Long head movement in Finnish

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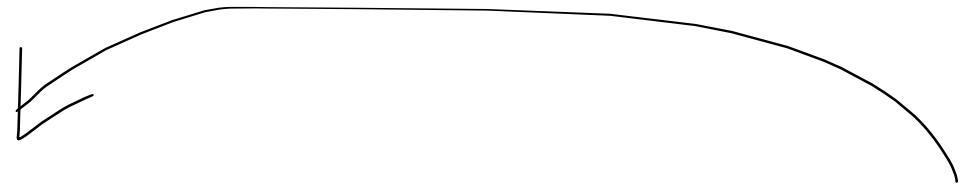
Data overview



Myy-dä-kö$_1$	*Pekka*	*aikoo* __$_1$	*koko*	*omaisuutensa?*
Sell-A/INF-Q	Pekka	plans	all	possessions

’Does Pekka plan <u>to sell</u> all his possessions?’ (Special prosody on *to sell*)

’Is it selling that Pekka plans to do with his possessions?’

Contents of this talk

- Background assumptions
- Reformulation of the problem
- Hypothesis 1: Phonological-perceptual theory (Chomsky 2001)
- Problems, and Finnish data in more detail
- Alternative hypotheses
  - Standard theory
  - Matushansky-style hypothesis
  - Remnant VP movement hypothesis
  - Other possibilities
- Construction of a positive model, Python formalization

Some background assumptions

- We'll use recognition grammar
- We'll work out a mathematical model, write it in Python, and calculate the data from the model

Establishing common ground: Morphological reconstruction in recognition grammar

Pekka *aiko-o* *myy-dä* *koko* *omaisuutensa.*

Pekka plan-PRS.3SG sell-A/INF all possessions

'Pekka plans to sell all his possessions.'

Morphology/lexicon

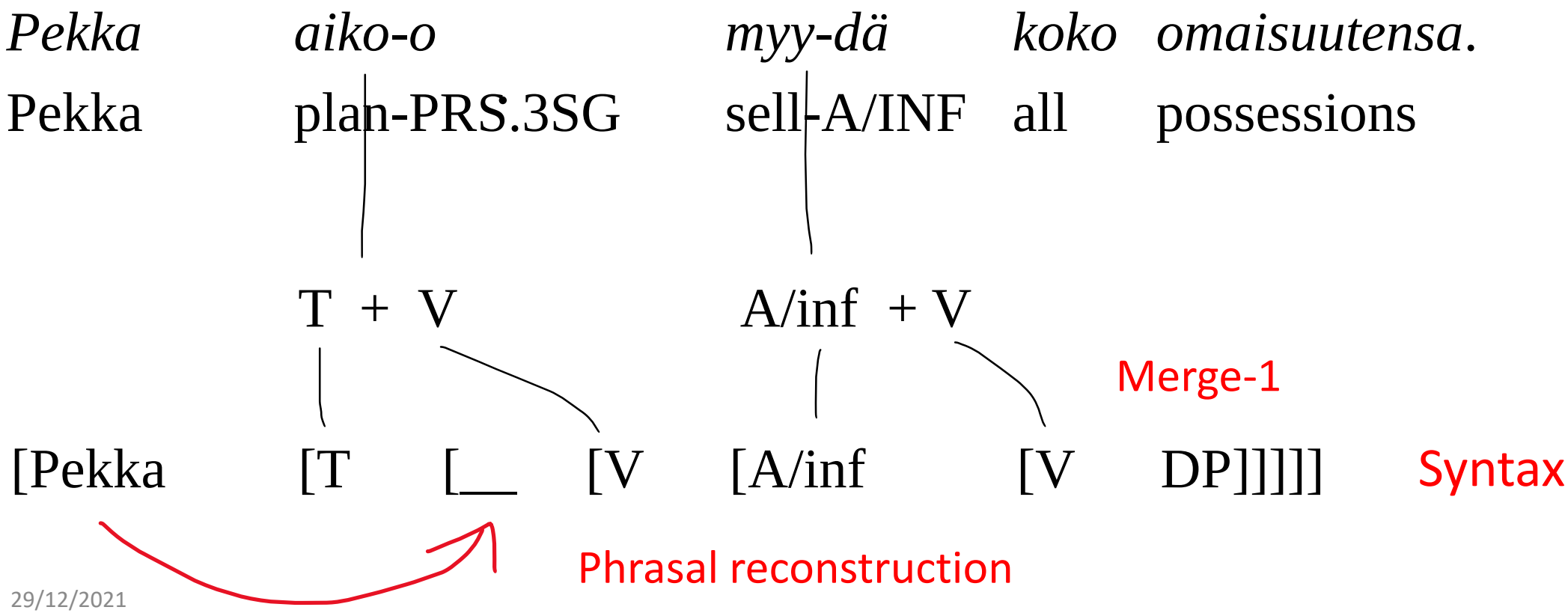
T + V A/inf + V

Some processing

[Pekka$_1$ [T [__$_1$ [V [A/inf [V DP]]]]] LF endpoint

Hypothesis 1: Phonological-perceptual theory

- Morphologically complex words are decomposed inside a presyntactic phonological-perceptual system (Chomsky 2001, recognition grammar Brattico & Chesi, 2020).



Consequences

- No complex heads in syntax;
- No head reconstruction in syntax;
- Complex words are invisible for semantic interpretation;
- Complex words constitute ”sensorimotoric chunking.”

Problems

(1) *Does* *John* *admire* *Mary?*

$[_{TP}$ C $T_{[EPP]}$ $[_{vP}$ DP $[_{vP}$ v V DP]]]

(2) *Aiko-o*$_1$ *Pekka* __$_1$ *myydä* *koko* *omaisuutensa?*

Plan-PRS-3SG Pekka sell-A/INF all possessions

$[_{TP}$ T $[_{VP}$ V $[_{A/infP}$ Pekka [A/INF [V [all possessions]]]

Is this really postverbal argument?

Comment

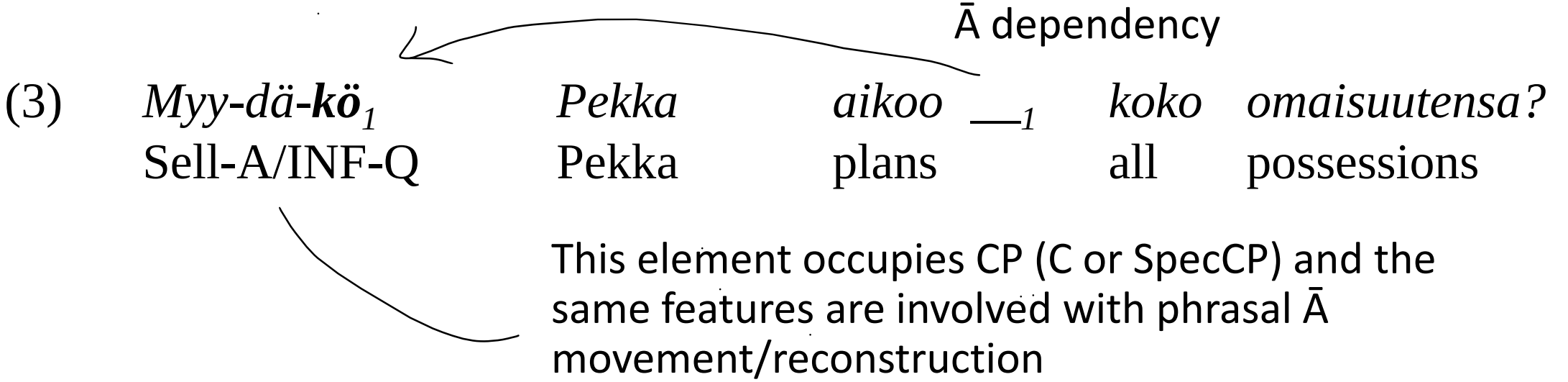
- The perceptual-phonological analysis works for morphological decomposition but not for head displacement;
- Sentences (1-2) are ”borderline cases” where the perceptual-phonological theory could still work in principle, thus an efficient algorithm is still conceivable;
- This system collapses with Finnish LHM (next slide). No perceptual system is ”intelligent” enough to process them.

Properties of Finnish LHM

Triggered by left peripheral C-particle Q *–kO* corresponding to (i) yes/no interrogativization and (ii) predicate clefting targeting the complex predicate for special interpretation (’was it selling…’)

Many other left peripheral particles and their combinations are involved (more than twenty)

Unless triggered by C-feature(s), head reconstruction is HMC-compliant and local



Examples of data

(1) Long-distance clefting

Myydäkö *Pekka sanoi* [*että Merja aikoo* __ *koko omaisuutensa?*]

Sell.A/INF.Q Pekka said that Merja plans all possessions

(2) No extraction from left branch/subject

**Myydäkö* [[$_{DP}$ *päätös* __ *asunto*] *syntyi* *nopeasti?*]

Sell.A/INF.Q decision apartment emerged fast

Intended: ’Did the decision <u>to sell</u> the aparment emerge fast?’

And so on: the data is very clear on this point

Some conclusions

- The perceptual-phonological theory cannot be correct, I think
- Syntax must access”head reconstruction” (=mental operation that allows the hearer to register the canonical position of the fronted verb);
- Syntax must access”complex heads” (=syntactic object that has other heads inside it, in some way);
- ”Head reconstruction,” in whichever way it will be implemented, must access Ā dependencies (Roberts 1993, 2010);
- In Finnish there is a clear distinction between Ā-reconstruction involving operator features and local HMC-compliant reconstruction
- Semantic interpretation must have access to all of the above.

Problem reformulated

- Create a recognition grammar algorithm such that it calculates all the data and tells what are complex heads; what is long and local head reconstruction; what are Ā dependencies; how these are interpreted semantically; explains what makes makes Finnish different; and has at least some crosslinguistic appicability.

Some possibilities

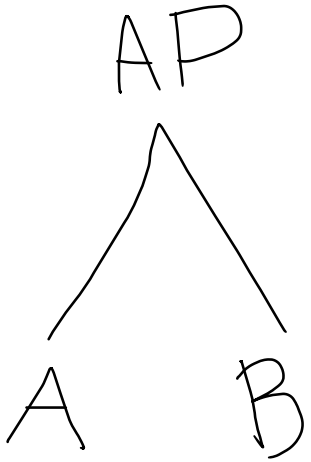
(H1)	*Myy-dä-**kö**$_1$*	*Pekka*	*aikoo* __$_1$	*koko*	*omaisuutensa?*
	Sell-A/INF-Q	Pekka	plans	all	possessions
	[[[V v] A/inf]$_1$ C]^0	DP	T V __$_1$	DP	
(H2)	*Myy-dä-**kö**$_1$*	*Pekka*	*aikoo* __	*koko*	*omaisuutensa?*
	Sell-A/INF-Q	Pekka	plans	all	possessions
	C$_{/myy\text{-}dä/}^0$	DP	T V __	DP	

(H3)	*Myy-dä-**kö**$_1$*	C	*Pekka*	*aikoo* __	*koko*	*omaisuutensa?*
	Sell-A/INF-Q		Pekka	plans	all	possessions
	[$_{A/infP}$ A/INF [v V __$_2$]]$_1$	C^0	DP	T V __ $_1$	DP$_2$	

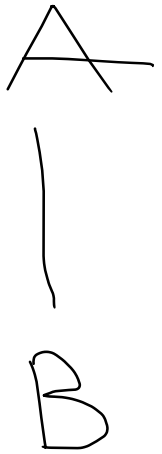
A positive model

Assumption 1

- Morphologically complex words are mapped into syntactically complex heads (”complex predicates”)
- Complex phrase $[_{AP}$ A B], complex head $[_{A}$ B] (=linear list structure)



A and B are in the domain of phrasal rules and are pronounced as separate entities; recursion is possible



B is not in the domain of phrasal rules; A and B are pronounced as one phonological word; more primitive linear structure

Assumption 2

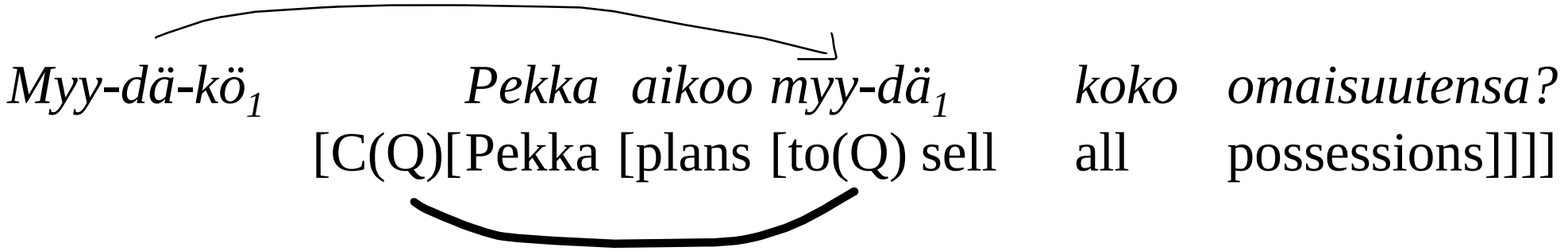
- Complex heads are reconstructed either by HMC-compliant A-reconstruction or Ā-reconstruction depending on the absense/presence of Ā-operator C-feature(s)(Roberts 1993: Ch. 1; 2010).

Myy-dä-kö$_1$	*Pekka*	*aikoo* __$_1$	*koko*	*omaisuutensa?*
Sell-A/INF-Q	Pekka	plans	all	possessions

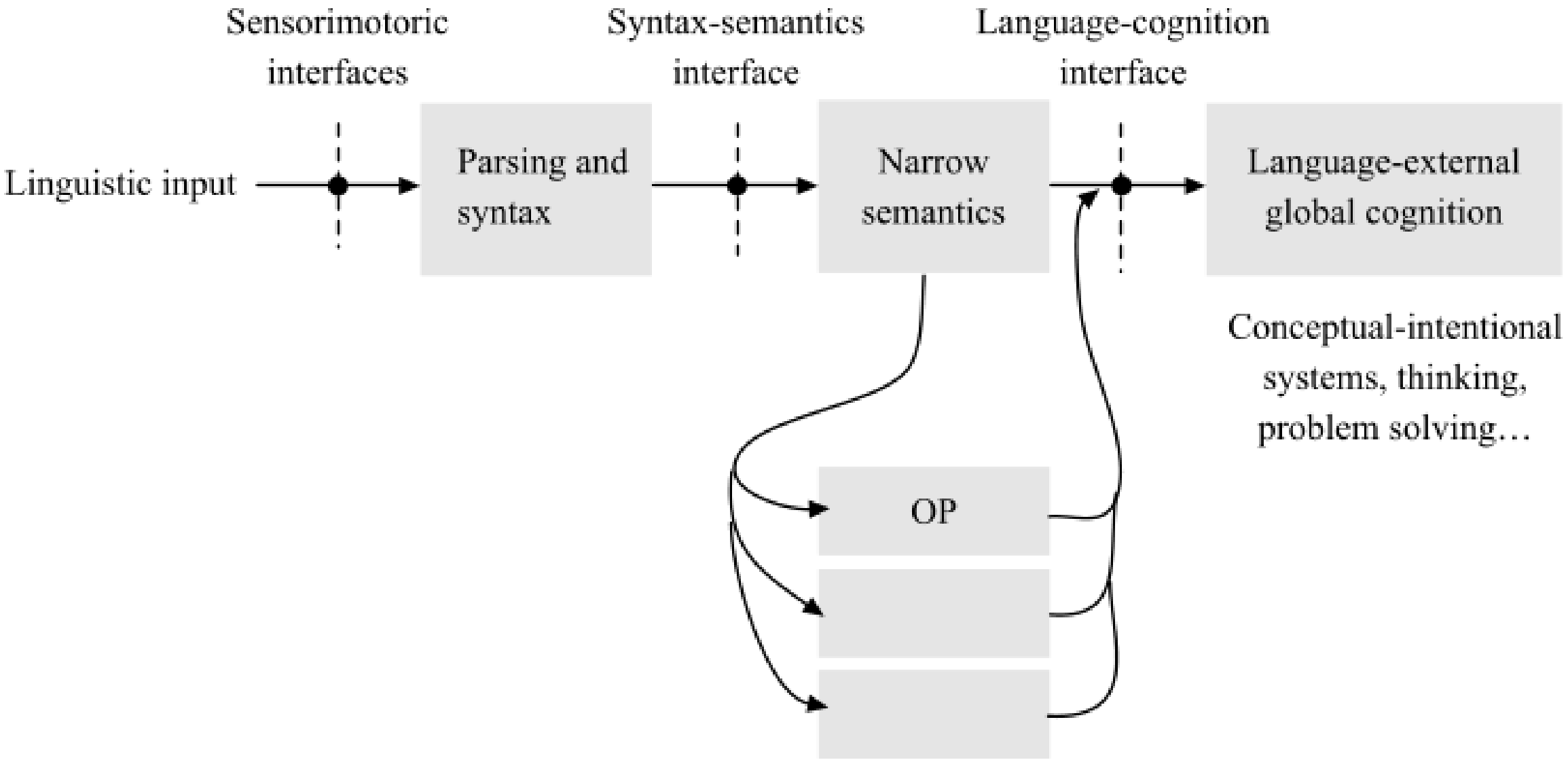
This element, which is an operator particle and is interpreted by the operator-variable module, triggers Ā-reconstruction and generates a corresopnding C head

Assumption 3

- Ā-dependencies, whether phrasal or head, are interpreted by a special cognitive operator-variable module (Chomsky 2008 ”duality of semantics” hypothesis), and only by this module.



- Q = operator feature (=goes into the special opertor module for interpretation) with interrogative force


Sensorimotoric interfaces
Syntax-semantics interface
Language-cognition interface
Linguistic input
Parsing and syntax
Narrow semantics
Language-external global cognition
Conceptual-intentional systems, thinking, problem solving…
OP

Assumption 4

- Phrasal Ā movement (2) = Ā head movement (1) + pied-piping (I. Roberts)

(1)	*Myy-dä-**kö**$_1$*	*Pekka*	*aikoo* *__$_1$*	*koko*	*omaisuutensa?*
	Sell-A/INF-Q	Pekka	plans	all	possessions

(2)	*[Koko*	*omaisuutensa-**ko**]*	*Pekka*	*aikoo* *myydä*	*__?*
	all	possessions-Q	Pekka	plans sell-A/INF	

Assumption 5

- Head reconstruction is literal minimal search following labeling/selection (dodging specifiers and right adjuncts) into first suitable gap position where the head can be selected ”from above.” To capture island effects, I used feature intervention for locality calculations.

Myy-dä-kö$_1$	*Pekka*	*aikoo* __$_1$	*koko*	*omaisuutensa?*
Sell-A/INF-Q	Pekka	plans	all	possessions

- Minimal search = reconstruction operation, no probe or goal features

```python
def reconstruct(self, phrase_structure):
    # ------------------ upward sequence ----------------------------------------------------#
    current_node = phrase_structure.bottom()
    while not (current_node.root() and not self.detect_complex_head(current_node)):
        targeted_head = self.detect_complex_head(current_node)
        if targeted_head:
            log(f'Reconstruct {targeted_head.right_const} from {targeted_head}...')
            intervention_feature_set = self.determine_intervention_features(targeted_head)
            current_node = self.create_head_chain(targeted_head, self.get_affix_out(targeted_head), intervention_feature_set)
            log(f'={phrase_structure.top()}...')
        else:
            current_node = current_node.mother
    # ------------------------------------------------------------------------------------#
    return phrase_structure.top()

def detect_complex_head(self, node):
    if node.complex_head():
        return node
    if node.is_complex() and node.left_const.complex_head():
        return node.left_const

def create_head_chain(self, complex_head, affix, intervention_feature_set):
    if self.no_structure_for_reconstruction(complex_head):
        complex_head.merge_1(affix, 'right')
        return affix
    else:
        phrase_structure = complex_head.sister()
        # --------------- minimal search ----------------------------------------------------#
        for node in phrase_structure:
            if self.causes_intervention(node, intervention_feature_set, phrase_structure):
                log(f'{node.sister()} causes intervention with {intervention_feature_set}...')
                break
            node.merge_1(affix, 'left')
            if self.reconstruction_is_successful(affix):
                self.brain_model.consume_resources("Move Head")
                return affix
            affix.remove()
        # ------------------------------------------------------------------------------------#
        if not self.consider_right_merge(affix, node, phrase_structure):
            self.last_resort(phrase_structure, affix)
        return affix
```

Search complex heads (bottom-up)

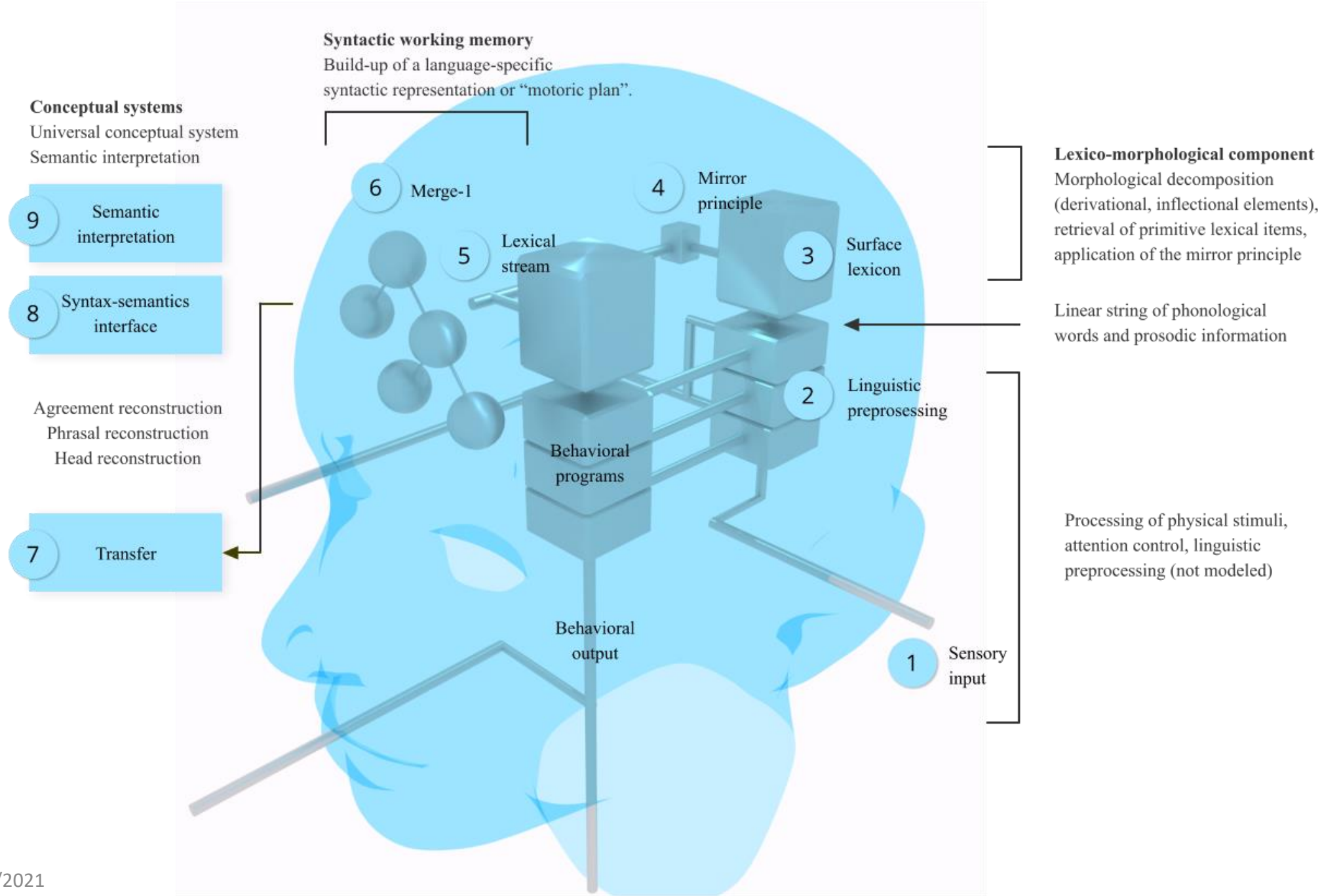
Minimal search (top-down)

Assumption 6

- Finnish is special due to the large (20+) catelogue of ”verbal” C-features functioning as operators and creating predicate clefting by Ā dependencies

Python implementation

- The analysis was implemented in Python (general-purpose programming language) and tested over a set of constructions capturing the data;
- The model reads input sentences, analyses them, and produces grammaticality judgments, syntactic analyses and semantic interpretations;
- The program creates an idealized brain model for speaker of language L which contains a basic recursive comprehension cycle (”parser”) plus the linguistic principles of interest (next slide).


Syntactic working memory
Build-up of a language-specific syntactic representation or "motoric plan".
Conceptual systems
Universal conceptual system
Semantic interpretation
9 Semantic interpretation
8 Syntax-semantics interface
Agreement reconstruction
Phrasal reconstruction
Head reconstruction
7 Transfer
6 Merge-1
4 Mirror principle
5 Lexical stream
3 Surface lexicon
2 Linguistic preprocessing
Behavioral programs
Behavioral output
1 Sensory input
Lexico-morphological component
Morphological decomposition (derivational, inflectional elements), retrieval of primitive lexical items, application of the mirror principle
Linear string of phonological words and prosodic information
Processing of physical stimuli, attention control, linguistic preprocessing (not modeled)