NORVIN RICHARDS: So we have already talked for a while about various kinds of ambiguity. And today, we're going to talk about ambiguity more. This is, if anything, the best time to talk about ambiguity because we're now actually into semantics. The kinds of ambiguity we were talking about before were kinds of what's sometimes called structural ambiguity-- that is, sentences that had more than one meaning. The way we were talking about it was had more than one meaning because it was possible to draw more than one tree for them.

So the sentence that we spend a lot of time talking about was I once shot an elephant in my pajamas, where the whole joke there was that "in my pajamas" could be attached in a couple of different places. It could either modify "the elephant" or it could modify the verb phrase "shot an elephant." And the upshot of that was, well, the pajamas could be on either of you, and yeah-- ambiguity. Similar kinds of ambiguities in these other examples.

But there's another kind of ambiguity that's the one I want to talk about today. People have claimed that this sentence is ambiguous-- "someone loves everyone." The claim is this can mean at least two things. It can mean-- let's get some lights on up here in the front. Oh dear, so many options. Stage left, stage right-- sure. Oh, I see. That's what I want.

Two kinds of meanings for this that people have posited-- one meaning in which it means the following situation holds everyone is loved. That is, for each person, there is someone that loves them. That's what's diagrammed in that first diagram up there, where the love relation holds between X and A and B-- X loves both A and B, and between Y and C, and between Z and both D and E. So that's a possible reading for the sentence.

And then there's another possible reading for the sentence, and then there are arguments about whether this is a different reading or not, in which it means someone loves everyone what that means is there is a person who loves everyone. Maybe it's my grandma-- very loving person. She loves absolutely everyone. And so the love relation holds between X and absolutely everyone, including herself. So that's a kind of ambiguity people have claimed to exist. I don't want us to get too hung up on whether it does. There are clearer examples maybe.

Think about a sentence like "Everyone in this room speaks two languages." This is going to be a clearer example because we'll see that the availability of the two meanings can be affected by things that we can do. What's something this can mean? Yeah?

AUDIENCE: For every individual, it's true that that individual speaks two different languages.

NORVIN RICHARDS: Yeah, so it's possible that it means everyone in this room is bilingual. So maybe I speak English and Spanish, and you speak Ukrainian and Polish, and you speak Mandarin and Japanese. So everybody in this room is bilingual. It could mean that. What's another thing it can mean? Yeah?

AUDIENCE: If you put together all the languages that everyone in this room knew, it would only be two.

NORVIN RICHARDS: Right, exactly. So if you took a survey of everybody in this room and found out all the languages that they speak, there would be two things, two languages that we all have in common. Maybe we all speak English and we all speak Tagalog. Maybe some of you speak 12 languages, but two of them are English and Tagalog. That's another thing that it could mean. Yeah?

AUDIENCE: I don't actually read the sentence that second way. If everyone in this room speaks two languages, as in collectively, everyone in this room speaks two languages. That just doesn't-- I don't read it like that.

NORVIN RICHARDS: That's not the first reading you get for it. Yeah, I agree with you, actually. So what you're claiming is that if I were to say "Everyone in this room speaks two languages, namely English and Tagalog," your interpretation would be that everyone in this room is bilingual in English and Tagalog. (Tagalog is a language from the Philippines.) It's a lot easier to get that reading, I agree with you, than it is to get the other reading, where it just means everyone in this room is bilingual. Yeah?

AUDIENCE: I think I would have [INAUDIBLE] something to me in total.

NORVIN RICHARDS: Everyone in this room speaks two languages between us. Yeah, you feel as though there could be modifications that you could make that would make that reading. Here's one modification you can make that makes that reading come out. You can passivize the sentence. So "Two languages are spoken by everyone in this room," I think has that reading really clear. There are two languages that we all have in common. It's possible that it can also mean the other thing, that it can also mean everyone in this room is bilingual, but at least can mean that.

The fact that we can have this sensation that these two imaginable readings are maybe both available for both of these sentences, maybe not, but certainly one is more available than the other depending on whether the sentence is active or passive-- it suggests we want to be able to talk about this kind of difference in meaning between these sentences. So we're going to develop the tools to do that today.

So in order to do that, we're going to need to develop a theory of a certain special kind of noun phrase-- what's called a quantifier. And to do that, we're going to start by talking about what noun phrases mean more generally. So here's a noun phrase-- refers to a person who's the TA for some of you. And if you were to ask, what does that noun phrase mean? Well, we talked about this a little bit.

I had the example of there are various things that you could use to refer to me. You could refer to me as "Professor Richards" or as "Norvin" or "that so-and-so who gave me a C"-- and we're talking about that. So similarly, here's a phrase that if you ask what it means, you might expect that if we look this up in your mental lexicon, what we would find is a picture of this guy-- those of you who have him as your TA, at least. So if you don't have him as your TA, maybe you don't know who he is, but he's one of the TAs.

And to say, for example, "Enrico Flor is an avid hangglider" is to say something like-- we ask what that means, it's going to mean something like-- we'll have to figure out the meaning of avid hangglider. What is it to say that someone is an avid hangglider? But when we figure out what that is, we'll have a list of all of the people who are avid hanggliders. And this claim is that list will have Enrico Flor's name on it. That's what that means. So that's a comparatively simple meaning for a noun phrase. Enrico Flor-- that noun phrase refers to that guy.

What if I wanted to tell you, the 24.900 TAs are avid hanggliders. So again, we're going to have a list of the avid hanggliders. What does this sentence say? What does it mean?

AUDIENCE: You first have to parse what the 24.900 TAs are and decompose that into a list of people and match them up with who are the [INAUDIBLE].

NORVIN RICHARDS: Yeah, exactly. That's a nice way to say it. So we're going to have a list of the avid hanggliders, and we're going to have a list of the 24.900 TAs. It'll have Enrico Flor, and it'll have Yash Sinha, and it'll have all four of the TAs. And what this says is if you look at that list of avid hanggliders, it'll have all four of those names on it.

I'm trying to lure you into a false sense of security here. So far, this should seem pretty simple. So yeah, there's a list-- set. I've made it a set here. It's a set that contains Enrico and Peter and Yash and Anton. And what we're saying is that set is a subset of the set of avid hanggliders.

What set does "every Italian"-- Enrico Flor is Italian-- what set does "every Italian" refer to, if we're going to let noun phrases refer to sets? Yeah?

AUDIENCE: Either every person such that that person has Italian citizenship or Italian ancestry?

NORVIN RICHARDS: Yeah, so you're being very careful. But yes, so somehow we'll have to define what we mean by Italian. You're right. That's right. And then we'll end up with a list of Italians. And then that'll be the set. So similarly, if you say "Every Italian is an avid hangglider," what we mean is it's kind of like "The 24.900 TAs are avid hanggliders." Everyone in this list is also in this list. Everyone in this set is also in this set. That's what that means. So "every Italian" will have a list of Italians-- that's how the list could start. And you're saying everybody in that list is an avid hangglider. OK, so far, so good.

How about "No Italian?" What set is that? Yeah?

AUDIENCE: It's like if you took the set of all people, but you took out all of the Italians.

NORVIN RICHARDS: Subtracted the Italians.

AUDIENCE: It would be the partition of all people who's not Italian.

NORVIN RICHARDS: But if it means that-- no, that's a nice idea. So we'll take the set of people, and we'll subtract from it all of the Italians, everybody who was on the list of Italians. But then what is "No Italian is an avid hangglider" going to mean? Yeah?

AUDIENCE: Just means that of the list of people that you identify as Italians, none of them will be found in the list of avid hanggliders.

NORVIN RICHARDS: So we want it to mean that. But if it meant what Raquel-- if no Italian meant what Raquel wanted it to make-- I'm sorry, Raquel, I'm picking on you because you were smart enough to make a suggestion-- it would mean everyone who is *not* Italian *is* an avid hangglider. And that's not what "No Italian is an avid hangglider" means, I think. Sorry, what were you going to say?

AUDIENCE: [INAUDIBLE]

NORVIN RICHARDS: Say that, yes. Yeah, I'm sorry, I should start calling on you guys instead of-- yes, Raquel?

AUDIENCE: If there is an avid hangglider, it has to be part of the subtracted-- like the set that doesn't have Italian-- like every single one must, but if there is going to be one, it better be in that.

NORVIN RICHARDS: All the other hang gliders have to be in the complement set of the set of Italians, something like that. Yeah? Yeah, Joseph?

AUDIENCE: Instead of Italians, instead of hanggliders, the intersection is a null set.

NORVIN RICHARDS: Yeah, so I think what we're saying, what we're getting to and I think you said this more or less the same way, every other set that we've talked about, when we said "The 24.900 TAs are avid hanggliders," we said, yeah, there's a set of 24.900 TAs and there's a set of avid hanggliders, and the first set is contained in the second set. That's what that means. And every Italian is an avid hangglider-- there's a set of Italians and a set of avid hanggliders, and the first set is contained in the second set.

But "no," as in "no Italian," makes you have the sets interact with each other in a different way. It says this first set is not contained. Nothing in this first set is contained in the second set. So this is a popular way of talking about the meanings of what are called quantifiers-- words like "every" and "no." So it's not the null set. It's not a set containing no Italian.

A popular way of talking about the meanings of these kinds of expressions-- these are called quantifiers, these expressions which do fancier things with sets than just say, oh yeah, this set is inside this set-- a popular way of talking about them is to say they do fancier things with sets. They allow you to do more interesting things with set interaction than just say this set is a subset of that set. That's what they do. That's what they're for.

Quantifiers have a bunch of interesting properties. They're weird in other ways too. So, for example, there is something called the Law of Contradiction. If-- the Law of Contradiction says if you take two predicates that are contradictory, like "be inside" and "be outside," if you join me in imagining that it's not possible to be both inside and outside-- and I can see some of you thinking of alternative ways of thinking about the world in which-- but suppose I'm halfway inside and halfway outside. Which am I? I'm in the Department of Linguistics and Philosophy, so I'm used to hearing people talk like that. But please stop.

Just imagine that you're either inside or you are outside and that's all. And imagine that Paul is a single person. There's only one person on Earth named Paul. So then "Paul is inside and Paul is outside" cannot be true. That's the Law of Contradiction. So if you have two predicates that are opposites of each other, cannot both be true of a single person, then if you apply them to a single person, then the sentence has to be false. That's what that first example is. It's an example of the Law of Contradiction.

But there are quantifiers like "several Americans," which just flagrantly violate the Law of Contradiction. So "Several Americans are inside and several Americans are outside"-- fine. No problem. And you don't have to play games with whether if you're halfway inside or halfway outside or you're inside the building but you're outside the campus or something. Just forget about all that.

There are also quantifiers that fail what's called the Law of the Excluded Middle. The Law of the Excluded Middle says if you have two predicates like "be under 6 feet tall" and "be over 5 feet tall," then a sentence like "Takashi is under 6 feet tall or Takashi is over 5 feet tall" has to be true. We don't have to measure Takashi to find out whether that's true because the set of people who are under 6 feet tall and the set of people who are over 5 feet tall overlap. If you have both of those sets together, they cover all people. Any height that someone is, they are at least one of those two things, possibly both. Someone who's between 5 feet tall and 6 feet tall is both. And someone who's under 5 is under 6, and someone who's over 6 is, well, over 5.

That sound right? These are two predicates such that here's 5 feet tall. Here's 6 feet tall. We're talking about people who are under 6 feet tall and also the people who are over 5 feet tall. Well, we've covered everybody. So we don't have to look at Takashi. We don't have to know who Takashi is. That first sentence is true-- Takashi is under 6 feet tall or Takashi is over 5 feet tall.

But the second sentence is false, or at least doesn't have to be true. So "All Japanese men are under 6 feet tall or all Japanese men are over 5 feet tall." That could be false. Can somebody name a context in which that would be false? I'm asking you to do it because I can't do math while standing up here. Yeah, Joseph.

AUDIENCE: There happened to be a particularly tall-- someone who's over 6 feet, or particularly short under 5 feet [INAUDIBLE], and the population of Japanese men are [INAUDIBLE].

NORVIN RICHARDS: Yeah, there we go, good. So as long as you have at least one Japanese man who's over 6 feet tall and at least one Japanese man who is under 5 feet tall, the rest of the Japanese men can all do whatever they want. The sentence will be false. Good.

So quantifier phrases, quantifiers, quantification expressions, like "all Japanese men" or "some Italians" or "no Italians," fail these otherwise reliable generalizations about sentences. So expressions like "no Turks" or "several Americans" or "all Italians" or "most Ukrainians" don't refer to sets of people. What do they mean? Well, what they do is they-- already said this-- these words at the beginning, like "no" or "several" or "all" or "most," are doing cool set theoretic things with the set that they are combining with. So the set of Turks or Americans or Italians or Ukrainians, they're causing that set to interact in interesting ways with a set that's determined by the rest of the sentence.

In order to talk about this, let me do a quick review of set theory. You're not going to need to very much that theory in order to do this. I tell you this because I don't very much set theory, and I can do this, so I'll just show you what I'm going to show you here.

Here are two sets, pi and phi-- a Venn diagram. It's hopefully not too unfamiliar. Two sets, pi and phi, which have an overlap that contains D and F, and then there are also things that are only in pi and not in phi, like A and B. And there are some things that are only in phi and not in pi, like C and E. That sound right? People are all familiar with Venn diagrams.

We say that D and F is the intersection of pi and phi, and that little hoop is the thing that you use to express intersection. And we say that A, B, C, D, and F is the union of pi and phi, where I have, for some reason, used the word "of" twice. I'll try to fix that before I put up the slides. And the little thing that looks more or less like a U is the expression for union.

We also say that A, B, and D is a subset of pi, and there's a symbol that's used sometimes for subsets. None of this seems alarming-- subsets, union, intersection? OK, so here's the popular answer-- which we've now already gone through for quantifier meaning-- what we say is when you're saying something like "All Americans eat junk food" is you are asserting a relation between the set of Americans and the set of junk food eaters. You're saying something about what happens when you intersect those two sets. And depending on what quantifier you're using, you're making different assertions about the relation between these two sets. So "all" says set number one is a subset of set number two-- what some say. Yeah, [INAUDIBLE]?

AUDIENCE: The intersection is not a null set.

NORVIN RICHARDS: Yeah, the intersection is nonempty. So there are things that are in both sets. "No" says the intersection of set one and set two is empty-- "No Americans eat nattoo"-- are people familiar with nattoo? Have we talked about nattoo in this class? Yes, some of us are from nattoo cultures. Nattoo is a Japanese food. It's very good, and it's good for you. It's high in protein, but it's one of those kinds of food-- I think a lot of cultures have something like this. It's a kind of food one of the points of which is to feed it to outsiders so that you can watch and be amused.

So this happened to me when I was living in Japan. We were visiting some the family of a Japanese friend of mine, and the mother made me up a big dish of nattoo and they put it in front of me, and the entire family gathered around to watch. So you see what is he going to do?-- Nattoo is fermented soybeans. So the soybeans are covered in a thin layer of slime, and then you mix this up with rice and often mustard and soy sauce. It's really tasty. It's really good, but it's also very messy. So if you're like me and you have facial hair, by the time you're done, your entire face is covered in nattoo slime, so you have to go take a shower after you eat. But it's good for you. Tasty stuff.

So it's not true that no Americans eat nattoo, but it's grammatical. And what it means is the set of Americans-- you're looking at the set of Americans and the set of nattoo eaters, and you're saying the intersection of those sets is empty. There's nothing that's in both of these sets.

OK, I don't know whether we have a food like that in our culture, a food that you feed to people in order to be amused by their attempts to eat it. This is something to think about. I can tell you that the Tagalog version of it though. I'm sorry, I'll start talking about sets again in a second.

The Tagalog version of this is something called balut. Have I talked about it in this class? You've had balut too? You're an adventurous person.

AUDIENCE: I have not had [INAUDIBLE].

NORVIN RICHARDS: Not balut, OK.

AUDIENCE: --a whole other level.

NORVIN RICHARDS: Yeah, balut is a duck's egg that has been allowed to be fertilized. It's a popular food in the Philippines, so people sell it in the street. You have balut sellers who walk around saying, balut [NON-ENGLISH], which means "Balut strengthens your knees." That's apparently the standard thing you say. And balut is a duck's egg that's been fertilized and then hardboiled before it hatches. So you've got a hardboiled duck's egg with a duck embryo inside, which you're supposed to eat.

When I was living in the Philippines, my host brother got me got me a balut. And we were in a dark room. He handed me the balut, and I went to turn on the light he was like, no, just eat it. And I unfortunately turned on the light, so I chickened out. I looked at it, and there's a little duck looking up at me. Pretty weird.

So quantifiers-- so that's their version of that. Quantifiers then-- quantifiers like all or no or three-- are saying things about the interactions of the two sets. So "all" says the first set. So in a sentence like "All Americans eat nattoo," the first set is the set of Americans and the second set is the set of nattoo eaters, "all" says the first set is a subset of the second set. "Some" says the intersection of these sets is nonempty. "No" says the intersection of these sets is empty. "Three" says, if you look at the intersection of these sets, you will find three things. That has cardinality three. That's the kind of meaning that a quantifier has.

If you're already familiar with set theory, it's obviously interesting to try to think about what kinds of intersections between sets quantifiers can state. So mathematicians can get sets to tangle with each other in all kinds of entertaining ways. I mean, there are all kinds of things you can get sets to do. It turns out that natural language quantifiers are what's called conservative, which means that you can always replace set number two with the intersection of set number one and set number two and get the same meaning.

That is to say-- maybe I'm about to do this on the slide, but here, we'll do it on the board-- if this is set number one and this is set number two, I've been talking about quantifiers as though they tell you something about this set and this set. But all of the quantifiers can be stated in terms of this set, set number one, and this area here, the intersection of set number one and set number two. This part of set number two is always irrelevant to the meaning of a quantifier. That's a fact about natural language quantifiers.

And it's not a necessary fact. So here's an example, if I say "All opera singers smoke," which I believe to be false, but anyway, I'm making a claim about the relationship between the set of opera singers and the set of smokers. I'm saying that the set of opera singers is completely contained in the set of smokers. But that's essentially the same thing. It is the same thing as saying that all opera singers are opera singers who smoke. That is, opera singers are all in the set of smoking opera singers. We don't care about smokers who are not opera singers when we are thinking about the meaning of "All opera singers smoke."

So if I tell you "All opera singers smoke" and you begin to talk to me about someone who smokes and is not an opera singer, which may be fun to talk about that, but it's not relevant to the truth of my claim. The truth of my claim is only about the set of opera singers and the set of smoking opera singers. It says that the set of opera singers is completely contained in the set of smoking opera singers. Does that make sense? So if I say "All opera singers smoke" and you tell me, "Oh no, Arnold Schwarzenegger smokes, and he's not an opera singer," you haven't contradicted me. It doesn't matter.

You can imagine quantifiers which would not be conservative. So I've just made one up. Here's a quantifier, "glorp." It says, if you add up all of the things in set number one and set number two, so the union of set number one and set number two has cardinality three. I just made up glorp. I'll give you an example. It would be true, in this picture, that glorp circles are red because if you add up the number of circles and the number of red things, the total is three. There are two circles and one red thing. So if there were a quantifier glorp, then you could say that glorp circles are red in this picture.

There is no quantifier glorp, not in English and not in any language on Earth as far as we can tell. So quantifiers don't ever do this kind of thing. And this would be a nonconservative quantifier because in order to evaluate glorp, you would have to look not just at the part of set number two that's intersecting with set number one, but also at the part of set number two that I've hatched out here, the part that's not part of set number one. So this is a nonconservative quantifier, and there aren't any. That's the point.

OK, good. So just practice some more-- so "all Brazilians love soccer." There's this danger when you do simple sentences with qualifiers in them that you will find yourself trafficking in stereotypes. This is why I like to use examples like "All opera singers smoke," which there isn't a stereotype about as far as I know. So, of course, it's not true that all Brazilians love soccer. It might almost be true. It says there's a relation between the set of Brazilians and the set of people who love soccer-- namely, the first set is a subset of the second set. If you look at the set of people who love soccer, inside that set, you will find all of the Brazilians, the people in the Brazilian set.

Let's talk a little more about how we get these sets, just to be slightly more formal about it. So what we'll say is the set of Brazilians-- maybe that's not such a mystery. So all Brazilians love soccer-- you're taking the set from the rest of the noun phrase. So "All Brazilians love soccer"-- the first set is just the set of Brazilians, the thing that comes after all that's part of the noun phrase there. If it were more extensive than just Brazilians, then that set might change. So if I said something like "All female Brazilians love soccer," "All Brazilians from São Paulo" love soccer, we'd have a different set, Brazilians from São Paulo.

And then the second set-- what we're doing is we're taking the set of things x such that x loves soccer. We're getting that set by replacing the quantifier "all Brazilians" with a variable. So we start off with "All Brazilians love soccer." We're going to replace "All Brazilians" with a variable called x. So x loves soccer. So the second set is the set of x. We have this property x loves soccer.

This is just an attempt to do very slightly more formally what I've been kind of breezing through in the preceding slides. But does any of this seem alarming or disturbing? Is it causing unhappiness? Have you all had your nattoo this morning? This is good-- maybe I should bring some nattoo and I can stand around and watch. It would be revenge. I will not bring a balut to class. Not sure where I would get one.

So it's worth doing this because doing this slight formalization of what we've been doing because, well, I've have been carefully giving you examples in which the quantifier is a subject, but, of course, quantifiers don't have to be subjects. You can say things like "Soccer bores all Americans." Here, the first set is going to be the set of Americans. What's the second set? So "Americans" as a subset of what set? Again, what we do is-- sorry, go ahead.

AUDIENCE: X such that soccer bores x?

NORVIN RICHARDS: Yeah, x such that soccer bores x. So we take this sentence, we replace "all Americans" with x, and now we have the set of x such that soccer bores x. X doesn't have to be in subject position. That's the only point here. That can be anywhere.

So that's how we'll do the meaning of qualifiers. So it says "Americans" is a subset of the people whom soccer bores, the x such that soccer bores x. So the quantifier has been replaced with the variable.

So now we can get back to the ambiguity that I started us off with, and I will try to do this slowly and carefully. What we're going to see is that a way of thinking about the ambiguity that I started this off with is to think, yeah, you have these two qualifiers that are doing these operations involving the formation of sets.

So in all of the sentences I've given you before, there's only been one quantifier, so it forms these sets and asserts a relation between them. But in a sentence like this, where there are two qualifiers, well, you're going to need to perform that kind of operation twice. And the ambiguity just has to do with the order in which you perform the operations.

So do you do the operations for "some child" first and then the operations for "every puppy," or do you do the operations for "every puppy" first and then the operations for "some child"? So if I remember my own slides correctly, I think what we're going to do now is work fairly slowly and painfully through what happens if you do the two things in that order.

But I'm telling you this now in advance to give you some hope that you will have an understanding by the time we're done of what the heck is going on here. It's just what order do you do the operations in. That's why there's ambiguity here. You have these two qualifiers and you have options about which one to interpret first. So if you interpret "every" first, then you're saying the set of puppies is a subset of the set of things that some child loves.

And then, if you interpret that part, you're going to say, what's the set of things that some child loves? Well, it's the set such that the intersection of the set of children with the set of things that loves them is nonempty. So if we interpret "every" first, then the sentence means the set of puppies is a subset of the set of things such that the intersection of the set of children with the set of things that love those things is nonempty-- whew.

If we do the operations in that order we get that reading. That is, we get the reading the set of puppies is a subset of the things that some child loves. Some child loves many things, possibly, and among those things is the set of puppies-- so every member of the set of puppies is such that the intersection of children such that there is some child that loves it. And I think I have a picture of that now-- yeah, there.

So doing the operations in that order, we get this reading. Every member of the set of puppies has this property-- there is some child that loves it. That's a reading the sentence can have, and we can get this reading by doing the interpretation of every puppy first. That's one reading the sentence can have. So that's the reading that's pictured here, where there are many puppies and many children, and every puppy is loved by at least one child, possibly more than one. There are also children who love more than one puppy. Children are not monogamous when it comes to puppies.

What if you interpreted "some child" first? Well, then you'd be saying take the set of children and the set of things that love every puppy. That intersection is nonempty.

So take a deep breath because we're about to interpret the second part of that, but even before we interpret the second part of that, maybe this is the point at which things are as coherent as they're ever going to get. What this means is there is at least one child that loves every puppy. There's at least one child who's very fond of puppies. That's the other kind of reading we were saying this kind of sentence could have. So we next interpret that.

So the intersection of the set of children and the set of things such that the set of puppies is a subset of the things that that thing loves is nonempty. And to put that back in English, it means there is at least one child such that the set of puppies is a subset of the things that x loves. Or to put it another way, there is at least one child such that all puppies are loved by them.

So early in this-- maybe one of the first things I said today was a sentence like "Some child loves every puppy"-- or I think the example back then was "Someone loves everyone"-- people have argued that it's ambiguous, that it can mean either there is one person who loves everyone or everyone has someone that loves them. And these are both meanings that the sentence can have. And I switched over to people and languages because our intuitions about the difference between the two meanings are a little sharper for that kind of example.

Here, I'm showing you some mechanics that we can use to get this ambiguity, and the mechanics involve allowing yourself to do the operations for interpreting the quantifier-- when you have more than one quantifier in a sentence, you're allowed to interpret them in either order. So you're allowed to do the operations for the subject first or the operations for the object first, and depending on which of those things you do, you get these two different readings for the sentence. So far so good? Sorry, this is a lot to deal with on a Tuesday morning through a mask.

So here's the tree for that sentence "some child loves every puppy." And we've said that's an ambiguous tree. So why is the tree ambiguous? What I've now said a couple of times-- and who knows, this could be true-- is yeah, you've got these two qualifiers. You've got to perform operations that form these sets. The part of the process of interpreting these qualifiers involves forming these sets and there's nothing in particular telling you what order to perform those operations in.

And so you can interpret them in either order, and so you get ambiguities. That's the way I've been talking. That turns out to be a lie, which is kind of interesting. We have lots of good evidence, and I'll show you some of it, that we don't just get to freely choose the order in which we interpret qualifiers. But what really happens is that there is another kind of movement operation.

So we've left syntax behind, and maybe some of you were hoping we wouldn't have to see things move anymore, but actually, in semantics, there's also movement going on, possibly movement of an even sneakier and weirder kind. There's lots of evidence that the reason that the sentence is ambiguous is that there's an operation which is optional that takes the object "every puppy" and moves it to a position above "some child" in the process of interpreting the sentence.

Now there are several alarming things about this movement. All of the movements that I've shown you up until now-- so when I first tried introducing you to movement, I think I was showing you things like "Mary devoured a pizza." I was saying yeah, look, the pizza absolutely has to be here. You can't say "Mary devoured." That's out. So "devour" selects for a sister-- it absolutely has to have a sister. And moreover, its sister absolutely has to be right next to it. So if I put an adverb here, it gets bad. So Mary devoured quickly a pizza-- that's no good. So we know something about the properties of the "devour." It absolutely has to have an object, and the object absolutely has to be right after. It cannot be anywhere else.

And then I said, wait, what about "what did Mary devour?" And we ended up deciding that "what" is starting off here and it's moving up to here. And that's why it's over there. So we said the process of producing a sentence like "what did Mary devour" involves "what" starting off exactly where it should-- as the sister of "devour" right next to "devour"-- and then there's this other process that doesn't care about what "devour" wants.

This process of wh- movement that takes "what" and moves it to the beginning of the sentence, we saw. Some languages have this and others don't. I was looking at WALS the other day. It turns out roughly a third of the world's languages have this, and English does. So you take what and you move it to the beginning of the sentence.

So every kind of movement that we've seen up until now has been like this. It's been part of an explanation for why you pronounce things in different places than you would expect. You would expect "devour" to have a sister, to have an object that would be right after it. And "what" isn't there, and it's because of a movement operation.

I'm going to give you some evidence now that this ambiguity shows up because you have the option of moving "every puppy" to a position to the left of "some child," higher than "some child" in the tree. But this had better be a different kind of movement because the sentence is ambiguous even if you don't see the noun phrases going anywhere else.

This is a type of movement called covert movement, and you should all be very suspicious of this because basically, it's like the-- what's it like? It's like the dark matter that physicists have to posit in order to explain why most of the matter in the universe doesn't seem to be there. So there's all this undetectable matter that's out there. We just haven't detected it yet. Somehow, when physicists say things like this, we believe them because they can build bombs and things.

But I'm about to say something kind of similar to that. We have some arguments, really good ones-- I'll try to show you some of them, anyway-- that this thing can move. And the fact that when it moves, you still pronounce it as though it hadn't moved, this is really interesting, but what it shows is that this is dark matter. It is moving. It's just not moving in a way that changes the order of the sentence, order of the words.

All of you are making the appropriate face, which is a very skeptical one. I mean, some of you are wearing masks, so I can only see your skeptical eyebrows and eyes, but I appreciate that. Let me show you some arguments.

First, there are some languages-- yeah, so here's another ambiguous example. "Most people ate two cakes." That can mean two things. It can mean either-- what's one thing it can mean? Softening you up for the next set of slides. You don't have to use x's and y's and things. Just tell me what it seems to mean. Yeah?

AUDIENCE: Most of the people in the room ate two cakes for each person.

NORVIN RICHARDS: For each person. So there were a whole bunch of cakes, and there was a free for all. People could have as many cakes as they wanted, and we were keeping track of how many cakes people wanted, and most people ate two cakes. Some people ate three. There was this Richards guy who ate 12. And then some people didn't eat any. But most people ate two. That's one thing it can mean.

What's another thing it can mean? Yeah?

AUDIENCE: There are a total of two cakes from which most people have eaten.

NORVIN RICHARDS: Yeah, so there were various cakes out there, maybe really big cakes that you could eat a slice of, and we were finding out what the most popular cakes were, and most people ate two cakes, the vanilla frosted and the chocolate frosted, and then there were a couple of other cakes that were not as popular. So concentrate on those. It can kind of mean that. Some of you were raising your eyebrows at that. But it can sort of mean that.

So one reason to take seriously the idea that this ambiguity comes from an optional movement operation which you can't see is that there are languages in which you can see it. So you remember how I said English has wh-movement and there are languages out there that don't, languages like Mandarin or Japanese or Chaha or whatever? Similarly, this operation that takes one quantifier and moves it past another quantifier-- you don't get to see it in English, but you do get to see it, for example, in Hungarian.

So in Hungarian, the Hungarian translations for "Most people ate two cakes" have two word orders, each of which means only a single thing. So you either say, in Hungarian-- I don't speak Hungarian and I won't try to say these sentences. Does anyone here speak Hungarian? OK, that's very freeing. I almost feel as though I should try to say these sentences. I know you don't know what Hungarian is supposed to sound like, but I won't.

The first sentence only has one meaning, and the second sentence also has only one meaning. So you can take these expressions "most people" and "from two cakes" and put them in either order, and depending on what order you're in, you only get one reading. So the first sentence means the first reading that was offered, the most reasonable reading, most of the people ate two kinds of cake. The second meaning means there were two particular cakes that were the most popular ones. So in Hungarian, the order in which you apply the operations to interpret the qualifiers is not optional. It's completely fixed. It's determined by the order of the phrases. That's what determines what's going on.

And the claim is that all languages are Hungarian deep down. It's just that some languages are better at this than others. So there are languages like Hungarian, for example, that are really good at being Hungarian. You can just see it right there. And then there are other languages, like English, that are Hungarian but they're shy about it. And so you don't get to see the relevant kinds of movement.

OK, what are we doing? So I'm going to show you some more reasons to take this idea seriously that this operation, which is called quantifier raising, or QR, that it exists. So we'll talk about some of the properties of it. We'll talk about some of the properties of it in the next little while.

Here's another sentence with two qualifiers in it. This is work that I'm taking from my colleague Danny Fox, who's done a lot of fantastic work on the properties of quantifiers. So here's an ambiguous sentence, "A guard is standing in front of every building." What does this sentence mean? Yes?

AUDIENCE: Either that every building has a different guard standing in front of it, or there is one guard that is continuously standing in front of every building.

NORVIN RICHARDS: Yeah, there we go. So it has a sensible reading-- every building is guarded. And it has a reading involving a very large guard, or maybe lots of really small buildings or something like that. Oh yeah, no, let's imagine that there's more than one building. So those are two things the sentence could mean. So yeah, here are a bunch of buildings, a bunch of guards, one guard per building, or a bunch of buildings and one guard who is kind of wide. So it could mean either of those things that's it.

AUDIENCE: [INAUDIBLE]

NORVIN RICHARDS: Ah, yes, so if the buildings are all in a circle and they're all facing each other, there could be one guard in the middle. A guard is standing-- he managed to stand in front of every building by standing right in the center spot. Yes, I suppose it could mean that. I think that's right. Let's discount that reading.

So here's an ambiguity, the kind of ambiguity we've been talking about. You've got these two qualifiers and you can interpret-- so the first pass on why we got this kind of ambiguity was there's this process of interpreting qualifiers where you figure out what the sets are that the quantifier is relating, and you relate them to each other. And if you have a sentence that has two qualifiers in it, you get to do that process-- either you've got to quantifier, quantifier number one and quantifier number two. You either apply that process to quantifier number one first or quantifier number two first.

And then I asserted and offered you, so far, only evidence from Hungarian. I asserted that there is actually this operation of quantifier raising that has the option of moving one quantifier to a higher position than the other quantifier, and that the order in which you perform the operations is actually fixed. It's completely determined by the structure that you get after you've done quantifier raising, if you have.

So what I'm going to do in the next few slides is show you some reasons to take that seriously, even for English. So here's a sentence that has ambiguity and the story was going to be it's ambiguous because you have the option of leaving "every building" where it is or the option of moving "every building" so that it's higher than "a guard." And if you take the option of moving "every building" so that it's higher than "a guard," invisibly, without changing the word order-- very weird to try to understand what's going on-- then what you do so the generalization is that you must interpret the highest quantifier first.

So if you do QR of "every building" higher than "a guard," what you're saying is you're going to start by relating the set of buildings to the set of things that a guard is standing in front of. And you're going to say that first set is completely contained in the second set. And then you will interpret the quantifier of "guard." So you have this optional operation of QR, and there isn't actually any optionality in the order in which you interpret quantifiers. You always interpret the highest quantifier first. That's going to be the story. The optionality has to do with the optionality of the application of QR. So here's a sentence with two qualifiers in it, and it's ambiguous. And I'm asserting it's ambiguous because you can do QR.

Here's another sentence with two quantifiers in it: "A guard said that I should stand in front of every building." Now is this ambiguous in the same way? No. It doesn't mean-- so what does it mean? Joseph?

AUDIENCE: The guard thinks that I have to be particularly--

NORVIN RICHARDS: Large.

AUDIENCE: --to be able to stand in front of all [INAUDIBLE].

NORVIN RICHARDS: Yeah, exactly. There is one guard who demands that I gain weight-- wants me to be wide enough to stand in front of every building. Yeah, Faith?

AUDIENCE: I interpreted it instead as move from one building to the next one.

NORVIN RICHARDS: Yeah, that's a more reasonable thing for the guard to ask me to do, isn't it? And I guess it helps that we've switched here to "That I should stand in front of every building" rather than-- so what we had before was a guard is standing in front of every building. I guess we could interpret that as meaning that there's a single guard who is walking from building to building and standing briefly in front of them. These are all ways of getting a single guard to do all the work. There's only one guard. Yeah, you're absolutely right.

But it doesn't have the other reading. It doesn't mean there was one guard who wanted me to stand in front of the Stata Center and another guard who wanted me to stand in front of the Student Center, and another guard who wanted me to stand in front of the MIT Museum. It doesn't mean that. All right, why not? Because we've got two qualifiers. Why can't we interpret these qualifiers in any order we want?

Well, if we believe in QR, we have an answer to that. We get to say what's special about this example and distinguishes it from the examples we had before is that "a guard" is in the matrix clause, and there's an embedded clause, an embedded CP, that I should stand in front of every building. Yeah, that's an embedded clause. Is that clear? Should I draw a tree? So say it's taking, as its sister, a CP that I should stand in front of every building. And what we're learning is that although there is this optional operation, QR, that can get one quantifier passed to another, it can't get you out of a clause. We're going to have to figure out what counts as a clause, but apparently this counts as a clause. There's some limitation on how far you can QR.

How about this one? "A guard seems to be standing in front of every building." Is that ambiguous? I think so. So it means either "Looks like every building is guarded" or "Man, that guard is wide!" or "Man, that guard is running hard to be in front of every building at once!" or "Look how clever that guard is at geometry. He's managed to stand in front of every building at once!" (Lucky thing for him, they all face each other.)

So it has two meanings, one with a very wide or clever or fast-moving guard, and then the other more normal reading where it's like every building has a guard. So either every building is such that there's a guard standing in front of it, or there is a guard who is somehow standing in front of every building. So yes, this is ambiguous.

How about this one? "I seem to a guard to be standing in front of every building." Is that ambiguous? No. This is a sentence about one guard who needs rest, who needs to be taken off-duty and convinced to get some rest. This is a guard who thinks that, I don't know, maybe he goes to one building and I'm there and he goes to another building and I seem to be there too, and he's seeing me everywhere and this guard has problems. And besides-- yes?

AUDIENCE: Is it just because "a guard" could be referring to multiple guards whereas I-- you can't have more than one I?

NORVIN RICHARDS: But the question still remains, the other reading-- you're absolutely right. But the other reading that this could have would be one with something like every building has this property: I seem to a guard to be standing in front of it. That would be a reading that would be, like, "For this building, there's a guard who thinks that I'm standing in front of it. And for this other building, there's another guard, maybe a different guard, who thinks that I'm standing in front of it." That's a story where there are lots of guards who don't necessarily believe that I am simultaneously standing in front of lots of buildings. They just all-- their hallucinations are more simple than that. They just all see me in front of one building, one particular building, maybe the building they're supposed to be guarding. All of them are taking the day off because they're like, oh yeah, that Richards guy, he's guarding that building. Yeah?

AUDIENCE: [INAUDIBLE]

NORVIN RICHARDS: Yeah?

AUDIENCE: Somehow it didn't register to me that you were the one-- not the guard.

NORVIN RICHARDS: Yeah, so that's what the second sentence means. But the point is that it only means one thing. It means there is one guard who thinks that I'm standing in front of every building. It doesn't mean every building is such that there is some guard who thinks I'm standing in front of it. Doesn't mean that. Yeah?

AUDIENCE: Could it be that a guard [INAUDIBLE]? It's a singular phrase, but it could refer to any number of people, whereas "I seem to a guard" means that there is one entity that "a guard" refers to and it can't be anyone else. There is a person who has this quality that saw you.

NORVIN RICHARDS: Yeah, so that's-- I think there was a related comment earlier, and I think that's onto something, but it's describing the problem that we have. If it's "A guard is standing in front of every building," or "A guard seems to be standing in front of every building," then yeah, "a guard" can either be one guard that's in many places at once or it can be many guards, one for each building. That's the original ambiguity. "A guard" has that power that it can do that.

But why can't it do it in the second sentence is the question? Why can't the second sentence mean there are three guards-- let's call them A, B, and C, and guard A thinks that I'm standing in front of building number one, and guard B thinks that I'm standing in front of building number two, and guard C thinks that I'm standing in front of building number three. Why can't it mean that when the first sentence can mean A seems to be standing in front of building one, B seems to be standing in front of building two, C seems to be standing in front of building three. We can play that game, the alphabet and number game, with the first example, but not with the second example. We're trying to figure out why. Yep, I'm trying to figure out why.

Here's a plausible story about why. We went through this very fast, so I don't blame anybody if you don't remember this. But when we were doing "A guard seems to be standing in front of every building," sentences like that-- what we said was that there is a movement operation going on in sentences involving "seems," this kind of sentence involving "seems," where "seem" is followed by an infinitive. What's going on is that "the guard," the thing that ends up in subject position, starts out in the embedded clause. Here is a guard, and it's raising, moving up to here. There's NP movement-- so a movement.

I'm sorry, I know it's dangerous taking 24.900 from a syntactician, because I keep trying to change the subject back to syntax. So now we're going to talk about syntax some more. This is a bit of syntax that we talked about. I tried to convince you that sentences like this, sentences with "seem" and an infinitive in them, the subject of the whole thing started out in the embedded clause.

One of the kinds of arguments had to do with properties of idioms, that you could say things like "The shit seems to have hit the fan," where we think that the idiom is "The shit hit the fan," that "the shit" needs to be somewhere near "hit the fan," but it's way over there, and the story was, yeah, that's because it starts out in the embedded clause, and it undergoes NP movement into the matrix clause. So it moves, it raises. That sound familiar at all? Have you all expunged the terrible memory of syntax? That's the way we were talking before.

So we said a bit ago that QR is clause-bound. There we go. That's us saying the QR is clause-bound. "The guard said that I should stand in front of every building." I said yeah. Why isn't that ambiguous? Well, it's not ambiguous because "every building" is inside an embedded clause that doesn't contain "a guard." So QR can't take "every building" and move it past "a guard." And then I think I also said, if we're saying things like that, we eventually will have to explain what kinds of things-- what we mean by clauses, exactly. So clause has to include things like that-- I should stand in front of every building.

What about a sentence like "A guard seems to be standing in front of every building"? Well, here we get ambiguity. And it could be that we're getting ambiguity here because, well, "every building" has the option of undergoing QR here. The chalk I'm using is very small. I'm blaming my illegible handwriting on the poor quality of my chalk. It's foolish of me to pick up a new piece of chalk, because that will blow that excuse out of the water in just a second.

So here's "a guard" in the end. It could be that there's ambiguity in "a guard seems to be standing in front of every building" because "every building" can undergo QR up to here to a position above "every guard." If that's possible, then that would be telling us that well this TP down here, "to be standing in front of every building" doesn't count as a clause that you can QR out of that. So when we say that QR is clause-bound, we don't mean this kind of thing. We mean tensed clauses.

But another possibility is that we do actually mean tensed clauses and that the reason we do actually need every TP, that QR out of this TP is impossible, and that it's not possible to QR up to here, it's only possible to QR here. And that the reason that you get ambiguity in "A guard seems to be standing in front of every building" goes like this-- "every building" can QR to a position in the periphery of that embedded clause, and "a guard" started out in that embedded clause. And that's enough.

This would be a story where we're already-- if we're doing QR at all, we're slowly, hopefully, getting accustomed to the idea that part of interpreting sentences will be interpreting things in places where we cannot necessarily see them. So we can take things and move them invisibly to other places and interpret them there.

So in "A guard seems to be standing in front of every building," there are two invisible movements going on. One is we are invisibly moving "every building," maybe not all the way up to here, but just to the edge of the embedded clause, the embedded TP. And we are invisibly taking "a guard," which started out in the embedded subject position and moved up to here and underwent NP movement, and we're putting it back. So we end up with "every building" above "a guard."

And the reason to take that-- you're stunned. I don't blame you for being stunned. So there are these two invisible things happening. A reason to take that idea seriously is the fact at the bottom of this. So "I seem to a guard to be standing in front of every building--" we can get a story about why we're not getting ambiguity here if we're willing to say no, QR can't, in fact, get out of an infinitival clause like "to be standing in front of every building." It can only get to the edge of such a clause. And what's special about this example is that "a guard" is not inside the embedded clause "to be standing in front of every building." It's an argument of "seem." So it's in the higher clause.

I don't know why I did this with a blackboard. I think I have slides here. So let me show you the slides. Maybe they will help. So we think that "a guard seems to be standing in front of every building" involves a step of movement. "A guard" is moving out of the embedded clause and into the matrix subject position. And I see now I don't actually have slides that help with any of this.

So the reason we're getting this ambiguity is not that "every building" can QR past the higher position of "a guard." It can only QR past the lower position of "a guard," and that's good enough. So we get to interpret the lower position of "a guard" as well as the higher invisible position of "every building." So we get a handle on all of these facts as long as we're willing to posit these particular invisible kinds of movements. Learning something about QR-- when we say it's clause-bound, we mean it can't get any further than TP, any kind of TP, tensed or nontensed.

Now Danny Fox also discovered something else that's cool about QR. He's discovered many cool things. And the next thing is quite long and complicated, so maybe I will pause here and take questions. Do people have questions about this? Would you like me to go through it more slowly or carefully?

I've been talking so far as QR is always optional. Danny Fox has discovered-- it was one of his early discoveries-- it's actually more complicated than that. What we'll see, and we'll start doing this next time, is that you can only do QR if it's going to change the meaning of the sentence. So if you have two qualifiers, you can QR the lower quantifier past the higher quantifier if that's going to give you a different meaning, a meaning you wouldn't have had if the QR hadn't happened.

If you have a sentence where QR wouldn't affect the meaning, it can't happen. And what we'll do next time-- we'll start with this next time-- we'll develop the tools to discover that, the tools that Danny Fox discovered, and then I'll show you that that's true.

So any further questions about any of this? At this point, you should all be weirded out. Suddenly things are moving around in an invisible way, and this is part of interpreting them. Yeah?

AUDIENCE: If QR are can only happen if it will change the meaning of the sentence, that indicates that the English language, and I imagine other languages that allow this, they build in the ambiguity as opposed to trying to mitigate the ambiguity?

NORVIN RICHARDS: Oh, I see what you mean. I think I see what you mean. I mean, the claim in the end is that the structures that are interpreted are never ambiguous. You either do QR or you don't. And if you do QR, then you get one reading. And if you don't do QR, then you get another reading. And English is one of the languages in which you don't get to see QR, and the result is that the sentence is ambiguous because you can't tell whether QR has happened or not. There are languages out there, like Hungarian, where you can see QR, and so the sentences are not ambiguous. But yes, that means there are certain kinds of ambiguities in English that don't exist in some other languages, like Hungarian.

There are other languages where it's more complicated than that. So there are languages like Japanese, and German, actually, has a version of this too. But in Japanese, if you have two qualifiers, their scope with respect to each other is unambiguous unless you move one of them past the other, and then it becomes ambiguous. So basically, it's as though the movement operation that moves one quantifier past the other could be QR or it could be something else. And so you can't tell whether you have done QR of that thing or not. But there is no invisible QR in Japanese-- something like that. Cool.

All right, good. Thank you for coming in braving my possible cold viruses. I apologize for exposing you to them. And I will see you on Thursday.