FRIEDERIKE MOLTMANN

THE SEMANTICS OF *TOGETHER*[*]

The semantic function of the modifier *together* in adnominal position has generally been considered to be that of preventing a distributive reading of the predicate. On the basis of a new range of data, I will argue that this view is mistaken. The semantic function of adnominal *together* rather is that of inducing a cumulative measurement of the group that *together* is associated with. The measurement-based analysis of adnominal *together* that I propose can also, with some modifications, be extended to adverbial occurrences of *together*.

Together is an expression that can act both as an adnominal modifier, as in (1a), and as an adverbial one, as in (1b) and (1c), and in the two positions it exhibits rather different readings:

(1) a. John and Mary together weigh 200 pounds.
b. John and Mary together earn more than 100, 000 dollars a year.

(2) a. John and Mary are writing a book together.
b. John and Marysang together.
c. John and Mary sat together.

The function of *together* in adnominal position as in (1a,b) has usually been taken to be that of an antidistributivity marker and in adverbial position as specifying collective or cooperative action (2a,b) or spatiotemporal proximity (2c). As always, the preferred analysis would be one that posits a single lexical meaning of *together* and derives the various readings from that meaning in conjunction with the syntactic and semantic context in which *together* occurs.

The present account, which is trying to achieve that, takes as its point of departure a reevaluation of the apparent antidistributive reading displayed by *together* in adnominal position. I will argue that the function of adnominal *together* is in fact not that of preventing a distributive reading of the predicate, but rather that of inducing a cumulative numerical

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measurement of the group *together* relates to, e.g. in (1a) a measurement in terms of weight and in (1b) a measurement in terms of income. With an appropriate generalization of the notion of measurement (from a mapping of entities to numbers to a mapping of entities to events) the account can be carried over to the readings *together* displays in adverbial position, as well as to certain additional readings of adnominal *together*. What kind of measurement will be induced – that is, what kind of reading *together* will display – will depend on the measure function that is semantically accessible in the syntactic context in which *together* occurs.

This measurement-based analysis of adnominal *together* also provides a new motivation for Generalized Quantifier Theory. In order for adnominal *together* to enforce a cumulative-measurement reading of the predicate, the denotation of the NP with *together* needs to be construed as a set of properties (namely those properties able to provide a cumulative measurement). Further support for the quantifier status of NPs with *together* comes from the fact that such NPs exhibit just the same scope restrictions as quantificational NPs that share the same monotonicity properties.

I will first introduce a number of new observations about *together* in adnominal position and formally elaborate the measurement account of adnominal *together*. I will then more briefly show how the account can be carried over to adverbial *together* and certain other readings of adnominal *together*, as well as to the related expression *alone*.

1. Adnominal *Together*

1.1. *Some Generalizations and Previous Accounts*

First some syntactic remarks about adnominal *together*. Even though *together* in (1a) could potentially modify either the VP or the NP, there is evidence that *together* in that position always relates to the subject, rather than the VP. First of all, it is easy to see that *together* can be adjoined to the subject. *Together* must be in adnominal position in coordinate NPs as in (3a), complex NPs as in (3b), and cleft constructions as in (3c):

(3) a. John and Mary together and Bill alone weigh 200 pounds.
b. The weight of John and Mary together exceeds 200 pounds.
c. It was John and Mary together who solved the problem.

Second, it appears that in between subject and VP, *together* exhibits the same readings as when it occurs in a syntactic context where it must be adjoined to the subject, namely before auxiliaries, as in (4):[1,2]

(4) John and Mary together have lifted the piano.

Let me henceforth call an NP modified by *together* a *together*-NP.

Generally, the semantic function of *together* in adnominal position has been taken to be that of preventing a distributive reading of the predicate. The antidistributive function of adnominal *together* seems to be supported by the observation that the predicate must allow for both a distributive and a collective reading in order to be compatible with adnominal *together*.

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[1] Thus, it appears that adverbial *together* patterns together with VP-internal adverbs like *fast* (occurring after the finite verb), rather than adverbs that could be adjoined to the VP such as *quickly* or floated *both*:

(i) a. John and Mary both/quickly left the room.
b. * John and Mary fast left the room.
c. John and Mary left the room fast.

For some speakers, floated quantifiers and *together* can occur in postcopular position before the verb:

(ii) a. # John and Mary have together lifted the piano.
b. John and Mary have both read the poem.

In this position, however, *together* and *alone* always yield exactly the range of readings of adnominal, rather than adverbial *together* and *alone*.

The phenomenon exhibited by (ii) seems to be related to the one found with floated quantifiers:

(iii) John and Mary have each lifted the piano.

There are two views one might take. First, the NP originates inside VP and leaves the modifier behind (Sportiche 1988). Second, the NP and the modifier are base-generated where they are, but the modifier (as an adverbial) may be linked to the NP so as to be interpreted as a modifier of the NP, rather than the VP. In this paper, which is a semantic than a syntactic investigation, I remain neutral on this matter.

[2] Bayer (1993) notes that *together* can occur in between a subject-relative pronoun and the VP and takes this as evidence that *together* in between subject and VP can be adverbial:

(i) It was John and Mary who together lifted the piano.

However, the evidence shows that *together* in (i) may very well be adjoined to the pronoun, as in (ii):

(ii) Concerning John and Mary, they together certainly would make a nice couple.

Thus, *together* seems impossible with obligatorily distributive predicates, as in (5), or with obligatorily collective predicates, as in (6):

(5) a. # John and Mary together are asleep.
b. # The two houses together are red.

(6) a. # John and Mary together are married.
b. # John and Mary together are unrelated.

Generally the readings of adnominal and adverbial *together* do not overlap. This can simply be seen from the fact that when adverbial *together* in (2a,b,c) is put into adnominal position, the results are degraded, as in (2′a,b,c). Also, when adnominal *together* as in (1a,b) is put into adverbial position, the sentence becomes bad, as in (1′a), or it means something different, as in (1′b) (which implies that John and Mary are paid as a couple):

(2′) a. # John and Mary together are writing a book.
b. # John and Mary together sang.
c. # John and Mary together sat.

(1′) a. # John and Mary weigh 200 pounds together.
b. John and Mary earn more than 100,000 dollar a year together.

There are a number of proposals in the literature to account for the antidistributive effect of adnominal *together*, namely Bennett (1974), Hoeksema (1983), and Schwarzschild (1992, 1994). The governing idea of those proposals is that adnominal *together* has the function of enforcing a nondistributive reading of the predicate; that is, the contribution of *together* to the sentence meaning consists in the following, where < is the relation between members and groups to which they belong:[3]

(7) $[\text{NP } \textit{together} \text{ VP}] = 1 \rightarrow \forall d(d < [\text{NP}] \rightarrow \neg\, d \in [\text{VP}])$

Bennett (1974), Hoeksema (1983), and Schwarzschild (1992, 1994) present different technical elaborations of (7). I will not go into the details of these proposals and their differences, but rather focus on the general problems faced by an account of *together* as an antidistributive marker. One such problem is that such an analysis does not provide a way of accounting for adverbial *together* (rather, it imposes or would have to impose an ambiguity on *together*). Another, more severe problem is that the characterization of

[3] See Link (1983), Lasersohn (1989), Roberts (1987), and Moltmann (1997a) among others for treatments of distributivity.

the semantic effect of adnominal *together* as antidistributive appears to be mistaken. This will be discussed at great length in the next section.

In Moltmann (1997a,b, 1998) I tried to give a unified account of adnominal and adverbial *together* (and related expressions such as *alone*) within a semantics based on situations and the notion of an integrated whole. Even though I now reject that account for adnominal *together*, some crucial features of it will be carried over to the extension of the new measurement-based analysis of adnominal *together* to adverbial occurences.

The fundamental idea of my earlier account was that *together* always expresses a property of entities in situations (or a relation between entities and situations), namely the property of being an *integrated whole in* a situation. Only a rather simple notion of integrity was required for *together*, according to which an entity is an integrated whole just in case it consists only of parts that are all related to each other by some relevant relation and none of its parts is related to an entity that is not one of its parts. The different readings of *together* then arise because the situations are different to which *together* applies. For adnominal *together*, it was assumed that the *together*-NP is evaluated with respect to certain situations (reference situations) that will not be able to include the information content of the predicate. When *together* holds of a group in such a situation (whose information content will be almost empty), it can only specify that the group is conceived as an integrated whole. There is a purpose, though, to specifying a group as a conceived integrated whole, and that is that this will prevent a distributive reading of the predicate. As on most accounts, the distributive reading of a predicate involved quantification over the parts of the relevant group argument (either by means of a distributivity operator or as part of the lexical meaning of the predicate). Crucially, a general condition, the 'Accessibility Requirement', was posited (and independently justified) according to which a quantifier can range over the parts of a group in a (reference) situation only if the group is not an integrated whole in that situation. In short, adnominal *together* enforces a collective reading of the predicate by requiring the group argument to be conceived as an integrated whole in the reference situation.

The account has much greater plausibility for adverbial *together*, which, as we will see later, displays various readings depending on the nature of the predicate, or rather the event described by the predicate. In adverbial position, the situation *together* applies to is one only containing information about the described event. For a group to be an integrated whole in such a situation, its parts must be connected to each other by a relation involving that same event, and moreover, for that purpose, the event must be an integrated whole. If the event is a group activity, it has integrity if the group members interact with each other or the subactivities bear some other relation to each other (e.g., being about the same thing). In the case of static predicates, the described event can hardly have integrity in another way but by being a state that is (more or less) continuous in space and time (see section 2).

Even though this account meets the general condition that the readings of *together* be derived from a single underlying meaning and the semantic and syntactic context in which *together* occurs, there are serious problems with it. First, it requires assumptions about situations that lack very strong independent motivations besides the semantics of adnominal *together* and related expressions: situations are required not only for the evaluation of individual NPs, but will also have to form a component of an argument of a predicate. Second, the account makes the truth conditions of sentences dependent on acts of conceiving entities referred to in a certain way (as integrated wholes). However, the truth conditions of sentences – including those with adnominal *together* – are independent of whether anyone has conceived of anything in any way. Thus, (1a) is true even in a world in which no one conceives of the group of John and Mary as an integrated whole, as long as their weight is in fact 200 pounds. The main problem for the account, however, as for all the previous proposals concerning the semantics of adnominal *together*, is that it is based on wrong empirical generalizations concerning adnominal *together*.

1.2. *A New Generalization Concerning Adnominal* Together

Together in adnominal position behaves differently from an antidistributivity marker in several ways:

1. Adnominal *together* is not acceptable with just any predicate allowing for both a distributive and a collective reading.
2. When it is acceptable, it does not always yield the ordinary collective reading of the predicate.
3. Adnominal *together* is possible also with certain predicates that only have a collective reading.

The predicates in the examples below are among numerous ones that clearly have both a distributive and a collective reading, but are impossible with *together* modifying the subject:

(8) a. # John and Mary together are paid monthly.
b. # John and Mary together have applied for a grant.
c. # John and Mary together were carrying the box.
d. # John and Mary together are writing an article.

These predicates contrast with the following, which do allow for adnominal *together*:

(9) a. John and Mary together are paid 100,000 dollars per year.
b. The boxes together weigh 100 pounds.
c. The paintings together are worth 10 million dollars.

What distinguishes the predicates in (9) from those in (8)? As seen by comparing (8a) and (9a), it is hardly the nature of the event described by the verb that matters, nor does tense or aspect seem to play a role. Rather, what distinguishes the predicates in (9) from those in (8) is that they involve some numerical measurement, expressed by a measure phrase. It appears that this measurement is the 'focus' and licencer of *together*. The contribution of *together* then is to specify that adding up the measurements of the members of the group yields the measurement expressed by the measure phrase. For example, what *together* in (9a) says is that adding the wages of John and of Mary per year amounts to 100,000 dollars. Note that the way (9a) is understood shows that the function of adnominal *together* is truly different from that of triggering a collective reading: (9a) implies that John and Mary are paid individually rather than collectively.

Just a few words about the notion of measurement (cf. Suppes and Zinnes 1963; Krantz et al. 1971). Measurements serve to represent certain empirical properties and relations among objects. They involve an empirical system, consisting of a domain D and relations $R_1, \ldots, R_n$ or operations $O_1, \ldots, O_n$ involving elements in D and a numerical (representation) system, consisting of a subset of the real numbers R and relations $R_{1'}, \ldots, R_{n'}$ involving elements in R. A measure function is a mapping from D to R that preserves the relations $R_1, \ldots, R_n$ and operations $O_1, \ldots, O_m$: it is a homomorphism between $(D, R_1, \ldots, R_n)$ and $(R, R_{1'}, \ldots, R_{n'})$; that is, if for $x_1, x_2 \in X$, $x_1\ R_i\ x_2$, then $f(x_1) R'_i f(x_2)$ for $i \leq n$. Thus, the measure function of weight w preserves the relation 'is heavier than' among the numbers assigned to objects, in virtue of these numbers being ordered by the relation $<$. That is, if a is heavier than b, then $w(b) < w(a)$.

If will assume roughly the account of Link (1983) and related work on the semantics of definite plurals and NP conjunctions. That is, besides individuals the domain of entities includes groups, obtained by sum formation from the individuals, which will serve as the semantic values of definite plural NPs. *John and Mary* will refer to the group consisting of John and Mary. Individuals and groups in the domain thus form a set D, which is closed under sum formation $\vee$; that is, if $d \in D$ and $d' \in D$, then $d \vee d' \in D$ (and moreover, if $D' \subseteq D$, $D' \neq \emptyset$, then $\sup_<(D') \in D$ – the least upper bound of D' with respect to $<$, the relation 'is a proper part of').

The relevant measure functions for our purposes are functions that preserve the operation of group formation $\vee$, by representing it in terms of the operation $+$ on the elements in a numerical system; that is, they are functions w from the structure $(D, \vee)$, closed under the operation $\vee$, to $(R, +)$ with R being a set of real numbers closed under the operation of addition $+$, such that for entities a, b, $c \in D$, if $c = a \vee b$, then $w(c) = w(a) + w(b)$. Functions such as those measuring weight, size, or the number of members (parts) can fulfill this condition only, however, if they apply to nonoverlapping entities, that is, if they are 'additive measure functions' as defined in (10), where $\circ$ is the relation of (mereological) overlap (cf. Krifka 1990):

(10) A measure function f is additive iff $\neg\, x \circ y$ & $f(x) = n$ & $f(y) = m \rightarrow f(x \vee y) = n + m$.

With this notion of additive measurement, the semantic function of *together* in the examples in (9) can be described as follows. *Together* ensures that the measurement (specified by the measure phrase) is that of the entire group and, moreover, that it is the sum of the measurements of the group members.

In a first approximation, the lexical meaning of *together* can be construed as an (intensional) relation TOGETHER that holds (relative to a world and a time) between a group d, an additive measure function f, and a measuring entity n just in case f applied to yields n:

(11) For an additive measure function f from the structure $(D, \vee)$, for a set of entities D, to the structure $(R, +)$, for a set of real numbers R, for any world w and time t, and entities $d \in D$ and $n \in R$, $< d, n, f > \in$ TOGETHER^{w,t} iff $f(d) = n$.

The logical form of (9a) can now be simply given as in (12), where (λx [earn(x)]) is the function mapping entities to what they earn (in dollars) and $j \vee m$ the sum of John and Mary:

(12) earn 100,000 dollars $(j \vee m)$ & together $(j \vee m, 100{,}000, \lambda x[\text{earn}\,(x)])$

The first conjunct of (12) gives the meaning of (9a) without *together*, whereas the second conjunct represents the specific semantic contribution of *together*. That is, (12) states that the group of John and Mary earns 100,000 dollars (individually or together) and that the sum of the earnings of John and the earnings of Mary amounts to 100,000 dollars.

I will come to a more explicit analysis of adnominal *together* below. First some further empirical evidence that measurement is in fact involved in the semantics of adnominal *together*. It comes from the behavior of NPs with *together* when modifying another NP. It appears that nouns are subject to the same restrictions as predicates when they take NPs with *together* as a modifier. Thus, the head nouns in (13) allow for both collective and distributive readings with respect to an *of*-phrase, but they cannot be modified by an *of*-phrase with *together*:

(13) a. # The work of John and Mary together is about history.
b. # The singing of John and Mary together is beautiful.
c. # the invitation of John and Mary together
d. # the trip by John and Mary together

The reason obviously is that the head nouns in (13) do not express measurement. By contrast, those in (14) do, and thus accept NP-modifiers with *together*:[4]

(14) a. the weight of the boxes together
b. the earnings of John and Mary together
c. the worth of the ten paintings together

However, if an NP with a *together*-NP as modifier does not itself refer to some measurement, but modifies another NP that does, then also acceptability results. This can be seen from the contrast between (13a) and (15a), as well as the one between (13c) and (15b) and the one between the examples in (16) and those in (17):

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[4] One might think that the examples in (14) should have the analysis in (ib), rather than (ia):

(i) a. the weight of [the boxes together]$_{NP}$
b. the [weight of the boxes]$_{NP}$ together

But there are good indications that the analysis in (ia), at least for the examples in question, is right. First, *together* can generally only specify sum formation as in (iia), not addition as in (iib), as would be required for a number-denoting NP like (14a):

(ii) a. John and Mary together are a nice couple.
b. ?? 4 and 5 together are 9.

Second, an NP with *weight* as a head noun does not seem to take *together* in the first place, as can be seen from the unacceptability that results when *the boxes* is put into specifier position:

(iii) ?? the boxes' weight together

Finally, note that on the analysis in (ib), it should be possible to extract the complement NP without *together*, but that is in fact impossible:

(iv) * [Of which boxes]$_i$[did John write down the[weight t_i]together].

(15) a. the amount of work of John and Mary together
b. the number of invitations of John and Mary together

(16) a. # the children of John and Mary together
b. # the books of John and Mary together

(17) a. the number of children of John and Mary together
b. the amount of books of John and Mary together

In isolation, (16a) (with *together* modifying *John and Mary*) and (16b) are unacceptable even though the head noun would allow for either a distributive or a collective reading with respect to *John and Mary* – again evidence that adnominal *together* is not an antidistributive marker.

The examples in (13) become acceptable not only when modifying another NP that refers to a measurement, but also with particular types of predicates, namely precisely those predicates that would be possible with *together* modifying the subject – that is, predicates that express measurement:

(18) a. # The children of John and Mary together are young.
b. # The children of Sue and Mary together are in the room.

(19) a. The children of John and Mary together outnumber those of Bill and Sue together.
b. The children of John and Mary together are too many to fit into the car.

(20) a. # The books of John and Mary together are interesting.
b. # The books of John and Mary together are heavy.

(21) a. The books of John and Mary together are enough to fill a shelf.
b. The books of John and Mary together weigh more than 500 pounds.

Sentences (19a) and (19b) as well as (2la) and (21b) are acceptable, obviously, because the predicates express measurement. In these cases, the measure function is expressed in part by the VP, but also in part by the head noun of the subject. That is, in (19a) and (19b) the measure function is the function mapping individuals to the number of their children. Compositionally, the measurement correlate is not associated with the VP, but with the VP together with the content of the head noun – that is, the measure function is now to be obtained by composing the function expressed by the head noun with the measure function that is part of the meaning of the VP.

Thus, for (21b) the measure function would be defined as in (22a) (meant as weight in pounds), so that the logical form of the entire sentence would be as in (22b):

(22) a. For any object d, $f(d) =$ the weight of(the books of(d))

b. weigh(the x[books(x) & of(x, $j \vee m$)], 500) & together($j \vee m, n, f$)

1.3. *The Relation of the Measure Function to the Content of the Predicate*

The way the measure function and the measuring entity that *together* takes as its argument relate to the content of the predicate is often more indirect than (11) might suggest, and in fact an inspection of a wider range of cases will require a slight modification of (11).

It is easy to see that the predicate need not specify a particular measurement. A quantified measure phrase will do:

(23) a. John and Mary together are paid a lot.

b. John and Mary together earn more than 100,000 dollars a year.

In these cases, the measure phrase only expresses a property of measurements, rather than naming a particular measurement.

Other cases where no particular measurement is mentioned explicitly are the excessives in (24) and indexicals as in (25):

(24) a. John and Mary together are too heavy.

b. Even John and Mary together are not rich enough.

(25) John and Mary together are not that heavy.

Moreover, predicates comparing measurements are acceptable that do not mention any particular measurement at all, as we have seen with *outnumber* in (19a), and as we can see with the comparatives below:

(26) a. John and Mary together are heavier than Sue.

b. John and Mary together are richer than Bill.

A predicate acceptable with *together* not only does not have to mention an explicit measurement of the object;[5] the predicate need not even imply any measurement having taken place.

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[5] It is also a well-known linguistic fact that measure phrases do not act as referential arguments of the verb, but rather behave like predicates. For example, they do not allow for passivization and pattern with adjuncts with respect to extraction (cf. Rizzi 1990). Thus, *100 pounds* in *weigh 100 pounds* does not act like a referential expression, referring to a number that will act as an argument of the weigh-relation. From a linguistic point of view, it would therefore be inadequate to take *weigh* (in *weigh 100 pounds*) to express a relation between individuals and weights (numbers). The measure phrase is better seen as expressing a property of measurements, rather than referring to a specific number.

How then should the relation between the content of the predicate and the measure function and measuring entity be conceived? First of all, the application of the predicate to an object in any circumstance should be equivalent to a measure function applying to the object and yielding a measurement that satisfies a particular condition. Thus, in (24a), the measure function is the weight function and the condition that of being heavier than a certain context-dependent limit. In (26a), the measure function is again the weight function, which will apply to two objects, and the condition is that the measurement of the first be greater than the measurement of the second.

But clearly the equivalence between the predicate and the application of a measure function satisfying a particular condition should obtain in all circumstances, not just the actual one. If it happens that the set of people that are walking is the same as the set of people that are 2 m tall, *John and Mary together are walking* is still unacceptable, since there will be circumstances in which the walkers do not coincide with the people that are 2 m tall. Thus, we need to make use of intensional measure functions, functions that relative to a world and a time map entities to real numbers.

Together does not presuppose that the predicate as such be equivalent to the application of a measure function from a structure $(D, \vee)$ to a structure $(R, +)$. It just requires that the predicate in a particular context be correlated with such a function. A case where a predicate itself does not express such a function is *write n books*. The function mapping an individual d to the books that d wrote is not a measure function of the required sort: d may have written a book together with another person d'; that is, the number of books that $d \vee d'$ wrote will be greater than the number of books that d wrote added to the number of books that d' wrote. The reason why a phrase like *the number of books of John and Mary together* is acceptable is that in this particular case it is presupposed that John and Mary did not write a book together. In this case, the function mapping an entity d to the number of books d wrote applied just to the set {John,Mary} is a measure function.

Thus, what we need is first to associate a predicate not with a particular measuring entity, but with a property of measurements (such as being a lot, or more than 100,000), in addition to a measure function. Second, for the set of entities in question, this correlation should obtain in all possible circumstances. I will call the pair consisting of such a measure function and a property of measurements the *measurement correlate* of a predicate. If the predicate expresses a relation, then *together* requires a measure function as well as a relation such that the function applied to the two arguments yields a pair of numbers that stand in that relation. Thus, the two cases of a measurement correlate can be defined as below:

(27) For an intensional measure function f and a property S of real numbers, the pair $< f, S >$ is a *measurement correlate* of a property $P(\mathrm{MC}(f, S, P))$ iff for any world w and time t and for any entity $d : d \in P^{w,t}$ iff $f^{w,t}(d) \in S^{w,t}$.[6]

With the notion of a measurement correlate, the lexical meaning of *together* needs to be modified accordingly:

(11′) For an intensional additive measure function f from the structure $(D, \vee)$, for a set of entities D, to the structure $(R, +)$, for a set of real numbers R, for a property S of real numbers, for any world w and time t, and any entity $d \in D, < d, f, S >$ $\in$ TOGETHER^{w,t} iff $f^{w,t}(d) \in S^{w,t}$.

There is one potentially problematic case for this account which calls for a brief discussion. Generally, *together* is not very felicitous with vague uses of the positive of adjectives, whereas it is fine with the comparative, the excessive, or any use of an adjective involving a specific measurement or a property of measurements:

(28) a. # John and Mary together are heavy.
b. ?? John and Mary together are rich.

On the traditional view of adnominal *together* as an antidistributivity marker, *heavy* and *rich* (as predicates with both a distributive and a collective reading) should allow for adnominal *together*. But noncomparative *heavy* and *rich* are acceptable with adnominal *together* only when used in a context in which a particular measurement counts condition for applying the predicate (let us say, when it is agreed that something counts as 'heavy'

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[6] One might think that a relational notion of a measurement correlate, as below, is required for predicates like *outnumber* or *is heavier than*, which allow for adnominal *together* for both of their arguments:

(i) For an intensional measure function f and a two-place intensional relation M between real numbers, the pair $\langle f, M\rangle$ is a *measurement correlate* of a two-place relation R $(\mathrm{MC}(f, M, R))$ iff for any world w and time t and for any entities d and $d' : \langle d, d'\rangle \in R^{w,t}$ iff $f^{w,t}(\langle d, d'\rangle) \in M^{w,t}$.

Later, however, we will see that the compositional semantics of sentences with adnominal *together* in fact needs to make use only of the nonrelational notion in (27).

just in case it weighs more than 200 pounds or that only someone with a net worth of at least 1 million dollars counts as rich).

It is not obvious how the present account excludes *together* with vague uses of the positive. Often the positive is analysed as involving a context-dependent degree, as an implicit argument of the adjective (cf. Cresswell 1976, Lerner and Pinkal 1992). Any such account, however, would be unable to explain why a sentence such as (29), which would on that account be equivalent to (28a), accepts *together*:[7]

(29) John and Mary together weigh more than expected.

Thus, it is better not to take the vague positive to involve a particular degree argument, but rather to just act as a one-place predicate whose content does not require a particular measurement.

A better explanation for why the vague positive is incompatible with adnominal *together* may reside in the nature of its context dependency. *Heavy* is context-dependent in quite a different way than *heavier than expected*. In particular, generally (that is, when not used in a context specifying a particular measurement) *heavy* has a reading relativized to a type or concept (heavy for a person, heavy for a book, heavy for an insect). Clearly, then, there is no single measurement condition that would govern the application of *together* in any circumstance.

There is another approach to the comparative in the literature on which the comparative, but not the positive, involves measurement. Kamp (1975) and, following him, Klein (1980) analyse the comparative in terms of a context-relative positive. On this account, (18b) would be paraphrased as 'There is a context c such that John and Mary are heavy relative to c and Bill and Sue are not heavy relative to c'. Now the number of contexts in which the predicate applies or does not apply to an object certainly provides a measurement of the object. Thus, if the comparative *heavier* holds between two objects a and b, then there will be a measure function assigning a value a that is higher than the one it assigns to b. By contrast, the positive will apply

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[7] This is presupposed in one common analysis of comparatives according to which they involve quantification over degrees (cf. Cresswell 1976; Lerner and Pinkal 1992; Moltmann 1992). For example, on the analysis of Lerner and Pinkal (1992), (ia) is to be paraphrased as: 'There is a degree d', such that John and Mary are heavy to degree d' and for every degree d to which Bill and Sue are heavy, $d' > d$', as in (ib), where *heavy* is construed as a relation between objects and degrees:

(i) a. John is heavier than Mary.
b. $\exists d'(\text{heavy}(\text{John}, d')\ \&\ \forall d(\text{heavy}(\text{Bill} \vee \text{Sue}, d) \rightarrow d > d')))$

to a single context, and that context does not give a clue as to what measure should be assigned to a given object.

1.4. *The Meaning of Adnominal* Together *in Different Syntactic Contexts*

Adnominal *together* obviously has a semantic function that consists in anticipating the content of the predicate. To account for this, Generalized Quantifier Theory with its construal of NP denotations as sets of properties is an eminently suitable formal tool. In fact, adnominal *together* provides another application of Generalized Quantifier Theory, quite different from quantification itself. However, unlike for classical applications of Generalized Quantifier Theory, the denotations of *together*-NPs must be construed not from sets but from properties, in the sense of functions from world-time pairs to sets of individuals. The idea is that *John and Mary together* will denote a subset of the set of properties that John and Mary, on the generalized-quantifier construal, would denote (the set of all the properties that the group of John and Mary has), a subset restricted in a certain way by *together* (namely the subset of those properties P that the sum of John and Mary actually has for which there is a measurement correlate $\langle f, S\rangle$ such that for any world w and time t, $j \vee m \in P^{w,t}$ iff $f^{w,t}(j \vee m) \in S^{w,t}$).

The denotation of adnominal *together* (when modifying the subject) can be taken to be an operation mapping an individual (the denotation of the NP without *together*) onto a generalized quantifier (the denotation of the NP with *together*), so that *John and Mary together* will have the following denotation, where 'S' and 'P' are variables ranging over properties:

(30) $$[\textit{John and Mary together}_{\text{adnom}}]^{w,t} = \{P \mid \exists f \exists S(MC(f, S, P) \& \langle j \vee m, f, S\rangle \in \text{TOGETHER}^{w,t})\}$$

That is, *John and Mary together* denotes the set of properties (relative to a world and a time) for which there is a measurement correlate whose measure function maps the group of John and Mary onto a measurement that satisfies the condition given by the measurement correlate.

The meaning of *together* as an adnominal modifier itself will be the function from individuals to generalized quantifiers below:

(31) For any world w, time t, and object d, $[\textit{together}_{\text{adnom}}]^{w,t}(d) = \{P \mid \exists f \exists S(\text{MC}(f, S, P) \& \langle d, f, S\rangle \in \text{TOGETHER}^{w,t})\}$

Alternatively, *together* may be construed as operating on the generalized quantifier expressed by the NP without *together*. However, conceiving of the meaning of adnominal *together* as a function from individuals to generalized quantifiers is justified because adnominal *together* occurs only with definite and specific indefinite NPs:[8]

(32) a. # Most people/At least two people together solved the problem.
b. Two people/These people together solved the problem.

The same denotation can be assigned to *together* when it modifies an NP that in turn modifies the subject, as in (19) and (21). All that is needed is the assumption that the *together*-NP undergoes Quantifier Raising, moving up to sentence-initial position, as in (33), for (21b):

(33) [John and Mary together]$_{\mathrm{NP}_i}$[The books of t_i weigh more than 500 pounds]$_{\mathrm{IP}}$.

Quantifier Raising is plausible in that an NP with *together* has indeed the denotation of a quantified NP. Based on (33), the scope of the *together*-NP in (21b) is then evaluated as the property below:

(34) $\lambda x[\text{weigh}(\text{book of}(x), \text{more than 500 pounds})]$

This property involves a complex additive measure function, the function that is the composition of the 'book-of'-function with the weight-function.

In object position, as in (19a), *together*-NPs undergo the same shift in denotation as generalized quantifiers do: they now denote (partial) functions from relations to one-place properties, as in (35):

(35) For any world w, time t, object d and intensional two-place relation R, $[together_{\mathrm{obj}}]^{w,t}|(d)(R) =$ the function g such that for any world w and time $t, g(w,t) = \{d' | \exists f \exists S(MC(f,$ the function h such that $h(w,t) = \{d' | \langle d', d\rangle \in R^{w,t}\}, S)\ \&\ \langle d, f, S\rangle \in \text{TOGETHER}^{w,t})\}$

According to (35), *together* with an object NP denotes the function that maps an object d to a function from relations R to functions (properties) that in turn map a world and a time to the set of objects for which there is a measure correlate $\langle f, S\rangle$ for the property of being an entity which stands in the relation R to d, and f applied to d satisfies the property S.

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[8] *Together* can modify indefinites in generic sentences, though, which is briefly discussed later in the paper:

(i) Two people together can lift the box.

Indefinites in generic sentences like (i), though, are commonly treated as variables, to be bound by some explicit or implicit adverb of quantification.

Exactly the same denotation can be assigned to *together* for the cases in (14). Thus, the meaning of *earnings of John and Mary together* in (14b) can be computed as follows:

(36) $[John\ and\ Mary\ together_{\mathrm{obj}}]([earnings\ of\,])(w,t)$
$= \{d' | \exists f \exists S(MC(f,$ the function h such that $h(w,t)$
$= \{d' | \langle d', j \vee m\rangle \in [earnings\ of\,]^{w,t}\}, S) \,\&\, \langle j \vee m, f, S\rangle \in \mathrm{TOGETHER}^{w,t})\}$

In order to get this meaning compositionally, again Quantifier Raising has to be invoked, which will adjoin *John and Mary together* to the entire NP, as in (37):

(37) [the$_i$ [[John and Mary together]$_{\mathrm{NP}_i}$[earnings of t_i]$_{\mathrm{NP}}$]$_{\mathrm{NP}}$]$_{\mathrm{DP}}$

The denotation of *the number of children of John and Mary together* in (17a) can be obtained analogously, based on Quantifier Raising as in (38):

(38) the [[John and Mary together]$_{\mathrm{NP}_i}$ [the number of children of t$_i$]]$_{\mathrm{NP}}$

1.5. *Adnominal* Together *and the Cumulative Reading*

It is not just predicates expressing measurement that are acceptable with adnominal *together*. Also certain other predicates, if they have a quantified complement, yield what looks like a *cumulative reading* of *together*:[9]

(39) a. John and Mary together have published 10 articles.
b. John and Mary together own less than four cars.

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[9] The ‘cumulative reading’ is familiar from sentences containing multiple quantified plural NPs with determiners such as *all* or *10, exactly 10*, *fewer than* 10, as in (i) (cf. Scha 1981):

(i) a. Exactly 10 students solved exactly 12 problems.
b. Fewer than 10 students solved fewer than two problems.

Example (ia) on the cumulative reading means ‘The total number of students that solved a problem amounts to exactly 10, and the total number of problems solved by a student amounts to exactly 12’, and similarly for (ib).

A cumulative reading with *together* is harder to get with quantifiers such as *every* and impossible with *each*, as seen in the contrast between (iia) and (iib):

(ii) a. John and Mary together climbed all the mountains/10/exactly 10/fewer than 10 mountains.
‘John climbed half of the mountains and Mary the other half/John climbed five of the mountains and Mary five others/. . .’
b. John and Mary together climbed ?? every/# each mountain.
‘John climbed half the mountains and Mary climbed the other half.’

Sentence (39a) means that the sum of the number of articles published by John and the number of articles published by Mary is (at least) 10, and (39b) that the sum of the number of cars owned by John and the number of cars owned by Mary is a number less than 4.

In these examples, the predicate (the VP) is also associated with a measure function. However, the measure function is not expressed by the verb alone, but by the verb together with the head noun of the object NP. In (39a), the measure function is the function mapping an individual to the number of articles he or she published, and in (39b) it is the function mapping individuals to the number of cars they own. (39b) does not involve a specific measurement, but only a property of measurements, namely the property of being less than four. Arguably the same holds for (39a), taking '10' to mean 'at least 10'. In (39a) and (39b), the measure functions and the measurement properties thus are associated with the meanings of the VPs, which are given below:

(40) a. $\lambda x[\exists \geq 10y(\text{publish}(x,y)\ \&\ \text{article}(y))]$
b. $\lambda x[\exists > 4y(\text{own}(x,y)\ \&\ \text{car}(y))]$

The measurement correlates of these properties will be as in (41a) and (41b), where f_1 is the (partial) function that maps individuals or groups onto the number of papers they published and f_2 the (partial) function that maps individuals or groups onto the number of cars they own:

(41) a. $\langle f_1, \lambda n[n \geq 10]\rangle$
b. $\langle f_2, \lambda n[n > 4]\rangle$

The cumulative reading of *together* cannot be taken as a special case of some more general antidistributive reading. This is quite obvious from examples such as (42a), which says that the total number of children of either John or Mary is one. (42a) differs thus from (42b), which only says something about the children that John and Mary have as a couple:

(42) a. John and Mary together have one child.
b. John and Mary have one child together.

An interesting general constraint on the cumulative reading of *together* is that it is available only when *together* is adjoined to the subject, not to an object. This is seen in (43):

(43) a. John and Mary together selected 10 students.
(John selected five and Mary another five)
b. # Ten students were selected by John and Mary together.
(five by John and five by Mary)
c. # Five doctors saw John and Mary together.
(Two doctors saw John and three others Mary)

This constraint does not obtain for comparative measurement predicates, which do allow *together* modifying an object:

(44) a. John's income exceeds Sue's and Mary's income together.
b. The children outnumber the men and the women together.

The difference between the two cases can be explained if *together*-NPs must undergo Quantifier Raising, adjoining to the category that provides the measure function. In (44b) that category is just the VP, as the measure function is associated just with the verb. Hence the *together*-NP may adjoin to the VP, as in (45):

(45) The children [[the men and the women together]$_{NP_i}$[outnumber t_i]]$_{VP}$

In (43b), by contrast, the measure function is associated with both the subject and the verb. Hence the *together*-NP will have to adjoin to the IP, as in (46):

(46) [[John and Mary together]$_{NP_i}$[$_{IP}$ [10 students [$_{VP}$ were selected by t_i]]$_{IP}$]$_{IP}$

But it is well known that not all NPs undergoing Quantifier Raising can move out of the VP: quantified NPs with *every* and *each* can move out of the VP, taking scope over the subject when occurring in object position, even though, quantified NPs with *no, few,* or *exactly two* cannot.

It has been argued that it is monotonicity properties that are crucial for explaining the limitations of Quantifier Raising (cf. Beghelli and Stowell 1997 and Szabolcsi 1997): only NPs that denote upward monotone quantifiers can move out of the VP to sentence-initial position (i.e. NPs with *every* or *each*, but not those with *no, few*, or *exactly two*). If this is right, it is clear why *together*-NPs are also subject to the same constraint: *together*-NPs, like NPs with *no, few*, and *exactly two*, certainly do not denote an upward monotone quantifier. That is, from *John and Mary together own four cars* one cannot infer *John and Mary together own cars*, just as one can't infer from *Exactly one woman owns four cars Exactly one woman owns a car* and from *No woman owns four cars No woman owns any cars*.

Thus, on the assumption that *together*-NPs are subject to Quantifier Raising, *together*-NPs with measure verbs and with cumulative readings can be given exactly the same analysis.

2. Adverbial *Together*

The analysis of adnominal *together* that I have given can be carried over to adverbial *together,* with certain modifications.

Let me start with some general facts about the readings of adverbial *together*. There are at least four prominent readings that *together* in adverbial position displays: the collective-action reading, as in (47), the coordinated-action reading, as in (48), the spatiotemporal-proximity reading, as in (49), and the temporal-proximity reading, as in (50) (where John and Mary took the exam at the same time, but perhaps in different places):

(47) a. The men lifted the piano together.
b. John and Mary solved the problem together.

(48) a. John and Mary thought together about the problem.
b. John and Mary talked about politics together.
c. John and Mary climbed the mountain together.
d. John and Mary danced together.

(49) a. John and Mary sat on the bench together.
b. The books fell together into the water.

(50) John and Mary took the exam together.

An important fact is that the readings that adverbial *together* may display are not always all available, but rather are determined, at least in part, by the content of the predicate. The temporal-proximity reading, for example, is unavailable in the examples in (47) and (48). The collective-action reading is obviously not available in (48) and (49), and neither is the spatiotemporal-proximity reading in the examples in (47) and (48). Roughly the following correlations hold between types of predicates and the readings of *together*:

(51) a. predicates describing actions (*lift the piano, solve the problem*) → group action, # spatiotemporal proximity
b. predicates describing activities (*think about the problem, talk about politics*) → coordinated action, # spatiotemporal proximity
c. stative predicates, predicates of movement (*sit on the bench, fall into the water*) → spatiotemporal proximity
d. predicates describing (nonsocial) activities (*take the exam*) → temporal proximity

Another general fact about adverbial *together* is that it can display several readings simultaneously. With human agents, generally a spatiotemporal- or temporal-proximity reading is accompanied by an implication of social interaction or some other connection among the agents. Compare (52a) with (52b), and (52c) with (52d):

(52) a. John and Mary were sitting together.
b. John and Mary were sitting close to each other.
c. John and Mary were laughing together.
d. John and Mary were laughing at the same time.

Sentence (52a) does not just mean that John and Mary were sitting spatially close and at the same time, but also implies some social interaction between John and Mary taking place. There is no such implication in (52b). Similarly, (52c) does not just mean that John and Mary laughed at the same time; it also strongly suggests that they laughed about the same thing. By contrast, (52d) carries no such suggestion.

The correlation between the content of the predicate and the readings of adverbial *together* suggests rather strongly that the different readings of adverbial *together* are not a matter of ambiguity, but rather of the same meaning manifesting itself differently in different semantic contexts. This is a problem for the account of adverbial *together* that Lasersohn (1990) gives. Lasersohn takes *together* (and related expressions) to be multiply ambiguous and traces the various readings of (adverbial) *together* to distinct, though formally analogous meanings. Simplifying, the group action meaning of *together* on Lasersohn's account will be due to the meaning given in (53), which is a function mapping a verb denotation (construed as a function from events to sets of participants) and an event to a set of event participants:

(53) For a function f from events to participants and e an event, $[together](f, e) = \{x | x$ is a group & $x \in f(e)$ & $\forall e'(e' < e$ & $(\exists y\ y \in f(e')) \rightarrow f(e) = f(e'))\}$

Here '$<$' is the relation 'is part of'. According to (53), *together* maps an event function f and an event e to a set of groups x such that any subevent e' of e which yields a nonempty set under f has exactly the same participants as e (with respect to f). That is, *together* prevents e from having subevents (of the same type) with just members of the group x that is the event participant of e, thus enforcing a collective reading.

The temporal- (spatiotemporal-) proximity meaning of *together* is exactly analogous to (53); it is obtained by replacing 'f' in (53) by 't', representing the function mapping an event to the time interval (or space-time) at which the event takes place, so that any subevent of e of the same type will take place at the same time.[10]

Even though Lasersohn in a way provides a unified account of the readings of adverbial *together*, by assigning *together* formally analogous meanings, his account has at least two serious shortcomings. First, it does not capture the fact that the readings do not seem to constitute an ambiguity, but depend on the context and, moreover, may be simultaneously present. Second, there does not seem to be a way of carrying the account over to adnominal *together*.

The account of adnominal *together* that I have given can be extended to adverbial *together* as follows. When occurring in adverbial position, *together* has the same lexical meaning it has in adnominal position, but it will take different arguments; that is, it will take a different kind of measure function and a different property of the measuring entity as its argument. The measure function will be the function mapping group members to the subevents of the described event in which those group members are engaged. The sum of those events will act as the measuring entity. The property that will be involved is an essential feature of my previous account of adverbial *together* (Moltmann 1997a, b): the property of the measuring entity will be the general property of being an integrated whole, and integrity, crucially, can be fulfilled in various ways, and even in different ways simultaneously. More precisely, in adverbial position, *together* specifies that the members of the relevant group are engaged in activities or states that together make up

[10] Lasersohn (1990) actually posits a spatial-proximity reading, rather than a spatiotemporal-proximity reading. But a pure spatial-proximity reading does not seem to exist. Thus, (i) cannot mean that John and Mary were standing in the same place, but perhaps John stood there yesterday and Mary only today:

(i) # John and Mary were standing together. (in the same place, but at different times) the described event or state and that that event or state forms an integrated whole. That is, the sum event composed of the subevents that the group members contribute must be an integrated whole. It is this rather unspecific property of being an integrated whole that *together* takes as one of its arguments when occurring in adverbial position and that will then act as the property of the measuring entity (the sum event just described).

Take the example in (54) with the cooperation reading of *together*:

(54) John and Mary work together.

In the Davidsonian tradition, I will take *work* to have an additional argument position for events. If e is the event of working together as described in (54), then the function that TOGETHER takes as one of its argument is the function f_e that maps John onto the subevent of e of which John is an agent and Mary onto the one of which she is an agent. The property argument of *together* will be the property INT-WH, the property of being an integrated whole. Thus the analysis of (54) will be as in (55):

(55) $\exists e(\text{work on}(e,\ j \vee m)\ \&\ \text{together}(j \vee m,\ f_e, \text{INT-WH}))$

This obviously requires a further generalization of the meaning of *together*, as in (11″):

(11″) For an intensional additive measure function f from the structure $(D,\vee)$, for a set of entities D, to the structure $(R,+)$, for a set of objects R, for any property S of objects in R, any world w and time t, and any object $d \in D, \langle d,f,S\rangle \in \text{TOGETHER}^{w,t}$ iff $f(d) \in S^{w,t}$.

Let us now take the spatiotemporal-proximity reading as in (56):

(56) John and Mary sat together.

I take stative verbs to also involve an event variable – basically a space-time region that instantiates the property expressed by the verb. In (56), the relevant function then maps both John and Mary onto some space-times of their sittings so that those space-times coincide in time and their sum is continuous in space. Thus, integrity will be fulfilled by spatiotemporal proximity.

A bit more difficult is the case of the group-action reading, as in (57):

(57) John and Mary solved the problem together.

Here *together* specifies that John and Mary help constitute the event of solving the problem, but not in virtue of being the agents of individual events of problem solvings, but in virtue of being the agents of some activities that together make up the event of solving the problem. In this case, the measuring entity is the sum of the activities of John and of Mary that contribute to the solution of the problem, but that are not themselves solvings of the problem. Nonetheless, that sum has integrity in that it *constitutes* a solving of the problem. For a sum event to constitute a certain type of single event is another way of having integrity. The function f_e, which maps individuals to the subevents of (57) in which they are involved, is an additive measure function, mapping John to an event e' and Mary to an event e'' and the group consisting of John and Mary $j \vee m$ to the event $e' \vee e''$.

The meaning of adverbial *together* can now be specified as a function from relations involving event arguments to relations as in (58a) (for transitive verbs) and (58b) (for intransitive verbs and a subject-oriented reading of *together*):

(58) a. For any world w and time t, and two-place intensional relation R, $[together_{\text{adverb}}]^{w,t}(R) = \{\langle d,e\rangle | \langle d,e\rangle \in R^{w,t} \;\&\; \langle d, f_e, \text{INT-WH}\rangle \in \text{TOGETHER}^{w,t}\}$

b. For any world w and time t, and three-place intensional relation R, $[together_{\text{adverb}}]^{w,t}(R) = \{\langle d,d',e\rangle | \langle d,d',e\rangle \in R^{w,t} \& \langle d,f_e,\text{INT-WH}\rangle \in \text{TOGETHER}^{w,t}\}$

Together thus will have a unified semantic analysis in adverbial position, with the different readings of adverbial *together* being traced to different ways for an event to constitute an integrated whole.

It is now clear why adnominal and adverbial *together* yield different readings. Adnominal *together* has access only to the generalized-quantifier meaning and thus only to the meaning of the predicate as such. By contrast, adverbial *together* has access to specific arguments of the predicate, in particular the event argument. As a result, a different measure function is available and a different property of the measuring entity.[11]

[11] There are other phenomena where the inaccessibility of information provided by the predicate for the interpretation of referential NPs arguably plays a role. Keenan (1979) observes that the interpretation of predicates such as *cut* may be dependent on the interpretation of the NP, but a converse dependency does not seem to occur. An instance of the same general principle, according to Keenan (1979), is the fact that relative adjectives such as *flat* may depend in their interpretation on the head noun *(flat road, flat table, flat tire, flat voice)*, but a converse relationship does not obtain. From these observations, Keenan draws a correlation between the direction of agreement and semantic dependency and proposes the following principle:

(i) *The Meaning-Form Dependency*
Given A and B distinct constituents of a syntactic structure E, A may agree with B iff the semantic interpretation of expressions of A varies with the semantic interpretation of expressions of E.

3. Other readings of Adnominal *Together*

There are a number of other readings that *together* in adnominal position displays that I have so far neglected. The reason is that those readings are more similar to the readings of adverbial than to adnominal *together*, and they are thus better analyzed in relation to adverbial *together*.

First, adnominal *together* has what one may call a *mixture* and a *configuration reading*:

(59) a. The vinegar and the wine together tasted terrible.
b. The pictures together look nice.

(60) a. John and Mary together are a nice sight.
b. John and Mary together form an interesting couple.

In (59a, b), *together* obviously does not relate to some measurement specified by the predicate. Rather it emphasizes the composition or configuration of the quantity or group in question: in (59a) the fact that the entity is the mixture of the wine and the vinegar and in (59b) that it consists in a particular spatial configuration of the individual pictures. Similarly, *together* in (60a,b) specifies that John and Mary form a social or spatial unit. Note that in (60b), the predicate is obligatorily collective and thus provides another sort of evidence that the function of adnominal *together* is not that of enforcing a collective reading.

The mixture and the configuration readings of adnominal *together* seem rather different from the measurement reading, but they are close to the reading *together* has in adverbial position. On the mixture and configuration reading, *together* just emphasizes that the group in question forms an integrated whole in some way or another. Formally, I take this to mean that *together* in those cases involves the identity function as the measure function and takes the property INT-WH as an argument, using the generalized lexical meaning of *together* in (11′). Thus, in such cases, even though the lexical meaning of *together* would be the same, a different function of adnominal *together* needs to be distinguished, which is then associated with a different denotation.

Together sometimes allows for event-related readings even in adnominal position. Thus, for many speakers, an event-related reading is possible in the following cases:

(61) a. John and Mary together have lifted the piano.
b. John and Mary together have solved the problem.

But there are many eventive predicates with which an event-related reading of adnominal *together* seems universally unacceptable:

(62) a. # John and Mary together stood up.
b. # John and Mary together were working.

Moreover, stative predicates seem to never allow for a space-time related reading of adnominal *together*:

(63) a. # John and Mary together were sitting.
b. # John and Mary together were standing in the corner.

The reason why an event-related reading is possible in (61a) and (61b) may be this. If the verb describes a telic event – that is, an event that has integrity, then *together* can specify that the group it applies to helps in constituting this event. For telic predicates, there is thus a measurement correlate consisting of the event and a function mapping individuals to a sum event constituting that event. If no telic event is described by the predicate, then there will be no such measurement correlate.

Adnominal *together* displays an event-related reading also in another context, namely when occurring in generic or modal sentences:[12]

(64) a. John and Mary together can easily lift the piano.
b. Two people together can lift the box.
c. John and Mary together would interact well with each other.
d. John alone would be unable to perform the task.

In such sentences, for all speakers, it appears, an event-related reading where *together* specifies cooperation is unproblematic. The present account of *together* does not yet tell us, though, how such a reading could come about, except by possibly assimilating such cases to the case of telic events as in (61).

4. *ALONE* AND OTHER RELATED MODIFIERS

Alone is an expression that like *together* occurs both in adnominal and in adverbial position and in fact displays readings quite analogous to those of *together*. Adverbial *alone* in (65) displays event-related readings and in (66) space-time related readings; adnominal *alone* in (67) displays measurement readings and in (68) a constitution reading:

(65) a. John played alone.
b. John solved the problem alone.

(66) John sat alone.

[12] See Krifka et al. (1995) for discussion of generic sentences.

(67) a. The box alone weighs 10 pounds.
b. John alone published 10 articles.
c. These children alone form a class.

(68) Vinegar alone tastes terrible.

The readings of *alone* can in fact be derived in the same way as those of *together*. All that is needed is that *alone* be assigned a particular lexical meaning, namely, as I want to suggest, the relation that holds between an entity d, an additive measure function f, and a property of real numbers (or more generally objects) S just in case f maps d onto a number (or other object) satisfying S and maps no entity that has d as a proper part ($<$) onto that number (or object). Thus, the more general lexical meaning (which corresponds to (11″)) will be:[13]

(69) For an intensional additive measure function f from a structure $(D, \vee)$, for a set of entities D, to a structure $(R, +)$, for a set of objects R, for any property S of objects, any world w and time t, and object $d \in D, \langle d, f, S \rangle \in \text{ALONE}^{w,t}$ iff $f^{w,t}(d) \in S^{w,t}$ and for no $d', d < d'$, $f^{w,t}(d') \in S^{w,t}$.

Alone, unlike *together*, also has another, property-related reading on which it is equivalent to *only*:

(70) John alone got an A on the exam.

Like the cumulative reading of *together* (and *alone*), the property-related reading is available only if *alone* is adjoined to the subject:

(71) a. John likes Mary alone.
b. # John wrote to Mary alone.

Example (71a) does not allow for the reading 'John likes only Mary' (but only for the reading 'John likes Mary when she is isolated'), and (71b) does not allow for any reading at all (even though the property-related reading would make sense). The restriction to subjects, again, indicates that *alone* on

[13] *Alone* with potentially collective predicates is different from *together* in that it seems to prevent a reading that is hardly available in the first place. Only in certain cases, such as (i) below, may the predicate be understood as applying to a larger entity, that is, the box including its content:

(i) The box weighs 2 pounds.

This is the reading that is prevented by the presence of adnominal *alone*, as in (ii):

(ii) The box alone weighs 2 pounds.

the property-related reading is subject to Quantifier Raising and in (71b) involves a property denoted by the entire IP, including the subject.

It is not easy to assimilate the property-related reading to the measurement reading. For that reading, it seems, a slightly different meaning of adnominal *alone* needs to be posited, one not available for adverbial *alone*. That meaning is also based on the relation ALONE, but the measure function will be the identity function *id*, and the property of a measuring entity the property that the predicate itself expresses, as in (72):

(72) For any world w, time t, and entity d,
$[alone_{\text{adnom2}}]^{w,t}(d) = \{\text{P} | \langle d, id, P\rangle \in \text{ALONE}^{w,t}\}$

There are other modifiers related to *together* such as *as a whole*, *whole* (*wholly*), and *individual(ly)*. They are best called 'part structure modifiers' (cf. Moltmann 1997a, b). Part structure modifiers often have similar semantic effects as *together* and *alone*, but it appears that they do not have a semantics involving measurement or constitution. For example, *as a whole* not only modifies plural NPs, but also singular ones, as seen in (73a); it does not allow for a cumulative reading, as seen in (73b); and it does not display the internal reading, as seen in the contrast between (74a) and (74b):

(73) a. The picture as a whole is nice.
b. # The pictures as a whole were seen by 50 people.

(74) a. The pictures as a whole are nice.
b. # The pictures together are nice.

As a whole in (73 a) triggers a global evaluation of the pictures; *together* in (74a) requires an evaluation of a particular configuration of the pictures. All this suggests that for part structure modifiers such as *as a whole*, the analysis as relations between entities and situations is in fact suitable.

5. Conclusions

In this paper, I have given a unified account of *together*, taking as a starting point the semantics of adnominal *together* when it has a measurement reading. The analysis made crucial use of additive measurement functions and their values: the lexical meaning of *together*, on the first reading, was conceived as a relation between groups of entities, measure functions, and properties of real numbers. The other functions of *together* were accounted for by positing somewhat different measure functions and properties of the measuring entity. What is unusual in this analysis is that two of the arguments of adnominal *together* are never expressed or referred to by any expression in the sentence, but must be obtained by reflecting on the application conditions of predicates.

Adnominal *together* also provided an additional application of Generalized Quantifier Theory within an intensional semantics: *together* in adnominal position was in fact analysed as expressing a restriction of the set of properties that the NP without *together*, as a generalized quantifier, would denote.

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Department of Philosophy
University of Stirling
Stirling FK9 4LA
UK
E-mail: fm15@stir.ac.uk