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<th>The Design, Development and Evolution of Unbounded Merge</th>
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<tr>
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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 ⇄ <PHON,SEM>
(2) Explanatory Adequacy ⇄ I-Language
(3) Evolutionary Adequacy ⇄ 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

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?)

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

\[ \begin{array}{c}
\alpha \\
\gamma \\
\end{array} \begin{array}{c}
\alpha \\
\beta \\
\end{array} \]

- Non-local Embed

\[ \begin{array}{c}
\beta \\
\gamma \\
\alpha \\
\beta \\
\end{array} \rightarrow \text{exocentricity} \]

- 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

\[ \begin{array}{c}
milk \\
\end{array} \begin{array}{c}
cup \\
\end{array} \]

(2) endocentric

\[ \begin{array}{c}
milk \\
cup \\
\end{array} \]

(3) *exocentric

&

\[ \begin{array}{c}
milk \\
cup \\
\end{array} \]

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.’

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 neknek-hata ‘sufficiency+to be= sufficient’

Scalise et al.
**Action Grammar**

- **Pairing Method**
- **Pot Method**
- **Subassembly Method**


---

**I. Pairing Strategy**

**II. Pot Strategy**
III. Subassembly Strategy

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

- 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
     |
  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) vP – again(i)
    John
    CAUSE
    the door
    VP – again(ii)
    OPEN

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

Evidence from Developmental Data

CAUSE (2;0.4) ≥ HAVE (2;0.7) ≥
   Double Obj verbs (2;1.6) ≥
   GO (2;4.0) ≥ Dative Obj verbs (2;4.9)


Ditransitives

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

(2) a. John gave a book to Mary.
   b. [\[ John \text{ v [vp a book V to Mary ]} \]
   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

\[
\text{Agent} \xrightarrow{\text{V'}} \text{VP1} \xrightarrow{\text{V}} \text{V1} \xrightarrow{\text{VP2}} \text{Causer} \xrightarrow{\text{V'}} \text{V2} \xrightarrow{\text{VP3}} \text{Theme} \xrightarrow{\text{V3}}
\]

cf. \{ x \text{ DO } y \text{ CAUSE } \text{ y BECOME } \ldots \}]

K. Fujita, Double objects, causatives and derivational economy, \textit{LI} 27. (1996)

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


\textbf{tham/hây} causatives in Thai:

1. “Saakhaa \textit{tham} kracok treek dooy tançay.
   Saka cause mirror break by intend
2. Saakhaa \textit{hây} dek win dooy tançay.
   Saka have child run by intend
   Saka cause have chair fall by intend


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<th>Middles</th>
<th>implicit Agent</th>
<th>Generically quantified</th>
<th>eventive</th>
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<tr>
<td>Ergatives</td>
<td>(implicit Causer)</td>
<td>Existentially quantified</td>
<td>eventive</td>
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</table>

(1) This glass breaks easily.
[TP this glass T [\text{VP1 IMP V1 [VP2 V2 [VP3 breaks this glass ]]}]]

(2) This glass suddenly broke.
[TP this glass T [VP1 V1 [\text{VP2 IMP V2 [VP3 breaks this glass ]}]]]
**Simpler Syntax?** (Culicover and Jackendoff 2005)

John gave Mary a book.
CS: [ x CAUSE [ y HAVE z ]]

Layerd VP:  
\[
\begin{array}{c}
\text{John} \\
\text{v} \\
\text{VP} \\
\text{Mary} \\
\text{v'} \\
\text{a book}
\end{array}
\]

Flat VP:  
\[
\begin{array}{c}
\text{John} \\
\text{V} \\
\text{Mary} \\
\text{a book}
\end{array}
\]

---

(1) John killed the cat on purpose.
(2) John caused the cat to die on purpose.

J. Fodor (1970)

(1') \[ v x \text{CAUSE} [ v p y \text{DIE} ] \]
(2') \[ v x \text{v}(\text{cause}) [ v p v [ v p T [ v x v(\text{die}) [ v p v ]]]] \]

---

- Flat VP: optimal for SM-system
  - Language for communication
  - Lexicalism
- Layerd VP: optimal for CI-system
  - Language for thought
  - Anti-Lexicalism
- Symplicity is in the eye of the beholder!

---

From FLB to FLN:
- Recursive syntax could be an exaptation from the recursive CI-system.
Given that \(bok\) is syntactically complex, the right-branching compounding also requires S-Merge.

\[\rightarrow \text{`Root` compounding}\]

- Exocentric compounds are in fact endocentric.

(1) \(A + A \rightarrow N\)

(2) \(\sqrt{\sqrt{n}} + n \rightarrow N\)

- 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.
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.

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.

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<th>Central System?</th>
<th>Adaptation?</th>
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<tr>
<td>Fodorrian Module</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Chomskyan Module</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Darwinian Module</td>
<td>Yes</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.