Sign Language Semantics Day 2: Pronouns in space

Jeremy Kuhn
Institut Jean Nicod, CNRS, EHESS, ENS

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Section 1

Pronouns in space

Pronouns in space

One of the earliest observations in sign language semantics:

- Sign language pronouns can be indexed in the signing space.

Pronouns in space

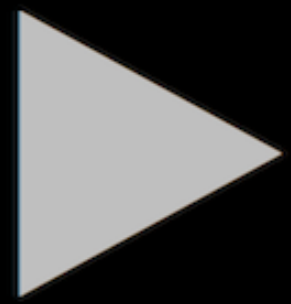
- Pronominal ambiguity in English:

  (1) John told Bill that he would win.

  a. John told Bill that John would win.
  b. John told Bill that Bill would win.

- In sign language: ambiguity removed by the use of space!
  - NPs may be associated with locations ('loci').
  - Pronouns point to locus of their antecedent.

Pronouns in space



(2) IX-a JOHN TELL IX-b BILL {IX-a/IX-b} WILL WIN.
'John$_i$ told Bill$_j$ that he$_{\{i/j\}}$ would win.'

Background: Indexing individuals in space

Pronouns in space

- What's going on here?

Pronouns in space

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- Analogies in spoken language? In linguistic theory?

Pronouns in space

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- Analogies in spoken language? In linguistic theory?

Some possible connections:

- Pointing gestures?
- Gender or person features?
- Syntactic indices / variables?

Pronouns in space

Loci = gestures?

(3) I choose $\overset{\text{POINT}}{\overline{\text{him}}}$!

Pronouns in space

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Loci = features?

(4) John told Mary that she would win.

Pronouns in space

Loci = gestures?

(3) I choose $\overset{\text{POINT}}{\overline{\text{him}}}$!

Loci = features?

(4) John told Mary that she would win.

Loci = variables?

(5) John$_i$ told Bill$_j$ that he$_j$ would win.

Pronouns in space

- We will consider each of these connections.
- We will rule out some specific theories.
- *The ultimate picture:* Loci are a little bit gestural, a little bit featural, and a little bit variable-like.

Methodology

- Native signers of ASL and LSF.
- **Playback method:** (Schlenker 2010)
  1. A native signer signs sentences of interest; they are videotaped.
  2. The same signer assess these sentences for acceptability (usually by comparing several sentences).
  3. Step 2 is repeated at different times, with the same or with different signers [to assess the stability of the judgments].
- Ratings on a 7-point scale [7=best]
- *A note:* Videos include *ungrammatical* sentences, too.

Section 2

Loci as gestures?

Loci as gestures?

Similarities between sign language loci and gestural pointing:

- Pronouns for people present are directed at these people (e.g. speaker and addressee).

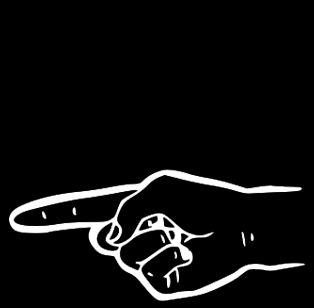
  (6) IX-1 HAPPY
  'I'm happy.'

- Pronouns may generate iconic inferences.
  - E.g. pointing upwards for a tall (non-present) referent.

The same system?

- **Important question:**
  Is this even the same linguistic system as pronouns in other (spoken) languages?

The same system: syntax



IX

SELF

POSS

- Binding Theory conditions

(7) a. * JOHN-a LIKES IX-a.
b. JOHN-a LIKES SELF-a. (ASL)

- Crossover effects
- Resumptive uses for islands

The same system: semantics

- Bound and free uses

(8) [EACH POLITICS PERSON]-a TELL-STORY IX-a WANT WIN
'Every politician said he wants to win.' (ASL)

(9) ONLY IX-a JEAN SEE POSS-a MOTHER
'Only Jean saw his mother.' (LSF)

(10) GIANNI-a SECRETARY POSS-a VALUE. PIERO SAME.
'Gianni values his secretary. Piero does, too.' (LIS)

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- Setting aside the use of space, sign language pronouns otherwise look just like systems in spoken languages.
- **Conclusion:** the same abstract pronominal system.

Loci as gestures?

Aside:

- Does (co-speech) gestural pointing allow bound uses?

Section 3

Loci as variables? ...as features?

Loci as variables?

- Some observations about loci:
  - There are theoretically infinitely many possible loci.
  - There is an arbitrary relationship between a given noun phrase and the locus where it is assigned.
- In spoken language, no analogous phonetic marker is able to disambiguate logical forms.

Loci as variables?

(1) IX-a JOHN TELL IX-b BILL {IX-a/IX-b} WILL WIN.
'John$_i$ told Bill$_j$ that he$_{\{i/j\}}$ would win.'

- Striking parallels between loci and formal variables!
  - appear on pronoun and antecedent
  - there are arbitrarily many
  - disambiguate pronouns under multiple levels of embedding
- Lillo-Martin and Klima (1990):
  Loci are the overt phonological manifestation of syntactic indices/variable names.

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- A putative case of **visibility**.

The Variable-Free Hypothesis

On the other hand:

- A rich thread of semantic work argues that the logic of natural language does not use variable names.
- Variables not logically necessary for expressive purposes.
  - Any Turing complete language can be translated into Combinatory Logic, which makes no use of variables.

    (Curry and Feys 1958)
- Some telling titles:
  - Quine 1960: "Variables explained away"
  - Szabolcsi 1987: "Bound variables in syntax (Are there any?)"
  - Jacobson 1999: "Towards a Variable-Free Semantics"

  (and further works by Steedman, Szabolcsi, and Jacobson, among others)

Variable-Free Semantics

- **One motivation from parsimony:** Variables are never overt in natural language — in (spoken) language, there is never a phonological difference between 'he$_x$' and 'he$_y$'.

  (Jacobson 1999)

- **BUT!**
  As we have seen, ASL provides a potential counterexample to this generalization.

- A conflict!

Another way to look at it

- The Curry-Feys isomorphism is a sword that cuts both ways: anything that is expressible without variables can also be expressed with variables.
- **The question, then:** to what extent do these linguistic objects seem to have the formal properties of variables?
- What are the formal properties of variables?
- In doing this, it will be helpful to provide another hypothesis that we can test against. Features.

The Hypothesis

(11) **The (strong) loci-as-variables hypothesis:**

There is a one-to-one correspondence between ASL loci and formal variables.

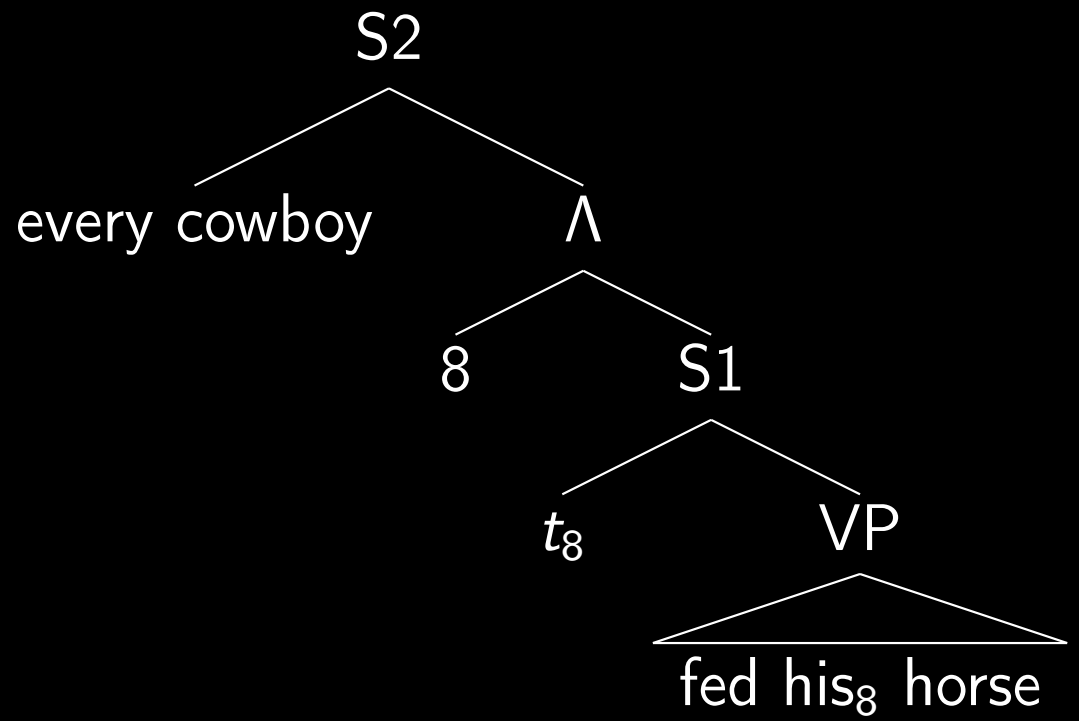
(12) **The loci-as-features hypothesis:**

Different loci correspond to different values of a morphosyntactic spatial feature.

Binding with variables

- Standard Heim and Kratzer:

(13)



(14) a. $[\![\text{S1}]\!] = \lambda g[g(8) \text{ fed } g(8)\text{'s horse}]$

b. $[\![8 \text{ S1}]\!] = \lambda g \lambda x [\![\text{S1}]\!]^{8 \to x}$

Binding with variables

- **Variable capture:** A variable is bound by the lowest operator which scopes over it and quantifies over that variable.

(15) $\exists x[\forall x.R(x,x)]$
$= \exists x[\forall y.R(y,y)]$
$\neq \exists x[\forall y.R(y,x)]$

- Critically, assignment functions are **functions**: each variable is mapped to only one individual.
- So, if loci are variables, then a given locus can only index a single individual.

Variables vs. features

(16) Jay told Bob that [his$_{[+\text{masc}]}$ cat licked his$_{[+\text{masc}]}$ dog].

(17) Jay told Bob that [his$_{x}$ cat licked his$_{x}$ dog].

Locus recycling $\neq$ locus sharing

- Can one locus be used for two different individuals?
- Preliminary answer: clearly yes!
  - Indexing something in space doesn't lock you in for life.
  - Even in adjacent sentences, loci are recycled.
- But, this is not a valid counter-example.
- Two occurrences of a formal variable may be semantically independent with an intervening operator:

(18) a. $\exists x[P(x)] \wedge \exists x[Q(x)]$
b. $\exists x[P(x)] \wedge \exists y[Q(y)]$

The test case

- The critical configurations: cases of variable capture.
- We're looking for examples with two pronouns, indexed at the same locus, both free within the same sub-expression.

(19) ...NP_a [...NP_a [...IX-a...IX-a...]]...

English: Pronouns under *only*

- English: Pronouns under *only* may optionally co-vary in the focus alternatives.

  (20) a. [Only Mary$_x$] $\lambda y.y$ did her$_x$ homework.
  $\rightarrow$ John didn't do Mary's homework.

  b. [Only Mary$_x$] $\lambda y.y$ did her$_y$ homework.
  $\rightarrow$ John didn't do his own homework.

- In (a), the pronoun is free and co-referential with Mary; in (b), the pronoun is bound by the lambda operator.

English: Pronouns under *only*

- When two pronouns appear under *only*, two mixed readings are available: one pronoun bound and one free.

(21) Only Billy told his mother his favorite color.

(22) [Only Billy$_x$] $\lambda y.y$ told x's mother y's favorite color.

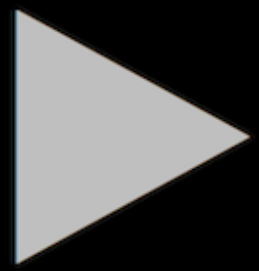
Context: When Billy's mother has his friends over to play, she tends to ask them all sorts of personal questions, which they are usually reluctant to answer. Yesterday, she asked them what their favorite color is, but only Billy answered.

ASL: Pronouns under *only*

- If ASL loci are variables, then the use of loci should make these mixed readings unavailable.
  - Two spatially co-indexed pronouns — denoting the same variable — must be captured by the same operator.
  - Both must give the same reading: bound or free.

ASL: Pronouns under *only*

- However, mixed readings *are* attested.



(23) IX-a BILLY ONLY-ONE PAST TELL POSS-a MOTHER POSS-a FAVORITE COLOR.
'Only Billy told his mother his favorite color.'

OK: *bound-bound, bound-free, free-bound, free-free*

Result (both examples)

- The loci-as-variables hypothesis **undergenerates**.

Loci as features

- *Claim:* loci are mediated by a featural layer.
- A pronoun may be bound by any NP with the same features.

(24) Jay told Bob that [his$_{[+\text{masc}]}$ cat licked his$_{[+\text{masc}]}$ dog].

Uninterpreted features

- What about pronouns under *only*?
- **Heim:** under focus sensitive operators, features may remain **uninterpreted**. E.g. (25a) entails that John didn't do his homework, even though he is not a female.

(25) a. Only Mary did her homework.
b. Only I did my homework.

Uninterpreted features

- Sentence (23) is exactly parallel: the pronoun bears a spatial feature which is uninterpreted in the focus alternatives.

(23') IX-a JENNY TOLD-ME IX-b BILLY ONLY-ONE PAST-TELL POSS-b MOTHER POSS-b FAVORITE COLOR.
'Jenny told me that only Billy told his mother his favorite color.'

- E.g. on the *bound-bound* reading, (23') entails that Jenny didn't tell her mother her favorite color, even though she is not indexed at locus *b*.

Spatial features in sign language

One implementation:

- A presupposition on the value of the pronoun:

(26) a. $[\![\text{FEM}]\!] = \lambda x : \text{female}(x) \,.\, x$

b. $[\![\text{-a}]\!] = \lambda x : \text{at}(\text{a})(x) \,.\, x$

Spatial features in sign language

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Still to be explained:

- What is the meaning of a locus?
- What does it mean to be ‘at’ this locus?

Spatial features in sign language

My answer:

- Loci are referents in a iconic, pictorial representation that grows as discourse develops.
  - A pictorial discourse referent must be introduced before it can be retrieved.
- Additionally, iconic inferences arising from a mapping that preserves structural properties.

Section 4

Iconicity and local contexts

Iconicity

Claim: Spacial loci are interpreted iconically.

- Sometimes, this is obvious!
  - Can represent individuals in a 3D environment.
- In other cases are less clear.

(27) OBAMA-a TELL SARKOZY-b IX-a WILL WIN.

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- We assume a simple iconic constraint:
  Two distinct loci $\rightarrow$ two distinct values

Iconicity

But at what *level* is this constraint interpreted?

- Consider cases where embedded quantifiers range over the same set of individuals.

(28) EACH-TIME SOMEONE-a HELP SOMEONE-b, IX-b THANK-a
'When someone helps someone, they thank them.'

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Iconicity

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MVI_1183

- *Does not mean:* 'When someone from group a helps someone from group b, ...'
- The same individuals may be 'at a' and 'at b'.

The problem with the global context

- The source of the problem is that the presupposition is taken to be a constraint on the *global context*.
- We can avoid these problems if we relativize to the *local context* of a locus.

Local contexts

- Global context $\approx$ the common ground
- Local context = the immediate scope in which an expression is interpreted
  - Incorporates information about the syntactic environment in which the expression appears

(29) If it's raining, I'll bring an umbrella.

Local contexts

- Constraints on discourse reference are sensitive to the local context.

1 Availability of a pronoun

(30) a. If John has a cow, he milks it.
b. * If John has a cow, he's happy. I milked it.

(31) a. Nobody received a prize and bragged about it.
b. * Nobody received a prize. It was made of gold.

Local contexts

2. Presupposition of *other*

(32) One boy coughed. Another boy laughed.

(33) a. When a kid sees another kid, they say hi.

b. ? When a kid is happy, they laugh. When another kid is sad, they cry.

(34) a. Every boy told every other boy that he'd win.

b. ? Every boy coughed. Every other boy laughed.

Local contexts

- Let's reconsider the LSF data in this light:

(35) EACH-TIME SOMEONE-a HELP SOMEONE-b, IX-b THANK-a
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MVI_1183

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MVI_1183

- We assumed the iconic constraint:
  Two distinct loci $\rightarrow$ two distinct values
- In the local context, this is (trivially) satisfied!

Local contexts

- What evidence in favor of an iconic inference?

(36) *Context:* Explaining the rules of a card game

a. IF SOMEONE-a DRAW IX SWORD, SOMEONE-a LOSE
'If someone draws the sword card, someone loses.'

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b. IF SOMEONE-a DRAW IX SWORD, SOMEONE-b LOSE
'If someone draws the sword card, someone else loses.'

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Local contexts

- NB: there may often be a *tendency* to interpret iconicity with respect to the global context.

(Kuhn 2020)

- What would this mean?

Local contexts

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  (Kuhn 2020)

- What would this mean?
  - A preference to avoid bound pronouns under negative quantifiers (Graf & Abner 2012)
  - A preference for a 'two group' readings for some embedded quantifiers (Kuhn 2016)

Section 5

Dynamic iconicity

Descriptive meaning over time

- Consider how a series of linguistic utterances change a discourse representation:

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(37) a. John entered.

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(37) a. John entered.
b. Mary saw him.

Descriptive meaning over time

- Consider how a series of linguistic utterances change a discourse representation:

(37) a. John entered.
b. Mary saw him.
c. She called Susan over.

Depictive meaning over time

- Consider how a pictorial production changes a discourse representation:

(38)

Depictive meaning over time

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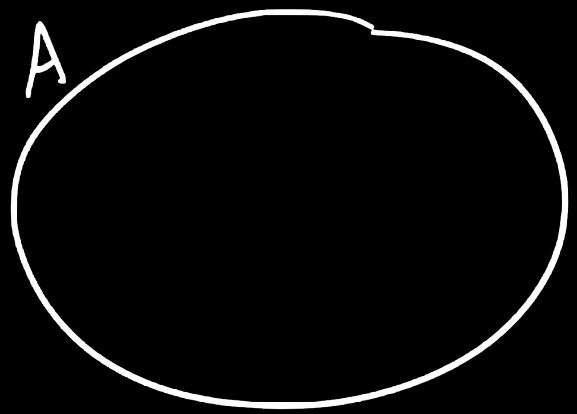

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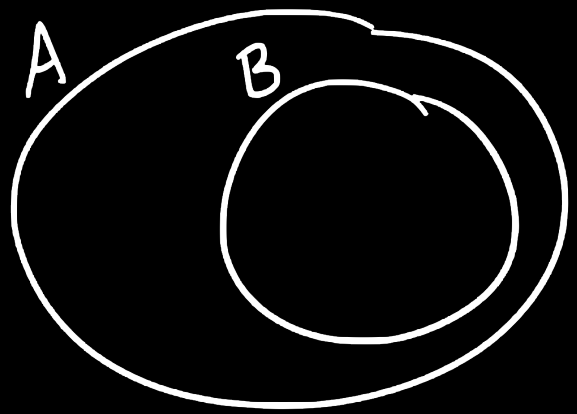

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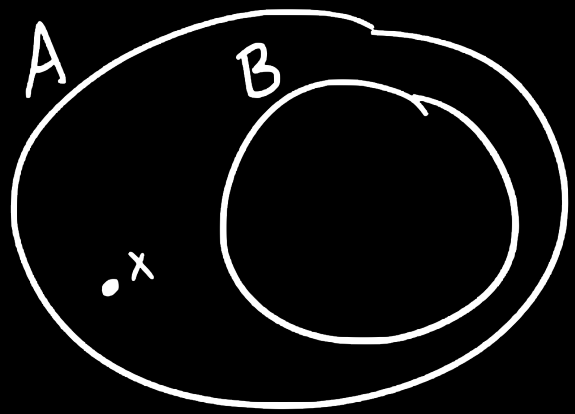

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  - Introduction
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- In a multimodal system, the two may interact:
  - Linguistic anaphora may retrieve depicted referents
  - Iconic inferences may involve linguistic referents
- Claim: this is the case for sign language loci

Dynamic semantics

Specifically:

- Both descriptive and depictive meaning should be represented using **dynamic semantics**, in parallel but interacting systems.

Dynamic semantics:

Information and discourse referents are introduced gradually into context as a discourse unfolds

- Left-to-right evaluation

Order sensitivity

- Dynamic systems show order sensitivity:

(39) a. [A man]^{i} entered the room. He$_{i}$ began to sing.
b. * He$_{i}$ began to sing. [A man]^{i} entered the room.

- If iconic representations are dynamic, they should also show order sensitivity.

Order sensitivity

Evidence of order sensitivity: **cataphora**.

- In the definition of locus features, there are two variables
  - The pronoun value (x), and the locus (a)
  - $[\![\text{-a}]\!] = \lambda x : \mathsf{at}(\text{a})(x) \,.\, x$
- Even when x is subject to quantificational binding, the locus still needs dynamic binding.
- Cataphora allows a dissociation of the two.

Cataphora

Cataphora: when a pronoun precedes its binder

(40) Before he$_i$ left the office, Jean^i turned out the lights.

Cataphora

Observation: cataphora is *less available* in sign language.

(van Hoek, 1997; Koulidobrova & Lillo-Martin, 2016)

(41) SINCE JEAN-a MISS PLANE, IX-a CAN'T GO NYC
'Since Jean missed the plane, he can't go to NYC.'

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(42) * SINCE IX-a MISS PLANE, JEAN-a CAN'T GO NYC
Intended: 'Since he missed the plane, Jean can't go to NYC.'

MVI_9652

- *Intuition:* you can't point to something until it has been introduced

Cataphora

If this is a constraint on iconicity, then a prediction:

- Cataphora should become possible if a non-spatial pronominal form is used.

Cataphora

If this is a constraint on iconicity, then a prediction:

- Cataphora should become possible if a non-spatial pronominal form is used.
- This seems to be correct:

(44) SINCE __ MISS PLANE, JEAN-a CAN'T GO NYC
'Since he missed the plane, Jean can't go to NYC.'

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Cataphora

Another prediction:

- Cataphora becomes worse in spoken language if an iconic form is used.

Cataphora

Another prediction:

- Cataphora becomes worse in spoken language if an iconic form is used.
- *Former* and *latter* as 'temporal loci'? (Schlenker 2011)

  (46) Alice and Claire both did well in the class, but the former is clearly the better student.

Cataphora

This seems correct!

(47) * By the time the former reported the bad news publicly, the CEO and the CFO had already sold all their stocks in the company.

(48) The CEO and the CFO had already sold all their stocks in the company by the time the former reported the bad news publicly.

Section 7

Conclusions

Pronouns in space

The meaning of a locus: $[\![\text{-a}]\!] = \lambda x : \text{at}(\text{a})(x) \,.\, x$

- **Loci = gestures?**

  (49) I choose $\overset{\text{POINT}}{\overline{\text{him}}}$!

- **Loci = features?**

  (50) John told Mary that she would win.

- **Loci = variables?**

  (51) John$_i$ told Bill$_j$ that he$_j$ would win.

Conclusion

- **A common theme:** as soon as you get rid of the use of space, the patterns are exactly those of spoken language.
- But, by using space, sign language is able to do something that is more than what we see in spoken language.
  - Elimination of ambiguity in certain constructions.
  - Power of pictorial representation.
- This allows us a window into the deeper machinery behind the scenes, and to make connections between different parts of linguistic theory.

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