Anaphora in Comparison[*]

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Abstract A common assumption in degree semantics is that there is a function-argument relationship betwen the comparative morpheme *er* and the overt standard. Drawing on observations from comparatives without an overt standard, I argue for reconsiderations of this assumption and offer a re-analysis, where *er* itself takes implicit arguments as its comparison standard, and the overt standard and the discourse antecedent are different ways of specifying *er*'s implicit arguments.

1   Introduction

In degree semantics, it is commonly assumed that the English comparative morpheme *er* takes the standard of comparison served by the *than*-P (be it clausal or phrasal) as its semantic argument. There is great variation among the analyses, but generally they fall into variants of either (1) or (2); the choice depends on whether one takes the standard to be a single degree (1) or a degree set (2).

(1) $[\![\mathrm{er}]\!] := \lambda d \lambda g \lambda x . \exists d' : g d' x \wedge d' > d$ Rullmann (1995), a.o.

(2) $[\![\mathrm{er}]\!] := \lambda P \lambda Q . \mathsf{max} Q > \mathsf{max} P$ Heim (2006), a.o.

In this paper, I argue this seeming function-argument relationship is only an approximation. Looking more closely, I propose the comparison standard is introduced by *er* itself; we resolve this comparison standard either in the prior discourse or in the complement of *than*.

Observations motivating this departure comes from *incomplete comparatives* where the comparative is used without an overt *than*-P. Felicitous incomplete comparatives require what I will call PARALLELISM IN THE SCOPE OF COMPARISON: a (contextually salient) parallel relation between the scope of the comparative morpheme and the descriptive content that gets associated with the standard degree in the

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discourse. In the classic approach where the target and the standard of comparison are separated and computed independently, this tight correlation is unexpected.

I will pursue a theory that has parallelism built into the meaning of comparison. Building on the direct analysis proposed in Heim (1985), I propose comparatives are fundamentally about comparing *alternatives* (i.e. things with the same semantic type) on a given measurement dimension. The crucial departure from Heim is in the way *er* accesses its comparison standard. In my theory, *er* directly takes implicit arguments (cf. Schwarzschild 2010; Larson & Wellwood 2015) – both the alternative correlate and its measurement – as its comparison standard, which are in a co-construal relation with things in the prior discourse or in the complement of *than*. A constellation of semantic and pragmatic factors that participate in resolving these implicit arguments lead to the observed parallelism in the scope of comparison.

The bulk of this paper is devoted to incomplete comparatives, for which a simple static formalization is enough to present the basic ideas. For a fuller understanding of the phenomenon in the general context of comparative semantics, it turns out a dynamic account is necessary. The ontological assumptions I make for degrees are minimal: they are points or intervals on an abstract representation of measurement that we call *scale* (Seuren 1973; Cresswell 1976). I also follow the customary definition of gradable adjectives as a relation between individuals and degrees. Recent works sometimes assume a much more enriched structure for degrees (see Grosu & Landman 1998; Rett 2008; Scontras 2014; Law 2019); without going through possible implications of these enrichments, my goal here is only to present a new approach, which I believe deserves serious considerations in its own right.

2 Data: anaphoric dependency of comparatives

2.1 Incomplete comparatives are anaphoric

Incomplete comparatives are comparatives used without an overt standard clause or phrase, and for which the relevant comparison standard is dependent on the information provided in the context (Sheldon 1945). In the previous literature, this context-dependency is generally acknowledged (cf. Gawron 1995) but rarely subjected to scrutiny (but see Schwarzschild 2010).

The empirical starting point of this chapter is that the range of this kind of context dependencies parallels that displayed by ordinary anaphoric pronouns. With these parallels, it is reasonable to treat incomplete comparatives as anaphoric expressions.

- Deictic, non-linguistic antecedent:

  (3)   (Pointing to a customer) I can't close the store until she leaves.

(4)   (Someone hands me a copy of *War and Peace*). No, I need a more interesting book.

- Discourse-internal antecedent:

(5)   A linguist^x came in. She$_x$ sat down.

(6)   John read *War and Peace*. Mary read a more interesting book.

- Quantificational subordination:

(7)   Harvey has a guard with him at every convention.
        He is usually one of Harvey's long-time friends.

(8)   Every department hired a linguist. The linguist they hired usually has a backup offer for a better-paid job.

- Donkey anaphora

(9)   Every farmer who owns a^x donkey beats it$_x$.

(10)   Every student who read a book from my list recommended a more interesting one in their report.

A meaningful question, then, is whether we can predict the behaviors of incomplete comparatives, given the standard theory of anaphora on the one hand and the classic degree-based approach to comparatives on the other. In what follows I offer close examinations on the anaphoricity involved in incomplete comparatives, and argue that the data shed new light on the semantics of comparison. Before we get into that, I should mention that the empirical patterns we are about to see go well beyond scalar comparatives: based on the observations reported in Hardt, Mikkelsen & Ørsnes (2012); Hardt & Mikkelsen (2015, 2019), identity comparatives *same/different* in their incomplete use behave in a completely analogous manner. The recurrence of these patterns strongly suggests they are related to some fundamental aspects of the meaning of comparison.

2.2   Parallelism in the scope of comparison

In the traditional degree-based approach to gradability, the comparative morpheme *er* takes the denotation of the overt *than*-P as its semantic argument. If we keep this meaning constant, then ⟦er⟧ needs this argument in incomplete comparatives too. A reasonable hypothesis would be (11), in which anaphora in comparison uniformly reduces to binding of this covert degree pro form that serves as the argument of ⟦er⟧. Although (so far as I know) no one has explicitly defended this theory, it has been implicitly adopted in a number of places (e.g. Gawron 1995), all generally assume that *er* directly *composes* with either the *than*-P or the discourse antecedent.

(11) In incomplete comparatives, the standard argument of $[\![er]\!]$ is reduced to a covert pro form.

Notably, (11) provides no explanation as to why things other than the saliency of the intended antecedent should affect the felicity of comparative anaphora. In light of this, this section showcases a series of examples that point to an unexpected parallelism requirement in (12).

(12) *Parallelism in the scope of comparison*:
Incomplete comparatives are anaphoric to a degree antecedent associated with a character that is parallel to the character of the target degree.

What I mean by *degree character* is the descriptive lense we associate with a given degree in the discourse, which in a way resembles the way we conceptualize individuals in the discourse (cf. Aloni 2005). For example, when we say *John is six feet tall*, the degree *six feet* is associated with the character of being John's height.

Some more notations and terminologies should be fixed, in order to keep the discussion manageable. I will call comparatives with cardinality and mass measures *amount comparatives* and those with adjectival measures *adjectival comparatives*. Co-indexation between a comparative morpheme and a degree indicates that degree is the intended standard degree. The character of a degree description is formally equivalent to the scope it *could* take: if we let *six feet* take scope in the sentence *John is six feet tall*, its scope argument would be exactly the property of being John's height (λd.john is d-tall). For the target degree of a comparative, I will stipulate that its character is aligned with the semantic scope of the degree operator, in (13) it is λd.mary is d-tall, i.e. the property of being Mary's height.

(13) John is six feet^d tall. Mary is taller$_d$.

The two degree characters in (13) are intuitively parallel[1], and I aim to show this is by no means a coincidence. In the following three scenarios where comparative anaphora is infelicitous despite the presence of a salient degree antecedent, the infelicity can always be attributed to violations of the parallelism constraint in (12).

2.2.1 True character

The first observation is that anaphora in certain comparatives is sensitive to the truth of the clause containing the intended degree antecedent.

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1 The notion of *parallel* is kept intuitive and vague in this section, though it obviously bears certain resemblances to the parallelism in Kehler (2002). The precise and formal interpretation of the parallelism at play here will be given in section 3.

Observe in (14), when the antecedent clause *John read ten books* is negated, the amount comparative anaphora is disrupted (14a). In contrast, the degree demonstrative *that* in (14b) is felicitous, suggesting – for whatever reason[2]– the discourse potential of the antecedent degree transcends the scope of negation; it just can't be picked up by the comparative. Aside from amount comparatives, the blocking effects of negation is observed in predicative uses of adjectival comparatives as well, as shown in (15). Once again, the degree demonstrative *that tall* is not affected (15b).

(14)   John didn't read ten^d books.

     a. # Mary read more$_d$ (books).

     b. I have never seen that$_d$ many books on his shelf.

(15)   John isn't six feet^d tall.

     a. # Mary is taller$_d$.

     b. Do you used to think he's that$_d$ tall?

I propose the disruptions occur because in (14) and (15), no degree character is truthfully associated with the intended degree antecedents in the local context of *er*: when *er* is interpreted, all we know is that *ten* is *not* the amount of books John read and *six feet* is *not* the height of John.

A clarificational note is in order here. Though the examples in (14) - (15) all involve an overtly mentioned degree as the intended antecedent, we have robust evidence that implied degrees are good enough antecedents for comparative anaphora. Consider the example in (16): the importance of silence is obviously compared to that of baked goods, fresh coffee, and the luxurious furniture, even though the degrees to which they are important to Celia are never mentioned. (17) makes the same point with an amount comparative: *more* compares to the maximal amount of books John read, despite that this degree is not mentioned and likely not known to the speaker. It seems that all is required is the existence of such a degree is entailed in the prior context. In examples (14a) and (15a) the comparative actually has no sensible reading, because from the given context we can't infer any antecedent degree associated with a true character.

(16)   Neither the delicious baked goods, nor the fresh coffee nor even the luxurious furniture could draw Celia into Rob's new cafe. What finally caused her to enter was something invisible but to her mind far more important: silence.

                                                     (Schwarzschild 2010: ex. (36))

(17)   John read many books, possibly more than ten. Mary read even more.

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2 One obvious solution is to take the idea that these measure phrases are degree names (Law 2019) seriously, then they are supposed to have the discourse potential parallel to individual names.

2.2.2 Parallel structure

Our second observation is the attributive use of adjectival comparatives appears to be different at first glance, it is not nearly as sensitive to clausal negation. In (18), the comparison standard of *more interesting* is naturally read as the (maximal) interestingness of *War and Peace*.

(18)   John didn't read *War and Peace*.

        a. He read a more interesting book.

        b. # He/Mary read more books.

Upon closer look, the felicity of (18a) is reasonably expected. It's well-known that the discourse potential of names transcends the scope of negation (e.g. *I didn't meet Mary^x, but I heard she$_x$ is lovely.*), so *War and Peace* should remain accessible in the local context of the comparative, together with the implied interestingness of the book. Therefore, in this case we do have an antecedent degree associated with a true character, in spite of the presence of negation.

What's not expected is the contrast between (18a) and (18b). By the same token, we expect the amount comparative anaphora in (18b) to be able to pick up the cardinality of the book as its antecedent. This is of course under the assumption that cardinality is also a measurement dimension like interestingness and tallness, but this seems to be a rather uncontroversial position in degree semantics. This would amount to saying that Mary read more than one book, which is not a possible reading of (18b). In fact, (18b) seems to have no sensible antecedent at all, just as bad as (14a). Since this time we do have a possible (implied) antecedent degree associated with a true character, some other reasons must be responsible for the infelicity.

I propose to trace the contrast between adjectival comparatives and amount comparatives back to another well-known difference between them, namely the scope of the measure function that the comparative combines with. Hackl (2000) makes the case that the measurement function in amount comparatives, many, behave quite unlike gradable adjectives, as it appears to obligatorily scoping over the verb phrase of the sentence. The standard solution, since Hackl, is to take many to be a parameterized determiner of type d → et → et. This means the character of the target degree in an amount comparative is always syntactically derived by many scoping over the entire clause, whereas in adjectival comparatives it could be derived inside the noun phrase.

But how is this related to the antecedent? The idea is that the contrast in (18) can be accounted for if comparative anaphora also requires the degree character associated with the antecedent degree to be one that parallels the character of the target degree. The kind of parallel requirement I have in mind is the structural parallel condition usually assumed for ellipsis and discourse congruence, i.e. identity

up to variable names (Rooth 1992a,b: a.o.). Though the cardinality of *War and Peace* does have a true character ($\lambda d.\text{wp}$ is d-tall), this character is not structurally parallel to that of the target degree, which can only be obtained on the clausal level ($\lambda d.\text{mary read } d\text{-many books}$). For the adjectival comparative, the character of the target degree in (18a) is simply the interestingness of the book John read ($\lambda d.x$ is d-interesting, where x is the book he read), and it *is* parallel to the antecedent – the interestingness of *War and Peace*.

2.2.3 Parallel predicates

Last but not least, we observe that the verbal predicates in the character of the antecedent degree and the target degree must be parallel in *meaning*, in the sense that there is a non-trivial common theme between them.

In (19) - (21), we see that the character of the antecedent degree and the target degree can differ on the verbal predicate[3], but the difference is restricted. Alternating between parallel predicates such as *criticized* and *praised* – both are ways of evaluation – is allowed (19). In contrast, with predicates that are not obviously parallel, such as *criticized* and *read* or *forgot to read* and *read*, the felicity of the intended comparative anaphora is immediately downgraded, though perhaps not categorically bad. (20b) and (21b) show that the sensitivity to predicate meaning is not observed on the degree demonstrative, this is, again, unique to comparatives.

(19)   John criticized ten^d books. He praised more$_d$.

(20)   John criticized ten^d books.

        a. ?? He read a lot more$_d$.

        b. He read more than that$_d$.

(21)   John forgot to read one^d book.

        a. ?? Mary read more$_d$ (books).

        b. Mary read more than that$_d$.

It's important to note here that this meaning parallel is not a lexical semantic feature – whether the meaning of two predicates counts as parallel is ultimately context dependent. Compare (22) and (23). (22) shows the anaphoric interpretation in (22) is odd when the two predicates are antonyms. Yet, when the context in (23) makes it salient that *found* and *lost* are both related to managing the coin collections of the team, the comparative anaphora becomes felicitous. Here, with enough contextual support, we can associate the meaning of two verbal predicates

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3 To satisfy the structural parallelism constraint just proposed, these examples require thinking of these predicates as names of predicate-type variables (cf. Hardt 1994, 1999; Charlow 2012, 2017).

with the same teleological goal[4], in which case they are regarded as parallel by virtue of both being paths to the same goal. Comparative anaphora is possible in these contexts even with predicates that don't belong to an *a priori* natural category.

(22)   John found ten coins. ?? Peter lost more.

(23)   (Context: John and Peter teamed up to participate in a game. For each team, the task of the game is to walk through a forest, find the coins hidden in the forest, and collect as many as they can. The participating teams were all given a few sample coins at the beginning of their journey. In their team, John is responsible for finding the coins and John is responsible for keeping their findings. However, Peter was careless and lost lots of coins on the way.) John found ten coins, Peter lost more (so they walked out of the forest with less coins than before entering).

Readers may have noticed that all these examples (19) - (23) involve amount comparatives. Indeed, adjectival comparatives behave differently. It's not quite observable in their predicative use, since the verbs compatible with the predicative use are a very limited set (e.g. *is*, *seem*, *look*) and perhaps all imply the same meaning. The attributive use of adjectival comparatives, however, clearly don't exhibit the same kind of sensitivity to verbal predicates. In (24) we have the pair of predicates that have troubled the amount *more* in (21); the comparative is naturally read as the book John read is more interesting than the book he forgot to read.

(24)   John forgot to read a book. He read a more interesting one.

I propose this sensitivity to verbal predicate meanings comes from a semantic parallelism between the character of the target degree and the antecedent degree imposed by comparative, which needs to be defined appropriately to accommodate the contextual influence. As for the difference between amount comparatives and the adjectival comparatives, it is entirely expected: only in amount comparatives the character of the target degree obligatorily contains the verbal predicate. Since the degre character for adjectival comparatives is merely measurements of individuals (e.g. in (24), the interestingness of a certain book), verbal predicates are simply out of the scope of comparison in those cases.

2.3   Taking stock

The data presented in this section initially seem to diverge across different types of comparatives, but once we take into considerations of the scope of the target degree (i.e. the scope of *er*), they fall into a pattern: the intended degree antecedent must be

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4 I thank Simon Charlow for pointing this out to me.

truthfully associated with a degree character that is *structurally* and *meaningfully* parallel to the the character of the target degree in the given context.

These data are surprising for the hypothesis in (11). Anaphora to a degree is clearly not enough, as shown by the comparison with the degree demonstrative throughout our examples. And it's unlikely that the other variant of this hypothesis – anaphora to a degree set – is going to make any better predictions. Note that whenever a degree is mentioned, it's possible to derive a degree set antecedent by scoping the degree (cf. Barker 2013: for similar mechanisms used in sluicing), therefore it seems in all the examples where a salient degree is present, we could have a degree set as the intended degree antecedent as well. Yet the comparative anaphora still fails (25). As I've mentioned above, in these examples the use of the comparative feels infelicitous because it can't find *any* sensible comparison standard.

(25)   didn't [one [λd. John read d-many book]^P]. # Mary read more$_P$ books.
        (# under the reading of *Mary read more books than John read*.)

At the heart of the problem is a basic feature of the classic approach: the standard and the target of comparison are separated and computed independently. This leaves the strong parallellism consraint in incomplete comparatives unaddressed.

A possible response at this point is we can try to keep the comparative semantics as is and derive the parallelism constraint from some construction-independent general principles. Whatever this principle is, it must be able to explain the difference between incomplete comparatives and the degree demonstrative. An obvious candidate is to suppose incomplete comparatives involve ellipsis (cf. Collins 2017), then perhaps parallelism in the scope of comparison can be attributed to the parallelism constraint governing deaccenting in general (cf., e.g., Schwarzschild 1999), much in the same way the parallelism observed in explicit comparatives has been reduced to ellipsis licensing (Gawron 1995). Unfortunately, an ellipsis-based approach to incomplete comparatives seems not obtainable, at least not in its basic forms. Consider the example in (26), an ellipsis-based theory goes as follows: assuming the absence of *than* is somehow acceptable (see Collins 2017; Collins & Postal 2012: on "ghosting"), the covert comparison standard in (26a) can be resolved to the degree property λd. John read d-many books, de-accented because it's already given in the prior context. The problem with this analysis is two-fold. First, ellipsis in general imposes no truth requirement and is not sensitive to negation (as shown in (26b)), therefore the resolution in (26a) should be possible, generating an unattested reading that Mary read more books than John read. Second, ellipsis doesn't seem to allow for antecedents that are entirely pragmatically construed, and we've seen often times such implied antecedents are enough for comparative anaphora ((16) - (18)); it seems more reasonable to think two different mechanisms are at play(cf. Schwarzschild 2010: for a similar point). In conclusion, I believe we need to find parallelism

somewhere else.

(26)   I don't think John read ten books.

    a. # Mary read more than λd.John read d-many books.

    b. Mary did read ten books.

In the next section, I will propose a re-analysis of *er* that directly builds parallelism into the meaning of comparison. What we have observed in incomplete comparatives is a much tighter relation between the comparison target and standard than previously thought, and it will turn out to be a natural consequence of the re-analysis.

3 Proposal: comparing alternatives

3.1 The direct analysis

There *has* been one proposal that builds parallelism into the meaning of a comparative operator. This is the direct analysis (Heim 1985; Bhatt & Takahashi 2007) for phrasal comparatives such as *John is taller than Mary*.

Different from clausal comparatives (e.g. *John is taller than Mary is*), the complement of *than* in phrasal comparatives shows no trace of clausal structure in the surface form. We could posit more surface reductions for these cases; another logical possibility is they involve no reductions, the complement of *than* is only a noun phrase at any level of the derivation. Under the assumption that ⟦er⟧ takes the denotation of the *than*-P as its semantic argument, this possibility calls for a lexical entry for *er* that can compose with an NP meaning. The direct analysis posits such a lexical meaning (27); with this, phrasal comparatives don't directly compare degrees, they compare two individuals x, y on a measurement function f.

(27) ⟦er⟧ := $\lambda y \lambda f \lambda x.\mathsf{max}(\{d \mid fdx\}) > \mathsf{max}(\{d \mid fdy\})$

Take the sentence *John is taller than Mary* for example. In this sentence the measurement function is clearly people's height. As shown in Figure 1, *er* gets access to it by taking *parasitic scope* (cf. Richards 2001; Barker 2007) over the abstraction of the target individual *john*, thereby taking the derived function $\lambda d \lambda x.x$ is d-tall as its scope argument. Plugging in the definition in (27), we arrive at the interpretation of the sentence in (28), true if John's height exceeds Mary's height.

(28) $\mathsf{max}(\{d \mid \mathsf{john\ is\ }d\text{-tall}\}) > \mathsf{max}(\{d \mid \mathsf{mary\ is\ }d\text{-tall}\})$

What comes out of this is built-in parallelism between the character of the two degrees under comparison. The character of both the standard and the target degree
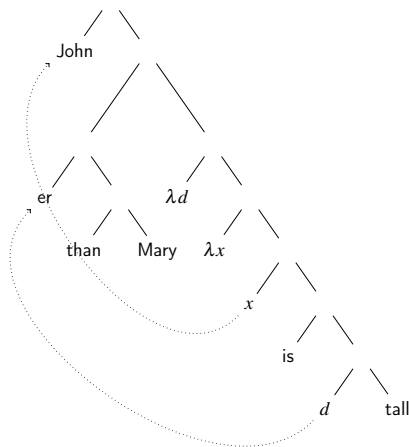
Figure 1   Deriving *John is taller than Mary* in the direct analysis

are derived by plugging one of the comparates into the measurement function f, threfore they are identical up to the name of the individual, e.g., in (28) these are *the degree to which John is tall* (λd.john is d-tall) and *the degree to which Mary is tall* (λd.mary is d-tall). Given the data pattern in the previous section, this parallelism is exactly as desired for comparative anaphora.

Nevertheless, a direct extension of the direct analysis to the anaphoric use, following (11), won't get us very far. Since the standard argument for $[\![\,\text{er}\,]\!]$ is now an individual, comparative anaphora is naturally reduced to anaphora to an individual. This wrongly predicts that (29) has a felicitous reading of *Mary read more books than John did*, by co-indexing the covert standard argument of $[\![\,\text{er}\,]\!]$ with the salient individual John, while in fact this *more* can't find any sensible comparison standard in this context. On the flip side, asserting the explicit comparative in the same context, as in (30), is perfectly acceptable. With the asymmetry in (29) and (30), it would seem that analyzing the incomplete comparative in (29) as essentially the same as the explicit one is simply on the wrong track.

(29)   John^y didn't read ten books. # Mary read more$_y$ (books).

(30)   John didn't read ten books. Mary read more books than John.

3.2   The proposal

Let's re-think the way the comparative morpheme finds the comparison standard. Instead of taking it as a syntactic argument, *er* takes the comparison standard – both

the correlate and the corresponding degree – as its implicit arguments. These implicit arguments are co-construal with an antecedent, in incomplete comparatives, or with semantic objects introduced in the complement of *than*, in explicit comparatives.

We'll get to the more complicated nature of this co-construal relation later, for now it suffices to to view it as (roughly) fixing the value of free variables. Formally, the poposal is to replace the lexical entry in (27) with the one in (31): co-indexed with a degree variable d' and an individual variable y, this *er* makes comparison to y on its scope function, presupposing its maximal measurement on this function would come out as d'.

(31) $[\![\text{er}_{d',y}]\!] := \lambda f_{\mathsf{d}\to\mathsf{e}\to\mathsf{t}}\lambda x_{\mathsf{e}}.\underline{d' = \mathsf{max}(\{d \mid fdy\})}.\mathsf{max}(\{d \mid fdx\}) > d'$

<div align="right">(to be revised)</div>

As in the Heimian direct analysis, the scope-taking of this *er* is parasitic on the would-be scope of some other operator in the sentence. Exactly which element licenses its use in this way determines the shape of the measure function and therefore the comparison. Take *Mary read more books* for example, assuming English subject takes scope – perhaps a reflection of its standardly assumed movement from a lower θ-position to a higher inflectional projection – *er* can scope over the abstraction of the subject (32), thereby comparing Mary to the alternative individual it introduces, with regard to the amount of books they read (33). This underspecified comparison then gets resolved when we fix the value of the two free variables on *er*. In incomplete comparative, they are co-construal with appropriate antecedents in the priior discourse (34).

(32)   Mary [er$_{d',y}$ $\lambda d \lambda x$ [x read d-many books]]

(33) $\underline{d' = \mathsf{max}(\{d \mid y \text{ read } d\text{-many books}\})}.\mathsf{max}(\{d \mid \mathsf{m} \text{ read } d\text{-many books}\}) > 10$

(34)   John^y read ten$^{d'}$ books. Mary read more$_{d',y}$ (books).

Subject comparison is not the only possible reading of a comparative sentence like this, because the subject is not the only possible scope taker in the sentence. We've seen above that the comparative in *John criticized ten books. He praised more.* has a most salient reading of comparing the amount of books John praised to the books he criticized. This can be derived by having the verb take scope. I assume this movement is triggered by focus marking on the verb, as the intonational stress does seem to shift to the verb in this reading (i.e. *John criticized ten book. He PRAISED more.*)[5]. *er* then takes parasitic scope under *praised*, as in (35). Now the free variable Q that *er* introduces must be type $\mathsf{e} \to \mathsf{e} \to \mathsf{t}$, and we get the targeted reading by co-indexing *er* with an antecedent verb, such as *criticized*.

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5 A scope-taking approach to focus marking has a (seeming) disadvantage in explaining the island-insensitivity of focus association. See Charlow (2014) for a way to make them compatible.

(35) PRAISED [$\text{er}_{d',Q}\, \lambda d\lambda P$ [He P d-many books]]

It should also be possible to compare more than one thing at a time. In the current technical setting[6], this involves (i) relaxing the definition in (31) to allow *er* co-indexed with any number of variables, as in (36); and (ii) successive tucking in in scope taking, as in (37a). In (37a) the focused verb takes scope, then the subject tucks in between the verb and its abstraction, and finally *er* takes scope above the abstraction of the subject. This gives us the desired measurement function: a function that maps a pair of an individual x and a verbal predicate P to the amount of books that x did P to. The comparison we derive is shown in (37b); we resolve the alternative individual to john and the alternative predicate to criticized, in the context of (37c), this turns into the salient reading in this context, which says the amount of books Mary praised is more than the amount of books John criticized.

(36) $[\![\text{er}_{d',y_0,\ldots,y_n}]\!] := \lambda f\lambda x_0\ldots\lambda x_n.\,\underline{d' = \max(\{d \mid fdy_0\ldots y_n\})}.$
$\underline{\max(\{d \mid fdx_0\ldots x_n\}) > d'}$ (final static version)

(37) a. PRAISED [Mary [$\text{er}_{d',y,Q}\, \lambda d\lambda x\lambda P$ [x P d-many books]]]

b. $\underline{d' = \max(\{d \mid yQ\,d\text{-many books}\})}.\,\underline{\max(\{d \mid \text{m read } d\text{-many books}\}) > d'}$

c. John^y criticized^Q ten$^{d'}$ books. Mary PRAISED more$_{d',y,Q}$ (books).

In this picture, the nature of comparative anaphora is the resolution of the standard alternative and its measurement in the discourse. I now turn to explain how this gets us the particular parallelism requirement in incomplete comparatives.

3.3 Theory application

3.3.1 Parallelism in semantics

TRUE CHARACTER and PARALLEL STRUCTURE are semantic restrictions imposed by the meaning of *er*.

The antecedent degree must be associated with a degree character, because it is presupposed to be the maximal measurement of the alternative on the given function. In the examples repeated in (38) - (39), negation has negated the association, making this presupposition impossible to satisfy, as *ten* and *six feet* are not the maximal measurement of anything in the given context. Moreover, the first sentence in (38) and (39) in fact does not imply the existence of any maximal measurement, the comparative sentence thus fails to find any possible antecedent.

(38) John didn't read ten^d book. # Mary read more$_d$ books.

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6 In a dynamicized version of the proposal, none of these additional complications are necessary, nor does the parasitic scope taking of *er* require syntactic tucking-in. See Li (2021) for a sketch.

(39)   John isn't six feet^d tall. # Mary is taller$_d$.

In (40), however, the context does imply a degree with a true character, i.e. the maximal reading amount of John. Following the literature on weak familiarity of definites (cf., e.g., Roberts 2003), I assume something can be an accessible antecedent in a context c as long as its existence is entailed by c[7]. This means John's maximal reading amount is a possible degree antecedent in the local context of *er*; the comparative meaning comes out as (41), both free variables y and d' can find an antecedent that satisfy the presuppositional content, therefore (40) has a felicitous anaphoric interpretation.

(40)   John read many books, possibly more than ten. Mary read even more.

(41) $d' = \max(\{d \mid y \text{ read } d\text{-many books}\}).\max(\{d \mid \text{m read } d\text{-many books}\}) > d'$,
where $y = \text{john}$, $d' = $ John's reading amount

That the character associated with the antecedent degree must be structurally parallel to the target degree also comes from this presupposition, which requires the two degrees to be measurement results of the same function. For an adjectival comparative, the mesurement function is derived inside the noun phrase: let the determiner take scope (cf., e.g., Heim 1982; Barker 1995; Charlow 2020), *er* then takes parasitic scope over the scope of the determiner. With this, in (42a) we derive a function mapping books to their interestingness, and all we look for in the context is an alternative individual with a maximal measurement of interestingness. The intended antecedent *War and Peace* satisfies this requirement, so (42a) is felicitous. On the other hand, there is no way for *er* to take noun phrase internal scope in an amount comparative, because (following Hackl 2000) it is attached to a (parameterized) determiner. Consequently the measurement function is obligatorily derived at the clausal level. For instance, with *er* taking scope immediately under the subject, it is a function mapping an individual to the amount of books they read, as we've seen in (32). Then we must find the maximal reading amount of an alternative individual as the antecedent degree; no such degree is found – the alternative individual is easily *John*, but his reading amount is not given, thanks to negation. Other ways of scoping *more* derives different measure functions, all with a clausal structure. For example, the one derived by *er* taking parasitic scope on the scope-taking of the verb is a function mapping an activity P Mary does to the amount of books that she does P to ($\lambda d \lambda P.\text{m } Pd\text{-many books}$). No given degree is

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7 This kind of implied antecedent arguably does not work for individual pronouns, as shown in Partee's marble example (*One of the marbles are in the bag. ?? It is probably under the sofa.*). In requiring only the existence of a unique referent with the descriptive properties, the standard degree in an incomplete comparative behaves more like a weak definite description than a pronoun.

truthfully the measurement result of any of these functions in this context. Therefore, the comparative in (43) receives no sensible reading here.

(42)   a. John didn't read *War and Peace*. He read [a [er $\lambda d \lambda x$ [x [d interesting book]]].

         b. $\exists x. d' = \max(\{d \mid \text{interesting}(d, y) \wedge \text{books} y\})$.
$\max(\{d \mid \text{interesting}(d, x) \wedge \text{books} y\} > d' \wedge \text{read}(\text{john}, x)$

(43)   John didn't read *War and Peace*. # He/Mary read more books.

3.3.2   Parallelism as pragmatic restriction

PARALLEL PREDICATES comes from pragmatic restrictions on anaphora resolution.

Finding the discourse antecedent of an incomplete comparative is a pragmatic process, and should be constrained by general pragmatic principles. Of particular interest here is the resolved proposition should be a relevant one. Among the various technical ways of defining relevance on the market (cf. Roberts 1996), Lewis' definition based on aboutness with regard to a subject matter can be conveniently adapted to the current setting. I have formalized the definition in (44): subject matters are equivalence relations between possible worlds, things we can intuitively think of as *the 17th century* and *how many stars there are*; a proposition is about a subject matter Q iff its truth supervenes on Q, i.e., whenever Q holds between two worlds w, w' they give the same truth value to this proposition (see also Groenendijk & Stokhof 1984: for similar ideas in question semantics). With this, we can define the pragmatic principle in (45), restricting the anteceent to be one that makes the resolved proposition relevant to a salient subject matter.

(44)   A proposition p is about a subject matter Q iff
$\forall w, w'$ in the context set $: Qww' \rightarrow (pw = pw')$ (cf. Lewis 1988a: page 163)

(45)   *Resolution to a relevant antecedent*
Co-index expressions $A, B, \dots$ with the free variables $x, y, \dots$ in a proposition $p (\dots x \dots y \dots)$ iff this co-indexation makes p about a salient subject matter.

Let's see how this works for *John read two books. Mary read more$_{d, y'}$ (books).* Resolving the two free variables *more* introduces to *John* and *two* results in the proposition that Mary read more books than the amount of books John read, which is two. All the semantic presuppositions of *more* are satified, the only question left to consider is if this proposition is relevant. Absent a larger discourse, it depends on whether we can construct a subject matter this proposition is potentially about. Here this can easily be *people's reading amounts* – any two worlds that agree on people's reading amounts (if John and Mary are included) must also agree on whether Mary read more books than John. The anaphora is felicitous.

Where this relates to PARALLEL PREDICATES is that parallelism in predicate meanings facilitates the construction of such a subject matter. In (46), we can easily construct *John's evaluations of books* as a potential subject matter: any two worlds that agree on John's evaluations surely also agree on whether he criticized more or praised more. Once we replace *praised* with *read*, as in (47), there seems to be no obvious subject matter that this comparison could be about, at least in this kind of out-of-blue context, exactly because of the lack of a common theme.

(46)   John criticized ten books. He praised more.

(47)   John criticized ten books. ?? He read more.

Note that there are at least two kinds of subject matters that an utterance like (47) *is* about, but which shouldn't be used to grant its relevance. The first is the Big Question (Stalnaker 1978), *What is the way things are?*, which is a question demanding a maximally specific list of descriptions of the current situation and therefore is a subject matter that any proposition is about, including (47). And yet, intuitively that does not make every proposition always come off as a relevant one at a given time of a discourse. So the subject matters we use to navigate the discourse must be more specifc than the Big Question. The second kind is its own *whether*-question, e.g. *Whether John read more books than he critcized?*. (47) is obviously about this question, simply because any proposition p is about the question/subject matter of whether or not p. Again, this fact shouldn't make any proposition relevant, so we must be more restrictive; for a truly relevant proposition p we can always find a subject matter different from whether p.

In this view, parallelism in predicate meanings comes from the pragmatic preference to make the comparison about a specific subject matter that is directly related to our immediate concern. Whether such a concern exists is contingent on the context, so it is not surprising that context manipulations can save anaphora with lexically non-parallel predicates. This is what happens with *John found ten coins. Peter lost more.*, in (22) - (23). We've seen that the comparative anaphora to the first sentence is perfectly felicitous when the added context in (23) makes explicit that both finding coins and losing coins are related to managing their coin collections as a team. I've mentioned there that this contextual setting introduces parallelism by introducing a goal and temporarily making both predicates as paths to the same goal. Now we can sharpen our understanding of this process a little more: this context raises *How many coins did they collect?* as a salient subject matter, the comparison between fiinding and losing coins is a relevant one, as any two worlds agreeing on how many coins they collect would agree on whether they find more or lose more. In other words, introducing such a goal *is* introducing a contextually salient subject matter relevant to the comparison[8].

8 In fact, the kind of specific subject matters at play here seems a lot like the so-called *domain goals* in

It's worth to stress, at this point, that although the underlying pragmatic principle should hold for all anaphoric resolutions, the reason it gives rise to PARALLEL PREDICATES is precisely because incomplete comparatives are intepreted as a comparison between *alternatives*, as opposed to comparing to a random degree (set).

4   Dynamicizing the proposal

We have taken *er*'s implicit arguments as unbound free variables. This account becomes shaky when we consider explicit comparatives.

It seems possible to maintain a unified semantics of *er*, in which *er*'s implicit arguments are co-construal with the semantic objects in the complement of *than* in explicit comparatives (48). But what is the nature of these co-construal relations? On the one hand, they look more *semantic* than pragmatic as in incomplete comparatives: the co-construal relations are obligatory when the *than*-P is present, regardless of whether other possible antecedents are available or whether the predicate meanings are obviously relevant. On the flip side, these don't look like the familiar kind of semantic *binding* relation (in, e.g., quantificational binding), which typically requires the bindee to be in the semantic scope of the binder. Here *er* is not in the scope of Op or the overt correlate, and it seems impossible for it to be in the scope of both.

(48)   [[Mary [er$_{d',y}$ $\lambda d \lambda x$ [x read d-many books]]] [than [John Op $\lambda d' \lambda y$ [y read d'-many books]]]]

      a. Op := $\lambda f \lambda x. \exists m = \max \{d \mid fdx\}$

The modification I propose that answers this question involves re-casting the analysis in a dynamic framework. Dynamic semantics (Kamp 1981; Heim 1982: a.o.) allows for the possibility of addressing existentially closed arguments as if they were free variables. With this, we can let the implicit arguments of *er* be indefinite objects; finding a discourse antecedent of this comparative or completing it with a *than*-P are both processes of *speficiation* of these indefinite objects (cf. *existential disclosure* in Dekker 1993). The dynamic entry of *er*, couched in Muskens' CDRT, is in (49)[9]. The subject comparison reading of *Mary is taller*, derived by *er* taking parasitic scope over the abstraction of the subject, is now *Mary is taller than someone*.

(49) $[\text{er}^{n',u'}] := \lambda f \lambda u. \exists u'; \max_{n'}(\exists n'; fn'u'); \max_n(\exists n; fnu); n > n',$

      a. $\max_n(K) := \lambda s. \{i \in Ks \mid \neg \exists h \in Ks : h_n > i_n\}$

      b. $n > n' := \lambda s. \{s \mid s_n > s_{n'}\}$

Roberts (1996).

9 I use ; for dynamic conjunction.

The anaphoric component in incomplete comparatives is specification on the discourse level, which can be formalized into an operator $\mathbb{R}$ (50): it takes a dynamic proposition add a definedness condition on the context update output, requiring the assignments of n' and u' to be identical to these antecedents. When the propositional argument it takes is the underspecfied comparison, n', u are er's implicit arguments and m, v are some antecedent drefs of appropriate types. Subject-sensitivity is also incorporated into the meaning of $\mathbb{R}$ (50a) since its resolution is pragmatic in nature.

(50) $\mathbb{R}_{n',u',m,v,Q} := \lambda m \lambda s.s[m]$, iff $\forall l \in s[m] : l_{n'} = l_m, l_{u'} = l_v, m$ is about Q in s ; undefined otherwise

    a. A dynamic proposition K is about a subject matter Q in an info state s iff $\forall v, v'$ in the context set : $Qvv' \rightarrow (Ks^{w \rightarrow v} \neq \emptyset \leftrightarrow Ks^{w \rightarrow v'} \neq \emptyset)$

In explicit comparatives, the specification of er's implicit arguments is mediated by the standard marker *than*. It does so by being co-indexed with both er and the correlates introduced in its complement (51). Its core meaning, as shown in (52), is just that of $\mathbb{R}$ minus the subject-matter-sensitive relevance condition. Because these co-construal relations are encoded in the lexical meaning of *than*, the comparison standard of an explicit comparative can never be interpreted as anything external to the *than*-P. Since the specification of *than* is lexical and insensitive to subject matters, these co-construal relations hold regardless of the relevance of the comparison – therefore comparing non-parallel predicates (in, e.g., *John read more books than Mary criticized*) is entirely possible in these constructions.

(51) [[Mary [er$^{n',u'}$ $\lambda n \lambda u$ [n read u-many books]]] [than$_{n',u',m,v}$ [John Op $\lambda m \lambda v$ [v read m-many books]]]]

    a. [Op] := $\lambda f \lambda v.\mathbf{max}_m(\exists m; fmv)$

(52) [than$_{n',u',m,v}$] := $\lambda m \lambda s.s[m]$, iff $\forall l \in s[m] : l_{n'} = l_m, l_{u'} = l_v$; undefined otherwise

The definition in (52) implies the syntactic complement of *than* denotes a proposition. Since the proposal is intended to be a uniformed approach to comparatives of all types, it necessitates an ellipsis analysis of *than*-Ps that are not obviously clausal in the surface form (cf. Heim 1985; Lechner 2001, 2004; Bhatt & Takahashi 2007: for arguments defending the ellipsis approach).

5 Wrap-up

I hope to have shown you that we open up a more unified picture of comparative meaning by (i) treating comparatives as comparing two correlates on a given dimension; (ii) taking the comparison standard as implicit arguments of er that are co-construal with other expressions.

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Comparing Alternatives

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