Mother Tongue Acquisition: From Usage to Grammar

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PLAN

- 1. Usage Based L1Acq: an alternative to nativism

- 2. Pre-linguistic phase

- 3. Word learning

- 4. First utterances

- 5. First compositions

- 6. Type conversions and diatheses

- 7. Conclusion

Nativist perspective

Traditional perspective of **L1** acquisition is nativist

<u>Manifestly stated</u>:

In: N.Chomsky'80 ["Rules and Representations", Columbia Univ. Press], J.Fodor'83 ["The Modularity in Mind", MIT Press], D.Bickerton'90 ["Language and species", Chicago UniV Press], M.Atkinson'92 ["Children's syntax", Oxford], N.Hyams&K.Wexler'93 [Linguistic Inquery **24(3)**]

<u>Implicitly presumed</u>:

EX: R.Jakobson'68 ["Child language, aphasia and phonological universals", Mouton]) thought that the phoneme discriminating sound contrasts are acquired after 1;0, while learning new words, because they must distinguish lexical meanings. In fact, they are acquired before 0;11. Does it mean that meaning distinctions exist in pre-linguistic children?

Pinciples and parameters language model

- Universal Grammar is innated

- L1Acq is a process of setting UG parameters, which ultimately identify the specific grammar

EX: +(Sbj pronoun drop) selects for Italian ‖ Chinese
-(Sbj pronoun drop) selects for English

Criticisms:

- no consensus on the parameter set

- P&P gives no testable accounts of the details of L1Acq

- the observed L1Acq is a gradual inductive process

Bootstrapping puzzle

Bootstrapping theories:

- <u>*syntactic*</u> L.Gleitman'90 [Language Acquisition, **1**], B.Landau&L.Gleitman'85 ["Language and Experience", Harv. Univ. Press]: e.g., verbs with sentential complements (*know that* $clause$) are "perceptive / mental state"

- <u>*semantic*</u> S.Pinker'84 ["Lang. Learnability and Lang. Development", Harv. Univ. Press], K.Wexler&P.Culicover'80 ["Formal Principles of Lang. Acq.", MIT Press], L.Bloom'70 ["Language Development", MIT Press]: to acquire word combination rules, lexical classes ‖ thematic roles are needed

Usage Based L1Acq perspective

Usage Based theory of grammar acquisition: a new approach to L1Acq (cf. M.Tomasello [Cogn. Ling.,2000,**11**])

- CH have little (if any) underlying knowledge about grammar

- the process of L1Acq may start with statistical detection of basic asymmetries in the speech addressed to a CH

- CH may proceed by using frequent words in frequent set utterances
  (EX: *Where's Mommy?*) and then generalize to (*Where's X ?*)

- lexical acquisition may be based on general assumptions specific to the human perception

Preferential paradigm methods of detection of L1Acq facts are used in the pre-production period

Periodization of emergence of language

See B.MacWhinney'88 [Ann.Rev. of Psychology, **49**]

Pre-grammar phase 0;0 - 0;9 based on innate perceptual abilities of the mammalian auditory system:

COMPREHENSION:

- emergence of auditory patterns (detected via "sucking habituation paradigm")

- equivalent (wrt the L1) sound differences are lump together (CH attend to syllabic sequences soon after 0;0)

- CH prefer their L1-specific prosodic patterns, their mother's sounds soon after 0;0

- CH tend to better remember repeated word strings on top of normal L1-intonation about 0;2

- CH tend to learn prosodic patterns (e.g. "trochaic bias": stressed peak followed by 1 or 2 weak syllables)

- CH recognize their own name about 0;6, tend to extract repeating sound sequences about 0;8

Pre-grammar phase continued

PRODUCTION:

- emergence of articulation patterns

- first vocalizations (birth, pain, hunger and pleasure cries) 0;0

- first social vocalizations (cooing) about 0;3

- phonemic contrasts acquired before 0;11 (habituation studies show that this universal ability fades after 0;11, cf. L.Gerken'93 ["Child Phonology", In: Handbook of Psycholinguistics, Acad. Press], P.Bloom'93, [Language Acquisition. Core Readins])

- sound play consisting of a few simple sounds: bubbling 0;6 - 0;11 (evidence for a drift toward the segments and the prosody of the target L1) about 0;11

- initially, the auditory and the articulatory development proceed as de-coupled (e.g. the deaf CH bubble till about 0;6)
- evidence of a connection between bubbling and audition about 0;9 (deaf CH cease bubbling)

Lexico-semantic phase 0;9-2;0

- By 0;9 CH develop an internal model of a transformable spatial environment (can use spacio-temporal and perceptual cues to find a hidden object when their own perspective has been shifted)

- in the absence of grammatical knowledge, CH's comprehension rests upon the language redundancy and the input multimodality

  - social support (CH try to acquire names for the objects that adults are attending to; mother-CH mutual gaze; focusing the CH's attention to novel objects matching new words, etc.)

  - speech context (L1acq succeeds only in the context of CH-addressed speech about the observed-here-now)

  - prosody ("motherese")

  - semantic cues

  - morpho-syntactic cues

- comprehension of a linguistic phenomenon precedes to its poduction by 2-3 month

  - cues sufficient for discrimination are not always sufficient for production

  - articulation difficulties

Emergence of the first words

In <u>COMPREHENSION</u>: about 0;9-0;10
In <u>PRODUCTION</u>: about 0;11-1;0

First Words are salient to the CH's environment:
EX: individuals: *mama,dada,baby* , objects: *car* , animals *doggy* , toys *teddy* [bear], body parts *nose* , substance *water* , action verbs *give* , *go* , adjectives *big* , social interactions *hi, no* .

They are often closely related with the context:

EX: *duck* (hits the toy off the table), *see* (points and turns to the listener)

From distribution to lexical types

Can distribution provide necessary cues for bootstrapping?

There are evidences that CH of age 0;11-1;0 acquire the four main word types nouns (n), verbs ($*s$), adjectives (q) and adverbs (c) from the distribution alone (cf. T.Mintz'06 [In: "Action Meets Word: How Children Learn Verbs", Oxford Univ. Press])

Kind of distribution: intra-utterance [a] occurrence frames :

               <token..one-word position..token> (token: a word or an affix)

EX: <*you*..*the*> in *you take the puppet*, <*the*..*in*> in *I see the cat in the yard*

Frequent frames in a corpus:
- with a frequency superior to a threshold in the corpus,
- productive: the number of words in FF word positions is superior to a threshold

Categorization using FF: in 6 corpora of the adult's utterances addressed to 0;11-1;0 CH in CHILDES DB hand-labelled for word types:
- are detected about 50 FF out of 20000 occurrence frames,
- only 5% of words occur in FF, but they represent 50% of words not occurring in FF
- each FF represents a unique type with precision: .98, but with recall .08 (i.e., many verb types, noun types, etc.)
- on the whole, verb FF are three times more frequent than noun FF !!!

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[a] CH determine utterance boundaries from prosodic cues starting from 0;6 (K.Hirsh-Pasek et al.'87 [Cognition, **26**(3)]).

CH tend to class words using FF

T.Mintz used the Headturn Preferential Paradigm to learn CH of age 0;11-1;0 to distinguish nouns and verbs from the input in which occurred nonsense words: a half in noun FF, a half in verb FF

EX: *She wants you to deeg it*.   *I see the bist in the room*

In familiarizing phase: the nonce words respected the FF types

In test phase: some nonce words were misused: those defined by noun FF occurred in verb FF and vice versa in utterances differing only in the FF word position and in the same number

EX: *She wants you to bist it*.   *I see the deeg in the room*

Result: there was a strong asymmetry in ungrammatical utterance mean listening time for noun FF and verb FF:
- mean 7.5s grammatical / mean 7.8s ungrammatical for noun FF vs.
- mean 7.5s grammatical / mean 8.6s ungrammatical for verb FF

CONCL: the discovered verb-noun categorization was due to the distribution only

REM: 1. noun FF are three times less frequent than verb FF
2. In B.Hole et al.'04 [Infancy, **5**(3)], 1;3-old German CH categorized novel nouns, not verbs (**NB**: German articles mark for case and gender)

Word spurt and 2-word combinations

Two important events at about 1;6:

- a rapid rise in the size of the vocabulary: a CH can learn words at a rate of nine new words a day and keeps this rate through adolescence (cf. S.Carey'78 ["Lingv. Th. and Psych. reality", MIT Press]),
- a primitive syntax begins with first two-word phrases (see P.Bloom'93 ["Lang. Acq. Core Readings"]).

What might be the mechanism of new words acquisition?

Induction PB:

1. W.V.O.Quine'60 ["Word and Object", MIT Press]: for any taxonomic hypothesis (concept, construal), there will be an infinite number of logically possible hypotheses consistent with it.
2. L.S.Vygotsky'82 [Complete works, vv.1-6]: at least till 6;0-7;0, the CH'thinking is neither deductive nor inductive, but transductive (relating particular to particular).

Hypothesis (see S.Carey'78; E.Markman'92 [In: "Perspectives on Lang. and Cognition", Cambr.Univ.Press]; E.Clark'97 [Cognition, **64**]):
In the place of induction, CH use:
- lexical or relational associations and
- universal lexical assumptions

Lexical and relational associations

How are established associations between new words and construals ?

1. Taxonomic vs. Thematic associations (E.Markman'92):

Taxonomic associations: between (superordinate) objects, e.g., to which the same properties have been assigned:

$$\text{This } (O_1) \text{ does } P \text{ and this } (O_2) \text{ does } P .$$

Thematic associations: between objects mentioned as different arguments of a known verb: this (O_1) catches this (O_2)

	Standard object	Taxonomic choice	Thematic choice
	cow	pig	milk
EX:	door	window	key
	bee	ant	flower
	train	bus	rails

Taxonomic assumption: CH tend to establish taxonomic associations for named objects and thematic ones for unnamed:

When the standard object is named by a new (even nonsense) word (*This is a dax. Find another dax*, CH prefer taxonomic associations. Otherwise, they prefer thematic associations: (*Find another one like this*):

TXA explains why CH prefer to assign learnt count nouns to similar objects

Other lexical assumptions

Whole Object Assumption (**WHA**) (S.Carey'78): a novel term for an object refers to the whole object (not to its part, aspect,..).

Mutual Exclusivity Assumption (**MEA**) (E.Markman'92): to every object refers a single term (fallible, because classes overlap).

EX1: Shown unnamed,unknown(*pagoda*), pointed,named(its *finial*):
Here is a finial
QU: *Which one is the finial (the whole or the part)?*
CH tend to choose the pagoda:

$$\frac{W_{new} \ for \ (O_2 \in O_1); \ \neg\exists W \ (W \mapsto O_1)}{W_{new} \mapsto O_1} \ (\textbf{WOA})$$

EX2: Shown named(*pagoda*), pointed(its *finial*): *Here is a pagoda*
QU: *Which one is the finial (the whole or the part)?*
CH tend to point the finial:

$$\frac{\dfrac{W_{new} \ for \ (O_2 \in O_1); \ PAGODA \mapsto O_1}{W_{new} \not\mapsto O_1} \ (\textbf{MEA}) \quad Q_2 \in Q_1 \ salient}{W_{new} \mapsto O_2} \ (\textbf{WOA} \ discarded)$$

part-of simple (no conflict with **MEA**); is-a difficult (conflicts with **MEA**)

Two-word phrases: 1;6-2;0

Comprehension:

- CH distinguish between different intonations: neutral (ILL=DCL), interrogative (ILL=QUE), jussive (ILL=IMP),
- identify the verb arguments via the standard WO depending on the illocution force,
- cannot identify them using surface syntax markers (prepos., conj.):

  Watch Big Bird bending Cookie Monster / Watch Big Bird and Cookie Monster bending

Typical production:

All dry	*All messy*	*All wet*
I sit	*I shut*	*No bed*
No pee	*See baby*	*See pretty*
More cereal	*More hot*	*Hi Calico*
Other pocket	*Boot off*	*Siren by*
Mail come	*Airplane allgone*	*Byebye car*
Our car	*Papa away*	*Dry pants*

Observations:

- func. words recognized in comprehension are omitted in production,
- utterances are sentences with omitted copula, or are formulaic (copied from the input), or express semantic dependencies,
- standard WO is respected.

Three-word phrases (about 2;0)

Novel accounts in: M.Tomasello'03 ["Constructing a Language", Harv.Univ.Press]; A.Goldberg et al.'04 [Learning Argument Structure Generalizations, Cogn.Ling.**14(3)**]

Observed L1Acq process disproves the main nativistic thesis of "poverty-of-the-stimulus":

- CH tend to reuse the most frequent verbs in their input (*give, go, put, want, get, sleep*) and change the nouns accompanying them in the positions specified by the standard WO,

- This process converges to several schemes: e.g. under ILL=DCL:

SV: WHO V (*you sleep*)

SVL: WHO V WHERE (*I go to the backyard*)

SVO: WHO V WHAT (*I push the ball*)

SVOL: WHO V WHAT WHERE (*I put another ball here*)

SVOiO: WHO V WHOM WHAT (*I give her my ball*)

Before generalization: "pathbreaking" verbs

Typical production:

ILL	SBJ/AGT	ACTION	RCP	OBJ/PAT	LOC	SCHEME
DCL	Mommy	fix				SV(O)
DCL	Mommy			pumkin		S(V)O
DCL	I	ride		horsie		SVO
DCL	tractor	go			floor	SVL
DCL		give	doggie	paper		(S)VOiO
DCL		put		truck	window	(S)VOL
DCL	Adam	put		it	box	SVOL

- The schemes are represented by a unique word (e.g. SVL,SVOiO), or by several words (e.g. SVO) most frequent in both: the input and the production under this scheme (**EX**: *go* 76% in SVL, *put* 94% in SVOL)

- Learning these frequent "pathbreaking" verbs exponentially acceler-ates the acquisition of other verbs in each scheme (A.Ninio'96 [7th Int. Congr. for the Study of Child Lang]).

Productiveness: U-shape learning

Important particularity of CH's L1acq acquisition data is its U-shape character:
- after a generic phenomenon emerges in the CH's production, it has a tendency to be overgenerated (abundantly extended to improper cases),
- after some time, the scope of the phenomenon stabilizes and reduces to the norm.

HYP: This behavior may reflect a general CH's learning strategy:

- as a result of the input statistical analysis and its subsequent generalization, some schemes frequently detected in a context of the input become productive patterns: i.e. are systematically superposed onto new cases of this context, using symbolic superposition rules or algorithms

- when the frequency of cases non-fitting the scheme and occuring in the same context becomes sufficiently high, the non-productive cases obtain an exclusive status (**EX**: *holded - held*)

Overgeneration of productive schemes is an evidence of new grammatical rules/types acquired

From frequent verbs to productive patterns

- In the uncertain multiverb SVO scheme, the most frequent verbs emerge in SVO instances belonging to different meaning categories
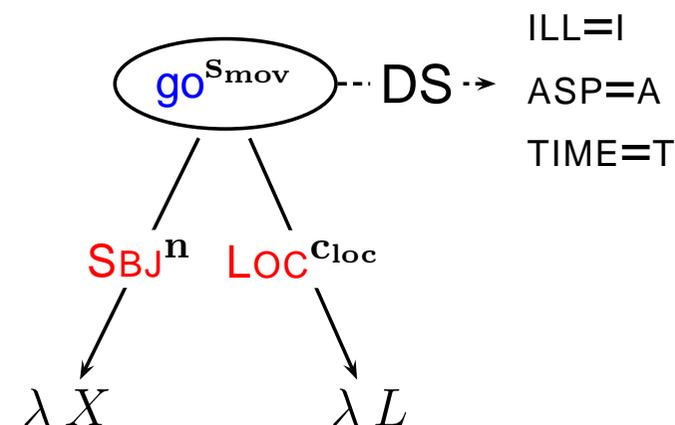N.Sethuraman&J.Goodman'04 [32d Stanford Child Lang. Res. Forum]:

	access	caused effect	effect	perc/mental-st
EX:	get, have, want, need, buy, keep, hold, use	take, find, put, bring, drop, make, open, fix, cut	do, eat, play, catch, heat, ride, turn, push, throw	see, like, say know, watch, tell, hear, hurt, love
Mothers	7 verbs/164 uses **have** 40% get 32%	23 verbs/117 uses **take** 22% make 21%	23 verbs/289 uses **do** 55% eat 17%	16 verbs/98 uses **see** 35% tell 12%
Children	8 verbs/500 uses **want** 44% have 23%	20 verbs/156 uses **open** 28% make 15%	48 verbs/470 uses **do** 55% eat 6%	17 verbs/171 uses **see** 38% like 15%

- Pronouns are the most frequent subjects and objects in the schemes (in English, French they mark for case). Highly frequent verb schemes with pronoun subjects/objects become productive: are gradually trans-formed into patterns imposed onto new verbs with matching pronoun subjects/objects in order to attribute them to the pattern's scheme (J.Childers&M.Tomasello'01 [Developmental Psych., **37**(6)])
EX: An overgeneration in *he done boots on* is due the pattern of *put*

First meaning structures?

Seemingly, between 2;0 and 2;4 the verb patterns become functional generic abstract predications:
- pattern verb position becomes the predication name
- other pattern positions become its arguments
- pattern argument discriminators (common or opposed in different patterns) converge to thematic proto-roles
- lexical categories predefined by pattern positions become (lexical) value types

$$\text{go}^{\mathbf{s_{mov}}} \;\text{-}\text{-}\text{-}\; \text{DS} \;\text{-}\!\!\to$$

ILL=I
ASP=A
TIME=T

$$\text{SBJ}^{\mathbf{n}} \quad \text{LOC}^{\mathbf{c_{loc}}}$$

$$\lambda\, X \qquad\qquad \lambda\, L$$

More general predications (cf. SOV evolution) have more general proto-roles:

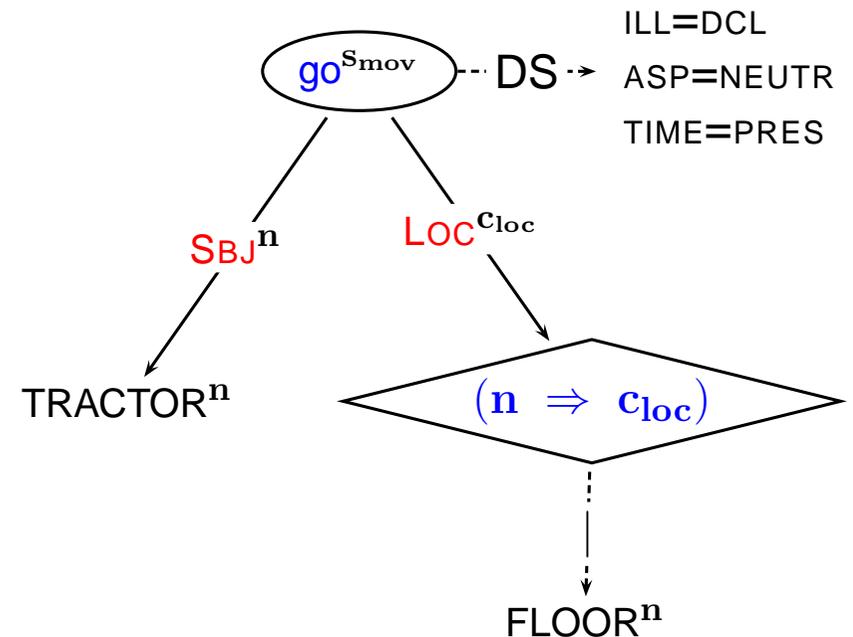AGT $\prec$ SBJ, PAT $\prec$ OBJ, ORIG $\prec$ LOC, DEST $\prec$ LOC, RCP $\prec$ OBL, INST $\prec$ OBL
and more general value types:

$s_{acc} \prec s$, $s_{caus-eff} \prec s$, $s_{eff} \prec s$, $s_{perc} \prec s$, $s_{psychst} \prec s$, $n_a \prec n$ (*animated nominal*), $c_{loc} \prec c$ (*locative circumstantial*), etc.

ILL, ASP, TIME, etc. are not predication arguments, but discourse status sentential parameters.

Predication arguments and types

The predication $\langle\!\langle go \rangle\!\rangle$ has the type $(\mathbf{n}\ \mathbf{c_{loc}} \rightarrow \mathbf{s_{mov}})$ The meaning of the utterance *tractor go floor* should be an instance of $\mathbf{s}$. So $\langle\!\langle go \rangle\!\rangle$ must be *applied* to meanings of the types corresponding to those of $\mathrm{S_{BJ}}$ and $\mathrm{L_{OC}}$ arguments.

$$go^{\mathbf{s_{mov}}} \dashrightarrow DS \dashrightarrow$$

ILL=DCL
ASP=NEUTR
TIME=PRES

$$\mathrm{S_{BJ}}^{\mathbf{n}} \qquad \mathrm{L_{OC}}^{\mathbf{c_{loc}}}$$

$$\mathrm{TRACTOR}^{\mathbf{n}} \qquad (\mathbf{n} \Rightarrow \mathbf{c_{loc}})$$

$$\mathrm{FLOOR}^{\mathbf{n}}$$

PB: the meaning $\mathrm{FLOOR}^{\mathbf{n}}$ cannot serve as $\mathrm{S_{BJ}}$-argument for $\langle\!\langle go \rangle\!\rangle$. So the CH must convert the type $\mathbf{n}$ into $\mathbf{c_{loc}}$, which corresponds to the meaning of the omitted surface proposition *to*. As a result, the expressed meaning is correct and sentential (even though the syntax is incomplete).

Starting from the age of 2;4, CH make no type errors.

New adjective ⟷ property associations

T.Mintz&L.Gleitman'02 [Cognition,**84**]; T.Mintz'05 [Developmental Psych., **84**(1)]

Fact1: CH of age (2;0-3;0) associate a new adjective with salient properties of (familiar or unfamiliar) objects iff:

(1) the objects are <mark>multiple</mark> and

(2) they are <mark>named with a basic level noun</mark> (*car, bear, plate,..*) [a] or with a <mark>superordinate noun</mark> (*toy*)

EX: *that's a drin car, ..a drin zebra,.. They are all drin* (all have yellow strips)
Here are two more things. Which is the drin one?

Fact2: CH cannot establish this association when the objects are <mark>not named</mark> : *that's a drin thing, ..another drin thing,..They are all drin*.

Fact3: When *thing* was replaced by *one*, the 2;0 young failed, the 3;0 young tended to succeed when the objects were familiar. For unknown objects they established the "similar form" association.

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[a] This may be observed even by the age of 1;9 (S.Waxman&R.Klibanoff'2000 [Developmental Psych., **36**(5)]).

Implications for adjectives' semantics

Conclusion1: the construal of the modified noun is necessary to acquire the adequate noun's attribute specified by the new adjective; the repeated salient property of objects is needed to determine the attribute's noninherent value associated with this adjective
(e.g. in *That's a drin zebra*, $\|drin\| \neq striped$ (which is an inherent property of zebras), but $\|drin\| = striped$ is possible in *That's a drin animal*)

Conclusion2: this phenomenon testifies to semantic dependencies from nouns to adjectives: the noun's semantics is a function of the semantics of the modifying adjective (not the opposite): the CH's semantics of a modified noun is:

$$\|AN\| = \|N\|(\|A\|) = \{e \in \|N\| \mid e.a = \|A\|\},$$

where a is the attribute of N specialized by A (e.g. color) and $e.a$ is its value in the object e (e.g. striped)

Conclusion3: the traditional montagovian typing of adjectives:
syntactic: n/n, semantic: $(e{\rightarrow}t){\rightarrow}(e{\rightarrow}t)$
is controversial

Struggle for compositionality?

A productive grammar should be compositional

S.Pinker'95, [In: Language. An Invitation to Cognitive Science **1**]: [By 2;0,] CH's output seems to meet up with a bottleneck. Their two- and three-word utterances look like samples drawn from longer potential sentences...

HYP: This should be due to problems of composition

EX: *Make boy walk in park* 2;0
QU: Is this already a composition of clauses?

R.Van Valin (Jr.)'01 [Cambridge Lingv. Soc., v.**2** The Panels]: Not really. The matrix clause is formulaic, its main verb is a causative pseudo-auxiliary ^{a}. It is a case of nuclear co-subordination: the closest relation between the predications.

REM: No type conversion PB here

$\text{make}^{S_{caus}}$ -- DS →
ILL=DCL
ASP=NEUTR
TIME=PRES

SBJ^{n_a} OBJ^{S}

$[\text{I}]^n$ $\text{walk}^{S_{mov}}$

SBJ^{n_ℓ} $\text{LOC}^{C_{loc}}$

BOY^n PARK^n

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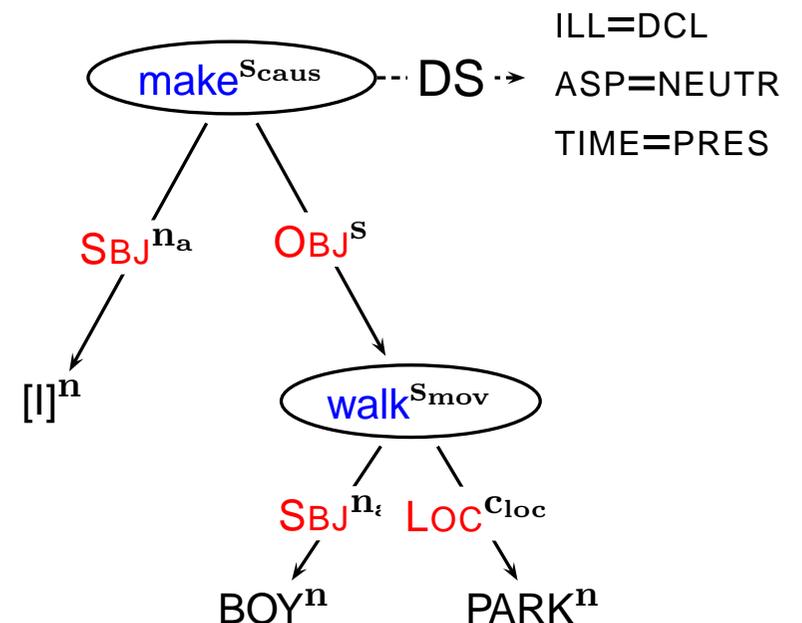
^{a}In Russian, *make walk=progulivat'* - one ditransitive verb.

Struggle for compositionality, continued

EX: *Cow wanna go sleep* 2;4
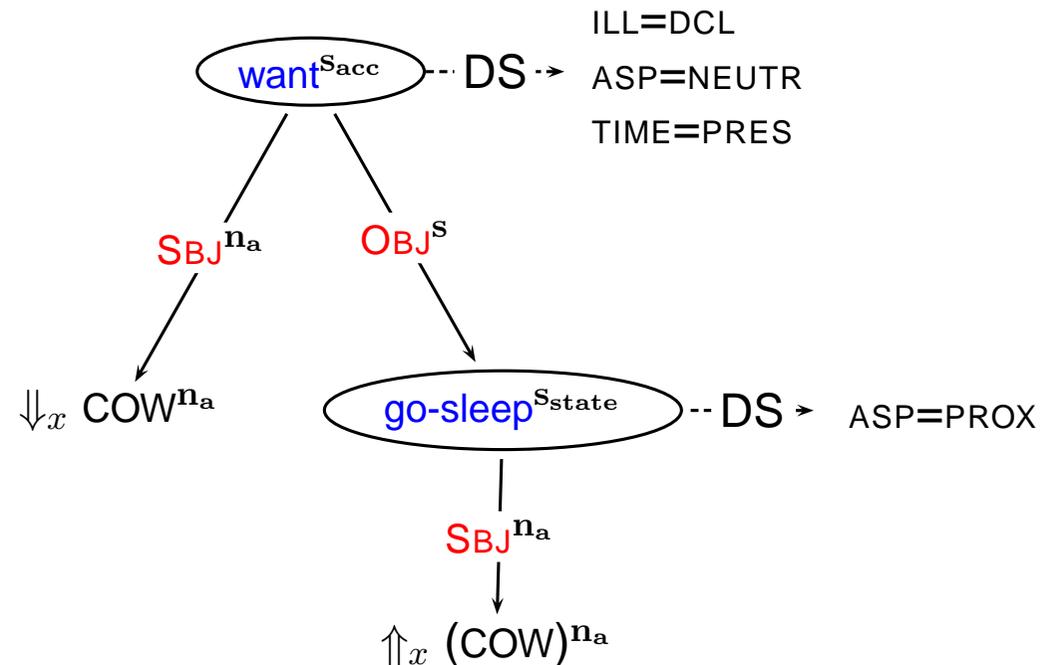**QU**: A composition of three clauses?

R.Van Valin'01: Not yet. The matrix clause is formulaic, the main verb want is modal (expresses an operator which applies to the utterance). It is another case of close relation:core cosubordination (with S$_{\text{BJ}}$-argument shared). The verb go has an aspectual meaning (expresses a rudimentary DS-parameter of sleep

$$\text{want}^{\mathbf{S_{acc}}} \cdots \text{DS} \rightarrow \begin{array}{l} \text{ILL=DCL} \\ \text{ASP=NEUTR} \\ \text{TIME=PRES} \end{array}$$

S$_{\text{BJ}}{}^{\mathbf{n_a}}$ O$_{\text{BJ}}{}^{\mathbf{s}}$

$\Downarrow_x \text{COW}^{\mathbf{n_a}}$ $\text{go-sleep}^{\mathbf{S_{state}}} \cdots \text{DS} \rightarrow \text{ASP=PROX}$

S$_{\text{BJ}}{}^{\mathbf{n_a}}$

$\Uparrow_x (\text{COW})^{\mathbf{n_a}}$

REM: First evidence of independent DS parameters of subordinate verbs foreshadowing the genuine compositions

Struggle for compositionality, continued

Already 2;4-old CH detect prepositions in the input. They distinguish the transitive *Cookie Monster turns Big Bird* from intransitive *Cookie Monster turns with Big Bird*

Precursors of compositionality: inflection and indirect speech in production
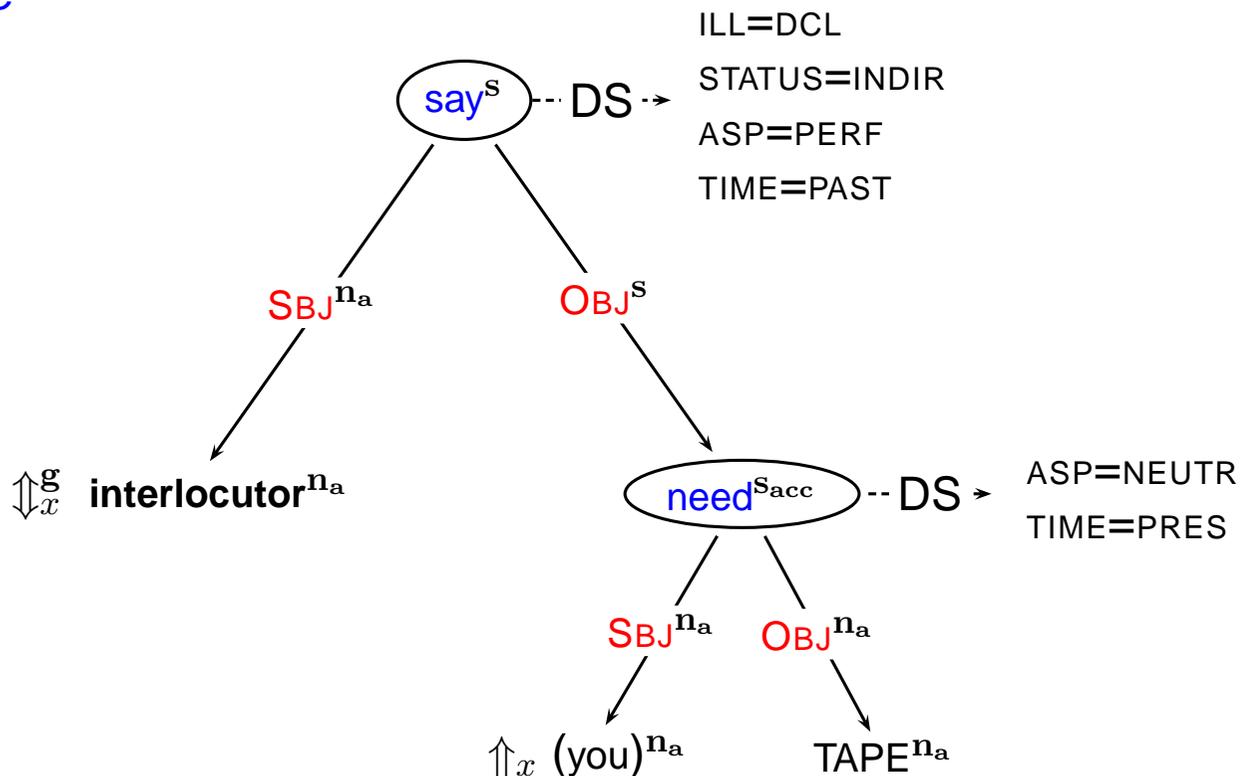
Up to 2;6 no traces of inflection in CH production. Starting from 2;6, the inflection emerges in production: *me car* 2;4 / *my car* 2;6, *Baby have bottle* 2;4 / *Baby has bottle* 2;6 (J.Galasso'04, [32d Stanford Child Lang. Res. Forum])

First compositions emerge in indirect speech by 2;8:

EX: *But you said so you need tape*

R.Van Valin'01: core coordination. DS-parameters of say and need are independent. This independence is a precursor of clause subordination

REM: No type conversion PB $\Updownarrow^{\mathbf{g}}_{x}$ **interlocutor$^{\mathbf{n_a}}$** here

$\text{say}^{\mathbf{s}}$ --DS→ ILL=DCL
STATUS=INDIR
ASP=PERF
TIME=PAST

$\text{SBJ}^{\mathbf{n_a}}$ $\text{OBJ}^{\mathbf{s}}$

$\text{need}^{\mathbf{s_{acc}}}$ --DS→ ASP=NEUTR
TIME=PRES

$\text{SBJ}^{\mathbf{n_a}}$ $\text{OBJ}^{\mathbf{n_a}}$

$\Uparrow_x$ (you)$^{\mathbf{n_a}}$ TAPE$^{\mathbf{n_a}}$

Compositions of clauses

Precursors of clauses emerge in production after 2;0. These are formulaic constructions "*I*+frequent verb$^{\mathbf{percep/psychst}}$+Clause" mostly copied from the input: *I think/know/see if*+C (see H.Diessel&M.Tomasello'01, [Cogn. Lingv, **12**]). Acquisition of clauses is intimately tied to Complement-Taking-Verb frequency (see E.Lieven&M.Tomasello'04 [32d Stanford Child Lang. Res. Forum])

First (OBJ) relative clauses emerge by 2;10. They witness of CH's capacity to carry out first complex abstractions:

EX: *Look at that train Ursula brought*
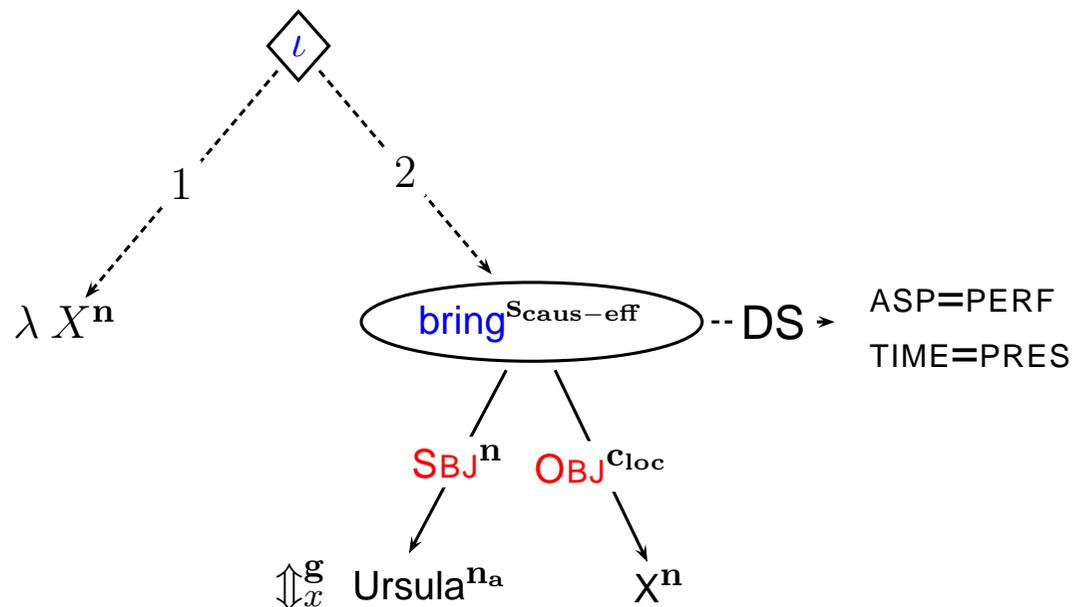
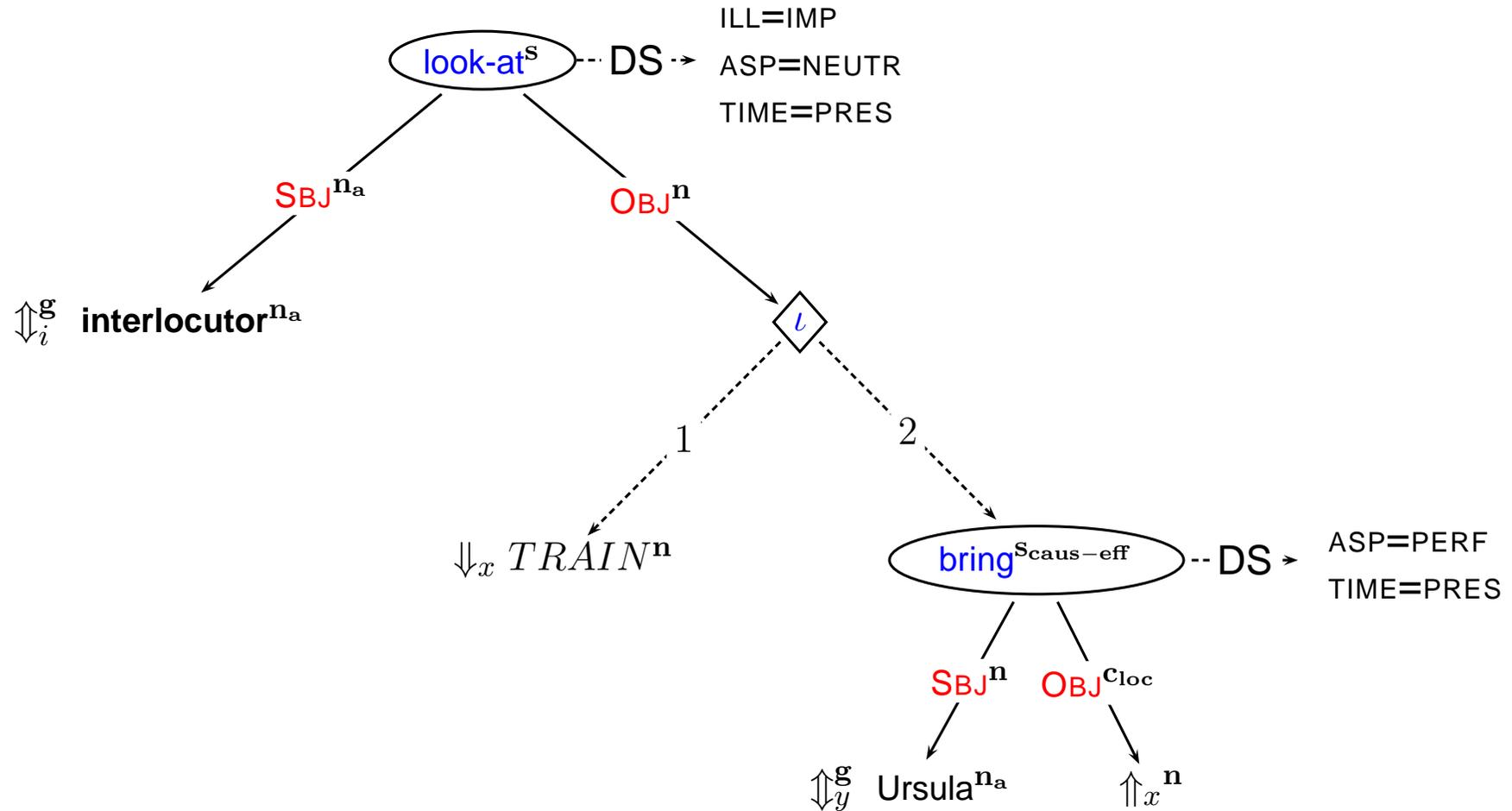The semantics of the clause is: $\left\lVert \text{THAT } Clause^{\mathbf{rel-obj}} \right\rVert = \lambda X^{\mathsf{OBJ^{n}}}. \, (\lVert X \rVert \, \cap \, \{e \, \| \, \lVert Clause \rVert \, (e)\})$

(the type of this abstract expression is that of X)

Relative clause composition

EX: *Look at that train Ursula brought*

look-at$^{\mathbf{s}}$ ---- DS → ILL=IMP
                                  ASP=NEUTR
                                  TIME=PRES

S$_{\text{BJ}}$$^{\mathbf{n_a}}$ O$_{\text{BJ}}$$^{\mathbf{n}}$

$\Updownarrow^{\mathbf{g}}_{i}$ **interlocutor**$^{\mathbf{n_a}}$ ι

                          1   2

               $\Downarrow_x TRAIN^{\mathbf{n}}$ bring$^{\mathbf{s_{caus-eff}}}$ ---- DS → ASP=PERF
                                                                                                 TIME=PRES

                                          S$_{\text{BJ}}$$^{\mathbf{n}}$ O$_{\text{BJ}}$$^{\mathbf{c_{loc}}}$

                                   $\Updownarrow^{\mathbf{g}}_{y}$ Ursula$^{\mathbf{n_a}}$ $\Uparrow_x{}^{\mathbf{n}}$

First semantic diatheses

The passive emerges in Engl. speaking CH around 3;0 (cf. M. Bowerman'79, [In: Fletcher&Garman(Eds.), Language Acquisition, Cambridge Univ. Press])

EX: *So it can't be cleaned?* 3;2

The CH expresses a change in perspective on the predication
$$\langle\!\langle \text{clean}\,(\text{SBJ}^{\mathbf{n_a}}, \text{OBJ}^{\mathbf{n}}, \text{INSTR}^{\mathbf{n}})^{\,\mathbf{S_{caus-eff}}}\rangle\!\rangle \qquad\qquad :$$

the OBJ-argument is topicalized, other arguments are eliminated and the predication itself is focalized. It is one of the passive diatheses:

$$\langle\!\langle \mathrm{dth}_{pass0sbjinst}\,(\bigstar_{\odot}, \emptyset \hookleftarrow \text{SBJ}_{\ominus}, \text{SBJ} \hookleftarrow \text{OBJ}_{\vec{\mathsf{T}}}, \emptyset \hookleftarrow \text{INSTR}_{\ominus})^{\,\mathbf{S_{caus-eff}}}\rangle\!\rangle$$

($\bigstar$(predication); $\vec{\mathsf{T}}$ (topic), $\odot$ (focus), $\ominus$ (periphery): communicative ranks)

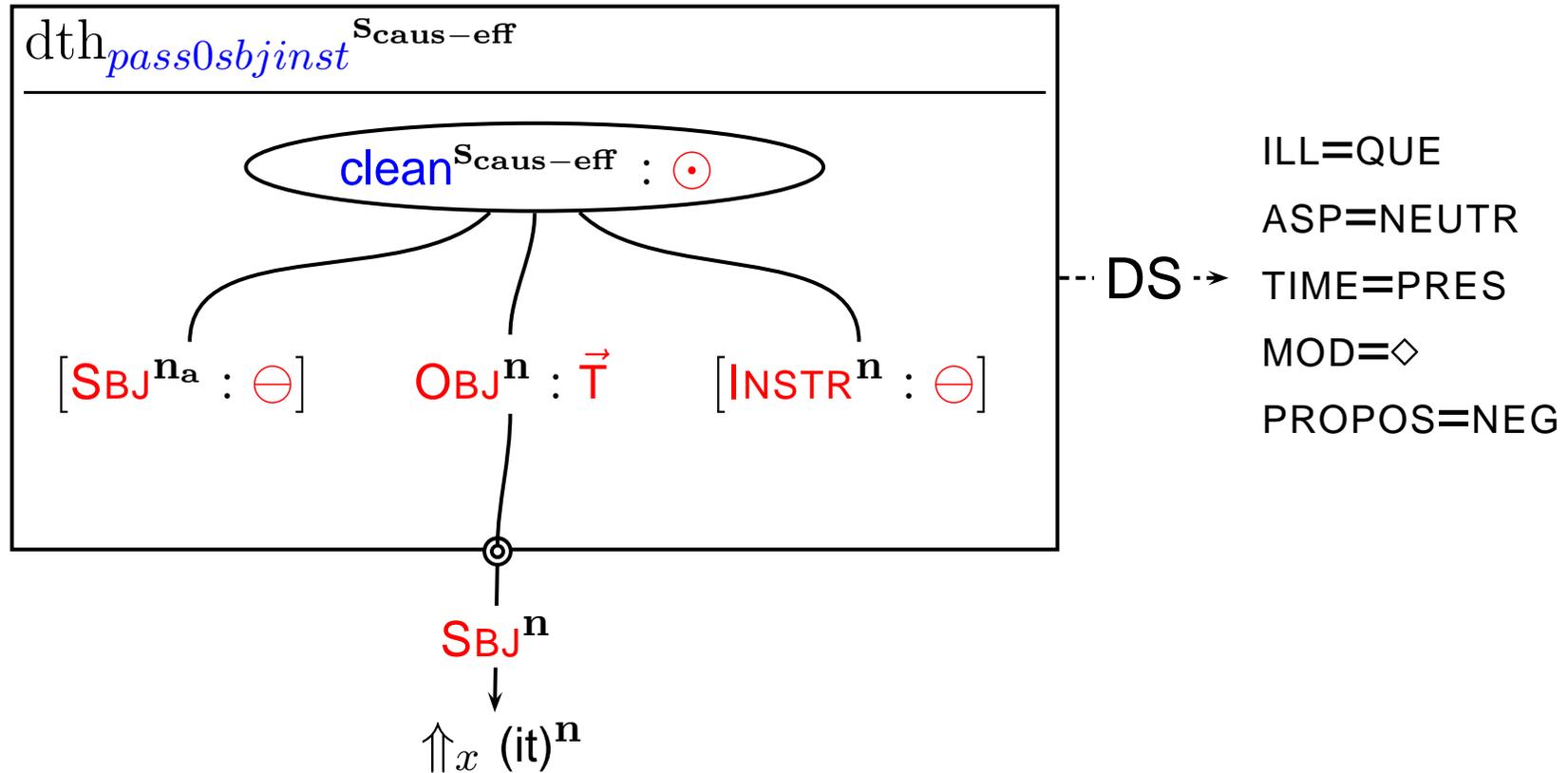The resulting semantic derivative has the profile
$$\langle\!\langle \mathrm{dth}_{pass0sbjinst}\,(clean)(\text{SBJ}^{\mathbf{n}})^{\,\mathbf{S_{caus-eff}}}\rangle\!\rangle$$

It is a true semantic revolution: predications become multiprofile situations with profiles determined by semantic diatheses.

The diatheses are very difficult to learn from the input because they are marked on the surface simultaneously with inflection, change of the standard WO, argument ellipsis, etc.

A passive diathesis with SBJ,INSTR elidation

EX: *So it can't be cleaned?* 3;2

$$\text{dth}_{pass0sbjinst}^{\textbf{S}_{\textbf{caus}-\textbf{eff}}}$$

clean$^{\textbf{S}_{\textbf{caus}-\textbf{eff}}}$: ⊙

$[\text{SBJ}^{\textbf{n}_{\textbf{a}}} : \ominus]$ OBJ$^{\textbf{n}}$: $\vec{\textsf{T}}$ $[\text{INSTR}^{\textbf{n}} : \ominus]$

SBJ$^{\textbf{n}}$

$\Uparrow_x$ (it)$^{\textbf{n}}$

DS

ILL=QUE
ASP=NEUTR
TIME=PRES
MOD=◇
PROPOS=NEG

Fluent spontaneous speech

Fluent speech is the evidence that the CH masters not only semantic compositional production rules (or type system), but also their surface realization

S.Pinker'95: Between the late two and mid-three, CH's language blooms into fluent grammatical conversation so rapidly, that it overwhelms the researchers who study it. Sentence length increases steadily and, because grammar is a combinatorial system, the number of syntactic structures increases exponentially, doubling every month, reaching the thousands before the third birthday.

Conclusions

- Bootstrapping process is lexicalized (word centered)

- It starts with detecting frequent frames of frequent words, continues with making them productive schemes, finally abstracting them to arrive at predications

- Lexical meaning is acquired due to general and universal principles specific to the human perception

- Emergence of multi-word utterances corresponds to formation of functional semantic structures

- Two main obstacles for the fluent production of complex utternce are:
  - type conversions
  - perspective-change predication transformations: diatheses

- the manner in which the CH overcome these obstacles testifies to formation of compositional semantic structures

- analysis of the facts of this "semantic acquisition" phase may help in reconstruction of an adequate semantic language