

## **Cognition, Language & Communication 2013**

4: Usage-based Grammar, Connectionism, Probabilistic Grammars

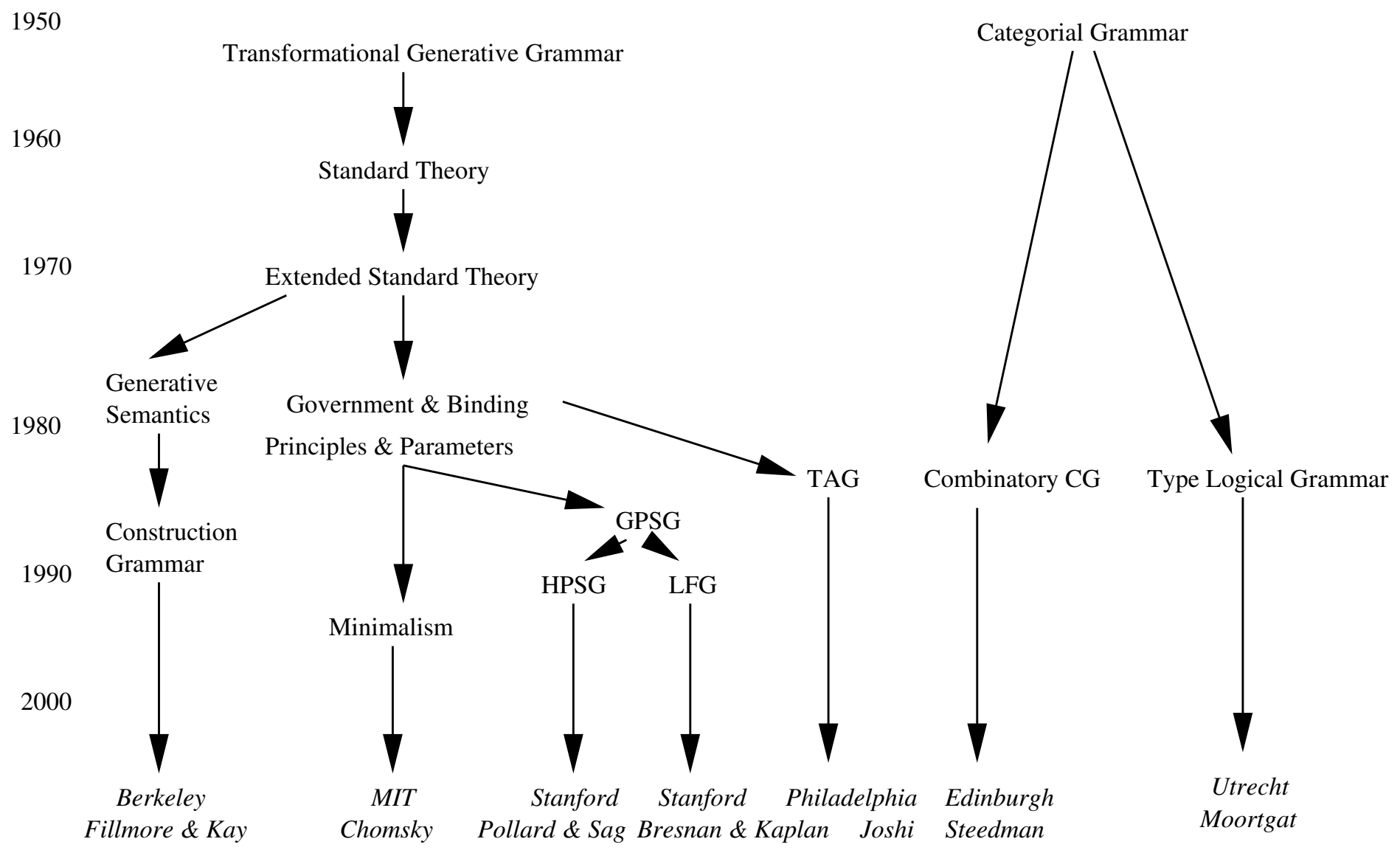
## Recap: Arguments for Universal Grammar

1. Formalism necessary to represent natural language syntax is quite complex (trans-finite-state, and probably trans-contextfree);
2. There are many seemingly arbitrary features in the syntax of natural languages, each with many a priori plausible, but non-attested alternatives;
3. Children nevertheless reliably arrive at the correct rules of grammar, based on relatively few example sentences and no negative feedback (the poverty of the stimulus): innate prior knowledge of language?;
4. Languages differ greatly at first sight, but detailed analysis reveals many similarities between distinct languages in the underlying structure: a universal plan underlying all languages?

## Plan for today

Can we trust the firm conclusions on an innate “Universal Grammar”?

- Problems within the generative grammar paradigm
- Problems with the generative grammar paradigm → Cognitive Linguistics, Probabilistic Linguistics



## Problems within the generative paradigm

- (1)
  - a. a violin which this sonata is hard to play upon
  - b. \* a sonata which this violin is hard to play upon (Steedman'03)
  
- (2)
  - a. Every acorn grew into an oak.
  - b. Every oak grew out of an acorn.
  - c. An oak grew out of every acorn.
  - d. \* An acorn grew into every oak. (Gruber, 1965)
  
- (3)
  - a. a book which I hope I will write, and I fear that most people will burn without reading
  - b. \* Three mathematicians in ten derive a lemma and in a hundred prove completeness (Steedman'03)

## Problems with the generative paradigm I: empirical base

Generative linguistics is built on a rather narrow empirical base

- Syntactocentrism
- Grammaticality 1/0
- Competence
- Formal models
- Synchronic
- Monolingual
- Functionalism
- Graded grammaticality
- Performance: experiments, corpora
- ?
- Synchronic, diachronic, developmental
- Multilingual

## **Problems with the generative paradigm II: learning**

A principles & parameters model cannot adequately describe the rudimentary grammars at several stages of child language acquisition.

See article by Tomasello.

## Problems with the generative paradigm III: constructions

(Fillmore, Kay & O'Connor, 1988; Culicover & Nowak, 2004; Jackendoff, forthcoming)

### Idioms

- (4) a. by and large
- b. lo and behold
- c. beat a dead horse
- d. make amends
- e. cast aspersions
- f. a flash in the pan



## VP constructions

- (5)
  - a. Pat sang/drank/sewed his heart out
  - b. \* Pat sang the Marseillaise his heart out
  - c. Leslie talked/cooked/composed up a storm
  - d. \* Leslie talked a storm up
  - e. \* Leslie cooked eggs up a storm
  
- (6)
  - a. Elmer hobbled/laughed/joked his way to the bank.
  - b. Hermione slept/drank/sewed/programmed three whole evenings away.

## Problems with the generative paradigm IV: Overgeneration & Ambiguity

(7) The man saw the woman with the telescope.

(8) a. #the a are of I ..... word salad?

b. John saw Mary ..... unambiguous?

(9) a. a hectare is a hundred ares

b. As described in section I paragraph a ...

c. The a paragraph of I is hardly readable.

d. Typhoid Mary

e. the Russia house butler

(Abney 1996)

## Probabilistic Context-Free Grammars

r1.	S	→ NP VP	.7
r2.	S	→ NP	.3
r3.	NP	→ N	.8
r4.	NP	→ N N	.2
r5.	N	→ John	.6
r6.	N	→ walks	.4
r7.	V	→ walks	1.0

John walks ..... S or NP?

$$P(r1 \circ r3 \circ r5 \circ r7) = .7 \times .8 \times .6 \times 1.0 = .336$$

$$P(r2 \circ r4 \circ r5 \circ r6) = .3 \times .2 \times .6 \times .4 = .0144$$

## Problems with the generative paradigm V: Incrementality & Sentence Processing

(10) The horse raced past the barn fell.

(11) The old man the boat.

(12) The man who whistles tunes pianos.

(13) Time flies like an arrow. Fruit flies like a banana.

(14) The Australian woman saw the famous doctor had been drinking quite a lot.

(15) Before the woman visited the famous doctor had been drinking quite a lot.

(16) While the pilot was flying the horse that had arrived stood over by the fence.

(wikipedia; Sturt, Pickering, Crocker, 1999; Pickering, Traxler, and Crocker, 2000)

## **Problems with the generative paradigm VI: Evolutionary Plausibility**

- Big Bang theories (e.g. Bickerton 1990)
- Gradualist theories (e.g. Pinker & Bloom, 1994)
- Agnosticism (Chomsky upto 2002)

## Orthodox nativism:

- Direct correspondence between internal machinery and its constraints, and observed variation;
- Monolithic UG, which provides a detailed innate specification of morphosyntactic patterns;
- So complex that it must be language specific and uniquely human, but couldn't have evolved in gradual evolution.

