

A Multi-Modal Combinatory Categorical Grammar Analysis of Japanese Nonconstituent Clefting

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A basic cleft sentence

- (1) Ken ga kono hon o yon-da.
Ken NOM this book ACC read-PAST
'Ken read this book.'
- (2) [Ken ga t_i yon-da] no wa [kono hon (o)] $_i$ da.
Ken NOM read-PAST NMLZ TOP this book ACC COP
'It is this book that Ken read.'
- (3) Template: A no wa B da. = 'A is B'
A: topic position ('old info')
B: focus position ('new info')

Clefting different kinds of constituents

- (4) [Ken ga yon-da] no wa *kono hon* (*o*) da.
Ken NOM read-PAST NMLZ TOP this book ACC COP
'It is this book that Ken read.'
- (5) [Kono hon o yon-da] no wa *Ken* (**ga*) da.
this book ACC read-PAST NMLZ TOP Ken NOM COP
'It is Ken that read the book.'
- (6) [Ken ga kono hon o mise-ta] no wa *Mari ni* da.
Ken NOM this book ACC show-PAST NMLZ TOP Mari DAT COP
'It is to Mari that Ken showed this book.'
- (7) [Taroo ga hon o yomi-oe-ta] no wa *tui*
Taro NOM book ACC read-finish-PAST NMLZ TOP just
sakki da.
a while ago COP
'It is just a while ago that Taro finished reading the book.'

Nonconstituent clefting

- (8) [Ken ga barasi-te simat-ta] no wa *Mari ni sono*
Ken NOM disclose EMPH-PAST NMLZ TOP Mari DAT that
himitu o da.
secret ACC COP
lit. 'It is to Mari that secret that Ken (inadvertently) disclosed.'
(which could answer 'What did Ken disclose to whom?')
- (9) [Sono himitu o barasi-te simat-ta] no wa *Ken ga*
that secret ACC disclose EMPH-PAST NMLZ TOP Ken NOM
Mari ni da.
Mari DAT COP
lit. 'It is Ken to Mari that (inadvertently) disclosed that secret.'
(which could answer 'Who disclosed that secret to whom?')

Nonconstituent clefting (cont.)

- (10) [Ken ga Mari ni barasi-ta] no wa *tikasitu de*
Ken NOM Mari DAT disclose-PAST NMLZ TOP basement LOC
sono himitu o da.
that secret ACC COP
lit. 'It is in the basement that secret that Ken disclosed to Mari.'
(which could answer 'Where did Ken disclose what to Mari?')
- (11) [Taroo ga happyoo-si-ta] no wa *kyonen NELS de da.*
Taro NOM present-do-PAST NMLZ TOP last-year NELS at COP
'It is last year at NELS that Taro presented (a paper).'

Scrambling in a simple sentence

- (12) a. Ken ga sono hon o kat-ta.
Ken NOM that book ACC buy-PAST
'Ken bought that book.'
- b. Sono hon o Ken ga kat-ta.
that book ACC Ken NOM buy-PAST
'Ken bought that book.'

Scrambling two nonconstituent arguments

- (13) [Ken ga barasi-te simat-ta] no wa *Mari ni sono*
Ken NOM disclose EMPH-PAST NMLZ TOP Mari DAT that
himitu o da.
secret ACC COP
lit. 'It is to Mari that secret that Ken (inadvertently)
disclosed.'
(which could answer 'What did Ken disclose to whom?')
- (14) [Ken ga barasi-te simat-ta] no wa *sono himitu o Mari ni da.*

A basic complex predicate sentence

- (15) Ken ga Mari ni sono hon o **yon-de** **morat-ta**.
 Ken NOM Mari DAT that book ACC read-MKR BENEF-PAST
 'Ken had Mari read that book for him.'
- V1 V2
 ↓ ↓

Clefting with complex predicates

- (16) a. [Ken ga yon-de morat-ta] no wa *Mari ni sono hon o* da.
Ken NOM read-MKR BENEF-PAST NMLZ TOP Mari DAT that book ACC COP
lit. 'What Ken had read for him was Mari that book.'
- b. * [Ken ga Mari ni morat-ta] no wa *sono hon o* da.
Ken NOM Mari DAT BENEF-PAST NMLZ TOP that book ACC read-MKR COP
intended: 'What Ken had Mari do for him was read that book.'
- c. * [morat-ta] no wa *Ken ga Mari ni sono hon o* da.
BENEF-PAST NMLZ TOP Ken NOM Mari DAT that book ACC read-MKR COP
intended: 'What was done for him was that Ken had Mari read that book.'

Ungrammatical cases of clefting

- (17) * [Morat-ta] no wa Ken ga Mari ni sono hon
 BENEf-PAST NMLZ TOP Ken NOM Mari DAT that book
 o yon-de da.
 ACC read-MKR COP
 lit. 'The thing that was done for the benefit of somebody
 was that Ken had Mari read that book for him.'
- (18) * [*t_i* Hon o Taro ga yon-da] no wa nagai;
 book ACC Taro NOM read-PAST NMLZ TOP long
 da.
 COP
 intended: lit. 'It is long that Taro read a book.'

CCG

Combinatory rules

(19) Function Application

a. $A/B \ B \vdash A$

b. $B \ A \backslash B \vdash A$

(20) Type-Raising

a. $A \vdash B / (B \backslash A)$

b. $A \vdash B \backslash (B / A)$

(21) Function Composition

a. $A/B \ B/C \vdash A/C$

b. $B \backslash C \ A \backslash B \vdash A \backslash C$

Lexical entries

From [Kubota and Smith, 2006]:

- (22) a. no: $(S \begin{bmatrix} +N \\ -T \end{bmatrix} \backslash \$) \backslash (S \begin{bmatrix} -N \\ -T \end{bmatrix} \backslash \$)$
b. wa: $(S \begin{bmatrix} +N \\ +T \end{bmatrix} \backslash \$) \backslash (S \begin{bmatrix} +N \\ -T \end{bmatrix} \backslash \$)$
c. da: $(S \begin{bmatrix} - \\ -T \end{bmatrix} \backslash X) \backslash (S \begin{bmatrix} + \\ +T \end{bmatrix} / X)$

Sample proof

$$(23) \frac{\frac{\text{Ken ga}}{NP_n} \frac{\text{watasi-ta}}{S[-N] \setminus NP_a \setminus NP_d \setminus NP_n}}{S[-N] \setminus NP_a \setminus NP_d} < \frac{\frac{\text{no}}{S[+N] \setminus \$} \frac{\text{wa}}{S[-N] \setminus \$} \frac{\text{wa}}{S[+N] \setminus \$} \frac{\text{wa}}{S[-N] \setminus \$}}{(S[+N] \setminus \$) \setminus (S[-N] \setminus \$)} \text{FC}}{S[+N] \setminus NP_a \setminus NP_d} <$$

$$\frac{\frac{\frac{\text{sono hon o}}{NP_a}}{S_{[+T]} \setminus (S_{[+T]} \setminus NP_a)} \text{TR} \frac{\frac{\text{Mari ni}}{NP_d}}{(S_{[+T]} \setminus NP_a) \setminus ((S_{[+T]} \setminus NP_a) \setminus NP_d)} \text{TR}}{S_{[+T]} \setminus ((S_{[+T]} \setminus NP_a) \setminus NP_d)} \text{FC} \frac{\text{da}}{(S_{[-T]} \setminus X) \setminus (S_{[+T]} \setminus X)}}{S_{[-T]} \setminus ((S_{[+T]} \setminus NP_a) \setminus NP_d)} <$$

$$\frac{\frac{\text{Ken ga watasi-ta no wa}}{S[+N] \setminus NP_a \setminus NP_d} \frac{\text{sono hon o Mari ni da}}{S_{[-T]} \setminus ((S_{[+T]} \setminus NP_a) \setminus NP_d)}}{S_{[-T]}} <$$

Overgeneration

$$(24) \quad \frac{\frac{\text{hon o}}{NP_a} \quad \frac{\text{Taroo ga}}{NP_n} \quad \frac{\text{yon-da}}{S[-N] \setminus NP_a \setminus NP_n}}{NP_a \setminus (NP_a / NP_a) \text{TR} \quad \frac{S[-N] \setminus NP_a}{S[-N] \setminus NP_a}} < \frac{\frac{\text{no}}{(S[+N] \setminus \$) \setminus (S[-N] \setminus \$)} \quad \frac{\text{wa}}{(S[+N] \setminus \$) \setminus (S[-N] \setminus \$)}}{(S[+N] \setminus \$) \setminus (S[-N] \setminus \$)} \text{FC}}{S[-N] \setminus (NP_a / NP_a) \text{FC}} <$$

$$\frac{S[+N] \setminus (NP_a / NP_a)}{S[+N] \setminus (NP_a / NP_a)} <$$

$$\frac{\frac{\text{nagai}}{NP/NP}}{S_{[+T]} / (S_{[+T]} \setminus (NP/NP)) \text{TR}} \frac{\text{da}}{(S_{[-T]} \setminus X) \setminus (S_{[+T]} \setminus X)} <$$

$$\frac{S_{[-T]} \setminus (S_{[+T]} \setminus (NP/NP))}{S_{[-T]} \setminus (S_{[+T]} \setminus (NP/NP))} <$$

$$\frac{\text{hon o Taroo ga yon-da no wa}}{S[+N] \setminus (NP_a / NP_a)} \frac{\text{nagai da}}{S_{[-T]} \setminus (S_{[+T]} \setminus (NP/NP))} <$$

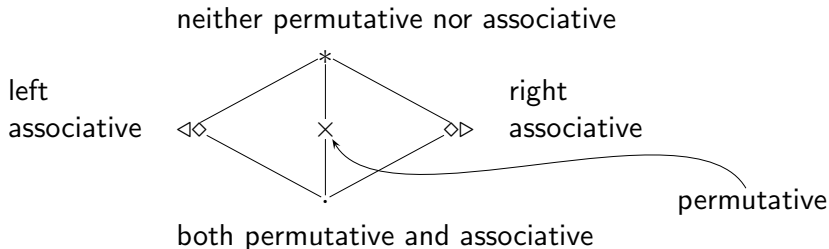
$$\frac{S_{[-T]}}{S_{[-T]}} <$$

MMCCG

Multi-Modal Combinatory Categorical Grammar (MMCCG) [Baldrige, 2002]:

- introduces slash modalities
- manifests these modalities in lexical entries
- provides fine-grained structural control in terms of these modalities

Hierarchy of modes



Combinatory rules with modalities

(25) Function Application

- a. $A/*B \quad B \vdash A$
- b. $B \quad A \backslash *B \vdash A$

(26) Function Composition

- a. $A/\diamond B \quad B/\diamond C \vdash A/\diamond C$
- b. $B \backslash \diamond C \quad A \backslash \diamond B \vdash A \backslash \diamond C$

(27) Type-Raising

- a. $A \vdash B/i(B \backslash_i A)$
- b. $A \vdash B \backslash_i(B/iA)$

(28) Permutation

- a. $A/\times B/\times C\$ \vdash A/\times C/\times B\$$
- b. $A \backslash \times B \backslash \times C\$ \vdash A \backslash \times C \backslash \times B\$$

Lexical entries

- (29) a. *morat-ta*: $S \backslash NP_n \backslash NP_d \backslash \triangleleft VP$ (V2 of complex predicate)
b. *yon-de*: $VP \backslash NP_a$ (V1 of complex predicate)
c. *nagai*: $NP /_* NP$ (adjective)

(/ and \ are the abbreviations for /. and \.)

Grammatical clefting with complex predicates

$$\begin{array}{c}
 (30) \quad \begin{array}{c}
 \begin{array}{c}
 \text{(V1)} \qquad \qquad \text{(V2)} \\
 \text{yon-de} \qquad \text{morat-ta} \\
 \hline
 \text{VP} \backslash \text{NP}_a \quad \text{S} \backslash \text{NP}_n \backslash \text{NP}_d \backslash \text{VP} \\
 \hline
 \text{S} \backslash \text{NP}_n \backslash \text{NP}_d \backslash \text{NP}_a \quad \text{FC} \\
 \hline
 \text{Ken ga} \qquad \qquad \text{Perm} \\
 \text{NP}_n \quad \text{S} \backslash \text{NP}_d \backslash \text{NP}_n \backslash \text{NP}_a \\
 \hline
 \text{Perm} \\
 \text{NP}_n \quad \text{S} \backslash \text{NP}_d \backslash \text{NP}_a \backslash \text{NP}_n \\
 \hline
 \text{S} \backslash \text{NP}_d \backslash \text{NP}_a
 \end{array}
 \end{array}
 < \frac{\text{no wa}}{\text{S} \left[\begin{smallmatrix} +N \\ +T \end{smallmatrix} \right] \backslash \$} \backslash \left(\text{S} \left[\begin{smallmatrix} -N \\ -T \end{smallmatrix} \right] \backslash \$ \right) < \\
 \hline
 \text{S} \left[\begin{smallmatrix} +N \\ +T \end{smallmatrix} \right] \backslash \text{NP}_d \backslash \text{NP}_a
 \end{array}
 \end{array}$$

$$\begin{array}{c}
 \begin{array}{c}
 \text{(dat)} \qquad \text{(acc)} \\
 \text{Mari ni sono hon o} \qquad \text{da} \\
 \hline
 \text{S}_{[+T]} / (\text{S}_{[+T]} \backslash \text{NP}_d \backslash \text{NP}_a) \quad (\text{S}_{[-T]} \backslash X) \backslash (\text{S}_{[+T]} \backslash X) \\
 \hline
 \text{S}_{[-T]} \backslash (\text{S}_{[+T]} \backslash \text{NP}_d \backslash \text{NP}_a)
 \end{array}
 <
 \end{array}$$

$$\begin{array}{c}
 \text{Ken ga yon-de morat-ta no wa} \quad \text{Mari ni sono hon o da} \\
 \hline
 \text{S}_{[+T]} \backslash \text{NP}_d \backslash \text{NP}_a \quad \text{S}_{[-T]} \backslash (\text{S}_{[+T]} \backslash \text{NP}_d \backslash \text{NP}_a) \\
 \hline
 \text{S}_{[-T]}
 \end{array}
 <$$

Ungrammatical clefting with complex predicates (1)

- (16b) * [Ken ga **Mari ni morat-ta**] no wa *sono*
 Ken NOM Mari DAT BENEF-PAST NMLZ TOP that
hon o yon-de da.
 book ACC read-MKR COP
 intended: 'What Ken had Mari do for him was read that
 book.'

(31)

$$\frac{\text{Mari ni}}{NP_d} \frac{\text{morat-ta}}{S \backslash NP_n \backslash NP_d \backslash \langle \diamond \rangle VP} * \text{Perm}$$

$$\frac{}{S \backslash NP_n \backslash \langle \diamond \rangle VP \backslash NP_d}$$

Ungrammatical clefting with complex predicates (2)

- (16c) *[morat-ta] no wa *Ken ga* **Mari ni** sono hon
 BENEf-PAST NMLZ TOP Ken NOM Mari DAT that book
o **yon-de** da.
 ACC read-MKR COP
 intended: 'What was done for him was that Ken had Mari
 read that book.'

$$\begin{array}{c}
 (32) \quad \frac{\text{Mari ni}}{NP_d} \qquad \qquad \qquad \frac{\text{sono hon o yon-de}}{VP} \\
 \hline
 (S \setminus NP_n) / ((S \setminus NP_n) \setminus NP_d)^{TR} \quad \frac{((S \setminus NP_n) \setminus NP_d) / \triangleleft ((S \setminus NP_n) \setminus NP_d) \setminus \triangleleft VP)^{TR}}{\triangleleft} *FC
 \end{array}$$

Blocked derivation for adjective clefting

- (18) * $[t_i$ Hon o Taroo ga yon-da] no wa *nagai*_i da.
 book ACC Taro NOM read-PAST NMLZ TOP long COP
 intended: lit. 'It is long that Taro read a book.'

(33)

$$\begin{array}{c}
 \frac{\text{hon o}}{NP_a} \\
 \hline
 NP_a \setminus * (NP_a / * NP_a)
 \end{array}
 \text{TR}
 \quad
 \frac{\text{Taroo ga}}{NP_n}
 \quad
 \frac{\text{yon-da}}{S \setminus NP_n \setminus NP_a}
 \text{Perm}
 \quad
 \frac{S \setminus NP_a \setminus NP_n}{S \setminus NP_a}
 \text{<}
 \quad
 *FC$$

Conclusion

- Our previous approach to nonconstituent clefting overgenerates in cases where clefting interacts with other phenomena (in particular, complex predicates).
- Accounting for these other phenomena requires the setup of MMCCG which distinguishes different combinatoric modes such as $\triangleleft\triangleright$ and $*$.
- Once the analyses of these other phenomena are implemented in MMCCG, the simple analysis of clefting interacts with them to automatically yield correct results.
- Thus, the proposed analysis provides a springboard for developing a unified analysis of a range of linguistic phenomena that explains the interactions of different phenomena in a principled way.

References



Baldridge, J. (2002).

Lexically Specified Derivational Control in Combinatory Categorical Grammar.

PhD thesis, University of Edinburgh.

[Available at <http://homepages.inf.ed.ac.uk/jbaldrid/dissertation/index.htm>].



Koizumi, M. (1995).

Phrase Structure in Minimalist Syntax.

PhD thesis, MIT.



Kubota, Y. and Smith, E. A. (2006).

Syntax and semantics of Japanese nonconstituent clefting in Combinatory Categorical Grammar.

In Davis, C., Deal, A. R., and Zabbal, Y., editors, *Proceedings of the Thirty-Sixth Annual Meeting of the North East Linguistic Society*, pages 413–426, Amherst, MA. GLSA Publications.



Moortgat, M. (1996).

Categorical type logics.

In van Benthem, J. and ter Meulen, A., editors, *Handbook of Logic and Language*, pages 93–177. Elsevier, Amsterdam.



Oehrle, R. T. (1998).

Multi-modal type-logical grammar.

To appear in R. Borsley and K. Borjars eds., *Non-transformational Syntax*. Blackwell.



Steedman, M. (2000).

The Syntactic Process.

The MIT Press, Cambridge, Massachusetts.