Japanese-Speaking Children's Interpretation of Comparatives with a Non-Numeral Scalar Quantifier: *Sukosi ooi* 'a few more'

Tomoe Arii and Takuya Goro

1. Introduction

Prior acquisition studies have reported that children often misinterpret comparatives modified by a differential phrase (e.g., *X ate 2 more tomatoes than Y*) despite showing no difficulty with bare numerals or simple comparatives (e.g., *X ate more tomatoes than Y*) (Arii et al., 2017; Hackl et al., 2021; Rosenstein et al., 2023). Arii et al. (2017) found that English- and Japanese-speaking children aged 4–6 years often failed to assign the correct *differential* interpretation to comparatives such as *the lion is 2 kiraris taller than the tiger*. This sentence includes the novel measurement term *kirari*, which is represented by a star-shaped figure in Figure 1.

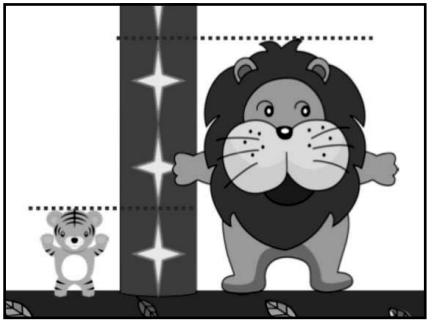

Figure 1. Example stimulus from Arii et al. (2017).

The most common non-adult-like response pattern reflected what is called an *absolute* reading, in which the differential phrase was interpreted as the absolute height of the compared animal (e.g., 'the lion is 2 kiraris tall'). The next most common response reflected a *simple comparative* reading, in which the

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differential phrase was ignored entirely (e.g., 'the lion is taller than the tiger'). Another response pattern, found only among Japanese-speaking children, reflected a *conjunctive* reading (e.g., 'the lion is 2 kiraris tall *and* taller than the tiger').

The current study focuses on comparatives in which the differential phrase consists of a non-numeral quantifier such as *sukosi* 'a few/a little,' as shown in (1).[1,2]

(1) Usagi-no-tabeta-tomato-wa saru-no-tabeta-tomato-yori sukosi ooi.
rabbit-GEN-ate-tomato-TOP monkey- GEN-ate-tomato-than a few many
'The rabbit ate a few more tomatoes than the monkey.'

We investigate how Japanese-speaking children interpret this type of comparative in order to evaluate three previous accounts of children's difficulties with differential comparatives. The following section reviews these accounts and derives their predictions for (1).

2. Predictions based on previous accounts

Regarding children's interpretations of the comparative in (1), different predictions can be derived from the accounts of Arii et al. (2017), Hackl et al. (2021), and Rosenstein et al. (2023). Arii et al. (2017) proposed a grammar-based account in which children's non-adult-like interpretations are argued to stem from a non-adult-like selectional restriction imposed by a covert degree head *Meas* (Sawada & Grano, 2011; Svenonius & Kennedy, 2006). Under their proposal, unlike adult *Meas*, child *Meas* is assumed to require its internal argument (i.e., adjectival predicates) to have a minimal degree of zero, which creates a compositional conflict with the nonzero standard introduced by the *than*-phrase. Consequently, they argued that when semantic computation fails, children are forced to resort to ad hoc strategies and thus ignore one of these components. If the *than*-phrase is ignored, the differential comparative is misinterpreted as an absolute statement (e.g., 'the lion is 2 kiraris taller than zero'). In contrast, if the differential phrase is ignored, it is misinterpreted as a simple comparative (e.g., 'the lion is taller than the tiger').

In contrast, Hackl et al. (2021) argued that children's erroneous responses stem from immature numerical knowledge, specifically, a failure to fully acquire the induction axiom, which is necessary for representing numerical differences. Finally, Rosenstein et al. (2023) argued that children's non-adult-like interpretations arise from the properties of the experimental design rather than from immature grammatical or numerical knowledge. They proposed that the

[1] Gloss abbreviations used in this paper are as follows: GEN = genitive; TOP = topic.

[2] The quantifier *sukosi* actually has a slightly different meaning from *a few*. *Sukosi* can refer to just one item, whereas *a few* typically refers to two or three items. Nevertheless, we translate it as *a few*, given that both function as quantifiers.

experimental method used in the previous studies—the Truth Value Judgment Task (TVJT) (Crain & McKee, 1985; Crain & Thornton, 1998)—encourages children to misinterpret differential comparatives as incremental *more* constructions, in which the standard of comparison is irrelevant (e.g., *I need some more milk*), thereby yielding an absolute interpretation.

These three accounts give rise to different predictions regarding children's interpretations of differential comparatives with non-numeral quantifiers, as in (1). According to Arii et al. (2017), children cannot assign a correct differential interpretation to (1) because of the non-adult-like specification of child *Meas*, which prevents them from interpreting *sukosi* as a differential and instead forces them to resort to ad hoc strategies as they do with numeral differentials. In contrast, if Hackl et al. (2021) are correct, we should not expect children to produce errors when no numeral is present in comparatives. Finally, in Rosenstein et al.'s (2023) account, when tested using the TVJT, children are expected to misinterpret differential comparatives as incremental *more* constructions and assign an absolute interpretation, regardless of whether the differential phrase is a numeral or a non-numeral. Accordingly, (1) is predicted to be interpreted as 'the rabbit ate a small number of tomatoes.' These predictions are tested in the experiment described in the following section.

3. Experiment

3.1. Participants

We tested 30 monolingual Japanese-speaking children aged 4;5–6;3 (mean age = 5;4) living in Kanagawa Prefecture, Japan. Five additional children were tested but excluded from the analysis due to failure to understand simple comparatives or a yes bias. We also tested 23 Japanese-speaking university students as the controls.

3.2. Stimuli and procedure

Following Arii et al. (2017), we used TVJTs. The story depicts a vegetable-eating contest among animals. A monkey, introduced as the Vegetable King, was the best at eating vegetables, and other animals attempted to eat more vegetables than the monkey to beat him. To direct the children's attention to the difference in the amounts eaten by the monkey and challenger animals, we introduced the following rules: animals that ate substantially more than the monkey received a gold medal; those that ate slightly more received a silver medal; and those that did not eat as much received an X-mark medal. Importantly, these rules were explained without using the target comparative constructions, using descriptions such as "If an animal tries much harder than the monkey, it gets a gold medal" (in Japanese). The story and medal system were presented orally by an experimenter using a series of PowerPoint slides, and the target sentences were presented as audio recordings.

The experiment included four trial types to distinguish among the possible interpretations that children might assign to the test sentences: Absolute (Abs), Differential-a (Diff-a), Differential-b (Diff-b), and Simple Comparative (SimCom), as summarized in Figure 2.

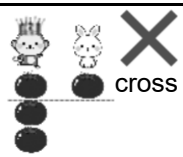
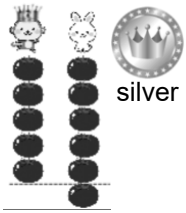
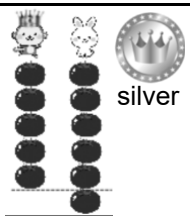
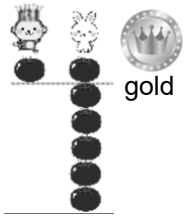
Trial type	Situation	Stimulus	Response
Abs		The rabbit ate a few (***sukosi***) more tomatoes than the monkey.	Diff: False Abs: True SimCom: False
Diff-a		The rabbit ate a few (***sukosi***) more tomatoes than the monkey.	Diff: True Abs: False SimCom: True
Diff-b		The rabbit ate far (***zutto***) more tomatoes than the monkey.	Diff: False Abs: False SimCom: True
SimCom		The rabbit ate a few (***sukosi***) more tomatoes than the monkey.	Diff: False Abs: False SimCom: True

Figure 2. Overview of the four trial types
Each row illustrates the visual scenario paired with a target stimulus sentence, presented as an English translation of the Japanese target sentence The *Response* column indicates whether the target sentence is true or false under each of the three possible interpretations: differential (Diff), absolute (Abs), and simple comparative (SimCom).

Each participant saw all the trial types. In all trials except the Diff-b trials, *sukosi* 'a few' was used as the differential phrase, as in (1). By contrast, in the Diff-b

trials, a different differential phrase, *zutto* 'far,' was used to ensure that children attended to the differential element, as shown in (2).

(2) Usagi-no-tabeta-tomato-wa saru-no-tabeta-tomato-yori zutto ooi.
rabbit-GEN-ate-tomato-TOP monkey- GEN-ate-tomato-than far many
'The rabbit ate far more tomatoes than the monkey.'

In the Abs trials, the sentence was true under an absolute interpretation (i.e., 'the rabbit ate *a few* tomatoes'), but false under both a differential interpretation (i.e., 'the rabbit ate *a few more* tomatoes than the monkey') and a simple comparative interpretation (i.e., 'the rabbit ate *more* tomatoes than the monkey'). In the Diff-a trials, it was true for both differential and simple comparative interpretations. In the Diff-b and SimCom trials, the sentence was true only under the simple comparative interpretation.[3] Based on the trial types described above, the three possible interpretations yielded the following response patterns: If participants assigned an adult-like differential interpretation, they should accept the target sentence only in the Diff-a trials. If they assigned an absolute interpretation, they should accept the target sentence only in the Abs trials. If they assigned a simple comparative interpretation, they should accept all trials except for the Abs trials.

Each trial type consisted of three items, with three additional filler items, yielding 15 items in the main experiment. Before the main experiment, the participants completed three practice items to ensure that they understood simple comparative constructions, such as *the rabbit ate more tomatoes than the monkey*. To control for order effects, half of the participants were assigned to Group 1, in which the first item was a Diff-a trial (*sukosi ooi* 'a few more'), and the remaining participants were assigned to Group 2, in which the first item was a Diff-b trial (*zutto ooi* 'far more').

3.3. Results

The overall percentages of correct responses for the four trial types are shown in Figure 3.

[3] When children accept the sentence in the SimCom trials, we cannot determine whether they are assigning a simple comparative interpretation or failing to compute the relevant scalar implicature—namely, that *a few more tomatoes* implies *not far more tomatoes*—thereby yielding an *at least sukosi* 'a few' interpretation (i.e., 'the rabbit ate at least a few more tomatoes than the monkey'). Therefore, we included the Diff-b trials, in which such scalar-implicature failures would not arise.

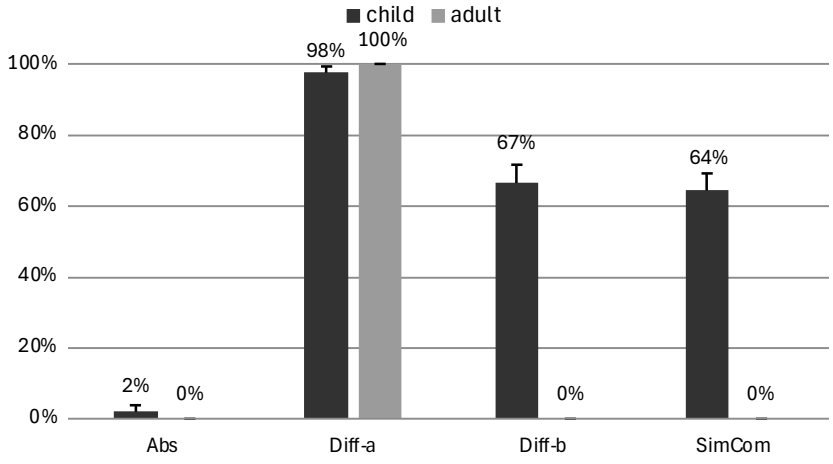


Figure 3. Acceptance rates for child and adult participants

As the figure indicates, the adult participants responded exactly as expected, accepting the target sentences only in the Diff-a trials. In contrast, the children performed poorly in the Diff-b and SimCom trials, incorrectly accepting the target sentences under these conditions, whereas they responded correctly in the Abs and Diff-a trials. Fisher's exact test of overall accuracy revealed a significant difference between adults and children ($p < .001$). Among the 30 child participants, only 7 children showed adult-like response patterns (mean age = 5;11).

The children's data were further analyzed using a generalized linear mixed-effects model (GLMM), with responses coded as 1 for correct and 0 for incorrect. We fitted a GLMM with trial order (Group 1 vs. Group 2) and trial type as fixed effects, and random intercepts for participants and ages in months. Trial order did not significantly affect the children's responses ($p = .681$). In contrast, the trial type had a significant effect. Children performed equally in the Abs and Diff-a trials ($p = 1.000$), but performed significantly worse in both the Diff-b ($p < .0001$) and SimCom ($p < .0001$) trials.

4. Discussion

The experiment reported in the previous section showed that the children almost consistently rejected the target sentences in the Abs trials, suggesting that they did not exhibit an absolute interpretation, which has been reported as the most frequent non-adult-like interpretation in previous studies. This pattern is plausibly attributable to the use of a non-numeral quantifier as the differential phrase. However, children did not exhibit an adult-like differential interpretation either. Many children consistently and incorrectly accepted the target sentences in the Diff-b and SimCom trials while responding correctly in the other trial types.

This pattern suggests that, when interpreting differential comparatives with a non-numeral quantifier, children tend to ignore the differential phrase and assign a simple comparative interpretation ('the rabbit ate more tomatoes than the monkey'), which has been reported as a less common non-adult-like interpretation in previous studies. In the present study, 15 of 30 children exhibited this pattern (mean age = 5;0). In contrast, Arii et al. (2017), who examined differential comparatives with a numeral differential phrase, reported that only 4 of 33 Japanese-speaking children and 3 of 23 English-speaking children exhibited a simple comparative interpretation.

We now consider the implications of our findings for the three accounts. Our experiment showed that children failed to correctly interpret differential comparatives, even in the absence of a numeral phrase. This challenges Hackl et al.'s (2021) proposal that children's erroneous responses stem from their incomplete numerical knowledge. Furthermore, the children did not exhibit an absolute interpretation even when tested using the TVJT, contrary to Rosenstein et al.'s (2023) claim that the TVJT encourages children to misinterpret differential comparatives as incremental *more* constructions, yielding an absolute interpretation.

However, our findings were consistent with Arii et al.'s (2017) account. Under their proposal, the semantic computation of differential comparatives fails in child grammar when both a differential phrase and a *than*-phrase are present, resulting in a compositional conflict. Consequently, children are forced to resort to ad hoc strategies that ignore one of these components. If a differential phrase is ignored, the sentence is interpreted as a simple comparative. Thus, Arii et al.'s (2017) account is more consistent with our data than those of Hackl et al. (2021) and Rosenstein et al. (2023).

Nevertheless, Arii et al.'s (2017) account does not directly explain our most striking finding; the absence of absolute interpretations when the differential phrase is non-numeral. If the analysis is correct, absolute interpretations should be available to children. Under their proposal, when the semantic computation of differential comparatives fails, children can ignore the *than*-phrase, yielding an absolute interpretation (e.g., 'the rabbit ate *a few* more tomatoes than zero'). Thus, their account does not explain why the availability of absolute interpretations depends on whether the differential phrase is numeral or non-numeral. In the following paragraph, we consider why different types of differential phrases give rise to different non-adult-like interpretations.

Building on Arii et al.'s (2017) proposal that children resort to ad hoc strategies when the semantic computation of differential comparatives fails, we suggest that a crucial factor is whether the differential phrase can be reinterpreted as absolute measures when semantic computation fails. Numerals denote precise values on a discrete, closed scale and are strongly linked to cardinality. Thus, even if the differential relation cannot be computed, a numeral can still be reanalyzed as a specific absolute amount (e.g., '2 kiraris tall'), making an absolute interpretation available. By contrast, non-numeral scalar quantifiers such as *sukosi* 'a few' denote vague, context-dependent values on a lower-bounded open scale.

As they do not specify a concrete quantity, they cannot be straightforwardly reanalyzed as absolute measures when semantic computation fails. When such an absolute reanalysis is not available, children must resolve the failure in another way. We suggest that they ignore the differential phrase and instead compare the two quantities directly, yielding a simple comparative interpretation. In this way, the numeral/non-numeral contrast affects the ad hoc strategy that children adopt.

Another possibility is that children's difficulty reflects limitations in computing the required difference (i.e., *between-set subtraction*). Research on mathematics education suggests that comparison-based subtraction is challenging for children (Gibb, 1956; Nunes & Bryant, 1996; Riley et al., 1983). For example, in problems such as "*Mary has three apples and John has two. How many more apples does Mary have than John?*", even school-aged children often respond with Mary's total number of apples (three) rather than the difference between the two sets (one). Notably, the task instructions themselves always contain a differential comparative (e.g., *how many more apples*). Future work should therefore assess children's between-set subtraction independently of comparative expressions to tease apart grammatical factors from numerical computations.

In conclusion, this study showed that Japanese-speaking children often ignore differential phrases and assign a simple comparative interpretation when interpreting differential comparatives with a non-numeral quantifier. This finding challenges the attribution of children's errors to immature numeral knowledge or task-induced misinterpretation. This is more consistent with Arii et al.'s (2017) proposal that children's errors result from a failure in semantic composition, which triggers ad hoc repair strategies. However, to explain why different types of differential phrases yield different non-adult-like interpretations, their analyses must be refined. We propose that a crucial factor is whether the differential phrase can be reinterpreted as absolute measures when semantic computation fails.

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