. So what I did was this—I took that metaphor. I took the forms of politics and I turned the metaphor backwards, I actually stated the mappings, turned them backwards and out-propped two ideal models of family, two utterly different models of what a family should be. It turns out that these are in fact conservative and liberal models of family life in America. They are a strict father family and a nurturant parent family. So I will tell you what they are and how they map onto politics. In an American strict father family, certain things are assumed. It is assumed that the world is a dangerous and a difficult place. It's dangerous out there. There is evil in the world. It's hard to live in the world. Not only that, there is competition in the world and there always will be competition. There will always be winners, there will always be losers, and your job is to be a winner. Another background assumption is that children are born bad and have to be made good. So those are the background assumptions. The reason you need a strict father is you need someone to protect you in the dangerous world, to win the competitions and to support you in this difficult world and to teach children right from wrong—to take the kids who were born bad and make them good.

There is only one way in which the strict father can do this in this kind of family, and that is punishment. When the children do the wrong things, they have to be painfully punished. They will have to have painful punishment, not just, you know, go to your room but painful punishment. The word for this is discipline—physical discipline. The idea behind it is that if you physically punish or discipline your child whenever they do wrong, then sooner or later they will get mental discipline, stop doing wrong and only doing right; they will then have discipline inside themselves. They will discipline themselves—that is necessary for someone to be moral. So the assumption is the only way that people are moral will follow rules if they are disciplined and go against their natural inclinations to do the wrong thing, and just halt themselves from doing that and only do the right thing.

Now in the strict father family, discipline has a secondary role because if you are disciplined, then you can follow your self-interest and become wealthy and self-reliant. Now this is an important part of the strict father family. It links prosperity to morality. It says that the same thing that makes you a moral person, disciplined, or makes you a prosperous person if you follow your self-interest. Now in America, in this version of the American life, in the conservative version, there is a further metaphor for morality. It's the morality of self-interest. It is moral to pursuit your self-interest. This, it turns out, is a version of American capitalism and the form of capitalism that was introduced by Adam Smith, originally in England. Adam Smith's metaphor was like this. He had a central metaphor called the metaphor of "the invisible hand."

The invisible hand refers to nature. And the metaphor goes like this: if everyone seeks their own profit, and if they go around and make as much money as they can, then the profit of everyone will be maximized by the invisible hand as a law of nature. That is Adam Smith's view of free market capitalism. This view has a metaphorical version of the family.

This metaphor of well-being is a kind of wealth as we saw in moral accounting. Well-being is like wealth—this says if everyone pursues their own well-being, then the well-being of everyone will be maximized. Therefore, it is moral to pursue your well-being and immoral to get in the way if someone else is pursuing their self-interest, or their well-being. So the idea here is that given the morality of self-interest and discipline, a disciplined person pursuing the self-interest without being interfered with should be prosperous. Moreover, it says if someone isn't prosperous, that means they are undisciplined. If they are undisciplined, they can not be moral because they can't follow the rules and they will do immoral things. So the bad people are the poor people. The poor people deserve to be poor and the rich people deserve to be rich because they are the disciplined people. This is an answer to the question about taxation. Remember "why should the best people be punished?" The best people are seen as the rich people—the disciplined people whose wealth shows that they are moral.

That is part of the conservative ideology in politics but also the conservative model of the strict father family. Then there is another part of this model. Which is that, when a child has grown up and reaches maturity, they will either be disciplined or not. If they are not, they will become dependent upon other people and they should not be taken care of any more. They should be given tough love, thrown out into the world to be disciplined by the world. If they are moral, then they don't need the strict father any more and their strict father should not meddle in their lives and should not tell them what they should do any more.

Now this meddling in their lives has everything to do with the government. The idea here is that the government is like the strict farther. The job of the government is to protect, to tell you what is right and wrong. But when the mature children who are good and know what's right and wrong, those children should no longer be under the control of the government. They should be free to do what they want, but the dependent children should be made to be more disciplined still.

Now let's think about what this means in politics before we go on to the other model. Why is this way of raising children political? It maps onto politics in the following way. In the history of America politics, one of the great achievements came from Franklin Roosevelt, what was called "the New Deal."

In the American Depression in the 1930s, what Roosevelt did was create a number of what is called public welfare and public works programs. For example, he would creat jobs where the government would pay people without jobs to do good things like build parks, build schools, build good public buildings where there were none, build libraries, do good things for the common good while using the government's money to stimulate the economy and pay people. That was part of it. Another part of it was what Roosevelt called social security. That is, there were a lot of old people, who after they could not work anymore, had no money and were impoverished. If they got sick, they could not afford doctors and so on. So social security was started. It was a way that said when you are earning a living, you can pay a certain amount into the account held by the government. The government keeps that until you are old and when you reach the age of 65 and retire, then you get this money back but in a higher amount because it has been invested—somewhat in a higher amount. Then you can be at least minimally supported in your old age. At least you won't be impoverished.

Later on, in the 1960s, the extension of that was put in for medicare where you paid a certain amount into the government for medical insurance for your old age so that after you retired at 65, then you registered for medicare, and you could get free medical help when you needed it. It was medical care for old people who no longer had work income.

It was a very, very great thing for the poor in America, and it stabilized America,—it was seen by progressive people and the Democrats as a great achievement. It was seen by the conservatives as awful. The reason it was seen as awful was that it was seen as making people dependent on the government. That is, it was seen as taking away discipline. So all social programs, for example, programs to send people to colleges if they couldn't afford to go to college, were seen as an evil. That is, if you believe that people have to be disciplined to be moral and that anyone who is disciplined can just make money on their own than otherwise, to help them out is to be seen as immoral. So all social programs, social security, medicare, all of these things were seen by conservatives as immoral—to be wiped out. And they were seen as well as making people dependent, hurting the people they were supposed to help. So conservatives have had it as a goal to get rid of these social programs. Now one of the ways in which they did this was very clever.

When Bush came into office, he had a very interesting bit of linguistic framing. On the day that he came into office, the White House started putting out press releases about what is today called his tax relief plan—tax relief. Now the idea here is that taxation is an infliction, that is, if you think about the linguistics

of this in order for there to be relief, there has to be an infliction. Someone who is harmed by an infliction and the afflicted party, a harmed party, a reliever, who takes that infliction away, is a hero. Someone who tries to stop the reliever, they are a villain, they are a bad person. Now tax relief says that taxation is an infliction. Now, taxes are what in America paid for social security, for medical care, for schools, for all sorts of things, public education. So for many people taxation was an investment in a moral society, in a fair society. But for conservatives taxation was seen as an infliction and a burden because the rich were paying a higher proportion than the poor. They said the rich were therefore being punished for being good people, for being rich. So, from their point of view, people needed tax relief. Now President Bush therefore cut taxes on the wealthy and the result was that the government got a lot less money. When they got less money, it couldn't afford all the social programs to help people. They started cutting social programs and they went into a deficit. America now is in a big deficit. This is not an accident. It was planned. It was planned by conservatives as a way to get rid of social programs so that the government couldn't pay for them.

So this is a very interesting part of American politics to understand, you know, what conservative politics is about. Now let's think about foreign policy. What does this say about conservative foreign policy? It says that in foreign policy, America is seen as the most powerful nation and therefore the strict father of nations, the nation who knows right from wrong, who is the moral authority, and other nations, third world nations are seen as children nations, who should listen to the strict father, who should obey. So from the conservative point of view should the US go to the United Nations to ask what it should do in Iraq or Afghanistan? No, the US doesn't have to ask anything just as the strict father doesn't ask the children what to do. Right? So the US doesn't ask third world nations what to do. It knows what to do and is going to do it. It might ask for support, but it's not going to ask them for advice or cooperation. It is just going to say "go along with me because I know best." That is the conservative view of the world and it is what has led the American foreign policy under George Bush.

Now there is a lot more we could go through—all the other positions and this book *Moral Politics* does that, but I'd like to give you a view of what the is other half of Americans believe, because that's only one half. The other half, the slightly larger half, believes something totally different. It has a different way of raising children. It has what is called a nurturant parent view of the family. So let me tell you what the nurturant parent view of the family is. It's a view that says both parents are responsible equally, that the world can be

made better. It may be difficult, but it can be made better and it's your job to help make it better. It also says that the job of the parent is to nurture, that is, to care for their children and to turn their children into nurturers of others. That is to make their children nurturers so that they want to be nurturers to care for others. That is the job of the nurturant parent.

What is nurturance? Nurturance is two things. First, empathy. Empathy means connecting with someone else, feeling what they feel. A parent must know what every baby's cries mean. Does the baby have to be changed? Is he hungry? Does he have to go to sleep? That is nurturance. Right? So, empathy is required. The second is responsibility. If you are a parent, you are responsible for your child and you can't take care of the child unless you can take care of yourself. So you are also responsible for yourself. So in order to raise the child to be a nurturant parent, you have to empathize with the child and be responsible for yourself and responsible for the child.

Now, from those two principles, empathy and responsibility, many things follow in the nurturant family. For example, if you empathize with the child, you will not want the child to be harmed, so you want to protect the child. So protection is a very important value. How does it show up in politics? It shows up in politics, in democratic ideas, that is, progressive ideas like environmental protection, consumer protection, worker protection. All of those are very important ideas in progressive politics.

If you empathize with the child, you will want the child to have a happy, fulfilled life. You want the child to be able to do as much as he can with his life. And this shows up in politics by saying that the Democrats want everybody in society to be fulfilled as much as possible, that it is the role of the government to work for the fulfillment of all the people because your job is to nurture others. So that's the political consequence of that. If you want your child to be fulfilled in life, then you'll want your child to have enough freedom to be able to do that because you cannot fulfill your life unless you are free to do so. So this comes into politics in the idea that the individual should be as free as possible, relative provided they don't interfere with the freedom of others. So the idea of freedom and that ideal is part of the progressive values.

Another part of this is fairness. That is, if you empathize with your child, you want your child to be treated fairly. This comes into politics in the idea of fairness because then you will want everybody in the society to be treated fairly. That is one of the ideals of progressive politics. There is another ideal, which is if you want your child to be free enough to be fulfilled in life, then they have to have opportunities, they have the opportunities to get a job, to go to college, to get educated and so on, have families, have houses. They need opportunities.

For opportunities they need prosperity. So opportunity, and the cultivation of the general prosperity for everyone is part of democratic values.

In order to cultivate prosperity and in order for children to be raised with the appropriate values to care for others. Every child is raised in a community. You can't just raise your child by yourself, other people will affect your child, so it's important to build community and maintain community. Community building is a major part of progressive politics. Now, if you are going to build and maintain a community, that requires cooperation, not just competition. Cooperation, that is, to be able to cooperate in building and maintaining communities. Cooperation requires trust. Trust requires honesty. So trust and honesty are major progressive values. If you are going to raise your child and you are going to empathize with that child, you have to be able to know what the child means and that requires open communication. In politics, that translates into openness of government. That is, the citizen should be able to question the government, to know why the government does what it does, their access to all the documents, and so on. That is, open communication is a progressive value. Basically, the nurturant parent family maps onto progressive politics. Every progressive policy in America is an instance of those values. So one can see immediately that, for example, on social programs, social security, medicare, etc, the progressives are going to be in favor of that, the conservatives will be against all social programs. In international relations the progressives will be in favor of global cooperation of helping poor people around the world to have better lives, of having cooperative global leadership rather than imposing just one's will on other countries because you of your moral authority.

So you have a very different idea of what foreign policy is if you are a progressive and have a nurturant parent view of the world. So what's interesting about this is that the idea of family life structures a huge amount of the American politics. America is just split down in the middle historically and right now between these two utterly different views of what morality and politics are about and what the government should do—about what a good person is like, about what a good family is like. There are completely different views.

One of the interesting parts of this is the following. These models are actually in everyone's brains. That is, when you learn a model of this sort or metaphor, that metaphor is in your brain physically, in the synapsis of your brain. It does not just go away simply, it's there. But everyone has both models if they grow up in the American culture, but it maybe active or passive. So for example, if you are a political progressive, you also have a conservative model, because if you can understand a movie like a John Wayne movie or an

Arnold Schwarzenegger movie which uses sort of the conservative model. If you understand it at least passively, you have that model in your brain. If you are a conservative, you can watch, say, a TV show called The Bill Cosby Show, which is about a nurturant family. If you are a conservative, you understand that show, you can watch it, understand it just as anyone can, then you have at least a passive nurturant model. The question is which of these models you live by, which is active in the way you live your life and which is just used for understanding other people.

Now in America, in American politics, one thing that political leaders know is that certain people, for the sake of elections, are absolute conservatives. Another bunch of people are absolute liberals. They are not going to change. They have the active conservative or liberal model for politics. That number of people is roughly between anywhere from 35% to 45%, somewhere in there, they used to be between 35% and 38%. The number seems to be going up on both sides. They will determine which view of the world dominates the American government. There are very different views of the world.

Now when you study the people who are in the middle, they turn out not to be people with neither model, but people with both models active, but both models active in different parts of their lives. For example, there are workers, who are called blue collar conservatives, that is, people who work in physical labor, who have a strict father view at home and a nurturant parent view in their jobs—in their union jobs. So people who work for unions in America generally have a strict father's at home but are nurturant in their politics. You have people who are heads of corporations, who are strict fathers in their jobs but nurturant in their home life. You have teachers who are strict fathers in the classroom but nurturants at home and in politics, and so on. There are lots of divisions of this sort. Now what each party is trying to do is hold on to its own base, its own voters, and extend that base to the other side, and the idea that the way it works is for each of them to activate their model in other people. That's the game, to activate their model in the people in the middle to try to get their votes in politics, to activate their model for politics, so to get the people in the middle to either use the strict father model about politics or the nurturant model about politics. If they can do that, then they get more people voting for them. That is part of what is going on in American politics everyday.

Now because the conservatives have a certain advantage in their think tanks and in their intellectuals, they have paid their intellectuals very well, they have built their think tanks, they have a large media concentration, and they have a developed language. They have the advantage in framing the issues from the strict father perspective. What they have done in the public media

is define the issues their way and if you can define the issues, you win the debate. There is a reason why, and it is very important to see why. It has to do with cognitive linguistics. One thing we know from cognitive science and cognitive linguistics has to do with framing. A frame is a way of understanding a situation. For example, understanding taxes in terms of tax relief and tax infliction or any other understanding of the situation. If you can fix the frame for understanding a situation, then you win. Why? Imagine negating a frame. There was a very famous incident in American politics regarding Richard Nixon, the American president who was forced to resign in 1974 for illegal activities. Before he resigned, he went before the nation and gave a famous speech, in which he stood there and said "I am not a crook" and thereby made everybody think of him as a crook.

When I teach frame semantics in an introductory cognitive linguistics course, the very first thing I do is I give an exercise. The exercise is "All of you, now, ready? Do not think of an elephant. Whatever you do, do not think of an elephant. Did anyone succeed?" The word "elephant" is defined, relative to image and frame which gives a certain amount of knowledge about a large animal with large ears and a trunk and tusks and a tail and so on. When you hear the word "elephant," you have to think of an elephant. If you say "don't think of an elephant," you still have to think of an elephant.

Now what does this say about framing in politics? It says, "Do not deny the other person's frame." Now the conservatives know this and they have language lessons for all their candidates, and they teach this, but the progressives and democrats do not know this. So we get the following situation. Right now John Kerry is the democratic candidate who will be running against Bush. Bush makes a claim about Kerry, which is false—they'll say "Kerry wants to raise your taxes 900 billion dollars." And Kerry's campaign stupidly comes back and says "John Kerry never said he wanted to raise your taxes 900 billion dollars" and people hear "raise your taxes 900 billion dollars." Or last week Dick Cheney, who is now in the country, made a false charge against Kerry. He said Kerry wanted to raise the gasoline tax 50 cents a gallon. That turned out to be false. That wasn't what he wanted to do. So Kerry's campaign came out and said "John Kerry never wanted to raise the gasoline tax 50 cents a gallon," and made people think that he did. That is the people running the campaign think they are telling the truth, and that is enough. This is a major liberal mistake.

The progressives in America don't know enough cognitive linguistics and unfortunately the conservatives in their think tanks have figured it out intuitively. They've gotten the idea and the progressives have not. So here are the progressives'mistakes. First, just denying what the other side says, using

their words—that's a mistake. There is another major mistake. It is assumed by progressives that all you have to do when the other side says something false is tell the truth. Say what is true. It doesn't work because the frame, the other side's frame will overcome the facts. Frames overcome facts, because the frames are in the synapses of your brain. If the facts don't fit the frame, the frame stays there. The facts will not be comprehended and will be ignored. So the democrats constantly make this mistake over and over and over again. They had just set up their first serious think tank. And what does that think tank mostly do? Whenever the Republicans make a false charge, they tell the truth. They say, "Here is the truth." They use the Republican's frame. They don't change the frame. What is necessary is imposing your own values, framing things your way, not their way.

That's not easy. Let me tell you why it is not easy. Again, the answer comes from cognitive linguistics. There is a phenomenon in the brain that has been discovered by cognitive scientists called hypocognition, which means the lack of ideas you need. That is, it says there are conceptual gaps that you need, when you need a concept or frame and you don't have that frame in your synapses. This was discovered back in the 1950s by an anthropologist named Robert Levy, who studied Tahiti. When he went to Tahiti, he was also not only an anthropologist, he was also a psychiatrist. He was trained in psychiatry and anthropology. He noticed when he got to Tahiti that the Tahitians had a very high suicide rate. A lot of Tahitians would commit suicide. So he started studying the Tihitian culture and suicides and discovered something very, very deep. That the people in Tahiti did not have a concept of grief or grieving. They not only did not have a word for it, they experience grief, they have the emotion. But they had no concept, no word, no rituals, no idea that grief was normal. And in certain situations, no idea there is certain things you can do about grief and so on. No idea of rituals for grief. No healing mechanisms for grief. And so what they did was think, when they experienced grief that there were demons after them who wouldn't go away or they had a terminal illness and they would commit suicide. Now the idea here is that sometimes there are ideas that you need when you don't even have the concept, much less the word.

And back in 1964 when the conservative Goldwater lost, conservatives had massive hypocognition. They didn't have the ideas they needed, but they invested and built these institutions, the think tanks, things like the American Heritage Foundation or the American Enterprise Institute, and so on. They built these think tanks, and the think tanks filled in the conceptual gaps over 30 to 40 years, so that they no longer have hypocognition, but the democratic progressives have hypocognition. They have a huge number of frame gaps, places where they need new frames, and they don't have them in their synapses

when they are not out there in the public. There is a way you can tell this. Any linguist can tell this immediately. We know from cognitive linguistics that words and expressions are defined relative to frames. Every word is defined relative to some frames. If there is no frame, you can't get a word for it. Because there is no "it," no frame to get a word "for." So every word is defined relative to a frame. Now suppose that liberals and conservatives are having a debate on television. They go on television. The conservative says "I'm in favor of tax relief." Tax relief has a frame. They have a frame that taxation is an infliction where the citizens are the afflicted party and the president is the hero who is relieving them and so on. That's the frame. So they can use the two words "tax relief." The progressive comes on and he has to give two paragraphs to explain what he means. If you watch political shows everyday, you will see that the Conservative has two words while the Democratic has to go on and on because there is no frame that can be named.

They have to construct frames and get them out in public and that takes a while, it takes some time to do. It's possible that they don't even know that's what they have to do. So there is a sadness in the linguist watching this, seeing that American progressives don't have all the frames they need and need to construct them and need to get them out in public and need to find words for them. They need to find language as well as construct frames. So this is something that most American politicians don't understand if they are progressives. The conservatives have had intellectuals figure it out and work it out and they don't need it because it has been done for them. That is what makes American politics right now very dangerous because the conservatives, although they are minority, have the advantage—the cognitive linguistics advantage. That is, they have all the frames they need, they have the language, they've got it into public discourse, and the other side hasn't done it yet.

One of the reasons that I want to start a political institute for progressives is to enable progressives to be able to catch up in this regard. Now, this is a very hard job. And there is one more thing I should mention. That's really deeply important. There's something that the conservatives know and have learned and the progressives have not. Conservatives understand something called strategic initiatives, cases where they do one thing and has huge effects.

For example, I mentioned tort reform. Tort reform is putting a cap, a maximum figure on the amount that someone can receive in a personal injury case when they sue a corporation, putting a relatively low limit on the amount you can receive. That's called tort reform. It's a funny word for it. But, that's what they have. Now why did they care so much about tort reform? What would happen if they actually did this? Well, obviously, individuals who would be harmed by corporations, let's say, they might have lost an arm or a leg because

of something that the corporation did and didn't care about safety or something like that. They wouldn't be compensated, they wouldn't be able to make a living, and they wouldn't get any money in compensation. That's the first thing, but that's not the real reason. The real reason has to do with many other things. If you have such a cap, then the corporations can continue to seek their self interest indefinitely. They don't have to worry about safety for the public, they don't have to worry about stopping pollution, they don't have to worry about making safe products because they can predict the amount they'll have to pay. It won't be that much. They can build it into the cost of doing business and then they can just go on their way. That is, they will not have, if you view the corporation as an individual who is disciplined, they can go about making their money freely and no one can interfere with them. Even if they did not operate for the public good, even if they operate against the public good, they can't be stopped. It means that they can violate all environmental regulations, they can pollute freely, they can do all kinds of awful things and they can't be stopped.

In addition, there is a little known fact about American politics. In these lawsuits, when the law`suits are very large, suppose, let's say, a thousand people sue a company for some injury, the law firms make a lot of money in the lawsuits. The law firms get sometimes 30 percent of the money. Often they defend people and if they lose the cases, they get nothing, but they can get a lot of money out of this. And the very wealthy lawyers, who are called tort lawyers in this case, are in some states the main people who support the democratic party. That is, they are the main contributors to the opposition to the conservatives and this is the way of taking the money away from the opposition.

So here they might have the idea that, say, let's cap the awards, isn't that unfair that they will have very large awards, but the effect is to allow companies to do whatever they want, to harm as many people as they want to and so on, and also to take money away from the opposition. So this is called the strategic initiative. It says one thing but the effects go widely in many other things. And in general, progressives don't know how to frame strategic initiatives. What they have is a lot of little programs, a program for this, a program for that, but not broad initiatives that have wide effect. and they need to learn to do that. They've just learned when they heard one example that I think convincing a number of people to work on. The people running this initiative are friends of mine and I am trying to get them to make it as broad as possible. It is called the New Apollo Initiative. Right now in America the oil and coal and gas industry, the fossil fuel industry that pollutes the world, uses 25% of the world's fossil fuels and produces 25% of the air pollution in the world. That is supported by American tax payers' subsidies of thirty billion dollars a year, thirty billion

dollars just given to the companies for certain kinds of rights and so on in tax. Thirty billion dollars a year to help them use oil and coal, to help them pollute. This is done because the oil companies have a lot of political power. They can give campaign contributions to conservative politicians who work for them. Now the Apollo initiative says: take the thirty billion dollars away from that coal and oil and put it into alternative energy that doesn't pollute. And we now have the science to do that. That is, we can have very effective solar panels, hybrid cars—electric, partially electric cars. We can have wind power, steam power, biomass. All sorts of forms of energy, that so you wouldn't need all that oil and gas and coal. You could run your cars without very much gas, mostly on electricity and hybrid cars.

What would happen would be this. If you invest that money in building this alternative energy, you will generate in America four million jobs and these jobs will have to be done in America, like building solar collecters, putting them in, installing them, fixing them, and so on—they can be American jobs. And if you did that in China, you had Chinese jobs and you wouldn't have all the pollution you have here. Beijing in the next six years is supposed to increase the number of cars by 40%. 40% more cars and they are not going to be hybrid cars. They are going to be cars using gas with more pollution.

If China says we are going to make hybrid cars like Japan now makes, instead of oil-burning cars, gas-burning cars, then you could slowly get rid of the pollution and you will have a new energy industry that can be then used for other things as well. In fact, China will probably in the long run make much more money by producing better energy and less pollution. But that's not happening here. It's not happening in America if the conservatives win. If the Democrats win, there is possibility, but if the Republicans win, there is no possibility.

But this is the strategic initiative for the following reason. It is a proposal about energy that has an effect on jobs, that it also has effect on international politics because then America would no longer be dependent on Middle East oil. Imagine America not dependent on Middle East oil. It would not have to have armies in the Middle East to protect its oil supply. Now, right now, third world countries also depend on Middle East oil and oil from Venezuela and Algeria and so on. Any country with the present technology for alternative energy, if they had the right technology, they could be energy producers, not energy consumers. Every country has some ways of producing energy by sun, by wind, by water, by biomass, and the technology exists to make that happen, but it takes investment to develop the technology to build it and then to explore it.

Imagine if around the world every country produced its own energy, and nobody had to buy Middle East oil. Not only that, imagine that nobody had to buy oil at all, that there was no pollution, that all the energy was non-polluting.

There would be no environmental destruction, no health problems with breathing, no pollution in the water. Not only that, the country would not have to import the oil, which means that they would not have to get a loan from the World Bank to buy the oil and they would not owe the World Bank the interest on the loan. It would change third world development enormously because every dollar, every Yuan, invested in the third world has a multiplier effect of six in development. So just investing in alternative energy is an enormous investment in third world development and helps the people of the world.

That is a possibility, but in America, if George Bush is reelected, that could not happen. It is something that could happen in China, but probably won't the way the present government is thinking about energy. All these are ways of framing situations. If you frame energy as a problem of getting enough oil, you have one set of consequences. If you frame the problem of energy as producing alternative energies, energies like solar energy, wind energy, water energy and so on, then there are other consequences and some consequences are much better than others, politically and otherwise. Framing semantics matters. How you frame an issue matters tremendously for the history of the world. That is why cognitive linguistics is so important in politics.

All original audio-recordings and other supplementary material, such as any hand-outs and powerpoint presentations for the lecture series, have been made available online and are referenced via unique DOI numbers on the website www.figshare.com. They may be accessed via this QR code and the following dynamic link: https://doi.org/10.6084/m9.figshare.5427058.

LECTURE 10

Summary and Overview: An Overall Picture of Cognitive Linguistics: What It Means and Where It Is Going

I would like to talk first a bit about the development of the theory of metaphor. In fact, the theory of metaphor has gone through three stages and since, in general, scientific theories are metaphorical, I would talk a bit about that. I'd like to talk about the metaphors for metaphor that the theory has gone through.

I mentioned in previous talks and in *Metaphors We Live By*, metaphor goes with "love is a journey" in which lovers are understood as travelers and relationships as vehicles and difficulties in the relationships as impediments, things that get in the way of traveling to its destination. And those are linguistic expressions for this conceptual metaphor—things like "it's a long bumpy road," "we are spinning our wheels," or "we are going in different directions." But in each case, there is a mapping from the domain of travel to the domain of love. Now, that mapping is the following: that travelers might map onto lovers, vehicles to love relationships, that the destinations, common destinations map onto common life goals, and that impediments to travel, since they stop you from reaching your goals, are mapped onto difficulties in the relationship.

Now originally, we tried to use the metaphor of the mathematical mapping for this, and it failed. It failed for interesting reasons. In a mathematical mapping, where you are mapping from one structure to another structure or perhaps one set to another set. Let me give you an example of the mathematical mapping. You multiply by two. One maps onto two, two maps onto four, three maps onto six, and so on. Mathematical mapping. In each case, the source and target of the mapping exist independent of the mapping. The mapping cannot create a new structure. With all the structures there, you just map from one pre-given structure to another, nothing is created. Not only that, nothing is overridden. I mean you map everything there to be mapped.

So, it turns out that this failed for a couple of reasons. The first reason is that real conceptual metaphors can add structure and add entities. For example, in the domain of love just by itself we'll have an emotion, a lover and beloved, and some positive emotion. There is no such thing just in love by itself as a crossroads, as a direction, as a dead end, and so on. All those entities are added by the metaphor of "love is a journey." That is, "love is a journey" adds entity structure to the love relationship. It introduces new entities and that is something

mathematical mapping cannot do. So that was one failure. A second failure was the following. There are cases where certain things are not mapped. In general, they work like this. I gave one of these examples before. Take the sentence "I give you that idea." If I give you that idea, if I say I give you this bottle, then I can no longer have the bottle. If I give you the idea, then I still have the idea. What's going on? What is happening is this: you know something different about ideas, and the metaphor overrides what you know about that idea.

So in order to account for the first problem, the additional structure to this, we made up a new metaphor for metaphor. It was the overhead projector metaphor. You know we put layers of projections, you put them on the overhead projector, where you can add structure that way. So we have an overhead projector metaphor. Now, one additional metaphor is that you can add entities that way, but it's a funny metaphor. It's not a real theory. It's just a way you think about it. But in the case "I give you the idea" you are subtracting structure and adding overheads—it doesn't allow you to take account of that. Now what we did was simply stipulate that there was a contradiction; you had what was called an override. Now that was an ugly theory. In fact it wasn't even a theory. It was the name, a way of naming the problems. More recently, in Narayanan's neural theory of metaphor, you have an explanation in a real theory of this phenomenon. The neural theory says that certain basic primary metaphors are learned very early and they are learned under conditions of experience. For example, you learn that achieving a purpose is reaching a destination, because if you want to go and get a drink of water, you have go to where the water is, or if you want to go to get a book, you have to go the library to get the book. That is, achieving a purpose regularly correlates with reaching a destination. That correlation activates different parts of the brain. When you activate different parts of the brain, you learn regularly over and over, you learn neural connections between them. Those neural connections physically constitute the metaphor, the primary metaphor. Now what that says is, first, if there is a contradiction between the two domains, if any parts are inconsistent, then the connections are never made. So, in "I give you that idea," there will be no connections to override, they will just never occur. Moreover, you could explain on this account why structure is added. The reason is that metaphorical reasoning will be taking place in the source domain, with the effects of metaphorical reasoning mapped over. That is, if you are reasoning, let's say about purposes in terms of motion through space to a destination, then your reasoning is about motion through space, and the results of that are mapped over to what you say about purposes. So, in that account, you have an account of why extra entities, the entities of the source domain, are used in the target

domain when you are thinking metaphorically. So, this is a nice example of the history of science.

We went through three stages, each with a different metaphor for metaphor, and the last metaphor for metaphor, namely, the neural connection metaphor, is a real scientific metaphor. It's something that can really occur in biology and it makes a lot of sense. But it's important again to understand that if you are talking about something scientific and abstract, you are very often using metaphors. Let me give you some more examples. Let's take Einstein's theory of general relativity. I assume that in the MIT of China I'm allowed to talk about scientific issues.

Einstein used one of the most common everyday metaphors in the theory of relativity, namely, that time is a dimension of space, and we have this metaphor universally. We have two metaphors for time, one in which time can move toward us and one of which we can move along with the time dimension in space, and both occur in languages around the world. Einstein took that second metaphor and took it as a truth about physics. Now in general relativity, Einstein took up the question of what is gravity, and he argued the following. He argued that there was no force, such a thing as the force of gravity, that gravity, as a force, acting at a distance did not exist, that Newton was wrong. What he said instead is that gravity is a curvature of space-time. So let me give you an example of this. He said "think about a star or the Sun, and imagine light from a distant star passing by the sun." The question is "does it curve?" Well, light, a photon has no mass. If it has no mass, it can't be pulled to the star by the attraction of a mass as a newton, and then it should go straight.

But, he said there is another way to think about the behavior of, say, objects with masses going by a large object like the Sun. Imagine, he said, a rubber sheet. You put a basketball on the rubber sheet and it goes down, it curves. You take a marble, a little marble, and you shoot it right pass the basketball, and it will curve. Not because there is gravity pulling it to the basketball, but because the rubber sheet, the space is itself curved. He said that a photon going by the Sun should curve. This was experimentally tested in 1919 when there was an eclipse of the Sun. During the eclipse, there was a star right next to where the eclipse was. And the question is "where would you see the star?" Was the light of the star over there with the light coming straight or would the star be there with a light curving? So that it would look there, but we know it was over here. We know it would just come like this. And the answer was the light curved. The star looked as if it was in a different place. Right? The light curved. What that meant was that it couldn't be pulled to the sun by gravity, so space itself had to be curved around large bodies. Now that was the Einstein's account. It's

a wild metaphor. What he's doing there is using a certain form of mathematics with Riemannian geometry in which spaces can curve. For example, take a sphere. The surface of the sphere is curved. It's very common to have spaces that curve or take a saddle on a horse. The saddle, as a space, is curved. It's a plain, but it's a curved plain. So, there are plenty of curved spaces that we experience in the world. Einstein said four-dimensional space-time is itself curved in a certain way, and it's curved when there are large masses near it. Now this is a very strange idea. It says there's no force of gravity, none at all, no force of gravity. Gravity is just curvature in space-time, always. So when you fall on the ground, and you hurt yourself. No force, just curvature in space-time. But falling hurts, curvature shouldn't hurt. That is, what Einstein did was introduce a very, very beautiful metaphor into physics. That allowed him to do all the computations correctly using a single mathematics—Riemannian geometry. It is strange because it postulates that there's no forces. It is a metaphor that says force is curvature. There's another way to understand it, which is that curvature in space-time is a very good metaphor for computing what will happen when you have gravity. That's a very different understanding of Einstein. There's one understanding that says what Einstein said is literally true, the metaphor is true. There's another understanding that says the metaphor is an excellent way to understand the world and do computations about it, but it's still a metaphor, and there's still a force of gravity. Two different understandings. I prefer the second.

Now what's particularly interesting about contemporary physics is that there are multiple understandings for concepts in physics. Right now, the most popular concept is string theory, in which you have as a universe that is a ten-dimensional space, where there are four normal dimensions, space plus time, and then six other really small dimensions, and there another metaphor is used. It's a kind of interesting metaphor. If you think about the study of elementary particles and forces, to say elementary particles, in quantum mechanics, traditional quantum mechanics before string theory had a metaphor that each particle is made up of smaller particles called quarks, and when particles interact, they give off other particles and absorb other particles, they exchange particles and the particles carry properties, properties like spin and charge and mass. And that the changes have to do with what quarks are exchanged in the interactions, and therefore what properties are exchanged. This theory is based on a very common metaphor that we all have, that properties are objects that we possess. We can say I have a headache, my headache went away, I got a headache, the noise gave me a headache, and the aspirin took my headache away. You can understand the headache as an object that comes to you as this object that you have the property. In classical quantum mechanics,

that's how a limitary particle was understood. Their properties are things like mass and charge and spin. Those properties were understood as objects that they possessed.

Now there is another way for objects. Notice we can say "I have a headache." You can also say things like "I have trouble, I have troubles, my troubles went away, that took my troubles away, the music took my troubles away." There are two ways to talk about trouble, either as an object you can possess or a space you can be in. You could say I'm in trouble, he got me out of trouble, or he got me into trouble. It can also be understood as a region of space. So that a property that something has, namely, me being in trouble, can either be seen as an object that I possess or a region of space that I'm in. What super string theory does is change metaphors. It says that instead of the object metaphor for properties like spin and mass and charge, what we will say instead is that there is another spatial dimension for each of those, and that the particle is located along that spatial dimension. For example, for charge, there are only three locations: plus, minus, and zero; for spin there are five locations: plus one, plus a half, zero, minus a half, and minus one, and they are very, very small in terms of numbers, compared to other numbers. So these are small dimensions and the idea is that some dimensions are long and some are small, and if you think of an image of something like that, it's like a string which is long in one dimension and small in other dimensions. Hence, string theory. Therefore, each particle can be thought of as having a location in a ten-dimensional space. That is, it's a metaphor shift to go to that, and why would they make the shift? Because you can then use Riemannian geometry. Riemannian geometry is the geometry of multidimensional space, which can be curved. And since it can be curved, you can again say that gravity is curvature and you can say that every force is curvature and generalize. All force becomes curvature and then everything in the universe is just geometry. If you take string theory literally, everything in the universe, including you, is just geometry, you are just made of a lot of points in space. You don't exist as you, just as a lot of points in space, and that's very strange. I think it's impossible to make sense of that theory of physics literally. I think it makes perfectly a good sense metaphorically. It says this is a really good way to think of physics if you are going to do computations linking space and time and charge and spin and all of these different ideas in one mathematical system. This is a very useful metaphor to use, but still there's no force there, and there's still you, and you are you, not just geometry. So, what I'm suggesting is that all science, especially physics, is metaphorical, and that it's necessarily metaphorical.

If you look at the magazine *Scientific American* from last August, there is a wonderful article for those of you who are interested in physics at all. It's

an article about a different metaphor for physics altogether, the information theory metaphor for physics. It's a theory that starts with thermal dynamics, which is based on information and information theory. Then it says, let's keep that idea instead of moving to string theory, consider everything as information, everything in the universe as information, and then they extend the metaphor more and more so that now there's a complete theory of physics in terms of information. No geometry, just information. What you have are two utterly different types of metaphors for the physical universe, and it turns out they are equivalent. All the predictions made by one can be made by the other. You can map one theory onto the other theory. That is, these are two different metaphors, two different ways of understanding the world in terms of one kind of mathematics or another kind of mathematics. But it's strange to take either of them literally because you are more than information. You are you, force is force, and so on. It just says information theory metaphor is a useful metaphor. Now this is a revolutionary way of understanding what science is and I think it is a correct way and an important way. And what's particularly interesting is that the same is true of mathematics itself.

I wrote a book four years ago with Rafael Nuñez. It's called *Where Mathematics Comes From*? It's a nice, big six hundred page book. I like six hundred page books. And the reason I like six hundred page books is that only then can you really get into all the details. What we did was not statistically simple mathematics. We started with addition and multiplication, but we went up to very, very complex higher mathematics. The last chapter of the book is about eighty pages long on the formula $e^{i\pi} + 1 = 0$ (e to the power πi plus 1 equals 0), and it explains what it means. I won't do that today, but I will explain to you why that is an appropriate problem for metaphor, for the theory of metaphor. Think for a minute about that formula: e to the power πi plus 1 equals 0, because it has the five most important numbers in mathematics: e, π, i, 1, 0. Very interesting formula.

Now think for a minute about raising something to a power. When I was in high school, they told me that raising something to a power was multiplying it by itself a certain number of times. So two to the fifth power is two times two times two times two times two, five times, and that is thirty-two. So, raising something to a power is multiplying it by itself. This cannot be true for this formula. Why? First, what are you raising? You are raising a number e, e is an infinite decimal, 2.1828182 … goes on and on and on infinitely. Now how do you multiply? Multiplication is given by algorithm, and you start on the right. This is infinite. Where do you start on the right. There's no right, because it goes on and on and on infinitely. There's no place to start. Problem one. Problem two. What does it mean to multiply a number by itself a π number of times?

3.14159 … as it goes on infinitely. That is not a number of times. It doesn't make sense. And finally, what does it mean to multiply a number by itself? And I, that is, the square root of minus one a number of times, an imaginary number of times makes no sense. You can think of doing it. That is, what that means is that raising something to a power cannot be just multiplying something by itself a number of times. It must be something else.

In the process of doing this we discovered that the 'something else' was a very interesting metaphor, and it is described in the book, and, if you want, you can go into it later. But it turns out that in order to describe and understand what that formula means—it has a meaning. To understand that it has a meaning, what it means, why it means this, requires about 15 different metaphors from five branches of mathematics. What we did in the book was work out all those metaphors in all those branches of mathematics and then show how they are put together in this formula. Now that's an advertisement for the book. Let me try to give you an example from it. It's kind of interesting. Have you ever wondered what infinity is? Anybody thinks about infinity? Well, there are two kinds of infinities, so you might be thinking about two different things.

The first kind of infinity is called potential infinity. Potential. Why? In potential infinity, for example, you start to count. You go one, two, three, four, and you go on and on, and you'll never stop. That is you never reach any infinity, it's just potential. Similarly, in geometry, what will potential infinity be? You take a line segment, and you double it, you make it twice as long, and then you double that, and you double that and you keep making each line of segment twice as long over and over again, and you'll never stop. It goes on and on and on, and that is potential infinity. Now, there's another kind of infinity called actual infinity. Actual infinity is very different. In actual infinity, for example, you may have the numbers one, two, three, four, five—the integers. They may go on and on forever, but there is a single set that contains all of them. That's the set of natural numbers, it's a small set that contains everyone of them, and infinite number that never stops. But it never stops, how could you get all of them? Right? Strange idea. That's what actual infinity is. Let me give you another example.

There's a form of geometry called projective geometry, in which you make a line segment longer and longer and longer, they will go on and on, but eventually, they reach a point at infinity. They never stop, yet there is a point at infinity. Not only that, all parallel lines meet at infinity. This is a job for metaphor. That notion of actual infinity has got to be understood somehow. What is the mechanism for understanding it? Not only that, there's a further question. I just gave you two examples of actual infinity. One of them was a set, an infinite

set; another one was a point at infinity. Are there other such examples? The answer is yes. There are many of them. There are many forms of actual infinity in mathematics. And for example, take mathematical induction. You've probably all seen mathematical induction. It means if you prove that something is true for zero and you prove that it is true for any number and it is also true for n plus one, then if it is true for zero, it is true for one; if it is true for one, it is true for two; if it is true for two, it is true for three, on and on and on. Then it has to be true for all the natural numbers even though you'll never reach the end. That's actual infinity. Similarly, there are transcendental numbers. Cantor's Aleph-null is the number, the size of the set that has actual infinity. There are degrees of other infinities requiring other metaphors. What we discovered was something interesting, that, in fact, the actual infinity is metaphorical after all. Think about it. If you never have encountered infinity, how can you understand it? The answer is by metaphor in terms of ordinary processes. But what ordinary everyday finite processes allow you to understand actual infinity? Not only that we discovered that there was a single general metaphor for every form of actual infinity, with each type being a special case. So let me try to tell you in about three minutes what actual infinity is, once you understand what the theory of metaphor is. The way to think about this is in terms of the linguistic concept of aspect. We've talked about aspect before. Aspect is the structure of events. There are various kinds of aspect. There's an initial aspect, which is called the encoded aspect, which is the first part of an event when you are first starting out.

There's another aspect which is continuity, when you do something continuously. There's one that is when you do something instantaneously—instantaneous aspect. There's one where you repeat things over and over, called iterative aspect. There's one where you finish something called perfective aspect, you will finish it, make it perfect, and imperfective, one where you go on and on, but you don't finish it—a word like "walk." "Walk" does not have any particular end point, so it's imperfective. If I say "walk ten steps," that's perfective, and it has an end point. Now potential infinity is an iterative process. It's an iterative aspect without an end point, goes on and on and on and on, and we can characterize this formally in the models that we have in cognitive linguistics. So, in this you have, let's say, the target domain of we are going to set up a metaphor. Its target domain is potential infinity. What we have is the process to begin, it goes on and on and on. Now the source domain of metaphor would be something very familiar. Namely, in the iterative process that starts, that iterates a certain number of times and then reaches the end state, it stops after some finite number stops. Now what we are going to do is understand the imperfective case, potential infinity where things go on and on and on in

terms of the iterative case that stops after the finite is out. The metaphor goes like this. We map the beginning state to the beginning state, the iteration to the iteration, and then we impose the end state structure onto the target domain where there's no end state. We add the entity for a metaphor. Now when you do this, this is a normal kind of metaphor to happen. There's an entailment, and the entailment from the source domain is that the end state is after all the other states and the first state is after all the other states. That's part of this metaphor.

What we claim is that the end state that you put on the top is actual infinity in all the cases. And then there are special cases. So if, for example, you iterate a process that is taking a number and making a larger set to all the previous language you have, you start with one, you add the number two, you get a bigger set. You start with one and two, you add three, and so on. You iterate. Then you end at an end point. What that says is that an end point contains all the previous sets and the smaller sets contained in them. Now what about that point at infinity? What does it mean to have a point at infinity? Here's a way to think about it. Imagine a triangle. This is a little triangle, there's two angles, one here and one here. It has sides of equal length. Now what we are going to do is make theses lines twice as long in each stage. Just double the length. It could be any other member, so you could make it longer, longer, longer, so the iterative process is you start out with a triangle, and at each point you have another triangle with the size twice as long. As it gets longer and longer, the lines get longer, and the angles get closer and closer to ninety degrees. Until when you add the end state, you still have the triangle, but the line is infinitely long, and these angles are ninety degrees. That is, these are parallel lines and they meet at infinity. That's what it means when we say parallel lines meet at infinity. And since we have chosen this arbitrarily with any distance and any orientation, this will be true for every set of parallel lines in any orientation, at any distance from each other. In this geometry, they will meet at infinity. Now you know what that means. By this way, what we do in this book *Where Mathematics Comes From* is go through most of the cases of actual infinity in higher mathematics and show how there's special cases of the single metaphor. Let me give you one more crucial example from mathematics.

It's the notion of a real number—it turns out a real number is deeply metaphorical, because all real numbers require an application of the basic metaphor for infinity. Think, for example, of an infinite decimal. You have decimal places 3.14159 … and it goes on for ever, but it's a thing. It's a particular thing that is infinitely long. It's actual infinity. That is, every real number works that way. And there are many different ways of characterizing real numbers. Those of you who have taken courses on this will recognize things like one way of

characterizing the real number is take an interval on the real line, then the smaller one inside that, the smaller one inside that, and you go on and on and on, taking the intersections, and finally the intersections of all the intervals at infinity are a single point. But how do you get from the length to the point? It's via this metaphor of actual infinity. What we do is show exactly how that works in the book. Add infinity, the distance is zero between the two points.

Now why am I bothering to say this? What I am doing is pointing out that we have this very lengthy treatment of metaphor in mathematics, showing that all mathematics uses conceptual metaphor. That means that mathematics itself is not out there as part of the world. Many people think it is. Let me give you a couple of examples. At Berkeley several years ago, right after it was announced that Andrew Wiles had proved Fermat's last theorem. It was a great celebration around the world in mathematical circles. One of the things I especially love about Berkeley is on that occasion there was a convocation in a large auditorium and over a thousand people came to celebrate the proof of Fermat's last theorem, and it was wonderful at the university. Now I went to this convocation and a great mathematician of Berkeley, who is a friend of Wiles, got up to announce this. He stated Fermat's last theorem and he said $a^n + b^n$ is not equal to c^n for any n greater than 2, very simple. And he says we now know that this theorem is true not only in Berkeley and in Princeton but also in England—and not only in England and America and in the northern hemisphere, but also in the southern hemisphere, and not only on Earth, but also on Mars, and not only on Mars and Earth, but throughout the whole solar system, and not only in this solar system, but also in Aries and Centaurus and not only there but in every solar system in the whole universe, and not only in this universe but in every possible universe. This is what I call the "romance of mathematics."

It assumes that mathematics is out there in the world and it has an objective existence independent of the human mind. However, if mathematics is fundamentally metaphorical, it cannot have an existence independent of the human mind. So it's very important to know whether mathematics is metaphorical or not. It changes utterly your understanding of mathematics. Now one of the ways that we argue the case that mathematics isn't just out there is firstly shown in that actual infinity of metaphor and also by looking at other kinds of examples. For example, take the notion of the set in set theory. Now most set theories are understood metaphorically in terms of a container metaphor. The set is seen as a container, a bounded region in space. We see things either inside of the bounded region or outside of it.

One consequence of that field of set is that a set can be a member of itself because a circle of the bounded region cannot be inside of itself. So it's hard

even to think of a set being a member of itself. However, a little over twenty years ago, certain mathematicians, who are working on the semantics of computer languages, decided they needed to have sets that are members of themselves. Why? Well, in the theory of formal languages, the way that you make sense and interpret formal language is by mapping it onto some set theoretical structure. In computer science, you have formal languages, formal statements which are recursive, which apply to themselves, so you can do loops in computer science. If you are going to interpret that in terms of set theory, that has to map onto sets that are members of themselves. Now luckily, the people working at this have a wonderful article on this by Jon Barwise and Larry Moss in *Mathematical Intelligencer* some years back. The people working on this read the book called *Metaphors We Live By*. That book pointed out that we think metaphorically. They realize that the container metaphor for sets was getting in the way of them doing mathematics of this sort. They say what we really need is the change of metaphors. We need a notion of the set that isn't a container. What they did was they came up with a different metaphor for sets. The metaphor for sets as a graph—when you have a point that starts at an arrow to the next point, and an arrow to the next point, with the arrow indicated set membership and the point indicated sets. Then if the arrow came back on itself, if it came back on itself, then we said the set was a member of itself. When they did that, they got a new set theory, and then they were able to formalize that set theory with the set of axioms, and then they made it into a new branch of mathematics called non-standard set theory.

Now, which set theory is really there? The standard one based on containers or the new one based on graphs? The answer is both are part of mathematics, both are set theories. That is, if you don't have any loops, you get reduction to ordinary set theory. Both are set theories. They are just based on different metaphors. That is, it is not the case that there is one subject matter or set theory with one kind of set. The universe is not structured by unique mathematical entities like sets. In fact, it isn't anybody who studies set theory knows what mathematicians make up new set theories all the time, by the hundreds. There are lots of set theories, hundreds of theories, just as there are thousands of kinds of mathematical logics, each made up by mathematicians who like to study them. That is, they are not structuring the universe as entities, as unique entities. They are products of the human mind. That's important because science is not using mathematics made up by human beings.

All of science is metaphorical, and mathematics is metaphorical. Metaphor and metaphorical thought is central to scientific thought. If you are at the MIT of China, you should know this. This is also true of the mathematics used in

formulating linguistics. It is when you make up a formal theory, whether it's a neural theory or a generative theory, you are using metaphor, and you are using metaphors in the mathematics itself, and then you are using another metaphor to apply the mathematics to a given theory. For example, as I mentioned in Lecture One, which now seems five years ago, but it was only last week, Chomsky has a central metaphor. It's the first two sentences of syntactic structures. It says that a sentence is a string of symbols—uninterpretable, meaningless symbols—a language is a set of these strings, and grammar is a procedure for generating that set. That definition says that a natural language is characterizable metaphorically by the theory of formal languages, that natural language is called formal language in the tactical term sense of recursive function theory. It says that you can understand natural language correctly using the mathematic recursive function theory, and that's a metaphor.

What I argued in the first lecture was that that metaphor did not work. That was false. We can go back to some of those arguments in a while. What I wanted to do was point out the very statement of it uses the theory of metaphor, and there's no way to get around it. This is a very profound thing. Anyone who is doing any kind of science should pay attention to the metaphors they are using in the science. That's why I started out with the fact that we are studying our own metaphors for metaphor. There is a reason for doing that. We are being responsible. What I've been doing in these lectures are two things.

In the first six lectures, I outlined what the basic mechanisms of thought are, as discovered in cognitive linguistics. Let me go over them again. There are conceptual frames, which have a structure of various semantic roles, relations between the roles, in various phases, and this is basically what a frame is, sometimes called the schema. Their image schemas which are made up of primary image schemas, which are things like container schemas, source-path-goal schemas, context schemas, and so on. These schemas have been modeled in the theory of neural computation by Terry Regier who argues that they are computed by brain structures, that there are special brain structures in the brain that have been discovered so we can compute each of these schemas, each of these primary schemas, and then we get complicated image schemas as we do in spatial relations like "through" or "into" by putting these primary schemas together. "Through" has, for example, a container schema and a source-path-goal. We start outside, go inside, and then outside again. You can combine those schemas, those primary ones together, and get complex ones. The mechanism, he says, at the neural level is neural binding and that each of these schemas is embodied. The central idea in cognitive linguistics is embodiment. If you take away nothing else from these lectures, it is important to know

that all of our thought comes out of our bodies and brains and the way we interact with them in the world—that thought is not an abstract thing; thought is not floating in air. It's not just, you know, somehow abstract. Thought is computed by neural system. What we did in Lecture Five was we went through studies taken from the work in mirror neurons at Parma, and showed how you could get at least one concept, maybe a couple more, but how concepts could arise and how abstract concepts can arise by actual neural computation. That is, all concepts are embodied in two different senses. One, neurally; they are computed by neurons. Two, because neural systems like the canonical neural system and the mirror system connect to the world. Mirror neurons remember fire when either we are performing an action or we see someone else performing the same one. They link us to other people. Canonical neurons fire when either we perform an action or we see something we could perform it on. I drink or I can look at the bottle or I can pick it up and take a drink from it. The same neurons can be firing.

That neural system connects us to the things we act on in the world—it connects us to the world. That is, to say that meanings and concepts are based on neural systems is not to say that they are entirely internal. It is not to say that they are disconnected from the world. It is to say that they are connected *to* the world and *to* other people. Meaning is in our connections to each other and the world, and it's also embodied in neural system and embodied in the way our bodies as whole bodies functioning in the world. So, for example, the embodiment of primary metaphor takes something like "he is a warm person" as a metaphor. The metaphor of "affection is warmth" has to do with your emotional system, their registered affection being activated, say, when a child is held by his mother and the metaphor, the notion of warmth, which is temperature, so when you are held, you are both experiencing affection and physical warmth. Two parts of your brain are activated, one at the temperature center and the other at the emotional center, and they are regularly activated over and over so that metaphorical circuits are formed between them.

Physics was going on in the physical system. They are not different. They are two sides of the same thing. They are not different forms of embodiment. They are two sides of the same form of embodiment. And notice what we are not saying. We are not saying that meaning is arbitrary. We are not saying that meaning is internal at all. We are saying that it's in the connections and it's not arbitrary. Meaning is there in a certain shape because we have the kinds of brains and bodies we have. Image schemas are not arbitrary. They are there because we have brains that have top grammatical maps of individual field in the orientational cells that can compute orientations like up and down and front

and back. If we didn't have cells in our brain and circuits that can compute up-down, front-back and so on, we couldn't have concepts like that. Every thought you think has to be embodied through the neural system and also through your growth, bodily functioning in the world at once. Two aspects involve the same thing.

Now I mention this because the theory of cognitive linguistics is often misunderstood. One misunderstanding is it's claimed that we are saying concepts are just imagination, they could be anything at all. We are not saying that. We are saying that in fact there are universals, conceptual universals, metaphorical universals, universals that arise because bodies cannot be just anything at all. We all have brains of basically the same kind. We all have bodies of basically the same kind. Differences to be sure, but we all have eyes and ears and noses and arms, we stand erect, we all have legs and toes, and we move. The earth is different. I mean it's different to be in Beijing than it is to be in California, but not that different. I mean, you breathe in air in both places, you drink water in both places, and there's gravity in both places, and there are trees and grass and all those things. We started listing the things that are the same. There are thousands of them. Those common experiences, given common bodies, give rise to common concepts that are not metaphorical and common metaphors as well. Those are the universals. Then there are things that have to do with culture. We are taking primary metaphors and basic concepts and putting them together in the ways of different cultures.

So, we are reclaiming that meaning is universal? Partly. Are we claiming that meaning is not universal? Partly. Yes. We are not either universalists or relativists. We are in between, and we ask empirically which is which. It's an empirical question all the time. So it's important to understand that cognitive linguistics provides a very different understanding of what meaning is, what language is, because language expresses meaning. We'll talk about that in a while. This is a different understanding of what mathematics is and what science is. And all of a sudden, you have something that grows out of linguistics in cognitive science and provides a new understanding of science itself, of mathematics itself, and of philosophy itself. In the lecture the other day on philosophy, what I did was this. I pointed out that Mark Johnson, who is the philosopher that I've worked with most, a very, very close friend, an expert on the history of philosophy, had observed that virtually no Western philosophies were consistent with the data on cognitive linguistics. That is, the reason was that they were virtually all disembodied, with a few exceptions like John Dewey and Merleau Ponty, but Dewey and Merleau Ponty did not have notions like metaphor, image schemas and anything as Richards said. They just noticed that language was embodied,

that thought was embodied somehow. What we've done is given the method for showing the details, one of the mechanisms of thought. Now in doing that, we've discovered that virtually all philosophies in the West are disembodied philosophies, and they are disembodied for certain interesting reasons. One of them is that they begin with the question of how can we get true knowledge of the world, and they assume that we get our concepts from the external world, not from our bodies or alike. Therefore, our bodies are independent of what the world is. They assume that there is an objective understanding of the world and that are concepts come from the world as structured independently, objectively. This has been true from the Greeks all the way up through present Anglo-American philosophy. It's a common understanding that runs through Western philosophy and it requires disembodiment and it's assumed that the body gets in the way of knowledge. Bodies are imperfect. They can fail. They can screw you up. Your vision can be wrong. You can have hallucinations. Therefore, the bodies get in the way of truth. Truth is out there in the world. You can sometimes get it, but your bodies get in the way of them. The reverse is true. It's your bodies and your brains that make truth possible. The reason they make truth possible is that they make understanding possible, and truth is based on understanding.

Think of it this way. If I give you a sentence and you don't understand what it means, how could you tell if it's true? In order to tell if a sentence is true, you at least have to understand it. If I put a bunch of random words together, and I say "run bottle microphones are." I give you some random words and you don't understand what I say. Is that true? You can't have the words fit the world. No way. And in general, metaphorical sentences can be true. As we said a couple of lectures ago, sentences like "he wasted an hour of time this morning" which assumes that "time is money" metaphor, or "I invested a lot of time getting a linguistics Ph.D. and now it's worthless." That metaphor of investment of time is a metaphor. Time is not external of people, something that can or cannot be invested. It's a metaphor. It's part of your mind. Yet if you understand the world in terms of valid investment metaphor, that sentence could be true. Or someone in fact could waste an hour of your time this morning, if you understand time as money like resource. If you don't have that metaphor at all, then it's meaningless, and not everybody in the world does have that metaphor. Now that's a very profound thing. It says that truth is not independent of people. Truth depends upon how you understand something, and you understand things in terms of what the mechanisms of thought—frames, image schemas, metaphors, metonymies, and blends. That's the mechanisms that you understand in terms of using a neural system. So those are important things to know

and they lead to a new philosophy. They lead to a philosophy that says that understanding is central, that understanding occurs via a neural computation, and it's what we call, you know, simulation semantics, that you neurally simulate the world. The reason you can do this is another discovery from neural science that the same neurons are firing when you either act in the world or perceive or imagine acting or imagine perceiving. The same neurons are firing and therefore imagination is central to understanding. If you can't even imagine what it is to take a drink out of a bottle, you can't understand the sentence "he took a drink out of a bottle." You have to at least be able to imagine it. Now that imagination is embodied and linked to the world as we've seen. So, that is a very different basis for philosophy, and then when you go to apply it to concepts like causation and time, which we saw the other day, and the self and the mind and morality, we discover certain amazing things. It had been assumed in previous Western philosophy that there was only one causation in the world. There was, you know, only one correct logic of causation.

We've discovered that there are over twenty different ones, that every different verb of force, motion, if you use a different logic of causation like bringing, carrying, growing, and so on, they all can be used in causal sentences but with different logics. We go through our book, we have about two dozens different logics of causation, depending upon which metaphor you're using with which verbs, with which verbs of force because there are lots of different kinds of force and logics of force. Once you notice that, you notice that there isn't one thing, you say what caused that, your answer first must be a question—what kind of cause you are talking about. There are different kinds of causation. And it is important if you are studying science—science studies causation. Which kind are you looking at? Are you looking at causation as correlation? Are you looking at causation as force? Is it force over time? Continued application of force? Initial application of force?

So if you take a look at Chapter 11 of *Philosophy in the Flesh*, you will find a nice list of lots of types of causation. When you are studying science, you can ask yourself which is it. Let me give you another example. Suppose you are studying economics or political science. In economics or political science as done technically, probably here at Tsinghua University, since it is a technical university, the models used are called the rational actor models. That's one of the major models used. In the book *Philosophy in the Flesh*, we have a chapter studying the cognitive structure of the rational actor model. The rational actor model assumes that every person is rational. And what does rational mean? It means pursuing self-interest in an optimal way as well as possible. The assumption is that every person pursues self-interest all the time and they do it as well as they can, as well as can be done. And then they make the mathematical

models of this formal rationality. The idea behind this is that if you are not pursuing your self-interest, you are just irrational. Now, we'll come back to that in a moment. The mathematics of this system is something that I analyzed with the use of Game Theory and a formal Game Theory, and I sat down with the Berkeley game theorists to teach this. We figured out, we asked what is the metaphorical structure of this mathematics. We figured out it turns out to have a metaphorical structure.

We also asked what is the pure math behind this model. In Game Theory, whenever they introduce it, they talk about it in terms of winning strategies, losing strategies, rational action, but winning and losing and rational actions are not parts of abstract mathematics. So what's the abstract mathematics? It turns out to be a bit of formal language theory plus probability theory of a certain kind and we sat down and wrote it down. Then, looking at the mathematics itself, it turned out that mathematics had nothing to do with rational action at all. It was just mathematics. You can prove theorems in abstract symbols. They said nothing about action or rationality in themselves. So we asked the question what is the difference, how you go from math, the abstract math to the idea of rational action. The answer is three layers of metaphor. You have to have a layer of metaphor to go from one kind of math to a way of understanding math in terms of branches in trees, and then you have to have the event structure metaphor, and then you have to have other metaphors like "a firm is a person" or "a country is a person" and so on.

Now, why should anyone care whether or not the theory of rational action is metaphorical? Why should anyone care about these metaphors? Well, when you look at them in detail, there is every reason to care about them. In detail, these metaphors, like all other metaphors, have entailments. That is, in order to have a theory of rational action with this metaphor, there must be a starting point, time must have a beginning. And in order to know which course of action has the most value, the highest utility, you have to have an ending point at which you compare utilities. Time must have an end. It has an ending point, which is not real—time doesn't have an beginning and ending point, at least in normal human affairs. But in these cases you must do it. That is, in order to apply this, you have to apply it over a certain amount of time. Then you might say where are these models applied.

One of the most important places they are applied is in war. These models were developed, you know, in the United States by the US Air Force for war. One of the places that they've applied them is in the Gulf war and the Iraq war. So, for example, in the Gulf war, there were discussions before the war of these models. The question they asked was "is it worth it to go war?" Worth it. That is the metaphor of money. You know you're understanding these models in terms

of how much advantage and how much money you could get, but your understanding is in terms of just numbers. Is it worth it in terms of what's called utility? Then in order to answer that, you have to be able to map this model onto Iraq and the American army and the first Gulf War. The mapping went like this. In order to have a loss, you had either a gain or a loss, for something to be worth it, you had to have more gains than losses. A loss is where the cost is negative. If one of your soldiers gets killed, that's a cost to you. If one of their soldiers gets killed, that's a gain. That's a funny way of thinking about things. Unfortunately, that was not funny—but rather a sad way of thinking about things. But that is how killing the enemy soldiers becomes a gain and having your soldiers killed is a loss. Having your material blown up, they blow up your tanks, you lose. You blow up their tanks, you win. That's a gain. What about people, ordinary civilians? They don't enter into the calculation. They are off on the side. They are not in the calculation except as propaganda. That is, if you wind up bombing a hospital, then there's a propaganda loss. That is in the calculation. But otherwise, the loss of civilian lives doesn't count in the rational actor model. What about the ecology of the Gulf? Sadam Hussein let all that oil into the Gulf. Colin Powell, in the first Gulf war, was asked when Sadam Hussein threatened that, he was asked would there be any cost if Sadam Hussein did this. He said, "No, our troops could still land." That is, from the perspective of the model, the ecology of the Gulf, which was destroyed—all those fish, shrimps, and sea life were destroyed—didn't come into the calculation. Nothing counts. Now what's interesting is that you have to say metaphorically what is a cost and what is a gain in order to apply this model. And when you do that in the world, you're doing something inhuman.

Moreover, look at the present Iraq war. It had a beginning when they started the war. It had an end point when they declared the war over. You know, Bush came on the aircraft carrier and he came out of the flight and said we won and that it was all over. The model ended, and we won, but history didn't end. It's still going on and on and on, even though the model said that was ended. It matters that the rational actor model is used in calculations about war and foreign policy, and it matters what the metaphors are that are applied, and that is a mathematic—that is a metaphorical model. It matters a lot. Cognitive linguistics teaches you this and cognitive linguistics matters.

Now why should anyone from China want to do cognitive linguistics? First, the Chinese conceptual system is not the same as the American conceptual system. We saw yesterday in the lecture about politics how the concept of the family is very, very different in China and how the concept of the family is central toward politics. That is, it would be very useful in understanding the difference between Chinese politics and American politics. So understanding what

concepts including those of the family are different in China and how things are differently understood. We saw pointedly in yesterday's lecture when someone talked about the issue of Taiwan, and pointed out that from the Chinese perspective the metaphor was family reunion and from the Taiwan perspective, the metaphor was freedom and independence. Two different metaphors are clashing. We hope not leading to war. The point is that metaphor shows up everywhere, in politics, in everyday life, in science, in mathematics. If you are going to understand your life, your society, your culture, your politics, you need to study it. And only you can. People from America may be able to help a little bit, but you have to study your culture, your language, your minds. I can help you by giving you some tools, but you have to do it. And in the process, you probably learn that the theory doesn't work in some places, that it has to be fixed up, that new theories have to be developed. That's something that you might only find out by studying Chinese conceptual systems, but not English ones. The counter examples maybe in Chinese, but not in English.

The more people study different conceptual systems around the world, the more people get respect for the human mind and for the differences among human minds, as well as for the similarities. It's important if we all live together in one world to understand how we are similar and how we are different and to have an understanding at least of those differences, and preferably a respect and preferably to be able to understand it well enough to work out means of accommodation. To do that, cognitive linguistics is an important tool. So it's extremely important for people to study Chinese cognitive linguistics, and not just important for you—it's important for me. As an American, I will be affected by the way Chinese understand the world, just as you are affected by the way Americans understand the world.

Let me go through some more kinds of cases, maybe go back to some more linguistics. One of the things I mentioned in Lecture Five is that by understanding the neural theory of mind and language, we get a better understanding of language acquisition. Why is it important to study how language is acquired, first language is acquired by children? Why does that matter? Now we've recently learned through the work of Michael Tomassello and his colleagues at the Max Planck Institute in Leipzig that children, when they learn first learn grammar, they learn grammar for individual verbs. In particular settings, and the individual verbs describe particular actions, like giving things, falling, hitting people, pulling things, pushing things, putting things, putting in things, and so on. They start this, they start with the way they act on the world and then they extend and generalize.

I observed that the theory of Cogs which I mentioned in the Lecture Five could account for generalizations, that the generalizations are actually in the

special cases and that you do not need a theory of induction to do this. What it says is that by studying language acquisition, you can find out something about the nature of induction—but there is more. Language acquisition determines how language is going to be in adults, too. That is, when we find out, let's say, how children learn metaphor. They learn metaphor, and two domains of experience come together. That understanding, as I understand, is that metaphor is there neurally is part of neural computation for ordinary people, that everybody learns it unconsciously and automatically. And it gives this an appreciation for how much you can know without knowing that you know it. Little children don't know that they think metaphorically, most adults don't know that they think metaphorically. But by studying language acquisition, we can find out about things like the development of metaphor and we have a crucial piece of information that comes from language acquisition studies.

A crucial piece of our understanding of grammar and generalizations in grammar is coming from the work of Tomassello. We find through that work that grammar is embodied. When grammar is learned verb by verb, action by action, experience by experience, like giving, taking, hitting, pulling, pushing, falling, and so on. When that's learned case by case in terms of classes of basic childhood experiences, that means that grammar is embodied in those experiences, that those basic childhood experiences will limit the possibilities for basic constructions, and the basic constructions will be limited around the world because children pretty much function in the same way. That is, a lot of the universality of grammar is going to come out of the universality of childhood experience. That is one of the morals we learn from Tomassello. It's a deeply important moral, and it's important in the theory of grammar itself because we now have a theory of grammar, Chomsky's, in which there is no experience whatsoever in grammar. Grammar is supposed to be there when you are born. Experiences are supposed to be irrelevant. We know from Tomassello that it isn't. But it's supposed to be irrelevant and meaningless. That is, grammar as just the learning of formal systems without regard to their meaning are ludicrous. It's important to know this because when you really are understanding grammar, you need to know why you have the patterns that you have.

A week from today, Adele Goldberg will be here. Adele Goldberg did a marvelous dissertation at Berkeley—she was one of our students—and wrote a great book called *Constructions*. One of the results in that book was this. She took the double object construction in English, like "I give him a book." She said what's the relationship between that and something like "I told him a story," and she pointed out that the relationship was metaphorical, that it wasn't just in the grammar itself but the rules from the metaphorical system. And then she took twenty other kinds of double object constructions and she

showed that those two were metaphorical and that metaphor was central to the generalization in grammar. Now, that is not something you could find out in the Chomskyan theory because you can't look for metaphor there, you would never notice it. The original empirical work was done by two generative grammarians, Georgia Green and Dick Hurley, who were both Chomskyans, and they just piled lots and lots of data and never figured out the generalization. It took Adele Goldberg to figure out that metaphor was still behind the generalization.

It's a very important thing to know about grammar itself if you are studying grammar. Now there are many other things like that that we could talk about, but what I want to do is this. I want to summarize by giving you some notion of the importance of what we are doing. Then, I want to finish by talking about what we might look forward to, what will this be like ten years from now. Ten years from now, if I can be sure, there we will know a lot more about neural science. A huge amount of work. It turns out that every bit that we learn year by year increases our understanding of how we think and our understanding of language. It's been absolutely remarkable, and I would have never guessed when I entered linguistics forty two years ago that I would be working with people who understood enough about the brain to explain how we get concepts and how we are connected—how our concepts are connected to the world. I would never ever have guessed that that was possible. We cannot guess what neural science will tell us next, but we do know that it's going to be a lot more, and it's important to know it.

The reason I started with that is that most linguists don't bother reading neural science, and they should. If linguistics is cognitive linguistics, then neural science is a normal thing to read because it is part of cognitive science. If cognitive linguistics is seen as an autonomous discipline separated from everything else, you will never learn what neural science will teach you, you never find out, and you will never learn what cognitive psychology or developmental psychology will have to teach you, you will never learn what other sciences have to teach you, or what anthropology has to teach you. Language is affected by everything and language affects everything. It lies at the center of all subject matter in the university. Take language in the sense of studying ideas as well as linguistic forms, metaphors, frames, and so on applies to every form of knowledge. We'll see how it applies to economics, how it applies to political science, how it applies to poetry, politics. We will see how it applies to politics, to philosophy, to mathematics, to science. It applies everywhere.

To understand it, you have to understand many other disciplines. A university is a place where all disciplines come together. That's why it is called a university as a universe. It's the universe of disciplines. Cognitive linguistics is

the right discipline to be in the university. Cognitive science is a central discipline to any university, and I understand that there's plans to set up a cognitive science program here. I hope those who set it up will remember that it's actually four things—neural science, psychology, linguistics, some philosophy, linguistics, and computer science. It is not—it is linked to everything. And the reason is that the mind of language is linked to everything. If you become a linguist, you have the tools to study all kinds of interesting things. You can have a lot of fun. I have a lot of fun. Honest. Think of all the fun things I get to study. I get to study poetry, and then when I get tired of poetry, I can study mathematics, and when I get tired of that I can study politics, and then I can go back to study grammar. You know, think of all the fun things I can do, and you can do. So, that is why I thought it was important to talk about all the things that I've talked about, all the modes of thought that we've learned about, what we've learned, where we've learned it from, and what we can apply it to. Thank you.

Websites for Cognitive Linguistics and CIFCL Speakers

(All the websites were checked for validity on 30 June 2017)

PART 1

Website for Cognitive Linguistics

1. http://www.cogling.org/
   website for the International Cognitive Linguistics Association, ICLA
2. http://www.cognitivelinguistics.org/en/journal
   Website for the journal edited by ICLA, *Cognitive Linguistics*
3. http://CIFCL.buaa.edu.cn/
   Website for China International Forum on Cognitive Linguistics (CIFCL).
4. http://cosebrill.edmgr.com/
   Website for the journal *Cognitive Semantics* (*ISSN 2352-6408/ E-ISSN 2352-6416*), edited by CIFCL
5. http://www.degruyter.com/view/serial/16078?rskey=fw6Q2O&result=1&q=CLR
   Website for the Cognitive Linguistics Research [CLR]
6. http://www.degruyter.com/view/serial/20568?rskey=dddL3r&result=1&q=ACL
   Website for Application of Cognitive Linguistics [ACL]
7. http://www.benjamins.com/#catalog/books/clscc/main
   Website for book series in Cognitive Linguistics by Benjamins
8. http://www.brill.com/cn/products/series/distinguished-lectures-cognitive-linguistics
   Website for Distinguished Lectures in Cognitive Linguistics (DLCL)
9. http://refworks.reference-global.com/
   Website for online resources for Cognitive Linguistics Bibliography
10. http://benjamins.com/online/met/
    Website for Bibliography of metaphor and Metonymy
11. http://linguistics.berkeley.edu/research/cognitive/
    Website for Cognitive Program in Berkeley
12. https://framenet.icsi.berkeley.edu/fndrupal/
    Website for Framenet
13. http://www.mpi.nl/
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The CAL blog: https://causalityacrosslanguages.wordpress.com/
The blog of the UB Semantic Typology Lab: https://ubstlab.wordpress.com/

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34. CIFCL 03, 2006 (CIFCL 13, 2013)
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http://idiom.ucsd.edu/~rwl/
35. CIFCL 02, 2005
John Taylor, john.taylor65@xtra.co.nz
https://independent.academia.edu/JohnRTaylor
36. CIFCL 01, 2004
George Lakoff, lakoff@berkeley.edu
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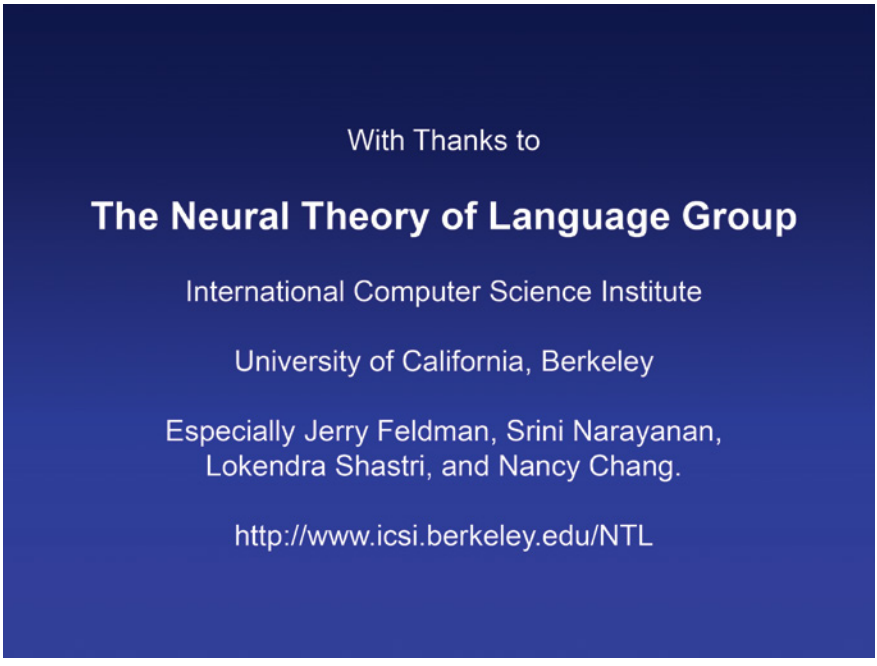
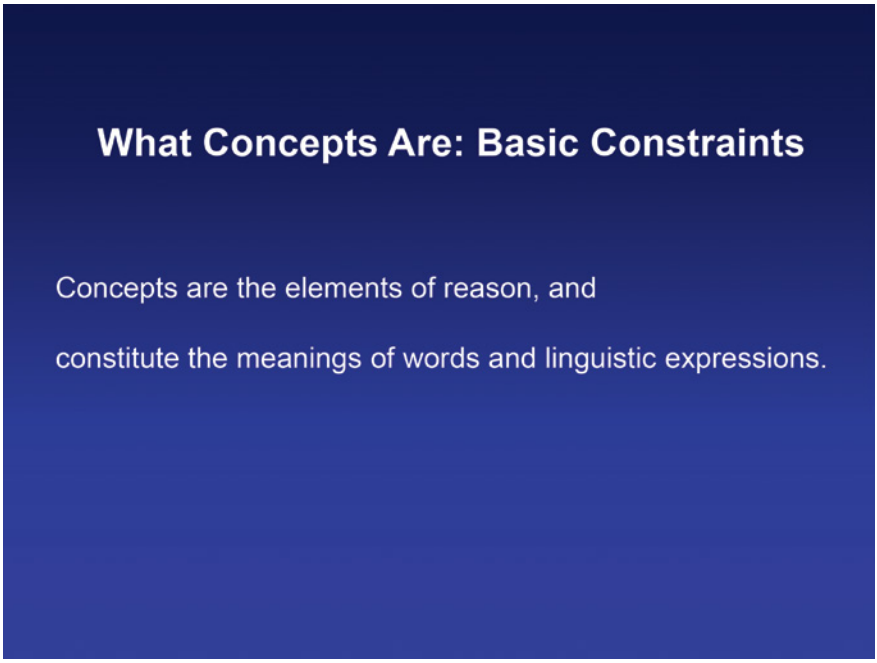
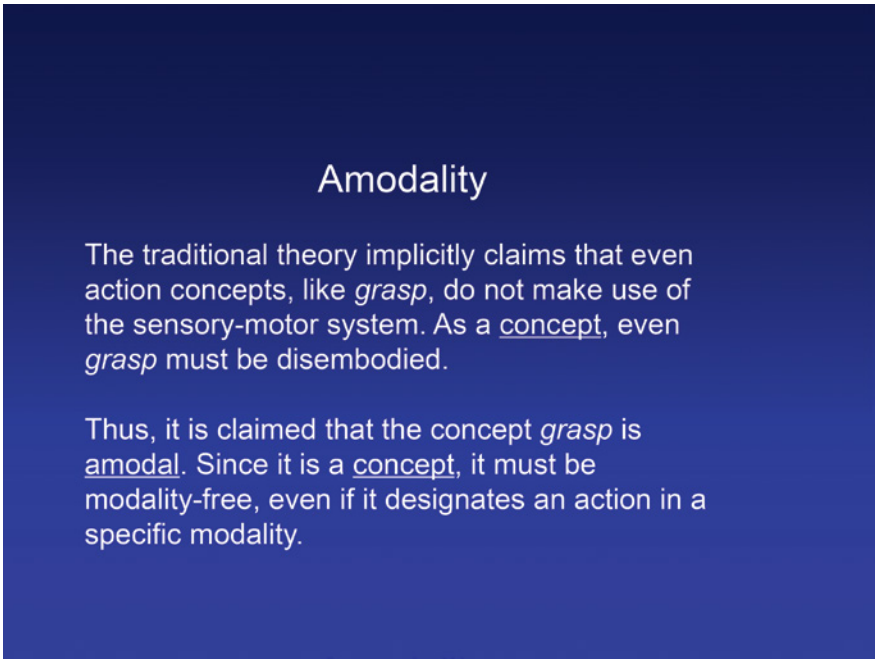
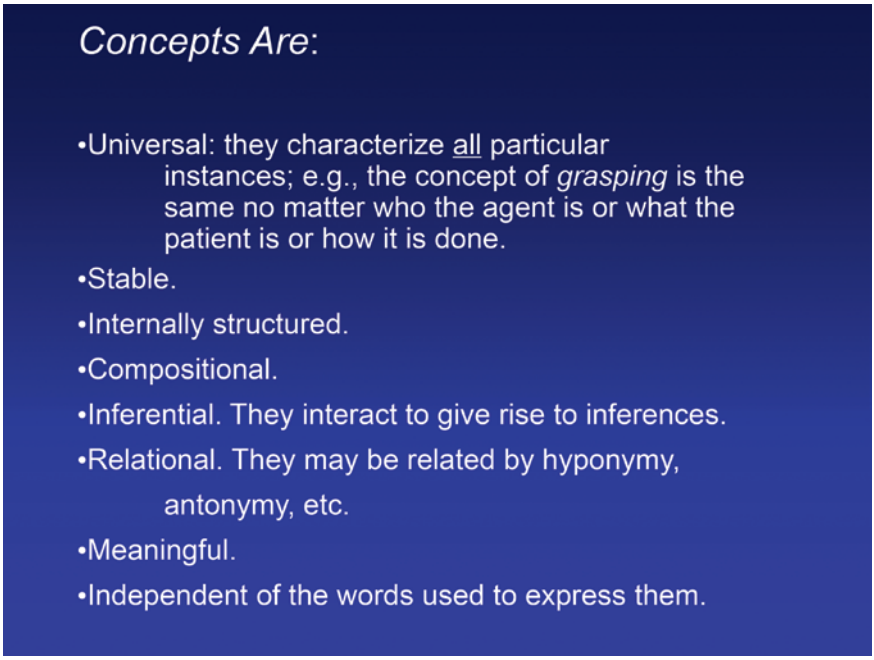
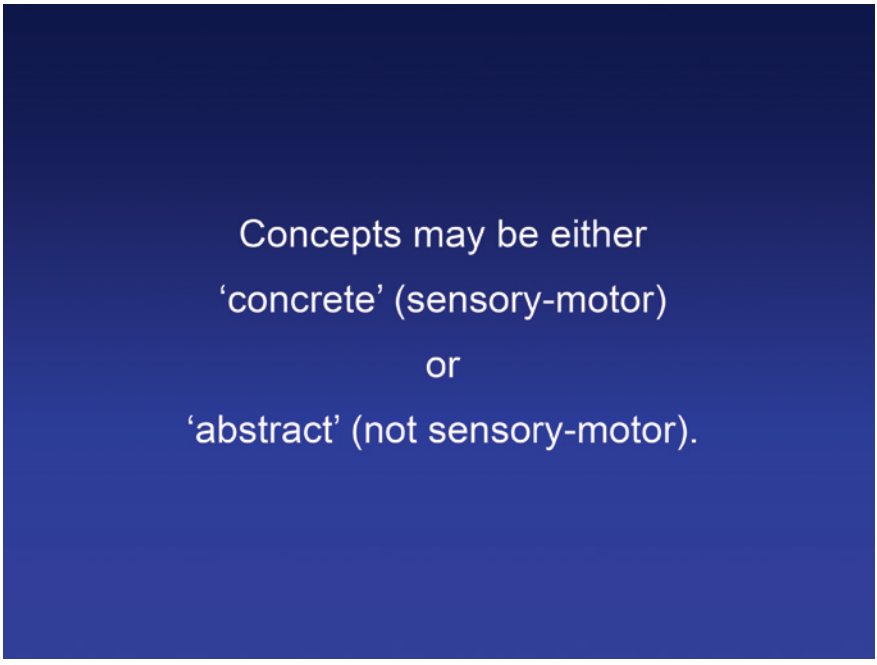
Appendix

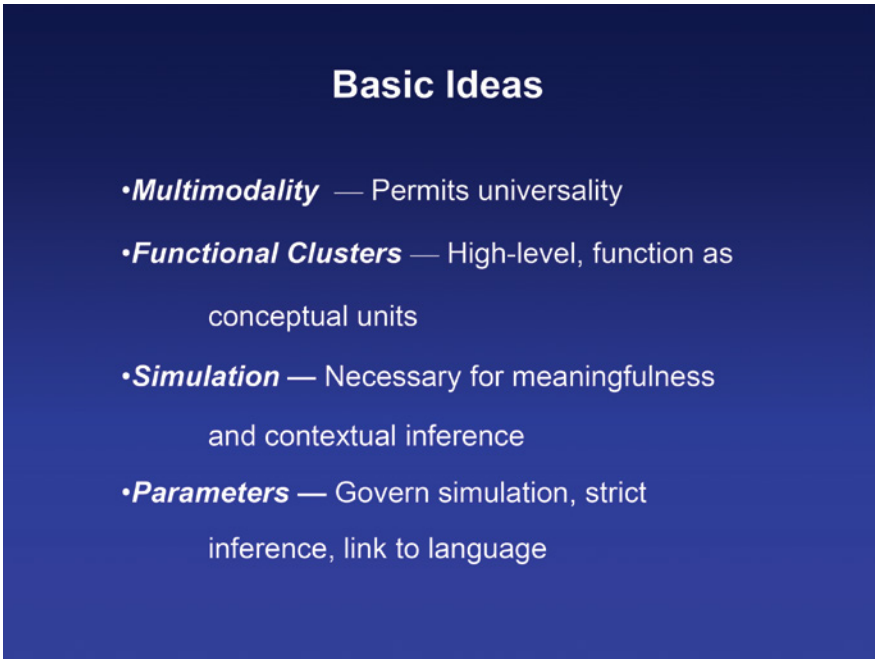


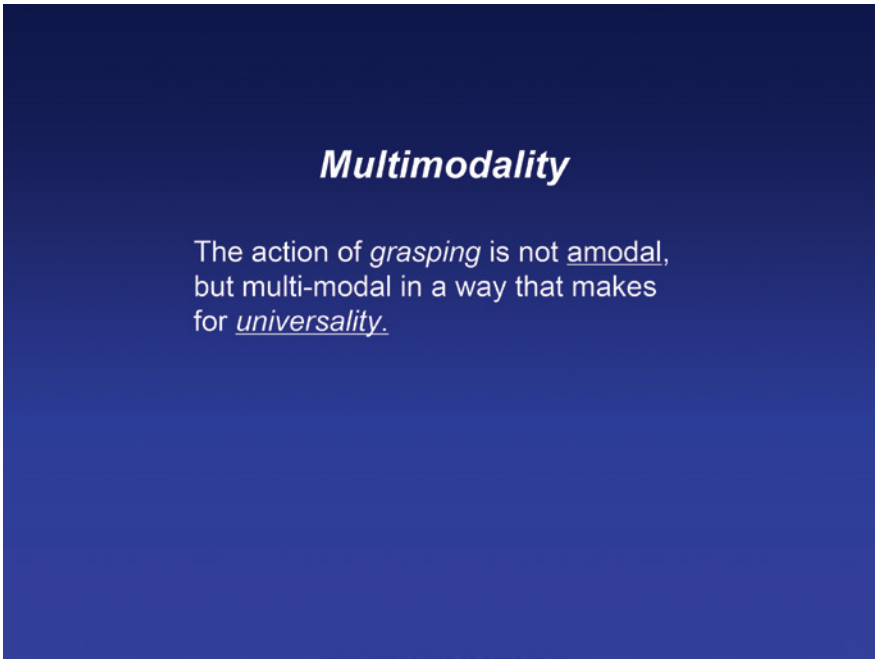


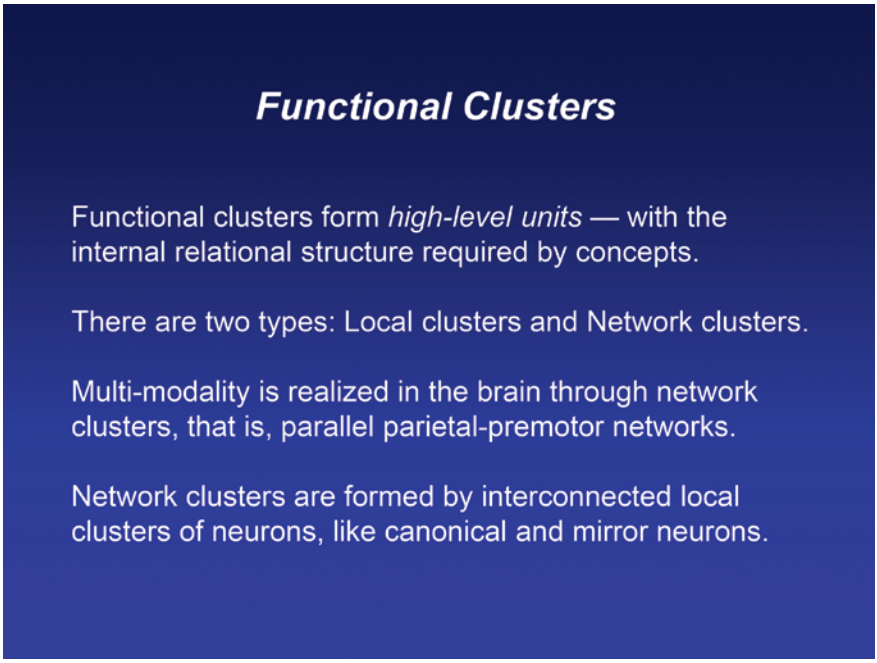


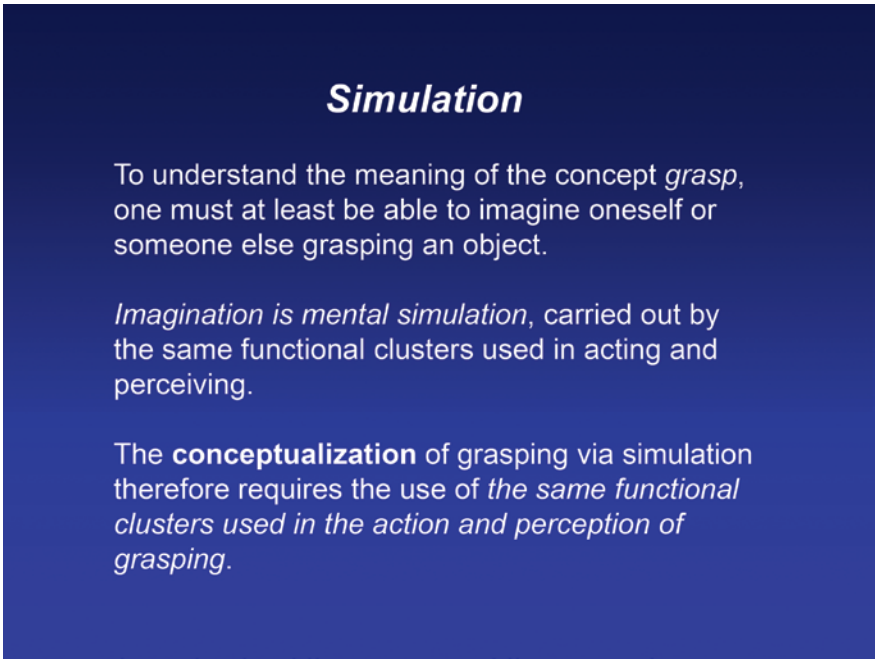


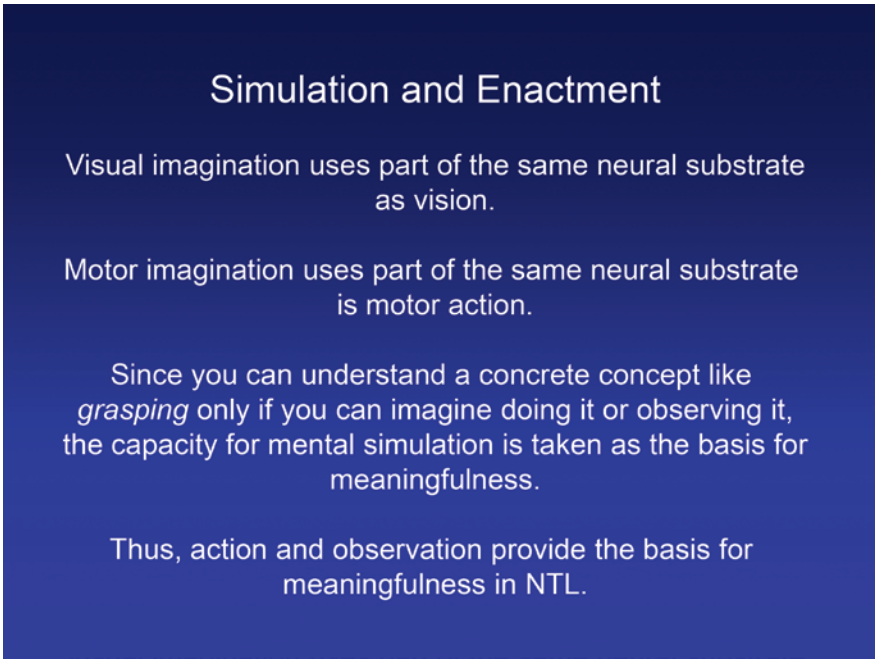


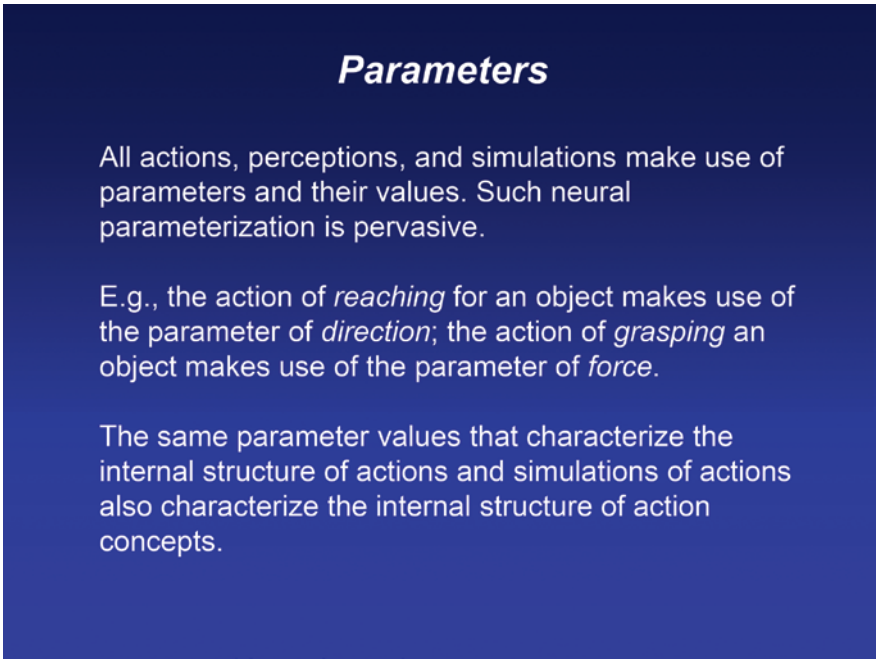


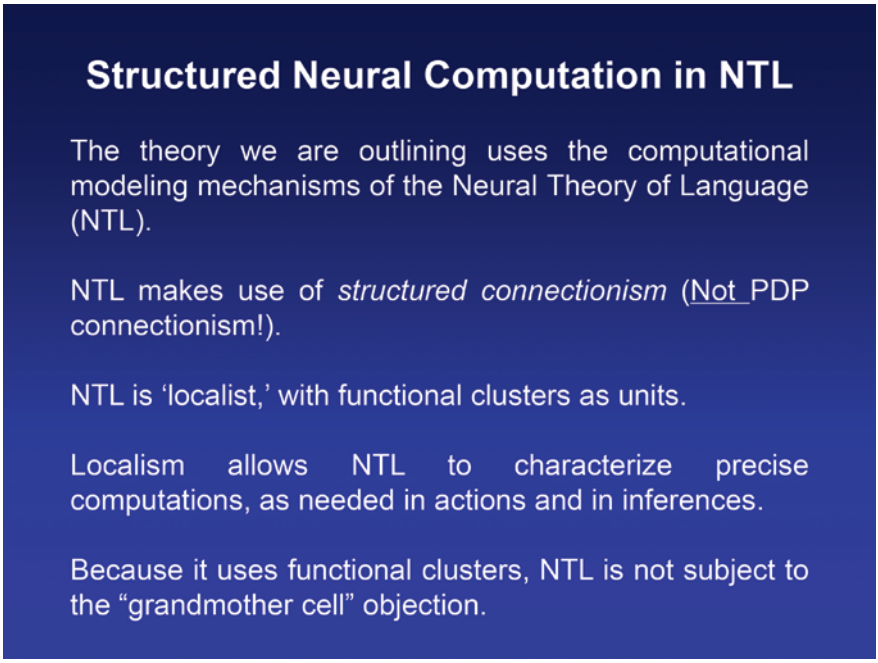


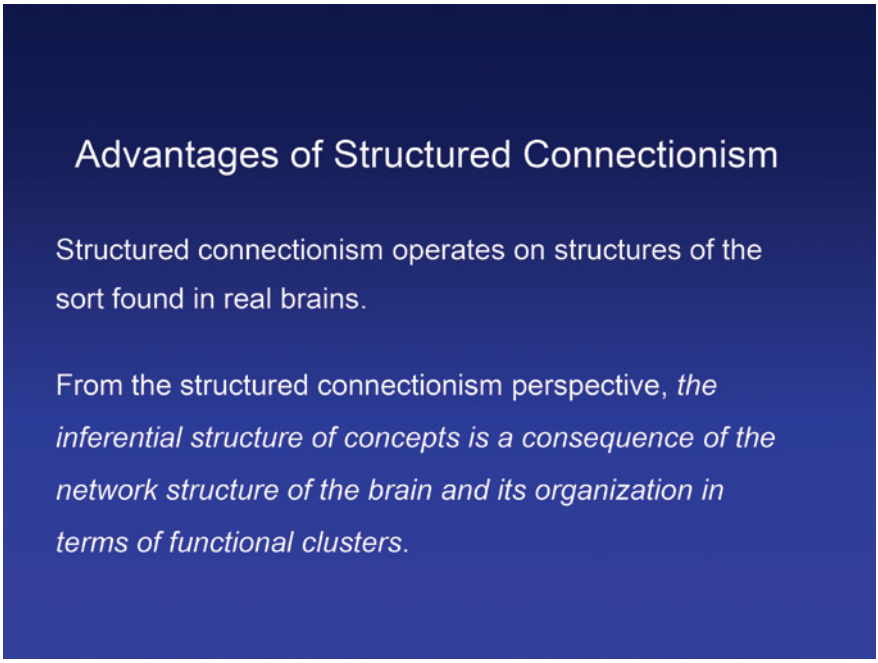


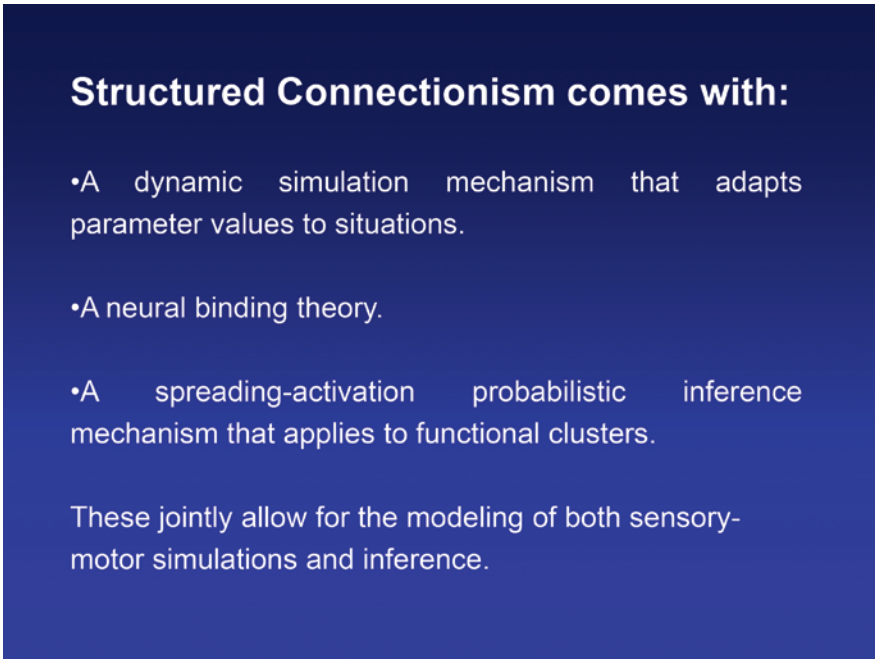


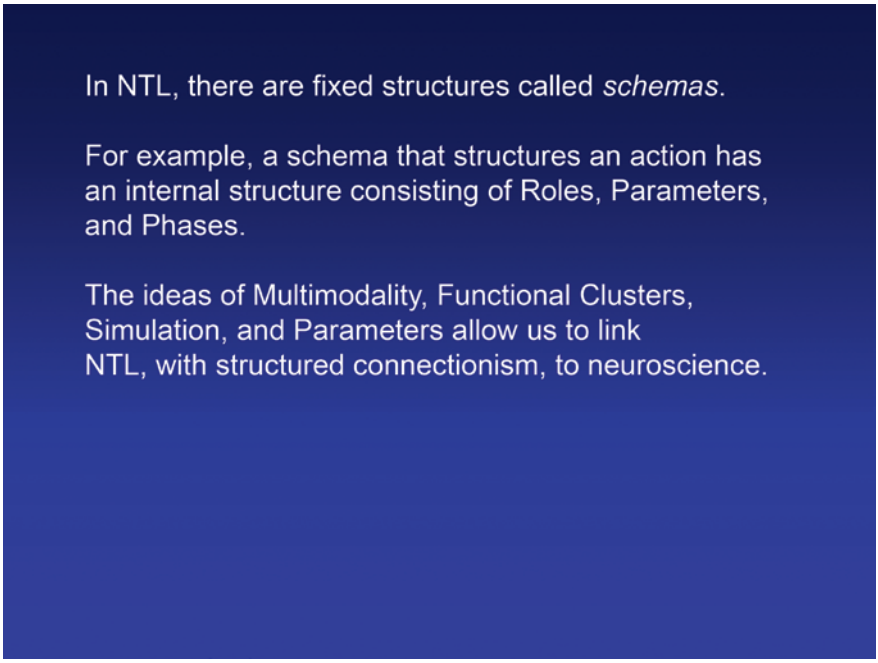


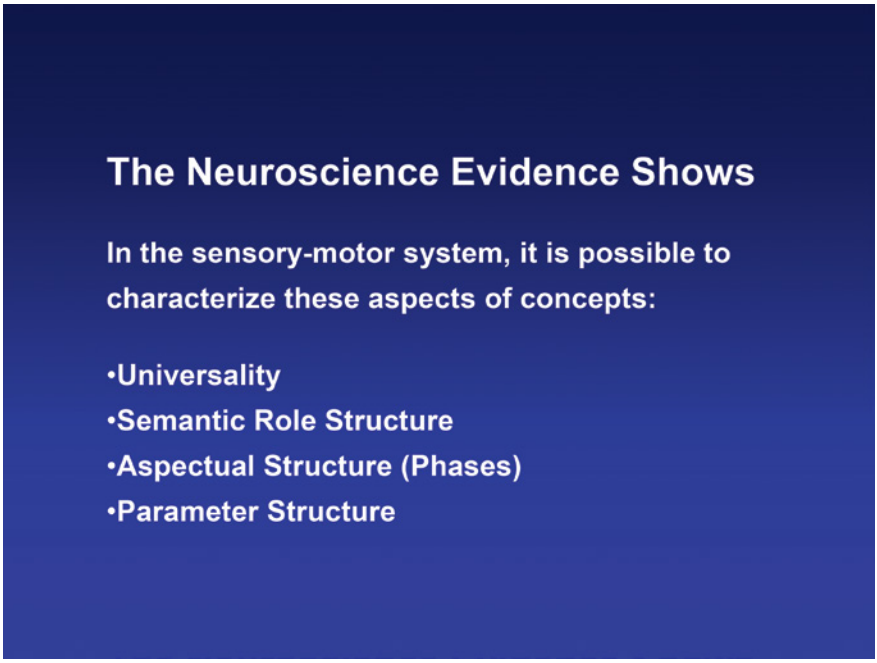


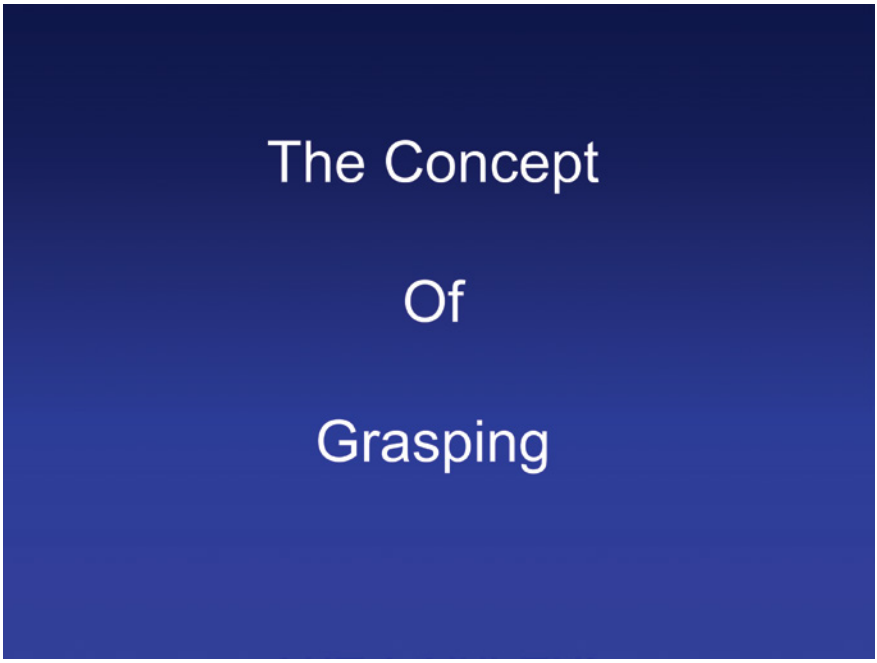












Universality Is Achieved by MultiModality

Multimodal functional clusters for an action like grasping fire when:

•Grasping is performed, observed, imagined, inferred, or heard;

•The grasping is of any type, done by any agent, on any object, in any manner, and in any location.

In showing such **multimodality** for a functional cluster, we are showing that the functional cluster plays the ***conceptual*** role of **universality.**

Multi-Modal Integration

The premotor cortex is not a uniform field, but a mosaic of functionally distinct areas (F1 to F7).

Each of these premotor areas is reciprocally connected with distinct regions of the posterior parietal cortex.

The premotor cortex is part of a series of parallel functional network clusters.

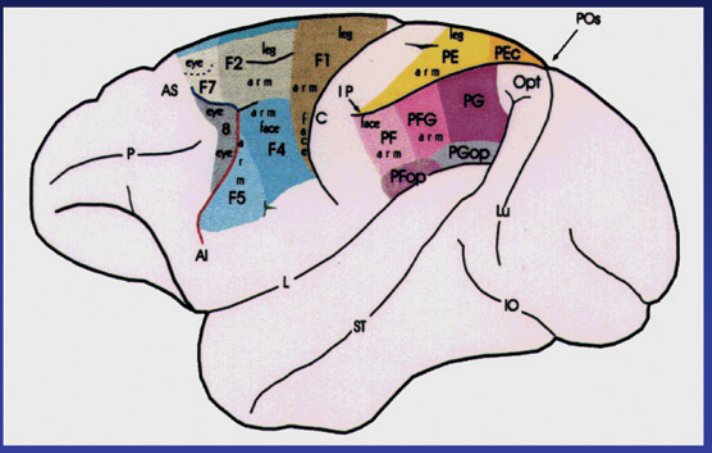
Multi-Modal Integration

Cortical premotor areas are endowed with sensory properties.

They contain neurons that respond to visual, somatosensory, and auditory stimuli.

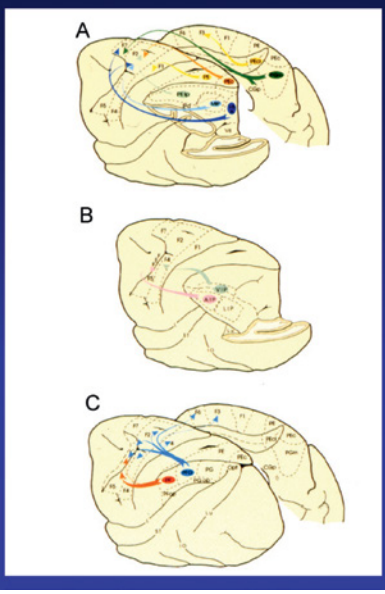
Posterior parietal areas, traditionally considered to process and associate purely sensory information, also play a major role in motor control.

A New Picture



Rizzolatti et al. 1998

The fronto-parietal networks



Rizzolatti et al. 1998

Area F5

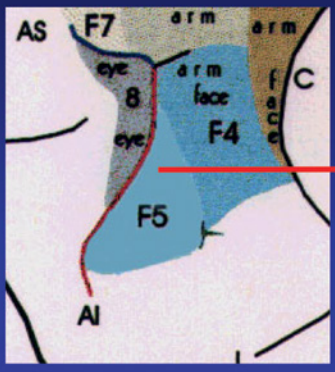
Three classes of neurons:

-Motor General Purpose neurons

-Visuo-Motor neurons:

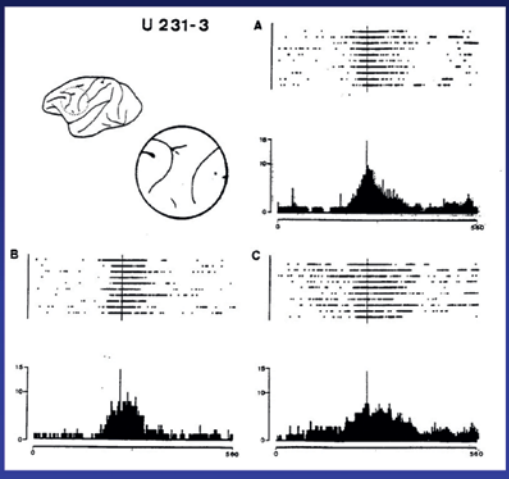
-Canonical neurons
-Mirror neurons

Area F5



General Purpose Neurons:
General Grasping
General Holding
General Manipulating

General Purpose Neurons in Area F5



A Grasping with the mouth

B Grasping with the cl. hand

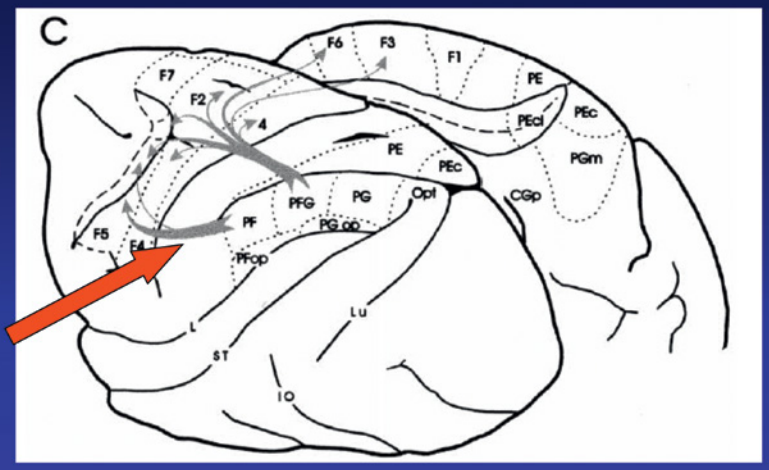
C Grasping with the ipsil. hand

(Rizzolatti et al. 1988)

General Purpose Neurons Achieve

Partial Universality: Their firing correlates with a goal-oriented action of a general type, regardless of effector or manner.

F5c-PF



Rizzolatti et al. 1998

The F5c-PF circuit

Links premotor area F5c and parietal area PF (or 7b).

Contains mirror neurons.

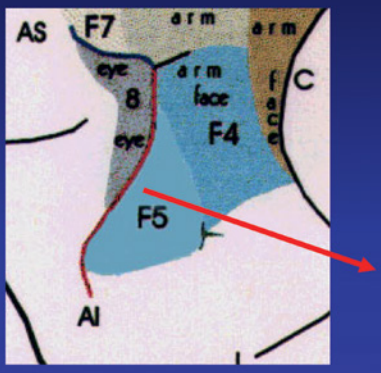
Mirror neurons discharge when:

Subject (a monkey) performs various types of goal-related hand actions

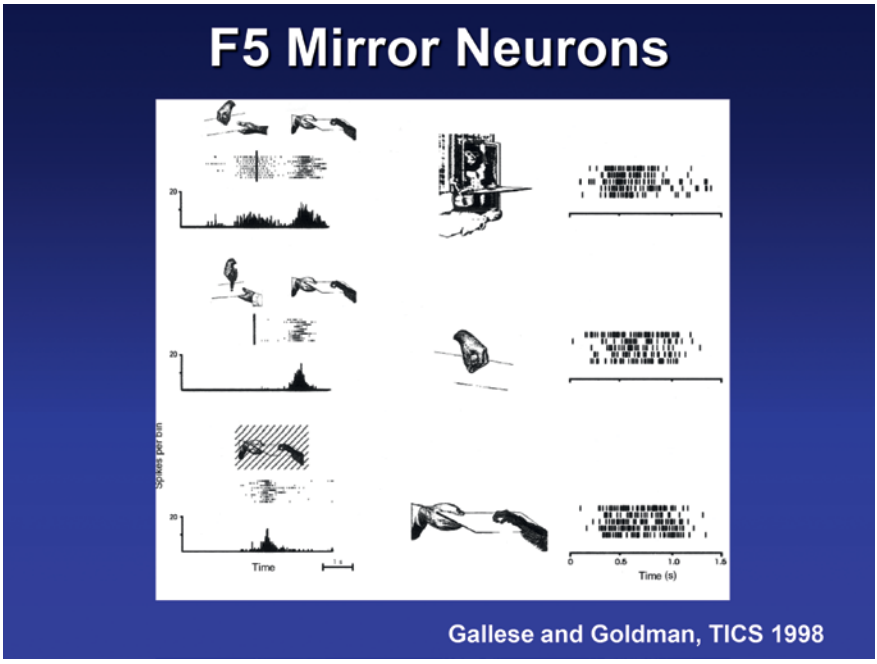
and when:

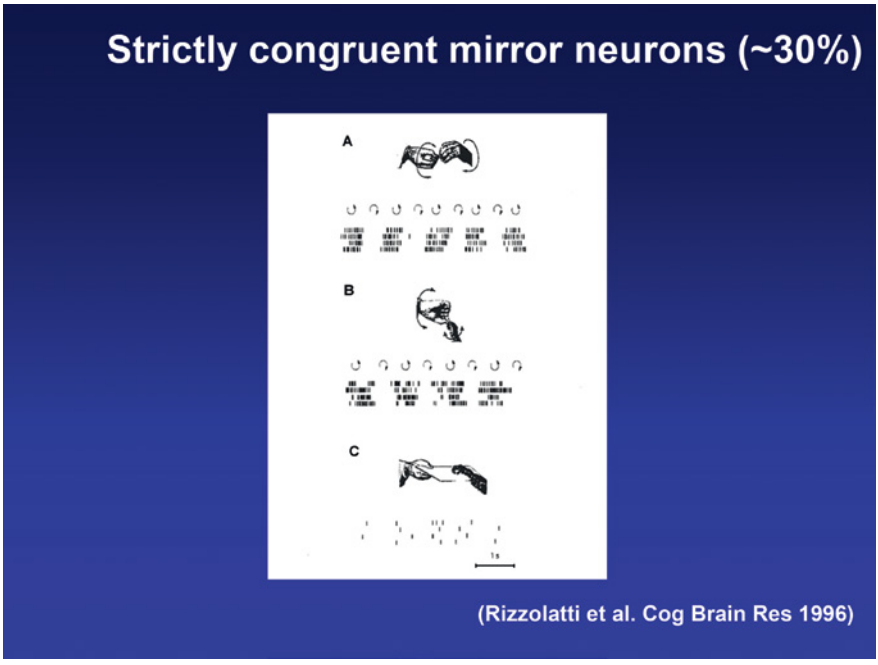
Subject observes another individual performing similar kinds of actions

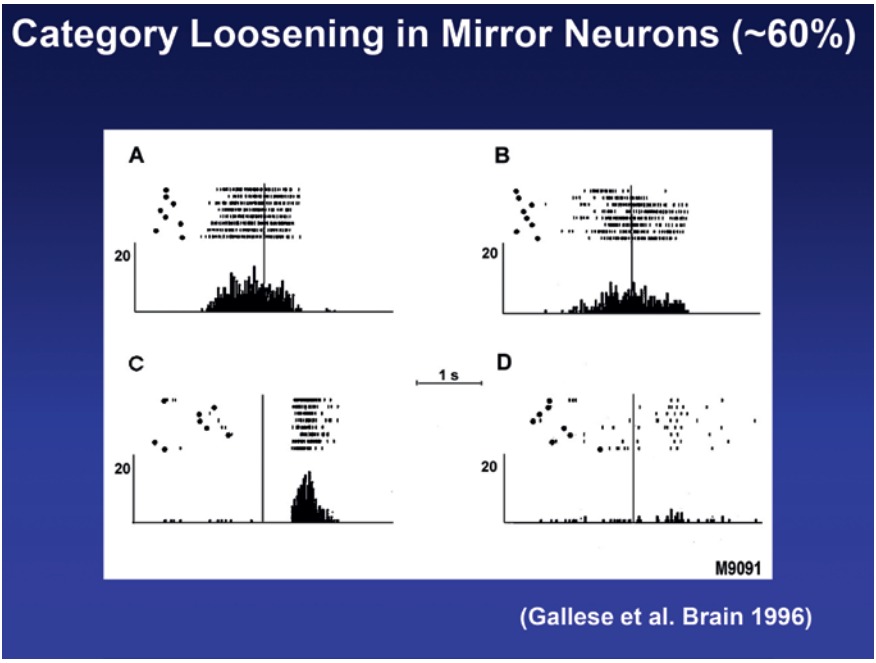
Area F5c

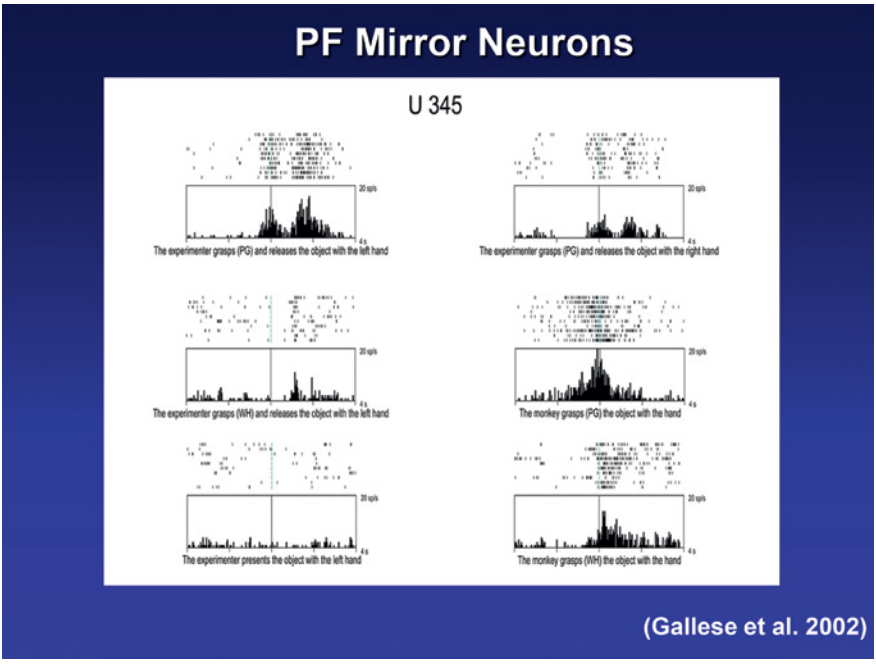


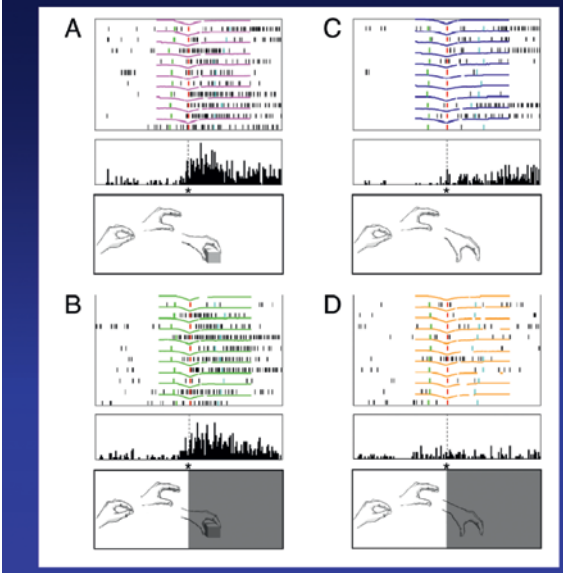
Convexity region of F5: Mirror neurons





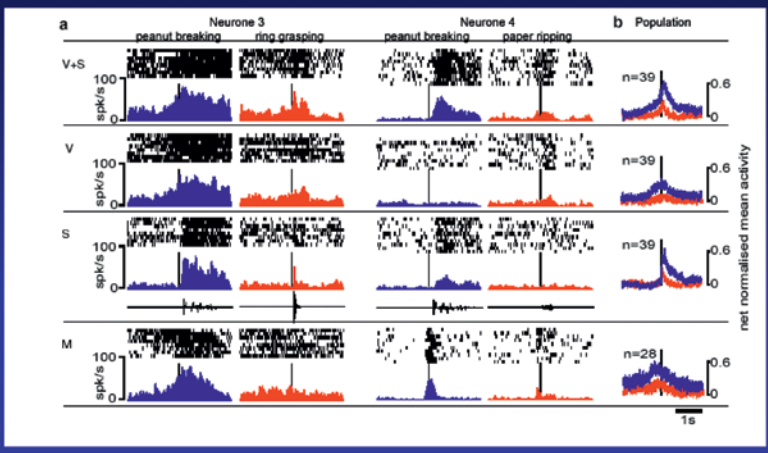






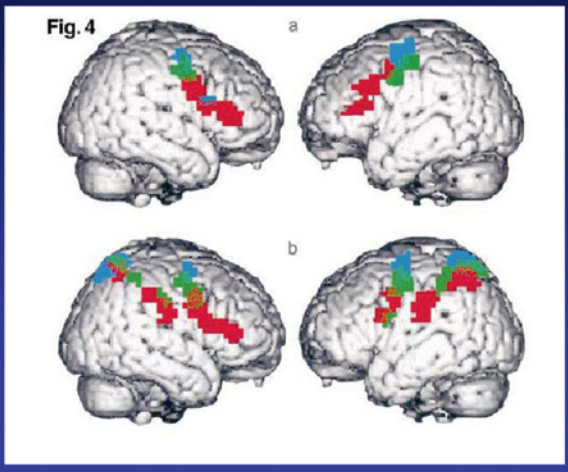
Like humans, monkeys can also infer the goal of an action, even when the visual information about it is incomplete.

F5 Audio-Visual Mirror Neurons



Kohler et al. Science (2002)

Somatotopy of Action Observation



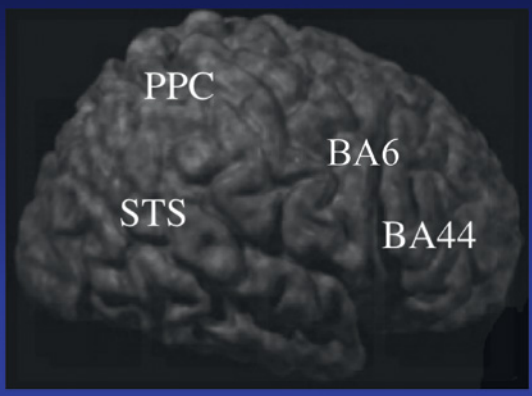
Foot Action

Hand Action

Mouth Action

Buccino et al. Eur J Neurosci 2001

The Mirror System in Humans



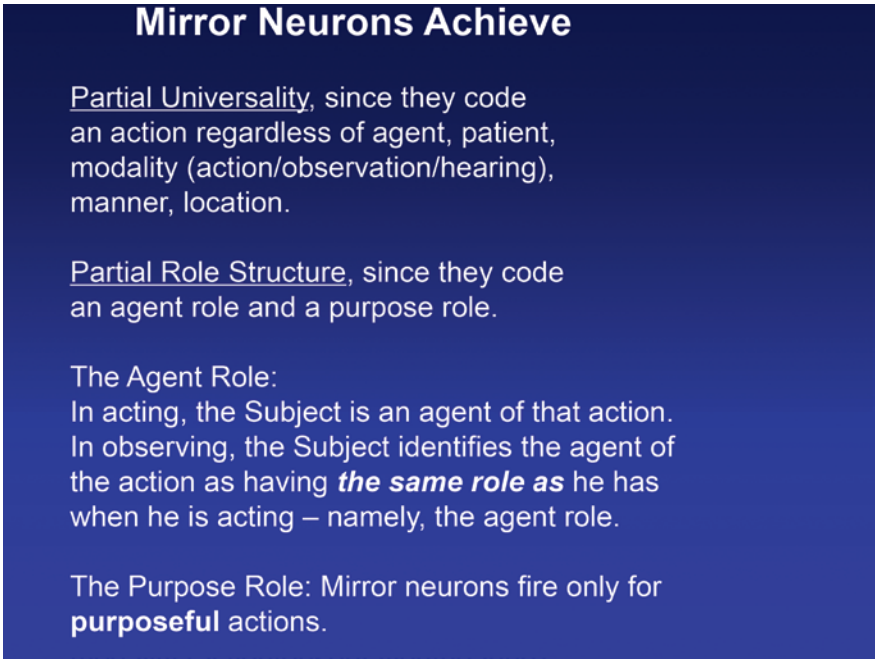
The Simulation Hypothesis

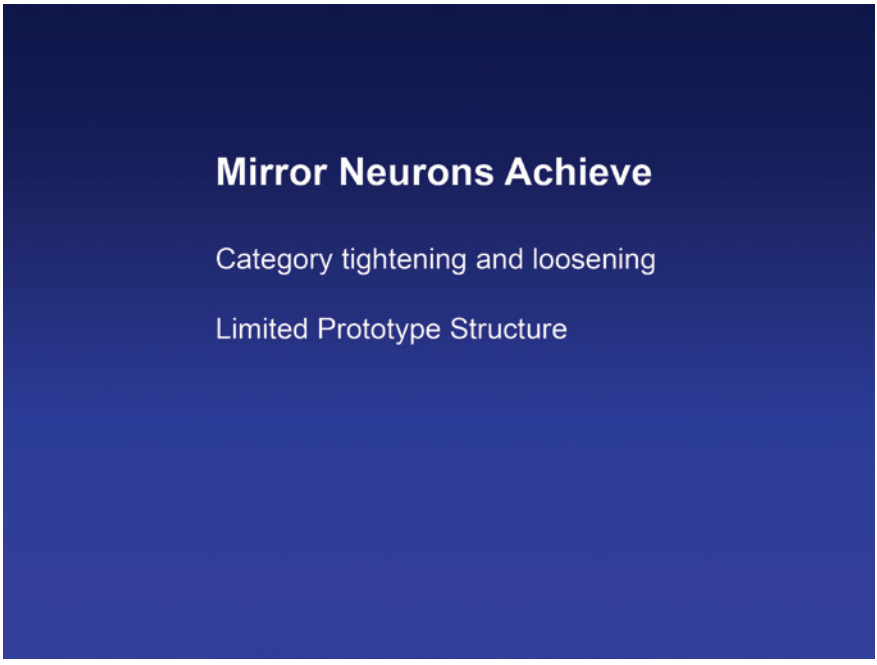
How do mirror neurons work?

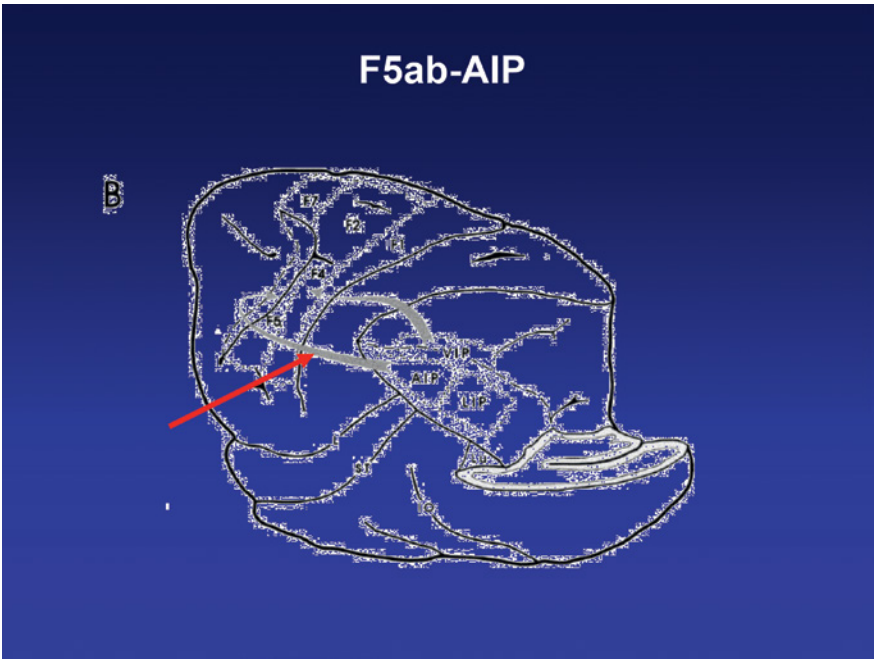
By simulation.

When the subject observes another individual doing an action, the subject is simulating the same action.

Since action and simulation use some of the same neural substrate, that would explain why the same neurons are firing during action-observation as during action-execution.







The F5ab-AIP circuit

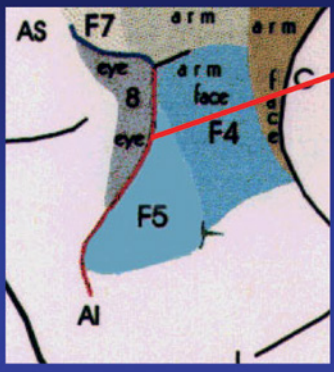
Links premotor area F5ab and parietal area AIP.

Transforms
intrinsic physical features of objects (e.g., shape, size)
into
hand motor programs required to act on them

Examples:

Manipulate objects, grasp them, hold them, tear them apart.

Area F5ab



Bank region of F5:
Canonical neurons

F5 Canonical Neurons

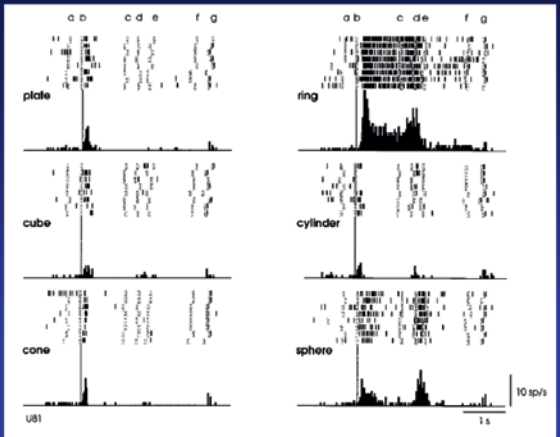
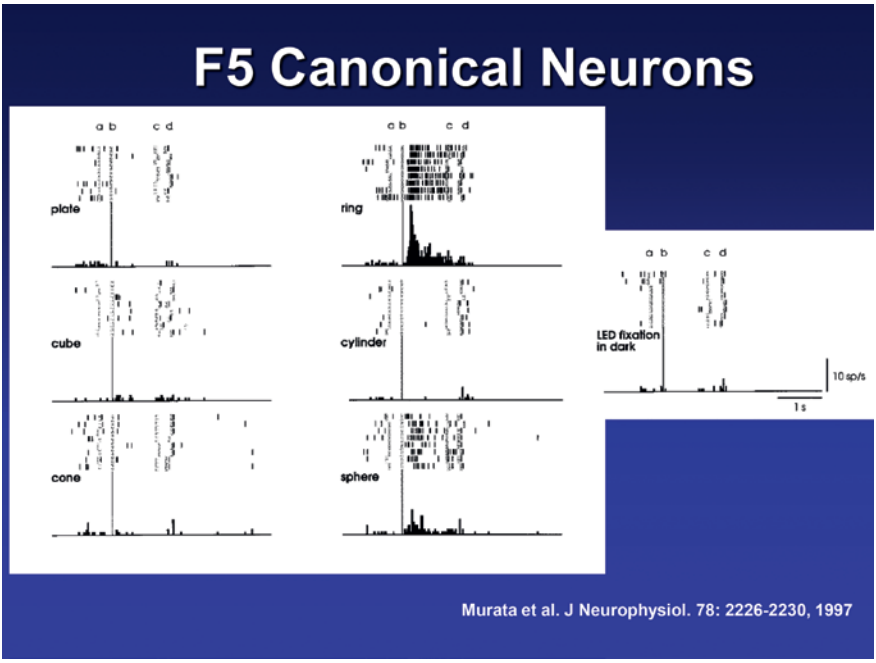


FIG. 1. Example of a selective F5 visuomotor neuron. Panels show neural activity recorded during the grasping in light task with 6 objects of large size. Rasters and histograms are aligned (vertical bar) with key press (onset

Murata et al. J Neurophysiol. 78: 2226-2230, 1997



The Simulation Hypothesis

How Do Canonical Neurons Work?

By Simulation.

The sight of a graspable object triggers the simulation of grasping.

Since action and simulation use some of the same neural substrate, that would explain why the same neurons are firing during object-observation as during action-execution.

Canonical Neurons Achieve

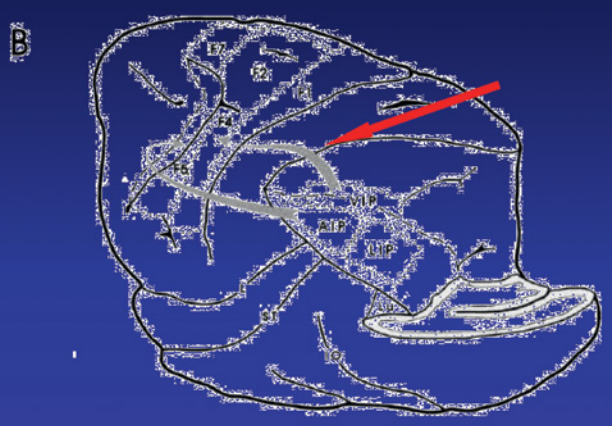
Partial Universality, since they code an action regardless of patient, manner, and location.

Partial Role Structure, since they code a patient role and a purpose role.

The Patient Role: Canonical neurons fire in the presence of an appropriate **patient** for a given action.

The Purpose Role: Canonical neurons fire only for **purposeful** actions.

The F4-VIP Network Custer



The F4-VIP Circuit

Links premotor area F4 and parietal area VIP.

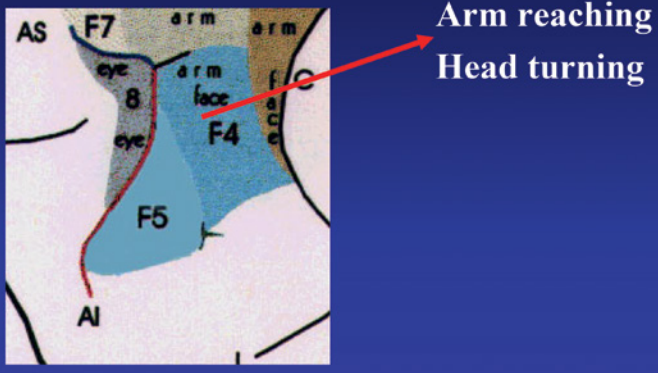
Transforms
the spatial position of objects in peri-personal space
into
motor programs for interacting with those objects.

Examples:

Reaching for the objects, or moving away from them

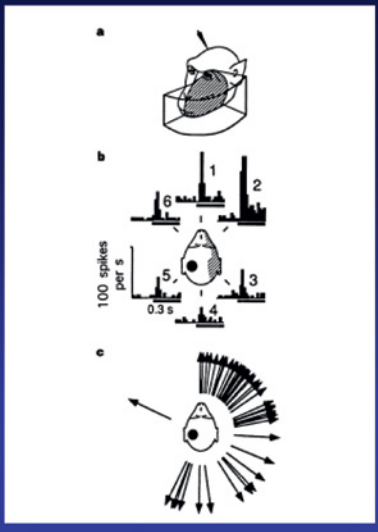
with various parts of your body such as the arm or head.

Area F4



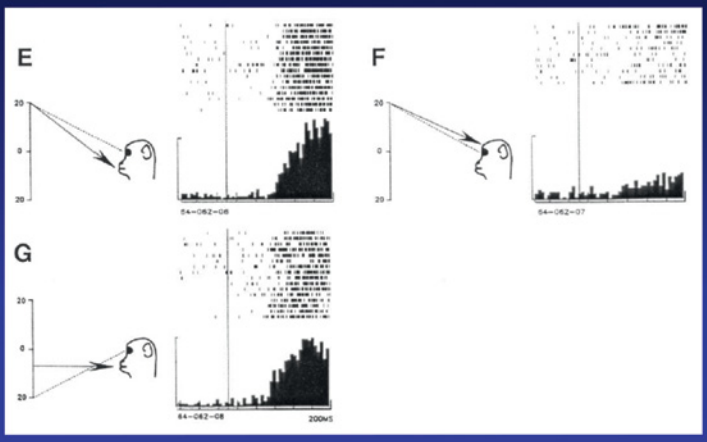
Somato-Centered Bimodal RFs in area F4

(Fogassi et al. 1996)



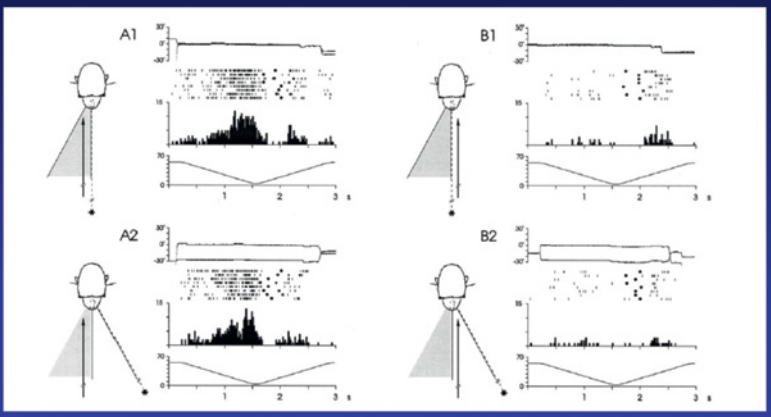
(Graziano et al. 1999)

Somato-Centered Bimodal RFs in area VIP

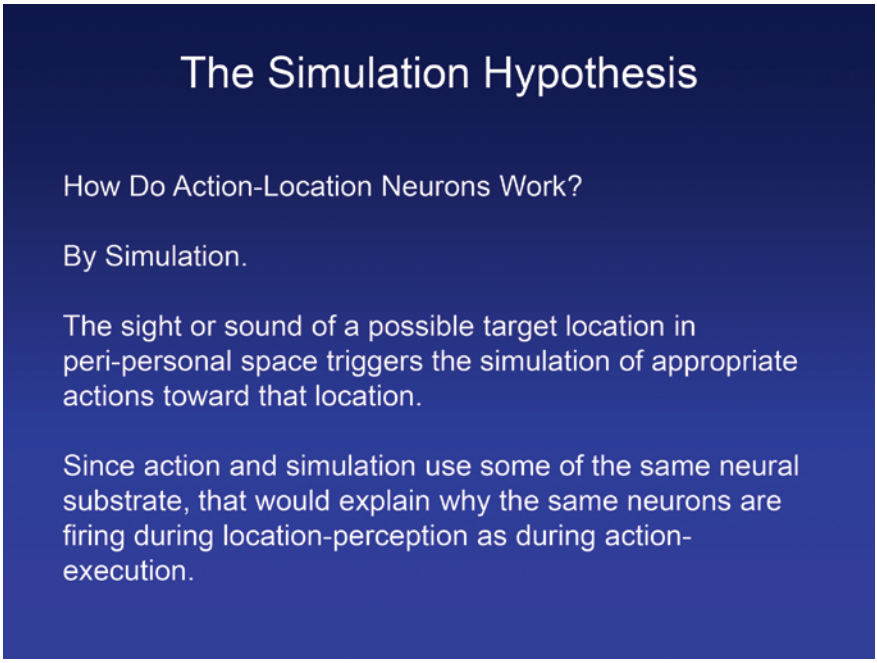


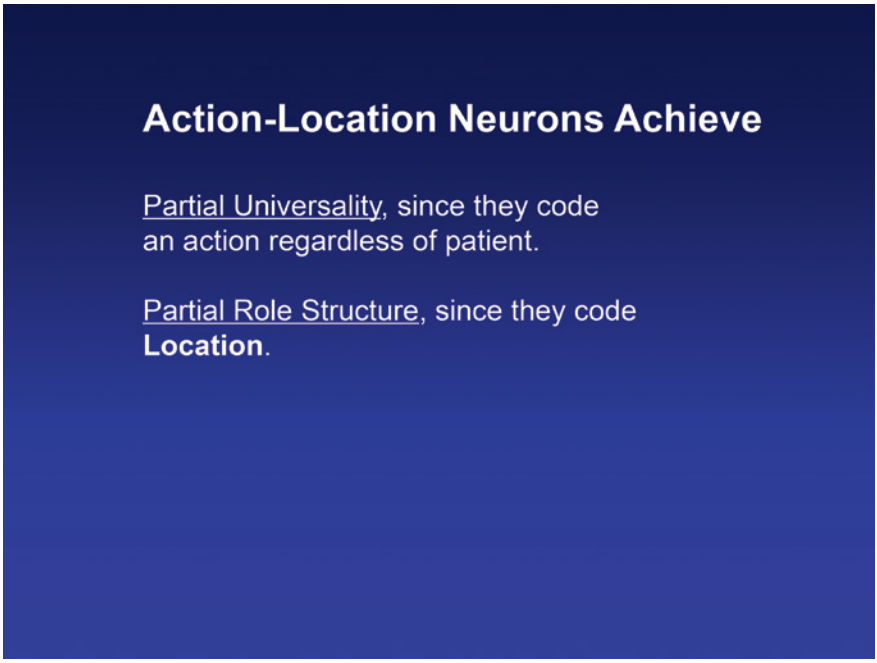
(Colby and Goldberg 1999)

Somato-Centered Bimodal RFs in area F4



(Fogassi et al. J Neurophysiol 1996)





Evidence in Humans for Mirror, Canonical, and Action-Location Neurons

Mirror: Fadiga et al. 1995; Grafton et al. 1996; Rizzolatti et al. 1996; Cochin et al. 1998; Decety et al. 1997; Decety and Grèzes 1999; Hari et al. 1999; Iacoboni et al. 1999; Buccino et al. 2001.

Canonical: Perani et al. 1995; Martin et al. 1996; Grafton et al. 1996; Chao and Martin 2000.

Action-Location: Bremmer, et al., 2001.

MULTI-MODAL INTEGRATION

The premotor and parietal areas, rather than having separate and independent functions, are neurally integrated not only to control action, but also to serve the function of *constructing* an integrated representation of:

(a) Actions, together with
(b) objects acted on, and
(c) locations toward which actions are directed.

In these circuits sensory inputs are transformed in order to accomplish not only motor but also cognitive tasks, such as space perception and action understanding.

Phases

Area F5 contains clusters of neurons that control distinct phases of grasping: opening fingers, closing fingers.

Jeannerod, et al., 1995; Rizzolatti, et al., 2001.

Summary

Jointly, these functional clusters in the sensory-motor system characterize the following ***conceptual*** properties of grasping:

- Stability
- Universality: Covers all particulars
- Internal Structure:
  - Semantic Roles
  - Phases (Aspectual Structure)
- Meaningfulness
- Independence of linguistic expression

Summary

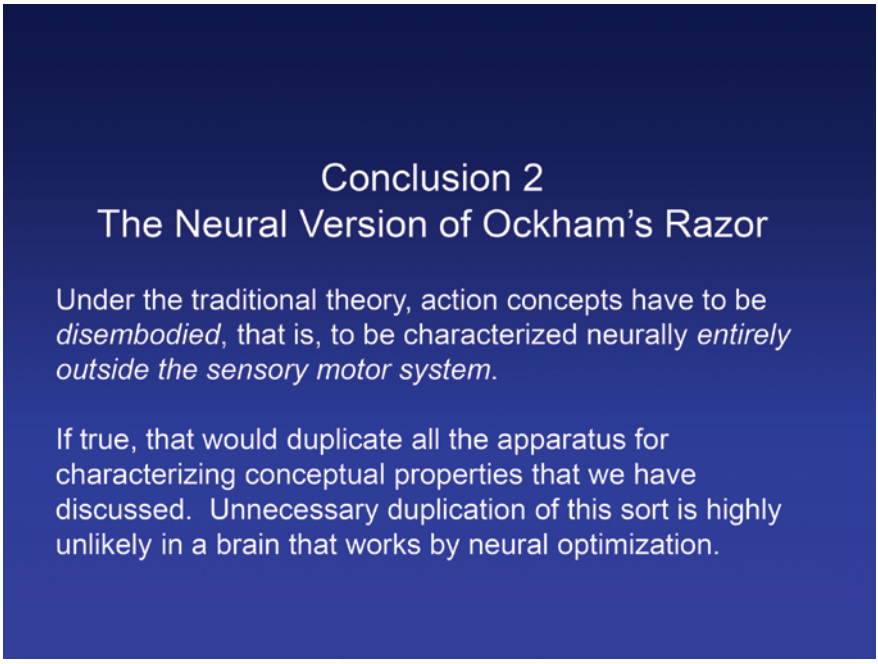
In NTL, structured connectionist mechanisms apply to units modeling functional clusters.

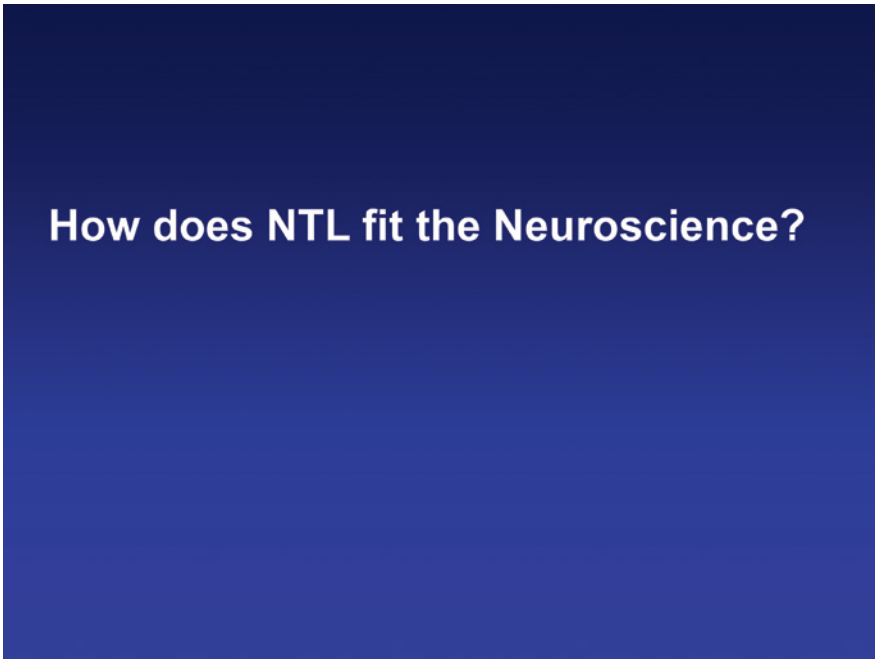
Compositionality is modeled via *neural binding*.

Inference is modeled via structured connectionist mechanisms for: *binding, spreading activation inference, and simulation.*

Conclusion 1
The Sensory-Motor System Is Sufficient

For at least one concept, *grasp*, functional clusters, as characterized in the sensory-motor system and as modeled using structured connectionist binding and inference mechanisms, have all the necessary conceptual properties.





Actions in NTL

For each type of action there is a Fixed Schema, consisting of types of fixed parameters; for example:

- Role Parameters, like Agent and Patient
- Phase Parameters, like Initial and Final State
- Manner Parameters, like Degree of Force and Direction

Grasp Schema

Roles: Action, Agent, Patient, Location
Manners: Force, Type of Grip; Effector Used
Phases:

Initial State:: Object Location: Within Peri-personal Space

Starting Transition:: Reaching, with Direction: Toward Object Location; Opening Effector

Central Transition:: Closing Effector, with Force: A function of Fragility and Mass of Patient

Goal Condition:: Effector Encloses Object, with Manner: (a grip determined by parameter values and situational conditions)

Final State:: Agent In-Control-of Object

Fitting The Grasp Schema to the Neuroscience of Grasping

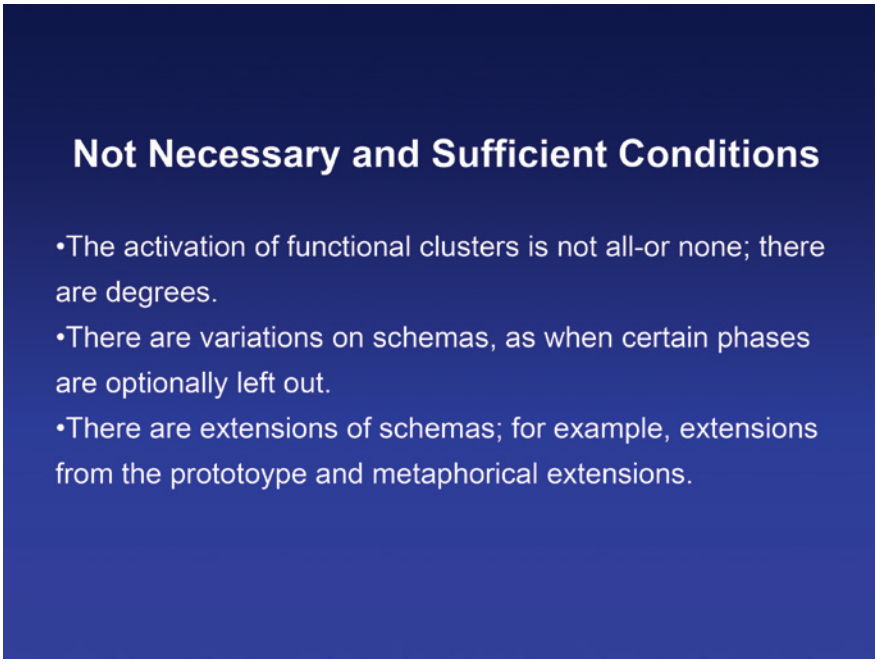
A **Fixed Schema** *Is* a Network of Functional Clusters
Each Parameter *Is* a Functional Cluster of neurons
Each Parameter value *Is* either
A firing pattern over a functional cluster, or
A neural binding to another functional cluster,
as when the role Agent is bound to a particular actor in context.

An **Executing Schema** (X-schema) *Is* a neural circuit connecting the parameters of the fixed schema so that they can dynamically coordinate firing over time and adapt their values over time to inputs from context.

Note!

The same neurons that define the **fixed schema** are the neurons subject to dynamic, contextually adjusted activation by the **executing schema** during performance, observation, and imagination.

Schemas are not like logical conditions. They run bodies — as well as they can, in real time adjusting to real conditions.



Not Representational

We conceptualize the world on the basis of the way we experience it; e.g., color is not in the world, nor is heat.

Since our experience is a function of our bodies, brains, and our physical and social environment, so are our concepts.

Since our experience comes through our physical nature — our bodies, brains, and physical functioning — so our concepts are physical in nature.

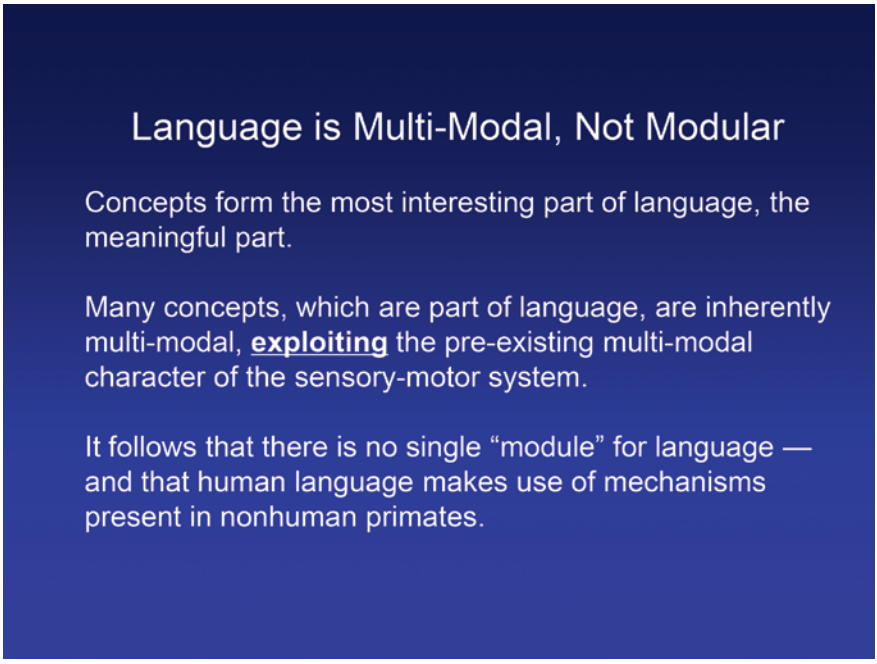
They are physical brain structures that, when activated, result in creative understandings shaped by the peculiar character of our bodies, brains, and lived experiences.

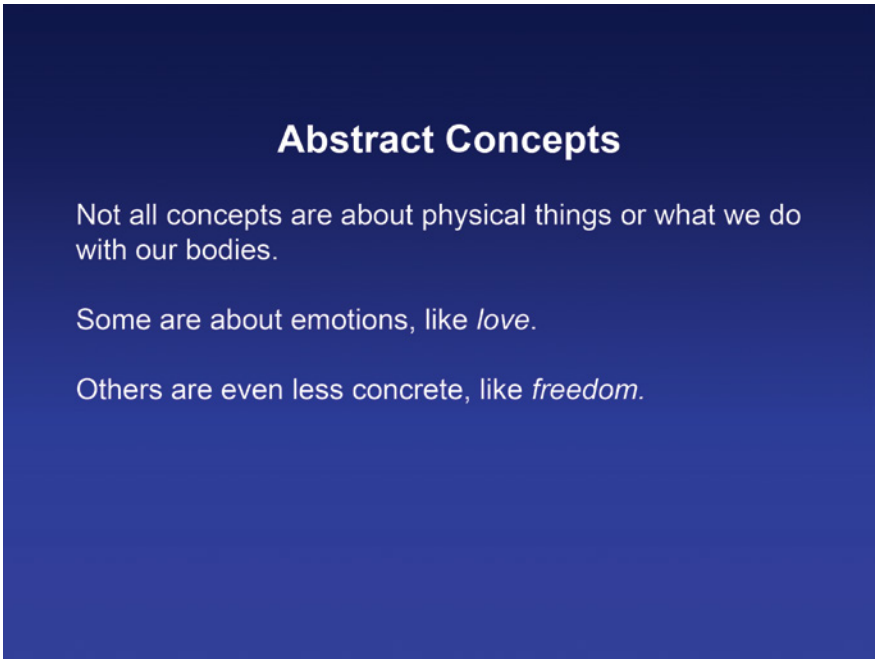
Not Symbolic

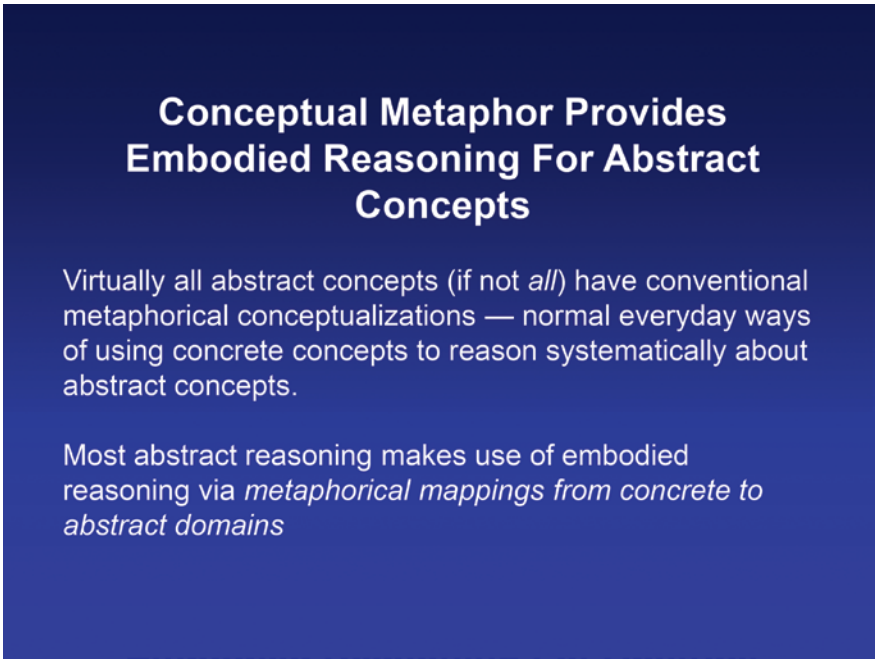
Note that we have written down symbols (e.g., Final State) as our notation for functional clusters.

This does *NOT* mean that we take functional clusters themselves to be symbolic. We only use symbols because we have to write things down.

The symbols are only our names for functional clusters, which, as we have seen, are made of neurons, though they function — from a computational modeling point of view — as units.







What Are Conceptual Metaphors?

In NTL, conceptual metaphors are structured connectionist "maps" — circuits linking concrete source domains to abstract target domains.

In the fit of NTL to Neuroscience, such metaphorical maps would be neural circuits in the brain linking sensory-motor regions to other regions.

We claim therefore that, in such cases, the sensory-motor system is **directly engaged** in abstract reasoning.

Metaphorical Grasping

There is a conceptual metaphor, *Understanding Is Grasping,* according to which one can *grasp ideas.*

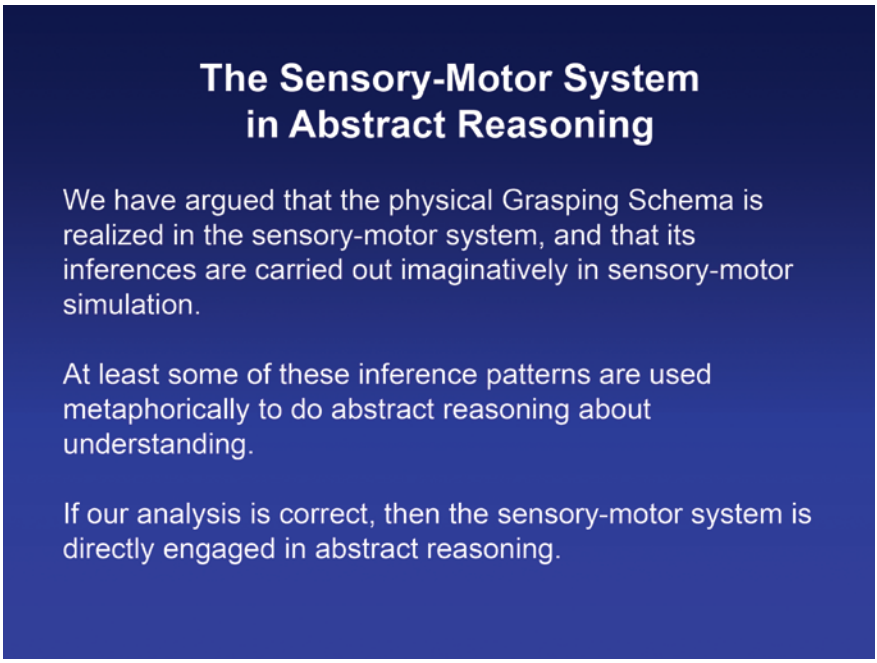
Reasoning patterns about physical grasping can be mapped by conceptual metaphor onto abstract reasoning patterns.

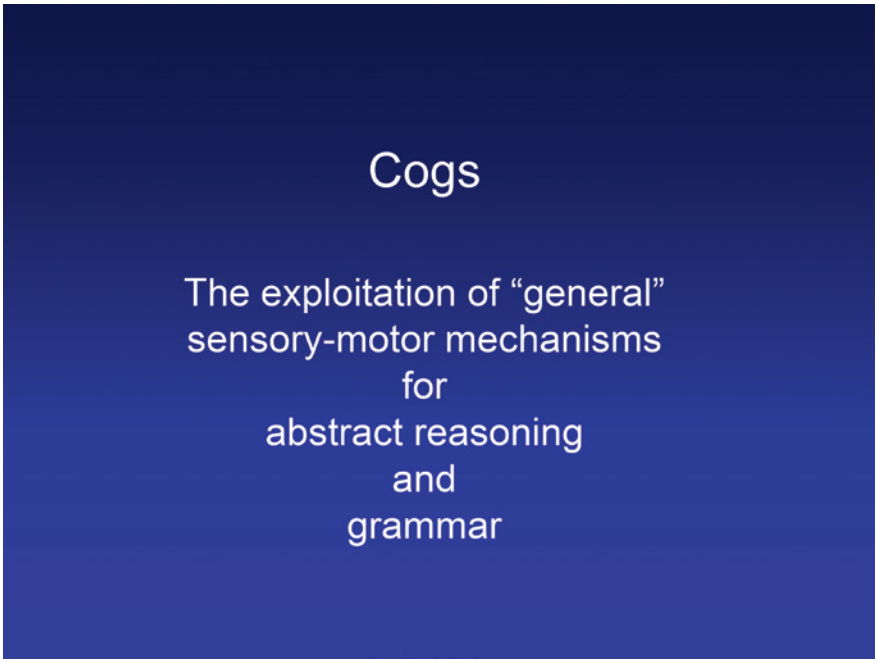
One can begin to grasp an idea, but not quite get a hold of it.

If you fail to grasp an idea, it can go right by you — or over your head!

If you grasp it, you can turn it over in your mind.

You can't hold onto an idea before having grasped it.





Premotor Versus Motor Cortex

Whenever we perform a complex motor movement, such as picking up a glass and taking a drink, at least two distinct parts of the brain are activated:

The motor cortex, where there are neural ensembles that control "motor synergies" — relatively simple actions like opening or closing the hand, flexing or extending the elbow, turning the wrist, and so on.

Complex motor schemas, however, are carried out by neural circuitry in the pre-motor cortex, circuitry connected via neural bindings to the appropriate synergies in the motor cortex.

In picking up a glass and taking a drink, both pre-motor cortex and motor cortex are activated, as are binding connections between them.

The Controller X-Schema

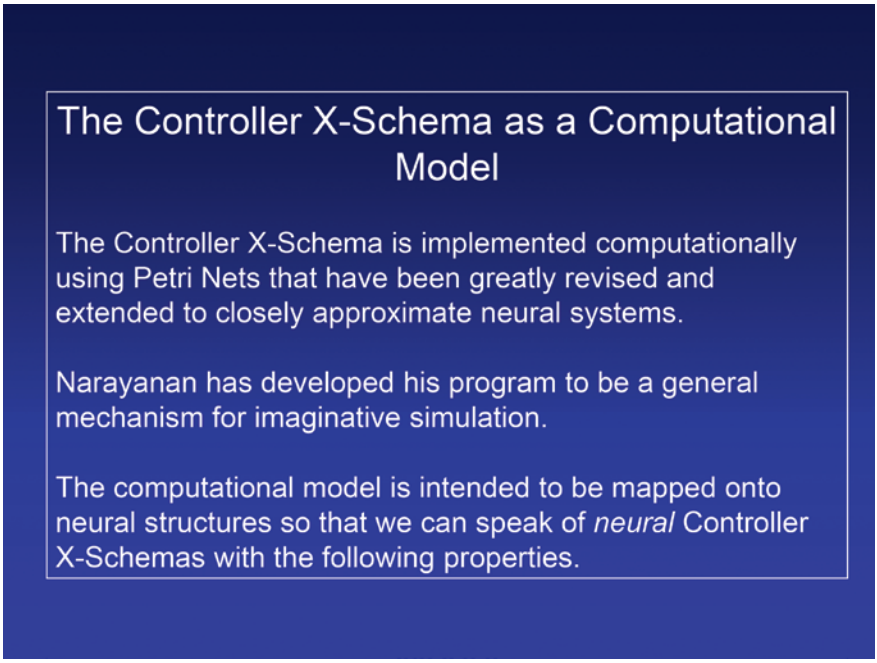
In modeling complex premotor action schemas, Narayanan made a remarkable discovery.

All complex premotor schemas are compositions of a single type of structure.

He then showed that the same neural computational structure, when disengaged from specific motor actions, can characterize aspect (that is, event structure) in the world's languages.

When dynamically active, this structure can compute the logic of aspect.

Narayanan called this structure the "Controller X-schema."



The Properties of A *Neural* Controller X-Schema

- It is a neural structure that is "general" in the sense that it can be bound via connections to different specific sensory-motor structures elsewhere in the brain.
- When those connections are deactivated, it can be connected to other regions of the brain and perform abstract reasoning.
- In its reasoning mode, it characterizes the semantics of a portion of grammar (e.g., aspect and its logic).
- The inference patterns it characterizes are "general," in that they can apply to a wide range of specific concepts.

I will call any neural structure with such properties a "**Cog**."

Other Cogs

Other examples of Cogs include primitive image-schemas — e.g., Containers, Source-Path-Goal, Contact, Rotation, Front-Back, Up-Down— as well as Talmy's force dynamic schemas, enumeration schemas (used in subitizing), and so on.

All of these can be bound to a wide range of specific sensory-motor details, can be used in reasoning, and can characterize the meanings of grammatical constructions.

Other Uses of Cogs

Linking metaphors that join different mathematical domains are Cog-to-Cog mappings.
e.g., Numbers Are Points on a Line

Cogs characterize form in art.

Dissociative learning is the inhibition of connections between Cogs and specific details.

The Sensory-Motor Nature of Cogs

The primary function of Cogs is a sensory-motor function.

Both evolutionarily and developmentally, Cogs first function to structure our embodied sensory-motor interactions in the world.

That function is not lost. Cogs continue in their sensory-motor function.

The sensory-motor characteristics of Cogs are ***exploited*** **in** reason, language, mathematics, and art — the highest of human cognitive functions**.**

All of these make direct use of the sensory-motor neural substrate!