

**The Psychology of Language**  
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**Lecture-12**  
**Sentences-I**

Hello friends, welcome back to this lecture number 12 on this course of the psychology of language, up till now, we have covered some bit of basics into how languages form psychological factors of language, the production and comprehension of language and a little bit about what are words, the topic of interest for today's lecture will be sentences. So we will focus on sentences and so what are sentences, these are group of words.

So, this lecture which is number 12 and number 13 will be entirely focusing on sentences, what are sentences, what role do they play in language, how they are comprehended, how they are produced, rules of sentence formation and those kinds of issues is what we are going to focus in the upcoming lecture as well as today's lecture. But before we do all these, let us take a short trip to the memory lane and refresh ourselves as to where we started and where we are now.

We started the journey by looking at what is language, the basic forms of language which is the animal communication system, which is also called the simplest form of language. So, we looked at characteristics of a language like that, we looked at to why do we need language and the best way to study that is to study the animal communication system, which is a very, very basic form of language, we compared that with the idea of human language.

We looked at the structure of human language in terms of its phones, to the morphemes, then words, sentences, discourse and so on and so forth. We looked at the origin of language, how it all started, where exactly can we place ourselves into the language chain and how language started for us non animals, I would not say human beings we say non animals. So, then we give examples of the brutal language, the basic form of language, the idea of it.

And then several other interesting things that we studied there, which focused on how language developed historically. The next section we quickly took a tour into the science of language, the methodology that we use in language, the design research, how they conducted in language studies, and we also looked at the brain areas, which are connected to producing language or which are involved with language in any way.

We looked at techniques like EEG, MRI, FMRI, how these techniques helps us in studying language in a more meaningful way. The next 2 sections were dedicated to the perception of speech and production of speech and perception of speech we detailed on to the idea of the ear, how the auditory canal perceives speech, which is in form of sound waves, we looked at the idea of speech perception, then extracting meaning from the perception of speech.

Articulating of not only articulating, but also comprehending of the basic speech, phones, we looked at models of speech perception, the motor theory and other theories related to it. And then we looked at how speech perception develops in infants. The next section, since very related, we saw how speech is produced itself. And so, we looked at the whole idea of the vocal tract, and how the vocal tract is made, how it produces speech, models of speech production, the learning of language, according to the idea of speech perception.

And then how infants learn this whole process of producing speech. If you refer back to those sections, you will get a more detailed idea of what we did there. And then the last 3 lectures we dedicated to words. Now, words are as I said, away station between the basics of speech production and language, so is the way station because words are the point at which the phonological interpretations, or the phonological speech stream is converted into a meaningful symbol.

So, words are the link between the pronunciation and the symbols. We looked at words, what are words, they are not having of words, how words expressed symbols, theories of word production, we looked at how words are processed, how they are interpreted, how they are comprehended. And all those issues are what we concern ourselves in the last 3 lectures. Now, once we have words, these words need to combine with each other in a recursive manner to make a sentence.



The verb is signifying, what the subject, this is called subject, this is called verb, and this is called object, what the subject is doing, what activity is doing, and the object is who, or what the subject is performing the action on, so, any sentence of the subject, the one person about whom the sentences the word, which defines the action that the subject is taking, and the object, which is what the subject is exactly doing.

Now unlike a primate cousins, who uttered single sentences, we combine words together to express complex ideas in relationships, how do we do it, we combine these words together using something called syntax and the syntax are what these are roles are combined the words together, and this language, this combination of words in tenses form the language, which help us in transferring ideas between people.

Now, psycho linguists, they suggest that each sentence has 3 levels of processing, the conceptual level, the syntactic level, and the phonological level. Now centers production starts with intended message, then syntactic conversions, and then spoken sentences, first one has to think then use grammatical roles, and then find the pronunciation of it, and then speak the word. In some time comprehension we first understand the spoken speech.

Later on break this book in speech into its constituents as to who is the subject, who is the verb, and what is the verb and what is the object. And then from there, take out the intended message. So more sentences at 3 levels of processing, the first level is called the conceptual level, here is where the intended messages formulated, we organize the thoughts into concepts that we have named for.

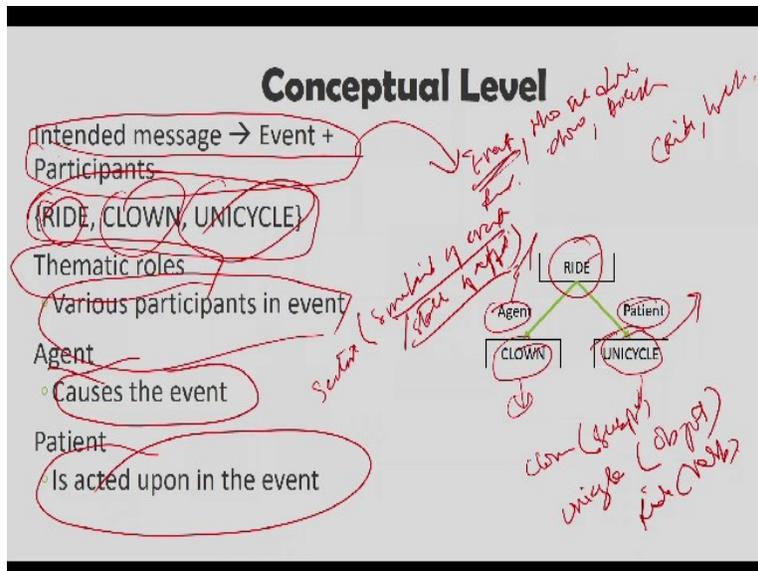
So what we do is the thoughts that we have, we make an organization of the thoughts of these thoughts that we want to transfer to people into concepts that we know of. And these concepts are represented by words. So we express these thoughts in words, now we search the mental lexicon. So first what we do is they intended message we organize the thoughts into concepts that we know, then we saw the mental lexicon for words, to match up the concept.

The lexicon stores we are the abstract words of the lemma form there, all these points that there are no particular order to the concepts in our internal message. So, if I want to write a sentence, clown, rides, bicycle or if I want to express rather writing this, if I want to express the idea that I see a clown riding a bicycle, if I want to express this idea that I see a clown riding a bicycle.

So, I see a clown riding a bicycle and I want to express this idea or share this idea with other people, what do I do at the conceptual level the picture of a clown riding a bicycle is transferred into words. So at the conceptual level, what will I will have 3 things, ride, clown and bicycle. As I said a conceptual level, what happen is you just search or you just come up with words to express the thoughts that you have.

So what is conceptual level, thoughts that people have or they want to share is converted into words, which means something, now this syntactic level. So once I have this ride, clown and bicycle, now these have to be arranged in a particular format in a particular way, in a particular sequence. And as you can see.

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So the conceptual level, the intended message even plus participant, ride, clown, bicycle, so the event is ride, and the participants are clown and basically. So at the conceptual what I need is, what is the action and who are doing the action. So here clown and bicycle are doing the action, and the event is riding. So then, once this is done, so how do I make this thought of a clown riding a bicycle into this kind of structure.

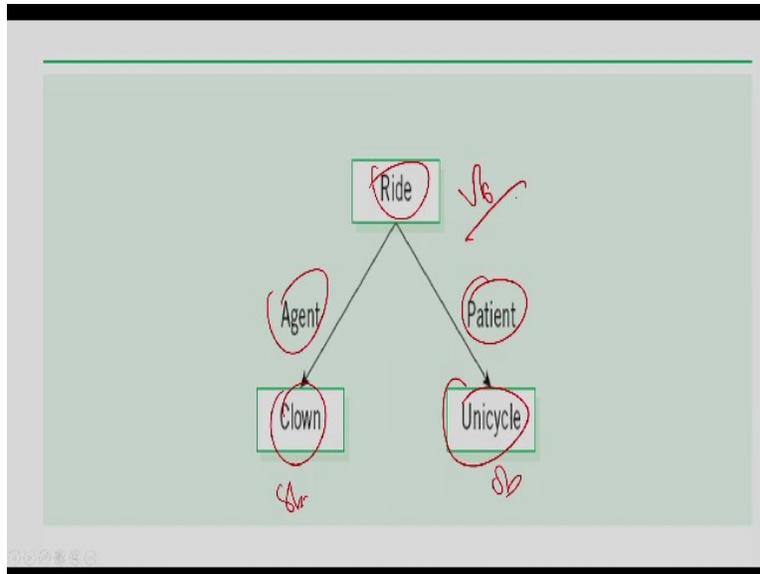
Ride, clown, bicycle is through assigning thematic roles, various participants in the event of thematic roles. As you can see, the clown is the agent because he is the one who is riding the bicycle. The unicycle or the bicycle is the patient. So what I have done is I have interchangeably use unicycle and bicycles, please adjust to that. And so this unicycle is a patient because that is the one which is redone, agent is the one who is the person who is riding and ride is the action that is doing.

So, what I do is then the clown has the dramatic role of subject the unicycle as the thematic role of an object and ride has the thematic role of a world, this is assigned a agent causes the event and patient is did upon by the even. So, each sentence then it is some kind of event or state of affair. So, sentence expresses some kind of event or an affair. And the nature of event is defined by the kinds of participants involved in the event.

The agent is the entity that causes the event portrayed in a sentence to occur. So, the entity which makes this sentence occur is called the agent, the patient is the entity that is acted upon in the event that the portrayed in a sentence. So this is the one in which that action is being happening on. And so what is thematic role, the various type of participants involved in the event portrayed in a sentence is called thematic role.

So basically, the role that these objects in a sentence are assigned is called the thematic role. So at the first level, the thought is converted into conceptual, or concepts. And these concepts are then arranged according to or assigned thematic roles, or what role they are playing.

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As you can see, ride agent, patient, clown, cycle, this is the subject, this is the object and this is the word.

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### Syntactic Level – Assigning Roles

Syntax

- Set of rules for ordering words in a sentence

Canonical word order

- Typical sequence of sentence elements
- English: subject-verb-object (SVO)

Thematic role assignment i.

- Mapping of thematic roles onto syntactic positions

For example

- Agent → Subject → CLOWN
- Patient → Object → UNICYCLE

Now what happens in the syntactic level, at the syntactic level roles are assigned, syntax, a set of roles for ordering words into a sentence. So what is syntax, it is basically a rule, a kind of rule, which tells you how to arrange the sentence. So, the syntactic level, the language forces us to put our thoughts into some kind of order. Now, each language has own typical sequence of sentence elements, but the canonical word order for English is subject verb object,

Now different sentences will have different rule, but English generally has the rule of SVO where subject, verb and object in the same manner in each sentences, most sentences are all sentences, English will have this kind of world order and this is called canonical word order in English, the mapping of thematic role onto the syntactic position such as the subject and object is called automatic rule assignment.

So, the agent assigning the agent the role of subject and assigning the patient the role of object is basically and ride assigning ride the role of an event, the verb is even, this is basically called this process is called thematic role assignment. Now referring to earlier example, ride, clown, unicycle can now be assigned this kind of an order. So, you have ride, this ride, this is the verb agent which is the clown becomes the subjects.

So clown patient unicycle is the object and becomes the intersection. So clown ride bicycle, this is the proper sentence, the basic sentence that anybody can get. So, canonical words in English typical sequences of sentence elements in English this the, subject work order is the canonical sequence. Now thematic rule assignment, mapping of thematic roles of this syntax position.

So assigning this kind of a role. So, this follows the SVO format, where this subject verb object, so SVO and this kind of arrangement is called thematic role assignment. Now, for example, agent subject is the clown and patient object is the unicycle.

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### Syntactic Level – Satisfying the Grammar

**Subject**

- Singular or plural? → Just one, so clown
- Already mentioned? → Yes, so add the
- CLOWN → The clown

**Verb**

- Present or past? → Present, so ride
- Subject agreement? → Yes, so add -s
- RIDE → ride-s

**Object**

- Singular or plural? → Just one, so unicycle
- Already mentioned? → No, so add a
- UNICYCLE → The unicycle

Now, once we have assigned the thematic roles to the various agents and patients or actors and events in a sentence we need to satisfy the grammar grammatical rule also for this sentence to be correct. Now, this kind of assignment is the second step in syntactic level identification of a sentence. So, we need to now add some inflections of access and functional work to satisfy the rules of grammar.

Now, we have to add certain rules to grammar, certain grammatical rules to the sentence because clown, ride bicycle or unicycle rather, this is not a sentence This is a proper sentence it tells you what the subject verb an object are, but this is not a sentence by any means, it needs some inflection suffixes a functional words to be arranged in a certain manner that it becomes a sentence and so, this is what the sentence is and so, this happens to the second level.

So, subject first of all singular or plural I just one so clown. So, we look at the subject now this is singular, and so we leave it as clown. Now, if the clown has been mentioned earlier in the sentence, now we assume that the clown has been earlier mentioned and so we add the the, which is an article and the article says that this particular noun has been expressed previously in the sentence.

So, that is why it is and so clown becomes the clown. Now, since this clown has been already mentioned, and so, yes, and so, we added. Now, we not do a little bit of fixing of the word, now whether the verb was the present tense in the past tense in this particular sentence clown ride bicycle, it is the present tense. So, ride will be the actual verb lemma or the actual word form. Now subject agreement, whether the verb agrees with the subject, the subject is clown. And so, if I add s to the subject, it becomes clowns. And in those cases, when I add s to clown, it becomes a plural and then ride is ok.

But the moment I add s to the verb here, so if I write rides here, it becomes or it agrees with the single clown or a single subject, so what I do is subject to agreement, yes, so add s ride becomes rides. So clown rides, and when I put an s here in my verb it agrees with the singular subject, object singular or plural, just one, so this is the unicycle, already mentioned we assume that it is not an already mentioned.

And so we are up because that particular bicycle we are talking about, and or you are exactly talking about a unicycle is the unicycle. And so, this is what it is. So, what we did was we assign these words, and match these. So the clown rides as unicycle, we add an s here, we add the here, a here and that changes the sentences. Example so, we took this example of a syntactic position, subject, verb, an object or phrases are not words.

So, subject, object and verb are phrases and they are not just words, non phrases, subject object, determinative adjective. So, we have a noun phrase here and we have this part of it is called verb phrase, it will have a verb and a noun phrase, and in this case will have a noun and a subject and object that determined adjective and verb phrases main verb, auxiliary verb, and so on and so forth. Now, once we have this kind of a.

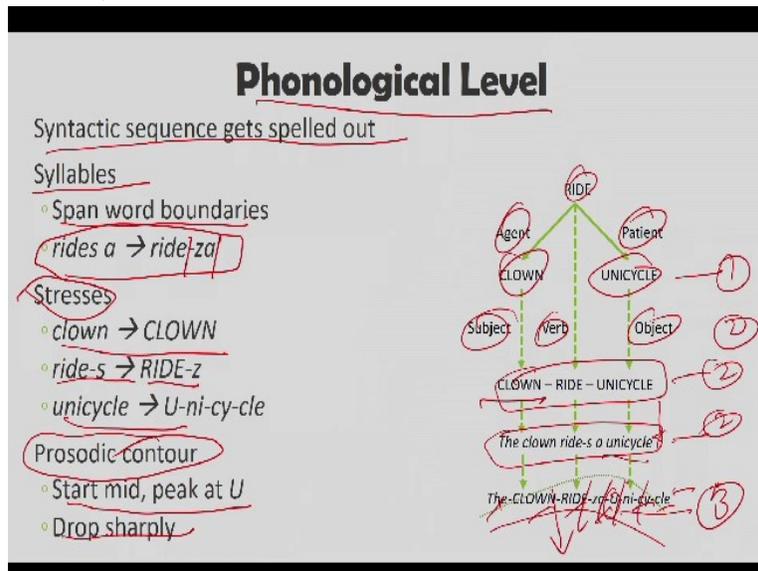
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S	Sentence
NP	Noun Phrase
VP	Verb Phrase
D	Determiner
N	Noun
Pro	Pronoun
A	Adjective
V	Verb
PP	Prepositional Phrase
Triangle	Indicates that detail has been omitted

And so, if we look at in terms of phrases, if we divided in terms of phrase, will have something like this will have subject and will have the non phrase. So we will have the subject, the object, the determiner, adjective, all falls under the non phrase, so we will have subject, phrase and verb phrase and within the noun phrase, we have the determiner and the noun. And so, the terminology is the noun is clown.

Within the verb phrase we have the main verb which is rides, then we have the noun phrase here and the noun phrase determiner, which is r and then the noun, which is the unicycle. Now, this is the second step for assigning not only grammatical rules.

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But we are also adding things into the proper sentence to make it a perfect sentence, make it a comprehensive sentences. Now this syntactic equals now goes to the phonological level, where it is spelled out in terms of syllables and stresses, so, that it can be articulated. So, at the phonological what happens is syntactic sequences gets spelled out the syllables span word boundaries for example, rides a ride and za these are the 2 things, it also looks at stresses, for example, clown the stress is on clown and ride z and unicycle you ni cu cle.

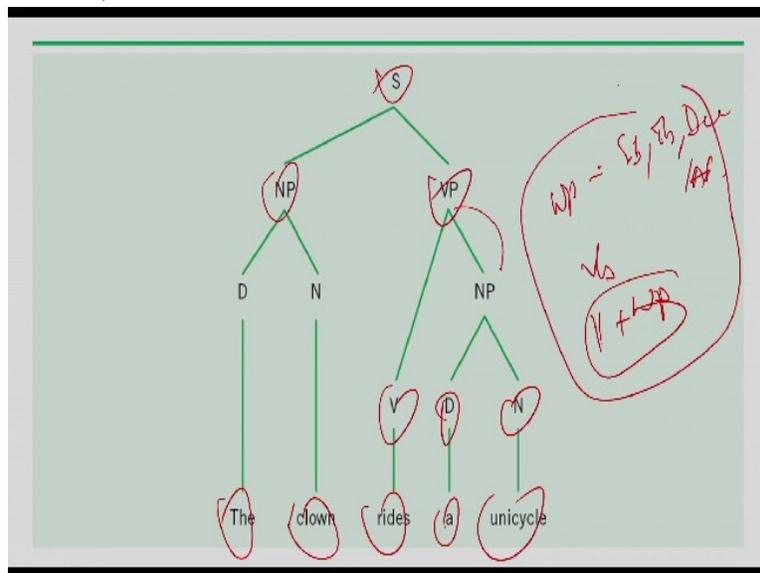
We also look at prosodic contour, we also add prosodic contour to it, how we should be speaking the sentence and so we start mildly and peek at the You at unicycle and drop sharply after that. So, we start like this, the clown rides a unicycle that is how the prosodic mean is the crown rides the uni cycle as the prosodic form of it. So, we have ride agent patient, this is the clown, this is unicycle first level, second level, we have the subject verb and objects.

So clown, rides, unicycle, this is the syntactic thing. And so assigning syntactic grammatical structures the clown ride, unicycle and this is the phonological level. So the clown, rides are unicycle because we need these boundaries. And then this is the prosodic level, which is how do we say the sentences. Now syllables in the syntactic sequence now goes to phonological level where it is spelled out in terms of syllables and stresses. So that can be articulated.

So that happens, now syllable separated by hyphen, and stresses in the capital and so it becomes the clown, the clown, rides uni cycle, we expressing that kind of thing. So drop is after you the sentence is spoken in a single prosodic phrase. And so spoken this sentence it is not broken down into too many prosodic, one single prosodic phrase, start sentences with fundamental frequency of my voice, at a medium level, then it rises through the course of single sentence, or reach the unicycle, which I want to emphasize.

And after that the voice falls. So this is how the sentences are. So it is not only just the noun phrase and verb phrase or subject, object and verb or the idea of agent and patient of how this kind of structure or syntactic structures are we can have all these kind of arrangements or all these kinds of categories for expressing sentence.

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So subject, noun phrase verb phrase, as I said, the clown rides unicycle, determiner, noun, verb, this is the verb phrase, so verb phrase has verb + noun phrase, and noun phrases as subject, object determiner, adjective, if possible. And so this is how the segments actually look like.

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## Active and Passive Voice

### Subject

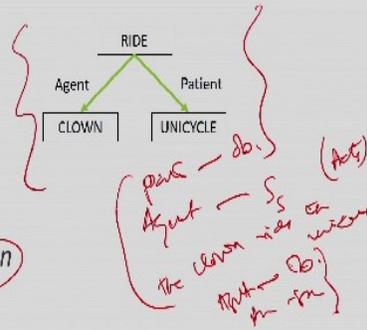
- What the sentence is about
- Focus of attention

### Active voice

- Agent maps onto subject
- The clown rides the unicycle

### Passive voice

- Patient maps onto subject
- The unicycle is ridden by the clown



We also have active and passive voices. So subject when the sentence is about and focus of attention is the subject. So if we can also translate these sentences into active and passive voice for emphasizing certain facts. And so if you have active voice the agent maps on to the subject, now the agent maps to the subject. This generally is called active voice. And so here we have the clown rides the unicycle.

Now if in this case the agent is mapping to the subject, and the patient is mapping to the object, if we reverse the sequence, and map the agent to the object, and the patient to the subject, my sentence become the unicycle is ridden by the clown and so I have passive voice the clown rides a unicycle, the passive is the patient maps on to the subject, the unicycle is ridden by the clown. So I can change this in this way I am putting more emphasis on the unicycle and less emphasis on the clown. In this case I am putting more emphasis on the clown and less emphasis on the unicycle.

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## Reversible and Irreversible Sentences

### Irreversible sentence

- No longer makes real-world sense if agent and patient swap subject and object positions

◦ The clown rides the unicycle → The unicycle rides the clown (?)

### Reversible sentence

- Still makes sense, but with different meaning, if agent and patient swap subject and object positions

◦ The clown chased the lion → The lion chased the clown

### Reversible passive

- Reversible sentence in passive voice

◦ The lion was chased by the clown

- Difficult to process, especially for young children or patients with aphasia

So I can have this kind of syntactic structures who basically come up with sentences or come up with syntactic rules. Now grammar is extremely complex. Have a cycling based use some common syntactic structures, as these structures can shed light on how the sentences are basically analyzed. So we have analyzing the sentence. Now the way the thematic roles at the conceptual level are mapped onto the syntactic categories at the syntactic level.

We also have something called canonical world order. So we can analyze sentence by using either the thematic role assignment, we can also look at the canonical word order of our sentences to the subject noun phrase, verb phrase, object noun phrase, of how the sentence is divided into and the sentence consists of 2 main components we have the subject in the predicate, the topic of the sentence is called the subject.

And the comment about the subject is called the predicate, now activity is a sentence structure in which the agent is mapped onto the subject position. So, as we saw, and passive voice is the sentence in which the patient is mapped on to the subject position. Now, syntactic structures tells us who did what and to whom. In addition we often rely on real world knowledge to infer thematic role, the unicycle rides that clown.

For example, if I say the unicycle rides the clown, now in this case that all the thematic role is correct, but then the sentence is not correct, because unicycle cannot ride the clown. And so, we

when forming passive voice or when transferring sentences using syntactic structures we have we aware of what is possible and what is not possible in the world. And so we have to take care of that also or take that aspect also, we have to have something called the real world knowledge.

Now there are 2 kinds of sentences we have something called reversible, irreversible sentences. Now irreversible sentences which no longer make real world sense if agent and patients have swapped, subject and object, for example, a clown rides the unicycle, unicycle rides the clown, in this case real world knowledge says that this is not possible. And so this kind of sentences called irreversible sentences.

They generally are meant to be read in a particular way, reversible sentences or those sentences mystery will make sense but different meaning, if agent and patients are of the subject positions, for example, the clown chase the lion, the lion chase the clown. In this case, the clown is running out of the lion, in this case, the lion is running up to the clown. And so here could be funny. In this case, it is fear that we actually get and so how what meaning they are making that can be as reversible sentence.

Those sentences where we if we change the subject object position agent patient position or change the thematic roles of the subject object, what is the really going to happen is the sentence will be valid, but the meaning changes. We can also make reversible passes for example reversible sentences and passive voice the lion was chased by the clown, we can make a reversible passive was the clown was chased by the lion.

Now, difficult to process especially for young children or patients with aphasia. Now irreversible sentences are those that no longer make sense. If the agent and patients swap subject and object position, reversible sentences, that still makes sense. But with difficulty now the clown was chased by the lion is one such an example of reversible sentences.

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## Adding Complexity: Cleft Sentences

### Clause

- Simple sentence that is part of a larger complex sentence
- Recursion allows us to put sentences inside sentences to express complex thoughts

### Cleft sentence

- Attaches introductory clause to beginning of sentence
- Highlights one of the participants in the event

### Subject cleft

- The lion chased the clown → It was the lion that chased the clown

### Object cleft

- The lion chased the clown → It was the clown that the lion chased
- Can be hard to process, especially when reversible

Now we can add complexity to sentences or we can make more syntactic changes in sentences by using something called cleft sentences. So what order not only thematic arrangement of words or thematic arrangement of roles and the subject verb object the canonical word order are the ways of or active and passive voice making other ways of creating sentences. We can also use a technique which is called adding class sentences for adding complexity in sentences.

Now simple sentence that is part of a large complex sentence is known as a clause. What is a clause. It is a simple sentence that is a part of a larger complex sentence. Recursion allows us to put sentences and sentences to express the complex thought. Now one way to build complex sentences is through the use of conjunctions. We can use conjunctions to make or conjunctions to make complex sentences.

For example, we can make sentences like the clown ride a unicycle while the dog barks. And so what I have done is while I have used while as a conjunction, and this conjunction add 2 sentences, the clown rides the unicycle, and the dog barks we can use cleft sentences to make complexities or to make a sentence complex. What is cleft sentences, they attaches introductory clause the meaning of a sentence.

Cleft sentences those sentences which attach a introductory clause at the beginning of sentences, and it highlights one of the participants in the event for example, cleft sentences, the syntactic

structure that attaches an introductory clause and the meaning of a sentence for the purpose of highlighting one or more participant in the sentence. For example, the clown rides a unicycle while the dog barks.

So what I have done is in the cleft sentences, so I can have 2 type of cleft, if I add a clause at the start of a sentence, to emphasize a particular part of the sentence or a particular object in a sentence. That is basically in English called crafting. Now I can have a subject class for example, lion chase the clown, it was the lion that chase the clown. So if I say it was a lion, that chase the clown, and change is the lion chase the clown.

So it was the lion when I am emphasizing the lions. And this is basically called the subject cleft. So I am done is I have added this clause. Now in the object cleft, what happens is the lion chase the clown, it was the clown that was chased by the lions, what I have done is I have emphasizes the clown in this way. And this side moved to the beginning of a sentence. So it was the clown that was chase the lion, who was chase as the clown.

So emphasizing on the clown, when I say it was a lion that chase the clown, and then the lion, so I am using subject cleft and object cleft, and can be hard to process especially when it is reversible in nature.

(Refer Slide Time: 31:31)

**Adding Complexity: Relative Clauses**

Relative clause

- Sentence placed inside another sentence to describe a noun

Subject relatives

- Subject of relative clause refers to entity in main clause
- The lion chased the clown + The clown rides the unicycle
- The lion chased the clown [that rides the unicycle]

Object relative

- Object of relative clause refers to entity in main clause
- The lion mangled the unicycle + The clown rides unicycle
- The lion mangled the unicycle that the clown rides
- Tend to be difficult to process, especially when reversible

*Subject & Object*

So interesting clauses inside of other sentences throughout the use of relative clause sentences that displays inside another sentence for the purpose of describing a noun. Example, the lion chase the clown that rides a unicycle. Now we can have subject related clause and we can have object little clause also. Now at the heart of all the clause is actually a verb. Some verbs do not take the object was most of them actually take one or more object. We also look at the syntactic agreements.

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### Adding Complexity: Dative Constructions

Dative construction

- Syntactic structure expressing the meaning of doing something for the benefit of someone else
- Requires two objects with thematic roles of **patient** and **recipient**

Double object construction

- Recipient + Patient
- *The clown fed the lion a steak*
- *The strong man baked the bearded lady a cake*

Prepositional dative construction

- Patient + Preposition + Recipient
- *The clown fed a steak to the lion*
- *The strong man baked a cake for the bearded lady*

We can also use something called relative clauses for adding complexity to sentences.

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### Adding Complexity: Relative Clauses

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- *The lion chased the clown [that rides the unicycle]*

Object relative

- Object of relative clause refers to entity in main clause
- *The lion mangled the unicycle + The clown rides unicycle*
- *The lion mangled the unicycle that the clown rides*
- Tend to be difficult to process, especially when reversible

So what is it, what is the relative clause, it is a sentence place inside another sentence to describe a noun, subject related so I can use subject related clauses and object related clauses. I can add a

clause inside a sentence for or I can add a relative clause to describe the noun and in this way I can make a sentence complex. So I can have subject related subject or relative clauses refers to the entity of the main clause.

Example the lion chase the clown, plus the lion ride the unicycle, the lion chase the clown that rides the unicycle, and this kind of thing is called the use of relative clause for making sentences. So here what I have done is, the lion chase the clown, which clown that tries the unicycle and so what happened is I am using subjective relative clause. In objective relative because what happens is the object of relative clause refers to the entity or in the; refers to the entity the main class.

Now the lion mangled the unicycle, the clown rides the unicycle, there 2 sentences, I can add them together by using a relative clauses object nature, so I have the lion mangled the unicycle the clown, rides. So what I have done is that the clown rides this particular part is called the relative clause. And in this case, the; that tries the unicycle is the relative clause.

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**Adding Complexity: Dative Constructions**

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Double object construction

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- *The clown fed the lion a steak*
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Prepositional dative construction

- Patient + Preposition + Recipient
- *The clown fed a steak to the lion*
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So I can use a relative clause to make complexity in 2 sentences, I can also use dative constructions for making complexity in sentences. And so, what I can do is I can use dative constructions for example, syntactic structures expressing the meaning and or doing something for the benefit of someone else. Now, what are dative constructions, these dative constructions or structures, which express the meaning of doing something for something else.

For example, he gave the part to the hungry lion. Now, it requires 2 objects with thematic role of patient and recipient. I can have a double object construction in which recipient + patient is there, so the clown fed the lion, the clown fed the lion a steak, in this case there is the recipient and the patient and I have used the double object construction, lion steak or the object and clown is the subject.

The strong man baked the bearded lady a cake, the strong man bearded lady cake as of the ear you see double object constructions. I cannot be positional dative constructions in this case the patient added to the preposition and the recipient. In this case I have the recipient + patient, in this case as a patient + preposition and recipient. So the clown fed the steak to the lion. This is my preposition. The strong man bake the cake for the bearded lady preposition, the bearded lady recipient, strong men bake the cake is the patient. And so I can use complexities like that.

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**Adding Complexity: Agreement**

Agreement

- Set of syntactic devices for linking related elements within and between sentences

Subject-verb agreement

- Subject and verb agree in number (in some cases in English)
- ~~The clown ride-s the unicycle~~ but ~~The clown-s ride the unicycles~~

Noun-pronoun agreement

- Pronouns agree with the noun they refer to in number and gender (in some cases in English)

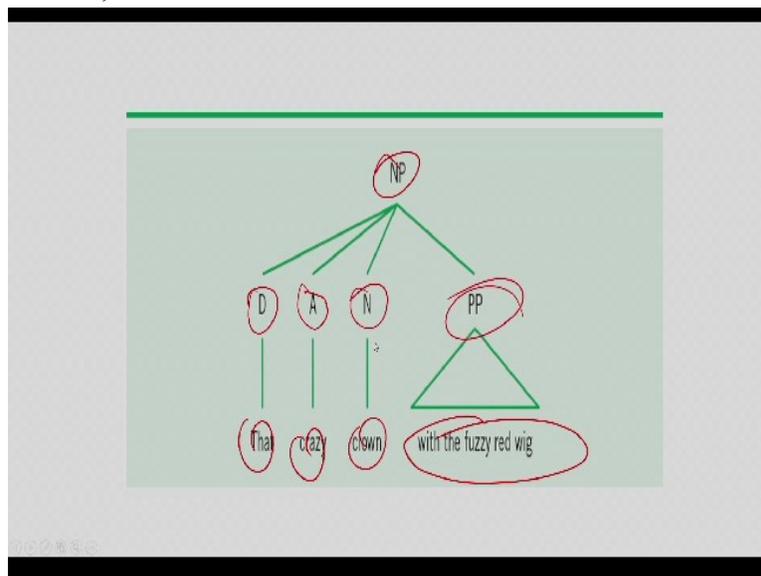
~~My brother... He...~~  
~~My sister... She...~~  
~~My parents... They...~~

I can use complexity or add complexity by using something called agreement. Now what is agreement, agreement is a set of syntactic devices for linking the relative elements within and between sentences. Agreement is a set of syntactic devices for linking related elements within and between sentences. Now, in English, the agreement is simple, now, if the subject is in the third person and if the verb is in the present tense.

Then the subject in the verb was agree in number, subject verb agreement, subject and verb agree in number in some cases, in English, the clown rides a unicycle, but the clown ride the unicycles. So if it becomes the noun becomes plural the verb immediately drops the s, but the if the noun is singular the verb takes the S and so add the clown rides unicycle, but when I make plural of clown, the clowns it become the clowns ride the unicycle right.

Noun pronoun agreement, pronoun agree with the noun they refer to in number and gender and in some cases maybe English my brother, my sister, so my brother becomes he, my sister become she, my parents become they and so I can use this kind of agreement for making complexity.

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As a noun phrase that crazy clown with the funny red wig, so I have the date if the article, the noun and the preposition phrase.

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## Sentence Comprehension Models of Sentence Comprehension

Sentence comprehension involves two processes

- Syntactic analysis of sentence structure
- Semantic interpretation of sentence meaning

Constraint-based (one-stage) model

- Syntactic analysis and semantic interpretation occur simultaneously, influence each other



So how do we comprehend sentences that is those are the ways in which we can actually make a sentence or we can add complexity to sentences and those are the 3 levels that each sentences analyze. Now sentence comprehension, how do we comprehend sentences, sentences comprehension involves 2 process understanding a sentence generally involves 2 process or 2 stage model is what is used in comprehending sentences.

At the first state a syntactic analysis and then structure and the second state is the semantic analysis or interpretation of sentence. So, at the first stage, the grammar of a sentence, the structure of a sentences and analyze, at the second stage is the meaning of sentences analyze, a 2 step process in sentence identification and sentence comprehension. Comprehending sentences involves a syntactic analysis of the sentence structure.

And we a semantic interpretation based on meaning of individual words and the way that the structure relates them together. So not only understanding the grammar of it, the structure of it also understanding the meaning of the sentences, which is different from the meaning of each word in a sentence. So, how these words which have their own meaning, they are combined together using certain roles to form a different meaning altogether.

So, the sentence may have a different meaning, then the word which is using a sentence, so that basically is the way in or the role or the model of sentence comprehension. Now, generally

speaking, there are 2 models which are there one is called the 2 stage model of sentence comprehension sentences analyzed first syntactic structure, right the first stage, the 2 stage model. In the first stage, what happens is the sentence is analyzed for syntactic structures.

And in the second stage, the lexicon is constructed or consulted for meaning. So first grammar is taken out then mental lexicon is asked or is referred to get the meaning of the sentence. Now, I can also have something called constraint based one stage model of sentence comprehension. And so, what is it a syntactic structure analysis and a semantic and interpretation happens at the same time on in parallel.

So syntactic analysis and semantic interpretation occur simultaneously influencing each other. So, 2 basic ways of sentence comprehension. The first way is saying that there is a sentence analysis or syntactic analysis, or the analyses of the grammar in which the sentence is written, the word order in which the sentences written and the second level, the basic words are picked out from these word order. And then meanings of these words are derived from the mental lexicon.

The one stage model says that it is a constraint based model, which says that both the processes of understanding the syntax or extracting the syntax, extracting the rule of how the sentence was created, and what is the meaning of the sentence, they happen in just one sentence or just one step.

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## Sentence Comprehension

### Models of Sentence Comprehension

Garden path model

- Two-stage model: (1) syntactic analysis; (2) semantic interpretation
- We use **heuristics** (mental shortcuts) to analyze syntax quickly

Garden path sentence

- Deviates significantly from expected structure, making it difficult to process

While Sarah bathed her baby played on the floor.

- Did Sarah bathe her baby? Who played on the floor?

Now consider this particular statement while Sarah bathed, while Sarah bathed her baby played on the floor. Now, what is the sentence like this, we assume baby was the object of bathed and what about play, now sentence comprehension models sentence comprehension, this model of sentence comprehension gets its evidence now something called the garden path model. The garden part model is a very good model which actually tells you or gives you an idea of how a sentence actually processed, what is the way of processing a sentence.

Now the garden path model has 2 stages, this 2 stage model how to explain garden path sentences first, syntactic analysis second, semantic interpretation. So we use heuristic mental shortcuts to analyze sentence quickly. Now the garden part sentences it deviates significant from expected structure making it difficult to process. Generally speaking, the garden path model says that first there was interactive analysis, and then there will be semantic analysis.

And so what we generally people tends to use something called heuristics or mental shortcut to analyze the syntax quickly, or if there is a problem in syntax they will be read back. Now garden path sentences are those sentences which deviate significantly from the expected structure, making it difficult to process. Look at the sentences while Sarah bathed her baby played on the floor. Now if you look at a sentence initially, you start with the while Sarah bathed her baby.

And you believe that her baby was the object of the sentence which other subjects Sarah, now while Sarah bathed her baby and the moment to come to this place, played on the floor this part of it is hanging. So considerable while Sarah we assume the baby was the object of bathed but what about being played. So as soon as the word played is introduced here, then the problem occurs. So did Sarah bath her baby who played on the floor.

Is that the meaning of the sentence or is it the meaning of the sentence is the baby was playing on the floor and Sarah was taking the bath or was it that while Sarah was bathing a baby was playing on the floor or Sarah bathe her baby played in the floor. So what was the meaning exact meaning and so that that kind of sentences called garden path sentences.

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**Examples of Garden Path Sentences**

Because he runs a mile is nothing.

We painted the wall with cracks.

He knew her as a young boy.

I told the girl the cat scratched Bill would help her.

The cat returned home was hungry.

*How would you rewrite these sentences to make them easier to understand?*

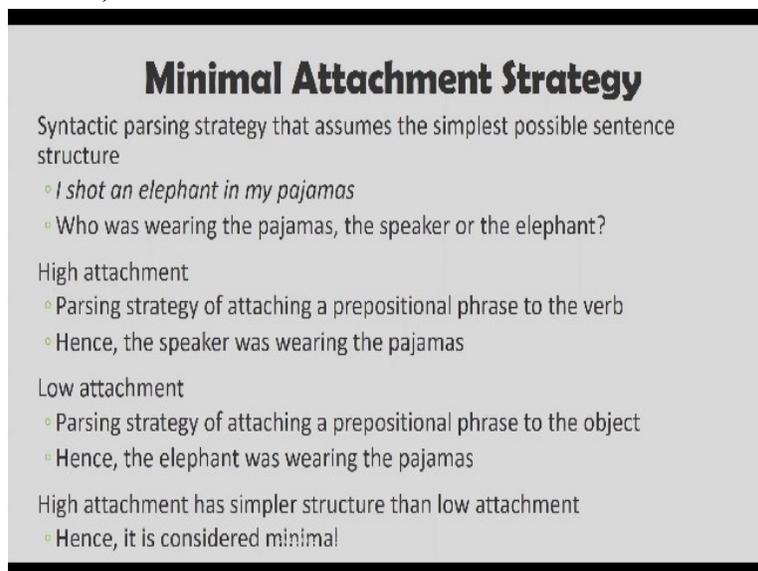
This path type of garden path sentences gives you an idea of how sentence comprehension actually happens. Now, there are some examples of garden path sentences, for example, look at it because he runs a mile is nothing, if you look at the sentence, the syntactic structure gives you no meaning, or the looking at the syntactic word order does not be with the meaning of sentences. Because he runs a mile is nothing.

Now the actual investment should be the meaning of the sentences because he runs a mile is nothing you put a comma here or we painted the walls with cracks, we painted the wall with cracks is the object. So the wall was the one which was having the cracks and painting is what

we were doing we did not paint the wall. He knew her as a young boy, I told the girl the cat scratched Bill would help her.

And the cat returned home was hungry. The cat which returned home was hungry and that is the meaning of it, the cat return home was hungry and so, these kind of sentences are garden path sentences and this is what the sentences actually tell you is how the sentence is at comprehend, these sentences will tell you that they are comprehensive at the same time a parallel comprehension happens. So, at the time when the syntactic order of the sentences analyze at the same time the semantic is understanding lies only then you can understand the meaning of it.

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**Minimal Attachment Strategy**

Syntactic parsing strategy that assumes the simplest possible sentence structure

- *I shot an elephant in my pajamas*
- Who was wearing the pajamas, the speaker or the elephant?

High attachment

- Parsing strategy of attaching a prepositional phrase to the verb
- Hence, the speaker was wearing the pajamas

Low attachment

- Parsing strategy of attaching a prepositional phrase to the object
- Hence, the elephant was wearing the pajamas

High attachment has simpler structure than low attachment

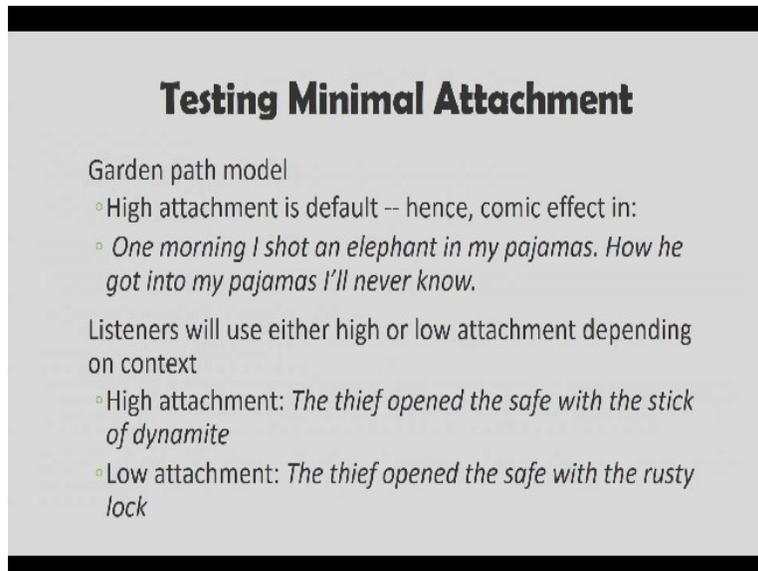
- Hence, it is considered minimal

So, how you rewrite these sentences and make them easier to understand, you can do it by something called minimal background theory. So, a sentence that they were significantly from expected structure making it difficult to process is known as a garden path sentences. So what is the garden path sentences, these are those sentences that deviate significantly from expected structure and it makes the processing of those sentences difficult.

Now based on I fixation data for garden path sentences, researchers proposed a 2 step model of sentence processing in which the syntactic analysis proceeds semantic interpretation, garden path model. Now we first build a syntactic structure based on apparent syntactic category for example noun, verbal etc, of each incoming word, this follows looking at the meaning of the words and then linking them to the sentence.

Now, when we are analyzing a garden path sentence or any sentences, we actually used 2 kind of heurist, we use something called a late closer heurist. Now what is the late closer heurist, late closer uses we use 2 heurist when signing sentences are structured. So, when we are assigning sentences, the structure we tend to use 2 kind of heurist late closer heurist and a minimal attachment theory.

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**Testing Minimal Attachment**

Garden path model

- High attachment is default -- hence, comic effect in:  
*One morning I shot an elephant in my pajamas. How he got into my pajamas I'll never know.*

Listeners will use either high or low attachment depending on context

- High attachment: *The thief opened the safe with the stick of dynamite*
- Low attachment: *The thief opened the safe with the rusty lock*

So let us look at what is a late closer heurist, now in a late closer heurist this is a syntactic parsing strategy that so late closer heurist and so what is this heuristics, it is a syntactic parsing structure that continues to add new words to the current structure until unless there is a sufficient evidence that a new segment should begin. So, in the late closer heurist what happens is a word is being read or more words are being attached to the sentence to the point of time.

That one believes that a new sentence will start and they should be then so in garden path sentences what happens is the processing of the sentence starts here because he runs a mile is nothing so because he runs, this is where the break is and then a mile is nothing in this case, he knew her as a young boy he knew her as a young boy. So the break should be here and the cat returned home was hungry as 2 part of it.

And so that is how the analysis actually happens. Now, the late closing heurist leads us to closing a structure too early. For example, look at the sentence the horse race pass the band fell. Now

making use of the oddity in the English grammar, which is known as reduce the relative clause is a kind of embedded syntactic structure that allows for economy of expression, but can be extremely difficult to process the sentence.

The second heuristic of the garden path model is called a minimal attachment strategy. So, we use something called a late closer heuristic and what does this series actually say we keep on adding words on to the syntax, onto the sentence till the point of time that we realized that it was administered actually come right, that the late closer heuristic. Now in the minimum attachment theory what we tend to do is the second heuristic is that garden path model.

Actually uses called the minimal attachment theory a syntactic parsing strategy that assumes that the simplest possible structure as and this basic structure or this basic heuristic says that we generally use or we generally use a passing strategy, which gives us the simplest possible structure of a sentence. So syntactic parsing strategy that is in the simplest possible invisible structure, I shot an elephant in my pajamas.

Now who was wearing the pajamas, the speaker or the elephant? Now, the easiest way to look into it is passing it in a way so that I shot an elephant in my pajamas, or I shot an elephant in my pajamas, if I look at this, this is one shot one simple is I shot an elephant was wearing my pajamas or I could I shot an elephant wearing my pajamas. Now, there are 2 types of attachments that can be used as sentences, I can use a high attachment and I can use a low attachment to making sentences or structure of sentences.

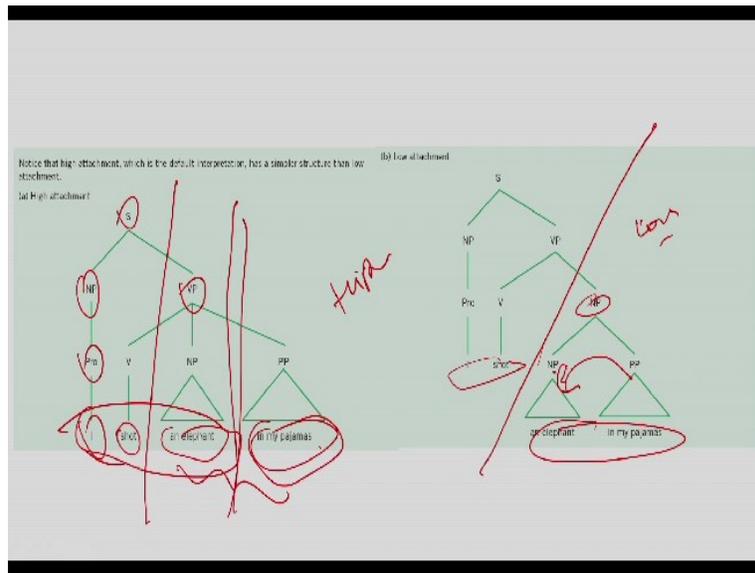
Now passing strategy which is how sentences are passed or how sentences are read, so passing strategy of attaching a prepositional phrase to the verb, and the speaker is wearing the pajama. So if I say I shot an elephant in my pajamas, in this case, I am using high attachment strategy. So the speaker is wearing the pajama and he shot an elephant. In a low attachment strategy passing strategy of attaching a preposition or phrase to the object.

If I do that, in this case, what happens is the elephant is wearing the pajama. So I shot an elephant in my pajama. So if that is the way I am breaking the sentence, then it becomes the low

attachment. Now high attachment as a simpler structure than low attachment and is considered minimal. And so to say that I shot an elephant in my pajama is the easiest. So I shot an elephant if that is one break, and in my pajamas other way.

So I am using the prepositional phrase to the verb, this is high attachment. But if I am using the prepositional phrase to the object, then I am having a different kind of structure. That is called the minimal attachment.

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So this is my high attachment. And this is my low or minimal attachment. So subject noun phrase, verb phrase, this is my preposition I shot an elephant in my pajama. So I shot what I have done is I have used the preposition here, and so I shot an elephant in my pajama, I shot an elephant in my pajamas. So, I shot an elephant is one part of it in my pajamas the other part of it and look at this one, I shot an elephant in my pajama.

If you look into it, this is another this is the break which is there and so your noun phrase you have noun phrase and prepositional phrase, you use the prepositional phrase to the not to the verb, but the prepositional phrases use with the object and so here what has happened is the shooting was done of the elephant in the pajama but in this case what happened is the person who was wearing the pajama shot the elephant.

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**Testing Minimal Attachment**

Garden path model

- High attachment is default -- hence, comic effect in:  
*One morning I shot an elephant in my pajamas. How he got into my pajamas I'll never know.*

Listeners will use either high or low attachment depending on context

- High attachment: *The thief opened the safe with the stick of dynamite*
- Low attachment: *The thief opened the safe with the rusty lock*

Because the propositional phrase is used with the verb, now in syntactic theory the verb is considered a higher in the sentence than the object hence the name, now how do we test this minimal attachment we use garden path model high attachment is default hence comic effect in one morning I shot an elephant in my pajama, how you got into pajama you never know, listeners will use either high or low tech when depending on the context.

High attachment the thief open the safe with a stick of dynamite, low attachment the thief open the safe with a rusty lock. And so these are the examples of how the minimal attachment should be there.

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## Syntactic Priming

### Syntactic priming

- Tendency to repeat previously heard sentence structure
- Supports garden path model

### Lexical boost

- Increase in syntactic priming when verb is repeated in prime and target sentences
- Supports constraint-based model

### Sentence-picture matching task

- Respondent selects from set of pictures on that is described by prompt sentence
- Frequently used as test of sentence processing in patients with aphasia

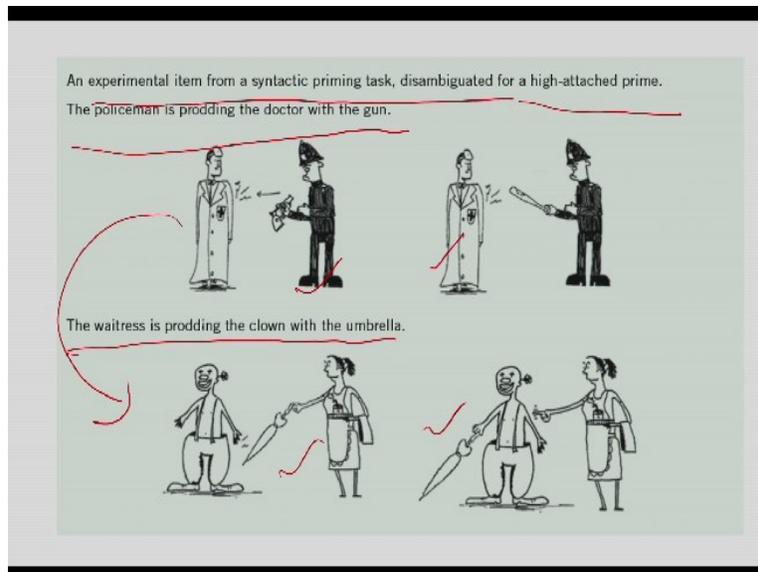
Behavioral, neuroimaging studies show that repeated syntactic structures are easier to process

Now there is also something called syntactic priming. Synthetic priming is a tendency to repeat previously heard sentence structures, support the garden path model. So syntactic priming actually basically what happens is syntactic primary some rules are primed even before our sentences read and so that leads us to process of partial sentence according to those rules which we have heard before.

Now I can use this syntactic priming leads to something called lexical boost, and what is lexical boost, is the increasing syntactic timing when verbs are repeated in prime and target sentences support the constraint with model and so in lexical boost what happens increases the syntactic priming when verb is repeated in primary target sentences. The same verb is using the prime and targets sentences the syntactic priming actually increases.

Now sentence picture matching task respondents selects first set of pictures on that is described by a prompt sentence and frequently user testing sentence crossing in patient with aphasia. Behavioral neuroimaging studies show that repeaters syntactic structures easier to process. So, have a look at the reference books that I have proposing that you will understand a little bit more about syntactic prime.

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For example look at it the experimental item from a syntactic priming task which called disambiguated high attachment primes, the policemen prodded the doctor with the gun and this leads this syntactically prime and waitress prodded the clown with an umbrella 2 sentences 2 fingers are there. So you look at the finger and then you make the meaning out of it and this is an example of it.

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## Anticipation

Cloze probability

- Likelihood that a person will complete a sentence with a particular word
- I take my coffee with cream and ~~sugar~~
- Cloze probability of sugar is nearly 100%

N400

- ERP component elicited after semantically inconsistent stimulus
- She spreads her toast with socks

P600

- ERP component elicited after syntactically inconsistent stimulus
- The horse raced past the barn fell

So the tendency to repeat a previously heard sentence structure is called syntactic priming, does syntactic priming support theory 1 or theory 2 model, now close syntactic priming in which only the structure but none of the words are repeated suggest we do in fact process sentence first and syntax level, which is 2 stage model or is such as final increase in syntactic priming. When the

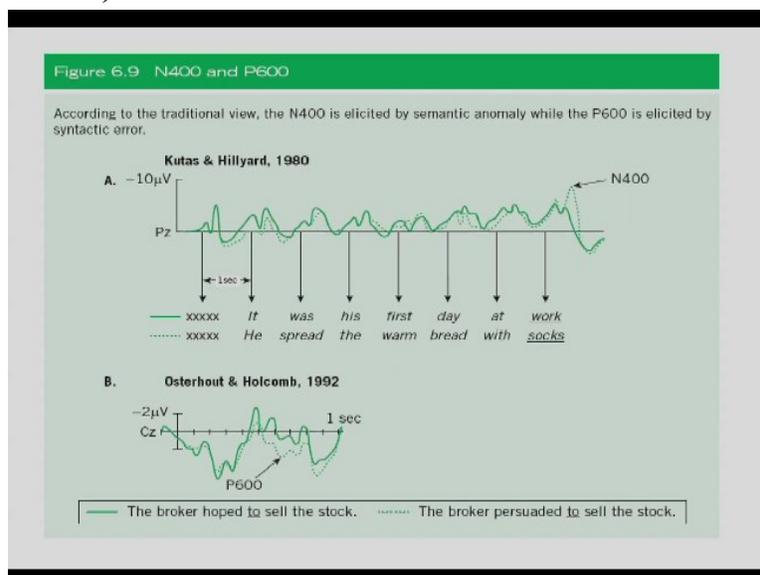
verb is repeated between the prime and the target sentences, lexical would suggest semantics in first aid model.

We also use something called anticipation to comprehend sentences, so what is anticipation as listeners we not only process each word as it comes to us, we also predict what is coming next. Now the likelihood that a person will complete a sentence with a particular word is known as the word closure probability. So we not only when we are speaking, we are not only speaking for the manner of speaking, we also predict what word should come next and that is called the closure property.

And what is the closest property is the likelihood that a person will complete a sentence with a particular word. For example, if I write this for I take my coffee with cream and the chances that he will say sugar here, now, this basically is called the closer property that was a property of sugar here is 100, I can also say butter here with the closer property of butter will be less.

Now the N400 is what is, one sees when semantically inconsistent stimulus is you but P600 is the ERP component which is elicited by syntactically inconsistent, so semantically inconsistent sentences are presented you will get N400 and negative 400 Peak, but if syntactically inconsistent stimulus represented we get a P600 a positive 600 P.

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That is the 400P 600.

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### Broca's Area Revisited

Traditional view: Broca's area involved in syntactic processing

Evidence: Broca's patients perform well on irreversible but not reversible passives

- Irreversible: *The fence was kicked by the horse* → *The horse kicked the fence* ✓
- Reversible: *The cow was kicked by the horse* → *The cow kicked the horse* ✗

Visual word paradigm

- Participants tend to look at object currently mentioned
- Broca's patients: normal eye movements if they understand

Dual stream model

- Ventral "what" stream processes semantics
- Dorsal "how" stream processes syntax
- Broca's area regulates action, plans action

And the lastly we do a revisit of the Broca area to look how sentences are processed earlier, Broca area was known as syntactic processing machines. So, traditional view of Broca area involves syntactic processing. Now evidence is Broca's patient perform well on the irreversible but not reversible passes. For example, irreversible sentence the fence was kicked by the horse, the horse kicked the fence, the Broca area patients are performing this very well.

But if we are reversals sentences example the cow was kicked by the horse, the cow kick the horse, if I put something like this, then they are not able to process this kind of irreversible sentences. Also using the word visual word paradigm, participants tend to look at an object currently mentioned Broca's patient normal eye movement if they understand what is happening. Now the dual stream model ventral what stream processes semantics dorsal the how stream the process the syntax and Broca's area regulate the plan and action.

So basically the dual stream model or sentence comprehension says that the what stream ventral stream is the what stream which processes the semantics of a sentence, the dorsal stream is the how stream with process syntax of a sentence and Broca's area is basically a working memory area which actually integrates the thing together. So Broca area plays a role in working memory on executive functioning consistent with his location in the frontal lobe.

Based on clinical evidence it has a long believed that broca area plays a role in syntactic processing, but reason clinical and neuro imaging calls to the view in question. Now instead new theories, what they suggest that the functions of broca area may instead be involved in working memory executed controller be an action planning.

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**Producing Sentences**  
**Models of Sentence Production**

- Serial model
  - All processing at one step needs to be completed before moving on to the next step
- Parallel model
  - Processing at one step occurs simultaneously with same processing at other steps
- Incremental model
  - Processing at one step is still underway when processing at next step begins.

Most evidence supports incremental model

That is, we start a sentence before we've planned it all the way to the end

So that brings us an end to today's section. And what we did in today's section is we looked at what are sentences, we looked at how sentences are comprehended, or how they are processed more not only at the semantic level, but at the syntactic level, the conceptual level, the syntactic level, as well as the phonological level, we looked at how sentences are made the sparse and what adds complexity sentences.

We looked at how sentences are comprehended; we looked at the kindness comprehension from the garden path view or sentence comprehension. We looked at what role does attachment and other factors play in syntax comprehension and that gives us some idea about what are sentences and how they passed and what do they mean, what is the structure and so on and so forth.

When we meet next we looking at how sentences are producer, so we will be looking at sentence production and models of sentence production. And will move forward from where we are now. So till that point of time when we meet next and for this lecture, it is goodbye and thank you from here.