Themes for Barbara
Semantics and Natural Logic

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A common thread to much current results

- The role of (some of forms of) logic in determining grammaticality patterns.

- Some sentences are ungrammatical *because* they are Logically determinate (i.e. logically true, and hence trivial, or logically false)

- This raises a 'demarcation' issue, since many L-determinate sentences are totally grammatical

On natural logic, you either are on my side or you are not.

A recurrent problem

(i) John promised Mary [PRO not to to hurt himself]

(ii) * John promised Mary [PRO not to to hurt herself]

- Chierchia (1984) : (ii) is a contradiction, as it clashes with the type of constraint on the interpretation of PRO that verbs in the *promise*-class are subject to.
- R. Cooper "The claim that control violations are contradictions is by far the least convincing feature of your dissertation."

  [Review of Chierchia (1984) for MIT Press]

Plan

- Discuss how logic determines grammaticality patterns
- The demarcation problem: which L-determinate sentences are ungrammatical and why?
- Discuss recent answers to these questions from Gaiewski (2002) to Del Pinal (2017) and beyond.
- See were that leaves us with respect to the relation between grammar and logic.

An easy example.

The role of (some of forms of) logic in determining grammaticality patterns.

QUD: How many assignments will you have graded by dinner time?

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i. Maybe even 50, if you let me work

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QUD: How many assignments will you have graded by dinner time?

i. Maybe even 50, if you let me work

ii. Maybe not even one, if you don't let me work

An easy example.

The role of (some of forms of) logic in determining grammaticality patterns.

QUD: How many assignments will you have graded by dinner time?

i. Maybe even 50, if you let me work

ii. Maybe not even one, if you don’t let me work

iii. * Maybe even one, if you let me work

How many assignments will you have graded by dinner time?

a. Maybe even 50
b. Maybe not even one
c. * Maybe even one.

i. *even p* presupposes: p is the least likely alternative under consideration

ii. I grade 50 assign…$\Rightarrow$ I grade 40 assign …$\Rightarrow$ I grade 1 assign.

iii. I don’t grade 1 assign…$\Rightarrow$ I don’t grade 10 …$\Rightarrow$ I don’t grade 50 …

How many assignments will you have graded by dinner time?

a. Maybe even 50, if you let me work

b. Maybe not even one, if you don’t let me work

c. * Maybe even one.

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(c) is deviant because it is contradictory: you can’t be less likely than what entails you.

NPIs work like *even + one*

a. i. * John believes that there are any cookies left

   ii. John doubts that there are any cookies left

b. i. * If you are getting hungry there are any cookies left

   ii. If there are any cookies left, you won’t be getting hungry

c. i. If there is even one cookie left, we won’t starve

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b. i. * If you are getting hungry there are any cookies left

ii. If there are any cookies left, you won’t be getting hungry

c. i. If there is even one cookie left, we won’t starve

ii. even [if there ___ is one cookie left, we won’t starve]

Some other cases of ungrammatical contradictions: Contradictory entailments.

i. Some students but John hate me	Exception phrases (von Fintel)
ii. John only weighs more than 60 kilos	Measure phrases (Fox and Hackl)
iii. There are any cookies left	NPIs (Lahiri, Krifka,…)
iv. John is taller than no other boy	Comparatives (Gajewski)_
v. There is every solution to this problem.	Definiteness effects (Barwise and Cooper)

The issue of ungrammatical contradictions arises in exactly the same form in the domain of presuppositions.

Grammatical contradictory presuppositions:

i. Maybe that's not true, but I just know it is.

ii. I did meet the Italian who is not Italian

Ungrammatical contradictory presuppositions:

iii. John broke his bike for an hour	Q-temporal adverbs (Dowty)
iv. There are three bloods on the floor	Mass/count violations (Link,…)
v. How much doesn't he weigh?	Weak islands (Abrusan)

L-determinacy = D(omain)-neutrality (modulo structural constraints on D)

ϕ is D-neutral if its value is constant across worlds and models (i.e., regardless of how you pick your domain D)

Another term often used in this connection: Permutation invariant.

The demarcation problem:
Which D-neutral sentences are ungrammatical? Why?

a. Not all D-neutral sentences are perceived as ungrammatical

i. How's the weather? Well, it rains and it doesn't.

ii. Is John up to task? Hmm, he is and he isn't

Ungrammatical D-neutral sentences are *subconsciously* logically determined.

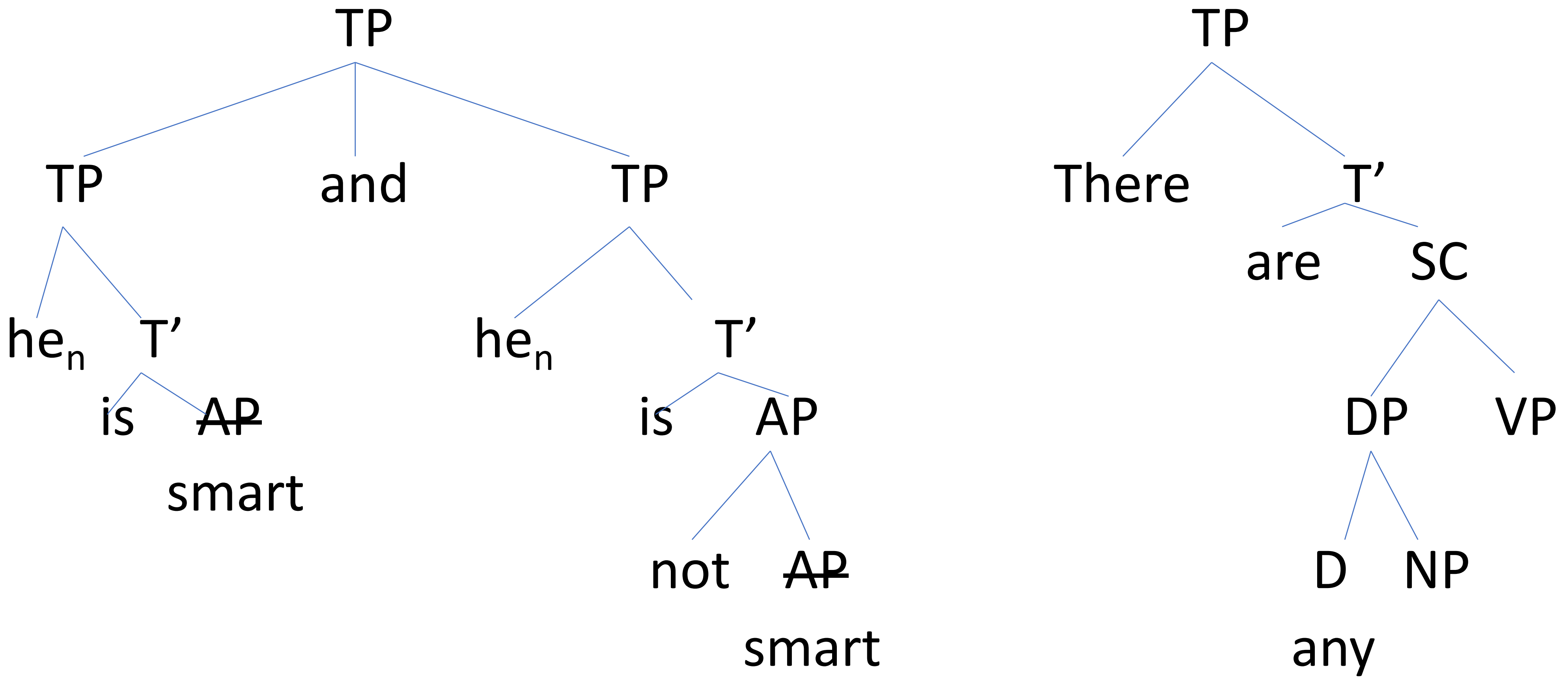
For grammatical D-neutral sentences, instead, it is easy to bring to consciousness the fact that they are L-determined.

Consequences of the existence of ungrammatical D-neutral sentences

i. Not all syntactically well-formed sentences are grammatical

ii. Logic enters directly in the definition of grammaticality

The debate on analyticity stages a come back: Gajewski (2002)'s proposal.



The debate on analyticity stages a come back: Gajewski's proposal.

- Ungrammatical D-neutral sentences (**G-trivial**) are those whose neutrality (= whether they are are true/false for any D) can be determined on the basis of the functional spine alone.
- Grammatical D-neutral sentences care about functional structure, but in addition they also care about whether two lexical items are the same or not.
- So, in a sense, D-neutrality comes in degrees.
- If Logic is the study of 'D-neutrality/L-determinacy', then Grammar is the most D-neutral area of logic.

Del Pinal (2017)'s amendment: Structure Dependent Contextualism (my label)

a. Freely insert a modulating function on any *non functional* item.

b. A modulating function is a variable ranging over functions of type <a,a> for any type a.

c. Examples:

i. There is any cookie left

ii. $even_{ALT}(\exists x[one(x) \wedge f(cookie)(x) \wedge f'(left)(x)])$

where $ALT = \{ \exists x[n(x) \wedge f(cookie)(x) \wedge f'(left)(x)]: n \in N\}$

iii. It rains and it doesn't

iv. $f(rain) \wedge \neg f'(rain)$

d. $[f(rain) \wedge \neg f'(rain)]$ is a **modulation** of the formula $[rain \wedge \neg rain]$

Del Pinal's amendment: Structure Dependent Contextualism

- For any (possibly modulated) formula ϕ, ϕ is D-neutral/L-determinate iff for any D, W, and **monotone** assignment g, $|| \phi ||^{D,W,g} = 1$, where an assignment g is monotone for ϕ iff for any free variable f of type <a,a> occurring in ϕ, g(f) is the identity map over D_a.

- ϕ is G-determinate iff for any D, W, and assignment g, $|| \phi ||^{D,W,g} = 1$.

Del Pinal's amendment: Examples.

i. There is any cookie left

ii. $\text{even}_{ALT}(\exists x[\text{one}(x) \wedge f(\text{cookie})(x) \wedge f'(\text{left})(x)])$

iii. where ALT = $\{ \exists x[n(x) \wedge f(\text{cookie})(x) \wedge f'(\text{left})(x)]: n \in N\}$

v. It rains and it doesn't

iv. $f(\text{rain}) \wedge \neg f'(\text{rain})$

Formula (ii) Is G-trivial, because it is false for any choice of D, W, and assignment g. Formula (v) is not G-trivial, because there are plenty of assignments for which it fails. It is however, L-Determinate, because it is false in any w for any monotone assignment.

Del Pinal's arguments for his emendment

- Use of modulation makes it easier to generalize G-triviality to alternative sensitive constructions

- It grounds functionally G-triviality: Ungrammatical D-invariant sentences are those that cannot be rescued by re-interpreting (content) words in context.

A key issue

- Both Gajewski and Del Pinal’s proposals rest on the distinction between ‘functional’ and ‘content’ word.
- This distinction is clearly related to that between ‘logical’ vs. ‘non-logical’
- While the functional/content distinction remains in part problematic, no linguist can live without it…

The problem of bound variables

i. John_i is never $\text{himself}_i \Rightarrow$ never [John $\lambda x_i . x_i$ is x_i]

ii. Today John_i is more eloquent than himself_i

- Bound variables are logical terms, if anything is. Hence, modulation should not affect them.
- Accordingly, (i-ii) are L-determinate/D-invariant for any modulation, and they should be ungrammatical on both Gajewski's and Del Pinal's definitions

Variables must be allowed to modulate

$$\lambda w.\ \text{John}\ \lambda x_i\ [\ x_i = f(x_i)(w)]$$

- f maps x in w onto the person that behaves the most the way x usually behaves.
- Modulation of individual variables is ‘intensional’, it maps individuals into individual concepts.

Modulation of directly referential terms (like variables) is independently needed: De re attitudes

i. Oedipus doesn't think that Jocasta is his mother

ii. Ralph believes that Ortcutt is a spy

iii. Johnny thinks that clouds are alive [BHP]

- Charlow and Sharvit (2014) develop a theory of belief de re based on 'Concept Generators', which can be viewed as a special case of our modulations.

What can be modulated:
The ‘right’ generalization.

Insert modulation functions into:

- Non logical constants
- *and* variables

= The referential points in a structure

= Whatever ranges over non logical meanings

Further bonuses:
'Semantic' type-shifting is a form of modulation

i. London is big and polluted (Chomsky 2013)

= London's surface is big and its air is polluted

$\lambda w.\ big_w(f(London)(w)) \wedge polluted_w (f'(London)(w))$

ii. This book has two hundred pages and is scary

= the physical object that realizes this book is 200 pp long and its content is scary.

$\lambda w[2\ hundred\ pages_w(f(\iota\ book)(w)) \wedge scary_w (f'(\iota\ book)(w))]$

Further bonuses:
As is ‘pragmatic’ type-shifting

The Boston office called

The ham sandwich wants his check (G. Nunberg)

'Absolute' vs. 'Model Theoretic' approaches to semantics.

a. Absolute

For any D, $u \in$ W, g, $u \in$ D, $w \in$ W, $||\text{run}||^{D, w, g}(w)(u) = 1$ iff u runs in w

b. Relative

For any M =<D,W, F>, $||\text{run}||^{<D, W, \mathbf{F}>, w, g} = F(\text{run})$

c. Absolute entailment

ϕ entails ψ iff for any D, W, g,

if $||\phi||^{D, w, g} = 1$, then $||\psi||^{D, w, g}(u) = 1$

d. Model relative entailment

ϕ entails ψ iff for any M=<D, W, F>, g, if $||\phi||^{M, w, g} = 1$, then $||\psi||^{M, w, g} = 1$

Consequences

- Absolute vs MT definitions agree on core cases of entailment, but diverge on cases like (i)-(ii). The absolute definition predicts that (i) *entails* (ii):
    i. There is water in that glass
    ii. There is oxygen in that glass
- This is problematic if entailment is meant to characterize speakers' competence.
- We want to distinguish knowledge of meaning from knowledge of 'hidden essences', and the like. Knowledge of meaning grows spontaneously in the child with very limited environmental input; hidden essences are a pretty different ball game.

Appeal to modulations reconciles these views.

- Use absolute definitions, if you like; assume free modulation
- ϕ is G-trivial iff for any D, W, and g $|| \phi ||^{D, W, g} = 1$
- ϕ is L-determinate iff for any D, W, and *uniform* g $|| \phi ||^{D, w, g} = 1$
- g is uniform for ϕ iff for any A, A' of any type a, and any variables f,f' of type <a,a> such that f(A) and f'(A') occur in ϕ, g(f) = g(f') whenever A = A'
- A uniform g maps distinct occurrences of A onto the same variant. So, e.g., a uniform g for $f(rain) \wedge \neg f'(rain)$ would have to be such that g(f) = g(f'). Accordingly:

i. $even_{ALT}(\exists x[one(x) \wedge f(cookie)(x) \wedge f'(left)(x)])$ G-trivial

ii. $f(rain) \wedge \neg f'(rain) = f(rain) \wedge \neg '(rain)$ L-determinate, non G-trivial

iii. $\exists x [f(water)(x)] \wedge \neg \exists x [f(oxygen)(x)]$ non L-determinate

On the relation between logic and language.

a. UG = A set of structure building principles + a deductive apparatus

b. Deductive apparatus:

   i. A family of structured domains: D = {<U, $\leq$>, <Ev, $\leq'$ >,..}
   ii. A set of operations on D: OP = < not, and, only/O, even/E, …>
   iii. A set of language specific choice points/mapping principles.

c. Modulations are the home of context dependent variations on general logical compositional structures, including:

- Type-shifting of various sorts
- Concepts/guises in de re attitudes

Consequences

- We have a cool way of sifting the role of logic in grammar from its role in general deduction
- Sentences that are L-determinate on any modulation are outright ungrammatical

  * ek bhii aadmii ayaa

  one even man came ‘even one man came’

  We can now offer an arguably principled answer to the question raised by R. Cooper
- Logic enters *directly* in the definition of grammaticality.
- We are getting ready for new hard outstanding questions:

  - How do the logical operations languages use (e.g. *even*) ‘emerge’?
  - *What* are the ‘substantive’ constraints on modulations?
  - *How* are subconscious inferences computed?

THANKS!

… To Barbara, who ventured there before
and showed us how to.

"We shall not cease from exploration
And the end of all our exploring
Will be to arrive where we started
And know the place for the first time"
T.S. Eliot, Little Gidding V