Semantics, Pragmatics and Discourse

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Outline

- introduction: semantics and pragmatics

- various ways of doing discourse semantics

- empirical issues

- theoretical and empirical challenges

- quantity implicatures and discourse

- lexicon and discourse

Introduction: Formal Methods in Semantics

- building on Tarski and Montague, semantics establishes a way of building a logical form in a formal language with a clear model theoretic intepretation from natural language syntax.

- Compositionality (the meaning of the whole is a function of the meaning of the parts–Frege, Montague)

- frameworks for constructing logical form: the simply typed λ calculus, unification.

- Different sorts of interpretations: static truth conditions, dynamic update conditions.

Some key points

- the importance of the lexicon as furnishing the basic building blocks of the composition process

- Why truth or related concept (update conditions): entailment

- Pragmatics is traditionally considered separate from semantic content. A strain of Anglo-American philosophy continues to argue for a strict separation. Pragmatics does not enter into the composition process but is at another level entirely, as in Gricean implicature.

  (1) a. A: Did all your students pass the exam?

        b. B: Some did.   (implicates not all did)

- key feature: context of use a determinant aspect of pragmatic interpretation.

A more nuanced view

Various contextualists (Recanati, Sperber and Wilson) and increasing numbers of linguists (since Kamp 1973) believe that semantics and pragmatics have a much closer interaction.

- indexicals and demonstratives, *I, you, here, now*, dependence on deictic contexts.

- coercion:

    (2) I'm parked out back (Nunberg).
    (3) John enjoyed the film (watching the film)

- widening and loosening (relevance theorists, Sperber and Wilson, Carston).

    (4) that child is drawing such a pretty circle in the sand

More uses of context

- discourse anaphora

  (5) A man walked in. <u>He</u> <u>bought</u> some cigarettes. <u>Then</u> <u>he</u> left.

- modals (Kamp). Free choice permission statements change a contextually given set of permissions and prohibitions.

  (6) You may take a pear.

More phenomena

- modal subordination and modal dependency (Veltman, Roberts)

  (7)   #[Looking out the window] It's not sunny, but it might be sunny.
        (epistemic sense of *might*)

  (8)   It might be sunny. [Looking out the window] It's not sunny

  (9)   A wolf might walk in. It would eat you first.

- presupposition (Heim, van der Sandt, Beaver)

Questions about vehicles of content

- sentences vs. utterances (or "sentences in a context")
- sentences/utterances vs. texts or discourses

Sentences don't occur in isolation and they are not interpreted in isolation either.

The dynamic semantic point of view: the text + its context is the unit of meaning.

Each sentence is interpreted relative to a context and in turn contributes or updates the context of interpretation.
The meaning of a sentence is a relation between contexts.

Architecture question

How do pragmatics and semantics interact to give rise to a complete picture of content?

- classic model theoretic approaches (Stalnaker's 1978 Assertion paper, Schulz's 2007 ILLC dissertation)

- logical form approaches: underspecification + resolution strategies (DRT, SDRT, Bos's underspecification semantics, minimal recursion semantics)

- Dynamic semantic model theoretic approaches (Groenendijk and Stokhof 1991, Veltman 1996, Asher and McCready 2007). Complicate the notion of semantic value and of context.

More on discourse connections and discourse contexts

- what are discourse contexts?

- how do utterances or sentences in a context affect the context?

- How much structure does the discourse context have–sets vs. recors vs. trees vs. graphs?

- DRT, DPL, RST, SDRT have different answers. SDRT takes contexts (SDRSs) to be graphs or hypergraphs.

Two models

- Stalnaker: a discourse context is a set of possible worlds or points of evaluation in an intensional structure. Updating a discourse context C with an assertion that p: $C \cap p$.

- Discourse Representation Theory: a discourse context is a mental representation of what has been said, a DRS. Updating a discourse context C with an assertion that p: the merge of the contextually given DRS with the DRS for p.

  - DRS: $\langle U, C \rangle$
  - Update: K + K' = $\langle U_K \cup U_{K'}, C_K \cup C_{K'} \rangle$

A variation on the second model

- Dynamic Predicate Logic: a discourse context is a set of world assignment function pairs. Updating a discourse context C with p involves testing world assignment pairs for satisfaction and/or resetting of the assignments via $\exists$.

  - $(w, g)\|\phi\|^{\mathfrak{A}}(w', h)$ iff $w = w'$ and $g = h'$ and $w', h \models_{\mathfrak{A}} \phi$ for atomic ϕ.

  - $(w, g)\|\exists v\phi\|^{\mathfrak{A}}(w', k)$ iff $\exists(w, h)(g =_v h$ and $(w, h)\|\phi\|^{\mathfrak{A}}(w', k)$

  - $C + \phi = \{(w, h): \in C \exists(w', g)(w', g)\|\phi\|^{\mathfrak{A}}(w, h)\}$.

- uses the language of first order logic.

- non-standard denotations for sentences.

Generalization: Continuation Style Semantics

- A left discourse context is a data structure of type γ.

- A right context the discourse to come that exploits the left context. It is of type $\gamma \rightarrow \text{PROP}$, where PROP is the type of truth value or of intension as in MG.

- Semantic type of sentences: $\gamma \rightarrow (\gamma \rightarrow \text{PROP}) \rightarrow \text{PROP}$.

- Update through a binder rule (Moggi 1991). Says how text and sentence interpretations interact.

- Continuation style semantics can represent the effects of DPL or DRT within a classical model theoretic setting.

Implementation

- carry the left and right contexts down into the lexicon. E.g., resetting sentence type $\|IP\|$ in MG to $\gamma \rightarrow (\gamma \rightarrow \text{PROP}) \rightarrow \text{PROP}$,

  - $\|NP\| = (\text{E} \rightarrow \|IP\|) \rightarrow \|IP\|$

  - $\|N\| = \text{E} \rightarrow \|IP\|$.

  - pronouns: $\|it\| = \lambda P.\lambda ik.P\,(\text{sel}(i_{)}\,i\,k$, where $i\!:\!\gamma, k\!:\!\gamma \rightarrow \text{PROP}$, and where $\text{sel}(i)$ is a function that selects a *suitable* discourse antecedent inside i

- binder rule: $\|T.S\| = \lambda i.\lambda k.\|T\|\,i\,(\lambda i'.\|S\|\,i'\,k)$

Example

- ||a dog||: $\lambda P \lambda i.\lambda k.\exists x \, (\, \text{dog}(x) \wedge P(x)(i \cup \{x\})(k))$

- ||barked||: $\lambda u \lambda i.\lambda k. \, (\, \text{bark}(u) \wedge k(i))$

- ||was loud||: $\lambda v \lambda i.\lambda k. \, (\, \text{loud}(u) \wedge k(i))$

- ||a dog barked||: $\lambda i.\lambda k.\exists x \, (\, \text{dog}(x) \wedge \text{bark}(x) \wedge k(i \cup \{x\}))$

- ||It was loud||: $\lambda i.\lambda k. \, (\, \text{loud}(\text{sel}(i)) \wedge k(i))$

- ||a dog barked. It was loud.||:
  $\lambda i.\lambda k.\exists x \, (\, \text{dog}(x) \wedge \text{bark}(x) \wedge \, \text{loud}(\text{sel}(i \cup \{x\})) \wedge k(i \cup \{x\}))$

Discourse semantics with rich discourse structure

- DRT and DPL consider a discourse as having the structure of a list or sequence of sentence contents.

- But intuitively, texts and dialogues have lots of structure reflecting the discourse functions or purposes of a discourse's meaningful constituents (discourse units).

- SDRT: these discourse functions are discourse relations between DUs; they affect the truth conditional content of discourses.

Discourse Relations

Discourse relations are types of relational speech acts (D-speech acts). They are often, but not always, underspecified by lexical semantics, the syntax/semantics interface and the principles of composition. They are anaphors (and cataphors)

The basic types of discourse relations (Narrative, Causal, Thematic, Structural similarity) seem to be universal. Leth (2011).

In empirical annotation work, we use 17 discourse relations of two structural kinds, subordinating and coordinating. (SDRS graphs have 2 dimensions)

D-speech acts and the speech act tradition

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speech acts in the Anglo-Saxon literature are typically characterized as unary properties of utterances or sentences-in-a context.

except for the speech act type 'answer', which is in fact a relational speech act. (In CA many more relational speech acts)

but what the standard picture missed is the <u>relational</u> nature of many speech acts.

There are *many* relational "discourse" speech acts, things people do with sentence contents in a discourse context.

Varieties of speech acts

- They explain a previous position or why something happened.

- They narrate a story of what happened

- They provide backgrounding for some event

- They elaborate on the properties of entities they've already mentioned, or on an event or a plan.

- They describe the result of a previously mentioned event or state.

- They correct themselves or others' discourse contributions.

- They ask questions whose answers will help determine answers to previously asked questions

- They offer greetings, insults, and say good-bye.

More on speech acts

- speech acts (items with linguistic context uttered in a particular discourse) linked by discourse relations (types of speech acts)

- one and the same sentence content can have different, incompatible rhetorical roles in different contexts:

  (10) Max fell. John pushed him.

  (11) John and Max were at the edge of a cliff. Max felt a sharp blow to the back of his neck. Max fell. John pushed him. Max rolled over the edge of the cliff.

- labels will serve as speech act variables and tag the contents of discourse constituents.

Effects of relational speech acts

These relational speech acts have effects on content (causal and temporal structure, anaphora and ellipsis resolution, presupposition, scalar implicature triggering) and on prosody (Tyler 2010)

I will call these D(iscourse)- speech acts and also D-implicatures because of the way they are inferred.

Consequences of thinking of speech acts relationally

- a relational speech act is a discourse constituent that bears a rhetorical relation to another constituent in the context (anaphora)

- a relational speech act in a context can be thought of as a graph with a labelled arrow.

- a single constituent may be attached to several other constituents and with different labelled arrows to one constituent (multiple or complex speech acts)

- a discourse structure is thus a graph (even a hypergraph).

Embedding speech acts within operators

(12) Finish that dissertation and I'll marry you.

(13) Cross that line and I'll hit you

(14) Get a beer, if you're thirsty

(15) If we were to get more serious, should I tell him my name? (on line dating service)

(16) Someone get this walking carpet out of my way (Princess Leia Star Wars)

D-speech acts embed freely

If D-speech acts are implicatures, they embed robustly and differ from scalar implicatures which are somewhat fragile.

(17) a. If it was late, John took off his shoes and went to bed.

b. If it was late, John went to bed and took off his shoes.

c. If John drank and drove, he put his passengers in danger.

d. The CEO of Widgets & Co. doubts that the company will make a profit this year and that (as a result) there will be much in the way of dividends for shareholders this year.

(18) a. Il commence à dessiner et peindre en 1943 , * fréquente les ateliers de sculpture * puis de peinture de l' école des Beaux-Arts d' Oran , * où il rencontre Guermaz .

b. Julie had an excellent meal, beginning an elegant and inventive truffes du Périgord en première cuisson comme un petit déjeuner, followed by some wonderful scallops, then sweatbreads, a sumptuous cheese plate, and ending with a scrumptious dessert.

Representing SDRSs

A discourse structure or SDRS (Asher & Lascarides 2003) is a triple $\langle A, \mathcal{F}, Last \rangle$, where:

- *A* is a set of labels

- *Last* is a label in *A* (intuitively, this is the label of the content of the last clause that was added to the logical form); and

- $\mathcal{F}$ is a function which assigns each member of *A* an SDRS formula— e.g., *Explanation*(π_1, π_2), $\pi_1 : K$, where *K* is a DRS or DPL formula

(19) π_1. John bought an apartment

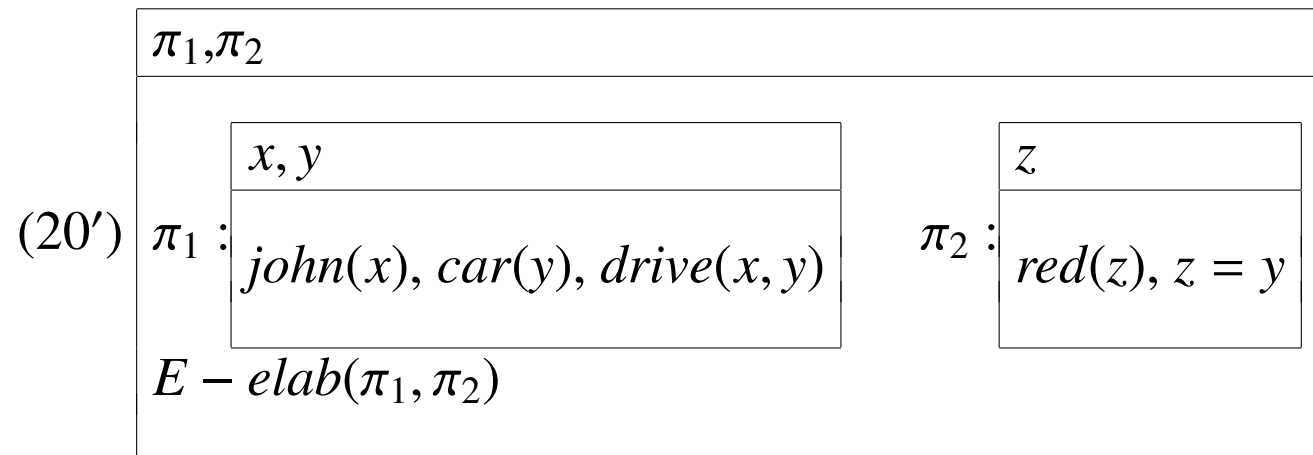π_2. but he rented it.

The discourse structure:

(19′) • $A = \{\pi_0, \pi_1, \pi_2\}$

  • $\mathcal{F}(\pi_1) = \exists x \exists e(e \prec now \wedge apartment(x) \wedge buy(e, j, x))$

   $\mathcal{F}(\pi_2) = \exists e'(e' \prec now \wedge rent(e', j, x))$

   $\mathcal{F}(\pi_0) = Narration(\pi_1, \pi_2) \wedge Contrast(\pi_1, \pi_2)$

  • $Last = \pi_2$

Note the two discourse relations between π_1 and π_2.

Examples

(20) John drives a car. It is red.

(20′)

$$
\boxed{
\begin{array}{l}
\pi_1, \pi_2 \\[4pt]
\hline
\pi_1 : \boxed{\begin{array}{l} x, y \\ \hline john(x),\ car(y),\ drive(x, y) \end{array}}
\quad
\pi_2 : \boxed{\begin{array}{l} z \\ \hline red(z),\ z = y \end{array}} \\[12pt]
E - elab(\pi_1, \pi_2)
\end{array}
}
$$

SDRT's view of semantics and pragmatic content

- the syntax/semantics interface results in an underspecified logical form—or constraints on discourse content. It is an important source of discourse content but not the only one.

- an underspecified logical form has many "holes" (Bos), underspecified elements that need to be filled in. There are holes in logical form that arise from simple predication (coercion) but also holes for operator scope, and discourse connection.

- SDRT provides a logic (glue logic) for filling in holes that are dependent on context both at the discourse and lexical levels.

SDRT continuation style

- SDRT's κ: a record, consisting of a set of labels, a subset of the labels where one can attach new information, a set of discourse entities and an intensional content.

- SDRT's PROP: a function from labels to intensional contents (sets of points of evaluation).

- A sentence's contribution to an input record is to add to a label and a content that links the sentence's contribution to some available label via one or more discourse relations. For more details see Asher & Pogodalla (2010).

Commentary

- Inevitably, SDRT needs some kind of dynamic semantics.

- Probably the continuation style semantics is the most elegant of these, abstracting away from irrelevant representational details. It also provides the cleanest separation between logic and linguistics.

Empirical Pressures

The structure and content of discourse in SDRT is complex. Why should we include this in a picture of content?

- Stalnaker's semantic picture is clearly problematic—temporal and pronominal anaphora, ellipsis, presupposition, modals.

- even classical dynamic semantics (DRT, DPL, Update Semantics) have trouble with the domains they were designed for. The motivating data for Asher (1993) and Asher and Lascarides (2003)

Propositional Anaphora

What is the referent of *this*?

(21) a. One plaintiff was passed over for promotion three times.

b. Another didn't get a raise for five years.

c. A third plaintiff was given a lower wage compared to males who were doing the same work.

d. But the jury didn't believe this.

(21′)   Three badly treated plaintiffs make claims

(21a) Continuation (21b) Continuation (21c)

Rght frontier: just the second clause of the first sentence as well as the constructed topic provide available attachment points. The set of available discourse entities for anaphora resolution depends on the attachment point as well.
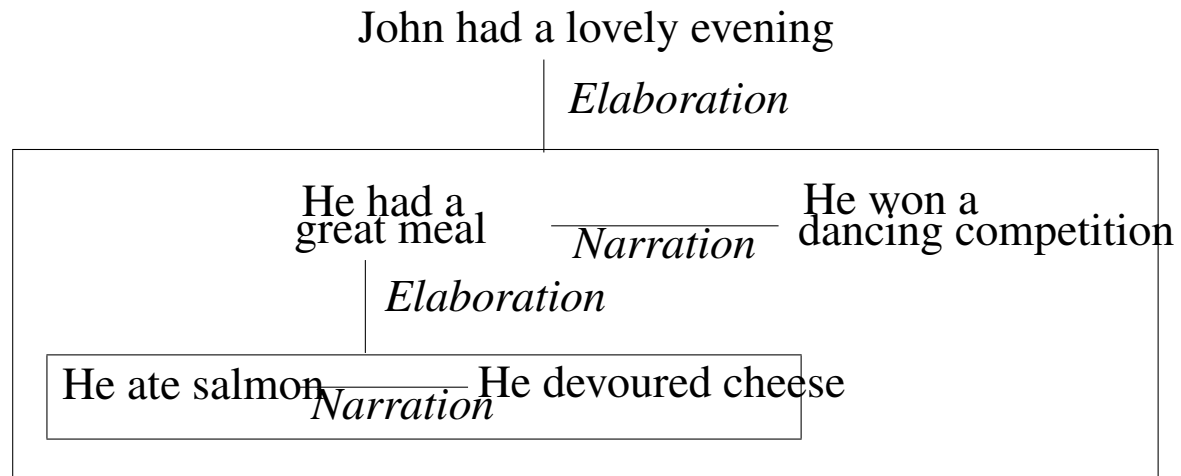
A Discourse Structure for (22)

(22) a. John had a great evening last night.

    b. He had a great meal.

    c. He ate salmon.

    d. He devoured lots of cheese.

    e. He then won a dancing competition.

    f. ??The salmon tasted great.

the SDRS graph

John had a lovely evening

Elaboration

He had a
great meal
Narration
He won a
dancing competition

Elaboration

He ate salmon *Narration* He devoured cheese

Tense and Temporal Structure (Lascarides & Asher 1993)

Here we see the effects of the content of the discourse relation itself, as well as the effects of the graph structure.

(23) Max fell. John helped him up.

(24) Max fell. John pushed him.

(25) Jill did well in school. She got A's in all her subjects.

- same sequences of tenses but different temporal structures. Dynamic semantics can't explain these differences

- different rhetorical relations linking the utterances in these examples can explain the differences in temporal structures: Narration($23a, 23b$),
  Explanation($24a, 24b$),
  Elaboration($25a, 25b$)

Ellipsis

R-implicatures give rise to a 2 dimensional structure (with subordinating and coordinating relations) that interact with grammaticality judgments.

Right frontier and ellipsis sluicing (Romero and Hardt 2004):

(26) a. John left and then Mary kissed someone. You'll never guess who.

b. Mary kissed someone and then John arrived. #You'll never guess who.

c. Mary kissed someone and then John arrived. You'll never guess from where.

d. John arrived and then Mary kissed someone. #You'll never guess from where.

More on sluicing

Further evidence that the Right Frontier Constraint is operative (and not some simpler constraint like adjacency of discourse units) come from the following data:

(27) a. Mary kissed someone after John left for some other party. You'll never guess who.

b. ??After Mary kissed someone, John left early. You'll never guess who.

c. Mary kissed someone. You know him. But you'll never guess who.

Analysis

SDRT predicts (27a,c) to be OK. The reason is that in these examples subordinating discourse relations obtain between the first two clauses.

According to the Right Frontier Constraint this allows for accessibility to either constituent.

Discourse relations even more important in dialogue

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(28) a. A: John got Mary roses.
      b. B: He got SUE roses.

Correction(28a, 28b) implies that dialogue content isn't additive.

How to build SDRSs

- lexical and compositional semantics, prosody underspecify discourse content and Discourse Logical Form.

- Need a representation of the contribution of these information sources to reason about discourse structure—underspecified representation or ULF.

- Need a segmentation of texts into elementary discourse units (EDUs). Need methods/algorithms for attaching EDUs to SDRS graphs and for inferring the appropriate ways of attachment (discourse relations).

Symbolic Methods

- symbolic methods exploit underspecified semantics and try to reduce the underspecification by using a variety of clues (lexical and compositional content), prosody, constraints coming from prior discourse.

- Use a nonmonotonic logic, which picks out preferred resolutions of underspecifications from the set of all possible specifications. These are "guesses", best estimates.

- Nonmonotonic logics are supraclassical but also provide defeasible inferences. E.g., *Dogs bark*, *Fido is a dog* $\not\models$ *Fido barks.*

- Some sample nonmonotonic logics: Abduction (Peirce), Circumscription (McCarthy 1980), Default Logic (Reiter 1980), Commonsense entailment (Asher & Morreau 1991)

Statistical Methods

- Symbolic methods are very hard to scale up. So far, they can only be usedwith very simple "toy" discourses.

- we have concentrated mostly on the defeasible inferences needed to infer discourse relations.

- Reasoning in the glue language goes from $?(\pi_1, \pi_2, \pi)$ to $R(\pi_1, \pi_2, \pi)$, for some particular discourse relation R.

- moving to hybrid inference techniques involving both machine learning and symbolic methods

Why the problem is hard

- Massive combinatorial problems, integration of syntactic, prosodic, lexical information. Constraint based approaches yield massive underspecification. Intractable with logical methods.

- Discourse structures are complex relational structures. Machine learning methods for these are still in their infancy.

- Discourse annotation is extremely expensive. Small data sets and non-homogeneous inductive classes. Semi-supervised and active learning techniques are very crude and not adequate to the task.

- A wide variation of discourse annotations for texts (low κ but not clear what measures to use). SDRS graph equivalences needed.

Results

- Discor, Annodis show that SDRT principles about discourse structure are robust on open domain text. e.g. validation of SDRT's right frontier constraint (Afantenos & Asher, *Coling* 2010).

- Detection of elementary predications, segmentation of texts into EDUs, is now reliable and automated. Room for improvement.

- Currently working on integrated statistical/symbolic models of the attachment problem. For certain subclasses, symbolic algorithms achieve 90% + accuracy for attachment.

- kernels with integrated symbolic constraints look to be promising for learning SDRS structures and arc labelling.

- detection of intermediate complex constituents a major problem.

Evaluation

- Investigations of discourse connectives, syntax and prosody have yielded a finer understanding of discourse relations.

- full formalization of discourse relation triggering rules not available due to impoverished lexical resources.

- efforts underway to solve the attachment problem by exploiting robust parsers, syntax and lexical information.

- efforts to infer discourse structure using statistical, or better hybrid tools.

Scalar implicatures and discourse

We've looked at discourse content as one sort of interface for pragmatics with semantics. What about other sorts of content?

- quantity or scalar implicatures (Horn, Levinson, van Rooij & Schulz,)
- evidentials
- expressive content

(29) John has four children.

(30) John or Susan came to the party.

(31) Some students finished their homework.

Gricean S implicature (Horn 1978, Schulz and van Rooij 2004, Schulz 2007)

- calculate implicatures after compositional semantics has finished its job.

- use Grice's maxims of conversation (quantity, quality, relevance).

(32) John or Susan came to the party $\rightsquigarrow$ John and Susan didn't both come to the party.

"Derivation" of implicature for (32)

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a the speaker has said "j or s", so she believes that j or s (quality)

b The speaker does not believe more than j or s (quantity), so she does not believe that j & s or that j or that s.

c The speaker believes the negation of more than what she said. (Opinionatedness).

Notice that the inferences in (a-c) are defeasible. Can be formalized in a nonmonotonic logic (Schulz 2007).

Caveat

Quantity is a two edged sword (Block 2009), if quantity is understood as (strict) logical entailment

By quantity, the speaker does not believe $(s \lor j) \land \neg(j \land s)$.

By propositional logic and the K axiom for modality, we have that the speaker does not believe $\neg(j \land s)$.

By opinionatedness, we have that the speaker believes $j \land s$.

Gricean "derivations" require a specified set of alternatives external to general Gricean principles (Block 2009).

How are these alternatives specified ? Lexically? By context?

Some more problems: embedded implicatures

_____

(33) John did the reading or some of the homework

implicatures:
¬ (the reading and some of the homework)
¬ (all of the homework)

Since Griceans compute implicatures only on whole utterances, it's not clear how to get the second implicature.

Localists (Chierchia, Spector, Fox)

Implicatures are, like presuppositions, conventionally determined by the lexicon and computed as a by-product of compositional interpretation

Compute a stronger meaning $\|\phi\|^s = \phi \wedge \neg\text{S-alt}(\phi)$ recursively, for expressions of all types. E.g.,

- $\|\phi \vee \psi\|^s = (\phi \vee \psi) \wedge \neg(\phi \wedge \psi) \wedge \neg\text{S-alt}(\phi) \wedge \neg\text{S-alt}(\psi)$

- (33) has the predicted implicature, if *John did the reading* has no alternatives other than $\perp$.

The strong meanings that aren't inconsistent with subsequent (semantic) content continue to be operative.

Issues

- empirical squishiness (Geurts and Pouscoulos, 2009, Chemla 2009)

- downward entailing contexts.

  (34) John doesn't think that <u>everyone</u> passed the exam. $\leadsto$ John thinks someone passed the exam. (reverse scalar implicature)

  (35) If you have cheese <u>or</u> dessert, the menu is 20 euros; if you take both there's a supplement. (exclusivity implicature is triggered in a DE context)

Implicatures are not always cancellable. Sometimes they are required for discourse coherence, in which case they are not cancellable.

(36) If you have cheese <u>or</u> dessert, the menu is 20 euros; if you take both there's a supplement. # But If you have cheese and dessert, the menu is 20 euros; if you take both there's a supplement.

(37) a. John has an even number of children. He has four. (implicature is that he has exactly 4)

   b. #John has an even number of children (π_1). He has three (children) (π_2).

   c. John has an even number of children (π'_1). He has at least three (children) (π'_2).

Complications for the theory

- it doesn't look as though the recursive calculation of quantity impli-catures can proceed without considering the discourse context.

- implicatures are not simply independent additions to truth condi-tional content

Examples from Chiercha, Fox and Spector.

(38) a. [If [you take salad or dessert]$_{\pi_1}$, [you pay 20 euros]$_{\pi_2}$]$_{\pi_3}$; [but if [you take both]$_{\pi_4}$ [there is a surcharge.]$_{\pi_5}$]$_{\pi_6}$

    b. If most of the students do well, I am happy; if all of them do well, I am even happier.

    c. If you can fire Joe, it is your call; but if you must, then there is no choice.

    d. Every professor who fails most of the students will receive no raise; every professor who fails all of the students will be fired.

A discourse structural analysis

Discourse structural principles trigger scalar and relevance implicatures.

Discourse attachment provides alternatives that can be used to generate implicatures.

If the discourse structure requires the S implicature for coherence, it isn't cancellable except on pain of incoherence.

Contrast(α, β) involves a structure preserving map μ from source β to target α where at least element x of τ_β is such that x and $\mu(x)$ defeasibly imply, in context, contradictory propositions (Asher 1993).

E.g., for two conditionals; the map μ must specify map the antecedent of the conditional in the source to the antecedent of the conditional in the target and the two antecedents must be defasibly contradictory.

A Look at (38a)

- Contrast requires a map $\mu\colon \pi_6 \to \pi_3$ such that:

- $\mu(\pi_5) = \pi_2$ and $\mu(\pi_4) = \pi_1$ where π_1 and π_4 are defeasibly contradictory.

- Given that the content of π_1 and π_4 are not as they stand defeasibly contradictory, we need to repair the situation with an S-inference if possible.

- The map μ provides a map from $A \vee B$ to $A \wedge B$, providing an alternative that allows GL to compute an S-inference: $\neg(A \wedge B)$.

- This S-inference is added to π_2, which then allows us to satisfy the constraint on Contrast.

Back to the lexicon

We've seen how discourse structure serves as a semantics/pragmatics interface, necessitating the computation of implicatures required for discourse coherence.

Coercion (Meaning shifts)

- event coercion *begin a novel, enjoy a cigarette*

- consummables *drink a bottle, have a beer*

- aspectual coercion *John is being silly*

- representations *The elephant in the living room should go in the bedroom, Chris sketched his hand, the garden with the flowers, the dress with the flowers*

- Containers, containees: *the bottle froze solid*

- concealed questions (O. Percus, 2010)
  John asked the sales clerk the price of the vase (what the price of the vase was)

John forgot (announced, concealed) Mary's birthday (the solution to the housing crisis).

- Determiner Count/Mass specifications:

(39) a. some water

b. a water

Coercion depends on the predicate and other arguments...

_____

(40) Sam enjoyed (started, finished) the zibzab.

(41) a. Sam announced the price.

b. Sam announced what the price was.

c. # Sam wondered the price.

d. Sam wondered what the price.

(42) a. #Smith has begun the kitchen.

b. The janitor has begun (with) the kitchen.

c. The cleaners have started the suits

d. The exterminator has begun (with) the bedroom.

e. The painters have finished the windows.

Discourse based coercions

(43) a. ??Yesterday, Julie began with the kitchen. She then proceeded to the living room and bedroom and finished up with the bathroom.

   b. Yesterday Julie cleaned her house. She began with the kitchen. She then proceeded to the living room and bedroom and finished up with the bathroom. (from L. Danlos)

   c. Last week Julie painted her house. She started with the kitchen. She then proceeded to the living room and bedroom and finished up with the bathroom.

(43a-c) show that the eventuality is *not*, at least in all cases given by the lexical entry of a noun in the theme argument of the verb or some adjoined PP.

Some more examples of context sensitivity

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(44) a. Where is John

    b. He's working

(45) a. How can John afford all those expensive holidays?

    b. He's working.

(from Peter Bosch)

The Case of the Genitive (Asher and Denis 2004)

A wide variety of relations:

(46) a. Bill's mother

    b. Mary's ear

    c. Mary's team

    d. The girl's car

    e. The car's design

    f. Mary's cigarette (i.e., the cigarette *smoked by* Mary)

    g. Bill's cake (the cake *baked by* Bill or the cake *eaten by* Bill)

    h. The wine's bottle

    i. A mother's boy

    j. The rapist's victims

    k. Japan's economy

    l. The economy's sluggishness

    m. The economy's performance

    n. Sunday's meeting

(47) [Context: Picasso and Raphael both painted a mother with a child.]
    Picasso's mother is bright and splashy —a typical cubist rendition.
    It makes Raphael's mother look so somber.

And where no relational noun is involved, discourse context can also affect how to interpret the underspecified relation introduced by the genitive.

(48) a. All the children were drawing fish.

    b. Suzie's salmon was blue.

More generalities

It also seems to be often a quite language specific phenomenon. Compare aspectual coercion of copular stative predications in English with those in French:

(49) a. Jean est idiot.
    b. #Jean est en train d'être idiot.
    c. Jean est en train de faire l'idiot.

(50) a. Mary finished eating the apple.
    b. Mary finished the apple.
    c. Mary stopped eating the apple.
    d. Mary stopped the apple.

Some pitfalls in dealing with coercion

- predicate modification (ellipsis)

    (51) I'm parked out back and Mary's car is too.

- argument modification–anaphora test and coordination.

    (52) I'm parked out back and am an old Volvo.

    (53) I enjoyed the book and the movie.

- coercion and aspect selection—both provide for copredication

    (54) George enjoyed many books that covered difficult topics

- But with coercion no quantificational domain shift. *Many* continues to quantify over books, so unlike aspect selection (see Asher 2011).

Some lexical theories and attempts at coercion

Sense enumeration lexicon: no account of why copredication works in some cases and not others.

No distinction between logical and accidental polysemy.

(55) I'm parked out back.

(56) Plato is on the top shelf on the right.

(57) The ham sandwich is getting impatient.

'the ham sandwich ': $\lambda P\text{the}(x)(f(ham\ sandwiches) \wedge P(x)$, where f is the transfer function mapping ham sandwiches to people who are eating them or who have just eaten them.

Technical problems: exactly when is f introduced?

Pronominalization Test

Pronominalization is a test to see whether there is a basic core meaning that can be picked up from one context to another.

(58) a. George Sand est lue par beaucoup de monde, bien qu'elle soit disparue depuis longtemps.

   b. ??George Sand est lue par beaucoup de monde, bien qu'ils ne soient plus édités.

Kleiber and others argue that Nunnberg's reference shifters don't really model polysemy, but rather replacements of sense.

(59) a. The mushroom omelet left without paying, because he found it inedible.

   b. ? The mushroom omelet is eating it with gusto.

Similar problems with copredication:

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(60) I'm parked out back and am an old volvo.

(61) George enjoyed many books last semester.

Could also shift the predicate meaning, but then you have problems with ellipsis.

(62) I'm parked out back and Mary's car is too.

(63) #I have a car that parked out back and Mary's car has a car that is parked out back too.

Properties of some parts of objects can sometimes be predicated of the whole.

(64) a. Paul est bronzé. (Paul['s skin] is tanned) vs. Paul['s skin] is oily.

b. Les américains ont débarqué sur la lune en 1969. (The Americans landed on the moon in 1969).

c. Le pantalon est sale. (The trousers are dirty)

d. Le stylo est rouge. (The pen is red)

e. John was hit in the fender by a truck.

Too limited. The *enjoy* coercions don't exploit any sort of part whole relation. No use of discourse context.

1. **Argument Structure**: Specification of number and type of logical arguments.

2. **Event Structure**: Definition of the event type of a lexical item. Sorts include STATE, PROCESS, and TRANSITION, nothing really special here.

3. **Qualia Structure**: A structural differentiation of the predicative force for a lexical item.

4. **Lexical Inheritance Structure**: Identification of how a lexical structure is related to other structures in the type hierarchy.

formalism of attribute value matrices or AVMs combined with types known as typed feature structures (Carpenter 1992).
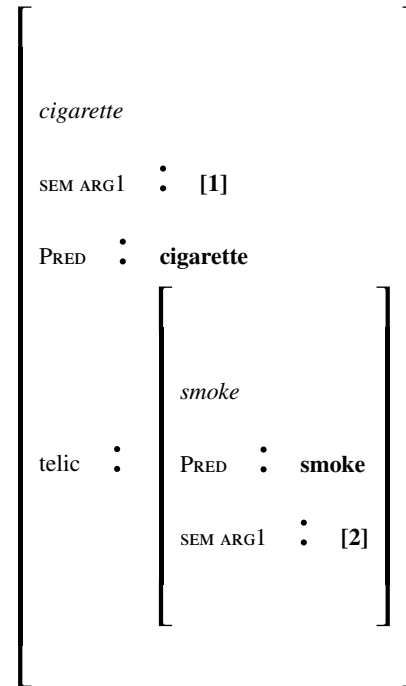
Qualia Structure

- the relation between an object and its constituent parts;
- that which distinguishes it within a larger domain;
- its purpose and function;
- factors involved in its origin or "bringing it about".

Qualia Structure of cigarette

$$
\begin{bmatrix}
\textit{cigarette} \\[4pt]
\textsc{sem arg}1 : [1] \\[4pt]
\textsc{pred} : \textbf{cigarette} \\[4pt]
\textsc{telic} :
\begin{bmatrix}
\textit{smoke} \\[4pt]
\textsc{pred} : \textbf{smoke} \\[4pt]
\textsc{sem arg}1 : [2]
\end{bmatrix}
\end{bmatrix}
$$

Evaluation

Classic GL's idea is that in cases of coercion, one of the qualia types of *cigarette* should be substituted for CIGARETTE. But how is this done in a unification based framework? Need a special lexical rule that would be quite complicated. Not a feature of the unification formalism.

Qualia selection is just a matter of coercing the head noun, similar to Nunberg's proposal. Same problems once you iron out the formal details.

No way of dealing with the context sensitivity of coercion in GL.

Pragmatic accounts

- postulate hidden variables that are filled in by context (Stanley-Szabo)

- appeal to processes of free enrichment (relevance theorists like Recanati)

Not enough constraints in these theories to account for the data. Types supply the relevant constraints to logical form adjustment.

Free enrichment seems to be a sloppy way of talking about predicate transfer and has Nunberg's problems.

What a coercing predicate demands

- imposes a type requirement or "presupposition" α on its argument

- licenses an underspecified polymorphic type $\beta: \gamma \to \alpha$ that takes the actual type γ of the argument and returns a type demanded by the predicate.

- Other arguments of the predicate or discourse context can specify this type.

- The type adjustment mechanism shifts the predicational environment via a natural transformation licensed by another type constructor.

$$g^{\alpha \times \beta} \times \alpha \times \gamma \xrightarrow{\quad BC \quad} g^{\alpha \times \beta} \times \alpha \times \gamma$$

$$\Big\downarrow id \times id \times dep$$

$$g^{\alpha \times \beta} \times \alpha \times \mathcal{B}(\alpha, \gamma)$$

$$C \qquad\qquad\qquad D$$

Implementation

- Use continuation style semantics but adapt the left context parameter (π) to carry type presuppositions.

- introduce presupposition justification rules (Asher 2011) that introduce material in the predication that will satisfy type presuppositions, as in the coercion natural transformation.

An entry for a coercion predicate

---

(65) $\lambda \Psi \lambda \Phi \lambda \pi \ \Phi(\pi * \text{ARG}_1^{\text{enjoy}} : \text{AG})(\lambda v \ \Psi(\pi * \text{ARG}_2^{\text{enjoy}} : \text{EVT} - \epsilon(\text{HD}(\Phi), \text{HD}(\Psi))$
$(\lambda y_1 \lambda \pi_3(\ \text{enjoy}(v, y_1, \pi_3) \wedge \ \text{ag}(y_1) = v(\pi_3)))))$

(66) George enjoyed many wines.

Constructing a logical form for the DP and applying it to the entry for *enjoy* gives us:

(67) $\lambda \Phi \lambda \pi \ \Phi(\pi * \text{AG})\lambda v \ \lambda Q \ \text{many}(x) \ (\text{bottles}(x, \pi * \text{ARG}_2^{\text{enjoy}} : \text{EVT} - \epsilon(\text{HD}(\Phi),$
$\text{WINE} \sqcap \text{CT}) * \text{ARG}_1^{\text{wine}} : (\text{P} \sqcap \text{CT}), Q(\pi)(x)) \ (\lambda y_1 \lambda \pi_1(\text{enjoy}(v, y_1, \pi_1)$
$\wedge \ \text{ag}(y_1) = v(\pi_1)))$

Type presupposition justification

With coercion we justify the verb's type presuppositions locally to the verb.

(68) $\lambda\Phi\lambda\pi\ \Phi(\pi*\text{AG})(\lambda v\ \text{many}(x)\ (\text{wine}(x,\pi),\ \text{enjoy}(v,x,\pi*\text{EVT}-\epsilon(\text{HD}(\Phi),$
$\text{WINE} \sqcap \text{CT}))\ \land\ \text{ag}(x) = y_1(\pi * \text{EVT} - \epsilon(\text{HD}(\Phi), \text{WINE} \sqcap \text{CT})))))$

The presuppositions in the nuclear scope of the quantifier cannot be satisfied as they stand. But the type presupposition of the verb licenses a transformation of the predicational context via the introduction of a functor which exploits the licensed type $\epsilon(\text{HD}(\Phi), \text{WINE} \sqcap \text{CT})$.

The functor in this case:

(69) $\lambda P\lambda u\lambda\pi''\ (\exists z{:}\ \epsilon(\text{EVT}, \text{BOTTLE} \sqcap \text{CT})\ \exists z_1{:}\ \text{AG}(P(\pi'')(z)\ \land$
$\phi_{\epsilon(\text{AG},\text{BOTTLE}\sqcap\text{CT})}(z, z_1, u, \pi'')))$

Finishing up

The functor applies to the λ abstract of the formula with the local type presupposition,
$\lambda y_1 \lambda \pi_1 \, (\text{enjoy}(v, y_1, \pi_1) \wedge \text{ag}(y_1) = v(\pi_1))$.

Applying the functor on the designated λ term within (68), we get:

(70) $\lambda \Phi \lambda \pi \, \Phi(\pi * \text{AG})[\lambda v \, \text{many}(x) \, (\text{bottle}(x, \pi), \exists z \exists z_1 \, (\text{enjoy}(v, z, \pi) \wedge$
$\quad\quad \text{ag}(z) = v \wedge \phi_{\epsilon(\text{AG,BOTTLE}\sqcap\text{CT})}(z, z_1, x, \pi)))]$

We can now integrate the subject into (70):

(71) $\lambda \pi \exists y (y = g(\pi) \wedge \, \text{many}(x) \, (\, \text{bottles}(x)(\pi), \exists z : \text{EVT}$
$\quad\quad (\, \text{enjoy}(y, z, \pi) \wedge \, \text{ag}(z) = y \wedge \phi_{\epsilon(\text{AG,BOTTLE}\sqcap\text{CT})}(z, y, x, \pi))))$

Specifying the polymorphic type

Sometimes the arguments will themselves specify the eventuality type, but sometimes it's just a defeasible specification.

We use something like SDRT's Glue Logic (nonmonotonic) to calculate the specifications.

ENJOY(HUMAN, ϵ(HUMAN, WINE)) >ENJOY(HUMAN, DRINK(HUMAN, WINE)

(72) $\lambda\pi\exists y(y = g(\pi) \wedge \text{many}(x) \ (\text{bottle}(x)(\pi), \exists z$: EVT
   $(\text{enjoy}(y, z, \pi) \wedge \text{ag}(z) = y \wedge \text{read}(z, y, x, \pi))))$

Sometimes discourse structure tells us how to fill in underspecifications.

Problems for coercion revisited

- ellipsis facts aren't a problem: the predicational context changes, not the predicate or its arguments (the verb or VP)

- coordination and copredication with coercions work because only the predication between the variable supplied to the verbal predicate shifts.

Other coercions

The sort of functors appealed to in Percus (2010) to account for concealed questions are straightforwardly implemented in TCL:

- *ask* or *debate* subtypes for a question in its theme argument but licenses a meaning shift from certain relational nouns to questions involving them.

- The same sensitivity to the actual word is also observed; just as *start* in its intransitive use doesn't license the same polymorphic type and natural transformation as *enjoy*, so too *wonder*, which also subcategorizes for a question, doesn't license the natural transformation from DPs to questions.

Conclusions

- the semantics/pragmatics interface has evolved from practically non-existent into a branch of linguistics, with formal and empirical progress.

- discourse structural principles constrain discourse content in various ways: temporal information, anaphora resolution, quantity implicatures, information structure.

- new tools developed to handle defeasible inferences and implicature; integration of statistical and symbolic methods.

- Extensions to game theory for conversation, a deeper model of conversational rationality

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