Children's Interpretation of Superlatives in Full and Fragment Answers

Lyn Tieu[1] and Zheng Shen[2]

1. Introduction

Cross-linguistically, sentences containing superlatives like (1) allow up to three possible readings, illustrated in (1a)-(1c): an absolute reading (ABS), a relative reading with NP-external focus (REX), and a relative reading with NP-internal focus (RIN) (Pancheva & Tomaszewicz 2012; Tomaszewicz 2015).

(1) Donkey bought the biggest photo of Kangaroo.
   a. *Absolute reading (ABS):*
      Of all the photos of Kangaroo, Donkey bought the biggest one.
   b. *Relative reading with NP-external focus (REX):*
      Donkey bought a bigger photo of Kangaroo than others did.
   c. *Relative reading with NP-internal focus (RIN):*
      The biggest photo that Donkey bought was of Kangaroo, not of someone else.

To illustrate these different readings, let us consider some scenarios where Donkey is at an art gallery, shopping for some pictures of his friends. Consider the sentence in (1). On the absolute reading of the superlative, Donkey bought the absolute biggest photo of all of the photos of Kangaroo. This reading would be true, for example, in Figure 1, where we have six photos of Kangaroo, and Donkey has bought the biggest one of the six.
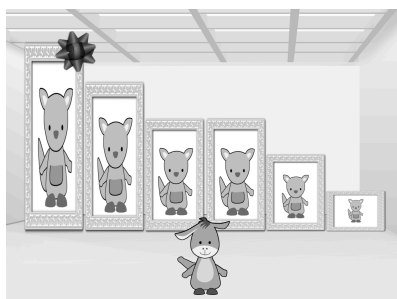
Figure 1: Example of a scenario that makes (1) ("Donkey bought the biggest photo of Kangaroo") true on the absolute (ABS) reading.

Now consider a scenario where Donkey, Monkey, and Sheep are all shopping for photos of their friend Kangaroo. On the so-called relative reading with NP-external focus, (1) means that Donkey has bought a bigger photo of Kangaroo than anyone else has; this is true in the scenario depicted in Figure 2, where among the three shoppers, it's Donkey who has bought the biggest photo of Kangaroo.

Figure 2: Example of a scenario that makes (1) ("Donkey bought the biggest photo of Kangaroo") true on the relative reading with NP-external focus (REX).

Certain languages seem to also allow a third reading of sentences like (1), referred to as a relative reading with NP-internal focus. On this reading, the biggest photo that Donkey bought is of Kangaroo, and not of anyone else. This reading is true in the scenario in Figure 3, where Donkey has bought pictures of both Kangaroo and Hippo, but the biggest picture that he's bought is of Kangaroo and not of Hippo.
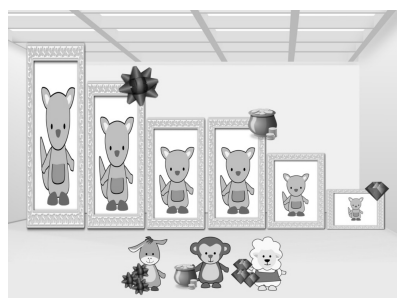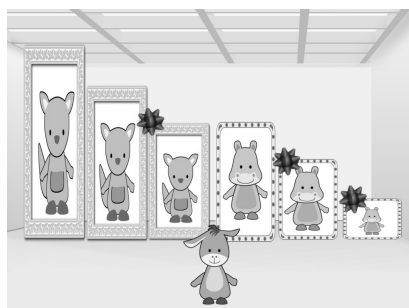
Figure 3: Example of a scenario that makes (1) ("Donkey bought the biggest photo of Kangaroo") true on the relative reading with NP-internal focus (RIN).

While the absolute reading and relative reading with NP-external focus are universally available across languages, the availability of the relative reading with NP-*internal* focus is restricted. In languages like English, which has overt determiners, the relative internal reading is only allowed when the focus undergoes overt movement out of the DP (Tomaszewicz 2015; Shen 2018), for example in wh-questions and clefts. Thus wh-questions (2a) (Szabolcsi 1986) and clefts (2b) allow the RIN reading, while polar questions (2c) and declaratives (2d), where the focus stays in situ, do not.

(2) a.   Who did Donkey buy the largest photo of?
       b.   It was Kangaroo that Donkey bought the largest photo of.
       c.   Did Donkey buy the largest photo of Kangaroo?
       d.   Donkey bought the largest photo of Kangaroo$_F$.

Let us consider the scenario in Figure 3 again, where among the three photos that Donkey has bought, the biggest one is of Kangaroo and not of Hippo. In response to the wh-question, "Who did Donkey buy the biggest photo of?", only the fragment answer, "Kangaroo", allows the relative internal reading; this answer seems true in Figure 3. In contrast, the full answer, "Donkey bought the biggest photo of Kangaroo", only has an absolute interpretation, which is false in the depicted scenario, because the photo of Kangaroo that Donkey bought is actually the smallest one of Kangaroo.

Shen (2018) uses this restricted distribution of the RIN reading to support a movement analysis of fragment answers (Merchant 2004): since the RIN reading is only available with movement, and it is available in fragment answers, fragment answers must involve movement.

To our knowledge, no previous studies have experimentally investigated the availability of the relative internal reading, with most previous work focusing on the absolute and relative external readings. The present study therefore had two goals: to experimentally verify the claim that fragment answers, but not full answers, allow this relative reading, and to investigate whether 4- and 5-year-olds, who should understand wh-questions like (2a), are sensitive to the distinction. To preview, the results reveal that for English-speaking adults, the availability of the RIN reading depends on whether the

superlative appears in a full sentence or is elided as part of a fragment answer to a question (only fragment answers allow the RIN); on the other hand, 4- and 5-year-olds can be led to accept the RIN reading in both full sentences and fragment answers.

2. Experiment
2.1 Participants

In total, 48 English-speaking children and 48 adult native speakers of English participated in the experiment. We tested 24 children (3;10-6;00, M=4;08) and 24 adults in the Full Answer condition, and 24 children (3;03-6;01, M=4;08) and 24 adults in the Fragment Answer condition. Children were tested in the lab at Macquarie University or in their childcare centre in Sydney, Australia. Adult participants were recruited through Amazon Mechanical Turk. Informed consent was obtained from adult participants and parental permission was obtained for all child participants prior to commencing any experimental procedures. Ethical approval for this study was obtained through Macquarie University.

2.2 Procedure

The task was framed as a guessing game. Participants listened to stories involving animal characters who were at the art gallery shopping for portraits of their friends. A puppet answered explicit wh-questions with guesses about the pictures that would be bought, in the form of full declaratives or fragment answers. The participant's task was to say whether the puppet's guesses were right or wrong. The instructions to participants are provided in (3).

(3) Look, this is our friend Shelly the Snail! Today Shelly's going to play a guessing game with us! We're going to see some stories about our animal friends who are visiting the art gallery to buy pictures of their best friends. Shelly's going to make some guesses about what will happen. Your job is to decide whether Shelly's guesses are right or wrong!

The experiment was implemented in Qualtrics. Adults participated by completing the web-based survey. Children saw the same version of the experiment on Qualtrics, but an experimenter was present to guide the children through the experiment, reading the stories out loud to the children (all test sentences, however, were pre-recorded to ensure uniformity across participants).

2.3 Materials

We tested the interpretation of two adjectives that were relatively easy to illustrate through cartoon images, "tallest" and "biggest". In the Absolute condition, the relevant comparison set contained pictures of one character, and the question was which picture would be purchased. In the Relative condition, the relevant comparison set corresponded to two characters, and

the question was whether the biggest picture that was purchased would be of the first character or of the second character.

We paired the full and fragment answers containing superlatives with scenarios that would make the target reading true, as well as with scenarios that would make the target reading false. On the absolute reading involved in (4), for example, the comparison set would contain pictures of Kangaroo. The target in (4) could then be paired with the images in Figure 4, in which the test sentences would be made true, or with the images in Figure 5, which would make the test sentences false (note that the actual animal characters were varied across trials to keep things interesting for participants). Participants received 4 True ABS targets and 4 False ABS targets.

(4) Example of ABS target (made true in Figure 4, false in Figure 5)
    a. *Experimenter's prompt/question to puppet:*
       "Look! Donkey is going to buy some photos of Kangaroo! Shelly, which photo of Kangaroo do you think Donkey will buy?"
    b. *Full condition:*
       Puppet: "Donkey will buy the biggest photo of Kangaroo!"
    c. *Fragment condition:*
       Puppet: "The biggest photo of Kangaroo!"
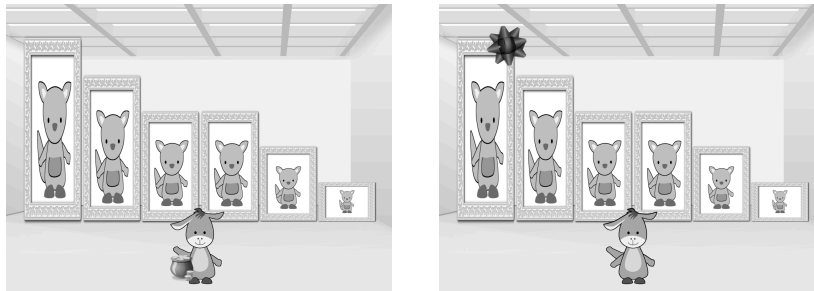

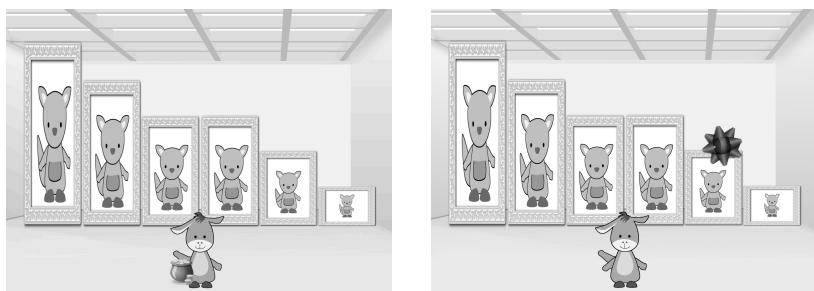**Figure 4: Example of a True ABS target (context image left, outcome image right), paired with (4).**

Figure 5: Example of a False ABS target (context image left, outcome image right), paired with (4).

On the relative internal reading involved in (5), the comparison set would correspond to Mouse and Raccoon. The example in (5) would be paired with

Figure 6 to make a True target, or with Figure 7 to make a False target. Participants received 4 True RIN targets and 4 False RIN targets.

(5) Example of RIN target (made true in Figure 6, false in Figure 7)
    a. *Experimenter's prompt/question to puppet:*
       "Who do you think Sheep will buy the tallest painting of, Mouse or Raccoon?"
    b. *Full target:*
       "Sheep will buy the tallest painting of Mouse."
    c. *Fragment target:*
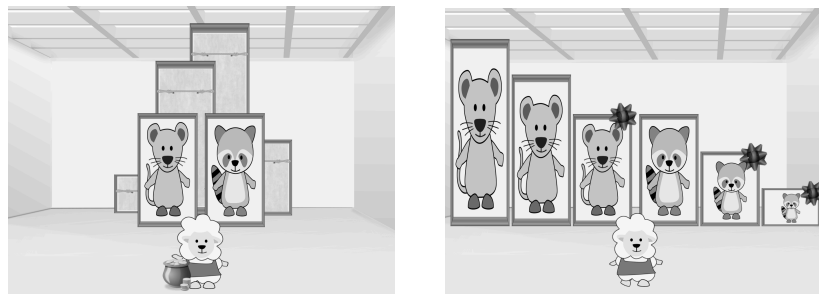   "Mouse."

Figure 6: Example of a True RIN target (context image left, outcome image right), paired with (5).
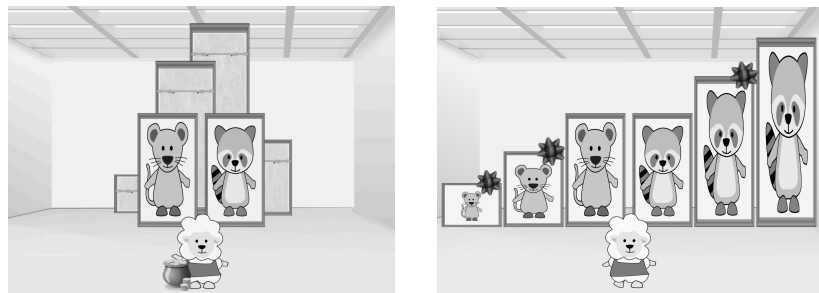

Figure 7: Example of a False RIN target (context image left, outcome image right), paired with (5).

Note that on the RIN targets, the absolute interpretation was falsified: in both of the scenarios depicted in Figures 6 and 7, there are three paintings of Mouse, and in neither case does Sheep end up buying the tallest of the three. For the False RIN targets, then, whether participants accessed the relative or absolute interpretation of the Full and Fragment targets, they were expected to reject the target sentences. On the True RIN targets though, although the absolute interpretation was false, the relative internal reading was made true: in Figure 6, the tallest painting that Sheep bought was one of Mouse and not of Raccoon. The question then was whether participants would accept the Fragment answers but not the Full answers in this condition, which would indicate that the availability of the RIN reading was restricted to cases of movement.

Note that in the outcome images, the portraits were always placed side by side in either increasing or decreasing height, to make the comparison of sizes easier, especially for child participants. For the False targets, we also varied which 'non-biggest' portraits were chosen by the character.

In addition to the 8 Absolute and 8 Relative targets, participants also saw two adjectival controls and two fillers. Examples of a true and false adjectival control are provided in (6), paired with Figure 8.

(6) Example of adjectival controls
  a. *Experimenter's prompt/question to puppet:*
     "Which picture do you think Hippo will buy?"
  b. *Full target:*
     "Hippo will buy the tall picture of Kangaroo."
  c. *Fragment target:*
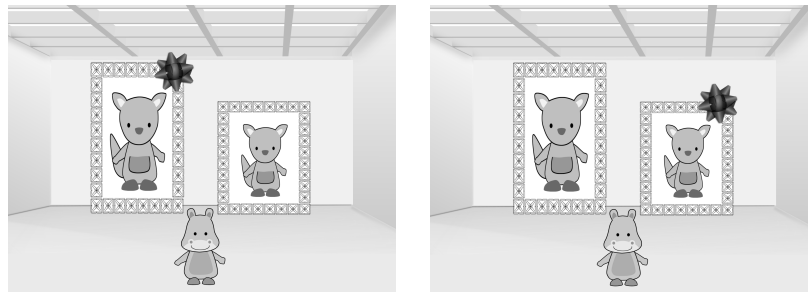   "The tall picture of Kangaroo."

Figure 8: Example of a True adjectival control (left) and a False adjectival control (right), paired with (6).

Before moving on to the results, it is worth pointing out some other features of the experimental materials that we implemented with the goal of lessening children's reported tendency to fixate on the absolute tallest/biggest object in the picture (Arii 2011; Tieu & Shen 2015). First, as described above, the test sentences were uttered in response to explicit questions. These questions helped to highlight the relevant comparison set, e.g., "Who do you think Sheep will buy the tallest painting of, *Mouse or Raccoon*?"

Second, the puppet's responses (guesses) were uttered before the outcome image was shown. This was meant to encourage children to formulate an interpretation without getting distracted by any particular element of the visual display (such as the absolute tallest/biggest object). As seen above, only the relevant alternatives for the target reading were pictured when the test sentence was uttered, e.g., one picture of Mouse and one picture of Raccoon in Figures 6 and 7.

Third, the test sentences were pre-recorded with what we took to be the most natural prosody for the target reading: "Donkey will buy the biggest$_F$ photo of Kangaroo" for the absolute targets and "Donkey will buy the biggest photo of Kangaroo$_F$" for the relative internal targets.

Finally, the RIN and ABS trials were presented in blocks, with the RIN block preceding the ABS block. This was meant to avoid contamination

effects from ABS to RIN, under the assumption that the absolute reading is generally the more frequent and easy reading to access of the two.

In all, participants saw 2 practice trials, followed by 8 absolute targets (4 True, 4 False), 8 relative internal targets (4 True, 4 False), 2 adjectival controls, and 2 fillers. Within the RIN and ABS blocks, trials were completely randomized across participants.

2.2 Results

Accuracy on the adjectival controls was 100% for both adults and children.

Figure 9 displays the adults' and children's proportions of *yes*-responses to the True and False absolute targets, for both Full and Fragment conditions. Both groups generally gave *yes*-responses to the True targets and *no*-responses to the False targets. This is as expected on the assumption that both full declarative answers and fragment answers allow the absolute interpretation of the superlative.
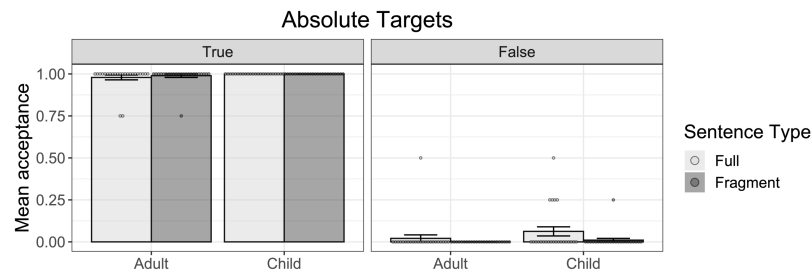

Figure 9: Results from ABS conditions. Dots represent individual participants' mean proportions of *yes*-responses.

Figure 10 displays adults' and children's proportions of *yes*-responses to the True and False relative internal targets, for both Full and Fragment conditions. Both groups generally rejected the False targets (though the adult group's performance was a bit noisier in the Fragment condition, driven by three participants in particular).

The critical conditions involved the True Full and Fragment targets. Crucially, when the relative internal reading was made true, adults tended to accept the fragment answers but tended to reject the full answers, whereas children, in addition to accepting the fragments, also appeared to show greater acceptance of the full answers compared to adults.
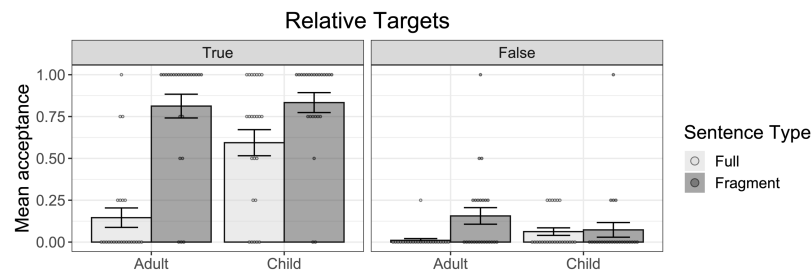
Figure 10: Results from RIN conditions. Dots represent individual participants' mean proportions of *yes*-responses.

We fitted a mixed effect logistic regression model to the True RIN responses with Group (adults vs. children), Sentence Type (Full vs. Fragment), and their interaction as fixed effects, and random intercepts for participant. Comparisons of this model with those without the factors of interest revealed significant effects of Group ($\chi2(1)=8.6$, p<.01) (children were overall more accepting than adults), Sentence Type ($\chi2(1)=42$, p<.001) (participants were overall more accepting of Fragment answers than of Full answers), and a significant interaction ($\chi2(1)=9.4$, p<.01) (adults distinguished between Full and Fragment answers more so than children did). Follow-up comparisons revealed that adults were more accepting of True Fragments than of True Full answers ($\chi2(1)=32.1$, p<.001), whereas children's responses did not differ significantly for the two sentence types ($\chi2(1)=1.91$, p=.17).

Figure 10 also displays individual participants' mean proportions of *yes*-responses. Recall that in the critical True contexts, the True Full answers were made true on the relative internal reading, but false on the absolute reading; despite the sentences being true on the relative reading, 21/24 adults rejected at least 3/4 of these targets (we will return in the Discussion to the three adults who appear to have consistently accepted these targets). As for the child participants, 7/24 children responded in an adult-like manner, rejecting at least 3/4 of the True Full targets. On the other hand, 14/24 children *accepted* at least 3/4 of the True Full targets. The remaining 3/24 children did not appear to have a consistent response pattern, accepting half of the True Full targets and rejecting the other half.

Overall, the results provide experimental evidence for the availability of the relative internal reading in fragment answers, in support of certain syntactic analyses according to which fragment answers involve movement (Merchant 2004; Shen 2018). The results also reveal that unlike adults, children as a group seem to be able to access the relative internal reading in full answers to wh-questions.

3. Discussion

The results of our experiment provide novel evidence that adults can access the relative reading with NP-internal focus in the case of elided fragment answers but not in the case of full declaratives. Children as a group

are less sensitive than adults to the prohibition against the RIN reading in full sentences, with over half of the child participants consistently allowing for the RIN reading in the full declaratives.

One possible explanation for children's performance may be related to how they recalled the puppet's guesses on each trial. We typically encouraged children to repeat the puppet's guesses, to ensure that they had heard them correctly and that they were paying attention. For example, if the question was "Who did Donkey buy the biggest photo of?", in the Full condition, the puppet would answer with the full declarative sentence: "Donkey bought the biggest photo of Kangaroo." The experimenter would then ask the child, "What did the puppet say?" Here, some children would reply, simply: "Kangaroo." Notice that this reconstruction of the puppet's sentence would effectively neutralize the difference between the two conditions, inadvertently turning the full sentences into fragments. This could very well have led to greater acceptance of the "Full" targets.

This explanation might also account for the performance of the three adult participants who consistently accepted the True Full targets. One could imagine a strategy by which the participant simply focused on remembering the name of the character mentioned by the puppet, to see if the puppet was right or wrong. If the puppet's guess was recast or recalled in the form of a fragment (e.g., "Kangaroo"), then the RIN reading might effectively become available.

A future study might follow up on this hypothesis by more systematically constraining the form of the recall (as either a full declarative or fragment), and seeing whether this has an effect on participants' responses. Such investigations will help to clarify the nature of the difference we have observed between adults and children. Do children at a certain developmental stage differ from adults in their grammatical knowledge? For instance, might they have a different analysis of the relevant declarative sentences than adults do, one which allows the generation of the relative internal reading? Or might children simply be more prone than adults to adopt certain experimental strategies that favour the RIN interpretation of full declarative sentences, for example, recasting or recalling the puppet's declaratives as fragments?

More generally, we hope that the present study opens the door to further exploration of the question of how children acquire interpretive restrictions on superlative expressions.

References

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