

Inferring verb meanings from syntactic frames by Japanese 2-year-old children: An experimental approach from an IPL paradigm with a dialogue phase

Syntactic bootstrapping is the proposal that children make use of syntactic frames to learn verb meanings. Gleitman (1990) assumed that learning verbs requires the use of syntactic frames since it is difficult that children identify the linguistically relevant aspect of referents by observing the situation alone. For example, an NP-V-NP pattern in English represents a sentence involving a transitive verb, which often conveys a causative meaning. Using an intermodal preferential looking (IPL) paradigm, Naigles (1990) demonstrated that English-speaking 25-month-olds are able to use syntactic frames to infer the causative/non-causative distinction. In the training, children saw a combination of two different actions performed by two animal entities, one causative, and the other non-causative, while they heard a novel verb in a transitive ('The duck is gorging the bunny') or intransitive frame ('The duck and the bunny are gorging'). In the test, the causative and non-causative action scenes were separately presented side-by-side while they were asked which action was denoted by the novel verb ('Which is gorging?'). The results indicated that the children looked preferentially at the causative scene for the transitive frame and preferentially at the non-causative scene for the intransitive frame.

However, there is still debate over whether Naigles's (1990) finding reveals strong evidence for syntactic bootstrapping (e.g., Yuan & Fisher, 2009). In her study, action events were visually shown in the training when providing target sentences. Such a procedure may make it possible for children to rely on the event observation for inferring verb meanings. If this is true, Naigles's findings may be inconsistent with Gleitman's original idea that syntactic frames are independently informative in early verb learning. More recently, Yuan and Fisher (2009) have succeeded in circumventing the procedural problem by providing syntactic information alone in the absence of visual cues. In a training of this experiment, children did not see an action event but saw a two-woman dialogue scene including a novel verb embedded in a transitive or intransitive frame. Then, causative and non-causative action scenes were simultaneously shown. The results showed that English-speaking 28-month-olds looked significantly longer at the causative action in the transitive frame, providing strong evidence that children can infer verb meanings from syntactic frames alone in the absence of visual cues.

The present study used the same methodology as Yuan & Fisher (2009) to investigate whether syntactic bootstrapping occurs in Japanese. Previous studies on syntactic bootstrapping have been largely limited to English, in which syntactic frames are highly informative about a verb's transitivity because argument NPs must be overtly expressed. However, in an argument-drop language like Japanese, syntactic frames may not be a robust cue to transitivity, and the children learning argument-drop languages may not be able to infer verb meanings from syntactic frames. We examined whether syntactic bootstrapping occurs in children learning Japanese under highly controlled conditions.

Methods

Thirty-two Japanese-speaking children with a mean age of 27.5 months (range: 27.1-28.7) were randomly assigned to a Transitive or an Intransitive condition. The children received 2 consecutive sessions that consisted of a dialogue and a test phase. In the dialogue phase, the children saw a video clip of two women engaged in a dialogue with natural gestures, accompanied by soundtracks of their recorded dialogues. The dialogue video appeared in the center of the monitor. As described in Table 1, the children in the Transitive condition heard the novel verb embedded in transitive sentence frames 'Tomo-kun-ga Yu-chan-o nema-tteiru/wage-tteiru yo' (Tomo is X-ing Yu), and those in the Intransitive condition heard the verb embedded in conjoined-subject intransitive sentence frames, 'Tomo-kun-to-Yu-chan-ga nema-tteiru/wage-tteiru yo' (Tomo and Yu are X-ing). In the test phase (a total of 4 trials), the children in both conditions saw two video clips side-by-side. One video clip showed a causative scene in which a man spun a woman around on a chair. The other showed a non-causative synchronous scene in which the same man and woman each waved a hand in circles. In the first 2 trials, the children were given baseline trials to measure their perceptual salience toward each clip with an arousal phrase (i.e., 'mite mite' [look!]). In the second 2 trials, the children were given test trials in which they watched two clips side-by-side while hearing a sentence including the verb without syntactic frames, 'Nema/wage-tteiru no docchi' (Which is X-ing?). We predicted that if the children were able to infer the meaning of the novel verb that they heard during the dialogue phase, the children in the Transitive condition would look longer at the causative scene than at the non-causative scene. In contrast, those in the Intransitive condition would look longer at the non-causative

scene than at the causative scene. A coder performed an offline frame-by-frame coding to calculate how long children looked at each scene during the baseline and the test trials from a video recording.




Results

The time spent looking at the causative scene in the test phase was analyzed with a mixed-design ANOVA with Condition (Transitive vs. Intransitive) and Word type (nemaru vs. wageru) as between-subjects factors, and Test phase (baseline vs. test) and Trial block (first vs. second) as within-subjects factors. The analysis revealed a significant main effect of Test phase, $F(1, 28) = 14.978, p = .001, \eta_p^2 = .349$, and a significant interaction between Test phase and Condition, $F(1, 28) = 24.788, p < .001, \eta_p^2 = .469$. No other main effects or interactions were significant. As depicted in Figure 1, further analysis with Bonferroni correction indicated that the children in the Transitive condition looked significantly longer at the causative scene in the test trials ($M = 66.1\%$) than in the baseline ($M = 56.4\%$), $F(1, 28) = 9.864, p = .004, \eta_p^2 = .261$. In contrast, those in the Intransitive condition looked significantly shorter at the causative scene in the test trials ($M = 45.5\%$) than in the baseline trials ($M = 57.5\%$), $F(1, 28) = 15.201, p = .001, \eta_p^2 = .352$, showing that they looked preferentially at the non-causative scene in the test trials.

Discussion

Using an IPL paradigm that adopts a dialogue phase similar to that reported by Yuan and Fisher (2009), the present study demonstrates that the Japanese-speaking 27-month-olds hearing transitive frames during the dialogue phase looked preferentially at a causative scene over a non-causative scene, while those hearing the intransitive frames looked preferentially at a non-causative scene over a causative scene. These findings suggest that children learning Japanese are able to infer the meaning of novel verbs from syntactic information alone in the absence of visual cues about referents. This is the first evidence to show that syntactic bootstrapping occurs in young children learning an argument-drop language from an IPL paradigm with a dialogue phase. In contrast to prior results that English-speaking children often failed to show their preference for a non-causative scene for intransitive frame (Yuan & Fisher, 2009), this study demonstrates that Japanese-speaking children successfully associate a non-causative scene with an intransitive frame as well as a causative scene with a transitive frame.

Table 1. Experimental design including examples visual and audio stimuli.

A. Dialogue phase	Transitive Condition
	1: Nee nee. Tomo-kun ga Yu-chan o nematteiru yo. (Hey. Tomo is nemarking Yu.) 2: E? Dare ga dare o nematteiru no? (Huh? Who is nemarking whom?) 1: Tomo-kun ga Yu-chan o nemattan yo. (Tomo is nemarking Yu.) 2: Honma? Tomo-kun ga Yu-chan o nemattan ya. Sugoi ne. (Really? Tomo is nemarking Yu. Good.) 1: Un, sugoi ne. (Yeah, I think so.)
B. Test phase	
	<u>1. Baseline trials</u> Mite mite (Look!)
	<u>2. Test trials</u> Nematteruno docchi? (Which is nemarking?)
causative scene	non-causative scene

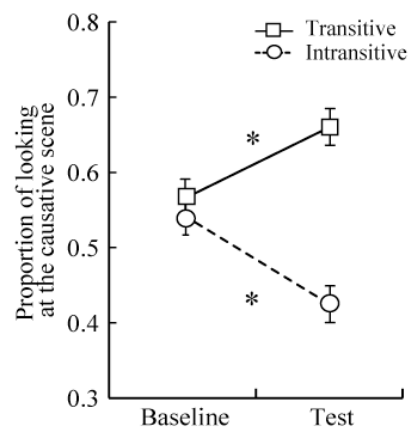


Figure 1. Proportion of looking time devoted to the causative scene in the baseline and the test trials for Transitive and Intransitive condition. Error bars show standard errors. * $p < .005$

References

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