The Human Linguistic System Engenders Creativity Through Recursive Operations

Shigeru Miyagawa
MIT

October 22, 2008
Kyoto University
Animal World

Vervet monkeys of Kenya

(Seyfarth, Cheney, Marler 1980 Science)

Alarms (courtesy of Marc Hauser)

eagle

snake

leopard
Honeybees communicate angle and distance of flowers by a dance.
Connecting the symbol and its meaning
Language Links Sound and Meaning
A defining characteristic of human language

Potentially infinite

Galileo, Descartes, von Humboldt, etc.

Limitless I: length of expressions

John thinks that Mary believes that her son said that Bob thought that the professor will handout the physics homework tomorrow.

There is no “longest” sentence.
Limitless II: combinations

that, boy, will, show, a, film

1. That boy will show a film.
2. A boy will show that film.
3. Will that boy show a film?
4. Will a boy show that film?
5. That boy will film a show.
6. A boy will film that show.
7. Will that boy film a show?
8. Will a boy film that show?
9. Show a film, that boy will.
10. Film a show, that boy will.

- A high school graduate knows up to 60,000 words

- Virtually limitless combinatorial possibilities
What is behind language’s infinity?

Infinite use of finite means (Wilhelm von Humboldt)

Recursion

the two big blue cars
blue cars
big [blue cars]
two [big blue cars]
the [two big blue cars]
The source of creativity

- Human language generates binary hierarchical structures by combining words and phrases.
- The structure that can be generated is potentially infinite because this operation is recursive (discrete infinity).
- This leads to creativity - limitless potential.
Movement operations reveal structure

(1) John bought a book.

(2) What did John buy___?
More movement operations

B

A

(3) Every student certainly will read this book.

(4) This book, every student certainly will read. (A)

(5) Read this book, every student certainly will. (B)
What is human language?

- Communication?
- Animals, bees

- How is language used mostly?
Domains

(6) John thinks that Mary believes that the professor will handout the physics homework...

John thinks

\{that Mary believes\}

\{that the professor will hand out...\}
What is the nature of these domains?

Smallest unit of “complete thought”

(7)  { John thinks  {  that Mary praised the students } } 

Reflexive pronoun: must find its antecedent in its Domain.

(8)  John thinks  {  that Mary praised herself } 
(9)  John thinks  {  that Mary praised himself } 

Pronoun: must NOT find its antecedent in its Domain.

(10) John thinks  {  that Mary praised him } 
(11) John thinks  {  that Mary praised her }
Movements and Domains

(12) What did {he say {that he wanted __} }?

West Ulster English

(13)a.  **What all** did he say (that) he wanted__?
    b.  **What** did he say (that) he wanted__ **all**?
    c.  **What** did he say **all** (that) he wanted __?
Domains sometimes block operations

(13) You bought a book.

(14) What did you buy ___?

(15) John left for that reason.

(16) Why did John leave ___?

(17) What do you wonder {whether to fix ___}?

(18) Why do you wonder whether to fix the car?

(19) Certain domains do not allow extraction of why
Some languages don’t move the wh-phrase

(20) a. Hanako-ga pizza-o tabeta.
   Hanako-NOM pizza-ACC ate ‘Taro ate pizza.’

b. Hanako-ga nani-o tabeta no?
   Hanako-NOM what-ACC ate Q ‘What did Hanako eat?’

(21) Hanako-ga \{anata-ga nani-o syuurisitai ka\} siritai no?
    Hanako-NOM \{you-NOM what-ACC fix-do-want Q\} want.to.know Q
    (i) ‘Does Hanako want to know what you want to fix?’

    (ii) ‘What does Hanako want to know whether you want to fix?’
Restriction on *why*

(18) Why do you wonder whether to fix the car?

(19) Certain domains do not allow extraction of *why*

(22)

Anata-ga  {Hanako-ga  naze Amerika-ni iku ka} siritai  no?

you-NOM  {Hanako-NOM why  America-to go  Q} want.to.know  Q

   (i) ‘Do you want to know why Hanako will go to America?’

   (ii) *‘Why do you want to know Hanako will go to America __?’*
Diagnosis for movement


    b. Hon-o gakusei-ga yonda.
    book-ACC student-NOM read
Quantifier float

West Ulster English

(13)a. What all did he say (that) he wanted__?
   b. What did he say (that) he wanted__ all?
   c. What did he say all (that) he wanted __?

   student-NOM 3-Classifier book-ACC read
   ‘Three students read a book.’

b.*Gakusei-ga hon-o san-nin yonda.
   student-NOM book-ACC 3-Classifier read
   ‘Three students read a book.’

(26) Hon-o gakusei-ga san-satu yonda.
    book-ACC student-NOM 3-Classifier read
    ‘A student read three books.’