Summary of Frazier

- Parsing preferences are guided by general principles:
  - Serial structure building
  - Reanalyze based on syntactic conflict
  - Reanalyze based on low plausibility ("thematic fit")

- Psychological assumptions:
  - Modularity: only syntactic (not lexical, not semantic) information used for initial structure building
  - Resources: emphasizes importance of memory limitations
  - Processing strategies are universal, innate
Grammar-Based Strategies

• Not concerned with representation or ‘form’, but defined in terms of syntactic ‘content’ – i.e. not based on “trees” but “principles of grammar”

• Strategies are modular, but ‘knowledge-based’

• Motivation: strategies are derived from the purpose of the task, not e.g. computational efficiency

• Closer competence-performance relationship

• Defined w.r.t. to deeper syntactic notions: less sensitive to minor structural details (cf. Minimal Attachment)


Pritchett (1992)

• Incrementally establish primary syntactic dependencies

• Theta-Criterion: (GB theory, also in LFG + HPSG)
  • Each argument must receive exactly one theta-role, and each theta role must be assigned to exactly one argument

• Consider:

  The boy put the candy on the table in his mouth
• **Theta-Attachment:**

  • Maximally satisfy the theta-criterion at every point during processing, given the maximal theta-grid of the verb

• **Theta Reanalysis Constraint:**

  • Reanalysis of a constituent out of its theta-domain results in a conscious garden-path effect

---

**Theta-Reanalysis: Easy**

*Reanalysis* to a position **within** the original theta-domain is easy.
Theta-Reanalysis: Difficult

Reanalysis to a position outside the original theta-domain is difficult.

Pritchett: Another example

- “Without her contributions the orphanage closed”
  - ‘Without’: a Prep with a single thematic role
  - ‘her’: an determiner of an unseen NP head, or a Full NP (Pronoun) [Theta-attach]
  - ‘contributions’: head of a new NP, with no role, or combine with ‘her’ for a Full NP [Theta-attach]
  - “Without her contributions failed to come in”
    - ‘contributions’ becomes subject of ‘failed’, violating [Theta-reanalysis Constraint]
Well-known local ambiguities

NP/VP Attachment Ambiguity:
“The cop [saw [the burglar] [with the binoculars]]”
“The cop saw [the burglar [with the gun]]”

NP/S Complement Attachment Ambiguity:
“The athlete [realised [his goals]] last week”
“The athlete realised [[his goals were unattainable]]”

Clause-boundary Ambiguity:
“Since Jay always [jogs [a mile]] [the race doesn’t seem very long]”
“Since Jay always jogs [[a mile] doesn’t seem very long]”

Reduced Relative-Main Clause Ambiguity:
“[The woman [delivered the junkmail on Thursdays]]”
“[[The woman [delivered the junkmail]] threw it away]”

Relative/Complement Clause Ambiguity:
“The doctor [told [the woman] [that he was in love with her]]”
“The doctor [told [the woman [that he was in love with]] [to leave]]”

Grammar-Based (cont’d)

- Theta-Attachment: reliance on theta-grids means it’s head driven
- O.k. for English, but not incremental for head-final languages
- Same problem for Abney (1989), and other head-driven models
- Argument-Attachment: Attach constituent into potentially role-receiving positions (Crocker, 1992)

― That study used phrase-by-phrase self-paced reading.
― Eye-tracking studies suggest the modifier attachment is actually preferred.
― Problematic for A-Attachment, unclear what Theta-Attachment would predict.
Pritchett’s Theory (1992)

- What **architecture** is assumed?
  - Modular lexico-syntactic processor with syntactic and thematic role features

- What **mechanisms** is used to construct interpretations?
  - Incremental, serial parsing, with reanalysis

- What **information** is used to determine preferred structure?
  - Grammar principles and thematic role information

- **Linking Hypothesis:**
  - TRC violation causes garden-path, reanalysis without TRC is relatively easy

Quick Recap: Syntactic Accounts

- **Frazier:** early parsing decisions driven by purely syntactic heuristics
  - **MA** and **LC** were argued to be by-products of a race mechanism

- **Pritchett:**
  - **Theta-attachment** determines preferred parse
  - **Theta-reanalysis** constraint determines when reanalysis of difficult

Eager dependency-formation plays a strong role in driving parsing decisions:

- What about **long-distance dependencies**?
Long Distance Dependencies

• Wh-Fillers:
  
  • *Who*$_i$ did Fred tell Mary *e*$_i$ left the country?  **dispreferred**
  
  • *Who*$_i$ did Fred tell *e*$_i$ Mary left the country?  **preferred**

• Subject-Relative preference:
  
  • *I met the man*$_i$ that John likes *e*$_i$.  **dispreferred**
  
  • *I met the man*$_i$ that *e*$_i$ likes John.  **preferred**

• **Active Filler Strategy:** (“Gap as a first resort”)
  
  • When a filler has been identified, rank the possibility of assigning it to a gap above all other options.

Further observations ...

• Filled-Gap effect:
  
  • *My brother wanted to know who*$_i$ Ruth will bring (*e*$_i$) us home to *e*$_i$ at Christmas*
  
  • *My brother wanted to know if Ruth will bring us home to Mom at Christmas*

  • Found an increased reading time at us, interpreted this as surprise

  • Intuitively easy:
    
    • *Who*$_i$ (*e*$_i$) did you want (*e*$_i$) Mother to bake (*e*$_i$) a cake for *e*$_i$?*
    
    • ... despite 3 possible earlier gap locations
Gaps versus Dependencies

• Consider:
  
  • \[\text{In which tin} i \text{ did you put the cake } e_i ?\] \hspace{2cm} \text{Gap account}
  
  • \[\text{In which tin} i \text{ did you put the cake ?}\] \hspace{2cm} \text{Dependency account}
  
• If keeping the filler in memory causes difficulty, we can compare:

  \[\text{In which tin} i \text{ did you put the cake that your little sister baked for you } e_i ?\] \hspace{2cm} \text{Easy}

  \[\text{Which tin} i \text{ did you put the cake that your little sister baked for you in } e_i ?\] \hspace{2cm} \text{Hard}

• Intuitive support for the dependency account, and against gaps.

Other evidence

• Implausibility detected immediately at the verb, as shown by increased reading times.

  • \text{That's the [pistol/garage] } i \text{ with which the heartless killer shot } e_i \text{ the hapless man } e_i \text{ yesteday afternoon.}

• Garnsey et al (1998) found an N400 at the verb, for the implausible condition

  • \text{The businessman knew which [customer/article] } i \text{ the secretary called } e_i \text{ at home}

• Pickering and Barry (1996) argued that a dependency-based account was preferable to a trace-based account.
Parsing in 2 dimensions

- Gaps don't exist in the input, so we needn't wait until they are found
- We can associate a filler & gap as soon as the structure licenses it:

Consider: Den Hund, sah, Maria e, e.

Psycholinguistic Evidence

- Are there really two types of reanalysis?
  - NP/S (A): “The woman saw the famous doctor had been drinking”
  - NP/Z (A): “Before the woman visited the famous doctor had been drinking”
  - NP/S (U): “The woman saw that the famous doctor had been drinking”
  - NP/Z (U): “Before the woman visited, the famous doctor had been drinking”

- All verbs are biased (BNC) towards NP complement
  - To make sure the object attachment is initially adopted, forcing reanalysis
  - Plausibility of the the direct object analysis is similar (pre-test).

Sturt, Pickering & Crocker, JML, 1999
Results

- Reading times: Region 3

“The woman / saw the famous doctor / had been drinking / all day”

- Main effects of construction type, ambiguity, and a significant interaction

- GP effect: NP/Z (400ms) vs. NP/S (87ms)