

## **An eye-tracking study of syntactic and semantic facilitatory interference in Japanese**

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A variety of research has reported syntactic or semantic facilitatory interference where the acceptability/reading-time of syntactically or semantically incongruent agreement is raised/faster [1][2]. Few studies, however, have compared syntactic and semantic facilitatory interference, especially in non-Indo-European languages. The purposes of this study are to confirm whether syntactic and semantic facilitatory interferences occur in Japanese and to compare syntactic and semantic facilitatory interferences in Japanese.

In syntactic conditions (1a-1d), the predicate verb is attached with the honorific affix *o...ninaru*, which requires the subject NP1 (target) to be honorable, so the stimuli of (1c) and (1d) are ungrammatical. However, NP2 (attractor) of (1c) is equipped with the honorific feature, which could lead to facilitatory interference compared with (1d). In semantic conditions (2a-2d), NP3 (target) must be congruent with the semantic feature of the predicate verb, but NP3 of the stimuli of (2c) and (2d) is not semantically congruent. However, NP2 (attractor) of (2c) has the semantic feature congruent with the verb, which could lead to facilitatory interference compared with (3d).

Forty-three Japanese undergraduate and graduate students (M= 20.6 yrs old) participated in this study. Their right eye movements were measured by Eyelink 1000 Plus. 48 sets of 8 stimuli sentences were constructed and divided into 8 lists and mixed with 96 fillers. Participants read a sentence presented in one line, and answered a content question about it.

The data was analyzed using lme4 with type (syntactic/semantic), target (congruent/incongruent) and attractors (congruent/incongruent) as fixed factors with their interactions. The maximal random-effect models with random slope and random intercept for subject and item were adopted. First-pass data showed the main effect of type and tendency of target, but no significant effects of attractor nor interactions in the predicate region (Fig.1). Total time showed the main effect of type, target and attractor, but no interactions in the predicate region (Fig.2). Participant read the predicate region more slowly in syntactic conditions (1a-1d) than in semantic ones (2a-2d); incongruent stimuli (1c&1d / 2c&2d) more slowly than congruent ones (1a&1b / 2a&2b). Furthermore, they read incongruent stimuli with congruent attractors (1c/2c) faster than incongruent conditions with incongruent attractors (1d/2d). Pairwise analyses showed that they read syntactic incongruent conditions with congruent attractors (1c) significantly faster than syntactic incongruent conditions with incongruent attractors (1d), which revealed facilitatory interference. In contrast, there was no significant differences between the semantic incongruent conditions (2c) and (2d).

This eye-tracking study confirmed the syntactic facilitatory interference in Japanese processing, but no semantic facilitatory interference was observed. These results were not consistent with those of the previous research [2], which showed both syntactic and semantic facilitatory interferences by the self-paced reading method. This could be caused by the difference of the experimental method.

## Stimuli

(1) Syntactic conditions: NP1 (target)-nom NP2 (attractor)-gen NP3-o o-Verb-ni naru ...

a. Tanaka-sensei ([+h])-ga Ueda-sensei([+h])-no tana-o o-ake-ni-natte([+h]) mita-youda.

NP1-honorific-nom NP2-honorific-gen cabinet-acc open-honorific tried seemed

b. Tanaka-sensei ([+h])-ga Ueda (-h)-no tana-o o-ake-ni-natte([+h]) mita-youda.

NP1-honorific-nom NP2-gen cabinet-acc open-honorific tried seemed

c. <sup>??/</sup>Tanaka(-h)-ga Ueda-sensei([+h])-no tana-o o-ake-ni-natte([+h]) mita-youda.

NP1-nom NP2-honorific-gen cabinet-acc open-honorific tried seemed

d. <sup>??/</sup>Tanaka(-h)-ga Ueda (-h)-no tana-o o-ake-ni-natte([+h]) mita-youda.

NP1-nom NP2-gen cabinet-acc open-honorific tried seemed

“Tanaka-sensei (+honorific) / Tanaka (-honorific) seemed to have opened the cabinet of Ueda-sensei (+honorific) / Ueda (-honorific).”

#[+h]: holding an “honorable” feature, [-h]: holding no “honorable” feature.

(2) Semantic conditions: NP1-nom NP2 (attractor)-gen NP3 (target)-o Verb

a. Tanaka-ga shorui-no tana-o akete mita-youda.

NP1-nom NP2-document ([+o])-gen NP3-cabinet([+o])-acc open ([+o]) tried seemed

b. Tanaka-ga shokki-no tana-o akete mita-youda.

NP1-nom NP2-dish(es) ([-o])-gen NP3-cabinet ([+o])-acc open([+o]) tried seemed

c. <sup>??/</sup>Tanaka-ga shorui-no saizu-o akete mita-youda.

NP1-nom NP2-document ([+o])-gen NP3-size ([-o])-acc open ([+o]) tried seemed

d. <sup>??/</sup>Tanaka-ga shokki-no saizu-o akete mita-youda.

NP1-nom NP2-dish(es) ([-o])-gen NP3-size ([-o])-acc open ([+o]) tried seemed

“Tanaka seemed to have tried to open the cabinet (openable) / size (unopenable) / of documents (openable) / dishes (unopenable).”

#[+o]: holding an “openable” feature, [-o]: holding no “openable” feature.

Fig.1 First-pass time

	Estimate	Std. Error	df	t value	Pr(> t )
(Intercept)	376.056	24.029	57.033	15.65	< 2e-16 ***
type	134.778	31.89	71.076	4.226	6.95e-05 ***
target	-43.321	24.697	69.358	-1.754	0.0838 .
attractor	-11.772	24	177.756	-0.491	0.6244
type:target	-10.399	37.691	70.007	-0.276	0.7834
type:attractor	-23.331	34.926	76.482	-0.668	0.5061
target:attractor	-3.467	33.821	125.708	-0.103	0.9185
type:target:attractor	62.362	50.561	63.635	1.233	0.222

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Fig.2 Total time

	Estimate	Std. Error	df	t value	Pr(> t )
(Intercept)	632.84	36.21	66.13	17.475	< 2e-16 ***
type	211.97	36.07	48.77	5.877	3.68e-07 ***
target	-100.01	22.24	41.77	-4.497	5.40e-05 ***
attractor	-49.18	21.36	49.88	-2.302	0.0256 *
type:target	41.37	41.55	57.31	0.996	0.3236
type:attractor	-17.49	41.65	47.16	-0.42	0.6765
target:attractor	46.62	46.4	42.66	1.005	0.3207
type:target:attractor	99.57	85.79	42.25	1.161	0.2523

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

## References

- [1] Cunnings, I., & Sturt, P. (2018). Retrieval interference and semantic interpretation. *Journal of Memory and Language*, 102, 16-27.
- [2] Schoknecht, P., & Vasishth, S. (in press). Do syntactic and semantic similarity lead to interference effects? Evidence from self-paced reading and event-related potentials using German. <https://doi.org/10.31234/osf.io/cwymg>