

Advanced issues in cognitive science and linguistics
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Part 1: Motivation for the Parallel Architecture

Agenda:

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Part 2: Two components of Parallel Architecture: Conceptual Semantics and Simpler Syntax

Part 3: A hierarchy of grammatical complexity and its bearing on the evolution of language

Part 4: A third component of Parallel Architecture: Morphology and the structure of the lexicon

Goals of linguistic theory

Broadest goal: To develop an integrated theory of language and its place in the mind/brain.

1. An account of linguistic information or linguistic representation – the traditional domain of linguistic theory.
2. An account of how this information is deployed in the mind in the course of producing and comprehending language, and with what resources – the domain of psycholinguistics: theories of language processing, experimental studies of processing, and computer modeling.
3. An account of acquisition: How the mind comes to acquire linguistic knowledge and the resources to process it, again with theoretical, experimental, and modeling components.
4. An account of what aspects of 1-3 belong specifically to language, and what aspects belong to more general mental phenomena.

Ideally, also (“biolinguistics”):

5. An account of neural computation: How 1-4 can be instantiated in brain tissue.
6. An account of biological development, such that the genetic code can lead to 5, and thence from 1 to 4.
7. An account of how the human genetic code evolved so as to make 1-4 possible, in particular the parts of 4 that belong specifically to language.

Goals 1-4: the program set out by Chomsky in the first chapter of *Aspects*. These goals are still central. My disagreement with Chomsky is in the implementation of these goals.

Goals 5-7 are largely beyond reach today. Brain imaging and computational modeling have made some inroads. But at the moment, we have no idea how something as simple as a speech sound is neurally instantiated, much less how biological development builds a brain and how evolution builds genetic codes that support language learning. Still, we should bear them in mind.

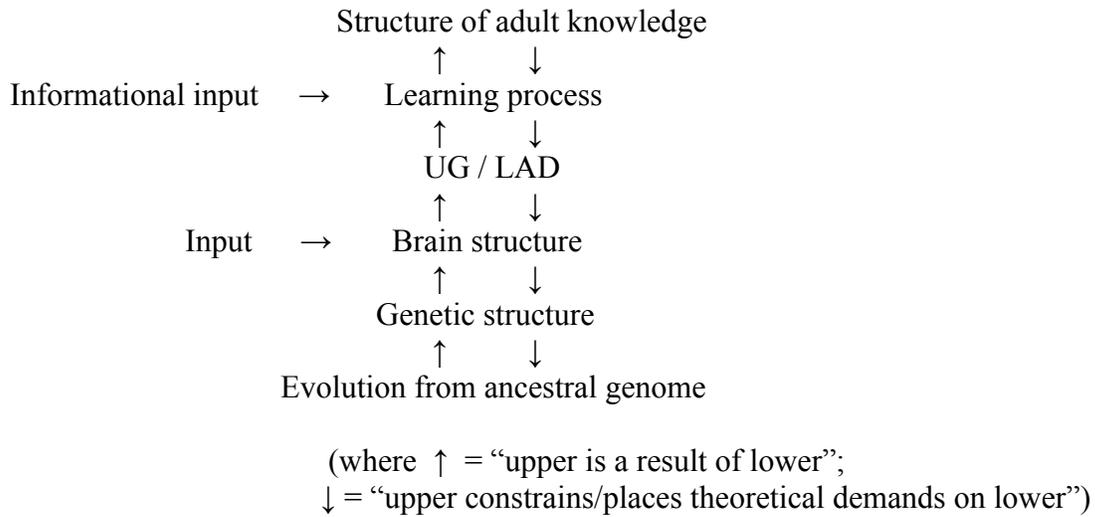


Figure 1: Chain of reasoning between evolutionary processes and everyday use of language

Subgoal of Goal 1: *Internally* integrated theory of linguistic representations.

Minimalist syntax, Optimality Theory in phonology, and Formal (model-theoretic) Semantics each have their own formal machinery, incompatible with the others. Can language be like that?



Figure 2. The state of linguistic theory

Desired: a theory of language in which phonetics, phonology, morphology, syntax, semantics, and pragmatics can fit together comfortably.

Also desired: a natural approach to various other manifestations of language such as gesture (both in signed and in spoken language), reading, narrative, conversation, song, bilingualism, and social aspects of language use.

Further desired: engagement with accounts of other faculties of mind, so as to afford explanations of how we can talk about what we see, how we can use language to support reasoning, etc.

Syntactocentrism vs. the Parallel Architecture

Central assumption (*Aspects*): The generative power of language comes from syntax; semantics & phonology are “interpretive.” Never defended.

But: Think about semantics from another angle:

- There has to be some common component of ‘meaning’ that different languages map into, so you can translate.
- ‘Meaning’ also needs to be couched in a form over which you can write rules of inference. It needs its own characterization, independent of the syntax – and vocabulary – of any particular language.

Under syntactocentric assumptions, this leads to impulse toward ‘universal base’, as in Generative Semantics.

Alternative: meaning has its own structure, *related* to syntax. But neither is derived from the other. In particular, there may be elements of meaning that are simply not expressed in syntax. This is the basic assumption of Parallel Architecture, and it was already being explored in the days of the Linguistic Wars (Jackendoff 1972).

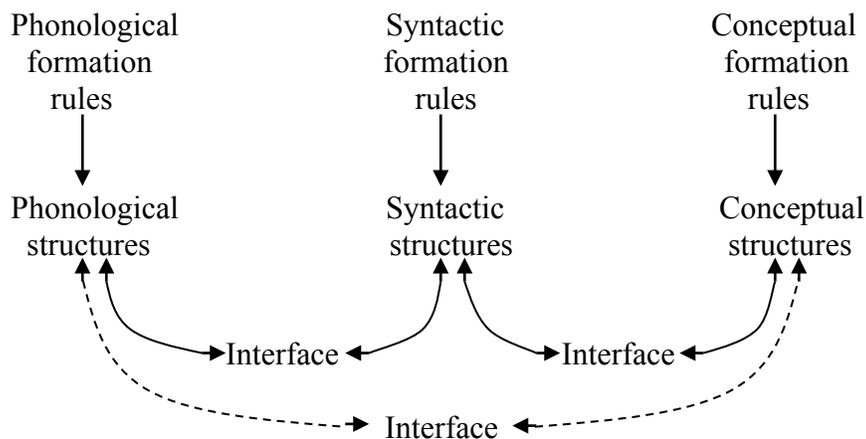


Figure 3. *The Parallel Architecture*

A well-formed sentence has well-formed structures in all three domains plus well-formed links between them. A word establishes a small-scale link between the three levels (part of interface).

The question: how much of the work of describing linguistic phenomena can be attributed to structure of meaning, how much belongs to (narrow) syntax, and how much to the interface between them? (What’s an interface? NOT a level of structure: rather, a correlation between 2 or more levels!)

Important methodological bias on the answer: If there’s a choice between attributing something to semantics or to syntax, and you’d need it in semantics anyway to drive inference, then you

don't need to put it in syntax too. Allows syntax to be simpler. Syntactocentric model doesn't give you this choice: every semantic difference has to be derived from syntax.

Goal for today: To take you through some of the phenomena that slowly convinced me this is the right approach. Four foundational points:

First: This is more or less the accepted architecture inside of phonology: independent tiers (segmental/syllabic, stress, tone, intonation) with principles that connect them.

Second: Apes & prelinguistic children manage to reason – maybe not as effectively as adult humans, but there's something going on there. We want to be able to say they have a level of mental representation that does this work. (Compare recent Chomsky on Language of Thought.)

Third: We can talk about what we see. There's no direct reference to the world, as in truth-functional semantics. Chomsky is right about this. Rather, the world of visual experience and visual understanding ("seeing") is constructed by the mind – it involves another level of mental representation (or several more, e.g. as in Marr 1982), which has to correlate with linguistic representations. It has to correlate not just with *cat*, but also with *the cat is on the mat*, i.e. combinatorial meaning correlating with combinatorial visual experience. Visual experience can't be *derived* from syntax. It's evolutionarily prior.

Fourth: There are linguistic phenomena whose meaning cannot be derived from syntax. Let's look at some phenomena not usually treated in traditional (or Minimalist) generative syntax.

OMB sentences (Culicover 1969, 1972)

- (1) One more beer and I'm leaving.
One more beer or I'm leaving

Syntactocentric approach has to ask: What full syntactic structure can it be derived from? How do you choose?

PA approach: An idiomatic syntactic structure with an idiomatic meaning, with a slot for pragmatics – semantic content that doesn't come from the words. A 1969 premonition of Construction Grammar!

Control

- (2) a. Sue promised Sam to wash the dishes. (Violation of Minimum Distance Principle)
b. Sue gave Sam a promise to wash the dishes. (Sue washes)
c. Sue gave Sam an order to wash the dishes. (Sam washes)
d. Sue got from Sam a promise to wash the dishes. (Sam washes)
e. Sue got from Sam an order to wash the dishes. (Sue washes)

Like *promise*: *vow, offer, pledge, commitment*

Identical syntax (aside from *from*). How would syntactocentric theory do this?

The solution (Jackendoff 1972, 1974):

1. Thematic roles of *give*: subject = Source, indirect object = Goal
Thematic roles of *get*: subject = Goal, object of *from* = Source
2. Thematic roles of verbs *promise* and *order*: subject = Source, (indirect) object = Goal
Same in nominals!
3. Meaning of *promise*: promissor (Source) undertakes obligation to perform action
(expressed by VP complement).
Meaning of *order*: orderer (Source) imposes obligation on Goal: Goal must
perform action (VP complement)
4. This difference in meaning accounts for difference in control! Match thematic roles of light
verbs with those of nominals. E.g. in (2b), *Sue* is Source of *give*, therefore Source of *promise*,
therefore controller of complement.

Conclusion: Differences in control in (2) arise from differences in *meaning*; syntax can remain
the same.

Deictic reference (Hankamer & Sag 1976)

Referential pronouns referring to the “world”:

- (3) a. Object:
Would you pick THAT up, please? [*pointing*]
- b. Action:
[Hankamer tries to stuff a 9-inch ball through a 6-inch hoop.]
Sag: I don't think you can do it.
- (4) a. Type or category:
I'd like one of THOSE. [*pointing to a Porsche*]
- b. Location:
Would you put your hat THERE, please? [*pointing*]
There was a fly buzzing around right HERE. [*pointing to empty space*]
The chandelier should hang down to about HERE. [*pointing to empty space*]
- c. Trajectory:
The fly went THATAWAY! [*pointing*]
- d. Action:
Can you do THIS? [*demonstrating*]
THAT had better never happen in MY house! [*pointing to, say, some random kids
smoking pot*]
- e. Manner:
Can you walk like THIS? [*demonstrating, say, a Groucho Marx walk*]
- f. Distance:
The fish that got away was THIS long. [*demonstrating*]
- g. Numerosity:
There were about THIS many people at the party last night. [*gesturing around room or
holding up fingers*]
- h. Sounds:
Did you hear THAT?

- i. Sentences:
Did he really say THAT?

The linguistic context determines ontological type (“semantic part of speech”) associated with the proform, and visual (or other perceptual) input determines its content. No reason to minimize ontology. The ontology is not a matter of truth about The World: it’s a matter of how we *conceptualize* the world. Strong internalist view of meaning: Conceptual Semantics.

Standard philosophy of language: Semantics is about truth-conditions for sentences – truth “in the world.” Mentalist approach, consistent with generative grammar: Sentences are mental constructs that language users *understand* to be in the world. The truth of a sentence is not objective, independent of language users: it is a matter of language users’ *judgments*, based on their understanding of the relevant situation.

Syntactic and semantic argument structure (Jackendoff 1972, 1990, building on Gruber 1965)

Basic story: Head of syntactic phrase \approx semantic function; syntactic arguments \approx semantic arguments. For example,

(5) [Ezra₁ loves₂ Levi₃]₄ \approx [State LOVE₂ (EZRA₁, LEVI₃)]₄

More complicated case:

- (6) a. John went into the room.
John entered the room.
b. John went to the top of the mountain (in a particular manner).
John climbed the mountain.

enter X \approx ‘go into X’; climb X \approx ‘go upward, clambering along surface of X, to the top of X’
‘go’ = [Event GO (Y, PATH)]
‘into’ = [Path TO ([Location INTERIOR (X)])]
‘enter’ = [Event GO (Y, = [Path TO ([Location INTERIOR (X)])])]

“Preposition incorporation” in semantics. *Enter* ends up as a syntactically transitive verb.

Next:

- (7) a. John buttered the toast.
b. John saddled the horse.
butter X > put butter on X (in the fashion that butter is meant to be used)
saddle X > put saddle on X (in the fashion that saddles are meant to be used)

The facts are purportedly captured in syntax by “noun incorporation” (Baker 1987, Hale and Keyser 1993.) But full semantics does not follow from ‘put Z on X’ (Millikan, Pustejovsky)

Better:

‘butter’ = [_{Event} CAUSE (Y, [_{GO} ([_{Event} BUTTER, TO ([ON (X)]); MANNER ...])]]]

Butter ends up as a syntactically transitive verb, with direct object having thematic relation of Goal, and BUTTER is Theme/Patient.

A harder problem for syntactic noun incorporation (Jackendoff 1990):

- (8) a. John buttered the toast with rancid margarine.
b. *John put butter on the toast with rancid margarine. (wrong meaning)

How do *butter* and *margarine* manage to occupy the same syntactic slot?

Alternative: *Margarine* is filling semantic Theme/Patient slot along with BUTTER and amplifies BUTTER. *With* marks this extra theme expression. (Parallel to clitic doubling?)

Next (Jackendoff 1990):

- (9) a. Sue bought a boat (from Jill) (for \$1000).
b. Sue obtained a boat (from Jill) (for \$1000).

With *buy*, Source and “counter-theme” are expressed optionally, but are always present in meaning. (Do we want to have them always in the syntax, but delete them? I hope not)

With *obtain*, Source is part of meaning of the verb, but “countertheme” is not – you can obtain something simply by being given it. Adding a *for*-phrase adds the entire extra part of a transaction event to the meaning. What does syntactic theta-assignment have to say about this?

Next (Jackendoff 1990, Goldberg 1995):

- (10) a. Jim joked his way out of the meeting. ≈ ‘Jim went out of the meeting (by) joking.
b. A billionaire lied his way into the presidency.

Syntactic argument structure is all wrong for *joke*; *joke* is understood as manner or means. Where does ‘go’ come from? What is *way* doing in there?

X’s way is occupying syntactic object position (a *syntactic* constraint):

- (11) a. Sam drank (*scotch) his way through the meeting.
b. Babe Ruth homered/*hit home runs his way into the hearts of America.

How can this be done in a syntactocentric framework?

In a PA framework (also Construction Grammar), it’s a constructional idiom:

- (12) [_{VP} V_x [_{NP} *pro*’s way] PP_z]_y = [_{Event} GO (X, PATH_z); MANNER_x]_y

Constructional idioms, like other idioms, can have normal syntax (like (10)) or idiosyncratic syntax (like *one more N and S, the more...the more*)

Another constructional idiom with canonical syntax (Booij 2002):

- (13) that travesty of a theory = ‘that theory, which is a travesty’
that fool/gem of a politician = ‘that politician, who is a fool/gem’

Syntactic head = semantic modifier; syntactic modifier = semantic head.

Syntactic head has to be evaluative – a selectional restriction, just like that for a word.

Another, with noncanonical syntax (Oehrle 1998, Jackendoff 2008):

- (14) a. Student after student came in with a complaint.
b. There was a serious error on page after page of the document.
c. Student after student turned in lousy paper after lousy paper.

Exhibits quantificational force without a quantifier in sight (note scope ambiguity in (14b)).

A binding problem (Jackendoff 1991, Culicover and Jackendoff 2005)

Scenario 1: The Beatles go to the wax museum. They’re admiring their likenesses, but suddenly

- (15) Ringo stumbles and falls on himself.

Scenario 2: The Beatles go to the wax museum. They’re admiring their likenesses, but suddenly Paul stumbles against the statues and

- (16) *Ringo falls on himself.

An LF solution: underlying syntax of the “extended sense” is *statue of X* at LF, so that in (15) *Ringo* c-commands *himself*, but in (16) it does not. Binding theory applies at LF; *statue of* is deleted in Spell-Out.

Problem: What can be deleted is determined semantically/pragmatically. Visual representations (picture, portrait, statue, etc.) are okay, but e.g. audio representations are not.

- (17) All the CDs were strewn on the floor. Carelessly, I stepped on Beethoven and ??Ringo stepped on himself.
Bill was doing charcoal sketches of the Beatles, and he gave me Ringo.
Bill was doing (verbal) sketches of the new employees, and *he gave us Harry.

Actor portraying X: What are the exact “underlying” words that are deleted? (Esp. with Merge)

- (18) In that production, Hamlet is a woman. [played by a woman vs. change of plot]
Nixon went to see *Nixon in China*. He listened to himself singing to Mao.
*Up on stage, Nixon listened to himself snoring in the audience.

Alternative solution: (14) and (15) have the same syntax. The work is done in the semantics and the interface.

- The relation between STATUE [RINGO] and *Ringo* is part of the syntax-semantics interface: $NP_x \approx [\text{VISUAL REPRESENTATION } (X_x)]$

- Semantics of (15) = FALL (RINGO_i, ON [STATUE [SELF_i]])
- Semantics of (16) = FALL ([STATUE [RINGO_i]], ON SELF_i)
- Define binding conditions on semantics: counterpart to c-command. (C&J call it “cs-command.”)
- In (15), RINGO is “dominated” by FALL, which “dominates” SELF.
- In (16), RINGO is “dominated” by STATUE, which does not “dominate” SELF.

Two more cases of “enriched composition”: nouns referring to something other than their normal referents:

(19) [One waitress to another:] The ham sandwich wants another coffee.

Another binding problem: *else* (Culicover and Jackendoff 1995, 2005)

Else is anaphoric. It can denote token-difference (like *her*) or type-difference (like *one*).

- (20) a. Tom talked about Sue, and Amy talked about someone else. (= someone other than Sue)
 b. Tom bought a car, and Amy bought something else. (= something other than a car)

It occurs in positions for anaphors (21a), allows strict/sloppy identity ambiguities (21b), allows a contextual referent (21c), and can be bound by quantifiers (21d). It also appears in VP anaphora (21e).

- (21) a. Joe only hates himself. He doesn’t hate anyone else (= other than himself).
 b. Joe went to his house, but Bill went somewhere else.
 (=somewhere other than Joe’s/Bill’s house)
 c. [Joe walks into the first meeting of a committee you’re on. In dismay, you say:]
 Oh, no, couldn’t they have appointed someone else? (= someone other than Joe)
 d. Everyone here thinks someone else will win. (= someone other than themselves)
 e. Joe wants to go swimming, but I want to do something else.
 (= something other than go swimming)

But in syntactic binding theory, anaphors fall under Principle A, definite pronouns fall under Principle B, and VP anaphora is handled by reconstruction. How can these cases be unified?

Could you derive *X else* syntactically from *X other than pro*? Do you want to be able to delete specific words like *other than*? Note existence of other “derived” anaphoric forms (Partee 1989):

- (22) a. Bill went to a local bar/a foreign country.
 b. Bill went to a bar in his vicinity/in a country not his own.

These can be bound by quantifiers too.

- (23) a. The mayor of every city hangs out at a local bar.
 b. Everybody enjoys visiting a foreign country.

Alternative solution: *else* means ‘OTHER THAN α ,’ where α is an anaphoric element in semantic structure; again binding theory applies (in part) over semantic structure. Won’t work out details today.

Implications for syntax (Culicover and Jackendoff 2005)

A lot of “invisible” structure can be eliminated from syntax: Simpler Syntax. Following HPSG and LFG and others, there is no movement. The grammar generates surface structures directly.

Many of the traditional arguments for movement are based on semantic relations, e.g. active/passive, raising, wh-fronting. The proposal is that these are all to be accounted for in terms of alternative mappings between syntax and semantics.

Notion of simplicity in Simpler Syntax:

1. Syntax should be the simplest possible to map between semantics and phonology.
2. Simplest \neq smallest number of branches from each node (binary branching);
Rather, simplest = smallest number of nodes (flatter, multiple branching trees)
3. As for the phenomena above: No core-periphery distinction: Knowledge of language includes *all* the facts.

Two last cases: Sluice-stranding (Culicover 1999) and sluicing

- (24) a. John came to the party with someone, but I don’t know who. [Sluicing]
b. John came to the party, but I don’t know with whom. [Sluicing with pied-piping]
c. John came to the party, but I don’t know who with. [Sluice-stranding]

Standard syntactic account:

- (25) a. ... but I don’t know [_{CP} who ~~he came to the party~~ with t] by wh-fronting and deletion
b. ... but I don’t know [_{CP} who with ~~he came to the party~~ t] by pied piping and inversion

Problem: This is supposed to be a general derivation. But the acceptable combinations of wh-word and preposition are highly quirky. You have to learn which cases exist (as with irregular morphology – see Part 4).

- (26) ... but I don’t know who with/to/from/for/*next to/*about/*beside
what with/for/from/of/on/in/about/at
how much for/*by/*with
where to/from/*near
*which (book) with/to/from/next to/ about/beside

The easiest way to learn these is to hear their surface forms and store them as related idioms in the lexicon. Getting these results with any sort of rule features is madness.

A more general problem with sluicing (Culicover and Jackendoff 2005, Jackendoff and Culicover 2012):

Difficulty in specifying what’s deleted in (27) (a Rodgers and Hart song): Antecedent of sluicing is the entire situation – present in semantics but not syntax.

- (27) It seems we stood and talked like this before. We looked at each other in the same way then. But I can't remember where or when (we stood and talked like this before (and) looked at each other in the same way then as we're looking at each other now)???

The challenge for syntactocentric theory

Argument from Minimalists that PA isn't constrained enough: three "generative engines" and looser interfaces.

Counterarguments:

1. Minimalist theory has no account of this range of phenomena.
2. Minimalist theory has no theory of semantics or connection to visual understanding
3. PA's syntax – Simpler Syntax – is in fact highly constrained: no movement, virtually no invisible functional categories.