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Forward-Integration Processes

The parser already knows what antecedent is to be integrated with the gap.

ERP Reflecting Forward-Integration

Fiebach et al. 2001

sustained-LAN

the cost for the storage of the filler in working memory

P600

the cost for the establishment of the syntactic dependency

Background-Integration Processes

The quantified elements (host-NP) can precede the numeral quantifiers (NQ) in Japanese.

host-NP                        NQ (FQ)

e.g. gakusei-ga kinko san-nin kita.

‘Three students came yesterday.’

Experimental Sentences

a. Short-distance Condition (SC)
gakusei-ga kinko kombini-de jazzshi-o san-satsu katta.

‘Yesterday, a student bought three magazines at the store.’

b. Long-distance Condition (LC)
gakusei-ga kinko kombini-de jazzshi-o san-nin katta.

‘Yesterday, three students bought a magazine at the store.’

c. Adverb Condition (AC)
gakusei-ga kinko kombini-de jazzshi-o san-bai katta.

‘Yesterday, a student bought a magazine three times at the store.’

Present Study

In on-line sentence processing, when and how are the backward-integration processes performed?

ERP Reflecting Forward-Integration

Previous Studies

Fiebach et al. 2001

Fiebach et al. (2001) investigated ERPs elicited during the processing of indirect German wh-questions with either a subject or an object moved to the clause-initial position.

a. subject wh- question

Thomas fragt sich, wer, gap, am Dienstag nachmittag nach dem Unfall den Doktor verständigt hat.

sustained-LAN

b. object wh- question

Thomas fragt sich, wor, gap, am Dienstag nachmittag nach dem Unfall der Doktor verständigt hat.

P600

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sustained-LAN

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P600

Participants

Eighteen Japanese native speakers (mean age=21.9)

All were right handed, and had correct or corrected-to-normal vision.

Procedure

Presentation of Stimuli

*Stimuli were presented on a TFT screen.

-90A; 700msec; ISI; 100msec

List of stimuli

- Ninety experimental sentences (58 sentences in each condition) and 150 filler sentences.
- An acceptability judgment was imposed to all sentences.

Electrodes

- Fz, F7, P3, Pz, P4, Cz, F8
Predictions: when the FQs are presented

- 'san-satsu' three-volumes
- 'san-nin' three-persons
- 'san-ka' three-times

P600/SPS will be elicited in SC and LC compared to AC reflecting the increased integration cost.

Discussion 1
positivity in 350 – 550 msec

The processing cost of recognizing 'san-satsu' and 'san-nin' as FQs, and beginning to search for their host-NPs.

One possible account:
The integration processes consist of two processes.

- a. Judgment Process, examines whether the input element needs to be integrated with another element.
- b. Actual Integration Operation, associates two syntactic elements.

The judgment process may have elicited the positivity in this epoch.

Discussion 2
positivity in 550 – 950 msec

Memory search negativity

It has been proposed that the negativity is elicited reflecting the search process to the memory in 300 – 700 msec latencies. The scalp distribution of such negativity has been observed at central, posterior, parietal sites. This component has also been observed in letter search tasks using visual stimuli and in phoneme search tasks using acoustic stimuli.

(Miyatani 2000, for review)

Conclusion
Incrementality of integration

The backward-integration proceeds incrementally as well as the forward-integration.

Cost for working memory

The difference of direction is reflected in the differences of ERPs.