

The Beginning of Science

- “The beginning of science is the recognition that the simplest phenomena of ordinary life raise quite serious problems: Why are they as they are, instead of some different way?”(Noam Chomsky)
- Our purpose in this class is to discover what kind of system human language is.

1

A simple phenomenon that needs to be explained

Mary loves someone and I want to know who, so I ask ...

- > Who do you think Mary loves ___?
- OR
- > Who do you think that Mary loves ___?
- > that is **optional**: it can be absent or present

Someone loves Mary and I want to know who, so I ask ...

- > Who do you think ___ loves Mary?
- OR
- > *Who do you think that ___ loves Mary?
- > that is **impossible**: it must be absent

2

A simple phenomenon that needs to be explained

Who do you think Mary loves ___?
Who do you think that Mary loves ___ ?

Who do you think ___ loves Mary?
*Who do you think that ___ loves Mary?

- WHY?
 - > What is different between the two sentences that might explain the phenomenon?
 - > Have you been taught this difference. If not, how do you know it?

3

A Movement Rule

How are Yes/No questions made?

- The man is reading →
 - > Is the man __ reading?
- What is the operative rule here?
 - > The man is reading the book which is here.
- The man who is happy is reading →
 - > *Is the man who __ happy is reading?
 - > Is the man who is happy __ reading?
- The operative rule must move the auxiliary of the main clause.

4

Two imaginable structures

5

Movement MUST consider structure

A bad deduction of question formation

1. Is the man __ reading?
First AUX or highest AUX (=main AUX of the sentence)?

NO GOOD 2. *Is the man who __ happy is reading?
➡ 3. Is the man who is happy __ reading?

The rule: Move the structurally highest Aux in S
the man who is happy is the subject Noun Phrase (NP), so the *is* of the relative clause is not accessible. The rule targets not the first AUX, but the highest one, i.e. the one under Sentence (S).

6

More on Movement

- The man will have eaten.
 - > Will the man __ have eaten?
 - > *Have the man will __ eaten?
- The first/“highest” auxiliary of the main clause is the one which moves.

7

Structure Dependency Principle

*Is the man who __ happy is reading?
 Is the man who is happy __ reading?
 *Have the man will __ eaten?
 Will the man __ have eaten?

- The operative rule must move *the highest auxiliary of the main clause*.
 - > Rules of grammar necessarily analyze hierarchical structures rather than linear strings (unlike dolphins or primates).
 - > This principle is always fixed as such, although the mind could be different.

8

A surprising discovery: Sentence structure is not linear

“This is a surprising discovery, though the facts are entirely obvious to us. It is important to learn to be surprised by simple things—for example, by the fact that bodies fall down, not up, and that they fall at a certain rate; that if pushed, they move on a flat surface in a straight line, not a circle; and so on. **The beginning of science is the recognition that the simplest phenomena of ordinary life raise quite serious problems: Why are they as they are, instead of some different way?**”

NOAM CHOMSKY

9

Some surprising facts-reference

- Mary knows that she is hungry.
- She knows that Mary is hungry.
 - > Can *Mary* and *she* refer to the same person?
 - > What generalization can we make about the possibility of coreference?

10

Fine-tuning reference possibilities

Now compare the following:

- She knows that Mary is hungry.
- Her friend knows that Mary is hungry
 - > Can *Mary* and *her* refer to the same person in the second sentence?
 - > How can we modify our previous generalization about the possibility of coreference?

11

Structure is relevant for meaning

- She [knows that Mary is hungry].
 - > *She* combines with *knows that Mary is hungry*.
 - > Thus, *Mary* cannot refer to *she*
- [Her friend] [knows that Mary is hungry]
 - > *her* combines first with *friend*
 - > Then, *her friend* combines with *know that Mary is hungry*
 - > Thus, *Mary* can refer to *her*
- Disjoint reference principle: A name contained in some phrase cannot be coreferent with (must be disjoint from) a pronoun that combines with that phrase.

12

E105

Relevant phrase structures

13

Phrase Construction

- friend is a specific noun that is built into an NP (noun phrase) by the addition of a possessive pronoun or article by the rule N (noun) “projects” NP

14

More Phrase Construction

- The V (verb) *knows* is built into a VP (verb phrase) with the Sentence (S) *that Mary is hungry*, which is its **object**. The NP *her friend* is merged as **subject** NP of the sentence.

15

Some Phrase Structure Terms

- Words (lexical items), such as the N *friend* or the V *knows*, are called “heads”.
- These heads “project” more complex structural units that contain them.
- These higher projections are called “phrases”, such as the NP *her friend* or the VP *knows that Mary is hungry*.

16

More evidence for the Disjoint Reference Principle-1

- Consider the following sentences:
 - > A picture of her upset Mary.
 - Is coreference possible here?
 - > Mary’s picture of her upset Tom.
 - Is coreference possible here?
- Are the judgments consistent with the Disjoint Reference Principle?
 - [A picture of her] [upset Mary]
 - [Mary’s [picture of her]] [upset Tom]

17

More evidence for the Disjoint Reference Principle-2

- After she left the house, Mary felt hungry.
- After Mary left the house, she felt hungry.
 - > Can *Mary* and *she* refer to the same person?
- Mary felt hungry, after she left the house.
- She felt hungry, after Mary left the house.
 - > How about now? What are your intuitions?

18

E105

Subtle judgments on a complex paradigm

- After *she* left the house, *Mary* felt hungry.
- After *Mary* left the house, *she* felt hungry.
- *Mary* felt hungry, after *she* left the house.
- *She* felt hungry, after *Mary* left the house.
 - > Disjoint reference principle: A name contained in some phrase must be disjoint from a pronoun that combines with that phrase.
 - > Does the principle work here or not? What does it tell us about the structure of these sentences?

19

Structural relations

- [After *she* left the house], [*Mary* felt hungry].
- [After *Mary* left the house], [*she* felt hungry].
- *Mary* [felt hungry, [after *she* left the house]].
- *She* [felt hungry, [after *Mary* left the house]].

20

Plato's Problem

Bertrand Russell states (what Noam Chomsky calls) "Plato's Problem" as follows:

"How comes it that human beings, whose contacts with the world are brief and personal and limited, are nevertheless able to know as much as they do?"

Chomsky's answer:

"The solution to Plato's problem must be based on ascribing the fixed principles of the language faculty to the human organism as part of its biological endowment."

21

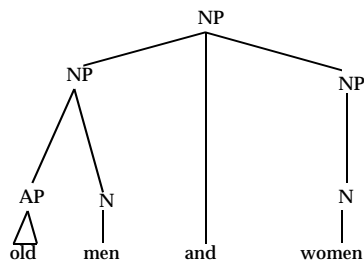
Some things to think about

- What advantages are there for human language to have phrase structure (as opposed to simple linear order)?
- What advantages are there for human language to have "movement"?
- What advantages are there for grammar to restrict how this movement operates?

22

Constituency and Meaning

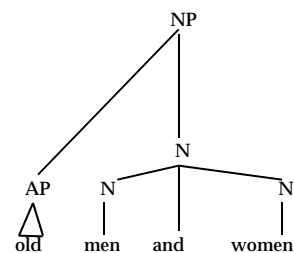
Coordination: structural ambiguity-1



23

Constituency and Meaning

Coordination: structural ambiguity-2



24

E105

More Structural Ambiguity-1

Mary decided on the boat.

= Mary made a decision while on the boat
= Mary selected the boat

WHERE?

```
graph TD
    S --> NP1[NP]
    S --> VP
    NP1 --> Mary[Mary]
    VP --> V1[V]
    VP --> PP
    V1 --> decided[decided]
    PP --> P[P]
    PP --> NP2[NP]
    P --> on[on]
    NP2 --> Det[Det]
    NP2 --> N[N]
    Det --> the[the]
    N --> boat[boat]
```

25

More Structural Ambiguity-2

Mary decided on the boat.

selected

```
graph TD
    S --> NP1[NP]
    S --> VP1[VP]
    NP1 --> Mary[Mary]
    VP1 --> V1[V]
    VP1 --> NP2[NP]
    V1 --> V2[V]
    V1 --> P[P]
    V2 --> selected[selected]
    P --> on[on]
    NP2 --> Det[Det]
    NP2 --> N[N]
    Det --> the[the]
    N --> boat[boat]
```

26

The relationship between Structure and Meaning

- Meaning is compositional
- Modifier "scope" is structural

27