

## 1 Syntactic vs. Semantic Bootstrapping

### 1. The Logical Problem of Language Acquisition:

*The poverty of the stimulus*

- Incomplete evidence
- Noisy evidence
- Lack of negative evidence

*The problem:*

Does a child use semantic cues to figure out a verb's syntactic possibilities?

and/or Does a child use syntactic cues to figure out a verb's semantics?

(for *verb* above, "word" can be inserted).

i.e. *Meaning* → *Form*? or *Form* → *Meaning*?

2. **Pinker:** the problem facing a child is figuring out syntactic frame possibilities. Child uses verb meaning to suss out subcategorization possibilities.  
**Gleitman:** the problem facing a child is figuring out the meaning of the verb. Child uses syntactic frame cues to restrict the search space for possible verb meanings.

Both admit/note/claim that it probably works or can work both ways.

## 2 Gropen, Pinker et. al: "Affectedness and Direct Objects"

3. "There is a strong correlation in English between a verb's semantic properties and its syntactic properties, and it seems obvious that speakers can sometimes exploit this pattern to *predict form from meaning*."

4. Meaning = paraphrase?  
*glip* = "to shove with one's elbow"  
*glip* has the same syntactic frame possibilities as *shove*.

5. Some linking tendencies:
 

<i>Agents</i>	Subject	(mostly)
<i>Patients</i>	Object	(mostly)

### 2.1 Early linking theories: thematic roles

6. "Arguments bear theta-roles which specify their general semantic role in the event or state denoted by the predicate."

*Some thematic roles:* Agent, Patient, Theme, Goal, Source, Location

*some others:* Recipient, Experiencer, Path

Worth noting: there's a weaker notion of "thematic role" according to which each verb's meaning specifies its own set of thematic roles: *love* (Lover, Lovee), *give* (Giver, Given, Givee), etc. See discussion in Pesetsky, later. For acquisition usefulness, though, a theta-role hypothesis like that in (7a), in association with a hierarchy like that in (7b), is what would be needed:

7. a. *Relativized UTAH* (Uniformity of Theta Assignment Hypothesis)  
(Baker 1986, this version, Larson 1991)  
*Identical thematic relationships are represented by identical relative hierarchical relations between items at D-Structure.*

b. AGENT>THEME>GOAL>OBLIQUE...

8. *Problems with thematic role theories:*

a. Apparently similar verbs ("locative" verbs, in this paper) with different linking patterns:

- i. figure-object  
I poured water into the glass
- ii. ground-object  
I filled the glass with water  
\*I filled water into the glass.

b. Identical verbs with alternating linking patterns:

- i. I sprayed paint onto the wall.  
I sprayed the wall with paint
- ii. I gave the book to John  
I gave John the book.  
(also: for category a. above  
I donated the book to the library  
\*I donated the library the book;  
John faxed/whispered the message to me  
John faxed/\*whispered me the message.)

c. For verbs that alternate, different linking patterns often entail a significant semantic difference in the verb's meaning. Notably, for the purposes of this paper, when an element is in object position, it appears to be *affected* by the action of the event in a way that it is not when it's in a prepositional phrase.

9. Thematic-role approaches to these facts:

'basic' vs. 'marked' or 'noncanonical' orders

Prediction: the latter are rarer and harder to learn.

Problem: This is not obviously true, especially in dative-shift cases.

Gropen, Pinker et al. have since shown that children can be induced to dative-shift novel verbs fairly easily, in an experimental paradigm very similar to this one. The 'subset' approach to markedness would entail no generalization without evidence, for any given verb.

## 2.2 Semantic structure theories

10. a. *fill*: Cause (X: the glass) to become full of (Y: water) by means of causing (Y: water) to be in (X: the glass).  
b. *pour*: Cause (X: water) to go downward in a stream into (Y: the glass).

11. Translated into thematic role theories: arguments bear multiple roles in a single sentence. There are *two* events in (10a), a state change and a location change.  
"The state change is the 'main event' and the location change is a subsidiary 'means' of achieving it... (This effect is reinforced by the fact that within the rigid word order of English, the choice of *fill* focuses the content as the 'new' entity by putting it at the end of the sentence, backgrounding the 'given' container by putting it immediately after the verb...)."  
*Focus structure*: Old info - container  
New info - content  
*Aspectual structure*: Telic/delimited by the main event, i.e. the direct object's fullness.

12. *A Linking Rule*  
Link the argument that is specified as "caused to change" in *the main event* of a verb's semantic representation to the grammatical object.
13. *How to tell if a verb refers to a main event of "change location" vs. "change state"*  
MANNER: type of motion vs. type of change.

"If a verb specifies *how* something moves in a main event, it must specify *that* it moves; hence manner of motion verbs link the moving entity to the direct object role. In contrast, if a verb specifies *how* something changes state in a main event, it must specify *that* it changes state.. hence the changing entity should be linked to the direct object role. By assessing speakers' judgements about the kinds of situations to which a verb can naturally refer, we can identify which feature of the verb's meaning is specified as its main event, and hence predict its direct object."

13. a. He filled the tub.  
b. He filled the tub with water.  
c. He filled the tub (with water) with a hose.
14. a. \*He poured water.  
b. He poured water into a glass/down the drain/out the window.
15. *Alternating verbs: "Lexical Rules"*  
a. Operates on a verb's semantic structure  
b. Changes, e.g., (10a) to (10b), or vice versa, whichever is 'basic', 'splash'  
c. *splash* can be either a manner of moving or a manner of covering
16. *Holism* effects in ground-object verbs:

"Since the most natural interpretation of a state change is that it is the entire object that undergoes the change, rather than one part, the ground is interpreted holistically in this form."

17. "There is a strong tendency for affected entities to be encoded as direct objects."
  - a. Sue kicked the chair.
  - b. \*This chair kicks easily.
  
18. *Overregularization?*
  - a. Bowerman: only one linking rule, the "canonical" one. Noncanonical cases are exceptions, like irregular verbs.
  - b. Pinker: two linking rules. Tendency for overregularization to figure-object rather than ground-object the result of general tendency: "Children have more difficulty acquiring meaning components relevant to changes of state than components relative to changes of location."
  - c. change of state *mix* vs. manner of motion *stir/shake*.
  
19. Correction by monitoring across situations: "Sooner or later *fill* will be used by an adult to refer to an event in which there is no pouring, so the incorrect "pouring manner" component can be expunged.
  
20. **Experiment 1:** Cautionary tale about the difficulty of extracting the relevant semantic information from a situation. Ended up unable to distinguish between an alternating verb and one which specified change-of-state.
  
21. Experimenters were careful to present novel words in a syntax-neutral context:
  - a. "This is keating"
  - b. "Find keating!"Note that this removes cues that are normally available to children in input...
  
22. **Experiment 2:** (change of state as cue to ground-object)  
Worked very nicely.
  
23. **Experiment 3:** (holism as cue to ground-object)  
Mostly worked, although the results are much more equivocal.
  
24. Seems to be a superset-subset relation:  
"Mary loaded apples into the cart": either partitive or holistic  
"Mary loaded the cart with apples": only holistic.
  
25. Novel verbs: *snarf, scarf, frob, mung, ding*. Denominalized verbs: "He tried to Rosemary-Woods the tape; He nroffed and scribed the text file".  
"In all such cases, the argument structure of the novel verb is not predictable from existing forms in the language and must be created from the verb's meaning by linking rules."

26. "Whenever a verb is heard in a grammatical syntactic construction, there is, strictly speaking, no need to use a linking rule to predict that the verb can appear in that construction. "...[The child] could use the linking rule in the reverse direction, to guide the acquisition of the verb's meaning."
27. What sort of semantic elements may be operated upon by lexical rules?
28. Semantic bootstrapping:  
 "[Children] might use linking regularities and word meanings to identify examples of formal syntactic structures and relations in parental speech and hence to trigger syntactic rule learning for their particular language...For example, if the patient argument of the verb comes after the verb in an input sentence, the child can deduce that it is a VO language, even if the child had no way of knowing prior to that point what counted as an object in that language." ...  
 "... the universal linking rules, shared by parent and child, would yield the correct syntactic analysis for the child as long as the child could identify which entities count as "affected". Obviously, it is not realistic to expect that the lexical semantics of a parent's verb matches the child's cognitive representation of the described event for all situations and languages."

### **3 Gleitman: The Structural Sources of Verb Meanings**

1. The learnability problem for word meaning:
- goal: associate meaning, structure with phonological string
  - requirement: share attention with parent, extract relevant information from immediate context
2. Introduction: blind kids and *look, see*
- a. interpretation = "explore haptically"
  - b. context for use: object within child's reach
  - c. *see*: only 39 % of uses involve an object the child can reach  
*look*: 72 % of uses involve an object the child can reach
  - d. compare: *give*: 97% of cases, *get* 50% of cases  
 relevance of nearness clear to verb meaning here

3. But: nearness isn't the only thing an infant can notice:
  - world contains unitary, bounded, enduring objects
  - objects move relative to each other
  - objects move relative to the child
  - objects can't occupy two places at once
  - objects have different physical properties: colors, rigidity, elasticity
  - objects move or don't
  - they are animate or not
  - they cause things to happen, or not
  - they come in different numbers
  
4. Can the learnability problem be solved by allowing the theoretic child to notice a broader range of phenomena? E.g., the perceived intentions of the parent? "But also the mother may be angry or distant or lying down or eating lunch and the object in motion may be furry or alive or large or slimy or hot, and the child might code for these properties of the situation as well, entering them, too, as facets of the words' meanings....An observer who notices everything can learn nothing, for there is no end of categories known and constructable to describe a situation."
  
5. Standard learning problem from syntax:  
 Vocabulary acquisition is:
  - a. efficient and systematic
  - b. elementary vocabularies very similar across languages
  - c. hence: reasonable to conclude that there are limits on hypothesis space?
  - d. lexical theorists don't, usually, and for one obvious reason: while elementary vocabularies are *largely* the same, there doesn't seem to be any problem for the child acquiring, say, the notion of "Cheerios" just because there are some Cheerios in his environment.
  
6. Pinker's proposed primitives for verb learning:
  - a. Notice the main event
  - b. Notice the path, direction, or location of an object, "literal spatial location or some analogue of it in a nonspatial semantic field."
  - c. Notice causation, manner
  - d. Notice some things about the participants
  - e. Notice temporal distribution
  - f. Notice purpose
  - g. Notice any coreferentiality of arguments
  - h. Notice truth value entailments
  - i. plus a couple
  
7. Gleitman: *can you really get all this from perceptual observations?*
  
8. Ambiguity of events:
  - a. George pushing the truck:

Truck moves, clanks, perhaps slides, rolls, crawls....

9. Pinker: comparison of verb uses across events to extract real contingencies of use
  - a. sample a subset of features
  - b. add or subtract to current definition a value for that feature
  - c. *permanently discarding any feature value that is contradicted in current sit.*
  
10. Gleitman:

Attention sharing often imperfect. So the child should only do 9a-c when attention-sharing reliably in place: if the child is focussed on the wrong thing, 9c especially will have disastrous consequences for word learning.
  
11. *Further problems:*

verb pairs: *chase/flee* used only in contexts where both are appropriate.  
subsets: *animal* always appropriate in *dog* contexts; *dog* always appropriate in *poodle* contexts, etc.  
*lack of positive evidence in these cases*, negative evidence as always sketchy  
"basic" categories vary: *grape* and *pea*, *bird* and *tree*  
*figuring out the meanings of unobservables from observables: think situations?*
  
12. "This class of solutions begins to invoke evidence that is not in the world of observation, but rather resides in the design of language itself; in the present case, the child's assumption about the lexicon is that for all practical purposes it excludes synonyms."
  
13. *Word/world relation:*

A large percentage of utterances are in the future tense, conditional, counterfactual, past... in these cases, the child cannot use here-and-now observations to learn word meanings. "Any scheme for learning from observation must have some machinery for dealing with the fact that caretaker speech is not a running commentary on scenes and events in view." Child must hence be very tolerant of mismatches
  
14. Pinker's cross-situational scheme: *how is a child to know when there's just a mismatch, and when to change a feature?* E.g., in the *sell/buy* pair, one can buy a Coke from a machine without it really being appropriate to describe the scene as *The machine sold me a coke*. So, if child has so far mistakenly concluded that *buy* means *sell*, because of cross-situational ambiguity up to now, "I bought a coke from the machine" might disambiguate it — but why will the child pay special attention to this mismatch, and not to others?
  
15. *Additional source of information: syntactic context*
  - a) Considering only the "canonical" frames for "look" (i.e. transitive or deictic), the environmental cues get much better: 100% of canonical instances of *look* to blind children are uttered when there's an object within reach; 72% of canonical uses of *see* are.

If the child can distinguish a transitive frame from others, they have a valuable clue about the interpretation of *look/see*.

b) Different numbers of noun phrases in a sentence with a verb is clearly semantically determined. Further, their structural positions carry information: Agents are nearly always subjects, Goals are nearly always in PPs. (Hence the whole idea about linking principles in the first place).

16. *to reiterate:*

Pinker: children learn *single words*, then make projections for them based on their meaning

Gleitman: children learn words *in their frames*, and make meanings for them that are compatible with those frames.

17. How syntactic bootstrapping works, e.g.:

"The component *transfer* is inserted into a verbs semantic entry in case it is observed to occur in three noun-phrase sentences."

"Certain abstract semantic elements such as 'cause', 'transfer', 'symmetry' and 'cognition' are carried on clause structures".

a) *cause*: transitivity (note: *within a semantic class!*)

b) *transfer*: ditransitivity

c) *symmetry*: reflexivization, plural subjects?

d) *cognition*: clausal complement

18. Syntax/semantic correlation:

a) transfer = 3 NP arguments

b) mental verbs = clausal complement

c) *verbs of mental transfer* = both a) and b)

19. Of course, the syntax can't decide differences within verb classes. But there, the real world can disambiguate.

20. Requirement: syntax mostly before semantics! Can infants parse, LouAnn?

21. "... no room for trivializing interpretations such as the strategy of assigning the animate entity to the subject position."

22. Same scene, different syntax      different interpretation.

a. *some blick*

b. *a blick*

c. *blicking*

23. Same item, different syntax      different level:

a. a gorp (type)

b. Gorp (name)

24. *2-year olds*: same scene, different conjectures about meaning of *gorp*
- a. The rabbit is gorpings the duck.
  - b. The rabbit and the duck are gorpings.
25. *3- and 4- year olds*: same scene, different conjectures about meanings
- a. The rabbit zarps the skunk
  - b. The skunk zarps the rabbit.
  - c. The skunk is biffing a blanket on the monkey
  - d. The skunk is biffing the monkey with the blanket.
26. *Difficulties*:
- a) deciding between arguments and adjuncts (cross-occurrence analysis)
  - b) idiomatic usages, determining "canonical" verb frame
  - c) Eventive vs. stative verbs?
  - d) Source of linking rules?
  - e) Error recovery? transitive *giggle*; *exit*, *enter* vs. *leave*, *come into*, *push* vs *pull*