Why Is Attributive "Heavy" Distributive?

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Abstract Schwarzschild (2006, 2011) observes that adjectives like *heavy* are obligatorily distributive when attributive, but not when predicative. He proposes a non-monotonicity requirement on attributive modification which rules out the collective reading: because the dimension of weight is not allowed to be monotonic on the part–whole relation determined by the noun phrase, and a collective reading of attributive *heavy* will be monotonic, only the distributive reading is available. Here, we propose that non-monotonicity *follows* from the independently determined distributivity of certain attributive adjectives. In addition to dimension adjectives like *heavy*, evaluative adjectives like *pretty* also result in obligatory distributive readings when in attributive position, while allowing collective readings when predicative, despite the fact that they are non-monotonic on both readings. Other adjectives, e.g., *numerous*, are collective in attributive position, despite being monotonic. We propose that the requisite distributive reading with attributive *heavy* (and *pretty*) stems *independently* of non-monotonicity, and is due to the particular way the adjective's comparison class is interpreted in the attributive position; the non-monotonicity of attributive *heavy* is then a *consequence* of distributivity.

Keywords Attributive and predicative adjectives
Relative and absolute adjectives · Monotonicity · Distributivity

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1 Attributive Adjectives and Distributivity

Schwarzschild (2006, 2011) observes that while adjectives like *heavy* allow both collective and distributive interpretations in predicative position (1), they are obligatorily distributive when attributive (2):

(1) The (twelve) boxes are heavy.
√ *distributive* (each box is heavy)
√ *collective* (the boxes are heavy as a group, each box may be light)

(2) The (twelve) heavy boxes sat in a corner.
√ *distributive* (each box is heavy)
* *collective* (the boxes are heavy as a group, each box may be light)

We will call this the *attributive* → *distributive* generalization, a name suggested to us by Schwarzschild (p.c.). Schwarzschild's (2006) explanation for the generalization is that there is a non-monotonicity requirement on attributive modification, which rules out the collective reading. Specifically, the adjectival dimension must not be monotonic on the part–whole structure of the noun phrase denotation. A collective interpretation of *heavy* would violate this requirement since the collective weight of boxes necessarily increases or decreases depending on how many boxes ("parts") are in the pile (the "whole"). The distributive interpretation of *heavy* passes the non-monotonicity requirement: the weight of individual boxes does not track the part–whole relation among boxes. Therefore, attributive *heavy* can receive only a distributive reading, the collective reading being ruled out by the requirement for non-monotonicity.

We agree with Schwarzschild that monotonicity plays an important role in adnominal expressions of measure and that attributive adjectives in sentences such as (1) are non-monotonic in the relevant sense.[1] However, we take non-monotonicity to *follow* from the independently determined distributivity of such adjectives. In other words, whereas for Schwarzschild attributive *heavy* in (1) is distributive because it has to be non-monotonic, for us it is non-monotonic, because it has to be distributive.

We suggest that the distributivity requirement follows from the syntax of attributive modification and the semantics of relative adjectives like *heavy*. These are adjectives whose denotation depends on a comparison class—to be *heavy* means to have a weight that exceeds the standard weight determined relative to the weight of a certain set of individuals (Klein 1980; Kennedy 1999, 2007; Rothstein and Winter 2004; Kennedy and McNally 2005; a.o.). We propose that the comparison class of relative adjectives, in both attributive and predicative position, is represented syntactically as a covert pronoun which denotes a predicate of individuals. The comparison class

[1] From now on, for reasons of brevity, when we say that an adjective is (non-)monotonic, we mean that the adjectival dimension is (non-)monotonic on the part–whole relation in the domain given by the noun phrase.

pronoun for the attributive adjective in *heavy boxes* has the same interpretation as the overt comparison class setting PP *for a box,* resulting in an interpretation of the adjective as *heavy for a box*, as in (3). The comparison class denotes a predicate of *atomic* individuals, and thus determines distributivity:

(3) The twelve heavy (for a box) boxes.
√ *distributive* (each box is heavy for a box)
* *collective* (the boxes are heavy for a box)

Predicative relative adjectives instead have the covert comparison class set by context, which allows for the weight of the boxes to be interpreted relative to either a set of boxes (as in the attributive case) or to a set of other contextually relevant entities. Accordingly, both distributive and collective readings are in principle available for predicative relative adjectives.

2 The Syntax of Monotonicity

Schwarzschild (2006) proposes that the interpretation of measure phrases and adjectives varies systematically with their structural position within the nominal phrase. The regulated property of the dimension is (non-)monotonicity on the part–whole relation in the domain given by the noun phrase. Two related constraints link the syntax of expressions of quantity with (non-)monotonicity: certain measure phrases and adjectives are required to be monotonic, while others are required to be non-monotonic.

In (4)–(5), we see how measure phrases can be monotonic or non-monotonic in this respect. The measure phrase is monotonic when plural and in a pseudo-partitive structure, (4), and non-monotonic when singular and attributive, (5). The measured weight of 2 lb is applicable to the group of cherries or to each individual cherry, respectively. In (6)–(7) we see that the monotonicity distinction extends to adjectives as well. "Q adjectives" (cf. Bresnan 1973) such as *much*, in the form of *too much* in (6), measure the total amount of paper (along different dimensions, e.g., weight, volume) and are thus monotonic with respect to the part structure of the noun. They have pseudo-partitive syntax, although this cannot be seen from the surface form. On the other hand, attributive lexical adjectives such as *heavy* in (7) must describe the weight per piece of paper, not the total weight, i.e., they are non-monotonic.

(4) He ate 2 pounds of cherries. [*total weight*]
(5) He ate 2 pound cherries. [*weight per cherry*]
(6) He used too much paper. [*total weight*]
(7) He used heavy paper. [*weight per unit*]

The two constraints regulating (non-)monotonicity explain the unacceptability of expressions like the following (based on Schwarzschild (2006)'s examples (12) and (14)).

(8) *a ring that contains 6 ounce gold

(9) *a ring made of 18 karats of gold

The attributive syntax of the measure phrase in (8) dictates that it should be interpreted non-monotonically, but the wider linguistic structure does not support the non-monotonic weight-per-unit interpretation. Conversely, the pseudo-partitive syntax of the measure phrase in (9) necessitates a monotonic interpretation, but the lexical semantics of the measure phrase does not support a monotonic interpretation since it expresses the dimension of gold purity, a dimension that does not track the part structure of the noun. The empirical generalization is summarized in Table 1.

Schwarzschild (2006) proposes that the relevant syntax behind the interpretative differences discussed above is the position of measure phrases and adjectives relative to a functional head, Mon^0, that determines monotonicity. Plural measure phrases and Q adjectives (pseudo-partitive expressions) merge above Mon^0, and are monotonic, and singular measure phrases and lexical adjectives (attributive expressions) merge below Mon^0 and are non-monotonic. The tree in (10) illustrates Schwarzschild's analysis.

(10)

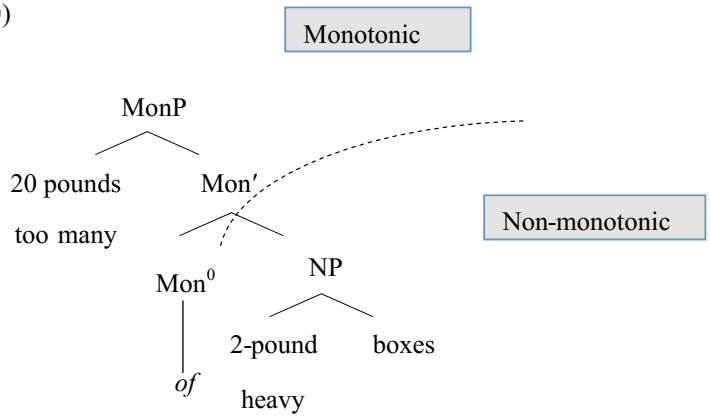

Table 1 Schwarzschild (2006)'s empirical generalization

	MPs and adjectives	Monotonicity
Pseudo-partitive	2 lb, (too) much	Monotonic (total weight)
Attributive	2 lb, heavy	Non-monotonic (weight per unit)

Ordering restrictions support this proposal. Attributive measure phrases and adjectives follow pseudo-partitive measure phrases and Q adjectives, as the following examples demonstrate[2]:

(11) a. He bought 20 pounds of 2 pound cherries.
b. *He bought 2 pound 20 pounds of cherries.

(12) a. He used too much heavy paper.
b. *He used heavy too much paper.

(13) a. He carried 30 pounds of heavy boxes.
b. *He carried heavy 30 pounds of boxes.

[2]Word order is reversed in two particular constructions (see Ionin and Matushansky 2004; Solt 2007), which differs from (13b) in the presence of an article. Notably, the attributive adjective *heavy* has a collective interpretation:

(i) He carried *a* heavy 30 pounds of boxes.

The interpretation here is that the collection of boxes is heavy (the sentence is true even in the case where each box is light, but together the boxes weigh 30 lbs.).

Kayne (2005) shows that a similar construction is possible involving both an attributive and a Q adjective in the reverse linear order (again, note the presence of the article):

(ii) John bought a great many boxes.

On Kayne's account, the adjective modifies a null quantity noun NUMBER, whose pseudo-partitive complement the lexical noun *boxes* is:

(iii) John bought a great NUMBER of boxes.

Extending this account to (i) would yield a null AMOUNT OF:

(iv) He carried a heavy AMOUNT OF 30 pounds of boxes.

We also observe that higher syntactic placement of the attributive adjective results in the return of the collective/distributive ambiguity for dimension adjectives (Ouwayda 2011).

(v) The heavy twelve boxes
√*distributive*
√*collective*

We take this to be a case of the same type of construction as in (i)—note the contrast in (vi)—and so a parallel structure to that of (iv) would be appropriate, as in (vii):

(vi) a. He carried *a* heavy twelve boxes.
b. *He carried heavy twelve boxes.
(vii) He carried a heavy AMOUNT OF twelve boxes.

Such examples are thus not a counterexample to Schwarzschild's generalization.

(14) a. The ring contains too little 18 karat gold.
b. *The ring contains 18 karat too little gold.

In sum, Schwarzschild (2006) establishes that the syntax of adjectives and measure phrases limits the dimension they can express, through the operation of two constraints centered on the property of (non-)monotonicity on the part–whole relation in the domain given by the attributively modified noun phrase.

3 Problems for the Non-monotonicity-Based Account of Distributivity

On Schwarzschild's (2006) proposal, non-monotonicity, an independent constraint on the syntax and semantics of nominal modification, in turn, derives distributivity. Attributive adjectives must occur below Mon^0 and so must be non-monotonic. As far as adjectives like *heavy* are concerned, if they were to be interpreted collectively, they would be monotonic. Therefore, such adjectives need to be interpreted distributively. Crucially, the syntax and semantics of Mon^0 drive the distributive interpretation in attributive position. Non-monotonicity for attributive adjectives is primary, and distributivity follows.

3.1 The Conceptual Issue

Schwarzschild's account unifies empirical observations regarding adjectives and measures phrases in (4)–(14). There is, however, a conceptual issue with the "syntax of monotonicity" as we have called it: non-monotonicity lacks a unitary source, and while the presence of a syntactic head (pseudo-partitive or otherwise) may drive monotonicity, the role of this head in deriving non-monotonicity is a stipulation.

A monotonicity requirement on measure phrases as in (4) and *much* expressions as in (6) is a very natural primitive of grammar. A dedicated functional head in the structure of nominals, when present, may suitably regulate the interpretation of measurement expressions that are merged above it (e.g. *many, much*, *20*, *20 lb*), ensuring that they measure quantities of the substance denoted by the noun in terms of e.g., cardinality, weight, volume, and such quantity measures are necessarily monotonic on the part–whole structure of the noun. This functional head would uniformly preclude the further merge of expressions, whose lexical semantics involves dimensions that do not measure the quantity (e.g. *hot*, *pretty*, *20°C*), as well as distributive adjectives like *heavy*, which do not measure total quantity. In other words, there is a clear role for a syntactic projection to play in regulating quantity measurement and, thus, monotonicity, in the extended functional structure of nominal phrases. This part of the account is simple and conceptually appealing.

There is no corresponding clear conceptual need for regulating non-monotonicity, however. Non-monotonicity does not have a unitary source: for some expressions, it holds because they do not measure quantity (e.g. *hot*, *pretty*); for others, because they measure quantity per unit but not total quantity (e.g. *2 lb*, distributive *heavy*). Moreover, the presence of the functional head in the syntactic structure, in the absence of a need for encoding quantity (e.g. *hot coffee*) has to be stipulated.

The link between syntax and semantics could easily be different: a functional head like Mon^0, when merged in the nominal structure, ensures monotonicity as a consequence of the measurement of quantity of the substance denoted by the noun; then, in its absence (or while computing the semantics of the structure below Mon^0), interpretations could be either along monotonic or non-monotonic dimensions. Indeed, this is what we think the grammar of nominal modification looks like, as argued for in Sect. 4.

3.2 Empirical Issues I: pretty, strong *and* expensive *versus* noisy *and* successful

In addition to the conceptual question in Sect. 3.1, there are also empirical issues with the proposal that a requirement for non-monotonicity drives distributivity. This proposal only concerns expressions of quantity, so any obligatory distributivity of evaluative adjectives would have to have a different source. Adjectives like *pretty, strong,* or *expensive* do not provide a measure of quantity; accordingly, they are non-monotonic, whether interpreted distributively or collectively. For example, if we add more paintings to a room, even pretty paintings, the collection of paintings will not necessarily become more pretty. In fact, exactly the opposite might occur, if the paintings clash with one another. Similarly for *expensive*: adding more bagels does not necessarily make a bag of bagels more expensive, as we know from expressions such as *two for the price of one* and *a baker's dozen*. Cost and quantity are not reliably linked. This is why, as Schwarzschild (2006) correctly predicts, **30 dollars of bagels* is not well-formed.[3]

If *pretty, strong,* and *expensive* specify a non-monotonic dimension, then they should allow a collective reading in attributive position, because a collective reading will also be non-monotonic. Yet, such adjectives are necessarily distributive when

[3]We note, however, that a search of *Corpus of Contemporary American English* Davies (2008) reveals several such examples. The presence of the expected *worth* (e.g., *fifty-dollars-worth of gas*) is apparently optional.

(i) Mindy reached back and removed a pony tail holder, unleashing ninety dollars of pink perm.

(ii) He said he didn't feel like burning fifty dollars of gas looking for a forty dollar truck.

(iii) Carlos selects five dollars of slow jams on the jukebox and they dance in the dim light of the empty poolroom.

attributive, much like *heavy*, while allowing a collective interpretation when predicative.[4]

(15) Context: Ugly pieces of gravel come together to form a beautiful mosaic.

a. #The pretty rocks formed a mosaic.
b. The rocks in this mosaic are pretty.

(16) Context: Each child is too weak to carry the piano alone, but together they are strong and are able to carry it.

a. #The strong children carried the piano.
b. The children carrying the piano are strong.

(17) Context: there is a sale at Noah's Bagels on Larchmont and all the bagels are very cheap. I try to stop my friend from buying a lot of bagels:

a. #We can't afford all these expensive bagels.
b. We can't afford all these bagels. They will be expensive.

Clearly, a requirement for non-monotonicity cannot be driving the distributive interpretation of *pretty, strong,* and *expensive* in attributive position. An independent factor must require the distributive interpretation in attributive position, while allowing a collective reading in predicative position. This raises the possibility that the same factor may be at play in the case of *heavy.*

It is worth remembering that not all attributive adjectives are distributive. Adjectives like *noisy* and *successful* allow both collective and distributive readings (Landman 2011); they remain ambiguous in attributive position. The following examples illustrate that attributive *noisy* and *successful* can be interpreted collectively.

[4] Jessica Rett (p.c.) observes that when (17b) is in the present tense (*They are expensive*) the distributive reading is the only available reading. We agree that there is a difference between the present and the future in this respect, although the collective reading is not completely ruled out under our intuitions. We don't know why the future allows a collective reading more easily than the present.

Table 2 Distributive generalization for two types of persistently non-monotonic adjectives (*pretty* vs. *noisy*) and adjectives of variable monotonicity (*heavy*) in attributive position

Attributive adjective	Collective?	Distributive?
heavy	* (monotonic)	✓ (non-monotonic)
pretty, strong, expensive	* (non-monotonic)	✓ (non-monotonic)
noisy, successful	✓ (non-monotonic)	✓ (non-monotonic)

(18) Context: Each child speaking in a hushed voice leads to a very noisy classroom.

The noisy children bothered the teacher.

(19) Context: The children attempt to carry a bookshelf on their own and fail; later they manage to do it together.

The successful children carried the bookshelf up the stairs.

Like *expensive, strong,* and *pretty*, *noisy* and *successful* specify dimensions that are non-monotonic on the part-whole structure of the nouns they modify or are predicated of. Taken on their own, these adjectives are not a counterexample to Schwarzschild's proposal, which only regulates the interpretation of dimensional adjectives.[5] Yet, if a requirement for non-monotonicity were behind the distributive interpretation of *heavy* in attributive position, all of these non-monotonic adjectives would behave the same, i.e., all would allow collective readings. Something else must be responsible for the different behavior of *expensive, strong* and *pretty,* whose collective reading is blocked in the attributive position, and of *noisy* and *successful,* whose collective reading remains available (Table 2).

3.3 Empirical Issues II: numerous, plentiful, *and* sparse

A seemingly direct counterexample to the "attributive → distributive" proposal is presented by *numerous* (as noted by Schwarzschild 2006). Similar in meaning to *many*, it measures quantity, it is clearly monotonic on the part–whole relation determined by the noun phrase, and yet, it is not banned from the attributive position by its monotonic and collective interpretation.

(20) a. The numerous boxes sat in a corner.
b. The many boxes sat in a corner.

[5] We use the term "dimensional" to refer to a subset of relative adjectives. Dimensional adjectives are associated with quantity scales such as length, weight, size. They come in antonym pairs, e.g., *tall–short, wide–narrow, heavy–light*, and the positive dimensional adjectives can typically be modified by conventional measure phrases: *6 ft tall, 4 cm wide.* "Evaluative" adjectives like *pretty, expensive, strong, lazy* are also relative, but they are linked to quality scales, and often to more than one scale and so they don't all have single antonyms, and they also are not associated with conventional measure phrases. See Bierwisch (1989).

It is possible, of course, that *numerous* in (20a) is only apparently attributive but in fact has the pseudo-partitive syntax claimed for *many* in (20b). If *numerous* is merged above Mon^0, like *many* in (20b) is said to, its monotonicity would be expected. But there is no evidence that the syntax of *many* and *numerous* is the same. Unlike *many, numerous* does not allow overt partitive complements:

(21) a. many of the boxes
b. *numerous of the boxes

The fact that *numerous* cannot appear in an overt partitive structure corresponds to its lacking a proportional reading altogether, unlike *many*, which is known to have a cardinal and a proportional reading (Partee 1989), similarly to determiners like *some*, *several,* and numerals.[6]

(22) a. Many boxes sat in the corner.
√ *cardinal* (there was a great number of boxes in the corner)
√ *proportional* (a great number of the boxes were in the corner)
b. Numerous boxes sat in the corner.
√ *cardinal* (there was a great number of boxes in the corner)
* *proportional* (a great number of the boxes were in the corner)

Kayne (2005) notes two further differences between *many* and *numerous*, which reveal that *numerous* behaves like lexical adjectives and unlike the "Q"-adjective *many*. First, *numerous* does not allow its NP to be missing:

(23) Many linguists like phonology, but many don't.

(24) *Numerous linguists like phonology, but numerous don't.

(25) *Good linguists like phonology, but bad don't.

Second, *numerous* does not combine with degree determiners like *as*/*so*/*too*/*how* in argument positions. In this respect, it behaves like lexical adjectives and unlike *many*.

(26) a. Too many linguists like syntax.
b. The linguists who like syntax are too many.

(27) a. *Too numerous linguists like syntax.
b. The linguists who like syntax are too numerous.

(28) a. *Too intelligent/young/good linguists like syntax.
b. The linguists who like syntax are too intelligent/young/good.

The adjectival morphology of *numerous* also puts it at odds with "Q adjectives" like *many*, not only in English, but also in other languages. In Bulgarian, the counterpart of *many* does not have adjectival inflection and does not show agreement with the

[6] As noted by Partee (1989), in the presence of *the* (as in (20b)), *many* only has a cardinal reading. The same is true for *several* and numeral determiners.

Table 3 Distributive generalization for obligatorily collective monotonic adjectives (e.g., *numerous*) and adjectives of variable monotonicity (*heavy*) in attributive position

Attributive adjective	Collective?	Distributive?
heavy	* (monotonic)	✓ (non-monotonic)
numerous, plentiful, sparse	✓ (monotonic)	*

noun, whereas the counterpart of *numerous* does, just like all attributive adjectives. Because *mnogo* "many" does not inflect for gender and number, the definite article is the default 3sg in (29a), while it is plural in (29b, c).

(29) a. mnogo-to deca
many-the.3sg children
'the many children'

b. mnogo-broj-n-i-te deca
many-number-adj-pl-the.pl children
'the numerous children'

c. šum-n-i-te deca
noise-adj-pl-the.pl children
'the noisy children'

The above considerations may not be conclusive as to the attributive syntax of *numerous* but they are certainly suggestive, and in the absence of evidence in favor of pseudo-partitive syntax for *numerous*, they raise a question for the link between attributive syntax and the non-monotonicity based account of distributivity.

Issues also arise with near-synonyms *plentiful* and *abundant* when interpreted to mean "present in great quantity", and with their antonyms *sparse* and *scarce.* They all have collective interpretations, can be used attributively, but are monotonic, in the case of *sparse* and *scarce* inversely, on the part–whole structure of the noun. The adjectives also have other, non-monotonic, interpretations, which are not of concern here. The following examples (obtained through a Google search) illustrate the collective interpretation of attributive *plentiful* and *sparse*:

(30) Try one of these unusual summer recipes to make the most of your plentiful peaches.

(31) The winds whipped and howled through the sparse trees and branches snapped, whole trunks ripped apart, …

Clearly, as the number of peaches increases, so does their "plentifulness"; the more trees there are, the less sparse they are. Yet, despite their monotonicity, the collective adjectives *plentiful* and *sparse* are acceptable in the attributive position (Table 3).

In sum, there are empirical and conceptual reasons to reject the proposal that non-monotonicity underlies the obligatorily distributive interpretation of attributive adjectives like *heavy* in *heavy boxes.* In the remainder of the paper, we seek to explain the necessary distributivity of such attributive adjectives without invoking non-monotonicity as the cause. The distributive interpretation of dimension adjectives such as *heavy* when it modifies nouns like *boxes* is indeed non-monotonic, as observed by Schwarzschild (2006, 2011), but as a *consequence* of distributivity, not as its *reason*.

4 Proposal: Non-monotonicity Is a *Consequence* of Distributivity

We propose that the different syntax of attributive modification and predication has consequences for the interpretation of relative adjectives with respect to the setting of their comparison class. This then derives the requisite distributivity of *heavy* as a modifier of plural count nouns, which, in turn, leads to a non-monotonic reading (*heavy boxes*). The account also predicts the distributivity of attributive *pretty*, while placing no distributivity requirement on attributive *noisy, plentiful* and *numerous.* Predicative relative adjectives have a different syntax leading to a different interpretation of the comparison class, and the resulting meaning imposes no requirement for distributivity on *heavy* and *pretty*.

4.1 Attributive and Predicative Relative Adjectives and Comparison Classes

Relative adjectives such as *tall, heavy, expensive, pretty* have an interpretation that is dependent on a comparison class (Klein 1980; Kennedy 1999, 2007; Rothstein and Winter 2004; Kennedy and McNally 2005; a.o.), a set of objects that contain varying degrees of the property denoted by the adjective. Compatibility with a *for*-phrase is a commonly used test to distinguish relative adjectives from absolute gradable adjec-

tives such as *empty, wet, clean*.[7] The *for*-phrase expresses overtly the comparison class.[8]

(32) These bottles are heavy for wine bottles.

(33) ??These bottles are empty for wine bottles.

Importantly, in the case of attributive adjectives, the comparison class is restricted by the denotation of the modified noun phrase, whereas with predicative adjectives the comparison class has a more general interpretation (Higginbotham 1985: 563).[9,10]

[7]It has been argued that absolute adjectives also depend on a comparison class (van Rooij 2011; Toledo and Sassoon 2011) but not of the kind that can be expressed by a *for*-phrase as the one in (32)–(33). On Toledo and Sassoon's (2011) account, absolute adjectives have a comparison class comprised of counterparts of the individual of which the adjective is predicated. Such a "counterpart" comparison class is incompatible with the extensional category generally referenced by *for*-phrases such as *for a wine bottle*. *For*-phrases that can co-occur with absolute adjectives have different form, and according to Toledo and Sassoon, reference individual counterparts (see (i) and (ii), Toledo and Sassoon's 2011: ex. (24), (25)).

(i) Well, Jones isn't angry compared to anyone else, he's just angry for JONES!

(ii) For a Friday, the dentist's schedule is very full.

[8]Different types of *for*-phrases may combine with gradable adjectives, not all of them expressing a comparison class (see Bylinina 2012). Other tests to distinguish between relative and absolute adjectives are discussed in Kennedy and McNally (2005), Kennedy (2007), Toledo and Sassoon (2011).

[9]Ludlow (1989) also notes that predicative adjectives can have a comparison class that is more general than the denotation of the NP of the subject of predication. This is particularly clear in cases like (i), which, read generically, cannot limit the comparison class to elephants.

(i) Every elephant is large.

He also notes a contrast with cases when the domain of quantification is restricted: in (ii) the comparison class is most naturally interpreted as being limited to elephants.

(ii) All of the elephants are large.

What matters to us is that predicative adjectives allow wider settings of their comparison class, as in (i), in contrast to attributive adjectives, where the comparison class is fixed by the modified NP.

[10]We do not discuss here nonlocal *for*-phrases as in (i) (from Schwarz 2010). The challenge with such examples is to determine how the comparison class set by the overt *for*-phrase interacts with the implicit comparison class associated with the positive attributive adjective.

(i) Mia has an expensive hat for a 3-year old.

(34) That is a heavy chair.

That is a chair, and it is heavy for a chair

(35) That chair is heavy.

That chair is heavy (for an entity not necessarily a chair; maybe a piece of furniture or another entity relevant to context)

We take this contrast between the attributive and predicative use of relative adjectives to be the key to understanding the different interpretations of *heavy*: this adjective is necessarily distributive in attributive position (*heavy boxes*) because its comparison class is fixed by the denotation of the NP (*heavy for a box*); however, both distributive and collective readings are available in predicative position (*The boxes are heavy*) because the comparison class is not necessarily limited by the NP of the subject (*heavy for a box*) but may be more general (*heavy for an entity*), with the collective reading allowed by the latter interpretation of the comparison class.

Before we turn to the details of the analysis, we address an objection to the contrast in (34)–(35). Kennedy (2007) disputes the claim that the attributively modified noun phrase necessarily determines the comparison class, and he gives examples like (36) [his ex. (16)] in support of his argument.

(36) Kyle's car is an expensive BMW, though it's not expensive for a BMW. In fact, it's the least expensive model they make.

We think that there is a difference between proper names and common nouns in this respect—we find a similar effect with a *rich Texan, an old Stradivarius*—and that the difference is encoded in syntax. Specifically, we suggest that the nominal phrase in (36) is, in fact, *an expensive BMW car*, with the overt proper name BMW modifying a covert NP *car*.[11] The comparison class for the attributive adjective is interpreted based on the covert NP, with or without the restrictive overt modifier: *expensive* {*for a BMW car/for a car*}. Kennedy's example is a case of the latter: the phonologically null NP without the overt modifier sets the comparison class. The same phenomenon is found with adjectival modifiers of overt NPs (from Ludlow 1989):

(37) This is a large European butterfly.

(*large for a European butterfly; large for a butterfly*)

[11] De Clercq (2008) discusses agreement patterns in object-denoting proper names used as common nouns (PUCs), as in (i), which is based on a personal proper name, and (ii), which is based on a brand name.

(i) She bought a Picasso.

(ii) There is a Danone in the fridge.

De Clercq notes that German provides evidence for the underlying presence of a common noun in PUCs as the article varies in gender depending on the gender of the non-overt noun:

Thus we maintain the validity of the contrast observed by Higginbotham (1985), despite the challenge presented by Kennedy (2007). We propose that the more restricted interpretation of the comparison class of attributive relative adjectives is behind their obligatory distributivity.

4.2 *Syntax/Semantics of Comparison Classes: Parallels Between Positive and Superlative Adjectives*

It has often been suggested that the comparison class is represented in the positive form of relative adjectives covertly, either as an argument of the positive degree quantifier or as a restriction on the adjective itself (e.g., Bartsch and Vennemann 1972; Cresswell 1977; von Stechow 1984; Kennedy and McNally 2005; Kennedy 1999, 2007; a.o.). Here we represent the comparison class as a covert pronoun, *C,* which is the first argument of a degree determiner POS, which then combines with relative adjectives.[12] The adjectival projection of the positive form of the adjective is complete after the merge of POS, an existential quantifier over degree intervals, which contributes the interpretation that the contextual standard is exceeded. The structure behind the relative adjective *heavy*, in both its attributive and predicative uses, is as in (38).

(iii) Sie kauft eine/ *einen/ *ein Bosch [~~Machine~~].
she buys a_{Fem} a_{Masc} a_{Neut} Bosch machine$_{Fem}$
'She buys a Bosch washing machine.'

(iv) Es gibt noch *eine/ einen/ *ein Danone [~~Becher~~] im Kühlschrank.
it gives still a_{Fem} a_{Masc} a_{Neut} Danone container$_{Masc}$ in-the fridge
'There's another Danone yougurt left in the fridge.'

(v) Ich habe *eine/*einen/ ein Picasso [~~Gemälde~~] gekauft.
I have a_{Fem} a_{Masc} a_{Neut} Picasso$_{Masc}$ painting$_{Neut}$ bought
'I bought a Picasso painting.'

In Belgian Dutch the article in such cases is invariably masculine, agreeing neither with the proper name nor with the likely underlying common noun. This complicates the analysis of the morphosyntax of the null expression that De Clercq posits, but for our purposes the details are immaterial, since we are focusing on the semantic effects.

[12]In McKinney-Bock (2013) the comparison class is introduced by a DEG head that is separate from POS. The advantage of this proposal is that the same POS can be used in combination with relative and absolute adjectives. We have made the simplified move to have a single quantifier, POS. Furthermore, on McKinney-Bock's account, the covert comparison class-denoting argument is a syntactically complex expression, a *for*-phrase with an elided NP, whose content is recovered under identity with the attributively modified noun phrase, i.e., it is a case of ellipsis resolution. As our goals in this paper are different, we do not adopt this particular proposal, but we note that it would be compatible with our account of attributive relative adjectives. We also note that there are several counterarguments to the (abstract) POS morpheme (Rett 2015), and our account of attributive relative adjectives does not depend on the existence of the morpheme POS; the formal weight could be carried in another way.

(38) $[_{AP}[\ \text{POS}\ C]$ heavy]

The interpretation proceeds as follows. Gradable adjectives denote functions from degree intervals to predicates of individuals, (39).[13] Overt comparison class setting *for*-phrases, as in (32), are standardly taken to denote predicates of type <*e*,*t*> (Kennedy 2007; Bale 2011; Schwarz 2010; a.o.). Accordingly, we will assume that covert *C* also denotes a predicate of individuals (though we will qualify the meaning of *C* and of *for*-phrases further). A *C* that represents a comparison class of boxes has the same interpretation as the overt comparison class setting PP *for a box*, (40). POS in combination with *C* introduces the standard of comparison and the positive measurement. S in (41) is a function that sets the standard degree relative to the comparison class *C* and context *c*. For a discussion of the separate contribution of the comparison class and of POS to the context sensitivity of gradable predicates, as well as for how the standard degree is chosen, see Kennedy (2007).

(39) $[\![\text{heavy}]\!] = \lambda D_{<d,t>}.\ \lambda x.\ x\text{'s weight} \in D$

(40) $[\![\text{for a box}]\!] = \lambda x\ .x$ is a box (to be modified later)

(41) $[\![\text{POS}]\!] = \lambda C_{<e,t>}.\lambda G_{<dt,et>}.\lambda x\ .\ \exists D[G(D)(x) \wedge \forall d\ [d \in D \rightarrow d > S_{(C,c)}(G)]]$

Then, the composition of the adjectival phrase *heavy*, with an implicit comparison class a (characteristic function of a) set of boxes, is as follows:

(42) $[\![\text{POS}\ C\ \text{heavy}]\!] = \lambda x\colon \text{box}(x).\ \exists D[\text{heavy}(D)(x) \wedge \forall d\ [d \in D \rightarrow d > S_{(\text{box},c)}(\text{heavy})]]$

The interpretation of the covert pronoun *C* is constrained by the LF syntax of POS in accordance with a presupposition associated with POS. Here we draw an analogy with the treatment of comparison classes in superlatives (see also Schwarz 2010). As with positive adjectives, superlative adjectives are interpreted relative to a comparison class that can be covertly or overtly specified, see (43)–(44).

(43) Mary is tall (for a first-grader).

(44) Mary is the tallest (of the first-graders).

Following Heim (1999), the comparison class in the case of superlatives is grammatically represented as a covert predicate variable, introduced by the superlative quantifier *-est,* as in (45). The LF syntax of *-est* partly determines how that variable

[13] We use interval semantics following McKinney-Bock (2013), although this is not crucial for our argument.

is interpreted, because the presuppositions associated with *-est* constrain the values of its three arguments.[14]

(45) $[\![\text{-}est]\!] = \lambda C_{<e,t>} .\lambda G_{<dt,et>}.\ \lambda x_e\ .\exists D[G(D)(x) \wedge \forall y\ [C(y) \wedge\ y \neq x \rightarrow \neg G(D)(y)]]$
defined iff (i) C(x), and (ii) $\forall y\ [C(y) \rightarrow \exists D\ [G(D)(y)]]$

Of particular relevance for us is the fact that the interpretation of superlative adjectives varies between the attributive and predicative positions. Let's consider first the syntax/semantics of attributive superlative adjectives. In (46) *-est* and its restrictor *C* QR locally to adjoin to the NP within the superlative DP. The presuppositions of *-est* require that all members of the comparison class, including *-est*'s individual argument, are arguments of the gradable predicate, thus fixing the comparison class to the set of first-graders. This set can then be further contextually restricted, e.g., to the set of first-graders in a contextually relevant school.

(46) the tallest first-grader
a. $[_{DP}$ the $[_{NP}$ [*-est C*] $[_{NP}$ *D*-tall first-grader]]]
b. $[\![C]\!] = \lambda x.\exists D$ [*x* is a *D*-tall first-grader]

Importantly, the content of the predicate variable *C* is resolved internally to the superlative DP, based on the denotation of the NP (first-grader), before being further restricted pragmatically. The LF syntax places an upper limit on what *C* can denote: in (46) it cannot be *elementary students,* or *students,* i.e., (the characteristic function of) a set that properly contains the set of first-graders. We suggest that the same mechanism is at play in the case of attributive positive adjectives. The POS quantifier QRs together with its restrictor *C* to an NP-adjoined position within the DP, see (47). The content of *C* is determined based on the LF position of POS in accordance with the presuppositions in (48), which are the same as the ones associated with *-est.* Accordingly, the denotation of the attributively modified NP limits the interpretation of *C* to the predicate *first-grader*; *C* is then subject to further contextual restriction.

(47) the tall first-grader
a. $[_{DP}$ the $[_{NP}$ [POS *C*] $[_{NP}$ *D*-tall first-grader]]]
b. $[\![C]\!] = \lambda x.\exists D$ [*x* is a *D*-tall first-grader]

(48) $\text{POS}(C, G, x)$ is defined iff (i) C(x), and (ii) $\forall y\ [C(y) \rightarrow \exists D\ [G(D)(y)]]$

We emphasize that the comparison class is constrained in a uniform way in positive and superlative attributive adjectives—a desirable result—and is determined in both cases by the denotation of the attributively modified NP in accordance with the LF syntax and presuppositions of the POS and *-est* degree quantifiers.

[14]The lexical entry in (45) is from Heim (1999), updated to work with the interval semantics for gradable adjectives we assume here.

Turning to superlative adjectives in predicative position, the comparison class *C* is not syntactically restricted and is set purely contextually; therefore, it is less constrained (provided the presuppositions of *-est* are satisfied). In (49) the lexical semantics of *tall* determines that *C* is a set of individuals. It is further restricted to the set of relevant individuals in a given context, and one very natural interpretation is the set of relevant first-graders, though this is not the only interpretation.

(49) The first-grader is (the) tallest.

a. The first-grader is [[-*est C*] [$_{AP}$ *D*-tall]]

b. $[\![C]\!] = \lambda x.\ \exists D$ [*x* is a *D*-tall individual]

In the case of positive predicative adjectives, the comparison class variable is resolved in a similar way. In (50) the comparison class is a set of individuals, which is further restricted, possibly but not necessarily to a contextually relevant set of first-graders.

(50) The first-grader is tall.

a. The first-grader is [[POS *C*] [$_{AP}$ *D*-tall]]

b. $[\![C]\!] = \lambda x.\ \exists D$ [*x* is a *D*-tall individual]

We thus derive the distinction between attributive and predicative adjectives noted by Higginbotham (1985).

4.3 The Role of Genericity

A final note on the determination of the comparison class is in order. The examples discussed in this section all had a singular NP determine the comparison class. But of central concern to us is the interpretation of attributively modified plural NPs (*heavy boxes*). A plural NP is true of both plural and singular individuals (e.g., Sauerland and Yatsushiro 2005; a.o.), so the expectation is that the members of the comparison class *C* will also be singular and plural individuals. Indeed, Fitzgibbons et al. (2008) develop a semantics for superlatives that relies on a comparison class that can include singularities and pluralities.[15] Yet we suggest that the comparison class in the case of positive adjectives is restricted to singular individuals.

At this point is important to consider an observation made by Graff (2000) that interpreting positive adjectives relative to a comparison class is not an extensional phenomenon. As she points out, if it happens to be the case that all and only basketball players are golfers, it is not true that anyone who is tall for a golfer is tall for a basketball player. She thus notes that comparison classes for positive adjectives do

[15] A pragmatic restriction to singularities has been suggested by Stateva (2005) for distributive readings of plural superlatives (e.g., the interpretation of *John and Bill are the tallest students* as *Each of John and Bill is taller than any other (relevant) student*). Plural superlatives also allow group readings, perhaps less saliently, see Fitzgibbons et al. (2008).

not just contribute sets; they need to contribute a kind. Indeed, looking closer at the overt PPs that express the comparison class with positive and superlative adjectives, we note that *for a first-grader* in (43) evokes a prototypical, generic, first-grader, unlike *of the first-graders* in (44) which references actual first-graders. Applying Graff's "all and only basketball players are golfers" example to superlatives confirms this distinction: the tallest golfer is also the tallest basketball player. So, whereas so far we have treated the comparison class in positive and superlative adjectives as the same, we now see that they diverge. Both are limited by the denotation of the NP the adjectives modify, but whereas the comparison class for superlative adjectives is a predicate of ordinary (token) individuals (singular and plural), the comparison class for positive adjectives is generic in reference.

Consider again the form of the overt comparison class denoting *for*-phrases. The nominal they contain is either an indefinite singular (e.g., *for a first-grader* in (43)) or a bare plural (e.g., *for wine bottles* in (32)). These are forms that appear in characterizing generics, i.e., generics that express generalizations over individuals, as in (51)–(52).[16]

(51) A tiger has stripes.

(52) Tigers have stripes.

Accounts of characterizing generics vary in detail (see Leslie and Lerner 2016 for a recent discussion). We will assume for the sake of concreteness that characterizing generics express normative generalizations about the prototypical or normal members of the kind (Heyer 1990; Nickel 2008; a.o.).[17] What is particularly important for our purposes is that prototypical members are singular individuals. We have a concept of a

[16]The other types of generic sentences are direct kind predications, in which indefinite singulars cannot participate, as in (i)–(ii).

(i) The tiger is extinct.
(ii) Tigers are extinct.

The nominal phrases in direct kind predications (definite singulars and bare plurals) are standardly assumed to denote kinds, while the nominal phrases in characterizing generics (indefinite singulars and bare plurals) are assumed to denote predicates restricting a generic operator. Because definite singulars cannot occur in comparison class denoting *for*-phrases (e.g., ** for the first-grader*) we assume that the bare plurals that do occur (e.g., *for wine bottles*) are characterizing generic nominals rather than kinds. This is important because direct kind predications may express collective generalizations, as in (i)/(ii) and (iii)/(iv):

(iii) Bees form colonies.
(iv) The bee forms colonies.
(v) *A bee forms colonies.

[17]A reviewer notes that prototypicality may not quite be the notion we need, given that not all NPs have prototypes, citing as examples "male nurse", "non-Methodist", "resident". We acknowledge that this is a complex issue, but ultimately it is not essential for us to resolve: whatever notion

prototypical tiger, a jewelry box, or a cardboard packing box, but not of a prototypical plurality of tigers or boxes. The generic interpretation of the NP in *for*-phrases results in the interpretation of the comparison class as a predicate of singular individuals. We continue to assume that the covert variable *C* has the same interpretation as a *for*-phrase.

(54) is a reasonable approximation of the meaning of an overt *for a box* (or *for boxes*) and a *C* derived on the basis of an NP *box* or *boxes.*[18]

(53) $[\![\text{for a box}]\!] = \lambda x.\ x$ is a prototypical member of the box-kind

The interpretation of the comparison class as (the characteristic function of) a set of singular individuals is of central importance to deriving the distributive interpretation of attributive adjectives like *heavy*: *heavy boxes* is interpreted as *boxes that are heavy for a prototypical box,* which is necessarily distributive.

4.4 Attributive and Predicative heavy

We now have the necessary ingredients to derive the obligatory distributivity of attributive *heavy.* The interpretation of the null pronominal *C* ensures distributivity: it is not *heavy* alone that combines with *boxes* in (2) but an expression interpreted as *heavy for a box*, i.e., the constituent in (42), see (55). This is so because the NP *boxes* constrain the comparison class, and the comparison class needs to be a set of singular individuals that are members of the box-kind.

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best captures the semantics of characterizing generics is what is involved in comparison classes of relative adjectives.

Additionally, the same reviewer points out the following intuition.

(i) Context: I have never seen the dragon fruit before. This afternoon, my friend offered me a piece. I tried it and found it tasty. So I reported to you:
"This afternoon I ate a tasty dragon fruit."

In this example, the speaker has never had an experience of eating dragon fruit before, and so has no concept of a prototypical dragon fruit. The reviewer suggests that the comparison class in the above example is not restricted to the denotation of the NP, but instead to the speaker's experience of eating foods (other than dragon fruit).

We agree with the intuition in (i). At first, this appears to challenge Higginbotham's generalization that attributive adjectives are interpreted relative to the head noun, but we believe this is not the case. Given the context in (i), the sentence is only felicitous when the adjective has a pitch accent/ is focused. Adjectives with focus are interpreted relative to other comparison classes than the default, possibly because they are in higher position within the nominal phrase (McKinney-Bock 2013, see also footnote 1), and so for focused adjectives like *heavy* the collective reading returns.

[18] Since POS presupposes that its individual argument is a member of the comparison class, see (48), prototypicality will be ascribed to that argument by the presupposition.

(54) the heavy boxes

a. $[_{DP}$ the $[_{NP}$ [POS C] $[_{NP}$ D-heavy boxes]]]

b. $[\![C]\!] = \lambda x.\exists D$ [x is a D-heavy prototypical box]

Because attributive and predicative relative adjectives have different LF syntax, the interpretation of the covert comparison class pronoun varies in attributive and predicative position, resulting in the distinction noted by Higginbotham (1985) as well as in differences with respect to distributivity. The content of C is set by the context of utterance, provided the individual argument of POS is a member of that set, following (48). The comparison class may be set with respect to the NP of the subject, *boxes,* resulting in a distributive reading. Alternatively, it may be construed in more general terms as making reference to prototypical objects other than boxes, in which case the predication may be understood collectively, e.g., the weight of the pile of boxes is compared to contextually relevant prototypical entities. Both collective and distributive readings are therefore available in predicative position.

(55) The boxes are heavy.

a. The boxes are $[_{AP}$ [POS C] $[_{NP}$ D-heavy]]

b. $[\![C]\!] = [\![$ *for a box* $]\!] = \lambda x.\exists D$ [x is a D-heavy prototypical box]

c. $[\![C]\!] = [\![$ *for an entity* $]\!] = \lambda x.\exists D$ [x is a D-heavy prototypical entity]

We can confirm that it is indeed the comparison class which drives the distributivity of *heavy* by considering the effect of the overt *for*-phrase in (57): here, predicative *heavy* no longer allows a collective reading.

(56) The boxes are heavy for cardboard boxes.

√ *distributive* (each box is heavy)

* *collective* (the boxes are heavy as a group, each box may be light)

The consequence of this proposal is that the interpretation of the comparison class of attributive relative adjectives like *heavy* derives their distributivity. Once distributive over plural count nouns, non-monotonicity follows.

4.5 Obligatorily Distributive Attributive pretty

In Sect. 3.2, we demonstrated that Schwarzschild's account predicts *pretty* (as well as *strong, expensive*) to be either collective or distributive in attributive position, as it is persistently non-monotonic. However, empirically, these adjectives remain obligatorily distributive. When monotonicity is primitive, and derives distributivity, the obligatory distributivity of a non-monotonic adjective such as *pretty* remains a mystery. Under our account, the constraint on the collective reading can be derived from the interpretation of the comparison class in attributive position, predicting

heavy and *pretty* to pattern together empirically, as *pretty* is also interpreted relative to a comparison class. Then, non-monotonicity arises for *heavy* from a syntactico-semantic configuration that is already distributive. The lexical semantics of *pretty* ensures non-monotonicity in the first place.

(57) the pretty rocks

a. $[_{DP}$ the $[_{NP}$ [POS C] $[_{NP}$ D-pretty rocks]]]

b. $[\![C]\!] = \lambda x.\exists D$ [x is a D-pretty prototypical rock]

The analysis is unified for adjectives such as *pretty* as well as *heavy*: the syntax and semantics of the comparison class leads to a distributive reading in attributive position, which then gives rise to non-monotonicity in case the lexical semantics of the adjective is not already strictly non-monotonic.

4.6 Collective numerous

Section 3.3 showed several tests that suggest that *numerous* does not have the syntax of the Q adjective *many,* to which it is very similar in meaning, but patterns in many ways like an attributive adjective. *Numerous*, however, shows the reverse pattern of the other attributive adjectives discussed here, as it is obligatorily collective as well as monotonic, like *many* (as noted by Schwarzschild 2006). The same holds for *plentiful* and *sparse*.

We suggest an analysis of adjectives like *numerous* that captures Schwarzschild's insight that the syntax of measurement correlates with monotonicity. However, as in our earlier proposal, the interpretation of the comparison class derives monotonicity, just as it derives non-monotonicity with attributive *heavy*. We account for collective, monotonic *numerous* with a syntax that is distinct from that of *many*, and is instead similar to that of an attributive relative adjective like *heavy* in *heavy boxes*. We propose that *numerous* composes with POS and a comparison class, like attributive *heavy*, but that the comparison class for *numerous* is not of the kind denoted by the *for*-phrases we discussed in previous sections. Indeed, there seems to be a correlation between a comparison class over prototypical individuals and relative adjectives, excluding other classes of adjectives. As (59) suggests, *numerous* cannot combine with such an overt *for*-phrase, not being a relative adjective.[19]

(58) ??The boxes were numerous for boxes.

[19]The *for*-phrases that appear with *numerous* are of the type that are licensed with absolute adjectives as well, as we discussed in footnote 7. Consider (i) and (ii).

(i) For a Friday, there are numerous visitors to the dentist's office.

(ii) Well, Jones' mistakes are not numerous compared to anyone else's, they are just numerous for JONES!

We take *numerous* to differ in the type of measure function it incorporates, see (60). The collective, monotonic reading of *numerous* comes from the cardinality dimension, which tracks pluralities of individuals.[20]

(59) $[\![\text{numerous}]\!] = \lambda D_{<d,t>}.\ \lambda x.\ |x| \in D$

(59) is an approximate semantics, as *numerous* likely requires a plurality measured along a cardinality dimension that is not necessarily precise. In (60), the cardinality described by *numerous* is large, but there is no expectation that the exact number of protestors is known.

(60) The numerous protesters overwhelmed the counter-protesters.

In the positive form, the *D*-argument of *numerous* is saturated by the degree quantifier POS combining with a comparison class. Like gradable adjectives, *numerous* has attributive syntax. [POS *C*] undergoes QR DP-internally. However, the implicit comparison class is not a predicate of individuals, but of degree intervals (e.g., Penka to appear, on the comparison class for *many*). We don't have a more principled explanation for this distinction between the comparison class for *numerous* and relative adjectives, but at least it follows the observed pattern of distribution of *for*-phrases over prototypical individuals—prohibited with *numerous* but allowed with *heavy*,

[20] *Numerous* predicates only over pluralities, and to the extent that it allows distributive readings it distributes to sub-pluralities that are non-atomic. Champollion (2015) claims that sum predicates have distributive readings with numerous (a judgment that is not shared by several speakers who we consulted):

(i) All the committees were numerous.
'The committees each had a large number of members'

Additionally, a Google search returns several hits that contain both *many* and possibly distributive *numerous*.

(ii) No one signed me up for the company I started, the kids I had, or the many numerous committees I decided to join.

However, several other results show that *numerous* can co-occur with *many* in a context that is clearly not distributive.

(iii) One of the many numerous waterfalls on the beautiful Klondyke track.

(iv) Meanwhile Fyre led Chota and Lynx to where they could find eggs in the many numerous nests that could be found in the tree tops.

(v) Atown in the Northern Virginia/Fairfax/DC area commonly referred to as Koreatown because of the many numerous Korean stores, restaurants, and karaeoke [sic] bars.

Here, *numerous* seems to be modifying a dimension of density or frequency (according to our intuitions about these sentences). The stores are both many in number and numerous because they occur in clusters (and the same for nests in trees, or waterfalls along a hiking track).

and it also reflects the essential semantic similarity between *numerous* and *many*, in that neither is concerned with prototypical individuals but with pluralities.[21] See (62) for details of the syntax and semantics of attributive *numerous*.

(61) the numerous boxes

a. $[_{DP}$ the $[_{NP}$ [POS C] $[_{NP}$ D-numerous boxes]]]

b. $[\![C]\!] = \lambda D.\exists x$ [x is D-numerous]

(62) $[\![\text{POS}]\!] = \lambda C_{<dt,t>} . \lambda G_{<dt,et>}. \lambda x. \exists D [G(D)(x) \wedge \forall d [d \in D \rightarrow d > S_{(C,c)}(G)]]$

There are several arguments in the literature that demonstrate syntactic differences between (pseudo-partitive) *many* and *numerous*, and we have provided these and more in Sect. 3.3, and pointed to empirical support treating *numerous* as attributive rather than pseudo-partitive.[22] If *numerous* has attributive syntax in modifying *boxes*, as we have suggested here, then it is indeed a counterexample to the "attributive → distributive" proposal, as it is collective and monotonic.

4.7 noisy, successful, *and the Behavior of Nonlocal Adjectives*

Recall in Sect. 3.2 that *noisy* and *successful* can be interpreted collectively when attributive. The mystery is in comparing these adjectives to *pretty*: why is the collective reading available with *noisy*, but not *pretty*? Both *pretty*-type attributive adjectives and *noisy*-type attributive adjectives are non-monotonic, and both appear in the overt attributive (lower, non-pseudo-partitive) position. One possible explanation is that *noisy/successful* are not interpreted relative to the same type of comparison class as relative evaluative adjectives like *pretty*, *strong,* and *expensive*.

We would like to note an interesting parallel between the collective and distributive readings of *noisy/successful* with the nonlocal, adverbial readings of frequency adjectives. Turning to the classic observation by Bolinger (1967) regarding occasional sailors, we observe that *noisy/successful* share only the external/adverbial reading under a collective reading.

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[21] On the semantics of *many* see Rett (2014), Solt (2015), a.o.

[22] Although, *plentiful* and *sparse* can also appear in a pseudo-partitive structure, as revealed in the following examples.

(i) That is a plentiful number of peaches that we have picked.

(ii) The sparse number of trees in the landscape made the yard look like a desert.

This raises the possibility that there is an analysis of *numerous* as well where it realizes a pseudo-partitive structure with a null NUMBER (a la Kayne 2005).

(63) An occasional sailor strolled by.

a. Occasionally, a sailor strolled by. EXTERNAL /ADVERBIAL
b. Someone who sails occasionally strolled by. INTERNAL

(64) Context: Each child speaking in a hushed voice leads to a very noisy classroom.

The noisy children bothered the teacher.

a. Noisily, the children bothered the teacher.
b. #The children who are noisy bothered the teacher. (each child is a noisy child)

(65) Context: Each child attempts to carry a piano on their own and fail; later they manage to do it together.

The successful children carried the piano.

a. Successfully, the children carried the piano.
b. #The children who are successful carried the piano. (each child is a successful child)

The internal (b)-readings parallel a distributive reading for *noisy children*, while the external/adverbial (a)-readings parallel the collective reading. We take the comparison class for *noisy* and *successful* to come from the event taking place, rather than from the noun that it modifies.

(66) a. noisy for an event of whispering children EXTERNAL/ADVERBIAL
b. noisy for children INTERNAL

Morzycki (2014) describes several properties of adjectives that have both internal and external/adverbial readings, which he calls "non-local" adjectives. In particular, the external/adverbial readings of nonlocal adjectives resist either strong quantificational determiners or all quantificational determiners, and for such readings to arise the adjective needs to be adjacent to the determiner, cannot be coordinated with other adjectives, and cannot be modified by intensifiers such as *very*. *Noisy* and *successful* pattern with other nonlocal adjectives. In the following examples, the external/adverbial reading is unavailable (shown explicitly in (67), but carries over all of (67)–(70)).

(67) a. Every/some/several/two noisy child(ren) bothered the teacher.
= Every child who was noisy bothered the teacher.
≠ Noisily, every child bothered the teacher.
b. Every/some/several/two successful child(ren) carried the piano.
= Every child who was successful carried the piano.
≠ Successfully, every child carried the piano.

(68) a. The angry noisy children bothered the teacher.
b. The overjoyed successful children carried the piano.

(69) a. The noisy and angry children bothered the teacher.
b. The successful and overjoyed children carried the piano.

(70) a. The very noisy children bothered the teacher.
b. The very successful children carried the piano.

We believe this pattern may be suggestive of a deeper link between adjective position and monotonicity. In particular, the high, nonlocal scope of the adjective sets a comparison class which includes a plurality of children *within an event* (of whispering in a classroom, etc.). Rather than comparing individual entities, the comparison class is now comparing events whose participants are whispering children. The comparison class seems to be a set of alternative stages of an event, much like *for*-phrases like *full for a Tuesday* (Toledo and Sassoon 2011). Here, the external/adverbial reading involves quantifying over the frequency of an event over time, and the extension of the comparison class is a set of events. The scope of the nonlocal reading appears to be directly related to how the comparison class, C, can be resolved. Here, we note this interesting parallel, though we leave the details of such a proposal linking the comparison classes of nonlocal adjectives with those of absolute adjectives to future work.

5 Final Remarks: Attributive Modification of Mass Nouns

The interpretation of heavy in combination with collective mass nouns, or "multiparticipant nouns," like *traffic*, and "mixed participation" nouns like *jewelry*, *luggage*, or *furniture* (see Schwarzschild 2011) poses a problem for the link between attributive syntax and the semantics of non-monotonicity and distributivity. The attributive adjectives modifying such nouns appear to be interpreted collectively. If distributed over the participants in traffic, individual vehicles, *heavy* can only be interpreted along the dimension of weight, clearly not the intended meaning in (72), where *heavy* has the dimension of density (of vehicles). In the case of *jewelry*, weight is a possible dimension, and (73) allows a collective reading of *heavy* along the weight dimension (as well as a distributive reading, unlike *traffic*). Each individual piece of jewelry can be light, but their collective weight heavy. Under the quantity reading, only an apparently collective reading is possible.

(71) The heavy traffic was unbearable.

(72) The heavy jewelry weighed down the bride.

Furthermore, in (72)–(73), *heavy* is monotonic: the more traffic there is and the more jewelry a bride wears, the higher the degree of heaviness (whether measured in terms of density, weight, or quantity).

The availability of only the collective interpretation in the case of multiparticipant nouns (e.g., *traffic*) is supported in part by the fact that such nouns do not combine with "stubbornly distributive" predicates such as *large* or *big* (Schwarzschild 2011).

(73) *The traffic is large/big.

In contrast, the mixed participant noun *jewelry* in (73) does allow *large/big* to modify the size of individual participants in the jewelry, which is also the interpretation in (75), which patterns like the stubborn distributivity in (76) with singular count nouns. A reading concerning the collective quantity is unavailable in (75) and (76).

(74) The jewelry/luggage is large/big.

(75) The boxes are large/big. (distributive only)

Recall that the question for Schwarzschild's account of monotonicity is how attributive *heavy* can ever have a monotonic (and collective) reading—the reading observed with *heavy traffic* and also possible with *heavy jewelry*. We have so far derived distributivity and non-monotonicity via a comparison class which is a predicate over atomic individuals, which at first glance does not extend to mass nouns. We sketch one possible direction here.

We take the locus of an analysis of *heavy traffic* and *heavy jewelry* to be dependent upon the structure of the noun phrase, which, in turn, affects the interpretation of the comparison class, just as we have done so far. The crucial difference lies in the meaning of the NP. Following the N-State Hypothesis from Schwarzschild (2011, 2015), all nouns are one-place eventuality predicates. The extension of a count noun is a predicate of single participant states (e.g., *a box* is a predicate true of states that have a box as a single participant), the extension of a mass noun like *traffic* is a predicate of states with multiple participants (e.g., vehicles in transit), and the extension of a mass noun like *jewelry* is a predicate of states.

In the case of *heavy traffic*, *C,* rather than being a predicate over individuals, would be a predicate over states with multiple participants (participants in the traffic-state). The monotonic, apparently collective reading comes about because of the multiplicity of participants in the singular traffic-states that constitute the comparison class. In other words, the spirit of our account is preserved—the comparison class of attributive *heavy* is determined by the denotation of the NP it modifies, and the comparison class is a predicate of singulars, though instead of individuals they are states.

Turning to *heavy jewelry,* the basic approach will be the same. The comparison class is set with respect to the denotation of the NP, which following Schwarzschild (2011) is a predicate of mixed-participation states. Jewelry-states can have multiple participants or single participants (intuitively, *jewelry* is true of single pieces of jewelry as well as a collection of such pieces). Accordingly, the comparison class can be a set of *jewelry*-states with single participants, yielding a distributive (and non-monotonic) reading of *heavy jewelry,* where *heavy* is true of each piece of jewelry, or the comparison class can be a set of *jewelry*-states with multiple participants, resulting in a collective (and monotonic) reading of *heavy jewelry.*

This approach, based on the N-State Hypothesis, can be extended to the plural count nouns we discussed earlier (e.g., *heavy boxes*). *C,* rather than a predicate of individuals, would be a predicate of states with single participants. Obligatory distributivity is then derived. As Schwarzschild (2011) notes, a distributive reading involves quantification over events with a single participant in a given role.

6 Conclusion

We proposed an account that derives the obligatory distributive interpretation of attributive adjectives like *heavy*, observed by Schwarzschild (2006), from the interpretation of the comparison class of relative adjectives in attributive position. Attributive relative adjectives were argued to compose with a degree head POS that selects for a covert comparison class variable, which denotes a predicate of atomic individuals and is fixed by the denotation of the attributively modified NP (i.e., *heavy boxes* is interpreted as *boxes that are heavy for a box*). This determines the obligatory distributivity of such adjectives. Non-monotonicity of *heavy* then follows as a consequence of distributivity. Evaluative relative adjectives like *pretty*, whose collective interpretation is non-monotonic with respect to the part structure of plural nominals, but is nevertheless disallowed in attributive position (e.g., *pretty paintings*), are also explained naturally on our account, since such adjectives too have a comparison class set by the denotation of the attributively modified NP (e.g., *pretty paintings* is interpreted as *paintings that are pretty for a painting*). Additionally, a class of exceptions to the "attributive → distributive" generalization, and its links to non-monotonicity follows naturally from our account.

On the account we have proposed here, Schwarzschild (2006)'s insight about the requirement for measure phrases and Q adjectives to be monotonic on the part-whole relation determined by the NP is preserved. There is no non-monotonicity requirement on attributive adjectives, however. The non-monotonicity of attributive *heavy* as a modifier of plural NPs is derived from its distributivity rather than being a primitive of grammar.

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