

# Semantic Viruses and Multiple Superlatives

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## 1 Introduction<sup>1</sup>

Our starting point will be, oddly perhaps, a bit of moral philosophy. The essential slogan of utilitarianism is (1):

- (1) the greatest happiness for the greatest number

This seems at first gloss straightforward and unobjectionable, a simple statement of a benign and blandly inoffensive goal. But it isn't. Suppose the world contains just six supremely happy people. If we take (1) as our sole goal, we should prefer a world of seven equally happy people to this one. Adding an additional person means adding an additional mouth to feed. Facts being what they are, as we increase the population of the world and therefore increase the number of mouths to feed, we make the inhabitants of the world less—even if only vanishingly less—supremely happy. And here is where the trouble comes. Surely, it's desirable to increase the population of the world yet again, even if it comes at the cost of a vanishingly small reduction in general happiness. And surely it's desirable to increase that population again, and yet again, and again and again more or less indefinitely, until we arrive at a much more populated world of only barely happy people. Eventually, indeed, taking (1) as our slogan, we arrive at a world of very many people leading lives barely worth living.

Of course, this is not actually desirable. It's what Parfit 1984; Parfit 2016 calls the Repugnant Conclusion (informally phrased here):

- (2) THE REPUGNANT CONCLUSION (Parfit 1984; Parfit 2016)  
We should keep increasing the number of humans until everyone's life is barely worth living, full of 'Muzak and potatoes'.

An entire branch of moral philosophy, population ethics, is devoted largely to sorting out such questions. What is important for current purposes, though, is what this reveals about how native speakers react to the slogan in (1). It seems such a simple utterance. Why do we need philosophers to point out what it means? We routinely compute the truth conditions of extremely intricate sentences without batting an eye. Far more structurally complicated sentences than this hardly faze us.

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<sup>1</sup>Thanks to Adam Gobeski, Ai Taniguchi, Anne-Michelle Tessier, Cara Feldscher, Chris Kennedy, Curt Anderson, Eszter Rónai, Itamar Francez, Josh Herrin, Kai Chen, Richard Larson, Rose-Marie Déchaine, Taehoon Hendrik Kim, Tommy Grano, Yan Cong, Yenan Sun, and the audience at CLS. I've also benefited from presenting bits and pieces of the virus portion of this to audiences at NYU and UBC.

Why should we be so flummoxed by (1)? Why should we fail so utterly to discern its repugnant consequences?

This exemplifies the linguistic puzzle I'll explore in this paper. The more narrow question is how we interpret sentences with multiple superlatives. The broader one is why we initially overlook their complexity and indeterminacy, and what this says about how our semantic intuitions work.

To approach answers to these questions, I'll suggest, we need to situate them as part of a bigger picture. Standard assumptions about semantics of superlatives don't on their own deliver an adequate analysis of the relevant reading of multiple superlatives, what I'll call an **CORRELATED READING**. I'll take a stab at an analysis, one in which the crucial component will be the idea that multiple superlatives don't necessarily each contribute an independent superlative meaning. Rather, they can be construed as spelling out a kind of agreement. But there's something deeper going on here than a subtlety in the interpretation of superlatives. It's more generally the case that our judgments about the truth conditions of certain complex construction often fail to work as straightforwardly as one might expect. I'll argue that we need to recognize—and begin building a theory of—such constructions. In Morzycki 2017, I called them **SEMANTIC VIRUSES**, generalizing Sobin 1994; Sobin 1997; Lasnik & Sobin 2000's idea of grammatical viruses into the semantics.

In section 2 I'll examine multiple superlatives in more detail, pursuing the optimizing reading through a thicket of indeterminacy and uncertainty that obscures the way forward in this domain. Then, in section 3, after arguing that standard analyses of superlatives don't straightforwardly yield the correlated reading, I'll sketch an alternative in which the relevant reading arises from the interaction of the superlative morphemes with a covert modal. In section 4, I'll turn to viruses more generally. I'll provide some additional examples and speculate a bit about how a general theory of viruses might look. Section 5 concludes.

## 2 The puzzle of multiple superlatives

### 2.1 The readings

Multiple superlatives give rise to number of interpretations, and it's not straightforward to determine what exactly is going on.

The first point to establish is that the phenomenon also occurs in more prosaic sentences than (1):

- (3)
  - a. Floyd bought the nicest computer at the lowest price.
  - b. Let's adopt the simplest explanation with the widest empirical coverage.
  - c. The winner is whoever builds the tallest snowman in the least time.<sup>2</sup>

The interpretation of these sentences most at issue here is what I'll call the correlated reading, in which the multiple superlatives specify dimensions along which a balance is struck. In (3a), for example, Floyd bought a computer that struck the

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<sup>2</sup>A funny effect associated with this sentence, perhaps analogous to the truth-conditional effect with which we began: it usually takes a moment to realize that this rule isn't sufficient to identify a winner.

optimal balance between quality and price. This is brought out in a context such as (4):

- (4) Floyd: I can't believe you spent so much on a computer. You can't afford that thing.  
Clyde: Hey, I bought the nicest computer at the lowest price.

This is certainly not the only reading available to multiple superlatives, nor are sentences with this general syntactic shape the only ones that can express it.

This reading is also possible for stacked superlatives:

- (5) a. Floyd bought the nicest cheapest computer.  
b. Floyd bought the cheapest nicest computer.

Each of these variants of (4a) seems to permit the correlated reading, though the intuition begins to fray for some speakers. As far as I've so far been able to tell, though, the most natural reading for both of these is not the correlated one.

Among the more natural interpretations of (5) is what I'll call the INDEPENDENT READING. That's one in which Floyd bought the unique computer such that all other computers were worse, and all other computers were more expensive. On this reading, each superlative seems to make an independent contribution. This reading bears the hallmark of intersective interpretations of modifiers generally: droppability,<sup>3</sup> or what in for adverbs is called the diamond entailment pattern (Chierchia & McConnell-Ginet 1990; Geuder 2000; Morzycki 2016). Both sentences in (5) entail both of those in (6):

- (6) a. Floyd bought the nicest computer.  
b. Floyd bought the cheapest computer.

This reading is the only one available when the superlatives are conjoined, including *asyndetically* (i.e., when they are separated by a comma):

- (7) a. Floyd bought the nicest and cheapest computer.  
b. Floyd bought the nicest, cheapest computer.

By comparison, this reading is relatively straightforward and unsurprising.

That said, there is another interpretation of (5) of which this reading might be a special case, and that reading may be a bit more surprising. I'll call this the SUBORDINATED READING. For most speakers, I think it's the most natural reading of stacked attributive superlatives as in (5), and it gets different paraphrases for each variant:

- (8) a. Floyd bought the nicest cheapest computer.  
'Out of the cheapest computers, Floyd bought the nicest.'  
b. Floyd bought the cheapest nicest computer.  
'Out of the nicest computers, Floyd bought the cheapest.'

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<sup>3</sup>I believe the term originates in Wyner 1994.

It's bad enough that the independent reading may be a special case of this reading—it's not immediately obvious that the correlated reading isn't either. After all, in any scenario compatible with the paraphrases in (8), one might imagine Floyd struggling to balance competing imperatives of quality and price. So the next question on the agenda, then, is just how many *distinct* readings are there here and how can be distinguish them?

## 2.2 The readings are truth-conditionally weak and hard to distinguish

It's sadly unsurprising that the ordering of computers along the dimensions of price and quality should perfectly coincide. One might, for example, imagine a scenario in which there are five MacBooks available for purchase, as in (9):<sup>4</sup>

- (9) MacBook Pro 3.1GHz 256GB  
 MacBook Pro 2.3GHz 256GB  
 MacBook Pro 2.3GHz 128GB  
 MacBook Air 1.8GHz 128GB  
 MacBook Brick 0GHz 0GB
- ↑  
more expensive  
↑  
better

I'll explore evaluating (8a) (repeated as (10)) against this background. We might regard all but the most expensive model as among the cheapest, as in (11):

- (10) Floyd bought the nicest cheapest computer.  
 'Out of the cheapest computers, Floyd bought the nicest.'

- (11) MacBook Pro 3.1GHz 256GB  
**MacBook Pro 2.3GHz 256GB**  
 MacBook Pro 2.3GHz 128GB  
 MacBook Air 1.8GHz  
 MacBook Brick 0GHz
- } cheapest

Of these, the most expensive is the best, so *the nicest cheapest computer* is the MacBook Pro 2.3Ghz 256GB, as reflected in (11). But of course which computers we regard as cheapest is a matter of vagueness, to be resolved by context, and in another context we might regard all but the two most expensive as among the cheapest—and of course, because the would exclude the 256GB model, *the nicest cheapest computer* would therefore be the next one down, the MacBook Pro 2.3GHz 128GB. One could play this game again and again, until *the nicest cheapest computer* would be the second from the bottom of the ordering, the MacBook Air 1.8GHz.

Indeed, it seems to be an implicature that *the nicest cheapest computer* can't be the very cheapest, the MacBook Brick. Certainly, one might conclude from hearing (12a) that Floyd didn't buy this model, but this inference is easily canceled with the continuation in (12b):

<sup>4</sup>I hope it's obvious that I confine my attention to MacBook models here to keep the ordering simple, not as a product endorsement.

- (12) a. Floyd bought the nicest cheapest computer.  
b. In fact, it was the very cheapest.

The situation is less clear in the other direction, but I'm not convinced it's more than an implicature that he didn't buy the most expensive computer as well:

- (13) a. Floyd bought the nicest cheapest computer.  
b. As it turns out, that was the most expensive one, though.

The adversative *though* might give one pause, but this continuation doesn't have the flavor of a contradiction either—which, of course, is what one would expect if this were an entailment. The continuation in (13b) contrasts starkly in this respect with a continuation on which he denies buying a computer at all, for example.

The truth conditions, then, are startlingly weak. If this characterization of the facts is right, the sentence could be true on this reading in this scenario literally irrespective of whether Floyd bought the cheapest computer or the most expensive one, the worst or the best.

More frustrating still, this remains the case with the attributive superlatives in the inverse order as well, with the paraphrase in (8b), repeated here:

- (14) Floyd bought the cheapest nicest computer.  
'Out of the nicest computers, Floyd bought the cheapest.'

One might have hoped that this indeterminacy would be restricted to the stacked attributive cases, but the original correlative example (again, repeated) has exactly this indeterminacy as well.

- (15) Floyd bought the nicest computer at the lowest price.

The good news, if there is any, is that this indeterminacy is itself a striking fact. But it comes with the further bad news that none of this has helped us distinguish the readings from each other—and in that respect, has provided evidence that they should be treated as special cases of a single, extremely weak and underspecified interpretation. So far as I can see, considering contexts where the scales of expense and quality diverge is of no help.

Nevertheless, speakers report a robust distinction here, and that needs to be taken seriously, however difficult it may prove to tease them apart truth-conditionally. There may, however, be another strategy to employ.

### 2.3 Isolating the correlated reading

It's important that different interpretations emerge more naturally for different sentences. Indeed, in some sentences, the correlated reading seems to be entirely unavailable. That's the case in (16):

- (16) a. Floyd bought the nicest computer from the store [that had the lowest price (on it)].  
b. Floyd sold the nicest computer to a guy [who said he wanted it at the lowest price].

The correlated reading (striking a balance between quality and price) seems to be absent for (16a), and is either absent or difficult for (16b).

As the brackets reflect, the superlatives in (16) are separated by a finite clause boundary, but that's not what's crucial here:

- (17) a. Floyd bought the nicest computer from [a store with the lowest price].  
b. Floyd sold the nicest computer to [a guy demanding the lowest price].

These also lack or resist the correlated reading. Thinking in terms of locality may be appropriate, though. In all of the examples in (16) and (17), one of the superlatives is in an adjunct island, and in (16), a complex NP island as well.

Superlatives are widely believed to be able to move to a higher position to be interpreted (Szabolcsi 1986; Heim 1995 among others), so it would be natural to find that constraints on extraction might matter.

These examples all attempt to isolate the correlated reading by finding sentences that block it while allowing another reading. But it's possible to isolate it by blocking the others as well. The correlated reading comes out most naturally with explicit modals:

- (18) a. We *want* the greatest happiness for the greatest number.  
b. Floyd bought the nicest computer at the lowest price he *could*.  
c. Floyd bought the nicest computer at the lowest *possible* price.  
d. Floyd bought the nicest cheapest computer he *could*.

It's very hard to interpret these in any other way.

It's also hard to resist the correlated reading as the number of superlatives increases:

- (19) Floyd bought the nicest computer at the lowest price with the fastest delivery from the least sketchy Amazon dealer with the lowest shipping charges and the highest customer ratings.

In a sense, the surprising thing about (19) is that it's parsable at all.

Summarizing the evidence in this section, it appears that syntactic locality is relevant to correlated readings; that overt modals facilitate correlated readings in a way that suggests modality is a crucial ingredient; and the correlated reading becomes more natural—and, oddly, not especially harder to compute—as the number of superlatives increases. Collectively, all of these points support a larger conclusion: the correlated reading really is distinct.

### 3 Toward an analysis

#### 3.1 The independent reading

Standard assumptions about how superlatives work are sufficient to account for the independent reading, but not the others.

We'll start with the first point. Many theories of superlatives in the spirit of Szabolcsi 1986 and Heim 1995 assume a scope-taking movement process, but an

analysis of the independent reading doesn't require that. A relatively straightforward denotation like the one in (20) (modeled on one Heim 1995 uses as a point of comparison and discards) can deliver the right result:

$$(20) \quad \llbracket -est_C \rrbracket = \lambda G_{\langle d, et \rangle} \lambda x . \exists d[G(d)(x) \wedge \forall y \in C[y \neq x \rightarrow \neg G(d)(y)]]$$

This assumes that the superlative has a contextually-provided domain restriction  $C$ , and that it relates a gradable predicate and an individual that satisfies that predicate to a degree that no other relevant individual does. In (21), it combines with  $\llbracket cheap \rrbracket$  and then, intersectively, with  $\llbracket computer \rrbracket$ :

$$(21) \quad \begin{aligned} & \text{a. Floyd bought the nicest cheapest computer.} \\ & \text{b. Floyd bought the } \llbracket -est_C nice \rrbracket \llbracket -est_C cheap \rrbracket \llbracket computer \rrbracket \text{ ]} \\ & \text{c. } \llbracket \llbracket -est_C cheap \rrbracket \llbracket computer \rrbracket \rrbracket \\ & \quad = \lambda x \left[ \exists d[\mathbf{cheap}(d)(x) \wedge \forall y \in C[y \neq x \rightarrow \neg \mathbf{cheap}(d)(y)]] \wedge \right. \\ & \quad \quad \left. \mathbf{computer}(x) \right] \end{aligned}$$

The result of that combines intersectively with  $\llbracket -est_C nice \rrbracket$  to yield a property of an individual has if it's a computer and the nicest and cheapest relevant thing:

$$(22) \quad \llbracket \llbracket -est_C nice \rrbracket \llbracket -est_C cheap \rrbracket \llbracket computer \rrbracket \rrbracket \\ = \lambda x \left[ \begin{array}{l} \exists d'[\mathbf{nice}(d')(x) \wedge \forall z \in C[y \neq x \rightarrow \neg \mathbf{nice}(d')(z)]] \wedge \\ \exists d[\mathbf{cheap}(d)(x) \wedge \forall y \in C[y \neq x \rightarrow \neg \mathbf{cheap}(d)(y)]] \wedge \\ \mathbf{computer}(x) \end{array} \right]$$

There is, of course, no hint of striking a balance here, as the correlated reading requires. For the sake of convenience I've been slightly sloppy in one respect: without saying something more sophisticated about how the value of  $C$  is set, a purely intersective interpretation is too strong. It would seem to incorrectly predict that the definite description *the nicest cheapest computer* would fail to refer when there is a relevant non-computer that's nicer or cheaper. That could be corrected by building the noun into the gradable predicate (Sharvit & Stateva 2000 and scope theories) or by providing it as a separate argument (Farkas & Kiss 2000; Krasikova 2012).<sup>5</sup>

In theories in which superlatives move DP-externally to take scope, the same result should be achievable. The additional machinery brings with it more power. As far as I can see, there's no sense in which it diminishes the range of readings available. For that reason and for brevity, I won't attempt to demonstrate here that they too should be able to account for the independent reading.

<sup>5</sup>For the sake of explicitness, an appropriate denotation for the superlative morpheme that would achieve this might look like this:

$$(i) \quad \llbracket -est_C \rrbracket = \lambda G_{\langle d, et \rangle} \lambda P_{\langle e, t \rangle} \lambda x . \exists d[G(d)(x) \wedge \forall y \in C \cap P[y \neq x \rightarrow \neg G(d)(y)]]$$

One could also pursue an enriched understanding of how the comparison class works (e.g. Heim 1995; Krasikova 2012) rather than treating it as a simple set of individuals.

### 3.2 The other readings and covert plurality

One important point to notice about the denotation for the independent reading: it has built-in uniqueness. Every superlative requires that an individual exceed all others with respect to some property. That means that once the lowest attributive superlative is interpreted, the extension of the N' is at most a singleton set: there can only be one individual that exceeds all others. The next superlative up therefore can do exactly two things. First, it can leave the extension unchanged. It would simply run a test to ensure that the singleton member of this extension also meets the requirements imposed by the higher superlative. Second, if it fails to meet these requirements, it can reduce the extension to the null set, in which case the definite description would fail to refer.

So long as superlatives impose uniqueness in this way, stacking them will always be compatible only with the independent reading.

A strategy that suggests itself as a relatively conservative remedy is to suppose that this uniqueness is not actually present with multiple superlatives, at least on the non-independent readings. Superlatives routinely occur with plurals (Fitzgibbons *et al.* 2009), and in those cases, expectedly, the uniqueness is manifested as a kind of maximality:

(23) Floyd bought the nicest computers.

In (23), there is no requirement that a single computer be the nicest. Rather, there can be a set of computers, perhaps all tied for nicest or perhaps simply collectively at the top of the scale, all of which Floyd bought. Because this is not a singleton set, it can be further restricted by higher superlatives:

(24) Floyd bought the cheapest nicest computers.

If  $\llbracket \textit{nicest computers} \rrbracket$  is a set of computers that are sufficient nice,  $\llbracket \textit{cheapest} \rrbracket$  can remove from that set all but the cheapest of these. That would seem to either capture the subordinating reading, or get close to doing so.

But although this strategy seems in some respects promising, it very much goes against the empirical grain. There seems to be absolutely no evidence of morphological plurality in these structures, and I know of no reason to regard singular nouns as covertly plural. That's not the case for the converse: plural nouns might actually include atoms in their extension, as Sauerland *et al.* 2005 and others since have argued. But that doesn't help here.

Perhaps there might be a middle ground: Krasikova 2012 argues on independent grounds that certain readings of superlatives with morphologically singular nouns nevertheless involve plurality, but in the domain of degrees rather than individuals. This is a promising avenue I won't pursue further here, other than to note that the implementation wouldn't be trivial. It involves, on the relevant reading, placing a definite determiner in the specifier of DegP. With stacked attributive superlatives, there are two such positions.<sup>6</sup>

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<sup>6</sup>That said, spelling out *the* twice, once for each superlative, isn't actually obviously ungrammatical, surprisingly:



Even if it could be made to work in some way for the subordinating reading, it's less clear how the correlated reading should emerge. The best strategy might be to attempt to derive the correlated reading as a special case of the subordinated reading. That might be achievable for stacked attributive comparatives, as in (24), but it's less clear how that be implemented in cases in which the correlated reading involves superlatives that modify different nouns.

At best, one might imagine pursuing an analysis of the many-superlatives correlated-reading sentence, repeated here, along the lines of (25b):

- (25) a. Floyd bought the nicest computer at the lowest price with the fastest delivery from the least sketchy Amazon dealer with the lowest shipping charges and the highest customer ratings.
- b. 'Of the lowest prices,  
of the fastest delivery speeds,  
of the least sketchy Amazon dealers,  
of the lowest shipping charges,  
of the highest customer ratings,  
he bought the nicest computer.'

Again, it's not clear to me how that would actually work out compositionally (perhaps iteratively narrowing down the contextually-provided domain restriction?), but there's another problem. Fundamentally, this strategy doesn't resonate with what this sentence feels like it means. The paraphrase in (25b) just doesn't do justice to the intuition of balancing imperatives. It misses the sense that this is about correlating, not subordinating, degrees. Moreover, it predicts that the sentence should have 720 (=6!) scope configurations. That seems a bit excessive. The sentence certainly doesn't feel 720-ways ambiguous. Now in one respect this complaint is unfair. Perhaps some or many of those readings would wind up special cases of others, and therefore difficult to distinguish or discern. But there's no getting around that it would predict a huge number of LFs, at least on a scope theory of superlatives. That combinatorial explosion alone would be, one might expect, sufficient to boggle the parser. Yet (25a) goes down relatively easily, despite all its apparent complexity.

### 3.3 Comparative correlatives

Perhaps a more promising empirical analogy to guide the analysis than plurals may be comparative correlatives, also known as comparative conditionals (McCawley 1988; Beck 1997; Taylor 2013; Brasoveanu 2008). These are constructions in which two instances of a comparative together yield a specific interpretation that wouldn't have independently been expected:

- (26) a. The slimier the lawyer, the more successful he is.  
b. The bigger the monkey, the greater the risk of mauling.

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(i) Floyd bought the cheapest, the nicest computer.

This also forces the independent reading. I suspect it may actually involve right node raising from an asyndetic coordinate structure, though.

As with the correlating reading of multiple superlatives, the reading that results involves a claim that two scales are correlated with each other. Romanian correlative comparatives overtly spell out the underlying logical forms especially clearly Brasoveanu 2008:

- (27) Cu cât e mai înalt fratele decât sora, (tot) cu  
**With how much** is more tall brother.the than sister.the, **(also) with**  
 atât e mai înalt tatal decât mama.  
**that much** is more tall father.the than mother.the  
 ‘The brother is taller than the sister by a certain amount and the father is  
 taller than the mother by the same amount.’

The analytical intuition I’ll pursue is that the correlated reading of multiple superlatives is a superlative analogue of comparative correlatives. More specifically, it too is a degree construction that uses a specialized syntactic form to correlate two scales with each other. There is a more subtle similarity as well. Comparative correlatives have been analyzed as covertly conditional. As I’ll suggest in the next section, the correlated reading of multiple superlatives is inherently intensional as well, and often covertly so.

### 3.4 A covert modal

I noted earlier that the correlated reading comes out most naturally with explicit modals:

- (28) a. We *want* the greatest happiness for the greatest number.  
 b. Floyd bought the nicest computer at the lowest price he *could*.  
 c. Floyd bought the nicest computer at the lowest *possible* price.  
 d. Floyd bought the nicest cheapest computer he *could*.

Indeed, if we are to take seriously the intuition that in these readings a balance is struck between two scales, it’s hard to see how to avoid a semantics that is ultimately intensional.

What I’d like to suggest, then, is that on the correlated reading, a sentence like (29a) involves an implicit correlative-superlative modal CORR-SUP at the clausal level (THE is a kind of indefinite definite, standard in the analysis of superlatives, but see Krasikova 2012; Szabolcsi 2012 for refinement):

- (29) a. Floyd bought the nicest computer at the lowest price.  
 b. CORR-SUP  $\lambda d \lambda d'$  Floyd bought THE  $d$ -nice computer at THE  $d$ -low price.

The superlatives themselves are not making distinct semantic contributions of their own. Rather, they are simply distinct exponents of a single bit of semantics, a kind of agreement reflecting the presence of the licensing CORR-SUP operator above them.

A rough sketch of the semantics of this reading is in (30), where  $\text{Acc}_{w@}$  is an accessibility relation and  $w@$  the actual world:

$$(30) \quad \exists d \exists d' \left[ \begin{array}{l} \text{Floyd bought a } d\text{-nice computer at a } d'\text{-low price in } w_{@} \wedge \\ \neg \exists w \in \mathbf{Acc}_{w_{@}} \exists d'' \exists d''' \left[ \begin{array}{l} d \neq d'' \wedge d' \neq d''' \wedge \\ \text{Floyd bought a } d''\text{-nice computer} \\ \text{at a } d'''\text{-low price in } w \end{array} \right] \end{array} \right]$$

Normally, the accessibility relation would be one involving preference, so that the result is Floyd bought a computer of some niceness level and price in the actual world and there's no other niceness level and price that it would have been preferable for him to buy a computer at.

This appears to be more or less the desired reading. Importantly, it's suitably weak. It doesn't commit to a particular ranking of price and quality, and therefore is not inconsistent with Floyd having bought a computer of any price or any quality. It simply denies that he could have found a better price-quality pair.

Abstracting away from the specific example, the CORR-SUP morpheme itself would take a relation between two degrees:

$$(31) \quad \llbracket \text{CORR-SUP} \rrbracket = \lambda R_{\langle d, \langle d, st \rangle \rangle} \lambda w \exists d \exists d' \left[ \begin{array}{l} R(d, d', w) \wedge \\ \neg \exists w' \in \mathbf{Acc}_w \exists d'' \exists d''' \left[ \begin{array}{l} d \neq d'' \wedge d' \neq d''' \wedge \\ R(d'', d''', w') \end{array} \right] \end{array} \right]$$

The argument of CORR-SUP could be derived by a variety of means. One possibility would be to treat the superlatives of the correlated reading as essentially a kind of degree pronoun, saturating the degree argument and bound from above by a lambda inserted to avoid a type clash when combining with CORR-SUP. This, however, wouldn't predict the locality facts. An alternative that stands a better chance of doing so is to treat the superlative morphemes in something like the way that Heim & Kratzer 1998 treat the relative-clause *wh*-operator, as an expression whose sole purpose is to leave behind a trace of a certain type. On this view, the superlative morpheme might simply denote the identity function. This would trigger movement of both superlative morphemes to immediately below CORR-SUP.

Ultimately, of course, CORR-SUP would have to be polymorphic, applying to relations between arbitrarily many degrees.

One challenge for this approach is how this result should be achieved in the presence of overt modals. Having supplied an implicit one, we would face the problem of a modal too many. I won't pursue this here other than to offer a few pieces of speculation. First, one might imagine that at least in some circumstances, it's the overt modals that are misleading. They might actually be a form of modal concord (Geurts & Huitink 2006; Anand & Brasaveanu 2010)—like the *possibly* in *You couldn't possibly think that!*—with the overt modals expressing a kind of concord with CORR-SUP. That doesn't seem likely to extend to cases in which the overt modal actually embeds the modal superlatives, as is the case in attitude ascriptions like (28a). Another possibility would be to actually reconceptualize CORR-SUP as something like a covert version of *possible* itself, that is, as an adjective—one that, in the spirit of Larson 2000; Schwarz 2005; Romero 2013, embeds an elided clause containing degree variables in the positions corresponding to the overt superlatives in the embedding antecedent clause. This might make it possible to provide a more

conventional analysis of the superlative morphemes themselves, and an independent reason for why superlative morphemes should behave similar to degree variables. Importantly, though, this strategy would still require that there *be* a silent CORR-SUP morpheme.

There is, however, a bigger picture here. Providing a semantics for CORR-SUP is a starting point, but it doesn't explain why the construction is so elusive. Why do we need philosophers to help discern its truth conditions? A semantics that predicts weak truth conditions is a starting point, but why do we fail to notice how weak they actually are? Why does it seem like we fail to discern their consequences, as though through a kind of semantic inattention?

## 4 Semantic viruses

### 4.1 What's a virus?

As I've foreshadowed, the reason for our apparent at best partial control of correlative superlatives may be that they are semantic viruses.

In the syntax, viruses are phenomena that are distinguished by a family of features (Sobin 1997; Lasnik & Sobin 2000). They are formal, often literary or prestige forms. Speakers control them imperfectly, and they are distinguished by inconsistency, hypercorrection, and unsteady intuitions. Speakers are conscious of their use. They are a challenge for acquisition, and not characteristic of children's speech. And they require 'tutorial support', explicit coaching from other speakers.

The paradigm example involves case in coordinate structures (Sobin 1997):

- (32) a. Clyde and  $\left\{ \begin{array}{c} \text{me} \\ \text{I} \end{array} \right\}$  left.  
b. It is  $\left\{ \begin{array}{c} \text{me} \\ \text{I} \end{array} \right\}$ .

This is of course a prestige form, and it's prone to hypercorrection:

- (33) between you and I

Speakers are generally conscious of its use—indeed, they are often self-conscious about it. It's not used by children, and is often the result of a hearty dose of 'tutorial support' in the form of prescriptive bad

Another example is *whom*. Interestingly, as Lasnik & Sobin 2000 show, it's not a true accusative form. If it were, it would occur as a predicate nominal with the copula, as *her* does in (34a):

- (34) a. It was her.  
b. \*Whom was it?

But as (34b) shows, it doesn't. Sobin's idea, building on Emonds 1986), is that viruses are not really part of the grammar. Perhaps because of where I'd like to take the idea, I prefer the more cowardly interpretation that they are simply a *different* part of the grammar. It's important to emphasize right at the outset, though, that

calling something a virus shouldn't be a get-out-jail-free card with respect to providing an analysis. Viruses are still part of language, and are interesting because there's something to be explained.

If multiple superlatives on the correlated reading are a virus, our incomplete control of the construction would be expected. But to make this case, it will help to articulate a broader conception of what I mean by 'semantic virus'. In the spirit of Morzycki 2017, the next few sections very briefly review some instances of what might be semantic viruses, followed by some speculation about what a theory of semantic viruses might look like.

## 4.2 Zero

One potential semantic virus is *zero* (Bylinina & Nouwen 2017, Chen [this volume]):

- (35) a. Zero students passed.  
 b. There were zero students in the hallway.

Bylinina & Nouwen show that *zero* behaves like a numeral modifier rather than a negative quantifier like *no*:

- (36) a. This drink contains  $\left\{ \begin{array}{c} \text{zero} \\ *no \end{array} \right\}$  grams of sugar per bottle.  
 b. John visited his grandmother  $\left\{ \begin{array}{c} \text{zero} \\ ??no \end{array} \right\}$  times.  
 c.  $\left\{ \begin{array}{c} \text{No} \\ *Zero \end{array} \right\}$  students have visited me in years.

It's reasonable, then, to give it a similar semantics. They propose (37), where  $\#x$  indicates the cardinality of  $x$  and  $\times$  pluralizes a predicate in a particular way:

- (37) a. Zero MANY students passed.  
 b.  $\exists x[\#x = 0 \wedge \times \text{student}(x) \wedge \times \text{pass-the-test}(x)]$

This says what it appears to: that there is a plurality  $x$  that consists of students that passed, and that this plurality has zero members. They provide convincing argumentation in support of this hypothesis, yet it seems right to be proceed cautiously. A zero-membered plurality is an ontologically exciting beast, and it's not one for which we have extensive evidence from beyond *zero*. If such pluralities were ordinary inhabitants of the model, surely we should find evidence for them all over the grammar. On the other hand, if they were *extraordinary* inhabitants of the model, present only by virtue of a virus, we should expect the evidence for them to be just as it is: strong, compelling, and limited to a particular corner of the grammar.

One reason to suspect that *zero* might be a virus is the unsteadiness of judgments about it. It's not clear whether the sentences in (38) are fully grammatical, or what they're (trying to) mean:

- (38) a. ??I  $\left\{ \begin{array}{l} \text{will} \\ \text{have to} \end{array} \right\}$  leave in zero minutes.  
 b. ??Floyd left zero minutes ago.  
 c. ??I can leave at zero past right now.

They all share a feeling of a kind of self-aware metalinguistic jokiness. In addition to this self-consciousness and the wavering intuitions, *zero* has other features of viruses: it's a high-register construction, it's not typical of child speech, and it requires explicit instruction.

In addition to the core properties of Sobin's viruses, *zero* has some others that seem to me worth recognizing as reflective of viruses and that are broadly consistent with his vision. First, *zero* is not part of the native vocabulary of most languages. It seems natural that features of viruses should be crosslinguistically uncommon. Second, *zero* requires more power in the grammar than we normally assume. In this case, it's the notion of zero-membered pluralities. Third, *zero* is complex. It requires some measure of numeracy.

### 4.3 Other mathematical language

Other mathematical language also shows signs of being viral. Negative numbers, for example, can also give rise to semi-grammatical half-jokes like (39):

- (39) a. ??Negative three people arrived.  
           'Three people left.'  
 b. ??It got warmer by negative ten degrees.  
           'It cooled by ten degrees.'

Fractions can give rise to similar challenges. It's not clear how to square (40a) with normal assumptions about plurals, and the semantics of (40b) is even more challenging (Carlson & Pelletier 2002; Kennedy & Stanley 2009):

- (40) a. Floyd ate 2.3 apples.  
 b. The average American has 2.3 children.

The wavering judgments around percentages are especially striking. Does (41) (Gobeski & Morzycki 2017; Gobeski in preparation) mean that Floyd is 1.5 times Clyde's height, or 2.5 his height?

- (41) Floyd is 150% taller than Clyde.

Again, the same viral properties—the wavering judgment, the complexity, the high register—all correlate.

### 4.4 Respective(ly) & vice versa

There is a cottage industry struggling with the lexical semantics of *respective(ly)* (Dalrymple & Kehler 1995; Gawron & Kehler 2004; Kac 1987; McCawley 1968; McCawley 1998; Stockwell *et al.* 1973; Moltmann 1992; Pullum & Gazdar 1982;

Kay 1989; Eggert 2000; Okada 1999), and *vice versa* (Kay 1989; Farkas 2015) poses similar problems:

- (42) a. Fido and Felix ate Alpo and Whiskas, respectively.  
 b. Fido scratched Felix vice versa.

The challenge in a nutshell: *respectively* flags that each element of the conjoined subject is to be paired with each element of the conjoined object in the order *in which they were mentioned*. This requires that the semantics make reference to the linear order of constituents in a sentence, which is not normally something we regard it as capable of. In principle, if any linguistic expression could be sensitive to the linear position of any other, it would make a mockery of the principle of compositionality.

To cope, Gawron & Kehler 2004 propose that *respective(ly)* makes use of a ‘sequencing function’ that maps non-atomic objects of arbitrary type to assignment functions, which in turn map natural numbers to objects. For example,  $f(\mathbf{Felix} + \mathbf{Fido} + \mathbf{Rover})(2) = \mathbf{Fido}$  iff Fido was mentioned second. Their denotation, simplified, is as in (43):

$$(43) \quad \llbracket \textit{respectively}_f \rrbracket = \lambda P_{\langle e, t \rangle} \lambda x . \bigwedge_{1 \leq i \leq |f|} f(P)(i)(f(x)(i))$$

This applies to a plural property and a plural individual and conjoins the result of applying each of the members of the property to each of the members of the individual. It requires a kind of mental running recording of the discourse, which indeed seems to be exactly what *respective(ly)* relies on. But this grants a lot of power to a single modifier. Why, one might ask, isn’t grammar riddled with expressions that manipulate arbitrary discontinuous constituents across arbitrary parts of discourse?

Treating it as a virus provides an answer. It’s a high-register expression; it’s not children’s speech; it requires conscious attention to linguistic form by the speaker, a kind of real-time linguistic self-monitoring; and it requires more power in the grammar than we might want to grant to arbitrary expressions.

#### 4.5 Maybe privative and modal adjectives?

One final possible example of a virus: privative and other modal/non-subjective adjectives, as in (44):

$$(44) \quad \left\{ \begin{array}{l} \text{alleged} \\ \text{former} \\ \text{possible} \\ \text{probable} \end{array} \right\} \text{murderer}$$

These adjectives, of course, need to denote predicate modifiers:

$$(45) \quad \llbracket \textit{alleged} \rrbracket = \lambda P_{\langle e, st \rangle} \lambda x \lambda w . \forall w' \left[ \begin{array}{l} w' \text{ is compatible with what has} \\ \text{been alleged in } w \rightarrow P(x)(w') \end{array} \right]$$

The idea that an adjective should take an  $N'$  as an argument isn't particularly shocking, but there are reasons one might want to worry. This type should make possible a class of adjective denotations that are unattested von Fintel & Heim 1999; Landman 2001. One might, for example, imagine a hypothetical adjective like *residentialous* in (46a), which applies to a noun denotation and yields the property of living in something that satisfies it, or *lovery* in (46b):

- (46) a.  $\llbracket \textit{residentialous} \rrbracket = \lambda P_{\langle e, st \rangle} \lambda x \lambda w . \exists y [P(y)(w) \wedge x \text{ lives in } y]$   
 b.  $\llbracket \textit{lovery} \rrbracket = \lambda P_{\langle e, st \rangle} \lambda x \lambda w . \exists y [P(y)(w) \wedge x \text{ loves } y]$

Thus a *residentialous city* is an urban-dweller, and a *lovery terrier* is someone who loves a terrier. These seem completely impossible, but it's not clear why.

In the present context, a tantalizing if somewhat far-fetched explanation presents itself: perhaps the predicate-modifier type in adjectives is itself a virus. After all, adjectives like those in (44) have a number of virus-like properties. They are generally relatively high-register and adult. As a class, they don't seem to be common across languages. And they require power—in the form of their high type—that we might want to withhold from adjectives in general. There are reasons for doubt, though. For one thing, as far as I can see there are no wavering intuitions here. For another, speakers don't seem to be self-conscious about these in any relevant sense, and there's no sense that something metalinguistic is going on.

#### 4.6 What is a semantic virus theoretically

If we're willing to accept that semantic viruses exist, it's necessary to ask where they fit in as components of the grammar. In some sense, this is just a more pointed way of asking what a virus is, exactly—not by example, but theoretically.

Conceivably, the answer might be that a virus is simply a lexical item:

- (47) THE LEXICAL VIEW  
 Viruses are simply a class of lexical items like *respectively* and maybe CORR-SUP.

This would be stipulative, but it's at least simple. But on this view presumably zero-membered pluralities couldn't themselves be viruses. Would it be sufficient to simply say that *zero* is a virus, and that the additional grammatical power it requires is in some derivative sense infected? Another approach would be to stick more closely to Sobin's original conception and treat viruses as rules:

- (48) THE RULE VIEW  
 Certain rules—in some sense of the term—are viruses.

Potentially, this could include certain rules of composition (like e.g. Barker 2007's Parasitic Scope), and perhaps other 'rule'-like operations, like Gawron & Kehler 2004's sequencing functions. Perhaps a high type (or a high type for a particular syntactic category) could count as a rule as well. This would be natural enough for e.g. non-subjective adjectives, I'm not sure how to extend it to mathematical language, say. More generally, because of the vagueness around what counts as a



rule, though, this strikes me as unhelpful without refinement. Another possibility would be to look at it from the perspective of the model:

- (49) THE ONTOLOGICAL VIEW  
Certain objects in the ontology are viruses.

This is the natural strategy to pursue in the case of mathematical language. On this view, zero-membered pluralities might be the virus, and *zero* is infected by virtue of having a semantics that relies on them. Likewise, percentages, fractions, and sequencing functions might all be viruses. Finally, an especially brazen bit of speculation. Perhaps it's possible to really take to heart the idea that viruses—in the semantics, at least—are about giving the grammar 'more power' in some definable way. If that's the case, it should be possible to define rigorously what 'more power' means, say, in terms of computational complexity:

- (50) THE COMPUTATIONAL COMPLEXITY VIEW  
Viruses are operations that require more computational complexity of the grammar in some appropriate strict sense.

In syntax and phonology, it's possible to talk about power in terms of the Chomsky Hierarchy: whether a particular formal language is regular or not, whether it's context-free or not. Heinz & Idsardi 2013; Heinz & Rogers 2013; Graf 2015 argued recently that phonology and perhaps syntax are lower on the Chomsky Hierarchy than previously assumed. Might there be a way of restricting the formal power of the semantics in some insightfully analogous way, by ring-fencing certain outlier phenomena as viruses?

## 5 Final words

The smaller-picture point of this paper has been to wrestle with the observation that multiple superlatives get a puzzling reading whose complexity eludes native speakers. To do this reading justice, it might be necessary to assume a dedicated morpheme, an implicit modal that provides an additional ingredient beyond the basic semantics of the superlative. The superlative morphemes themselves, on this reading, would simply be the overt exponents of this implicit modal. But to *really* do this construction justice, we need to recognize that it is a semantic virus.

That, in turn, is the bigger-picture point. We need to recognize that semantic viruses exist. Their distinguishing features include these:

- They are complex, and require more power in the grammar than we might otherwise have cause to give it.
- They are high register.
- They are not characteristic of child speech.
- They are prone to fraying intuitions.
- They are not typologically common.

None of this requires any particular analysis of any particular virus. More impor-

tant, none of this relieves us of having to provide an analysis. To say that something is a virus is not to say that it is unexplainable, or that it is too peripheral to merit explanation. The aim here is not to stigmatize certain phenomena as beneath our understanding. Rather, we should aspire to an understanding of what makes viruses viruses, and what they have in common. That's not possible to do by disregarding them.

In Santa Cruz, California, there is a particular tourist trap called the Mystery Spot. The selling point is that it is a place where the laws of physics don't apply. Things that are far away appear to be closer. Things that are upright appear askew. Gravity works at an angle. For the most part, it turns out to be a building built dramatically and oddly out of square. There are several potential responses to the existence of such a place. First, one could simply elaborate the laws of physics to accommodate it. Second, one could throw up one's hands and deny the very existence of the place. Third, one could acknowledge that it's aberrant, and seek an enlightening theory of what it is that makes it aberrant. Groping toward an understanding of viruses is, I think, an instance of the third epistemic strategy.

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