Ordinal Numbers: Not Superlatives, but Modifiers of Superlatives

The semantics of ordinal numbers has seen little attention in the literature. The few existing accounts of ordinals attribute to them lexical entries and semantic properties similar to the superlative morpheme *-est* (Bhatt 2006; Herdan & Sharvit 2006; Sharvit 2010; Bylinina et al. 2014).[1] Indeed, ordinals and superlatives have striking similarities that seem to support a twin semantics: both exhibit Szabolcsi (1986)'s relative-absolute ambiguity (1), license NPIs and non-modal subject infinitival clauses (*the earliest/first/second train* <u>*to leave the station*</u>), and exhibit similar focus-sensitivity (see Bylinina et al. 2014 for overview).

(1) a. Joel caught the earliest train.
  Absolute: Out of all relevant trains, Joel caught the earliest one.
  Relative: Joel caught a train earlier than anyone else relevant did.
 b. Joel caught the second train.
  Absolute: Out of all relevant trains, Joel caught the second earliest one.
  Relative: Only one relevant person caught a train earlier than Joel did.

This work discusses a construction problematic for existing theories of ordinals: cases where an ordinal and superlative appear together, e.g. *Joel climbed the second highest mountain* (2). The ordinal and superlative adjective are a constituent in this construction, as adjectival predication (*this runner is third fastest*) and coordination (*the third best and fifth tallest runner*) illustrate.

Existing accounts of ordinals have trouble generating structures for (2) that respect the constituency facts and derive the correct meaning. No semantics for ordinals I know of allows *n-th* and *-est* to combine directly because of type mismatch (e.g. in Bylinina et al. 2014, *-est* has the type in (3) and *n-th* is of type <et,<et,et>>). But structures in which *n-th* dominates *-est* or vice versa also fail to predict adequate meanings, even when the types work out. On standard assumptions, a structure like [n-th [-est(C)(G)]] is problematic because [-est(C)(G)] is a singleton set, and *n-th* is undefined when it takes a singleton set as input (at least for any ordinal other than *first*). Structures like [-est [n-th…]] suffer from similar issues, with the added problem of guaranteeing the correct ordering source for the ordinal (e.g. height in (2)) once *-est* moves.

As an alternative, I propose the schema for *n-th X-est* shown in Figure 1. *N-th* takes *-est* (3) as its first argument. The ordinal next takes the null comparison class variable and a degree predicate (of type <d,et>) to return an <e,t> predicate. (4) shows the denotation of Figure 1's root node.

(3) $[\![\text{-est}]\!] = \lambda C \in D_{<e,t>}.\ \lambda G \in D_{<d,et>}.\ \lambda x \in D_e$: $x \in C$ and $\forall z\ [z \in C \rightarrow \exists d\ [G(d)(z) = 1]$. $\exists d$ $[[G(d)(x) = 1]$ and $\forall u\ [[u \in C$ and $u \neq x] \rightarrow G(d)(u) = 0]]$
(4) $[\![\text{n-th}]\!]([\![\text{-est}]\!])(C)(G) = \lambda x \in D_e$: $x \in C$ and $|C| \geq n$ and $\forall z\ [z \in C \rightarrow \exists d\ [G(d)(z) = 1]$. $|\{z \in C$: $\forall Q\ [[Q \subseteq C$ and $[\![\text{-est}]\!](Q)(G)(x) = 1] \rightarrow z \notin Q]\}| = n-1$

[1] Even Bylinina et al. (2014)'s "non-superlative" semantics treats ordinals similarly to *-est,* differentiating them principally in their scope possibilities. I find their judgments claimed to differentiate ordinals shaky, so I do not treat ordinals and *-est* as differing in scope possibilities.

Consider a set of mountains C such that m1 = 4,000 ft, m2 = 3,000 ft, m3 = 2,000ft, and m4 = 1,000 ft. The intuition behind the semantics in (4) is that, for example, m2 is *the second highest mountain* because n - 1 = 1 element (m1) is absent from every subset of C in which m2 is the highest mountain in that subset. This approach makes correct predictions for (2) on both a movement theory (Szabolcsi 1986; Heim 1985, 1999, etc.) and an "*in situ*" theory of superlatives (Heim 1999; Sharvit and Stateva 2002, etc.). I use Heim (1999)'s versions of both theories to illustrate. (2) has both an absolute and a relative reading. Using my approach to ordinals, (5a) is the LF for the absolute reading (on a movement theory) and both readings (on an *in situ* theory).

(5) a. Joel climbed [the [[[second -est] C] [λd. [[d-high] mountain]]]]
    b. $[\![$[7 [[t_7 high] mountain]]$]\!]$ = λd. λx. x's height ≥ d and x is a mountain
    c. $[\![$[[second -est] C] [7 [[t_7 high] mountain]]$]\!]$(x), when defined, is true iff |{z ∈ C: ∀Q [[Q ⊆ C and $[\![$-est$]\!]$(Q)([λd. λx. x's height ≥ d and x is a mountain])(x) = 1] → z ∉ Q]}| = 1

Using the semantics in (4), (5a) is true iff Joel climbed the unique x in the comparison class C such that x is a mountain and there is exactly one mountain in C higher than x. When C is the set of all relevant mountains, (5a) is the LF for the absolute reading of (2) (*Joel climbed the n-th highest mountain out of all relevant mountains).* An *in situ* theory derives the relative reading of (2) from (5a) by letting C = the set of all mountains climbed by a relevant person. Then, (5a) is true iff Joel climbed the unique element x in C such that x is a mountain and there is exactly one mountain climbed by someone else that is higher than x. A movement theory derives this same reading by scoping [[n-th -est] C] outside the DP and letting C = the set of relevant people (6).

(6) Joel [[[second -est] C] [λd. [climbed [A d-high mountain]]]]

(4) makes welcome predictions in the event of "ties." Suppose m1 = 4,000 ft, m2 = 3,000 ft, m3 = 3,000ft, m4 = 2,000 ft, and m5 = 1,000 ft. (4) predicts m4 to be *the fourth highest mountain* (and not *the third highest mountain*), matching the intuitions of the vast majority of naïve speakers I consulted. (4) also predicts *#the second highest mountain* and *#the third highest mountain,* as there are zero and two elements that fit these descriptions, respectively.

Finally, what about sentences that have an overt superlative or ordinal but not both? For cases like (1a), I assume that there is no ordinal in the structure. In this way, my approach interferes minimally with the vast literature on superlatives unmodified by ordinals. For cases like (1b), I assume a covert superlative that provides the contextually-determined ordering source for *second* (Figure 2); in (1b), this superlative is something like *earliest*, but it differs in other contexts (e.g. *the third (leftmost) book on the shelf*). While the inclusion of another null element in (1b) may seem unappealing, all existing semantics for ordinals posit some covert element or ranking function providing the ordering source. Identifying this covert element with a superlative has the advantage of explaining the superlative-like properties of (1b); what gives rise to such properties is not *second*, but rather the covert superlative required as *second*'s first argument.

Figure 1:

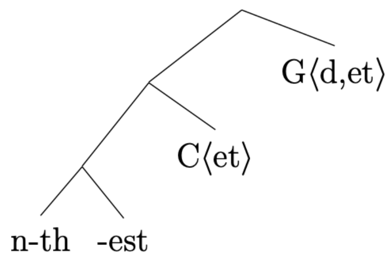
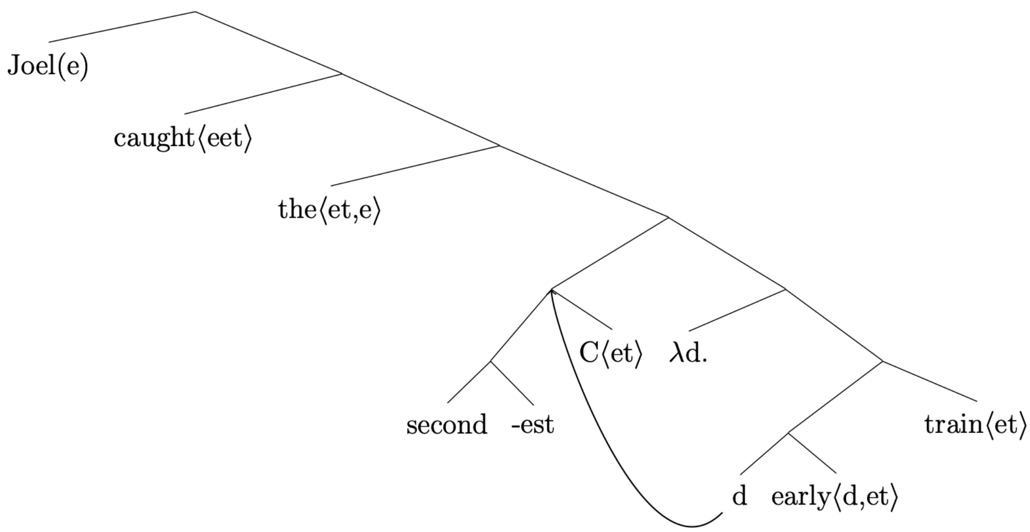


Figure 2: Analyzing (1b) with a covert superlative. Example: (1b)'s absolute reading



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