Is there a superlative rabbit in the ordinal hat? A study of ordinals vs. degree modifiers in nested definites

Elizabeth Coppock, David Beaver, Wilder Perkins, & Emily Richardson*

Abstract. This study probes how the semantics of ordinals relates to the semantics of comparatives and superlatives. We examine this question with the help of a picture task in which participants are asked to locate objects described by nested descriptions like *the candle on the first/closer/closest table*, with an ordinal, comparative or superlative modifier in the inner noun phrase. We show that ordinals systematically lack the 'relative readings' observed for unmodified nested descriptions like *the rabbit in the hat*, in which the inner definite is understood with enriched content, as in *the rabbit in the hat with a rabbit in it*, in contrast to superlatives. Our explanation for this relies on the idea that an ordinal expects an ordering that can be provided by context.

Keywords. relative readings; nested definite descriptions; ordinals; superlatives

1. Introduction. Nested descriptions like *the rabbit in the hat*, have been observed to have 'relative readings', in which the inner definite is understood with enriched content, as in *the rabbit in the hat with a rabbit in it* (Haddock 1987). As Bumford (2017) observes and explains via scope movement, nested descriptions with superlatives like *the rabbit in the biggest hat* have relative readings too, in this case paraphrasable as *the rabbit in the biggest hat with a rabbit in it*. In this paper, we show that ordinals resist relative readings to a substantially greater extent than superlatives (and we find that comparatives easily allow them in our experimental setting). We establish this with the help of a picture task in which participants are asked to locate objects described by nested descriptions like *the candle on the first/closer/closest table*, with an ordinal, comparative or superlative modifier in the inner noun phrase.

The differences we observe are in line with prior work showing differences between ordinals and superlatives (Bylinina et al. 2014). However, the results present difficulties for accounts of the semantics of ordinals on which they are entirely parallel to (Bhatt 2006) or contain superlatives (Alstott 2023). Such accounts would predict relative readings with both ordinals and superlatives in nested descriptions, *contra* what we found in the experiments we will report. Likewise, our results show that there is a danger that a model like Bumford's would overgenerate if applied to ordinal descriptions. His type-shifting model, which accounts for the relative reading with superlatives by allowing part of a nested description to be be interpreted with scope above its containing description, must somehow be restricted to prevent nested ordinals from undergoing the same scope-changing operations as nested superlatives. We discuss two general strategies for explaining the contrast we observe between ordinals and superlatives. The first strategy builds on Bylinina et al.'s idea that ordinals do not undergo scope movement, and the second builds on the idea that ordinals depend on a contextually salient linear ordering with a basis that is preferably iconic to the natural numbers.

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2. Experiments.

2.1. EXPERIMENT 1. The purpose of Experiment 1 (and indeed of both experiments) is to determine whether degree modifiers and ordinal modifiers differ in their propensity to give rise to relative readings for nested definites containing them. Ordinals are compared here to two types of degree modifiers: comparatives and superlatives.

2.1.1. MATERIALS AND DESIGN. In both of our experiments, participants were presented with a display involving objects placed on a sequence of locations, along with a series of questions about the display. In Experiment 1, participants were presented with the display in Figure 3, a set of stairs with various objects placed on them. (In Experiment 2, as we will show later, the display featured a sequence of tables rather than stairs.)

item	n	prompt in list {A,B}
e1	3	What's beside the cactus on the {first,lowest} stair?
e2	3	What's beside the cat on the {lowest,third} stair?
e3	3	What's beside the mug on the {third,highest} stair?
e4	3	What's beside the flower on the {highest,first} stair?
e5	2	What's beside the lamp on the {second,higher} stair?
e6	2	What's beside the basketball on the {higher,first} stair?
e7	2	What's beside the apple on the {first,lower} stair?
e8	2	What's beside the fishbowl on the {lower,second} stair?
m1	3	What objects are on the {lowest,first} stair with a cactus on it?
m2	3	What objects are on the {third,lowest} stair with a cat on it?
m3	3	What objects are on the {highest,third} stair with a mug on it?
m4	3	What objects are on the {first,highest} stair with a flower on it?
m5	2	What objects are on the {higher,second} stair with a lamp on it?
m6	2	What objects are on the {first,higher} stair with a basketball on it?
m7	2	What objects are on the {lower,first} stair with an apple on it?
m8	2	What objects are on the {second,lower} stair with a fishbowl on it?

Figure 1: Exp. 1 display and prompts in lists {A,B}.

Targets. On target trials, the prompt contained a nested definite, i.e., a definite description containing another. The nested definites were of two possible forms, depending on the POSITION of the target adjective (and the noun it modifies):

- EMBEDDED (the adjective modifies the lower NP):
  What's beside [$_{DP}$ the cactus on [$_{DP}$ the <u>first</u> stair]]?
- MATRIX (the adjective modifies the higher NP):
  What objects are on [$_{DP}$ the <u>first</u> stair with [$_{DP}$ a cactus on it]]?

The constructions with the adjective in the embedded position are the ones that are potentially revealing as to whether relative readings are available for the adjective. The matrix constructions serve as a control, to ensure that there is nothing conceptually wrong with the meaning that would result, and in particular that there is nothing wrong with the restriction on the comparison class that would be involved in a relative reading. The materials were divided into two lists (A and B), so that no participant saw the same adjective/noun pair in both embedded and matrix positions, but across participants, judgments were collected on both variants.

Comparative attributives (as in *the higher stair with a fishbowl on it*) are most felicitous in contexts where there are only two satisfiers of the modified description (*stair with a fishbowl on it* in this case).[1] Therefore, with a view toward felicitous use of comparative attributives, the display was set up so that four object types (namely apple, basketball, fishbowl, and lamp) are instantiated exactly twice in the scene. Four other object types (cactus, cat, flower, and mug) have three instances in the display, making perfectly felicitous a superlative attributive modifier such as *the highest stair with a cat on it*. The questions presented to the participants along with the display made reference to one of these eight object types, and cardinality of the object type in the display was coded as the variable CARDINALITY.

The prompts varied with respect to MODIFIER TYPE: ORDINAL VS. DEGREE. 'Degree' includes both comparative (*higher*) and superlative (*highest*) modifiers. Whether a degree modifier took the form of a comparative or a superlative was determined by cardinality:

- With nouns associated with cardinality 2, degree modifiers were *comparative*
  (e.g. *What's beside the lamp on the higher stair?*)
- With nouns associated with cardinality 3, degree modifiers were *superlative*
  (e.g. *What's beside the mug on the highest stair?*)

Modifiers also varied with respect to ORIENTATION:

- MAXIMAL: *highest*/*higher*, *third*/*second*
- MINIMAL: *lowest*/*lower*, *first*

The precise choice of ordinal modifier in this experiment depends on cardinality, too: the maximal ordinal for cardinality 2 is *second*; for cardinality 3 it is *third*.

[1] Aparicio et al. (2021) show that attributive comparative modifiers can be felicitous in contexts with more than two satisfiers of the modified description. However, their findings still support the notion that comparison classes must be binary in some sense, as *the bigger circle* was only felicitous when there were only two sizes of circles represented in the display. They propose that the binarity requirement that comparatives impose is really on the number of degrees instantiated in the context rather than on the number of objects. Here that distinction makes no difference.

The experiment thus had a fully crossed $2 \times 2 \times 2 \times 2$ design, for every combination of the two levels of POSITION, MODIFIER TYPE, CARDINALITY, and ORIENTATION, although ORIENTATION was not a treatment variable of interest, and was only included for variety among the stimuli. The cases with comparatives are those where MODIFIER TYPE is DEGREE and CARDINALITY is 2; the cases with superlatives are those where MODIFIER TYPE is DEGREE and CARDINALITY is 3.

There were two lists of target stimuli, both containing 16 questions, 8 with the modifier in matrix position, and 8 with the modifier in embedded position. Each set of 8 covered all four cardinality-2 nouns and all four cardinality-3 nouns. In each such group of four, two involved ordinal modifiers (one maximal, one minimal) and two involved degree modifiers (one maximal, one minimal).[2] No noun appeared with the same modifier twice in the same list. The two lists are spelled out in the table in Figure 3. The target and filler lists were independently shuffled randomly, and then interleaved with each other evenly so that every target trial was preceded by a filler trial.

The objects were placed carefully in the display so as to avoid absolute readings of the embedded modifiers in the stimuli. For prompts with *lower* or *lowest*, this means that the noun's object type cannot be instantiated on the bottom stair; *mutatis mutandis* for *higher* and *highest* and the top stair. With ordinal prompts, we intend the lowest stair to be the "first" stair, but there is a risk that the participant counts down from the top instead, treating the topmost stair as the "first", and the one below that as the "second". To guard against absolute readings arising through this direction, stimuli involving *first* never invoked an object type that was instantiated on the top stair; *mutatis mutandis* for *second* and *third*.

In addition, we ensured that the each object had a distinctive set of shelfmates. This enabled the free response texts provided by the participants to be coded as to whether the participant had identified the target referent.

Familiarization stimuli. For the purpose of familiarization with the display prior to answering the target questions, participants were asked to study the display, and answer questions like *How many mugs are there?* for the nine object types appearing in the display: mugs, apples, flowers, candles, cats, fish bowls, cactuses, lamps, and basketballs.

The familiarization phase also included some *What color* questions:

- What color is the ball beside the lowest cactus?
- What color is the mug beside the third cactus?
- What color is the cat beside the higher fishbowl?
- What color is the apple beside the first cat?
- What color is the candle beside the cat?
- What color is the mug beside the fishbowl?

The last two carry false presuppositions (there is no candle beside the cat, or mug beside the fishbowl), so the participants were expected to write "Doesn't make sense" for these cases.

[2]Partially in response to the need to avoid absolute readings, it turned out that the nested definite in the A list was usually but not always coreferential with the corresponding nested definite in the B list. For example, with item e8, the A list has *lowest* (minimal) and the B version has *third* (maximal). However, this did not lead to a skew in the materials with respect to orientation. In both lists, there were two items for each POSITION $\times$ TYPE $\times$ CARDINALITY condition, one maximal and one minimal.

item	prompt
f0	What else is on the stair that has a mug and a lamp?
f1	What else is on the stair that has a cat and a basketball?
f2	*What else is on the stair that has a basketball and an apple?
f3	What else is on the stair that has a cactus and a fishbowl?
f4	*What object is between a flower and a candle?
f5	What object is between a basketball and a fishbowl?
f6	What object is between a lamp and a cactus?
f7	What object is between a cat and a mug?
f8	What object is between an apple and a mug?
f9	How many stairs have both an apple and a lamp?
f10	How many stairs have both a flower and a fishbowl?
f11	How many stairs have both a flower and a cactus?
f12	How many stairs have both a basketball and a candle?
f13	How many stairs have both a cat and a mug?
f14	*What else is on the stair that has a lamp and a fishbowl?
f15	What else is on the stair that has a mug and an apple?
f16	What else is on the stair that has a flower and a cactus?

Table 1: Filler stimuli for Experiment 1.

Fillers. Fillers (listed in Table 1) were included among the target stimuli in order to introduce variety and provide some clear cases where "doesn't make sense" could be used, so that participants would solidify their confidence in deploying that option. Examples marked with an asterisk in Table 1 are ones to which a "Doesn't make sense" response is expected.

2.1.2. OUTCOME VARIABLE CODING. The free text responses provided by a participant would generally be in the form of a list of object types. The objects listed allowed us to identify which referent the participant assigned to the nested definite, and in particular whether the participant had assigned a relative reading to the adjective. We used a three-way coding of the responses:

- 1 - rejection of relative reading
- 0 - acceptance of relative reading
- NA - unexpected response (acceptance of an unexpected reading)

We coded the response as 1 (rejection) if the participant wrote some variant on "doesn't make sense". We coded the response as 0 (acceptance) if the participant listed the items that accompany the referent on a relative reading of the adjective.

Examples of responses that were coded as NA include the following:

- prompt: What objects are on the third stair with a cat on it?
  response: apple, flower, mug
  (these are on the second stair, which has a cat on it)
  expected under relative reading: fishbowl

- prompt: What objects are on the first stair with a basketball on it?
  response: a grey cat
  (maybe they thought the fishbowl was a basketball and counted from the top?)
  expected under relative reading: flower, cactus, fishbowl

In these cases, participants identify referents that are incompatible with the descriptions' literal meanings.

2.1.3. PARTICIPANTS. 40 native speakers of English were recruited via Prolific.

2.1.4. RESULTS. We coded 22 of the 640 responses to target questions as NA (3.2%). For the purposes of the statistical analysis, the NA responses were removed, leaving a binary outcome variable, 1 for 'reject' and 0 for 'accept'.

The mean rejection rates in each of the eight conditions of interest in Experiment 1 are shown in Figure 2. The group means and associated confidence intervals are listed in Table 2. With the modifier in MATRIX position (*first/lowest stair with a cat*), there was almost no rejection (as expected). Degree modifiers in the matrix position were rejected under 4% of the time, and indeed the rejection rate for these conditions was not significantly different from zero, as shown by the fact that the 95% confidence intervals cross the zero line. With *ordinals* in the matrix position, rejection was rare (under 25%), although the rejection rate is not entirely negligible, and is significantly different from zero, as shown by the fact that the confidence intervals around the means for these conditions do not cross the zero line. Despite this wrinkle, the matrix examples did establish a low-rejection baseline relative to which the embedded examples can be evaluated.

The effect of ordinal vs. degree modifier is strikingly large in the embedded condition, where relative readings reveal themselves. A strong majority of respondents (over 80%, in both cardinality conditions) rejected relative readings for nested descriptions with ORDINAL modifiers in the EMBEDDED position (*cat on the first stair*). Relative readings for nested descriptions containing DEGREE modifiers were sometimes rejected, but less often than with ORDINALS.

Moreover, rejection of a relative reading in the embedded position was over 30 percentage points more common with superlatives (45.58%) than with comparatives (10.25%). This contrast is reflected by the difference in height of the red bars in the upper two quadrants of the graph in Figure 2. The rejection rate for relative readings of superlatives in embedded position is shown by the red bar under 'embedded 3'; the corresponding rate for comparatives is shown by the red bar under 'embedded 2'.

The results of statistical tests confirm the visual impressions that Figure 2 gives rise to. Using the lmer and lmer-test packages in R, we constructed a mixed-effects logistic regression model with REJECTION as the outcome variable and POSITION, MODIFIER TYPE, and CARDINALITY along with all possible two- and three-way interactions as fixed effects and participant as a random effect. An ANOVA test based on that model revealed a significant interaction of POSITION×MODIFIER TYPE ($p < 0.001$), showing that the contrast between ordinals and degree modifiers is reliably greater in the embedded position. There was also a significant 3-way interaction between POSITION, MODIFIER TYPE, and CARDINALITY ($p < 0.05$), reflecting the fact that relative readings of superlatives in the embedded position were rejected more often than relative readings of comparatives in that position. The model coefficients and associated p-values are given

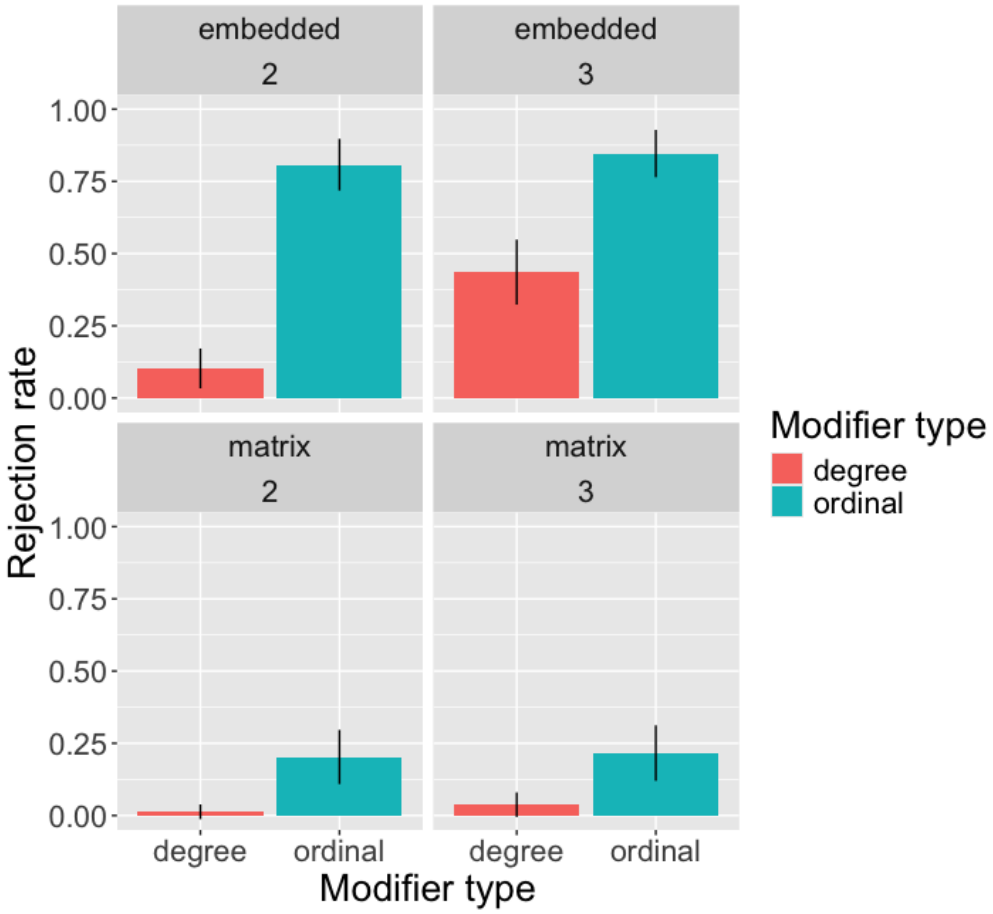


Figure 2: Results of Experiment 1. Error bars show 95% CI.

in Table 3.

The orientation (*lower* vs. *higher*, *first* vs. *second*, etc.) of the modifier was not a treatment variable of interest in this experiment, but given that it was systematically manipulated, we had the opportunity to see whether rejection was driven primarily by modifiers of one orientation or another. Given that *first* has been argued to be a superlative underlyingly (Alstott 2023), we might expect that the maximal ordinals *second* and *third* would be driving the high rejection rate for ordinals in the embedded position. We therefore built a mixed-effects logistic regression model on the embedded position subset of the data with modifier type, cardinality, and orientation along with all possible two and three-way interactions, and used ANOVA tests to determine which of these factors has a significant effect on rejection rate. Although there was a trend whereby maximal ordinal modifiers were slightly more likely to induce rejection than minimal ones, no significant effect of orientation was detected.

2.1.5. DISCUSSION. Overall, relative readings were found to be far less accessible with ordinal modifiers than with degree modifiers. The contrast is particularly stark when there are two objects of the relevant type: *the lamp on the higher stair* has a far greater chance of referring successfully

position	modifier type	#	estimate	std. error	(conf.low	conf.high)
embedded	degree	2	0.1025	0.0345	0.0337	0.1714
embedded	degree	3	0.4358	0.0565	0.3233	0.5484
embedded	ordinal	2	0.8076	0.0449	0.7182	0.8971
embedded	ordinal	3	0.8461	0.0411	0.7642	0.9280
matrix	degree	2	0.0128	0.0128	-0.0127	0.0383
matrix	degree	3	0.0375	0.0213	-0.0050	0.0800
matrix	ordinal	2	0.2027	0.0470	0.1089	0.2964
matrix	ordinal	3	0.2162	0.0481	0.1201	0.3120

Table 2: Group means (average rates of rejection) for each condition in Experiment 1

	Estimate	Sum Sq	Mean Sq	DF	F value	Pr(>F)	Sig.
intercept	0.0405						
card=3	-0.0375	0.0312	0.0312	1/592	0.2785	5.98E-01	
type=ordinal	0.0879	11.9345	11.9345	1/592	106.5541	4.40E-23	***
pos=emb	0.2500	49.4699	49.4699	1/592	441.6781	1.11E-73	***
card=3×type=ord	0.0501	1.4422	1.4422	1/592	12.8765	3.60E-04	***
card=3×pos=emb	0.2933	0.1111	0.1111	1/592	0.9923	3.20E-01	
type=ord×pos=emb	0.5620	4.1152	4.1152	1/592	36.7422	2.40E-09	***
card=3×type=ord×pos=emb	-0.4809	2.3024	2.3024	1/592	20.5571	7.01E-06	***

Table 3: Mixed effects logistic regression model coefficients and associated p-values based on ANOVA tests for Experiment 1. Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1.

to the lamp on the fourth stair than *the lamp on the second stair* does. This effect was not driven solely by ordinal modifiers of maximal orientation (like *second*, when there are two objects of the relevant type); absolute readings for *first* were rejected at comparable rates.

The fact that rejection was significantly more common with superlatives than with comparatives may be related to the availability of absolute readings for the inner DP. In the case of superlatives, the inner DP can be used in isolation to refer to one of the stairs, even though such a parse leads ultimately to global reference failure. For example, *the lowest stair* is a felicitous way of referring to the bottom stair. In contrast, in a context with many stairs, *the lower stair* does not refer in isolation, because comparatives require binary comparison classes, as mentioned above. Participants who reject nested descriptions with superlatives in the embedded position may be fixating on an absolute reading. Aparicio et al. (under revision) refer to this manner of being led astray by a doomed assignment of a referent as a 'referential garden path' effect. With comparatives, there is no absolute reading to fixate on in this context, loosening the grasp of this reading on the listener's mind, thereby making the relative reading more available.

It would not be entirely straightforward to test this hypothesis. The only type of context in which an absolute reading would be available for comparatives would be one in which the total number of stairs is 2, and then we would not be able to test for relative readings (and superlatives would be less optimal). Eliminating the absolute reading for superlatives would not be possible

as long as there is a finite set of stairs (or equivalent) with a lowest and a highest. Perhaps if the display were a snapshot of a staircase that continued below and above the visible region, then an absolute reading for a superlative could be eliminated. In that case, we would expect superlatives to be on par with comparatives in the embedded condition, with a negligible rejection rate, reflecting the availablity of relative readings. We leave this as a prediction to test in future research.

3. Experiment 2. To estimate the robustness of the effect found in Experiment 1, and to see whether the effect generalizes from vertical sequences like stairs to horizontal ones, we carried out a variation on that experiment using a horizontal sequence of tables, as shown in Figure 3.

3.1. MATERIALS AND DESIGN. Like Experiment 1, this experiment compares the availability of relative readings of nested definites with ORDINAL attributive modifiers (as in *the second table with a fishbowl on it*) with DEGREE attributive modifiers, including both comparative and superlative attributives. The display and the prompts were designed to ensure that an absolute reading of the nested definite would not be available, leaving only a relative reading. Rejection ("doesn't make sense") in this environment thus signalled the absence of a relative reading.

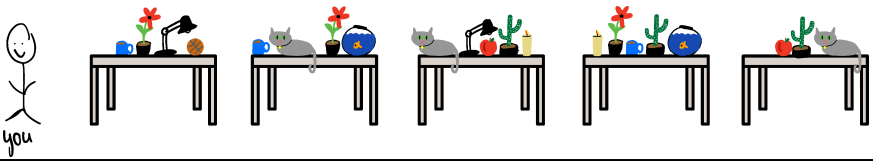
The treatment variables were the same as in Experiment 1. Along with examples with modifiers in the embedded position, corresponding examples with the same modifiers in matrix position were included as controls (MODIFIER POSITION: MATRIX VS. EMBEDDED). As in the previous experiment, the object types picked out by nouns in the prompts varied according to their CARDINALITY, being instantiated either twice or three times. Comparatives were used with cardinality-2 nouns and superlatives were used with cardinality-3 nouns. Here, the degree adjectives used were *closer* and *closest* rather than *lower* and *lowest*, and *farther* and *farthest* instead of *higher* and *highest*. The ordinals were the same (*first*, *second*, *third*). As before, the modifiers also varied with respect to ORIENTATION: MAXIMAL VS. MINIMAL.

3.2. PARTICIPANTS. Another 40 native speakers of English were recruited via Prolific.

3.3. RESULTS. There were two responses coded as NA (signifying that the participant neither rejected the question nor listed the expected set of shelfmates). These were removed from the dataset for the purposes of the analysis, leaving us with a binary response variable, 1 for rejection and 0 for acceptance.

The rejection rates in each of the conditions of interest in in Experiment 2 are shown in Figure 4 (righthand panel), which also repeats the results from Experiment 1. As the graph shows, we found the same pattern of results as in Experiment 1. With the modifier in MATRIX position (*first table with a cat*), there was almost no rejection. In fact, with superlatives in matrix position, rejection never occurred. A strong majority of respondents rejected relative readings for nested descriptions with ORDINAL modifiers in the EMBEDDED position (*cat on the first table*). Relative readings for nested descriptions containing DEGREE modifiers were sometimes rejected, but less often than with ORDINALS. And again, rejection was more common with superlatives than with comparatives.

Statistical analysis confirmed that these contrasts are reliable. As before, we constructed a mixed-effects logistic regression model with PARTICIPANT as a random effect and fixed effects for MODIFIER POSITION, MODIFIER TYPE, and CARDINALITY, along with all possible two- and three-way interactions of those factors. ANOVA tests based on this model revealed significant ef-



item	#	Prompt for {A,B} list
e1	3	What's next to the cactus on the {first,closest} table?
e2	3	What's next to the cat on the {closest,first} table?
e3	3	What's next to the mug on the {third,farthest} table?
e4	3	What's next to the flower on the {farthest,third} table?
e5	2	What's next to the lamp on the {second,farthest} table?
e6	2	What's next to the candle on the {farther,second} table?
e7	2	What's next to the fish bowl on the {first,closer} table?
e8	2	What's next to the apple on the {closer,first} table?
m1	3	What's on the {closest,first} table with a cactus on it?
m2	3	What's on the {first,closest} table with a cat on it?
m3	3	What's on the {farthest,third} table with a mug on it?
m4	3	What's on the {third,farthest} table with a flower on it?
m5	2	What's on the {farthest,second} table with a lamp on it?
m6	2	What's on the {second,farther} table with a candle on it?
m7	2	What's on the {closest,first} table with a fish bowl on it?
m8	2	What's on the {first,closer} table with an apple on it?

Figure 3: Exp. 2 display and prompts

fects of MODIFIER POSITION and MODIFIER TYPE individually, an interaction between MODIFIER POSITION and MODIFIER TYPE, an interaction between MODIFIER TYPE and CARDINALITY, and a three-way interaction among these three (all at the the $p < 0.001$ level).

4. Discussion. We conclude that ordinals are substantially less susceptible to relative readings than degree modifiers, in nested descriptions. This effect was found to be robust across modifier orientations (picking out the lowest/closest/first object vs. the highest/farthest/second/third object), and across orientations of the display (horizontal vs. vertical).

Granted, the comparison between ordinals and *comparatives* is not entirely fair because with ordinals there is a competing absolute reading for the inner definite, while with comparatives there is not. If the contrast between comparatives and superlatives is due to the availability of an absolute reading for the inner definites, then the difference in rejection rates for those two types of modifiers can perhaps be viewed as a measure of the magnitude of that effect. The contrast between superlatives and ordinals that goes over and above that cannot be attributed to the availability of an absolute reading; it shows that there is something else preventing relative readings for ordinals. The real finding of interest from this paper is the contrast between *superlatives* and ordinals, because these are fairly matched in terms of the existence of the absolute reading.

One strategy for explaining this result is to adopt Bylinina et al.'s stipulation that ordinals cannot undergo scope movement, made in order to explain the absence of 'upstairs *de dicto*' readings

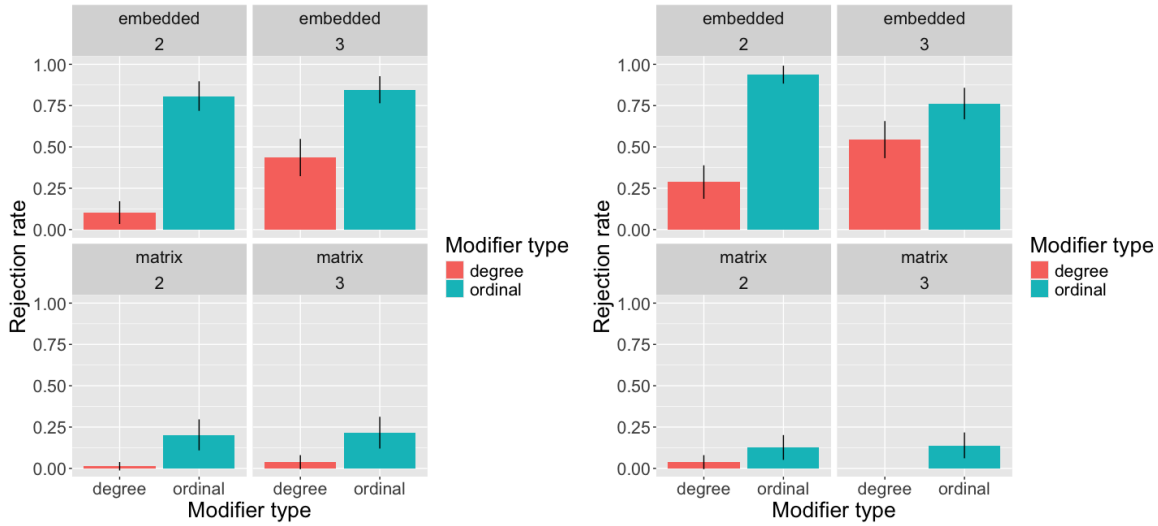


Figure 4: Results of Experiments 1 (left) and 2 (right). Error bars show 95% CI.

position	mod.type	#	estimate	std.error	(conf.low	conf.high)
embedded	degree	2	0.2875	0.0509	0.1861	0.3888
embedded	degree	3	0.5443	0.0563	0.432	0.6565
embedded	ordinal	2	0.9375	0.0272	0.8832	0.9917
embedded	ordinal	3	0.7625	0.0478	0.6672	0.8577
matrix	degree	2	0.0375	0.0213	-0.0051	0.0801
matrix	degree	3	0	0	0	0
matrix	ordinal	2	0.1265	0.0376	0.0516	0.2015
matrix	ordinal	3	0.1392	0.0391	0.0612	0.2172

Table 4: Group means for each condition in Experiment 2.

with ordinals. This assumption alone does not suffice to block relative readings, though, because in order to generate focus-related relative readings of ordinals as in Bhatt's (2006) *John$_F$ gave the first telescope to Mary*, Bylinina et al. assume that ordinals expect an implicit comparison class. So under this approach, one would need a theory of why the comparison class argument of *first* in *the cat on the first table* cannot be set to 'with a cat on it'.

Another possibility is related to constraints on the comparison class that regulate the choice between interpretations. On this view, ordinals and superlatives are subject to both absolute and relative readings. We have seen that even though superlatives can have relative readings, such readings are sometimes rejected when an absolute reading is available in the context. This suggests that there can be a stubborn adherence to the absolute reading, so stubborn that it will accept reference failure, even though a relative reading is generated by the grammar.

The idea that we would like to put forth is that given a choice between comparison classes, listeners will strongly prefer a comparison class that has an iconic basis, and in particular a basis that is iconic to the natural numbers. Suppose that an ordinal expects an *ordering* that can be

provided by context. The ordering is a function f from a 'basis' to satisfiers of the modified predicate. The basis is a linearly ordered set like a sequence of times (as in *second train*) or locations (*second stair*). The n*th table* is the nth object in a sequence $\langle f(i_1), f(i_2), f(i_3), \ldots \rangle$. We posit further that the more iconic a sequence is to the natural numbers, the more accessible it is as a basis for the ordering. The more evenly spread out a sequence is, as measured by a perceptually salient distance metric, the more iconic it is to the natural numbers. A visual display that is iconic to the natural numbers, such as a series of stairs or tables, will satisfy that iconicity constraint. The comparison classes that one is forced to construct in the matrix constructions in our experiments, on the other hand, restricting to only those stairs with a cat on them, do not have a basis that is iconic to the natural numbers. The low rejection rates in the matrix conditions show that bases need not be iconic, but in those cases the listener has no choice about how to construe the basis.

In the embedded condition, the listener's task is to choose a scope interpretation for the modifier. The relative reading depends on a non-iconic basis and the absolute reading depends on an iconic one. We suggest that in this experiment, the iconicity of the visual display pulls so strongly in favor of the absolute reading for the ordinals that the relative reading cannot be accessed. On this view, scope movement is possible in principle for ordinals, and is predicted to manifest itself in circumstances where competition from an absolute reading is not as great.

In closing, our consideration of relative readings for ordinals and degree modifiers shows that the pattern of availability of relative readings in Haddock descriptions is quite intricate. There are many types of operator for which there has, as yet, been no systematic study of their behavior in these constructions. These include exclusives: Our judgment is that *the rabbit in the only hat* and *the mug on the only stair* lack relative readings, and would be infelicitous in cases where there are multiple salient hats or stairs, respectively. The behavior of exclusives thus appears to parallel that of ordinals, so that once again a scope-based explanation of relative readings is in danger of overgenerating. Other expressions to consider in Haddock descriptions are markers of identity like *other* in *the mug on the other step*, further types of scale-dependent expressions (e.g. *next* in *the mug on the next step*), and proportional quantifiers, like *every* and *most* in *the mug on every/most step(s)*. Note that with regard to quantifiers, the standard wide scope universal reading is distinct from the relative reading *the mug on every/most step(s) (with a mug on it/them)*, and could not be generated by the same mechanism Bumford (2017) uses for definite descriptions. It is clear that Haddock descriptions present an empirically rich and puzzling domain for which further empirical investigation can potentially shed light on a range of interconnected theoretical issues, not only ordinal and degree operator semantics, but also the nature of scope-taking, and contextual restriction more broadly.

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