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<th>The Design, Development and Evolution of Unbounded Merge</th>
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<tr>
<td>Author(s)</td>
<td>Fujita, Koji</td>
</tr>
<tr>
<td>Citation</td>
<td>(2009)</td>
</tr>
<tr>
<td>Issue Date</td>
<td>2009-05-27</td>
</tr>
<tr>
<td>URL</td>
<td><a href="http://hdl.handle.net/2433/87740">http://hdl.handle.net/2433/87740</a></td>
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<tr>
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<td>Textversion</td>
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Kyoto University
The Design, Development, and Evolution of Unbounded Merge

Koji Fujita
Kyoto University

Language evolution is an instance of biological evolution (and cultural evolution).

→ If one’s theory of biological evolution fails to account for the evolution of language, then it needs a serious reconsideration.

Neo-Darwinism (Modern Synthesis)

- Adaptationist Program
  - Functionalism
  - Natural Selection / Sexual Selection as the First Resort
  - Gradualism

Neo-Néo-Darwinism (Expanded Synthesis)

- Non-adaptationist Program
  - Formalism
  - Pluralism
    - NS/SS as the Last Resort
  - Punctuated Equilibrium
  - Exaptation
“... an evolutionary novelty may result from the combination of two pre-existing parts with unrelated functions.”

- M. Ridley

“Evolution has recruited for language purposes brains structures that performed other functions in non-human primates.”

- T. Deacon

To create is to merge.

“To create is to recombine.”

- F. Jacob

(1) Design ........ Microgenesis
(2) Development ... Ontogenesis
(3) Evolution ....... Phylogenesis

(1) Descriptive Adequacy $\rightarrow$ <PHON,SEM>
(2) Explanatory Adequacy $\rightarrow$ I-Language
(3) Evolutionary Adequacy $\rightarrow$ UG
- Logical Problem of Language Evolution
- Logical Problem of Language Acquisition

- Arrival of the Fittest
- Survival of the Fittest

- The functions of the components that jointly constituted the language faculty later in the hominin evolution may have had nothing to do with the current (or even original) function(s) of language.

- Animal communication may have only an indirect bearing on language evolution.

- Strong Minimalist Thesis (SMT)
  - Language is an optimal solution to legibility conditions.
  - Unexplained elements of UG are zero.
  - There is virtually nothing special about the origins and evolution of language.
- Language is uniquely human.
- Are its components uniquely human, too?
- Minimize the discontinuity elements in language evolution.

FLN: Recursion
  (unbounded/recursive Merge)
  Discontinuity

FLB: Sensory-Motor system
  Conceptual-Intentional system
  Continuity

“… unbounded Merge is not only a genetically determined property of language, but also unique to it.”

“… for both evolution and development, there seems to be little reason to suppose that there were precursors to unbounded Merge.”

- N. Chomsky
- ... no clear evidence for languages that demonstrably lack recursion of any kind.  
  (B. Heine & T. Kuteva)

- Recursion is absent in Pirahã.  (D. Everett)

- Many languages have no, or very circumscribed recursion in their syntax.  
  (N. Evans & S. Levinson)

- Recursion is just a theoretical artifact.  (D. Bickerton)

- Derivational recursiveness:
  - Recursive Merge

- Representational recursiveness:
  - Self-embedding

(1) [CP C [TP T [vP v [VP V [CP C [TP T [vP v [vP V ...]]]]]]]

- Actual application of Merge is subject to a variety of constraints.

- If CP is never selected by a head, then there will be no clausal complementation in that language.  (functional parametrization?)

(2) [DP D [NP N [PP P [DP D [NP N [PP P ...]]]]]]

- Representational recursiveness is just one aspect of derivational recursiveness.
Language evolution boils down to the emergence of:

- Unbounded Merge
- Interfaces
- Lexicon


- Merge \((\alpha, \beta) = \{\alpha, \beta\}\):
  \[
  \begin{array}{c}
  \alpha \\
  \beta
  \end{array}
  \]
  (no endocentricity)

- Embed \((\alpha, \{\alpha, \beta\}) = \{\alpha, \{\alpha, \beta\}\}\):
  \[
  \begin{array}{c}
  \alpha \\
  \beta
  \end{array}
  \rightarrow \text{endocentricity}
  \]

Recursive Merge (without Embed)

- Recursive Embed

Internal Merge (Move) + Embed

- Why not \(\beta\) for direct Embed without Move?
  Embed \((\beta, \{\gamma, \{\alpha, \beta\}\}\})\)
- Local Embed

\[ \alpha \xrightarrow{\gamma} \beta \]

- Non-local Embed

\[ \gamma \xrightarrow{\alpha} \beta \rightarrow \text{exocentricity} \]

- Internally-headed relatives:

(1)  
[ John-ga saifu-wo nakushita no]-wo Mary-ga mitsuketa.  
[ John-Nom wallet-Acc lost Comp ]-Acc Mary-Nom found  
‘Mary found the wallet John had lost.’

- Merge = Move = Embed (set formation)

- Embed is itself an instance of Merge applying recursively.

- No independent evolutionary/developmental scenario is necessary for Move and Embed.

Labeling Two Word Utterances

(1)  
no label

(2)  
endocentric

Recursive Merge is already fully operative at the two-word stage.  
(see Roeper 2007)
But what about truly exocentric compounds?

(1) Tatemono-no takai-hikui-ga juuyoo da.
  building-Gen high-low -Nom important is
  ‘The height of the building matters.’

(2) 

A

N

A

‘Absolute categorial endocentricity’

Some Possible Precursors

- Syllable Structure
- Birdsong
- Music
- Social Intelligence
- Theory of Mind (ToM)
- Machiavellian Intelligence
- Navigation and Foraging
- Number
- Manual Dexterity, Motor Control
- Tool Using and Tool Making
- Action Grammar

(1) [A N+N]:
  Serbo-Croatian ribolik ‘fish+shape=fish-shaped’
(2) [A V+V]:
  Turkish yapis yapis ‘stick+stick=sticky’
(3) [A V+N]:
  French lève-blocs ‘lift+block=block lifter’
(4) [A N+V]:
  Korean neknuk-hata ‘sufficiency+to be= sufficient’

Scalise et al.
Action Grammar

- Pairing Method
- Pot Method
- Subassembly Method

P. M. Greenfield:
III. Subassembly Strategy

- Merge (saw, Mary) = \{saw, Mary\}
- Merge (John, \{saw, Mary\}) = \{John, \{saw, Mary\}\}

![Diagram showing subassembly strategy](image)

- Merge (the, boy) = \{the, boy\}
- Merge (\{the, boy\}, \{saw, Mary\})
  = \{\{the, boy\}, \{saw, Mary\}\}

Subassembly strategy required

---

Subassembly Strategy in Compounding

Swedish: barn bok klub:

```
barn       *                   
    bok       klub
```

English: child book club:

```
child     club
    book     club
```


Subassembly-type Merge (S-Merge) is the genuine recursive device in human language.

```
saw
    the
        boy
```

What if the bare noun *boy* is already syntactically complex (*n+BOY*, etc.)?

Lexicon as a Conceptual Barrier

- To the extent that the lexicon belongs to FLN as a distinct component of grammar, language evolution becomes a harder topic.

Anti-Lexicalism

- Words are also generated by recursive syntax.
- The (substantive) lexicon is decomposed into FLN (recursion) and FLB (SM/CI).
- The syntax-CI interface may be optimized.
- There is *virtually* no lexicon.
Syntactic Nature of ‘Lexical’ Verbs

(1) John opened the door again.
   i. repetitive reading
   ii. restitutive reading

(2) \[
\begin{align*}
\text{vP – again(i)} \\
\text{John} \\
\text{CAUSE} \\
\text{the door} \\
\text{VP – again(ii)} \\
\text{OPEN}
\end{align*}
\]

(3) LCS: \{ x \text{CAUSE} [ y \text{OPEN again(ii)} ] again(i) \}

Evidence from Developmental Data

\[
\text{CAUSE (2;0.4) } \geq \text{ HAVE (2;0.7) } \geq \\
\text{ Double Obj verbs (2;1.6) } \succ \\
\text{ GO (2;4.0) } \geq \text{ Dative Obj verbs (2;4.9) }
\]


Ditransitives

(1) a. John gave Mary a book.
   b. [\[ John v [vp Mary V a book ]
   c. [ J. CAUSE [ M. HAVE B. ]]

(2) a. John gave a book to Mary.
   b. [\[ John v [vp a book V to Mary ]
   c. [ J. CAUSE [ B. GO to M. ]]

The mapping between syntactic structure and conceptual structure is straightforward.

Merge in Early Grammar

- “No verb is an island.”
- “Children start to use Merge already with their very first word combinations.”

Three-Layered Split VP

Agent VP1

V1

Causer VP2

V2

Theme VP3

V3

cf. [ x DO [ x CAUSE [ y BECOME … ]]]

K. Fujita, Double objects, causatives and derivational economy, L/27. (1996)

“Causes are realized in a position that is asymmetrically c-commanded by the Agent position.”

● tham/hây causatives in Thai:

(1) “Saakhaa tham kracok treek dooy tançay.
   Saka  cause mirror break by intend

(2) Saakhaa hây dek win dooy tançay.
   Saka  have child run by intend

(3) Saakhaa tham hây kaw?i lom dooy tançay.
   Saka  cause have chair fall by intend

Simpler Syntax? (Culicover and Jackendoff 2005)

John gave Mary a book.

CS: [ x CAUSE [ y HAVE z ]]

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Given that *bok* is syntactically complex, the right-branching compounding also requires S-Merge.

→ ‘Root’ compounding

- Exocentric compounds are in fact endocentric.
  
  (1) $A + A \rightarrow N$
  
  (2) $\sqrt{\sqrt{\sqrt{n}}} + \sqrt{n} \rightarrow N$

- The issue of whether protolanguage was holophrastic (à la Wray, Arbib) or synthetic (à la Bickerton, Tallerman) is largely irrelevant.

- Word-like elements in protolanguage (protowords) could exist in the absence of / prior to syntax.

From Pot to Subassembly
From Subassembly to Merge

<table>
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<tr>
<th>Merge</th>
<th>Action Grammar</th>
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<tr>
<td>Unbounded?</td>
<td>Yes</td>
</tr>
<tr>
<td>Symmetric?</td>
<td>Yes/No</td>
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</table>

“Modularity, a biological approach that views organisms as the integration of partially independent, interacting units at several hierarchical levels, has been described as ‘a conceptual framework for evo-devo’, and ‘a meeting place for evolutionary and developmental biologists’.”

B. K. Hall and W. M. Olson eds.: Keywords & Concepts in Evolutionary Developmental Biology.

Modular Architecture of the Mind
- Domain-Specificity
- Informational Encapsulation
- Autonomous
- Innate
- Mandatory
- Fast
- Deterministic
- Neural Localization
- Idiosyncratic Pathological Breakdown

Against Strong Innateness
- Departure from strong genetic determinism in *Evo-Devo* and in MP
- “The third factor” in general biological design
Merge to Successor Function?

Merge (1,1) = 2
Merge (2,1) = 3, etc.

Mathematical capacity is an abstraction from linguistic operations.

<table>
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<tr>
<th>Central System?</th>
<th>Adaptation?</th>
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<td>Fodorian Module</td>
<td>No</td>
</tr>
<tr>
<td>Chomskyan Module</td>
<td>Yes</td>
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<tr>
<td>Darwinian Module</td>
<td>Yes</td>
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G. Marcus (2006):
descent-with-modification modularly
(as opposed to sui generis modularity)
Some Conclusions (tentative!)

- Recursion should be understood derivationally.
- S-Merge makes human syntax possible.
- Syntax generates words.
- Linguistic structure is always endocentric.
- Action Grammar may be explored as a precursor to Merge.

Recursion: The Generative Engine of the Mind

- Morality
- Number
- Music
- Concepts
- Theory of Mind
- Action Grammar
- Language
- Religion

Thank you.