Pronoun Preferences

• Previous work in pronoun resolution has proposed and argued about so-called ‘preferences’
  – Grammatical role hierarchies
  – Thematic role hierarchies
  – Parallelism
  – Semantics

• Why the argument?
  – The data is recalcitrant and seems to be mutually contradictory
Grammatical Role

(1) a. John went to the Acura dealership with Bill. He bought an Integra.
    
b. Bill went to the Acura dealership with John. He bought an Integra.
    
c. John and Bill went to the Acura dealership. He bought an Integra.

(2) a. John hit Bill. Mary told him to go home.
    
b. Bill was hit by John. Mary told him to go home.
Thematic Role

(3) a. John telephoned Bill. He lost the pamphlet on Acuras.
   b. John criticized Bill. He lost the pamphlet on Acuras.

(4) a. John seized the Acura pamphlet from Bill. He loves reading about cars.
   b. John passed the Acura pamphlet to Bill. He loves reading about cars.

(5) a. The car dealer admired John. He knows Acuras inside and out.
   b. The car dealer impressed John. He knows Acuras inside and out.
(6) Mary went with Sue to the Acura dealership. Sally went with her to the Mazda dealership.

(7) John seized the Acura pamphlet from Bill. Fred took the Mazda pamphlet from him.

(8) John passed the Acura pamphlet to Bill. He gave the Mazda pamphlet to George.
An account of pronoun interpretation should:

- *Explain* why we see evidence for these preferences, not posit them as primitives from the data which we are trying to explain
- Explain why different preferences appear to prevail in different contextual circumstances
- Explain how pronoun resolution fits within a broader account of discourse processing
  - Combine a theory of the linguistic properties of pronouns with a theory of discourse comprehension
Focus-Based Approaches

- Accounts which model salience as part of discourse state (Sidner, 1983; Grosz et al., 1995; Walker et al., 1994; Strube and Hahn 1996; Strube 1998)

- Motivated (in part) by ‘garden-path’ effects (from Grosz et al., 1995):

  (9) a. Terry really goofs sometimes.

  b. Yesterday was a beautiful day and he was excited about trying out his new sailboat.

  c. He wanted Tony to join him on a sailing expedition.

  d. He called him at 6AM.

  e. He was sick and furious at being woken up so early.
Focus-Based Approaches

- Preferences can change even when propositional content does not (Kameyama, 1996):

(10) John hit Bill. Mary told him to go home. [ him = John ]

(11) Bill was hit by John. Mary told him to go home. [ him = Bill ]
Coreference from Coherence

Hobbs (1979):

- Pronoun resolution occurs as a by-product of general reasoning processes
- Operates solely on logical representations at the semantic level
- Pronouns are modeled as free variables which get bound during inference, such as during coherence relation establishment

Explanation: Infer $P$ from the assertion of $S_0$ and $Q$ from the assertion of $S_1$, where normally $Q \rightarrow P$. 
An Example

- Example from Winograd (1972):

  (12) The city council denied the demonstrators a permit because
  
  a. they *feared* violence.
  
  b. they *advocated* violence.

- An (oversimplified) axiom:

  \[(\forall X, Y, Z, W) \text{fear}(X, Z) \land \text{advocate}(Y, Z) \land \text{enable_to_cause}(W, Y, Z) \supset \text{deny}(X, Z, W)\]

- The first sentence gives us:

  \[
  \text{deny(city\_council, demonstrators, permit)}
  \]

- The verb tells us which predicate to merge with, allowing the pronoun to be bound
Effects of Parallelism

• Sidner (1983):
  (13) a. The green Whitierleaf is most commonly found near the wild rose.
      b. The wild violet is found near it too.

• Kameyama (1986):
  (14) a. Carl is talking to Tom in the Lab.
      b. Terry wants to talk to him too.

• But what *kind* of parallelism?
  – Generally taken to be grammatical role

• Don’t get backtracking behavior as in the Terry/Tony example:
  (15) Margaret Thatcher admires Hillary Clinton, and Newt Gingrich absolutely worships her.
A Pattern in the Data

• Data cited in support of focus-based approaches are generally Contiguity relations
  – e.g., the Terry/Tony example

• Data cited in support of coherence-based approaches are generally Cause-Effect relations
  – e.g., the Winograd example

• Data cited in support of parallelism-based approaches are generally Resemblance relations
  – e.g., the Thatcher example
Properties of Pronouns

Combine the effects of focus of attention and need to establish coherence

• Pronouns:
  – refer to referents that hold a high level of salience or in the discourse model
  – require an (almost) immediate interpretation

• However, salience may change rapidly during the coherence resolution process
  – the underlying inference processes may make different entities salient at different times
Contiguity

- Contiguity relations are what we use to talk about a system of entities with more than one sentence.
- Speakers help by signaling the center of attention, such as by placing such entities in subject position.
- Recall the case of garden paths:
  (16) a. Terry really goes sometimes.
      b. Yesterday was a beautiful day and he was excited about trying out his new sailboat.
      c. He wanted Tony to join him on a sailing expedition.
      d. He called him at 6AM.
      e. He was sick and furious at being woken up so early.
Contiguity

- Inference process taps into expectations about the discourse topic(s)

- But remember the cases of thematic role preferences (Stevenson et al., 1994)

  (17) a. John seized the Acura pamphlet from Bill. He loves reading about cars.
      (Goal=John, Source=Bill)

  b. John passed the Acura pamphlet to Bill. He loves reading about cars.
      (Goal=Bill, Source=John)

- Grammatically-parallel cases do not always obey the preference for parallelism

  (18) Carl is talking to Tom in the lab. Terry will speak to him tomorrow about interrupting Tom’s work.
Cause-Effect Relations

• Revisit the Winograd example:

(19) The city council denied the 
demonstrators a permit because 

a. they feared violence. 
b. they advocated violence. 

• An (oversimplified) axiom: 

\((\forall \, X, Y, Z, W) \, \text{fear}(X, Z) \land \text{advocate}(Y, Z) \land 
\text{enable_to_cause}(W, Y, Z) \supset \text{deny}(X, Z, W)\)

• The first sentence gives us: 

\(\text{deny(city_council, demonstrators, permit)}\)

• The verb tells us which predicate to merge 
   with, allowing the pronoun to be bound
Garden Paths with Cause-Effect

(20) ? The city council denied the demonstrators a permit because they decided that the best way to draw attention to issues is to advocate violence.

(21) ? The city council denied the demonstrators a permit because they feared the police, whom the council would require to be present at the demonstration.

(22) The city council denied the demonstrators a permit.
   
   a. They feared violence.
   
   b. ? They advocated violence.
Establishing Resemblance requires that the similarity (or contrast) of parallel entities be established.

(23) Margaret Thatcher admires Hillary Clinton, and Newt Gingrich absolutely worships her.

These sentences give us:

\[ \text{admires(Thatcher, Clinton)} \]
\[ \text{worships(Gingrich, her)} \]

Recall that the definition of Parallel is:

**Parallel:** Infer \( p(a_1, a_2, \ldots) \) from the assertion of \( S_0 \) and \( p(b_1, b_2, \ldots) \) from the assertion of \( S_1 \), where for some property vector \( q, q_i(a_i) \) and \( q_i(b_i) \) for all \( i \).
Resemblance

• Thus we need to show:

\[ q_1(\text{Thatcher}, \text{Gingrich}) \]
\[ q_2(\text{Clinton}, \text{her}) \]

• It’s easy to establish similarity when one argument is a pronoun: coreference!

• The parallel element is the salient entity when the pronoun is encountered during discourse interpretation

• Thus, the parallel preference is tied to the coherence notion of Parallelism (not grammatical role)

• Explains why unambiguous cases of gender incompatibility is still odd in Resemblance:

  (24) Margaret Thatcher admires Ronald Reagan, and Newt Gingrich absolutely worships her.
Epiphenomena?

• Grammatical role parallelism due to coreference constraints

(25)  a. John called up Mike.

    b. He wanted to meet him.

• Implicit causality

(26)  a. George telephoned Walter because he wanted some information.

    b. George criticized Walter because he misplaced the file.
Psycholinguistic Models

Crawley et al. (1990) vs Smyth (1994)

• Crawley et al: *subject assignment* strategy over *parallel function*

(27) Brenda copied Harriet and Bill watched her.

• Smyth et al: cites only four sentences from Crawley’s data which he considers parallel:


b. Sarah visited Cathy at home and Charles phoned her at work.

c. Robert bullied Peter and Melanie attacked him.

d. Cheryl spoke to Monica about the next meeting and Steven questioned her about it.
"I conclude from these observations that pronoun interpretation in conjoined sentences involves an obligatory search for a morphologically compatible antecedent ... [which] has the same grammatical role as the pronoun. If a match is found, the parallel interpretation is obligatory, unless the pronoun is stressed, in which case it is selectively blocked. If no match is found, resolution is less certain, but will most often result in SA, although if the pronoun or the first clause verb is stressed, alternative strategies govern the selection of an antecedent.

On this view, SA is a default strategy for sentences in which the degree of nonparallelism exceeds some limit; PF is a specific outcome of the more general principle that the probability of parallel resolution depends on the number of features shared by the pronoun and the candidate antecedents. Retaining SA in the model allows us to account for an otherwise mysterious asymmetry between subject and nonsubject pronouns.”
Two Views of Coherence

• We perform many *actions* with language. We:
  – Motivate
  – Justify
  – Provide evidence for
  – ...

• We not only ask *what did the speaker say*, but *why did (s)he say that to me*?

• Is this latter question the basis for coherence?
Two Levels

• An example of intentional coherence:

(29) Customer: Where are the chuck steaks you advertised for 88 cents per pound? Butcher: How many do you want?

• But both levels are needed:

    b. He’s sure to veto House Bill 1711.

• Two coherent responses:

(31) But I thought 1711 is a crime bill.
(32) But Bob Dole introduced the bill.