Method: acceptability judgment
Easy vs. difficult sentences (that are all grammatical) center-embedding
Easy vs. difficult sentences (that are all grammatical)

a. the reporter disliked the editor
Easy vs. difficult sentences (that are all grammatical)

a. the reporter disliked the editor
b. the reporter who the senator attacked disliked the editor
Easy vs. difficult sentences (that are all grammatical)

a. the reporter disliked the editor
b. the reporter who the senator attacked disliked the editor
c. the reporter who the senator who John met attacked disliked the editor
Easy vs. difficult sentences center-embedding
(that are all grammatical)

(1) English center embedding with RCs
   a. The patient [the nurse likes] was discharged yesterday
   b. # The patient [the nurse [the surgeon trusted] liked] was discharged yesterday

(2) English right-branching with CP-verbs
   a. The nurse thought that the patient had been discharged
   b. The nurse thought [that the patient believed [that the surgeon was incompetent] ]
Easy vs. difficult sentences (that are all grammatical)

(3) Korean (CP-taking)

a. na-num [Chelswu-ka wulki sicakhayss-tako] mitnunta
I-Top [Chelswu-Nom cry started -that] believe
“I believe that Chelswu started to cry”

Sunhi-Top [Chelswu-Nom [Yenghi-Nom cried-that] said -that] believes
“Sunhi believes that Chelswu said that Yenghi cried.”

“Minca believes that Sunhi thinks that Chelswu said that Yenghi cried.”

Top   Topic marker
Nom   Nominative case marker
Method: self-paced reading
Easy vs. difficult sentences (that are all grammatical) vs. subject vs. object -extracted relatives
Easy vs. difficult sentences (that are all grammatical)

1. the reporter who sent the photographer to the editor hoped for a story
Easy vs. difficult sentences (that are all grammatical)

1. the reporter who sent the photographer to the editor hoped for a story

2. the reporter who the photographer sent to the editor hoped for a story

subject vs. object

-extracted relatives
Self-paced reading
Self-paced reading
Self-paced reading
Self-paced reading
Self-paced reading
Self-paced reading
Self-paced reading
Self-paced reading
Self-paced reading
Self-paced reading
Self-paced reading
Self-paced reading
Self-paced reading
Self-paced reading
The reporter who sent the photographer to the editor hoped for a good story.
The reporter who the photographer sent to the editor hoped for a good story.
subject vs.
object-extracted relatives

![Subject vs. Object-extracted Relatives Graph]

The graph illustrates the comparison between subject and object-extracted relatives in terms of reaction times. The x-axis represents various phrases, and the y-axis shows the reaction times in milliseconds (msec). The phrases include:

- The reporter who the photographer sent to the editor
- The photographer hoped for a good story

The graph shows that the subject relatives take longer to process compared to the object relatives. This suggests a potential difference in how the brain processes subject and object relations in language.
subject vs.
object-extracted relatives

• a bump when subcat frame of send is saturated
subject vs. object-extracted relatives

• a bump when subcat frame of *send* is saturated
• a bump on embedded V send in Obj-extracted only
Easy vs. difficult sentences (that are all grammatical)

1. the reporter who sent the photographer to the editor hoped for a story

2. the reporter who the photographer sent to the editor hoped for a story

subject vs. object
-extracted relatives

short!

long!
subject vs. object-extracted relatives: interaction with memory ability

Subject Relative

[The] reporter senator admitted the error.

Object Relative

[The] reporter attacked admitted the error.
Method: eye-tracking
Easy vs. difficult sentences (that are all grammatical)

Center-embedding

(4) Japanese center embedding with RCs

a. Hiroshi-ga [Masao-ga katta] pan-o tabeta
   Hiroshi-Nom Masao-Nom bought] bread-Acc ate
   “Hiroshi ate the bread Masao bought”

b. # Yoko-ga [Hiromi-ga [Asako-ga kaita] genkoo-o kakinaoshita] syorui-o yonda
   Yoko-Nom Hiromi-Nom Asako-Nom wrote draft-Acc rewrote paper-Acc read
   “Yoko read the papers that Hiromi rewrote based on the draft Asako wrote”

Nom  Nominative case marker
Acc  Accusative case marker
eye-tracking
Easy vs. difficult sentences
(that are all grammatical)
center-embedding in Japanese

(4) Japanese center embedding with RCs

a. Hiroshi-ga [Masao-ga katta] pan-o tabeta
   Hiroshi-Nom Masao-Nom bought] bread-Acc ate
   “Hiroshi ate the bread Masao bought”

b. # Yoko-ga [Hiromi-ga [Asako-ga kaita] genkoo-o kakinaoshita] syorui-o yonda
   Yoko-Nom Hiromi-Nom Asako-Nom wrote draft-Acc rewrote paper-Acc read
   “Yoko read the papers that Hiromi rewrote based on the draft Asako wrote”

(6) Kanji Character 头

atama
too
kasira
zu

Thus one Kanji may correspond to many moras. In addition to Kanji, Japanese uses two types of syllabic alphabets called Hiraqana and Katakana. Each kana character in these syllabaries represents one mora. Ordinarily, Japanese sentences employ a mix of these three types of characters. Kanji is used for content words most often and Hiraqana is used for particles and inflections. In print, each character takes up the same amount of space, and each mora takes approximately the same length of time when it is uttered. Thus, the written length of a sentence does not exactly correspond to its length when read aloud, depending on how many Kanjis are used and how many moras each Kanji represents.
Method: event-related potentials
Fig. 2. Difference waves from experiment 2 (strong semantic incongruity). These difference waveforms were obtained by subtracting the averaged ERP’s to the semantically congruous words from the ERP’s to the semantically incongruous seventh words. Each superimposed tracing (A) represents the difference wave from one subject. The ERP’s in (B) are the corresponding grand average waveforms over all 12 subjects.
event-related potentials

Semantic Deviation

(Bobcats) hunt mice squirrels rabbits laughs and many other small...

Grammatical Deviation

(Turtles will) spit out things they does not like to eat

N400

P600

[Graph showing event-related potentials with N400 and P600 peaks]
A
hi/hi He mailed the letter without a stamp.
hi/lo The bill was due at the end of the hour.
med/hi She locked the valuables in the safe.
med/med Too many men are out of jobs.
med/lo The dog chased our cat up the ladder.
lo/hi There was nothing wrong with the car.
lo/lo He was soothed by the gentle wind.

B

C

$5 \mu V$