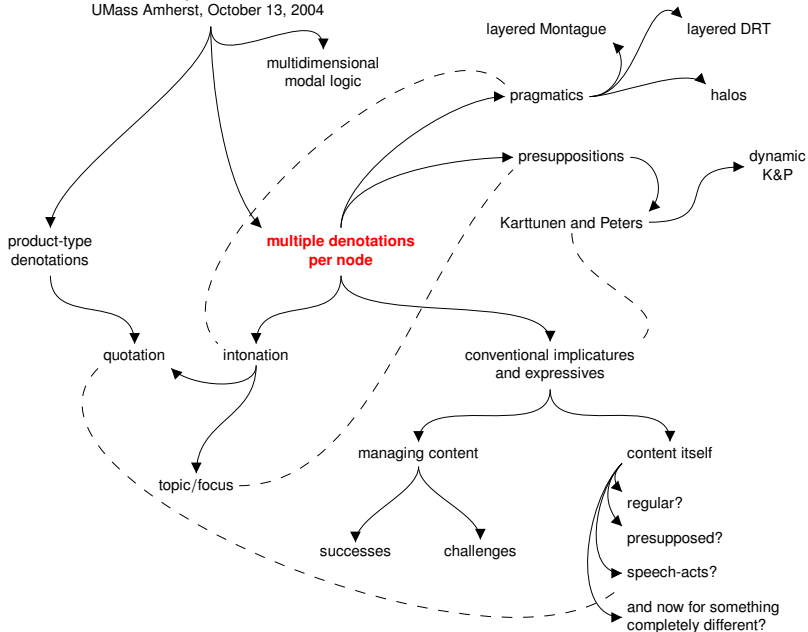


Multidimensionality in Semantics

Christopher Potts

Guest Lecture in Angelika Kratzer's Proseminar
UMass Amherst, October 13, 2004



basic claim

Some individual syntactic nodes have multiple independent denotations.

- Karttunen and Peters (1979) [a formal foundation]
- Bach (1999) [a rallying cry]
- Potts (2005)

It seems a simple idea. But it raises fundamental questions:

- How do we handle multidimensional content compositionally?
- Do all the denotations have the same status?
- Are they all made of the same stuff?

is this node semantically multidimensional?

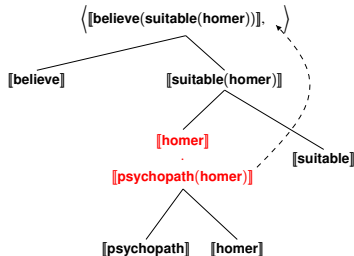
CENTRAL PROPERTIES

- The content you are interested in always has widest scope. (It is scopeless.)
- It cannot restrict the denotation of the phrase it modifies.
- It introduces secondary information (commentary; Asher 2000).
- It is speaker oriented in the same sense that (most) speech-acts are speaker oriented.

supplements: a clear example of multidimensionality

- (1) Sheila believes that Homer, a confirmed psychopath, is a suitable babysitter.
- ≠ Sheila believes that Homer is a confirmed psychopath and that Homer is a suitable babysitter.
- ≈ Sheila believes that Homer is a suitable babysitter. Homer is a confirmed psychopath.

the kind of calculation we'd like to do



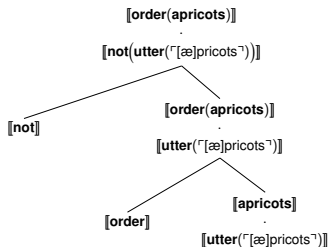
'metalinguistic' negation

- (2) # When in Santa Cruz, Chris didn't order apricots, he ordered apricots.
- (3) When in Santa Cruz, Chris didn't order "[æ]pricots", he ordered "[eɪ]pricots".

This is a more integrated kind of multidimensionality than we saw with supplements.

- The quotative dimension can be in the scope of the negation and the adverbial quantifier.

the kind of calculation we'd like to do



intonational meaning

It's no surprise that intonation and multidimensionality arrive together: *separate messages travel more easily on separate channels*.¹

IF NOT FOR INTONATION

All of the following are dramatically different without their intonational features (in red).

- (4) # The linguist, who works on presuppositions, spoke with the linguist, who works on vowel harmony.
- (5) Chris asked for "[æ]pricots", not "[eɪ]pricots".
- (6) He didn't call the police, he called the **polICE**.
- (7) Hein ist **WOHL** auf See. (Zimmermann 2004:3, 30)
 Hein is most-definitely on sea
 'Hein is most definitely at the beach.'

type theory

Semantic types provide the best window into the nature of multidimensionality. They also permit us to do a lot of semantics without a firm grip on what content we are manipulating (essential for these damn things).

TYPES (BASIC DEFINITION)

- e and t are regular types
- if σ and τ are regular types, then $\langle\sigma, \tau\rangle$ is a regular type
- ...[see slide 25]...
- ...[see slide 70]...
- ...[see slide 85]...
- ...[see slide 85]...
- nothing else is a type

TYPE DOMAINS

- the domain of type e is D_e , a set of entities; the domain of type t is D_t , the power-set of the set of all possible worlds
- the domain of a type $\langle\sigma, \tau\rangle$ is $D_{\langle\sigma, \tau\rangle}$, the set of all functions from D_σ into D_τ

¹My thanks to Lyn Frazier for helping me to see the connection.

logical expressions

- i. x, y, z are variables of type e
- ii. p, q, r are variables of type t
- iii. f, g, h are variables of type $\langle e, t \rangle$
- iv. **bart, lisa, maggie, marge, homer,** and **chris** are well-formed constants of type e
- v. **bald, dead, smiling, reading, reflecting, psychopath, total-snooze,** and **suitable** are well-formed constants of type $\langle e, t \rangle$
- vi. **see, eat, order** and **tease** are well-formed constants of type $\langle e, \langle e, t \rangle \rangle$
- vii. **manage** and **try-hard** are well-formed constants of type $\langle \langle e, t \rangle, \langle e, t \rangle \rangle$
- viii. **believe, wager,** and **realize** are well-formed constants of type $\langle t, \langle e, t \rangle \rangle$
- ix. if α is a well-formed expression of type $\langle \sigma, \tau \rangle$ and β is a well-formed expression of type σ , then $\langle \alpha\beta \rangle$ is a well-formed expression of type τ
- x. if β is a well-formed expression of type τ and χ is a variable of type σ , then $\langle \lambda\chi. \beta \rangle$ is a well-formed expression of type $\langle \sigma, \tau \rangle$
- xi. ...[see slide 26]...
- xii. ...[see slide 26]...
- xiii. ...[see slide 72]...
- xiv. nothing else is a well-formed expression

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classifications

CONVENTIONAL IMPLICATURE?

Potts (2005) tries to reinvigorate Grice's (1975) concept by connecting it explicitly with multidimensionality. I stand by the connection. But making too much of it can have negative effects:

- People read Grice different ways.
- It can cause misplaced anxiety in students.

So I'll mainly do without the label.

EXPRESSIVE CONTENT?

This is another coverterm I've used. But some things that seem expressive don't qualify as multidimensional in the present sense. Rather than continue groping for a prosaic coverterm for the meanings I am interested in, I'll let the theory do the talking.

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reuse

A single meaning might serve as the argument to two functors. Such reuse challenges resource-sensitive approaches to semantic composition (e.g., Asudeh 2004).

RESOURCE LOGIC

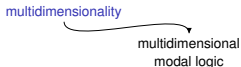
$$\frac{p \quad p \multimap q}{p \quad q} \quad [\text{INVALID}; p \text{ was used up in deriving } q]$$

TYPICAL MULTIDIMENSIONAL CALCULATION

$$\frac{\text{homer} \quad \text{homer} \multimap \text{psychopath}(\text{homer})}{\text{homer} \quad \text{psychopath}(\text{homer})}$$

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multidimensional modal logic



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a short distance from logic to linguistics

BLACKBURN ET AL. (2001:459)

“Multi-dimensional modal logic is a branch of modal logic dealing with special relational structures in which the states, rather than being abstract entities, have some inner structure. More specifically, these states are tuples or sequences over some basic set [...]”

- ▶ possible worlds are abstract entities
- ▶ possible world–time pairs are sequences in $D_{worlds} \times D_{times}$
- ▶ possible world–time–location triples are sequences in $D_{worlds} \times D_{times} \times D_{locations}$
- ▶ etc.

heavily decorated

a hierarchy of domains
(probably with some
additional structure)

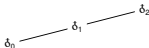
where you're at

\mathfrak{A}, w, j, l, g

a bridge from the/a syntax
into the domains

variable assignment
(a more abstract location)

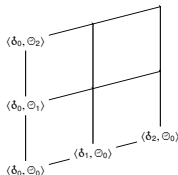
a simple relational structure, one dimension



PROPOSITIONS IN THIS MODEL

- ▶ D_t = the power-set of the set of worlds
- ▶ $\{\delta \mid \llbracket \text{smiling}(\text{chris}) \rrbracket(\delta) = 1\}$

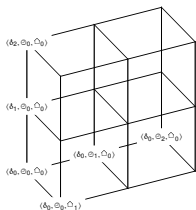
a simple relational structure, two dimensions



PROPOSITIONS IN THIS MODEL

- ▶ D_t = the power-set of the set of all world–time pairs
- ▶ $\{ \langle \delta, \vartheta \rangle \mid \llbracket \text{smiling}(\text{chris}) \rrbracket(\delta)(\vartheta) = 1 \}$

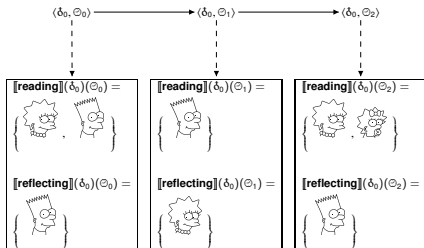
a simple relational structure, three dimensions



PROPOSITIONS IN THIS MODEL

- D_t = the power-set of the set of all world–time–location triples
- $\{ \langle \delta, \varnothing, \hat{\cup} \rangle \mid \text{[smiling(chris)]}(\delta)(\varnothing)(\hat{\cup}) = 1 \}$

as time goes by

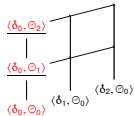


FOR MONTAGOVIANs

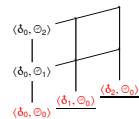
The dotted arrows model the action of \forall . The solid arrows model F .

different kinds of indeterminacy

$[\lambda t . \text{smiling(chris)}(w_0)(t)]$



$[\lambda w . \text{smiling(chris)}(w)(t_0)]$



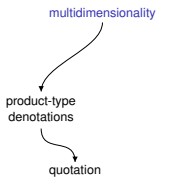
how many dimensions in this sense?

- Classical Montague grammar (Montague 1974) is $3d$.
- Much Amsterdam-style dynamic logic is $2d$: evaluation is relative to world–assignment pairs.
 - Probably they intend to have times and locations as well. So: $4d$.
- In Kaplan (1989), a context is a tuple consisting of a speaker, a hearer, a world, a time, and a place. Thus: $5d$.
- Potts and Kawahara (2004) augment Kaplan's contexts with an extra parameter for expressive content. (More on this move later.) $6d$

Why have we never taken these results to the media, the way physicists do whenever they get an inkling that they might need more dimensions?

- ▶ This kind of multidimensionality is neither new nor particularly controversial.
- ▶ In large part, it simply reflects the fact that things happen at specific space–time locations.
- ▶ The more novel kinds of multidimensionality explored in the remainder of this talk can, and ultimately should, be combined with something like multidimensional propositional denotations.

product-type denotations



product types

TYPES (WITH PRODUCTS)

- e and t are regular types
- if σ and τ are regular types, then $\langle \sigma, \tau \rangle$ is a regular type
- if σ and τ are regular types, then $\sigma \times \tau$ is a regular type
- ... [see slide 70] ...
- ... [see slide 85] ...
- ... [see slide 85] ...
- nothing else is a type

TYPE DOMAINS

- the domain of type e is D_e , a set of entities; the domain of type t is D_t , the power-set of the set of all possible worlds
- the domain of a type $\langle \sigma, \tau \rangle$ is $D_{\langle \sigma, \tau \rangle}$, the set of all functions from D_σ into D_τ
- the domain of a type $\sigma \times \tau$ is $D_{\sigma \times \tau}$, the set of all ordered pairs in which the first member is drawn from D_σ and the second is drawn from D_τ

product expressions

ADDITION TO THE DEFINITION ON SLIDE 10

- xi. if α and β are well-formed expressions, then $[\alpha, \beta]$ is a well-formed expression
- xii. $[p, q]$, $[x, p]$, etc., are product-type variables, with their types given in the expected way by their components

PROJECTION FUNCTIONS

- i. $\pi_1([\alpha, \beta]) = \alpha$
- ii. $\pi_2([\alpha, \beta]) = \beta$

are product types new? in a sense, they are not

CARPENTER (1997:64)

“the introduction of tuples into the λ -calculus does not in fact increase its power to represent functions. We will see that n -ary functions of arbitrary can be reduced to unary functions in a sense that I will make precise shortly.”

See also Heim and Kratzer (1998:28ff) on schönfinkelization.

SEE IT VIA THE TYPES (VIA AN INFORMAL CURRY–HOWARD BIJECTION)

$$\begin{array}{c}
 p \rightarrow q \quad p \quad \text{gimme a } p, \text{ get a } q \quad \text{oh, you have a } p! \quad \langle \sigma, \tau \rangle \quad \sigma \\
 \hline
 q \qquad \qquad \qquad \text{here's a } q! \qquad \qquad \qquad \qquad \qquad \qquad \qquad \tau
 \end{array}$$

$$\begin{array}{c}
 p \rightarrow (q \rightarrow r) \Leftrightarrow \langle t, \langle e, t \rangle \rangle \Leftrightarrow \\
 (p \wedge q) \rightarrow r \Leftrightarrow \langle t \times e, t \rangle \Leftrightarrow \\
 (q \wedge p) \rightarrow r \Leftrightarrow \langle e \times t, t \rangle \Leftrightarrow \\
 q \rightarrow (p \rightarrow r) \qquad \qquad \qquad \langle e, \langle t, t \rangle \rangle
 \end{array}$$

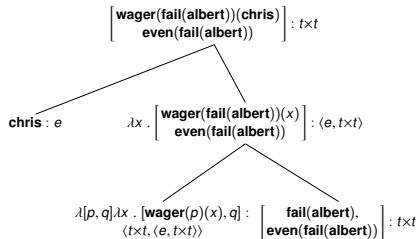
now a single node can denote a pair of meanings

FRANCESCOTTI (1995:153)

“Suppose that we are placing bets on whether Albert failed the exam. Feeling confident that he did fail, I utter sentence (8a). Suppose, however, that Albert’s failing is not at all surprising, and in fact is very likely. In this case, (8a) would certainly be inappropriate. However, assuming that Albert did fail, it seems odd to think that (8a) is false, and that I should therefore pay up.”

- (8) a. Even Albert failed the exam.
- b. Albert failed the exam.

now a single node can denote a pair of meanings



operators differ

- i. Verbs like *wager* seem not to care about non-initial projections.
- ii. Verbs like *believe* and *say* seem to apply to both projections.
- iii. As we will see when we discuss quotation (see slide 65), *not* is arguably free to apply to either projection — but not both in the same calculation.

projection

In the land of product types, the most pressing question is how to manipulate the secondary meanings in a systematic way. We would like an answer that makes as much sense as these:

- i. presupposition projection in Heim 1992
- ii. alternative projection in Rooth 1992 and Kratzer and Shimoyama 2002

We're not there yet. But . . .

a continuation operator

Chris Barker pointed out to me (p.c. March 2004) that the following, which I defined to handle subclausal quotation (Potts 2004), is a continuation operator:

- (9) a. **project** : $\langle \sigma, \langle \tau \times t, \rho \times t \rangle \rangle$
b. $\llbracket \mathbf{project}(\alpha) \rrbracket \llbracket [\beta, \rho] \rrbracket =$

$$\llbracket [\alpha(\beta), \rho] \rrbracket$$

or

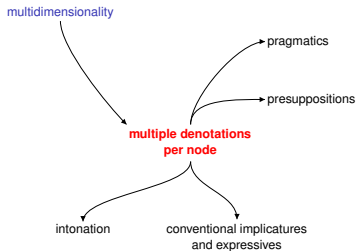
$$\llbracket [\beta(\alpha), \rho] \rrbracket$$

whichever is well formed

product types: in sum (for now)

- ▶ Using products, we can map individual nodes to tuples of values.
- ▶ This is a highly integrated kind of multidimensionality.
- ▶ It might be the most important kind of multidimensionality:
 - ▶ We'll see a diversity of potential applications below.
 - ▶ At present, we have a diversity of rules — what's the generalization?

multiple denotations per node



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toward a complete separation

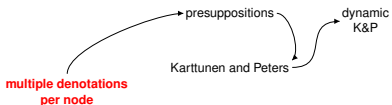
We now begin moving towards a class of meanings that seem truly independent from composition as usual.

Product types aren't the right tool — they are too integrated.

Along the way, we'll look at a variety of applications for a variety of multidimensional systems.

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presuppositions



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Karttunen and Peters 1979

3d DENOTATIONS

Expressions in this system have three denotations:

- an extensional (*e*) value
- an implicature (*i*) value
- a heritage (*h*) value

4 VALUES

This is in essence a translation of the 4-valued classical logic of Herzberger (1973) into an intensional logic.

$\langle 1, 1 \rangle$ $\langle 0, 1 \rangle$
 $\langle 1, 0 \rangle$ $\langle 0, 0 \rangle$

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the empirical focus of Karttunen and Peters 1979

Both the factual domain and the heritage function are largely from Karttunen's (1973) paper on presupposition projection. As a result, the theory is generally evaluated as a theory of presuppositions. From this perspective, it encounters a major difficulty, one that Karttunen and Peters recognize in the article.

Karttunen and Peters' binding problem

- (10) Someone managed to trick Homer.
- e. $\exists x . \mathbf{trick}(\mathbf{homer})(x)$
'Someone tricked Homer.'
 - i. $\exists x . \mathbf{try-hard}(\mathbf{trick}(\mathbf{homer})(x))(x)$
'Someone tried hard to trick Homer.'

A SCENARIO

- i. Lisa tricked Homer without trying hard.
- ii. Barney failed to trick Homer despite trying hard to do so.

The existential statements above are true in this scenario, but we judge the example to be false here.

CONCLUSION

These aren't the right truth conditions.

let me stress

The binding problem is not a problem of logic. It is a problem with an application of that logic.

the view from dynamic semantics

DYNAMIC LOGICS EXTEND BINDING DOMAINS FOR EXISTENTIALS

Someone smiled. He was enlightened.

$\mathbf{[person}(x)]$; $\mathbf{[smile}(x)]$; $\mathbf{[enlightened}(x)]$

$\{g \mid \mathbf{[person]}(g(x))\} \cap \{g \mid \mathbf{[smile]}(g(x))\} \cap \{g \mid \mathbf{[enlightened]}(g(x))\}$

the view from dynamic semantics

Someone managed to trick Homer.

$[[\text{person}(x)]]$; $[[\text{trick}(\text{homer})(x)]]$

$$\{g \mid [[\text{person}]](g(x))\} \cap \{g \mid [[\text{trick}(\text{homer})]](g(x))\} \\ \cap \{g \mid [[\lambda y . \text{try-hard}(\text{trick}(\text{homer})(y))(y)]](g(x))\}$$

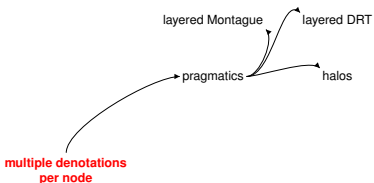
Dekker (2002) provides a full theory in this vein.

a brief aside on the facts

It has always seemed to me that (10) is ambiguous:

- (10) Someone managed to trick Homer.
- Some person both tricked Homer and tried hard to do so.
 - Some person tricked Homer; tricking Homer is difficult.
- The first is the reading that we can capture using dynamic binding.
 - The second is what we would expect if the secondary meaning (the trying hard) were a presupposition.
 - It is often the case that free-variables in presuppositions act as though they were bound by universals, and some systems deliver this behavior as a theorem (Heim 1983; but cf. Krahmer 1998).

pragmatics



layered Montague (Chierchia 2001)

- (11) a. Eddie: "Mary will run the meeting or Mary will operate the projector."
 b. Eddie believes that Mary will run the meeting or Mary will operate the projector.
- (12) a. at-issue: $\lambda p.\lambda q . p \vee q$ [classical disjunction]
 b. conversational implicature: $\lambda p.\lambda q . \neg(p \wedge q)$ [classical negated conjunction]

layered DRT

Explored in depth by Kadmon (1987) and Geurts and Maier (2003), and discussed approvingly by Levinson (2000). We use the syntax of DRT for both semantics and pragmatics, but we distinguish the two realms in the logic and, in turn, in the models.

w	x	y	z
$w = \text{mary}$	$x = \text{eddie}$	$\text{projector}(y)$	$\text{meeting}(z)$
$\text{believe}(x)$	$\text{run}(w)(z) \vee \text{operate}(w)(y)$ $\neg(\text{run}(w)(z) \wedge \text{operate}(w)(y))$		

The pragmatic meaning is in bold red. It is presumably defeasible.

intrusive conversational implicatures

Levinson (2000:§3) argues persuasively for an integrated view of pragmatic meanings.

INDEXICAL RESOLUTION

- (13) "Some of you know the news; I'm not talking to you; I'm talking to the rest of you."
 (14) "The meeting is on *Thursday*."

GENERALITY NARROWING

- (15) "Fixing the car will take some time."
 (16) "Chris is short." [relative to pro basketball players]
 (17) "Chris is tall." [relative to gymnasts]

SCALAR ITEMS

- (18) "Eating some cookies is better than eating all of them."
 (19) "Driving home and drinking three beers is better than drinking three beers and driving home."

pragmatic halos

THE BASICS OF LASERSOHN 1999

- The extension of *Mary arrived at 3:00:00* is false if Mary arrived at 3:00:15.
- But the sentence is generally considered felicitous in this situation — we are allowed to speak a little loosely.
- Lasersohn achieves this by assigning to every expression α a context-dependent set of alternatives to α , usually along with an ordering on that set.
- The definition of truth remains the same, but a sentence is regarded as 'close enough to true' iff its halo contains at least one nonempty (or true) denotation.

halo interpretation

IF α IS OF TYPE σ , THEN

- $[\alpha]^c \in D_\sigma$ [where c is a context]
- $[\alpha]^{c,h} = \langle A, \leq_{[\alpha]^c} \rangle$, where
 - A is the set of objects in the same domain as $[\alpha]^c$ that differ from $[\alpha]^c$ only in ways that are pragmatically ignorable in c
 - $\leq_{[\alpha]^c}$ is a relation that orders A according to similarity to $[\alpha]^c$ in c

example halo

We are trying to teach someone what *circular* means.

- Ideally, we transport ourselves to the Platonic realm to show this person a perfect circle.
- If that proves impossible, we must find an object to illustrate.

We want to present or mention something and say *This is circular*.

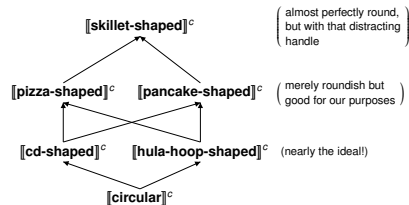
example halo

$[[\text{circular}]]^{c,h}$

$$A = \left\{ \begin{array}{l} [[\text{pizza-shaped}]]^c, \\ [[\text{pancake-shaped}]]^c, \\ [[\text{cd-shaped}]]^c, \\ [[\text{hula-hoop-shaped}]]^c, \\ [[\text{circular}]]^c \end{array} \right\}$$

example halo

$\leq [[\text{circular}]]^c =$



halo composition

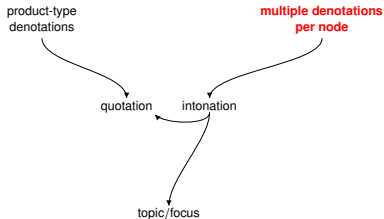
- Let $H = \langle f, \{f, g, h\} \rangle$
- Let $h = \langle a, \{a, b, c\} \rangle$
- Then $H(h) = \langle f(a), \left\{ \begin{array}{l} f(a), f(b), f(c), \\ g(a), g(b), g(c), \\ h(a), h(b), h(c) \end{array} \right\} \rangle$
- Ordering is preserved by composition. Thus, if a is more likely than b , then $f(a)$ is more likely than $f(b)$ for any f .
- "We will count a sentence as 'close enough to true for a context C ' iff its halo relative to C contains at least one nonempty element." (Lasersohn 1999:528)

pragmatics in sum

- The above are attempts to use multidimensional semantic techniques to describe pragmatic meanings.
- None *replaces* the Gricean maxims (on any of their many versions). They simply provide useful calculi for getting at potential (and/or default) meanings.
- **My guess** To gain a formal theory of pragmatic inferences, we need to break free of the normal mode of semantic analysis.
 - try game theory (Groenendijk 1999)
 - try economics
 - try Bayes Nets
 - try nonmonotonic logics
 - try something other than what you normally try

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intonational meaning



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separate channels

It's no surprise that intonation and multidimensionality arrive together: *separate messages travel more easily on separate channels.*

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the intonational lexicon: a sampler

COMMA INTONATION

- (20) a. # The linguist, who works on presuppositions, spoke with the linguist, who works on vowel harmony.
b. The linguist who works on presuppositions spoke with the linguist who works on vowel harmony.

WHEN SEGMENTAL PHONOLOGY INVADES THE SEMANTICS

- (21) a. Chris asked for "[æ]pricots", not "[eɪ]pricots".
b. # Chris asked for apricots, not apricots.

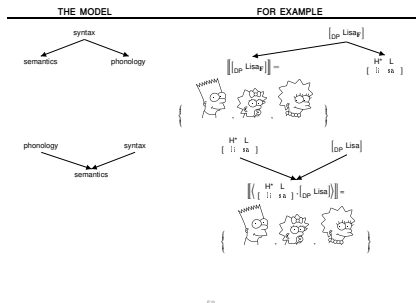
WHEN STRESS PATTERNS INVADE THE SEMANTICS

- (22) a. He didn't call the POLice, he called the poLICE.
b. # He didn't call the police, he called the police.

FOCAL STRESS AT THE LEXICAL LEVEL

- (23) a. Chris is SO next in line.
b. * Chris is so next in line.

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- The above models are probably descriptively equivalent; if you favor the first, just be prepared to rig the syntax with "forward-looking" features.
- In the first, "semantics" could instead be LF, presumably a syntactic object.
- We can reverse an arrow's direction just in case the original mapping is one-to-one. This will work for the second only if the interpretation function, $[[\cdot]]$, has pairs (phonology, syntax) in its domain.

alternative semantics for focus

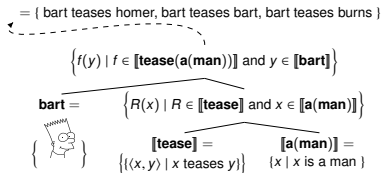
Alternative semantics for focus provides us with two ways of viewing the expressions of our logic (or of natural language directly).

IF α IS OF TYPE σ , THEN

- $[[\alpha]]^o \in D_\sigma$
- $[[\alpha]]^f = \{ [[\alpha]]^o \}$
- $[[\alpha_F]]^f = \{ X \mid X \in D_\sigma \}$
- $[[\alpha(\beta)]]^f = \{ X \mid \text{there is an } x \in [[\alpha]]^f \text{ such that } x(y) = X \text{ and there is a } y \in [[\beta]]^f \}$

connections with Kratzer and Shimoyama 2002

In the semantics of Kratzer (2002) (see also Alonso-Ovalle and Menendez-Benito 2003; Shan 2003; Kim 2004), there is a sense in which non-indefinites denote their non-F-marked counterparts in alternative semantics.



lexicalization hypothesis

In quotation, each prosodic word has a rise–fall–rise contour.

- In print, speakers use quotation marks and related devices.
- In speech, they sometimes use body language.



not a focal stress pattern

- (26) They made phone calls to three
H* L H% H*L H% H* L H% H*L H%
"prominent Indian government officials".
- H* L
- (27) They didn't call reporters, they called
H* L
prominent Indian government officials.

wrong discourse conditions for semantic focus

- (28) a. Burns: *The Godfather II* is a total snooze.
b. Homer: Well, Pauline Kael said that this "total snooze" is a defining moment in American cinema.
- (29) a. Burns: *The Godfather II* is a total snooze.
b. # Homer: *Godfather I* is a TOTAL SNOOZE as well.

theories of focus interpretation aren't any help

Quotation and contrastive focus are both anaphoric in the sense that their felicity depends on a prior utterance.

- But focus requires contrast, whereas quotation requires *identity*.
- Focus semantics invokes alternatives, whereas quotation does not.

a type for linguistic objects

Types (Full Definition)

- i. e and t are regular types
- ii. if σ and τ are regular types, then $\langle \sigma, \tau \rangle$ is a regular type
- iii. if σ and τ are regular types, then $\sigma \times \tau$ is a regular type
- iv. **u is a regular type**
 - v. ...[see slide 85]...
 - vi. ...[see slide 85]...
- vii. nothing else is a type

Type Domains

- i. the domain of type e is D_e , a set of entities; the domain of type t is D_t , the power-set of the set of all possible worlds
- ii. the domain of a type $\langle \sigma, \tau \rangle$ is $D_{\langle \sigma, \tau \rangle}$, the set of all functions from D_σ into D_τ
- iii. the domain of a type $\sigma \times \tau$ is $D_{\sigma \times \tau}$, the set of all ordered pairs in which the first member is drawn from D_σ and the second is drawn from D_τ

what's in D_u ?

D_u is the domain of linguistic objects (segments, words, phrases, sentences, ...)

- (30) a. The sentence *Bart burped* is annoyingly alliterative.
alliterative : $\langle u, t \rangle$
- b. Ali's favorite word is *salmagundi*.
- c. [æ]pricot begins with a low-front vowel.
- d. George W. Bush uttered the sentence *I don't think our troops are to be used for what's called nation building*.³
utter : $\langle u, \langle e, t \rangle \rangle$

³From Bush's second debate with Al Gore, Winston-Salem, North Carolina, October 11, 2000.

a semantic quotation function

Lexical items are triples $\langle \Pi ; \Sigma ; \alpha : \sigma \rangle$:

- i. Π is a phonological representation;
- ii. Σ is a syntactic representation; and
- iii. α is a semantic representation of type σ .

Clause (XIII) from Slide 10

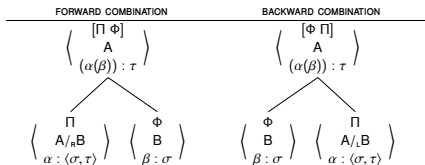
- i. If $\mathcal{P} = \langle \Pi ; \Sigma ; \alpha : \sigma \rangle$ is well-formed, then $\langle \Pi ; \Sigma ; \ulcorner \langle \Pi ; \Sigma ; \alpha : \sigma \rangle \urcorner : u \rangle$ is well-formed.

Useful abbreviation: $\ulcorner \langle \Pi ; \Sigma ; \alpha : \sigma \rangle \urcorner$ becomes $\ulcorner \Pi \urcorner$

enriched well-formed expressions

Elaborations of Part of the Definition on Slide 10

- iv'. \langle [hɒməɹ] ; NP ; **homer** : e \rangle
 \langle [lɪsə] ; NP ; **lisa** : e \rangle
- v'. \langle [bald] ; S_LNP ; **bald** : $\langle e, t \rangle$ \rangle
 \langle [dæd] ; S_LNP ; **dead** : $\langle e, t \rangle$ \rangle
- vi'. \langle [ɪt] ; (S_LNP)_RNP ; **eat** : $\langle e, \langle e, t \rangle \rangle$ \rangle
 \langle [sɪ] ; (S_LNP)_RNP ; **see** : $\langle e, \langle e, t \rangle \rangle$ \rangle



The interpretation function, $\llbracket \cdot \rrbracket$, is defined for the third member of these sound–form–meaning triples:

$$(31) \text{ SEM}(\langle \Pi ; A ; \alpha : \sigma \rangle) = \alpha$$

$$(32) \llbracket \ulcorner \text{Homer is bald} \urcorner \rrbracket = \langle \llbracket \text{hɒmər ɪz bɔld} \rrbracket ; S ; \mathbf{bald}(\text{homer}) : t \rangle$$

a subclausal quotation operator

- (33) a. **utter** : $\langle u, \langle e, t \rangle \rangle$
 b. $\llbracket \mathbf{utter}(\ulcorner S \urcorner)(\mathbf{b}) \rrbracket$ = the set of worlds in which $\llbracket \mathbf{b} \rrbracket$ utters $\ulcorner S \urcorner$

- (34) a. **quote-shift** : $\langle u, \langle e, \sigma \times t \rangle \rangle$
 b. the context must supply this entity

$$\llbracket \mathbf{quote-shift} \rrbracket(\mathcal{P})(d) = \left\langle \begin{array}{c} \text{the } X \text{ such that } d \text{ maintains that } X = \llbracket \text{SEM}(\mathcal{P}) \rrbracket \\ \mathbf{utter}(\mathcal{P})(d) \end{array} \right\rangle$$

for any $\mathcal{P} \in D_u$ and $d \in D_e$

an example

- (35) a. Burns: *The Godfather II* is a total snooze.
 b. Homer: Well, Pauline Kael said that this "total snooze" is a defining moment in American cinema.

"total snooze" \rightsquigarrow $\llbracket \mathbf{quote-shift}(\ulcorner \text{total snooze} \urcorner) \rrbracket$

the X such that d maintains that $X = \llbracket \mathbf{total-snooze} \rrbracket$

$$\left\langle \begin{array}{c} \mathbf{utter}(\langle \text{towtl snuz} ; \text{NP} ; \mathbf{total-snooze} \rangle)(\text{Homer}) \end{array} \right\rangle$$



'metalinguistic' negation

(36) He didn't call the POlice, he called the poLICE.

- (37) a. $\llbracket \ulcorner \text{police} \urcorner \rrbracket = \langle [p_o.'lis] ; NP ; \text{police} : \langle e, t \rangle \rangle$
 b. $\llbracket \ulcorner \text{polICE} \urcorner \rrbracket = \langle [p_o.'lis] ; NP ; \text{polICE} : \langle e, t \rangle \rangle$

The first of these has the property defined by the meaning of **stress-initial**. The second does not.

a single negation operator

Negation is a function taking pairs of propositions into pairs of propositions. But in its heart it remains a regular unary predicate:

- (38) a. $\llbracket \text{not}_1([p, q]) \rrbracket = \langle \{w \mid w \notin \llbracket p \rrbracket, \llbracket q \rrbracket\} \rangle$
 b. $\llbracket \text{not}_2([p, q]) \rrbracket = \langle [p], \{w \mid w \notin \llbracket q \rrbracket\} \rangle$

TRANSLATIONS FOR THE FIRST AND SECOND SENTENCES IN (36)

(39)

$$\text{not}_2 \left(\begin{array}{c} \text{he called the police,} \\ \text{the speaker utters } \langle [p_o.'lis] ; NP ; \text{polICE} : \langle e, t \rangle \rangle \end{array} \right)$$

(40)

$$\left(\begin{array}{c} \text{he called the police,} \\ \text{the speaker utters } \langle [p_o.'lis] ; NP ; \text{polICE} : \langle e, t \rangle \rangle \end{array} \right)$$

reemergence of resource sensitivity

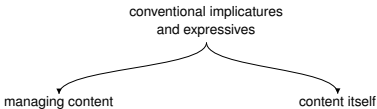
There is no reading of (36) on which it means that he didn't call the police and he did not utter the word "Police".

(36) He didn't call the POlice, he called the poLICE.

Perhaps **not** is in fact a unary operator. A functor like **project** from slide 32 could in effect allow it to take products into products.

hypothesis

The target of metalinguistic negation has the same intonational contour as quotation: rise–fall–rise.



I hope readers of this book are struck by how little pragmatics it contains. The original definition of *conventional implicature* dates to Grice 1975, the cornerstone of the most influential approach to pragmatics at present. This origin seems to have led many researchers to assume that there is something importantly pragmatic about this class of meanings. But this is not so. If we adhere to the original definition, as I try to do, then we remain firmly on semantic turf, and we find nothing but contrasts with the prototypical pragmatic meanings, conversational implicatures.

managing content



expressive types

TYPES (WITH PRODUCTS)

- i. e and t are regular types
- ii. if σ and τ are regular types, then $\langle \sigma, \tau \rangle$ is a regular type
- iii. if σ and τ are regular types, then $\sigma \times \tau$ is a regular type
- iv. u is a regular type
- v. ε is an expressive type
- vi. if σ is a regular type, then $\langle \sigma, \varepsilon \rangle$ is an expressive type
- vii. nothing else is a type

TYPE DOMAINS

- i. the domain of type e is D_e , a set of entities; the domain of type t is D_t , the power-set of the set of all possible worlds
- ii. the domain of a type $\langle \sigma, \tau \rangle$ is $D_{\langle \sigma, \tau \rangle}$, the set of all functions from D_σ into D_τ
- iii. the domain of a type $\sigma \times \tau$ is $D_{\sigma \times \tau}$, the set of all ordered pairs in which the first member is drawn from D_σ and the second is drawn from D_τ

expressive domains

WHAT IS IN D_ε ?

This is a difficult question. I've given a range of answers to it. The discussion of this begins on slide 94.

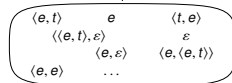
WHAT IS IN $D_{\langle\sigma,\varepsilon\rangle}$?

For each σ , the domain $D_{\langle\sigma,\varepsilon\rangle}$ is the set of all functions from D_σ into D_ε , just as the angle-bracket notation suggests.

semantic workspace

$\langle\varepsilon, t\rangle$

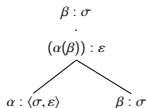
$\langle\langle\varepsilon, \varepsilon\rangle, \varepsilon\rangle$



$\langle\varepsilon, \varepsilon\rangle$

the heart of the matter

THIS COMPOSITION RULE CHARACTERIZES TRULY MULTIDIMENSIONAL CONTENT:



OTHER CHARACTERIZING COMPOSITION RULES

- **event modification** in Kratzer 1996
- **restrict** in Chung and Ladusaw 2003
- almost all classical Montague grammar (for better or worse)

parsetree interpretation

The interpretation of a semantic parsetree \mathcal{T} is the tuple

$$\langle \llbracket \alpha \rrbracket, \llbracket \beta_1 \rrbracket, \dots, \llbracket \beta_n \rrbracket \rangle$$

where α is the regular term on the root of \mathcal{T} and β_1, \dots, β_n are the ε -type expressions in \mathcal{T} , in their linear order.

Extensionally:

1	0				
⟨1, 1⟩	⟨0, 1⟩	⟨1, 0⟩	⟨0, 0⟩		
⟨1, 1, 1⟩	⟨0, 1, 1⟩	⟨1, 0, 1⟩	⟨1, 1, 0⟩	⟨1, 0, 0⟩	...
⟨1, 1, 1, 1⟩	...				
⋮					

- (41) Joan, who works as a translator, spoke with Sam, who **also** works as a translator.
- (42)[#] Joan, who **also** works as a translator, spoke with Sam, who works as a translator.

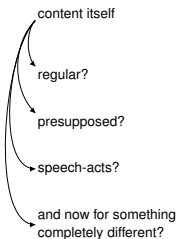
successes

- i. supplements
 - a. As-parentheticals (predicate- and clause-modifying)
 - b. nominal appositives (Potts 2003a)
 - c. supplementary relatives
 - d. niched coordinations
 - e. speaker- and utterance-oriented adverbs
- ii. expressive attributive adjectives
- iii. the descriptive content of epithets
- iv. honorifics
- v. formal and familiar pronouns
- vi. expressive small clauses like *You idiot!* and *Silly me!*

challenges

- i. discourse particles (product-types or truly multidimensional?)
- ii. evidentials (product-types or truly multidimensional?)
- iii. German discourse subjunctive (what are the facts for multiple-embeddings?)
- iv. multidimensional content that falls in the scope of quantifiers (so far not encountered by me; epithets are close)

content itself



94

regular?

- For supplementary expressions, it seems reasonable to treat ε things as propositional.
- This means that $D_t = D_\varepsilon$, and the difference between ε and t is syntactic.

- (43) Sheila believes that Homer, a confirmed psychopath, is a suitable babysitter.
- \approx Sheila believes that Homer is a suitable babysitter. Homer is a confirmed psychopath.

For a broad range of multidimensional meanings, we seem to find genuine model-theoretic differences between the dimensions.

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presuppositional? (no)

Don't use partial functions to try to achieve multidimensional effects within a single dimension.

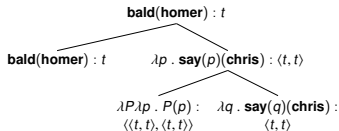
UNFORTUNATE CUBISM (POTTS 2002A,B)

- (44) $[\mathbf{as}(P)(p)](\delta)$ is defined only if $[P(p)](\delta) = 1$
 where defined $[\mathbf{as}(P)(p)](\delta) = [p]$

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presuppositional? (no)

- (45) Homer is bald, as Chris said.



This approach would force us to revise important aspects of the theory of presuppositions, and it would still incorrectly assign the supplement the status old (backgrounded) information. In fact, they are almost always new.

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presuppositional? (yes)

SOME NOMINATIVE FORMAL AND FAMILIAR PRONOUNS

	familiar	formal	
Danish	du	De	[same as 3rd plural]
German	du	Sie	[same as 3rd plural]
Russian	ты (ты)	вы (вы)	[same as 2nd plural]
French	tu	vous	[same as 2nd plural]
Spanish	tu	usted	[formal 2nd singular only]
Swedish	du	Ni	[same as archaic 2nd plural]

The following analysis is based on that of Asudeh and Potts (2004).

desiderata

THE EXPRESSIVE CONTENT OF FORMAL AND INFORMAL PRONOUNS SHOULD BE

- i. a feature of lexical meanings;
- ii. scopeless;
- iii. non-propositional; and
- iv. context-oriented.

denotations

EMOTIVE DEFINITE DESCRIPTIONS

Potts and Kawahara (2004) assign honorifics meanings based in the real-number interval $[-1, 1]$, which they metalogically interpret as a set of emotions. Definedness conditions on the context make them behave much like definite descriptions.

A SIMILAR SEMANTICS FOR THE FORMAL/FAMILIAR DIVIDE

We claim that, like honorifics, the formal/familiar distinction is one that is primarily about expressive meanings (Potts 2003b, 2005). And, like honorifics, we treat them as a kind of definite description.

two new objects

(46) \dagger represents formal content. (it recalls a necktie, no?)

If \dagger is in the discourse, then the speaker feels herself to be on formal terms with her addressee.

(47) ℓ represents familiar content. (it should look intertwined)

If ℓ is in the discourse, then the speaker feels herself to be on familiar terms with her addressee.

what are \dagger and ℓ ?

WHAT ARE EMOTIONS?

On this point, linguists should defer to astrologers, chemists, and/or psychologists.

contexts

EXTENDED FROM KAPLAN 1989 INTO THE REALM OF KAPLAN 1999

- (48) A context is a tuple $c = \langle c_A, c_H, c_P, c_T, c_W, c_{HON} \rangle$, where
- c_A is the agent (speaker) of c ;
 - c_H is the hearer of c ;
 - c_P is the place of c ;
 - c_T is the time of c ;
 - c_W is the world of c ; and
 - c_{HON} is the honorific setting for c ; $c_{HON} \in \{\dagger, \ell\}$.

analysis

A DEFINEDNESS CONDITION

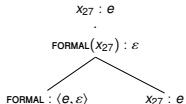
- (49) $[[\text{FORMAL}]]^c$ is defined only if the context tuple c contains \dagger
(50) $[[\text{FAMILIAR}]]^c$ is defined only if the context tuple c contains ℓ

honorific consistency

It is impossible to mix formal and informal pronouns within a single discourse:

- (51) *Sie haben gesagt, dass Du uns helfen würdest.
you.FORM have said that you.FAM us help would
'You said that you would help us.'
- (52) *Du hast gesagt, dass Sie uns helfen würden.
you.FAM have said that you.FORM us help would
'You said that you would help us.'

These examples fail because they place contradictory demands on the context, by requiring both \dagger and ℓ to be present.



This is a specific instantiation of the general composition principle on slide 88.

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speech-act?

Potts 2003c connects the extra dimensions directly with speech-acts. They are thus syntactically embedded speech-act operators that end up with the same semantic force as (root-level) assertions, commands, etc.

But, in this area, I sense progress whenever I move away from speech-acts, as with the example of honorifics above.

But the connection with speech-acts might be real. I am holding out for a theory of speech-acts that is not based on capital letters.

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Joachim Trommer pointed out to me that German shopkeepers sometimes say things like this:

(53) [A shopkeeper needs assistance, so she calls to her co-worker, who is in the back room]

Frau Müller, komm bitte her-ein!
Ms. _{FORMAL?} Müller come. _{FAMILIAR} please here-in

A violation of honorific consistency?⁴

⁴My thanks to Florian Schwarz for suggesting that I needn't worry too much about these examples.

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something completely different?

My brain is open.⁵

⁵Paul Erdős.

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what's next?

- Chris Barker has developed a computational implementation of part of the logic in Potts 2005. It makes apparent the connection between this work and continuations.
- Intonational meaning and multidimensionality often arrive together.
 - We should make better sense of the connection.
 - We should appeal to the phonology to bolster the unifying claims of the semantic analysis.
- How is multidimensionality affected by recent work on context-shifting (Schlenker 2003; Anand and Nevins 2004; Speas 2004)?
- Just what is the role of speech-acts in all this?

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