The linguistics of coordinated thought

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Coordination: Fine on Frege’s puzzle

- Fine’s 2007 *Semantic relationalism*: Coordinated expressions are conceived of as being about the same object.
- Occurrences of individual-denoting expressions can be coordinated or not.
- Rule of thumb: coordinate occurrences of the same name.

Coordination tracks **cognitive status** in unembedded examples:

1. Superman is Superman.
2. Superman is Clark Kent.

Coordination tracks **truth conditions** in attitude reports:

3. Lois believes Superman is Superman.
4. Lois believes Superman is Clark Kent.

How to integrate coordination in a compositional grammar?
Preview of my proposal: double indexing

(5)  a. Superman$\langle k,s \rangle$ is Superman$\langle k,s \rangle$.
    b. Clark Kent$\langle k,c \rangle$ is Superman$\langle k,s \rangle$.

  • First coordinate tracks binding and coreference
  • Second coordinate tracks coordination
  • Two occurrences are coordinated iff they have the same second coordinate

Other double-indexing accounts

Fiengo and May’s 1994 $\alpha$ and $\beta$ occurrences:

(6)  a. John$^\alpha_1$ saw his$^\alpha_1$ mother.
    b. John$^\alpha_1$ saw his$^\beta_1$ mother.

Santorio’s 2014 elevated indices:

(7)  a. Lois thinks Superman$^\chi_1$ is Superman$^\chi_1$.
    b. Lois thinks Clark Kent$^\chi_1$ is Superman$^\chi_1$.

Also: Ninan’s 2012 tagged multi-centered worlds
Pryor 2014 and the mutiplicity of objects

- Pryor’s proposal: represent thoughts as (hyper)graphs
- Nodes represent the objects of thought
- Edges represent relations among those objects

Pryor 2014:19:

“What unites the different models I’ve sketched here is their shared strategy of representing the difference between coordinated and uncoordinated thinking in terms of how many mental verticies are present in the underlying graph.”

- Lois’ double-thinking: two mental verticies, one person

Essential idea: let there be a distinct object in the model for each way of thinking about an entity.
Variabilism

Fine 2007, Cumming 2008: names in natural language are like variables in a formal language

[Each woman impersonates another in a way that fools Biron.]

(8) Biron thinks Katherine is Rosaline. (true)
(9) Biron thinks Rosaline is Katherine. (false)

- Cumming: names can be bound by quantifiers [hm.]
(10) Ann thinks every boy likes his mother.
    - Ann accurately tracks which boys like which women
    - Ann does not know which boys are related to which women

(11)
   a. Ann thinks every boy_i likes his_i mother. Coordinated
      |____________|
   b. Ann thinks every boy_i likes his_i mother. Uncoordinated
      |----//-------|

Scope is not the answer

(12) Ann is certain no boy likes his mother.
Quantifier must scope under attitude verb on pain of wrong TCs
Occurs even with reflexives

(13) Ann thinks that every strand passes underneath itself.

- Ann thinks: *this* strand passes underneath *that* strand...
- Ann thinks: I wonder which strands are connected to which other strands?

Information about grammatical coreference (e.g., reflexives) must be independent of coordination.
Concept Generators

Percus and Sauerland 2003, Charlow and Sharvit 2014:

A concept generator $G$ is a function from entities to individual concepts:

$$e \rightarrow s \rightarrow e$$

(14) a. Ann thinks every boy voted for himself.
   b. Ann thinks $\lambda G \forall x. \text{boy } x \rightarrow \text{voted-for } (Gx)x$

- The universal quantifier binds all occurrences of $x$
- The object of Ann’s thoughts is a proposition parameterized by a (sequence of) concept generator(s) $G$
- $G$ applied to an entity returns an individual concept that represents who Ann thinks $x$ is
- In all report worlds $i$, $Gxi = x$.
- In some of Ann’s belief worlds $j$, $Gxj \neq x$
Unforced errors

Pryor’s distracted mathematician:

(15) 17 isn’t divisible by 4, or by 2, or by 11, or by 17, or by 13. (uncoordinated)

(16) 17 isn’t divisible by 4, or by 2, or by 11, or by itself, or by 13. (coordinated)

• The distracted mathematician who utters (15) need not believe that 17 might not be the number we think of as 17.

Flugh the alien observes what appear to be spinning orbs via two eyes on long, flexible eyestalks, not realizing he is viewing a single object.

Thinking double about an object does not require believing that the two objects have any properties that distinguish them.
Deliberate uncoordination (Rappaport 2014)

Linguistic constraint: conjuncts must be uncoordinated

(17) Ann, Bill, and Ann left. (*infelicitous if Ann$_1$ == Ann$_2$*)

(18) The Evening Star and the Morning Star are the same celestial object.

• *The Evening Star* and *The Morning Star* are uncoordinated.
• Yet they are asserted to be identical.
• If we report that Ann believes (18), the two expressions must be identical in each of her belief worlds.

Thinking of objects as characterized by the same individual concept is neither necessary nor sufficient for coordination
Not compositional in the usual sense (not a dealbreaker)

But coordination does not affect the value of $\forall x. xRx$

Therefore no account of bound de re

Pronouns, names translate as an ordered pair of variables

Expressions are evaluated with respect to a pair of assignment functions

(19) $\llbracket \langle \alpha, \beta \rangle \rrbracket^f,g = \langle f(\alpha), g(\beta) \rangle$

Assume $f$ and $g$ map variables into the natural numbers

Then objects are identified by their position in the plane

The first coordinate governs binding and “coreference”

Expressions w/matching second coordinates are coordinated
(20) Superman is Superman.
\[ \langle k, s \rangle \textbf{is} \langle k, s \rangle \]

\[ f_k = g_s = 2 \]
Clark Kent is Superman

(21) Clark Kent is Superman.
   \[ \langle k, c \rangle \textbf{is} \langle k, s \rangle \]

   \[ fk = gs = 2, gc = 3 \]

Objects aligned vertically: coreferent, uncoordinated
Ann thinks Clark voted for Superman

(Santorio): How does a coordination relation impose constraints on the attitude state of the subject of an attitude report?

Domain = \{\langle 1, 1 \rangle, \langle 2, 2 \rangle, \langle 2, 3 \rangle\}

i_1: voted-for = \{((\langle 2, 2 \rangle, \langle 2, 2 \rangle))\}

i_2: voted-for = \{((\langle 2, 2 \rangle, \langle 2, 3 \rangle))\}

i_2: voted-for = \{((\langle 2, 2 \rangle, \langle 2, 3 \rangle), (\langle 2, 3 \rangle, \langle 2, 2 \rangle))\}

Index fit for belief: \( \forall P \forall a, b, c. P(\ldots \langle a, b \rangle \ldots) \equiv P(\ldots \langle a, c \rangle \ldots) \)

\( [\chi \ thinks \ p]^{f,g,i} = \forall i' \in DOX_x(i). i' \ is \ fit \ for \ belief \ \land [p]^{f,g,i'} \)

\( [Ann_{\langle 1,1 \rangle} \ thinks \ Superman_{\langle 2,2 \rangle} \ voted-for \ Clark_{\langle 2,3 \rangle}]^{f,g,\@} = \forall i \in DOX_{Ann}(\@). [Superman_{\langle 2,2 \rangle} \ voted-for \ Clark_{\langle 2,3 \rangle}]^{f,g,i} \)
Reporting confusion

(22) Biron \(\langle b, b \rangle\) thinks that Katherine \(\langle k, r \rangle\) is Rosaline \(\langle r, r \rangle\).

(23) Biron \(\langle b, b \rangle\) thinks that Rosaline \(\langle r, r \rangle\) is Katherine \(\langle k, k \rangle\).

(24) Biron \(\langle b, b \rangle\) thinks that Rosaline \(\langle r, r \rangle\) is Katherine \(\langle k, r \rangle\).

Coordinated but not coreferent

- Projection onto the horizontal axis: report world picture
- Projection onto the vertical axis: attitude world picture

See Percus and Sharvit 2014 for data and discussion
   b. \( \langle a, a \rangle \text{ thinks} \left( \forall \langle b, b \rangle. \langle b, b \rangle \text{ voted-for} \langle b, b \rangle \right) \)

(26) a. Ann thinks every boy voted for himself.
   b. \( \langle a, a \rangle \text{ thinks} \left( \forall \langle b, b \rangle. \langle b, b \rangle \text{ voted-for} \langle b, b' \rangle \right) \)
Quantificational details

\[ [\forall \langle \alpha, \beta \rangle . \phi]^f,g = \text{TRUE} \iff \text{for all } \langle m, n \rangle \text{ in } D, \exists g' \text{ such that} \]
\[ [\phi]^f[\alpha \mapsto m], g' = \text{TRUE} \]

Paraphrase: for each object in the domain, there must be a way of assigning coordination indicies to rows that makes \( \phi \) true

\[ [\exists \langle \alpha, \beta \rangle . \phi]^f,g = \text{TRUE} \iff \text{for some } \langle m, n \rangle \text{ in } D, \exists g' \text{ such that} \]
\[ [\phi]^f[\alpha \mapsto m], g' = \text{TRUE} \]

Bound de re under downward-entailing operators

(27) Ann is certain no boy pointed at himself. (= 12)

- For C&S 2014, requires universal quantification over sequences of concept generators.
- Diagnosis: selection of concept generators should happen at the level of the nuclear scope, not at the level of the attitude verb
(28) a. John$_1^\alpha$ saw his$_1^\alpha$ mother.
   b. John$_1^\alpha$ saw his$_1^\beta$ mother.

Fiengo and May 1994:48: “[superscript indicies] indicate whether an expression is dependent on its linguistic context (β-occurrence) or not (α-occurrence).”

- Exactly two possible choices for the upper index: α or β
- α occurrence: uncoordinated
- β occurrence: ‘dependent’ on a linguistic antecedent
\(\alpha/\beta\) marking leaves out some coordination schemes

\[\forall x [...x...x...x...]\]

- Five distinct coordination patterns:
  \[\langle x, a \rangle, \langle x, b \rangle, \langle x, c \rangle;\]
  \[\langle x, a \rangle, \langle x, a \rangle, \langle x, c \rangle;\]
  \[\langle x, a \rangle, \langle x, b \rangle, \langle x, b \rangle;\]
  \[\langle x, a \rangle, \langle x, b \rangle, \langle x, a \rangle;\]
  \[\langle x, a \rangle, \langle x, a \rangle, \langle x, a \rangle\]

- Four distinct \(\alpha\)-\(\beta\) configurations:
  \(\alpha, \alpha, \alpha;\)
  \(\alpha, \beta, \alpha;\)
  \(\alpha, \beta, \beta;\)
  \(\alpha, \alpha, \beta\)

- (Can’t have a \(\beta\) without a preceding \(\alpha\).)
Other double-indexing accounts: Ninan 2012

- Ralph sees Ortcutt sneaking around the docks late at night
- This is the only way that Ralph is acquainted with Ortcutt

(29) Ralph imagines Ortcutt flying a kite in alpine meadow.

- The problem: Ortcutt is not sneaking around the docks in any of Ralph’s imagination worlds, so in what sense does the person flying the kite correspond to Ortcutt?
- **Similar to the problem of de se**: there may be no qualitative property that reliably picks out the speaker in all of the speaker’s belief worlds
- Centered worlds provide a solution for de se: a centered world is a pair of a world and an individual, where the individual is taken to represent the speaker in that world.
- p. 28: “on the centered worlds approach, the ‘de se representation relation’ is extremely thin: anything anywhere in logical space represents a way for [the speaker] to be”
Ninan’s solution: tagged multi-centered worlds

- Generalize the de se solution to handle de re: let worlds have multiple centers, one for each object of thought
- ‘Tag’ each center to track who represents who
- For double vision, pair each tag with an acquaint. relation

(30) [Later, Ralph sees Ortcutt at the beach. Ralph thinks ‘What if the guy on the docks fought the guy on the beach?’] Ralph imagines Ortcutt\(_{o,d}\) fighting himself\(_{o,b}\).

\((w, ((Ralph, ident), x), ((Ortcutt, docks), y), ((Ortcutt, beach), z))\)
\((w', ((Ralph, ident), x'), ((Ortcutt, docks), y'), ((Ortcutt, beach), z'))\)

- I take the tags to be an individual in the report world
- The acquaintance relations allow multiple counterparts
- The special acquaintance relation ident marks the se
Comparison with my view

- A tagged center is a complex variable and its referent
- So the tagged center \(((\text{Ortcutt, docks}), x) \sim (\langle o, d \rangle, \langle f o, g d \rangle)\)
- Crucially, the content of the acquaintance relation plays no role in determining the referent. That’s Ninan’s point p. 33: “the solution is to relinquish the demand that the representing individuals in a potential imagingination alternative be qualitatively similar to the individual that they represent”
- The compositional link between expressions and which center represents them is not spelled out in Ninan 2012
- In particular, there is no explicit solution for bound de re
(31) a. Ann thinks every boy likes himself.

    b. Ann thinks \([\lambda_1[t^q_i \text{ likes } x^\omega_i]]\)

- p. 20 [my paraphrase]: We need to separate information about identity and coreference in the report worlds from information about identity and coreference in the attitude worlds.
- ‘Elevated indicies’ track the acquaintance relation with respect to which an attitude holder is acquainted with the object in question.
- Compositional connection similar to the one proposed here.

(Elevated index interpretation)  
\[
[a^K]_{c,g,a,i} = [a(K)]([a]_{c,g,a,i}(i))
\]

\(a\) assigns elevated indicies to concept generators

(31)  
\[
\lambda i \exists a. \forall i \in DOX_{Ann}, \forall x. a_\sigma x_i \text{ likes } a_\omega x_i
\]

In effect (like P&S, C&S) \(\exists\) over sequences of concept generators; like C&S, also need \(\forall\) for DE quantifiers?
Conclusions

(1) Acquaintance relations are bits of frozen causal history
(2) The have an explanatory role to play in understanding how mental content comes into being, and in particular, how at least some coordination relations do or don’t arise
(3) However, they are not motivated by linguistic facts, including predicting truth conditions
(4) Linguistic facts motivate something much thinner than an acquaintance relation, namely,
(5) Coordination relations, which track (only!) whether two expression occurrences are conceived of as necessarily the same, or not

THANKS
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Key References
Percus, Orin, and Yael Sharvit. 2014. Copular asymmetries in belief reports. SALT.