

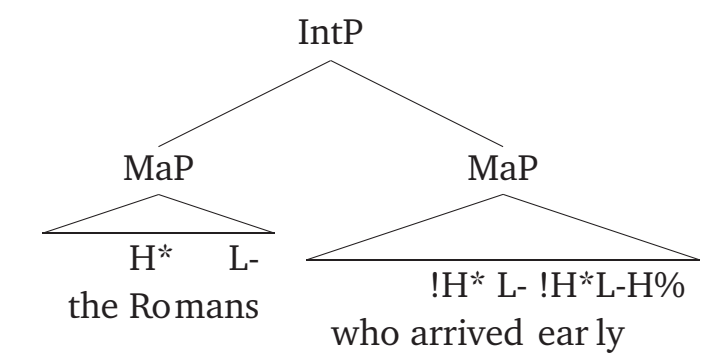
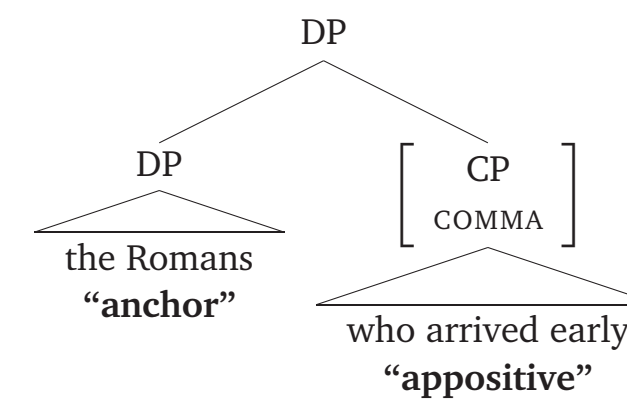
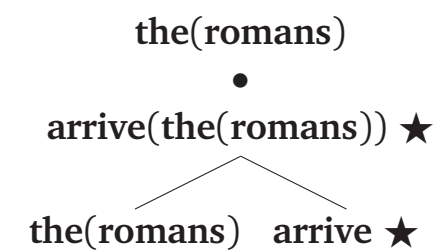
The dynamics of apposition

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With contributions from Jesse Aron Harris

Background structural and compositional assumptions



Empirical focus

Nominal appositives

- (1) Lucille Gorman, an 84-year-old Chicago housewife, has become amazingly immune to stock-market jolts. [Treebank]

Appositive relatives

- (2) uh, she starts a new job tomorrow, which should take her out of the house about four days a week. [Switchboard]

Outside the purview of this talk

- (3) a. Lance Armstrong has, it seems, taken up marathon running.
 b. The cyclist Armstrong is taller than the astronaut Armstrong.
 c. Armstrong the cyclist is taller than Armstrong the astronaut.
 d. As president, I would make linguistics madatory in high school.

The differences can be subtle, often tracing to the presence of absence of a single word.

Central questions

Craige Roberts (p.c.)

The main point for me is that I have come to strongly suspect that proper understanding and use of dynamic interpretation will permit one to account for/calculate conventional implicatures without a separate semantic dimension per se. Easy to say, I know, and far more challenging to really work out, but I think it would be worthwhile to try.

Question 1 Can we develop a dynamics of apposition that captures the special role appositives play in discourse?

Amaral et al. (2007:736)

This possibility of shifting from speaker-orientation toward anchoring to another doxastic agent (believer) is, as one might expect, context-dependent, and in general seems to be easier with embedded complements of attitude verbs than in indirect speech.

Question 2 What conditions facilitate non-speaker-oriented readings of appositives?

Appositives in the wild

In print van Delden and Gomez (2002) manually tagged 15,000 commas drawn randomly from newspapers and encyclopedias:

| | Percentage of commas |
|----------------------|----------------------|
| Appositive relatives | 16.5% |
| Nominal appositives | 16.2% |
| Modifiers | 35.9% |
| Coordination | 24.9% |
| Other | 6.5% |

In speech Appositives of this type are less common in speech than in writing. Rough counts:

| | Appositive relatives | Sentences | |
|--------------------------------|----------------------|-----------|-------|
| Discourse tagged Switchboard | 64 | 357,486 | 0.01% |
| CNN interview transcripts | 36,739 | 6,013,393 | 0.6% |
| Treebank 2 Wall Street Journal | 1355 | 89,143 | 1.5% |

The urge to appositivize Vacuous quantifications involving appositive relatives are common:

- (4) Conan O'Brian: There are funny things like "If They Mated," which, we're not kidding ourselves: We know that it's just funny pictures. (Interview in The Onion, May 23, 2001)

Perhaps appositivizing is so tempting as an information-structuring move that it is done even when there is no syntactic motivation for it.

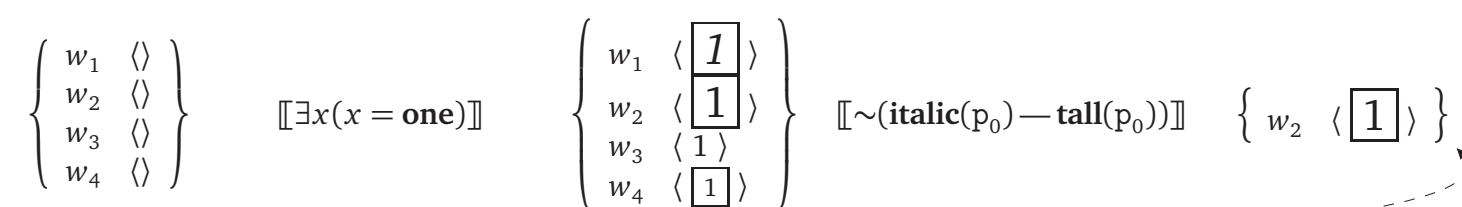
Overview

The case for appositive dynamics Discourse-level anaphoric relations (e.g., pronouns and their antecedents) can easily cross appositive boundaries. The evidence indicates that appositives are interpreted exactly where they sit in the string. It also shows that appositives are knit tightly into the fabric of the sentences that contain them.

Speaker and non-speaker orientation Wang et al. (2005), Karttunen and Zaenen (2005), and Amaral et al. (2007) show that (pace Potts) appositive content can be evaluated from a non-speaker perspective. I present novel evidence from corpora and human-subjects experimentation that point to a treatment of this that is based in perspective-shifting in the pragmatics.

Intensional PLA with Apposition This system is inspired by Groenendijk et al. (1996) (henceforth GSV), but it employs the stack-based theory of anaphora of Dekker's PLA, and it makes some use of the prominence-driven approach of Bittner (2001, 2003). The goal is a theory that is rich enough to permit a fair assessment of whether the dynamics can yield insights into why appositives are special.

Appositive pragmatics Intensional PLA with Apposition is useful, but, in my view, it doesn't fully answer the question of why speakers appositivize.



The number one exists.

That number, which is tall, isn't italic.

Is this all there is?

Two quick examples to get us started

Example #1

Adapted from Aloni (2000)

In front of Ralph stand two women. Ralph believes that the woman on the left, who is smiling, is Bea, and the woman on the right, who is frowning, is Ann. As a matter of fact, exactly the opposite is the case. Bea is frowning on the right and Ann is smiling on the left.

Which scenario reflects Ralph's belief state? Which reflects reality?

S1: Bea ☹️ Ann ☺️

S2: Bea ☺️ Ann ☹️

S3: Ann ☹️ Bea ☺️

S4: Ann ☺️ Bea ☹️

Example #2

The following is from a jaunty newspaper article about Alfred Kinsey, the biologist who founded the Institute for Research in Sex, Gender and Reproduction.

Far out on the grassy knoll of sexology, there is a cult of procastity researchers who claim that the late Alfred Kinsey was a secret sex criminal, a Hoosier Dr. Mengele, who bent his numbers toward the bisexual and the bizarre in a grand conspiracy to queer the nation and usher in an era of free sex with kids.

On your reading of this snippet of text:

Q1: Whose view is it that Alfred Kinsey was a secret sex criminal?

- The author of the text.
- The cult of procastity researchers.
- Ambiguous between the two (or perhaps both).

Q2: Whose view is it that Alfred Kinsey is appropriately described as a Hoosier Dr. Mengele?

- The author of the text.
- The cult of procastity researchers.
- Ambiguous between the two (or perhaps both).

1 Appositive dynamics

1.1 Additive particles

Additive particles are obligatorily anaphoric (never cataphoric):

- (5) a. Ellen is studying French. Annie is studying French too.
b. # Ellen is studying French too. Annie is studying French.

Appositives can host additive particles and provide antecedents for them.

- (6) a. A friend (who likes to jog) invited Ellen, who likes to jog (too).
b. # Ellen, who likes to jog (too), invited a friend (who likes to jog).
- (7) a. Ellen, (who likes to jog), invited a friend who likes to jog (too).
b. # A friend who likes to jog (too) invited Ellen, (who likes to jog), ...
- (8) Sam, who Joan invited, called Ellen, who invited Joan too.

Two women who were observing the scene asked the officer, who was holding a cell phone and also looking on, whether he didn't think he had better use it to call a doctor. ← (adapted from Dickens' Oliver Twist)

1.2 Pronominal and discourse referents

Appositives can establish discourse referents. Anaphoric pronouns should follow.

- (9) a. Joan, who bought a painting at the show, resold it a few weeks later for double the money.
b. # Joan, who bought it at the show, resold a painting a few weeks later for double the money.
- (10) Sue bought a puppy from her neighbor, whose allergies prevented her from petting it.

1.3 Epistemic modals and update coherence

- (11) a. Sam might know where the car is. ... He doesn't know.
b. # Sam doesn't know where the car is. ... He might know.
- (12) a. Sam, who might know where the car is, will call soon ... He doesn't know where it is.
b. # Sam, who doesn't know where the car is, will call soon. ... He might know where it is.

The facts are much the same for verb-phrase ellipsis, though a bit messier because of cataphoric ellipsis.

1.4 Evidence for pronominal anaphora

Sells (1985) and Del Gobbo (2003) argue that appositive relative pronouns are true discourse pronouns. The best evidence for this, in my view, comes cases in which the appositive has drifted away from its anchor a bit:

- (13) The plan was handed to Minister of Health Nkosazana Zuma Wednesday, who will decide whether or not to adopt it as South Africa's national health policy [Treebank]
- (14) 'It was like being back in the worst era of the SA [...], the government official responsible for immigrants and foreign workers, Cornelia Schmalz-Jacobsen said, who saw the events in Magdeburg as a 'horrible climax' to the xenophobic violence [Gigaword]

The extraposition-like drift seems to be possible only if no competing discourse referents intervene, suggesting that it is prominence-driven in some very controlled sense.

2 The interpretation of syntactically embedded appositives

2.1 Semantically embeddable?

Potts 2005 NAs and appositive relatives are always speaker-oriented: they project out of both holes and plugs (Karttunen 1973).

- (15) ESPN reported on Sunday, April 11, that the Lightning, who have been playing in 10,400-seat Expo Hall, are exploring opportunities to move to either Atlanta or Minneapolis. But Esposito [Lightning general manager —CP] said there was no truth to the report. (20_newsgroups)
- (16) King: And you don't think at all they have a point when they say you and others like you, who speak out forcefully against it, help al Qaeda?
Pelosi: No. (Larry King Live, Feb 27, 2007)
- (17) I think it would concern me even more if I had children, which I don't, [...]

Wang et al. 2005 Indefinite appositives with indefinite anchors can be trapped by conditional antecedents and modals:

- (18) If a professor, a famous one, publishes a book, he will make a lot of money.
(19) Mary wants to marry an Italian, a rich one.

Karttunen and Zaenen 2005 Appositive content projects like presuppositional content; "we agree with Potts that supplemental expressions give rise to conventional implicatures but we disagree with his view that the author is always unconditionally committed to them."

- (20) a. If Rader really is the BTK killer, then the murder of Miss Davis, Rader's last victim, has finally been solved.
b. If the charges against him are true, Hanssen, who sold FBI secrets to the Russians, could face the death penalty.

Amaral et al. (2007:738) "However, in the cases where CIs are anchored to an agent other than the speaker, they do appear to take narrow scope relative to the embedding attitude predicate [...]."

- (21) Joan is crazy. She's hallucinating that some geniuses in Silicon Valley have invented a new brain chip that's been installed in her left temporal lobe and permits her to speak any of a number of languages she's never studied. Joan believes that her chip, which was installed last month, has a twelve year guarantee.

2.2 Embedded appositives annotated dataset

278 appositive relatives with nominal anchors that appear in the syntactic complements to attitude verbs and verbs of saying. Example:

- (22) Hartzenberg said he would ask Terre'Blanche, who heads the extremist Afrikaner Resistance Movement (AWB), if he would meet Mandela.

2.2.1 Sources (about 177 million words in all)

- The Gigaword fragment downloadable from the LDC website
- The 20_newsgroups corpus
- The sample of the Penn Treebank distributed with NLTK
- Novels downloadable from Project Gutenberg
- TV show transcripts downloadable from CNN.com

2.2.2 Search method (after sentence-chunking)

PREDS (es|s|ed)?.*[A-Z][a-z]*\, \s+(who|whom|whose)\s

```
PREDS ::=
affirm allege announce argue assert
believe certain claim conclude conjecture
declare guess imply|implies judge move
presume request remark report rumor
say|said suggest suppose sure think|thought
trust understand
```

2.2.4 Annotator

```
Terminal - ruby -- 98x32
They kept this day as a holiday, then and ever after, and spent the time in feasting and dancing
"If our friends, the Scarecrow and the Tin Woodman, were only with us," said the Lion, "I should be
quite happy
" "Don't you suppose we could rescue them
" asked the girl anxiously
"We can try," answered the Lion

EMBEDDED_APPOSITIVE:
So they called the yellow Winkies and asked them if they would help to rescue their friends, and t
he Winkies said that they would be delighted to do all in their power for Dorothy, who had set the
m free from bondage

So she chose a number of the Winkies who looked as if they knew the most, and they all started awa
y
They traveled that day and part of the next until they came to the rocky plain where the Tin Woodm
an lay, all battered and bent
His axe was near him, but the blade was rusted and the handle broken off short
The Winkies lifted him tenderly in their arms, and carried him back to the Yellow Castle again, do
rthy shedding a few tears by the way at the sad plight of her old friend, and the Lion looking so
ber and sorry
When they reached the castle Dorothy said to the Winkies: "Are any of your people tinsmiths.

Root form of embedding predicate [enter 'irrelevant' if example is irrelevant]> say
What is the widest scope possible for the appositive content?
[return: unclear 0: text 1: matrix subject 2: embedded subject ...]
>1

Evidence for the classification> More textual evidence is needed for this classification, but the
appositive seems to have been offered by the Winkies as a reason for their eagerness to help. Expe
rts in these novels tell me it is true, though, that Dorothy is the Winkies' savior.

Other notes> [ ]
```

2.2.3 Evidence for the interpretive classifications

- Presupposition triggers dependent on the truth of the appositive.
- Text-level anaphoric devices (especially sentential *it*, *that*, and *this*) that depend anaphorically on the appositive.
- Patterns of contradiction in the broad sense defined by de Marneffe et al. (2008).
- Discussion that pragmatically presupposes the truth of the appositive content.
- The suggestions and restrictions specified in annotation guides for textual entailment corpora. (See the PASCAL website: <http://pascallin.ecs.soton.ac.uk/>.)

I emphasize *textual*. In all the cases where the given annotation is 'no textual evidence available', the content seemed clearly intended to be interpreted as text-level.

Javascript interface, data in XML, and notes on the motivation, data, and annotations: <http://people.umass.edu/potts/data/embeddedappositives/>

2.3 Initial results

2.3.1 Embedding runs counter to expectations

| Annotation | Example count |
|---------------------|---------------|
| No textual evidence | 182 |
| Text-level | 82 |
| First embedding | 13 |
| Second embedding | 1 |

- Of the 96 cases with textual evidence for a classification, 15% are non-text-level.
- For the entire dataset, 5% are not text-level.

Generalization A speaker who uses one with the intention of embedding it is engaged in risky behavior in the sense that our *expectations* about this construction are that it will be speaker-oriented.

2.3.2 Verbs of saying

| Embedding pred. | Embedded int. | Unembedded int. |
|-----------------|---------------|-----------------|
| say | 13 | 50 |
| not say | 1 | 32 |

Research question Does the type of the embedding predicate affect the likelihood of an embedded reading?

Logistic regression $p = 0.046077$

2.4 Conclusions

- **Appositive update order:** The updates happen in the order in which the content is heard.
- **Appositive embedding:** Attested but rare.

3 Unembedded perspective shifting

Though I don't presently have evidence that appositives can shift even when unembedded, I do have such evidence for predicates of personal taste and expressives.

Predicate of personal taste from Lasersohn 2005

(23) [Context: "Suppose John is describing to Mary how their two-year-old son Bill enjoyed a recent trip to the amusement park. Something like the following dialog might occur:"]

Mary: How did Bill like the rides?

John: Well, the merry-go-round was fun, but the water slide was a little too scary.

Expressive

(24) I was struck by the willingness of almost everybody in the room — the senators as eagerly as the witnesses — to exchange their civil liberties for an illusory state of perfect security. They seemed to think that democracy was just a fancy word for corporate capitalism, and that the society would be a lot better off if it stopped its futile and unremunerative dithering about constitutional rights. Why humor people, especially poor people, by listening to their idiotic theories of social justice? (Lewis Lapham, Harper's Magazine, July 1995)

Expressive and epistemic modal

(25) While shopping at one of my local Apple stores the other day, I overheard an earnest conversation about safeguarding Mac computers against things like viruses and trojans. The customer and companion were new to Mac life and were convinced that they should be very worried about viruses. The Apple salesperson on the floor repeatedly assured them that they would not need extra antivirus protection for their Mac. The customer then argued that Symantec makes an antivirus program for Macs, therefore, it must truly be a credible threat, otherwise there would be no such products. Some antivirus products are even sold in Apple stores. I've heard similar arguments before: if companies like Symantec or McAfee make antivirus applications for the Mac, then Macs must truly be vulnerable somehow, somewhere. Steve Jobs and the rest of the Apple cronies must be lying. (Found by Jesse Aron Harris on the Net)

For comparison, an embedded case from Amaral et al. 2007:

(26) [Context: We know that Bob loves to do yard work and is very proud of his lawn, but also that he has a son Monty who hates to do yard chores. So Bob could say (perhaps in response to his partner's suggestion that Monty be asked to mow the lawn while he is away on business):]

Well, in fact Monty said to me this very morning that he hates to mow the friggin' lawn.

3.1 Jesse Aron Harris's pilot study of unembedded epithets

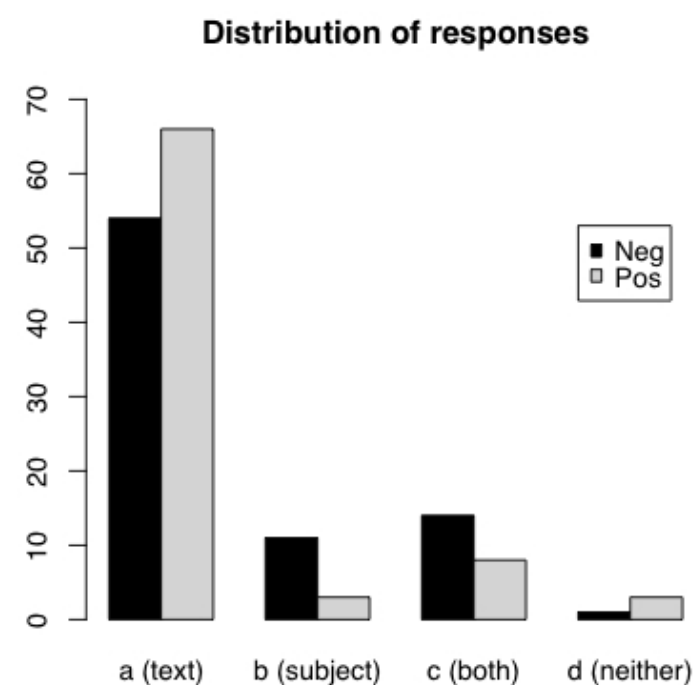
3.1.1 Set-up

- **Participants:** 20 UMass Amherst undergraduates.
- **Materials:** Questionnaires divided into four randomized, counterbalanced lists. Two other experiments were included, testing different constructions, along with 10 fillers, for a total of 58 items.
- **Question:** Will a positive or negative evaluative adjective affect the understood perspective for epithets?
- **Sample item:**

My friend Sheila said that her history professor gave her a really (high/low) grade. The jerk always favors long papers.

Whose opinion is it that Sheila's history professor is a jerk?

- a. Mine
- b. Sheila's
- c. Both mine and Sheila's
- d. Neither mine nor Sheila's



3.1.2 Analysis

Although the speaker orientation was preferred across the board, more participants reported more subject oriented interpretations in the negative condition (31.25%) than in the positive condition (13.75%).

A logit model with a single categorical variable of condition (neg vs. pos adj.) significantly predicts whether the epithet could plausibly be attributed to the matrix subject, rather than to the speaker ($p = 0.0096$).

4 Modeling information about the discourse and the world

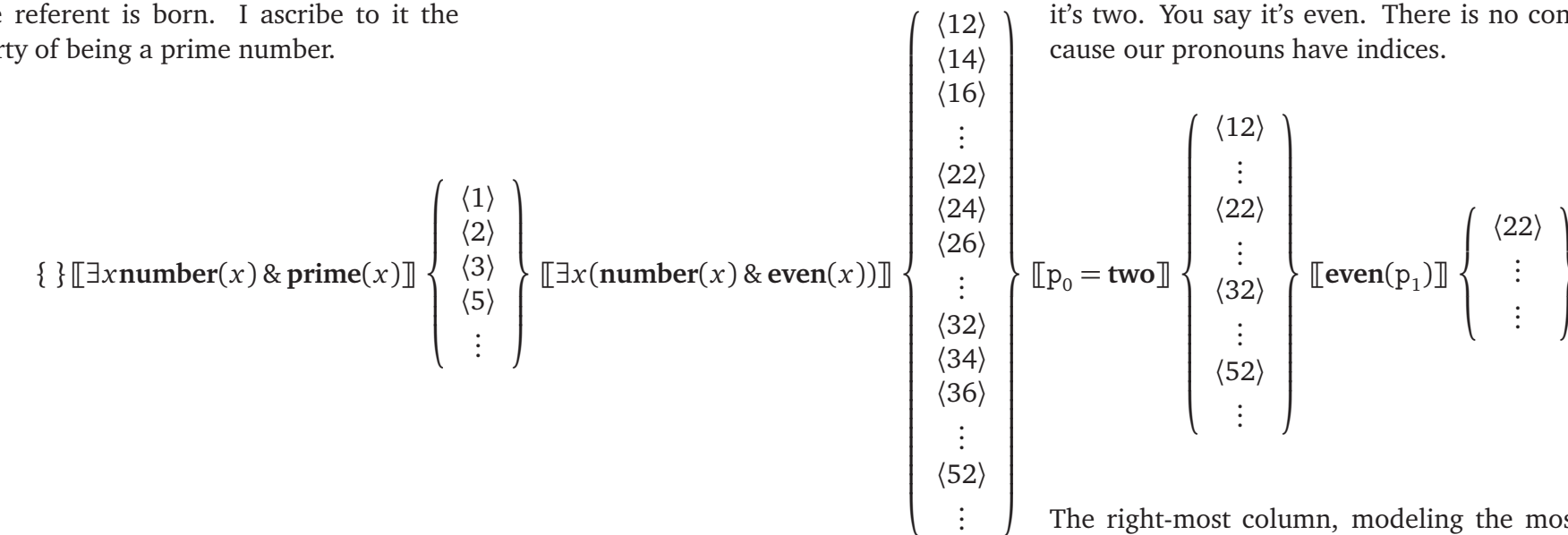
4.1 Information about the discourse: Stack-based anaphora

Dekker's (1994) Predicate Logic with Anaphora (PLA) is a conservative dynamic extension of predicate logic to handle the introduction and manipulation of discourse referents (Karttunen 1976). The presumption is that the discourse participants know everything about the world (which is a first order model) even before they start talking to each other. Discourse is about amassing information about discourse referents.

In the beginning, we share no discourse information. Then I use an existential. A discourse referent is born. I ascribe to it the property of being a prime number.

You say, *A number is even*, and a second discourse referent is introduced.

With two discourse referents, we can now use pronouns to ascribe additional properties to them. I say it's two. You say it's even. There is no confusion because our pronouns have indices.



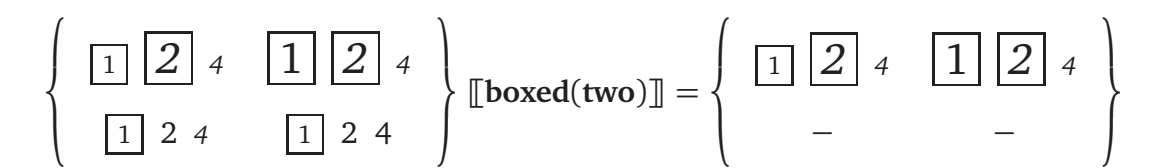
Our single discourse referent is modeled by the single column. (Best to think of it as the final column.) It contains only primes.

We extend every sequence in the input state in every way that is consistent with the properties of that new discourse referent.

The right-most column, modeling the most recently introduced discourse referent, is named by p_0 . The discourse referent introduced just before that one is modeled by the penultimate column and picked out with p_1 . And so forth.

4.2 Information about the world

Not all dynamic theories are about discourse information in the above sense. Those of Heim (1992) and Groenendijk (1999), for example, concern changes to the set of possible worlds that the discourse participants consider to be candidates for the actual world. The initial state, the state of ignorance, is the full set of possibilities. Updates are typically lawfully reductive (the 'classical update property').

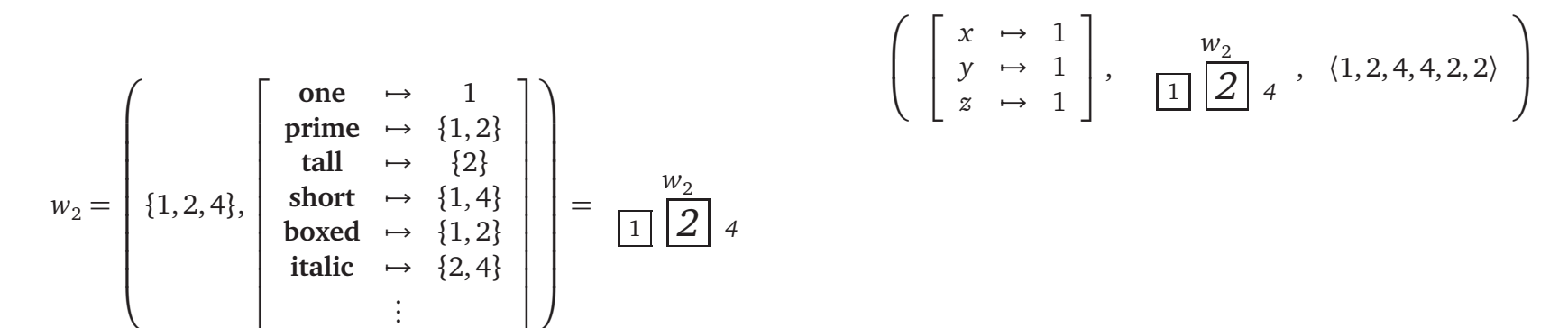


4.3 Putting the two kinds of dynamics together

Definition 1 (Expressions).

- i. Variables range over individuals: x, y , and the like.
- ii. **two, three**, and the like, with their expected meanings.
- iii. Throughout, my predicate symbols are 1-place: **number, even, prime, tall, boxed, null, odd, composite, short, italic**.

Definition 2 (Worlds). A world is a structure $w = (D_w, \|\cdot\|^w)$, where D_w is a domain of entities and $\|\cdot\|^w$ is a valuation function, mapping constants to members of D_w and n -place predicate symbols to subsets of D_w^n .



Definition 4 (Information states). An information state based on D and W is a set s of possibilities based on D and W such that if $i = (g, w, e) \in s$ and $i' = (g', w', e') \in s$, then $g = g'$ and $\text{length}(e) = \text{length}(e')$.

Definition 5 (Projection functions). $\pi_j(e)$ is defined iff $\text{length}(e) \leq j$. Where defined, $\pi_j(e)$ is the j th member of e .

Definition 6 (Extensions). $i = (g, w, e)$ extends to $i' = (g', w', e')$, written $i \preceq i'$, iff $g = g', w = w'$ and $\pi_j(e) = \pi_j(e')$ for all $j \leq \text{length}(e)$.

Definition 7 (Interpretation of basic expressions). The interpretation of α in the possibility $i = (g, w, e)$:

- i. If α is an individual constant or predicate symbol, then $i(\alpha) = \|\alpha\|^w$.
- ii. If α is a variable, $i(\alpha) = g(\alpha)$.
- iii. If α is a pronoun of the form p_j , then $i(\alpha) = \pi_{\text{length}(e)-j}(e)$ (undefined if $\pi_{\text{length}(e)-j}(e)$ is undefined; see definition 5.)

| | 1 | 2 | 3 | 4 | 5 | (tuple coordinates) |
|-------|-------|-------|-------|-------|-------|---------------------|
| | p_4 | p_3 | p_2 | p_1 | p_0 | (pronoun indices) |
| e_1 | a | b | c | d | e | |
| e_2 | a | a | a | d | e | |
| e_3 | a | b | b | d | d | |
| e_4 | e | d | c | b | a | |
| e_5 | a | b | c | b | a | |

4.4 Example: Interpretation in a possibility

- i. $i(\text{short}) = \|\text{short}\|^w = \{1, 4\}$
- ii. $i(y) = g(y) = 1$
- iii. $i(p_3) = \pi_{5-3}(\langle 1, 2, 4, 1, 1 \rangle) = 2$

$$\left(\begin{array}{l} x \mapsto 1 \\ y \mapsto 1 \\ z \mapsto 1 \end{array} \right), \quad \boxed{1} \boxed{2} \boxed{4}, \quad \langle 1, 2, 4, 1, 1 \rangle$$

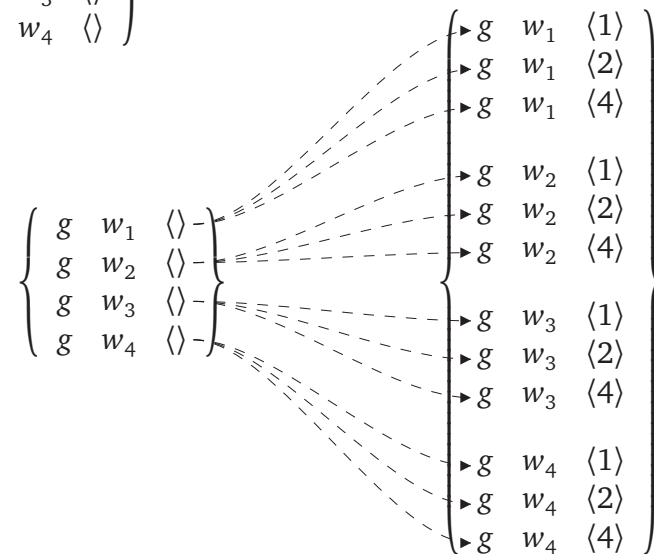
4.5 Example: Building an initial state and extending it

- i. Fix the domain D . $\{1, 2, 4\}$
- ii. Fix the set of worlds W and define their valuation functions. $\left\{ \begin{array}{l} w_1, \\ \boxed{1} \ 2 \ \boxed{4} \end{array} \right\}, \left\{ \begin{array}{l} w_2, \\ 1 \ \boxed{2} \ 4 \end{array} \right\}, \left\{ \begin{array}{l} w_3, \\ \boxed{1} \ \boxed{2} \ \boxed{4} \end{array} \right\}, \left\{ \begin{array}{l} w_4, \\ \boxed{1} \ \boxed{2} \ \boxed{4} \end{array} \right\}$
- iii. Fix an assignment function g that maps variables into D . $[x \mapsto 1 \ y \mapsto 1 \ z \mapsto 1]$

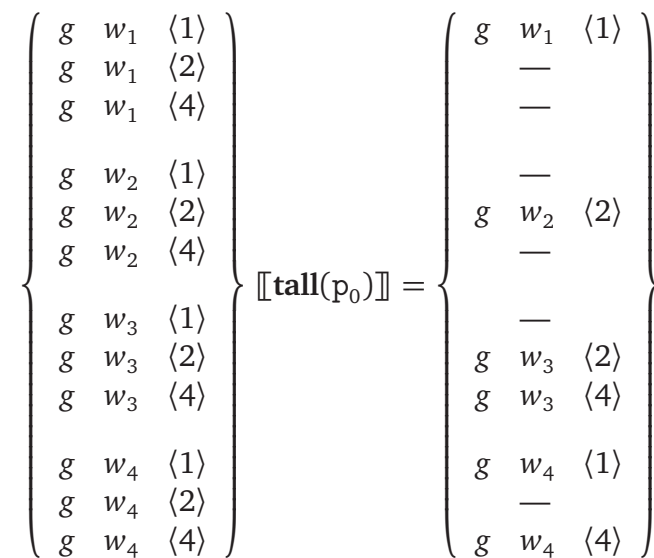
This is the start of the discourse, which means there is not yet any discourse information. Thus, the possibilities in s should have empty sequences:

$$\left\{ \begin{array}{l} g \ w_1 \ \langle \rangle \\ g \ w_2 \ \langle \rangle \\ g \ w_3 \ \langle \rangle \\ g \ w_4 \ \langle \rangle \end{array} \right\}$$

A pure, unfettered extension extends every existing possibility with every entity in the domain:



If you learn that the most recently introduced discourse referent is tall, then some sequences are removed.



4.6 What does it mean to be dynamic? (One answer)

An update function is static iff it is eliminative and distributive (van Benthem 1986; Muskens et al. 1997).

Definition 8 (Eliminativity).

$$s \llbracket \varphi \rrbracket \subseteq s$$

Definition 9 (Distributivity).

$$s \llbracket \varphi \rrbracket = \bigcup_{w \in s} \{w\} \llbracket \varphi \rrbracket$$

The metaphor [that assertions are like computer programs –CP] helps to explain some other features of discourse as well. For instance, it makes it easier to see why the meaning of a series of assertions is sensitive to order, why saying ‘John left. Mary started to cry.’ is different from saying ‘Mary started to cry. John left.’ Clearly, the result of executing two programs will in general also depend on the order in which we run them.

Muskens et al. (1997:589)

5 Intensional PLA with apposition

5.1 Formulae

The predicates and constants are as specified as in definition 1.

Definition 10 (Pronouns). The set of pronouns is $\{p_0, p_1, \dots, \infty\}$.

Definition 11 (Terms). t is a term iff t is an individual constant, a variable, or a pronoun. Call this set *Terms*.

Definition 12 (Formulae). The set of formulae is the least set *WFF* such that

- i. $R(t_1, \dots, t_n) \in WFF$ if R is an n -place predicate and $t_1 \dots t_n$ are terms.
- ii. $(t = t') \in WFF$ if t and t' are terms.
- iii. $\sim \varphi \in WFF$ if $\varphi \in WFF$.
- iv. $\diamond \varphi \in WFF$ if $\varphi \in WFF$.
- v. $+_j R(t_1, \dots, t_j, \dots, t_n) \in WFF$ if $R(t_1, \dots, t_j, \dots, t_n) \in WFF$ and $i \leq j \leq n$.
- vi. $(\varphi \& \psi) \in WFF$ if $\varphi \in WFF$ and $\psi \in WFF$.
- vii. $(\varphi - \psi) \in WFF$ if $\varphi \in WFF$ and $\psi \in WFF$.
- viii. $\exists x \varphi \in WFF$ if $\varphi \in WFF$ and x is a variable.

5.2 Semantics, intuitively (well, I’ll try ...)

Definition 13 (The basic update function).

$$\text{UPDATE}(\varphi, s, a)$$

Here s and a are *pointers* to an information state. Updates target these pointers. Changes to them are, semantically, changes to the state they point at.

Definition 14 (Standard updates). The *standard* way to update a state @ with φ is to define s as a pointer to @ and then do

$$\text{UPDATE}(\varphi, s, s)$$

Wiggle room: we could pass two pointers to different states \approx perspectives.

UPDATE(φ, s, a)

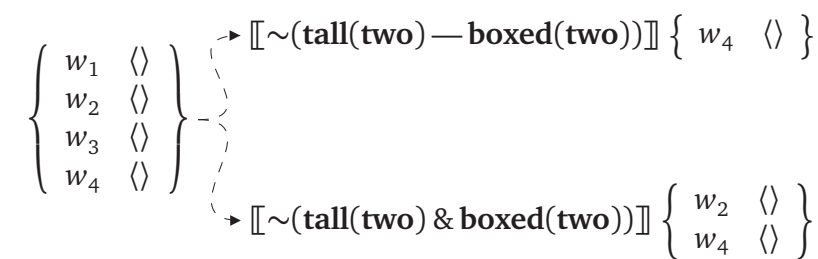
- 1 **if** $\varphi \cong R(t_1, \dots, t_n)$ ▷ atomic
- ▷ change the actual state s points at
- 2 **do** $s \leftarrow \{i \in s \mid \langle i(t_1), \dots, i(t_n) \rangle \in i(R)\}$
- 3 **elseif** $\varphi \cong (\psi \& \chi)$ ▷ conjunction
- 4 **do** UPDATE(ψ, s, a)
- 5 UPDATE(χ, s, a)
- 6 **elseif** $\varphi \cong (\psi - \chi)$ ▷ apposition
- 7 **do** UPDATE(ψ, s, a)
- 8 UPDATE(χ, a, a)
- 9 **elseif** $\varphi \cong \sim \psi$ ▷ negation
- 10 **do** $h \leftarrow \text{copy}(s)$
- 11 UPDATE(ψ, h, a)
- 12 $s \leftarrow \{i \in s \mid \text{there is no } i' \in h \text{ such that } i \preceq i'\}$
- 13 **elseif** $\varphi \cong +_j R(t_1, \dots, t_j, \dots, t_n)$ ▷ additive particle
- 14 **do**
- 15 **for** $t' \in \text{Terms}$
- 16 **do** $h \leftarrow \text{copy}(s)$
- 17 UPDATE($R(t_1, \dots, t', \dots, t_n), h, h$)
- 18 **if** $h = s$
- 19 **do** $s \leftarrow \text{UPDATE}(R(t_1, \dots, t_j, \dots, t_n), h, a)$
- 20 **return**
- 21 $s \leftarrow \text{undefined}$
- 22 **elseif** ...

Pause to work through examples with the online version:
<http://web.linguist.umass.edu/~potts/ul/>

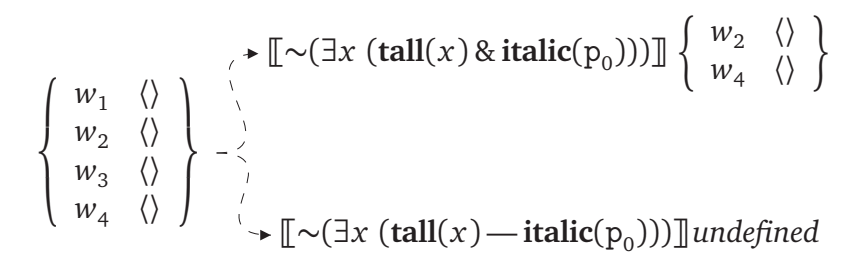
Chris Barker and Chung-chieh Shan have a plan for working this out nicely with continuations

5.3 Apposition and conjunction

Equivalent when unembedded



Divergence under negation



5.4 Inbound and outbound additive particles

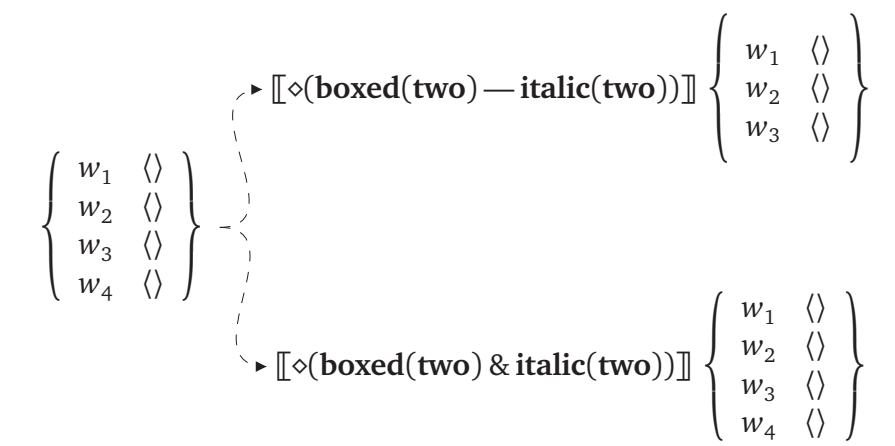
Two, which is italic, is boxed. One is italic too.

$$\left\{ \begin{array}{l} w_1 \ \langle \rangle \\ w_2 \ \langle \rangle \\ w_3 \ \langle \rangle \\ w_4 \ \langle \rangle \end{array} \right\} \llbracket ((\exists X (X = 2) - \text{italic}(p_0)) \& \text{boxed}(p_0)) \rrbracket \left\{ \begin{array}{l} w_1 \ \langle \boxed{2} \rangle \\ w_3 \ \langle \boxed{2} \rangle \end{array} \right\} \llbracket +_1 \text{italic}(\text{two}) \rrbracket \left\{ \begin{array}{l} w_1 \ \langle \boxed{2} \rangle \\ w_3 \ \langle \boxed{2} \rangle \end{array} \right\}$$

Two is tall. A boxed thing, which is tall too, ...

$$\left\{ \begin{array}{l} w_1 \ \langle \rangle \\ w_2 \ \langle \rangle \\ w_3 \ \langle \rangle \\ w_4 \ \langle \rangle \end{array} \right\} \llbracket \text{tall}(\text{two}) \rrbracket \left\{ \begin{array}{l} w_1 \ \langle \rangle \\ w_3 \ \langle \rangle \end{array} \right\} \llbracket (\exists X \text{boxed}(X) - +_1 \text{tall}(p_0)) \rrbracket \left\{ \begin{array}{l} w_1 \ \langle \boxed{1} \rangle \\ w_1 \ \langle \boxed{2} \rangle \\ w_3 \ \langle \boxed{2} \rangle \end{array} \right\}$$

5.5 Modals embedding appositives aren’t simple tests



6 Summing up

6.1 Empirical conclusions

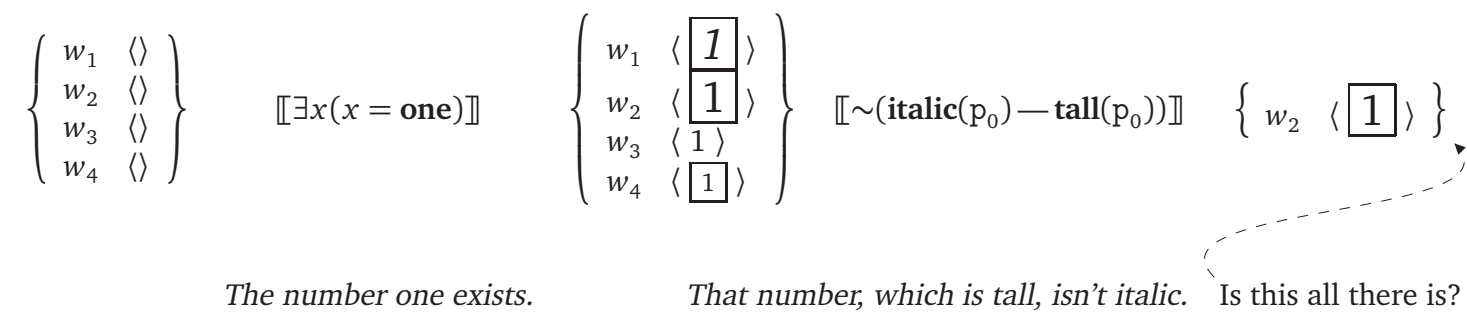
- i. Appositives are interpreted exactly where they sit in the sentence/discourse.
- ii. Semantically, appositives can be evaluated from non-speaker perspectives.
- iii. Semantically, appositive perspective-taking is not tied to higher operators — it’s not a matter of scope.
- iv. Pragmatically, non-speaker evaluations are marked moves — free as far as the grammar is concerned, but constrained in practice.

6.2 Results

The dynamic system PLA with Apposition deals with multidimensional states, where states encode perspectival and other information.

- i. A single formula can be evaluated from two perspectives simultaneously. The dual-state basis leaves some room for appositives to be evaluated from the perspective/info-state of someone other than the speaker.
- ii. Appositives can be interpreted (more or less) where they sit in the string/formula.
- iii. Appositives support discourse anaphora in the desired ways.
- iv. A variable in an appositive α cannot be bound outside of $\alpha \dots$ unless the perspectives align perfectly.

7 Left unexplained: Resolving indeterminacy appositively



Context dependency The scale for *even* is fleshed out.

(27) Even Gary Kasparov, a world chess champion for 15 years, lost to Deep Blue.

Reference resolution Ambiguous or obscure proper names.

(28) a. OTS, the regulator, was asleep at the switch and allowed things to happen without restraint. (Lou Dobbs Tonight, Jul 14, 2008)
 b. Bush, the elder, was not wholly committed. (Lou Dobbs Tonight, Feb 15, 2008)

Relevance resolution Even if a sentence’s context-dependent features are resolved, an appositive can still play an essential role, by helping the listener to understand why that particular content is being offered at all.

(29) a. Charlie, a pizza delivery person, is at the door!
 b. Charlie, an infamous axe murderer, is at the door!

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