Filler-gap Resolution in Cross-linguistic Wh-questions: L2 English and L1 Japanese

The study of wh-question processing offers valuable insights into the cognitive mechanisms of bilingual language comprehension, especially when the two languages are typologically distinct. Prior research shows that native English speakers tend to favor main clause (MC) interpretations (e.g., the "telling" location) over embedded clause (EC) interpretations (e.g., the "catching" location) when processing ambiguous wh-questions like (2a) [1]. These findings led to the proposal of the active gap-filling hypothesis, which suggests that comprehenders resolve filler-gap dependencies as soon as potential cues are encountered.

Under the active gap-filling hypothesis, native Japanese speakers have been reported to prefer EC interpretations when processing the Japanese counterpart of sentences like (2b), reflecting the head-final structure of Japanese, where EC precede MC [1,2]. This finding, however, contrasts with established Japanese processing theories, which emphasize the reliance on particle-based cues to determine the function of wh-indeterminate phrases [3,4].

Building on this, we address the question of how second language learners (L2ers) of English navigate filler-gap dependencies in Experiment 1: do L2ers' processing align with native-like incremental parsing, or are they shaped by influences from their L1 and proficiency constraints? Additionally, we examine the reliability of the Japanese findings in Experiment 2, given their divergence from established theories[3,4], underscoring the need for further investigation to clarify the mechanisms underlying sentence processing in Japanese.

Experiments employed a visual world eye-tracking paradigm. In Experiment 1, Japanese L2ers of English (n=51) were audibly presented with a context sentence such as (1), followed by an ambiguous wh-question such as (2a). While listening to the question, participants viewed three pictures on a computer screen: one representing the MC interpretation (Fig. 1a), another representing the EC interpretation (Fig. 1b), and a distractor (Fig. 1c). Eye-movements tracking their fixations on the three pictures were recorded throughout the task, and participants selected their answer by pressing a key. Experiment 2 followed the same procedure as Experiment 1, but the context and sentences were presented in Japanese, and the participants were native Japanese speakers (n=36).

In Experiment 1, key-press results indicated that Japanese L2ers of English exhibited a significant preference for the MC interpretation over the EC interpretation (p<.001, Fig. 2a) when processing English sentences. This behavior reflects active filler-gap resolution, as L2ers prioritized the first verb phrase they encountered, mirroring the behavior of the native English control group (n = 11). Eye-tracking analyses further revealed that L2ers fixated more on the MC interpretation picture from the onset of the wh-question until its mean offset (ps<.001, Fig. 2b). These results challenge existing frameworks such as the Shallow Structure Hypothesis [5], which suggests that L2ers rely on global parsing strategies and delay interpretations. Instead, the findings suggest that L2ers process syntactic dependencies incrementally, supporting the application of the active gap-filling hypothesis in L2 processing.

In Experiment 2, Japanese participants processing Japanese sentences displayed a markedly different pattern. Despite the EC information appearing earlier in the sentence, key-press results indicated that Japanese participants ultimately preferred the MC interpretation (p=.012, Fig. 3a). Eye-tracking data revealed that participants fixated more on the EC location upon hearing the EC information (1239ms, p<.001, Fig. 3b), but shifted their gaze to the MC location as the sentence progressed toward its end (1307ms, p=.022, Fig. 3b). These findings suggest that Japanese speakers delay filler-gap resolution until the end of the sentence. Although the results differ from some previously reported experimental findings, they align with the theoretical proposal that Japanese relies on particle-based cues for interpreting wh-indeterminate phrases [3,4].

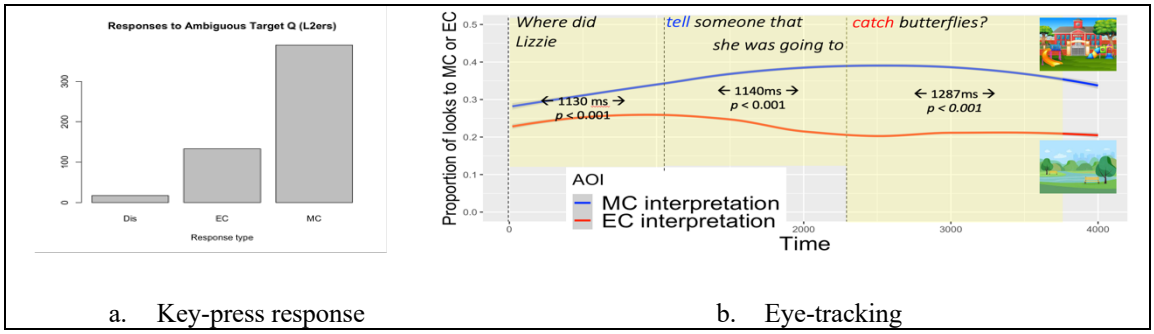
Together, these findings suggest that while incremental processing is fundamental to language comprehension, its application is dependent on language typology. In L2 English, Japanese learners showed incremental filler-gap resolution, consistent with the active gap-filling hypothesis, while in Japanese, they relied on a delayed, particle-driven strategy. These findings suggest that processing by L2ers adapts to the target language's grammar rather than being directly constrained by L1 strategies. Additionally, individuals across language proficiency levels appear to rely on similar cognitive mechanisms for navigating complex syntactic structures, such as wh-questions, when the grammar allows it.

(1) Example context (The order of events changed across conditions to control for recency effects)
a. Embedded clause event first main clause event second condition
Lizzie caught butterflies in the park using her net. In the afternoon, she saw her friend in the schoolyard and told him about it.
b. Main clause event first main clause event second condition
Lizzie saw her friend in the schoolyard. She told him, "I caught butterflies in the park using my net."

(2) Example ambiguous wh- question in English and Japanese
a. *Where did Lizzie tell someone that she was going to catch butterflies?*
b. *Doko-de Lizzie-wa* [pro *choucho-o tsukamaeta to*] *iimashita-ka?*
Where-at Lizzie-Top[pro butterfly-Acc catch-PST COMP] tell-PST-Q
"Where did Lizzie tell (someone) she was going to catch butterflies?"

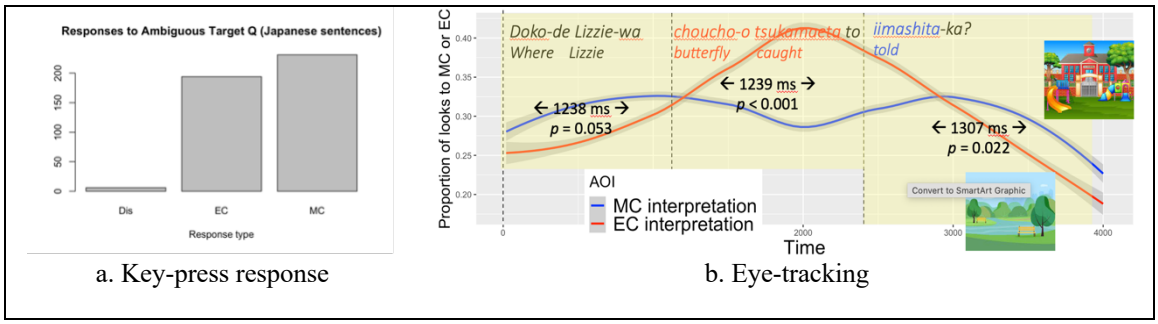
a. Main clause (MC) interpretation b. Embedded clause (EC) interpretation c. Distracter

Fig. 1 Three pictures presented with (2a, b)



a. Key-press response b. Eye-tracking

Fig. 2. Results of Experiment 1 (English sentences)



a. Key-press response b. Eye-tracking

Fig. 3 Results of Experiment 2 (Japanese sentences)

References
[1] Omaki, A., Davidson White, I., Goro, T., Lidz, J., & Phillips, C. (2004). No Fear of Commitment: Children's Incremental Interpretation in English and Japanese Wh-Questions. *Journal of East Asian Linguistics, 13*, 293-323.
[2] Aoshima, S., Phillips, C., & Weinberg, A. (2004). Processing filler-gap dependencies in a head-final language. *Journal of Memory and Language*, 23-54.
[3] Kuroda, S.-Y. (1965). Generative Grammatical Studies in the Japanese Language. PhD diss., MIT.
[4] Saito, M. (2017). Japanese wh-constructions and the division of labor between syntax and PF. In J. Emonds, M. Gonzales, & M. Ziková (Eds.), Language Use and Linguistic Structure: Proceedings of the Olomouc Linguistics Colloquium 2016 (pp. 267–284). Olomouc: Palacký University.
[5] Clahsen, H., and Felser, C. (2006). Grammatical processing in language learners. Appl. Psycholinguist. 27, 3–42.