Syntactic ambiguity

• Bob weighed three hundred and fifty pounds of grapes.

• The cotton shirts are made from comes from Arizona.

• The horse raced past the barn fell.
Syntactic ambiguity

• Bob weighed [three hundred and fifty pounds of grapes].

• The cotton [shirts are made from ___] comes from Arizona.

• The horse [____ raced past the barn] fell.

• The horse was raced past a barn.

• The horse fell.
Rampant ambiguity

- Much of language is actually ambiguous (we just don’t notice it)

- John bought the flower for Susan.
Rampant ambiguity

- John bought the flower for Susan.
- (referential ambiguity)
Rampant ambiguity

- John bought the flower for Susan.
- the flower is to give to Susan
Rampant ambiguity

- John bought the flower for Susan.
- The flower is to give to Susan.
Rampant ambiguity

- John bought the flower for Susan.
- the flower is for Susan to give to someone else
Rampant ambiguity

- John bought *the flower* for Susan.
- The flower is for Susan to give to someone else.
Question

- Do we pick one interpretation and stick with it unless proved otherwise
  
  (serial processing)

  OR

- Do we keep all reasonable interpretations somewhat active until we can decide which is best?
  
  (parallel processing)
Garden-path model

- Serial model: We do not entertain multiple possibilities
- Instead we have two strategies:
  - **Late closure**: Attach new items to the current constituent whenever possible
  - **Minimal attachment**: Attach new items to the current phrase structure using as few nodes as possible
- We have to stop and reanalyze when contrary information is encountered
Attachment Ambiguities (standing)

Tom said Bill got the mail this morning.

What does “this morning” modify?
Main clause: Tom said
Subordinate clause: Bill got the mail
Tom said Bill got the mail this morning.

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Tom said Bill got the mail this morning.

Late closure means “low attachment” preference.
• Evidence in favor:
  • Comprehenders often appear to prefer subordinate attachment
  • Longer reading times on disambiguating words when they do not support minimal attachment
The woman knew her goals for the next five years. The woman knew her goals were difficult to achieve.
The woman knew her goals for the next five years. The woman knew her goals were difficult to achieve.

Minimal attachment: attach as NP
The woman knew her goals for the next five years. The woman knew her goals were difficult to achieve.

Minimal attachment: attach as NP
The woman knew her goals for the next five years. The woman knew her goals were difficult to achieve.

Minimal attachment: attach as NP
• Evidence in favor of the minimal attachment
• Rayner et al. (1983)
• Stimuli
  • The kids played all the albums on the stereo before they went to bed.
  • The kids played all the albums on the shelf before they went to bed.
• Minimal attachment predicts stereo / shelf will go with albums
• Plausibility predicts the stereo will go with played
The kids played all the albums on the stereo ....
The kids played all the albums on the shelves ....
The kids played all the albums on the stereo ....
The kids played all the albums on the shelves ....
The kids played all the albums on the stereo ....
The kids played all the albums on the shelves ....
• If semantic plausibility plays an early role in parsing, then *stereo* should go with *played* initially and easily

• But it doesn’t

• Subjects look at it longer, indicating difficulty

• Minimal attachment plus reanalysis
• Key points of garden-path model

• Non-syntactic information like plausibility is not considered in the initial interpretation of the ambiguity

• Other possible interpretations are not considered unless forced by disambiguating input
Constraint satisfaction model

- Parallel model: We do entertain multiple possibilities
- Multiple constraints are combined to decide alternative interpretations in parallel
- Alternatives compete with one another during processing
Constraints

- Semantic fit between first NP and different possible thematic roles assigned by future structure
- Frequency that verb occurs in particular form or voice
- Frequency of particular argument structures with a given verb
- Information from post-ambiguity constraints
The actress selected
... by the end of the week. (past intransitive)
... the lead role. (past transitive)
... by the director was an unknown. (rel. clause participle)

How often do each of these uses occur?
Argument structure & verb form

- Frequency and semantic fit
  - Why is this sentence fine:
    - The land mine buried in the sand exploded
  - But this sentence is a garden-path:
    - The horse raced past the barn fell
The horse raced past the barn.

The mine buried in the sand fell and exploded.

more than just a “V”
Horses often race

Bombs don’t often bury

Constraint: Semantic fit between first NP and different possible thematic roles assigned by future structure
Constraint: Frequency that verb occurs in particular form or voice

“race” occurs in past tense usage 10 times more often than in past participle

“bury” occurs 5 times more often as a past participle than in past tense

The boy buried the toy < The boy was buried.
Constraint: Frequency of particular argument structures with a given verb

“race” typically used intransitively

“bury” typically used transitively
Constraint satisfaction

- Parallel model: We do entertain multiple possibilities
- Multiple constraints are combined to decide alternative interpretations in parallel
- Alternatives compete with one another during processing
  - The alternative that best fits the constraints has largest amount of activation
  - But other alternatives are not dismissed
Context counts

• Predicts that non-syntactic factors influence ambiguity resolution
  • Attachment preferences
  • Relative clause interpretations
Evidence

- Spivey & Tanenhaus (1998)
- Hypothesis
  - Presence of multiple referents should bias relative clause interpretations
<table>
<thead>
<tr>
<th></th>
<th>Preceding setup possibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>One-Referent</strong></td>
<td>An actress and the producer’s niece were auditioning for a play. The director selected/chose the actress but not the niece.</td>
</tr>
<tr>
<td>Setup context</td>
<td></td>
</tr>
<tr>
<td><strong>Two-Referent</strong></td>
<td>Two actresses were auditioning for a play. The director selected/chose one of the actresses but not the other.</td>
</tr>
<tr>
<td>Setup context</td>
<td></td>
</tr>
</tbody>
</table>
### Possible Target sentences

<table>
<thead>
<tr>
<th>Ambiguous reduced relative</th>
<th>The actress selected by the director believed that her performance was perfect.</th>
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<tr>
<td>Unreduced relative</td>
<td>The actress who was selected by the director believed that her performance was perfect.</td>
</tr>
<tr>
<td>Materials</td>
<td>Possible Target sentences</td>
</tr>
<tr>
<td>--------------------</td>
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Two actresses were auditioning for a play. The director selected one of the actresses but not the other.

The actress chosen by the director believed that her performance was perfect.
An actress and the producer’s niece were auditioning for a play. The director selected the actress but not the niece.

The actress selected by the director believed that her performance was perfect.
Hypothesis revisited

• Presence of multiple referents should bias relative clause interpretations
  • True
  • Reduced relatives can be licensed by context, and thus interpreted as such even in ambiguous reduced context
  • People don’t anyways follow the garden-path!
• So, what about Rayner et al. and other studies that show low/minimal attachment preferences?

• Spivey & Tanenhaus argue that the materials in these experiments probably had strong biases toward these attachment preferences

• Additional biases may not have been able to overcome them
• More evidence for constraint satisfaction

• Verb argument bias:
  • Complement-bias:
    (1) The woman knew her goals
  • NP-bias:
    (2) The woman realized her goals
The woman knew her goals ...

Complement-bias verb: The woman knew her goals ...

Continuation expected!
The woman knew her goals were unrealistic.
The woman realized her goals.
The woman knew her shoes ...

Complement-bias verb:

The woman knew her shoes ...

Continuation expected!
The woman knew her shoes were dirty.
The woman realized her shoes

Complement-bias verb: 

The woman realized her shoes

No continuation expected
The woman realized her shoes were dirty.
• Difficulty with sentence complement interpretation is not because of minimal attachment strategy
• Complement-bias:
  (1) The woman knew her goals
• NP-bias:
  (2) The woman realized her goals

Verb bias toward one kind of continuation versus another dictates (in part) which interpretation is preferred
• Evidence from attachment ambiguity

• Plausibility of the possible attachments

• The driver of the car with the moustache was pretty cool.

• Compared with

• The car of the driver with the moustache was pretty cool.
• Garden-path predicts low attachment
• The driver of the car with the moustache
• Garden-path predicts low attachment
• The driver of the car with the moustache
• No difference in reading times at prepositional modifier - *moustache* read in the same amount of time regardless of plausibility of nearest noun

• The driver of the car with the moustache

• Evidence against garden-path account

• Could be evidence in support of constraint satisfaction

• People use plausibility to avoid incorrect low attachment
• Key points about constraint satisfaction model
  
  • Pragmatic, semantic and syntactic constraints apply to interpretation
    
    • Including frequency of occurrence
    
    • All interpretations are maintained at least a little until resolution
    
    • Favored interpretation most active
Question revisited

• Do we pick one interpretation and stick with it unless proved otherwise
  • (serial processing)

  OR

• Do we keep all reasonable interpretations somewhat active until we can decide which is best?
  • (parallel processing)
About the midterm

(next Tuesday!)
• 10 long-answer questions
• You will need to answer 8
• Each will be worth 10 points

• See Review Sheet