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PART STRUCTURES IN SITUATIONS: THE SEMANTICS OF
INDIVIDUAL AND *WHOLE**

1. THE CHALLENGES OF INDIVIDUAL AND WHOLE

Individual and *whole* are expressions that can occur in different syntactic contexts (adnominally and adverbially) and display a variety of different readings:

- (1) a. The *individual* boxes are heavy.
b. The *whole* class passed the exam.
- (2) a. John compared the *individual* students.
b. John repeated the *whole* sentence.
- (3) a. John and Mary worked on the problem *individually*.
b. John forgot the poem *wholly*.

In adnominal position, *individual* in (1a) triggers a reading of the predicate on which it applies to each box, and *whole* in (1b) one on which the predicate distributes over all the members of the class. In (2a), *individual* triggers a particular collective reading of the predicate, and so for *whole* in (2b). In adverbial position, *individually* in (3a) specifies noncollective action and *wholly* in (3b) that the poem undergoes the event of forgetting exhaustively. On all their readings, I will argue, *individual* and *whole* display the part structure of an entity in a certain way: in the case of *individual*, the part structure of a collection and in the case of *whole* the part structure of an individual.

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For this reason *individual* and *whole* can be called *part structure modifiers*.

Individual and *whole* are highly interesting expressions and provide challenges for linguistic semantics, philosophy of language, as well as ontology as far as it is associated with natural language.

The challenge for linguistic semantics consists in finding a semantic analysis that derives the various readings of *whole* and *individual* from a single underlying meaning by taking into account the syntactic and semantic context in which those expressions can occur.

The challenge that *whole* and *individual* pose for the philosophy of language consists in the question of the semantic function of noun phrases that are modified by *whole* or *individual*. NPs with *whole* and with *individual* are neither quantificational nor ordinary referential terms. Rather, in adnominal position, their function is to influence the way the predicate applies to the argument by having the argument viewed with a particular part structure.

The challenge that *individual* and *whole* pose for the ontology of natural language concerns the notion of a part structure itself. Two aspects of part structures are central, I will argue, for an appropriate analysis of part structure modifiers:

[1] Part structures crucially involve the notion of an integrated whole and not just an ordering among parts.

[2] Part structures may be relativized to a situation, where by a situation I mean simply a way of specifying an entity with properties that may include only accidental properties and of specifying an entity possibly only partially with the properties it in fact has. Part structure modifiers thus involve a distinction between the actual part structure of an entity and the part structure an entity may have only in a situation. Making use of different such kinds of situations will be crucial for analysing the difference between part structure modifiers in adnominal and in adverbial position.

With respect to [1], the account of part structure modifiers that I will develop deviates from the dominant theories of part-whole structure in the 20th century, namely extensional mereological theories, the kinds of theories that have been taken over by linguistic semantics as well (cf. Link 1983, 1984; Ojeda 1993 and others). However, the account fits entirely with ancient and medieval conceptions of part and whole (starting with Plato and Aristotle) as well as contemporary approaches that reemphasize the importance of the notion of an integrated whole, such as Simons (1987) and Meirav

(2003). It is in fact hardly an accident that the expression *whole* had occupied the minds of philosophers such as Aquinas, Buridan and others throughout the middle ages, whereas it has been largely ignored in contemporary philosophy of language and semantic theory.¹

With respect to [2], the present account shares the spirit of any account that makes use of partial information and a notion of context consisting of partial information, not just Situation Semantics (Barwise/Perry 1983), but many other approaches as well.² It also goes along with accounts of distributivity that make use of contextually determined divisions of collections into subcollections, such as Gillon (1987) and Schwarzschild (1996).

The present paper will give a unified analysis of *individual* and *whole* which derives the various readings those expressions exhibit on the basis of the same underlying meaning. Roughly, *individual* specifies that no proper collections are part of the entity in question in the relevant situation and moreover that all the parts of the entity are essential integrated wholes. *Whole*, by contrast, maps an entity onto the sum of its actual parts (in possibly more than one sense of 'part'). While adnominal *individual* and *whole* display the part structure of an entity in what I will call a reference situation, (a situation that contains generally not much more than the information given by the descriptive content of the NP), adverbial *individually* and *wholly* display the part structure of an entity in the situation that contains only information about the described event. Thus, the various readings of *whole* and *individual* are derived by having different occurrences of part structure modifiers evaluated relative to different types of situations (in the sense of partial specifications of objects with properties) so that the information content of such situations will determine the way the content of the modifiers is to be understood.

The analysis of *individual* and *whole* in this paper can be considered a fully developed account of which the proposals in Moltmann (1997a, b) are rather sketchy predecessors. Those predecessors differ from the present account also in a number of details which, for reasons of space, I will not be able to discuss.

¹ Besides my earlier work (Moltmann 1997a, b), the only exception is, it seems, Morzycki (2001). Morzycki (2001), though, concerns himself only with what I will later call the part-related distributive reading of *whole*, exemplified by (1b), not whole-related and collective readings (the latter being exemplified by (2b)).

² For another approach using situations, see, for example, Recanati (2004).

2. ADNOMINAL *INDIVIDUAL* AND *WHOLE*2.1. *The Readings of Adnominal Individual and Whole*

Part structure modifiers exhibit different readings in adnominal and adverbial position, in quite systematic ways. The most important generalizations about the readings of part structure modifiers in the two positions are as follows.

In adnominal position, part structure modifiers exhibit readings that are independent of the particular content of the predicate. In this position, the main function of part structure modifiers is to influence the way the content of the predicate relates to the parts and the whole of the argument. Thus, the sole function of *individual* in (4) is to enforce a distributive reading of the predicate, and one function of *whole* in (5a, b) is to allow for a distributive reading that would otherwise not be available or to enforce a distributive application of the predicate to all the parts of an individual, as in (5c):

- (4) a. The individual boxes are heavy.
 b. John liked the individual paintings (but not the exhibition as a whole).
 c. Mary cannot remember the individual students (but only the class as a whole).
- (5) a. The whole/entire collection is expensive.
 b. John gave the whole/entire class an A.
 c. The whole/entire chair is made of wood.

Both adnominal *individual* and adnominal *whole* also allow for collective readings, enabling or influencing the application of certain collective predicates:

- (6) a. The individual students could not be compared.
 b. John ranked the individual students.
- (7) a. John counted the whole class.
 b. The whole group of soldiers surrounded the palace.
 c. The whole police force was distributed over the region.

Entire (or *entirely*) (as in (5)) is an expression largely synonymous with *whole* (or *wholly*) and I will make use of it in contexts in which it is slightly more felicitous than *whole* (*wholly*). In what follows, when I

talk about *whole*, I mean in fact occurrences of *whole* and *entire*, as well as occurrences of the adverbial versions *wholly* and *entirely* – and with *individual*, I mean both *individual* and its adverbial counterpart *individually*.

Sentences with adnominal *whole* (and *entire*) as in (5a, b) display a very interesting ambiguity, noted and discussed throughout the middle ages by philosophers such as Abelard, Aquinas, and Ockham (cf. Henry 1991). On one reading, the one mentioned above, the semantic contribution of *whole* consists in triggering a distributive interpretation of the predicate. With that reading, (5a) means that every part of the collection, every item it contains, is expensive, and (5b) that John gave every part of the class, i.e. every individual student, an A. But *whole* has another reading in (5a, b), which seems the opposite of the first. On that reading, *whole* means ‘not just a part, but the whole’, and thus enforces a collective reading of the predicate. With that reading, (5a) means that the collection as a whole is expensive, and (5b) that John gave the class as a whole an A. On the first reading, adnominal *whole* looks like a quantifier, ranging over the parts of an entity (members of a collection in (5a) and (5b) and of an individual in (5c)). On the second reading, by contrast, *whole* seems to just emphasize what the semantic contribution of the NP already is, namely a term referring to a particular individual, perhaps emphasizing that reference not to a part, but to the whole has been made, putting into focus the whole of that individual. Let me distinguish the two readings of *whole* as the *part-related reading* and the *whole-related reading*.

2.2. *The Distributive and Part-Related Readings of Individual and Whole and Their Status as Quantifiers*

One might like to take *individual* and *whole* on one of their readings to act just like quantifiers, ranging over the parts of the relevant entity. For example, *individual* in (8a) seems to have the same effect as *each* in (8b), and *whole* in (9a) that of partitive *all* in (9b):

- (8) a. The individual children were praised.
- b. Each of the children was praised.

- (9) a. The whole family was praised.
- b. All of the family was praised.

Medieval philosophers in fact, it appears, took NPs with *whole* on the part-related reading to act like what we would call a quantifier (ranging over the parts of the entity in question), whereas on the whole-related reading, they took them to act as referential terms. Whereas *whole* on the first reading was considered a syncategorematic expression, *whole* on the second reading was taken to act as categorematic expression (cf. Henry 1991). However, it turns out that adnominal *whole* on the part-related reading has quite a different semantic function from a quantifier – as does adnominal *individual* on the reading on which it triggers a distributive interpretation of the predicate.

First, individual and whole cannot interact in scope with other quantifiers (cf. Moltmann 1997b; Morzycki 2001). Thus, *individual* in (10a) cannot act like floated *each* in (10b) as a universal distributive quantifier taking wide scope over *exactly two presents*, and in (11a) it cannot act like the partitive quantifier *each* in (11b) taking wide scope over *two students*. Similarly for *whole* in (12).

- (10) a. The individual children received exactly two presents.
- b. The children each received exactly two presents.

- (11) a. Two students solved the individual problems.
- b. Two students solved each of the problems.

- (12) a. The whole family owns a car. (only one car for the entire family).
- b. Some students read the whole collection of articles. (one group of students for all the articles)

Interestingly, though, and I will discuss this further only in Appendix B, *whole* exhibits scopal interactions with negation, as noted by Morzycki (2001). Depending on the situation described, negation can take scope over the apparent part quantifier associated with *whole* or conversely, or both:

- (13) a. John did not like the whole collection.
- b. John did not eat the whole cake.
- c. John did not buy the whole collection.

(13a) has the reading on which the apparent quantifier ranging over parts takes scope over negation ('for every part of the collection it is

the case that John did not like it'), whereas in (13b) negation seems to take scope of the quantifier ranging over parts ('it is not the case that John ate every part of the cake'). (13c) allows for both readings ('John bought none of the collection' or 'John did not buy all of the collection').

Individual and *whole* also fail to be able to bind variables, as is illustrated by the contrast between (14a) and (14b) and between (15a) and (15b):

- (14) a. The individual students drove their own car.
b. The students each drove their own car.

- (15) a. The whole family drove its own car.
b. The family members each drove their own car.

(14a, 15a), unlike (14b, 15b), imply that there was only one car for the entire group of students or the entire family, which means that *individual* in (14a) and *whole* in (15a) cannot, unlike *each* in (14b) and (15b), act as universal quantifiers ranging over the members of the group of students or the family and thus bind the pronoun *its*.

Finally, NPs with *individual* and *whole* can act as the antecedent of unbound anaphoric pronouns, unlike quantifiers (cf. Morzycki 2001):³

- (16) a. The individual men arrived. They sat down.
b. ??Every man arrived. He sat down.

- (17) a. The whole class left. It never came back.
b. ??Every student left. He never came back.

³ The behavior of pronouns is different, though, with floated quantifiers, which do not prevent anaphora relating to the plural NP the quantifiers are associated with:

- (1) The students each left. They never came back.

But still in other respects, *individual* and *whole* differ from floated quantifiers. First, floated *each* does not allow for collective predicates holding of the entire entity, unlike *individual* and *whole*:

- (2)a. #The students each could not be compared.
b. #The students were each counted by John.

(2a) and (2b) do not allow for a collective, internal reading of the predicate. Another difference is that *each* in the VP can co-occur with *individual*, but not with floated *each*:

- (3)a. The individual children received two presents each.
b. #The children each received two presents each.

To summarize, on the one reading on which adnominal part structure modifiers seem to be equivalent to quantifiers ranging over the parts of an entity, they still do not exhibit typical properties of quantifiers. Of course, also the mere fact that *individual* and *whole* are compatible with collective or whole-related readings of a predicate shows the limits of a quantificational analysis.

3. ADVERBIAL PART STRUCTURE MODIFIERS

Adverbial part structure modifiers differ from adnominal part structure modifiers in that they generally exhibit readings that are, in some way or other, dependent on the content of the predicate, in particular the described event or action.

Thus, the adverb *individually*, when modifying a potentially collective action predicate, specifies noncollective action, as in (18a), where each student is sole agent of an act of problem-solving (*the individual-action reading*), and when modifying a predicate describing individual activities, it specifies noncoordinated actions (*the noncoordinated-action reading*), as in (18b), where each person left the room without that event being coordinated with the departures of others:

- (18) a. The students solved the problem individually.
 b. The people left the room individually.

Also *wholly* (or *entirely*) display action- or event-related readings. Then they yield what can be called a *complete-involvement reading*, as in (19):

- (19) The clouds have wholly/entirely disappeared.

When modifying other predicates, in particular those specifying spatio-temporal locations, part structure modifiers generally display space-related readings. Thus, *individually* in (20a) says that the cups are separated in space at the time of their standing on the cupboard (*the spatial-separation reading*), and *entirely* in (20b) that every part of the blanket is on the floor (*the complete spatial-coverage reading*):

- (20) a. The cups are standing individually on the cupboard.
 b. The blanket was lying entirely on the floor.

There are systematic correlations between semantic predicate types and readings of adverbial part structure modifiers. In general, when the predicate describes an action, adverbial part structure modifiers yield readings that involve the relation of coagenthood or cooperation during the action. When the predicate describes a spatio-temporal location, adverbial part structure modifiers yield readings that involve the relation of spatio-temporal closeness.

What is important about the various readings that adverbial part structure modifiers display is that they are not generally all available for a given occurrence of the adverbial modifier; rather only some of the readings are available in a given semantic context. For example, in (19a), only an individual-action reading, not a spatial-separation reading, is available, and in (20a) only a spatial-separation reading.

This clearly shows that the different readings of adverbial part structure modifiers are not a matter of ambiguity, but rather of context-dependency. If they were a matter of ambiguity, one would expect all readings to be available for a given occurrence of the modifier (as long as the reading is compatible with the semantic context).⁴ Part structure modifiers rather should have a more general, abstract meaning, which, in a given context, will yield the relevant reading. Moreover, this meaning should be the same that part structure modifiers have in adnominal position.

This then defines two challenges for a semantic analysis of part structure modifiers:

- [1] The analysis should provide a uniform meaning of part-structure modifiers in adverbial and adnominal position.
- [2] The analysis should allow deriving the various readings of a given part structure modifier from the syntactic and semantic context in which the modifier occurs.

In what follows, I will first outline the proposed analysis, which aims at meeting these two challenges, and then lay out in detail the conceptual background assumptions that this analysis involves. Only then will I specify the meanings of *individual* and *whole* explicitly and show how the various readings can be derived from them. The central idea of that analysis is that *individual* and *whole* have a uniform meaning, but that meaning will apply to different situations in adnominal and adverbial position, thus leading to the different readings.

⁴ Similar observations can be made for adverbial *together*, which is a problem for Lasersohn's (1990) analysis of the various readings of *together* as resulting from different, though analogous meanings.

4. AN OUTLINE OF THE ANALYSIS AND ITS MOTIVATIONS

At the core of my analysis is the view that both *individual* and *whole* have the semantic function of displaying the part structure of an entity (a collection or individual) in a certain way in a situation, whereby a part structure does not just consist in an ordering of a set of entities and a part relation, but also in conditions of *integrity*, that is, conditions such as conditions of form or coherence that give an entity unity. In the case of adnominal occurrences, the situation in question is the situation associated only with the NP itself that is modified by *individual* or *whole*, whereas in the case of adverbial occurrences, it is the situation that only contains information about the described event. Whereas in the adnominal case, *individual* and *whole* apply to a situation that I will call a *reference situation*, in the adverbial case, they apply to a situation that only contains information about the event described by the verb, the *event-dependent situation*. The reference situation, for our purposes, is a situation that contains mainly just the information given by the NP itself, information that may relate to the part structure of entities and may influence the application of the predicate. It is a situation *individual* and *whole* specifically relate to, but one that is also influenced by other modifiers.

A situation in turn serves two purposes: first, it may give only a partial representation of an entity and thus need not specify an entity with all the properties it actually has. Second, it may specify an entity with properties the entity has only accidentally. This in particular means that a situation may represent an entity with a part structure that differs from the part structure the entity actually has. For example, a situation may not contain all the actual parts of an entity and it may represent a subcollection as an integrated whole because it selects just those properties that unify this subcollection.

A possible discrepancy of the actual part structure of an entity and its part structure in a situation is crucial for an understanding of the semantic effects of *individual* and *whole*. This holds in two respects. First, we need to distinguish between essential and accidental integrity of an entity (especially in the case of *individual*); second, we need to distinguish between the actual parts of an entity and parts the entity has only in a situation (especially in the case of *whole*).

On my analysis, *individual* always applies to a collection, (an entity that is the sum of entities that are integrated wholes essentially

(individuals)), and it specifies that in the situation in question no subgroup of that collection forms an integrated whole. In the adnominal case, the group will be represented in the reference situation as a collection whose parts are only the individual members, triggering a distributive reading or a reading where no subgroups will play a role. In the adverbial case, the group will be represented in the situation that will contain only information about the described event, and when all the members of the group need to be present in that situation, this means that each member will be involved in a subevent of that event, triggering the exhaustive-participation reading.

Whole, in turn, can only apply to entities that are integrated wholes (individuals or groups) and it maps such wholes to the sum of their actual parts. Crucially, it may involve either one of two notions of a part: first the standard notion and a second notion of a part according to which also properties of form or structure count as parts of an entity. The first notion gives the part-related reading, whereas the second notion gives the whole-related reading. *Whole* then maps an entity onto the sum of all its parts in the situation in question, on one or the other understanding of 'part'. In the adnominal case, the entity *whole* applies to will be represented as a mere collection of parts in the familiar sense or else as a composition of parts in that sense and properties of form. In the adverbial case, the situation to which *whole* applies will, as in the case of *individually*, be a situation containing only information about the described event, which means that all the parts of the individual need to be present in that situation and thus need to be involved in a subevent of that event.

The notion of an integrated whole, which I will discuss in the next section, is important for a number of reasons. First of all, the lexical meanings of *whole* and *individual*, as indicated, involve the notions of both an essential and an accidental whole. Second, expressions like *whole*, across languages, generally do not impose a syntactic condition on what noun they can apply to, but conditions of particular degrees of integrity of the kinds of entities described by the noun: it is just that in English the required degree of integrity more or less coincides with the semantic condition imposed by singular count nouns (cf. Moltmann 1997a, Chap. 4.4.1). The notion of an integrated whole (more precisely of situated integrity) is also needed to account for semantic selectional requirements of certain predicates and for distributive interpretation, as we will see.

Given this outline of the analysis, the first question that arises concerns the notion of an integrated whole, namely its conceptual

status as well as its empirical motivations. The second question concerns the need to distinguish between situated and actual part structures and possible independent motivations for reference situations. While I will devote the next section to the first question, the second question will be addressed at various points in the rest of this paper.

5. THE TWO INGREDIENTS OF THE ANALYSIS: WHOLES AND SITUATIONS

5.1. *The Notion of an Integrated Whole*

While the notion of an integrated whole does not play a role in the extensional mereological theories of part structures that have been dominant in philosophy in the 20th century as well as in linguistic semantics, it is a notion that has been of central importance in ancient and medieval as well as, to an extent, modern metaphysics. It is a notion that has been considered central for the understanding of what it is to be an individual and what it is to have unity (and thus to count as one, rather than many). For example, the notion of an integrated whole plays an important role both in Plato's dialogues and in Aristotle's metaphysics and it continued playing an important role (due to the Aristotelian legacy) in the middle ages.⁵ In modern philosophy it is still important in the thinking of particular philosophers such as Leibniz and Husserl. The extensional mereological theories that have been developed in the 20th century had primarily the aim of giving an alternative account of classes than by means of set theory. Those theories also have been predominantly used in linguistic semantics, and they appear in fact quite suited to the semantic analysis of plurals and mass nouns (Link 1983). In more recent philosophical studies, however, both historical and systematic ones, the notion of an integrated whole has received renewed interest, in particular in the study of part-whole-relationships in Simons (1987) and Meirav (2003), as well as in historical works such as Harte (2002). It also is of central importance in the discussion of material constitution, the relation of an object to the material that constitutes it.⁶

In extensional mereology, a part structure $(A, <)$ consists of a set of entities A and a part relation $<$, which is transitive, closed under sum formation and extensional – that is, two entities are identical just in case they have the same proper parts (cf. Simons 1987). This kind

⁵ See in particular Aristotle, *Metaphysics*, Iota 1.

⁶ See, for example, the contributions in Oderberg (1999).

of part structure seems fairly adequate for the purpose of the semantics of mass nouns and plurals, as outlined in Link (1983) in the following way. Mass nouns take their extension from the domain of quantities, which forms a part structure $(M, <_m)$, where $<_m$ is the relation that holds between a subquantity and a quantity. Plurals take their extension from a domain of pluralities $(I, <_i)$, where $<_i$ is the relation that holds between an individual member or subgroup and a group. Whereas $(M, <_m)$ does not or does not necessarily have atoms, $(I, <_i)$ does: all the individuals are atoms of $(I, <_i)$, that is, the elements in the extension of singular count nouns.

For the domains of quantities and pluralities, transitivity, closure under sum formation, and extensionality are in fact quite plausible principles. However, such extensional mereological notions of part structure are quite unsuited for individuals and, not surprisingly, for the semantics of *individual* and *whole*.

As I have argued in more detail in Moltmann (1997a, 1998), there is also a fundamental problem with using extensional mereological part structures, and that concerns the needed distinction between different part relations and, in particular, the notion of an atom. If extensional mereology is used exclusively, the notion of an atom will have to account for what it means to be an individual (or to have unity): to be an individual will have mean to be an atom with respect to the plural-specific part relation $<_i$.⁷ The problem with this is that no conditions are given as to when an entity counts as an atom: the only way to find out whether an entity counts as an atom is to see whether it has been referred to by a singular count NP. While extensional mereology may look attractive because of its formal simplicity, it appears seriously flawed once distinct part relations are posited whose application is ultimately grounded just in the syntactic categories of the expressions used to refer to the entities in question.

Philosophers who use the notion of a whole, starting with Plato and Aristotle, by contrast, had as their aim to give conditions on when an entity has unity and thus can count as an individual, namely conditions such as having a shape or structure, having spatio-temporal continuity, or having some other form of integrity.

Most philosophers that have used the notion of an integrated whole did not very explicitly make attempts at formally defining it, with exceptions such as Simons (1987), who presents various formal

⁷ Thus the notion of an atom is used also to represent the referents of collective NPs in Link (1984) and Barker (1992).

notions of an integrated whole (without claiming a unified definition, though). For the semantic analysis of part-structure-related expressions such as *individual* and *whole*, fortunately, a rather simple and clearly defined notion of an integrated whole suffices, namely that of a (situated) R -integrated whole.⁸ If R is a symmetric relation of an appropriate sort, then an entity is an R -integrated whole in a situation s just in case all its parts are connected by R in s (or rather the transitive closure R_{trans} of R) and no part of it is connected by R (or rather R_{trans}) in s to anything that is not a part:

- (21) For an appropriate symmetric relation R , x is an R -integrated whole in a situation s (R -INT-WH(x, s)) iff for all x', x'' such that $x' <_s x, x'' <_s x$, it holds that $R_{\text{trans}}(x', x'')$, and for no x', y such that $x' <_s x$ and $\neg y <_s x$, it holds that $R_{\text{trans}}(x', y)$.
- (22) For an entity x and a situation s , if R -INT-WH(x, s) for some relation R , then INT-WH(x, s).

Here INT-WH is used as a more general notion of an integrated whole (in a situation).

What should count as an appropriate relation? An appropriate relation is, for example, closeness in space or time, but not distance. Moreover, only qualitative relations (relations whose extensions may differ with respect to different possible worlds) are appropriate and thus not relations such as being distinct or identical or the relation of being part of the same entity (otherwise many entities would qualify as integrated wholes that clearly should not).

Generally, singular count nouns convey integrity as a feature of the entities they describe. Thus, *the heap of sand* (a referent of a singular count NP) differs from *the sand* in that *the sand* (a referent of a mass NP) essentially has a certain shape, which is what is conveyed by the singular count noun *heap*. Besides such a notion of essential integrity, however, there is another kind of integrity: an entity may be an integrated whole only accidentally. A number of individuals gathering constitutes only an accidental integrated whole, a collection which would not cease to exist if it were to lose its integrity. Essential integrity individuates entities; accidental integrity is something an entity may have in one situation and lack in another. The

⁸ The notion of an R -integrated whole is taken from Simons (1987).

referent of *the heap of sand* essentially has a particular shape and thus has essential integrity. By contrast, the referent of *the sand* is not essentially an integrated whole, but may be one only accidentally. When the grains are spread, the sand remains the sand, but the heap does not remain the heap. Entities referred to by count NPs are not always essential integrated wholes, though. For example, one and the same entity may be characterized as an integrated whole in one situation by being referred to as *the (loose) collection of papers* and as not being an integrated whole in another situation by being referred to as *the papers* (cf. Moltmann 1990, 1997a, 1998). Thus only the following condition obtains:

- (23) For a singular count noun N , if $[N]^s(d) = 1$, then INT-WH(d, s).

I will use the one-place predicate 'INT-WH' for the notion of an essential integrated whole and a two-place predicate 'INT-WH' (that holds between entities and situations) for the notion of an integrated whole in a situation (which will include both essential and accidental integrated wholes).

The notion of an integrated whole is important in two quite different ways. First, integrity generally gives unity to an individual: it makes an entity count as a single object rather than as a collection of its parts. Second, and this is the respect that is more important in the current context, integrity in a situation influences what counts as the parts of an entity in that situation.

5.2. *The Situatedness of Part Structures*

Let me now elaborate the notion of a part structure in a situation. Certain entities, in particular collections and quantities, may have different part structures in different situations. Different situations may yield different part structures of the same entity because situations may specify or fail to specify an entity or its parts as accidental integrated wholes. As a result, certain entities, especially collections and quantities, may be divided differently into parts (subcollections or subquantities) in different situations (cf. Moltmann 1997a, 1998). A situation, moreover, may have a domain that contains only some of the actual parts of an entity. For example, the domain of a

situation may contain only some of the subgroups of a group, which will then be the only parts of the group in that situation.

In what way do integrity conditions influence the part structure of an entity in a situation? If a group is divided into certain subgroups in a situation, this is so not for arbitrary reasons, but because some connections hold among the members of those subgroups, that is, because the subgroups have integrity in that situation. If a group consists of subgroups that are integrated wholes in a situation, then those subgroups may count as the only parts of the group in that situation. This can be captured formally once the notion of a situation has been clarified.

By situations I mean simply partial specifications of some of the entities in the universe with properties: situations are partial possible worlds. They are as such always part of some possible world. They are abstract entities that are, unlike events, not located in time and space (rather they may contain events in their domain). The domain of a situation consists of the entities in that situation. I will impose the constraint, though, that only those objects can be in the domain of a situation s that are specified with some property in s .

Formally, I take situations to be primitives, but their identity and existence conditions depend on the propositions they support. When relativized to a situation, a property or relation may not only assign an n -tuple of entities the truth values 1 or 0, but it may also be undefined for it (or assign it the value #). N -place properties themselves (intensional relations) will be construed as partial functions from worlds or situations to n -place (extensional) relations. Situations are ordered by a part-of relation; in particular situations may be parts of possible worlds. The existence and identity of situations depends entirely on their information content: for any specification of entities with properties, there will be a corresponding situation, and two situations are identical just in case they specify entities with properties in just the same way. There is also an 'empty' situation s_0 : a situation with no information and an empty domain.

All this is captured by the following conditions on situations:

- (24) a. For an n -place property R and n objects x_1, \dots, x_n , there is exactly one situation s such that $R^s(x_1, \dots, x_n) = 1$, and for no other m -place relation R' and entities x_1, \dots, x_m , $R'^s(x_1, \dots, x_m) = 1$.

- b. Two situations s and s' are distinct iff for some n -place property R and entities x_1, \dots, x_n , $R^s(x_1, \dots, x_n) = 1$ (or 0) and $R^{s'}(x_1, \dots, x_n) \in \{0, \#\}$ (or $\{1, \#\}$).
- (25) a. A situation s is a part of a situation s' ($s < s'$) iff for every n -place property R and entities x_1, \dots, x_n , if $R^s(x_1, \dots, x_n) = 1$ (or 0), then $R^{s'}(x_1, \dots, x_n) = 1$ (or 0).
- b. For two situations s and s' , $\text{sum}_{<}(\{s, s'\})$ exists iff for no n -place relation R and entities x_1, \dots, x_n , $R^s(x_1, \dots, x_n) = 1$ and $R^{s'}(x_1, \dots, x_n) = 0$.
- c. There is a situation s_o such that $D(s_o) = \emptyset$.
- (26) An entity d is in the domain $D(s)$ of a situation s iff for some n -place property R and entities $x_1, \dots, x_{m-1}, x_{m+1}, \dots, x_n$, $R^s(x_1, \dots, x_{m-1}, d, x_{m+1}, \dots, x_n) = 1$.

We can now give a more formal characterization of part structures. I will say that a situated part structure has two components: it consists of a 'general' (situation-independent) part structure $(D, <)$ and a situation-dependent part structure $(D(s), <_s)$, for some situation s . The general part structure is supposed to be the situation-independent part structure. This is not the place to discuss the general part relation in any detail. Rather, I will simply assume that it has the following very general properties: it is irreflexive, not necessarily transitive, and closed under sum formation. The operation of sum formation $\text{sum}_{<}$ can then be defined as in (27b), where the overlap relation is defined in (27a) with the help of the transitive closure $<_{\text{trans}}$ of the general part relation:

- (27) a. $x O_{<_{\text{trans}}} y$ iff $\exists z(z <_{<_{\text{trans}}} x \ \& \ z <_{<_{\text{trans}}} y)$
 b. $\text{sum}_{<}(X) = \iota x[\forall y(y O_{<_{\text{trans}}} x \leftrightarrow \exists z(z \in X \ \& \ y O_{<_{\text{trans}}} z))]$

The part relation $<_s$ in a situation s is a restriction of the general part relation $<$. In order to allow for situated part structures where only certain subgroups of groups form parts of a group, $<_s$ should not be generally closed under sum formation: a sum in the sense of $<_s$ can be formed from a set of integrated wholes only if the sum of that set in the sense of $<$ is itself an integrated whole in s . Moreover, transitivity goes through only if the intermediate entity is not an integrated whole:

(28) $\langle (D, <), (D(s), <_s) \rangle$ is a situated part structure iff $(D, <)$ is an irreflexive ordering closed under the operation $\text{sum}_{<}$ and (i)–(v):

- (i) $D(s) \subseteq D$
- (ii) $x <_s y \rightarrow x < y$
- (iii) $x <_s y \ \& \ y <_s z \ \& \ \neg \text{INT-WH}(y, s) \rightarrow x <_s z$
- (iv) $X \subseteq D(s) \ \& \ x \neq \emptyset \ \& \ \text{sum}_{<}(X) \in D(s) \leftrightarrow (\forall x(x \in X \rightarrow \text{INT-WH}(x, s)) \ \& \ \text{INT-WH}(\text{sum}(X), s)) \vee \forall x(x \in X \rightarrow \neg \text{INT-WH}(x, s))$
- (v) For any set $A \subseteq D(s)$, $A \neq \emptyset$, $\text{sum}_{<_s}(A)$ exists iff $\text{sum}_{<}(A) \in D(s)$.

(28iii) allows parts of integrated wholes in a situation not to be parts of a larger entity having the integrated wholes as parts – permitting, for example, the part structure of the group of students to consist of subgroups only (as long as those subgroups are integrated wholes). This is one way in which the domain $D(s)$ of a situation s may fail to contain all the (general) parts of an entity.

(28iv) says that a set has a sum in a situation s just in case it is a set of integrated wholes and the sum is itself an integrated whole in s or it is not a set of integrated wholes. (28iv) thus limits closure under sum formation to sets of non-integrated wholes (a condition that will play a role later in the semantics of *individual(ly)*). This is the second way, then, in which the domain of a situation s , $D(s)$, may contain only some of the parts of an entity, depending on whether they themselves consist of integrated wholes or not.

5.3. *The Role of Situations in Sentence Meaning*

Now that we have the notion of a situated part structure, more needs to be said about the role situations play in the meaning of sentences. Recall that on the present account, the source of the difference among the readings of adnominal and adverbial part structure modifiers resides in the fact that part structure modifiers in adnominal position relate to a different situation than part structure modifiers in adverbial position.⁹

⁹ I use, the notion of a situation in just the specific way described, quite independent of the general project and the particular philosophical and formal assumptions of Situation Semantics (Barwise and Perry 1983).

Adnominal part structure modifiers relate to the reference situation, that is, the situation associated with the NP only.¹⁰ A reference situation, roughly, is a partial specification of objects with properties, properties considered relevant when referring to those objects. A reference situation contains the information provided by the descriptive content of the NP and possibly additional contextually relevant information, as, for example, when a speaker uttering the NP *the boxes* has a particular division of the boxes into groups in mind. The information given by descriptive modifiers may be responsible for the particular division of a collection into subcollections, for example in (29) the division of the collection of balls into the subcollection that consists of the red balls and the subcollection that consists of the green balls:

- (29) John compared the red and the green balls

In (29) *green* and *red*, respectively, characterize subgroups of the balls as integrated wholes with respect to the relation that holds between two entities just in case they are both green/red.

With reference situations, sentence meanings will have to be conceived as relations between n reference situations and a possible world, so that a sentence would be true at a world relative to n reference situations. Moreover, and we will see reasons for this later, if a referential NP provides an argument for a predicate, the argument will in fact be a pair $\langle d, s \rangle$ consisting of an object d and a reference situation s .

Adverbial part structure modifiers do not apply to a reference situation, but rather relate to a situation that is part of the world of evaluation, namely the part w_e of a world w that contains only information about the described event. I will call a situation like w_e an *event-dependent part* of w . w_e is defined as the maximal subsituation of w which specifies any n -place property with respect to an n -tuple of entities positively or negatively only if one of these entities is the event e itself or else a part of e :

¹⁰ Reference situations share some similarities with the resource situations that Situation Semantics makes use of (Barwise and Perry 1983; Cooper 1993). But reference situations, unlike resource situations, are also part of an argument of a predicate. For a critical discussion of resource situations in relation to incomplete descriptions see Soames (1986).

- (30) For a possible world w ,
 w_e = the maximal subsituation s of w such that for any n -place relation R and entities x_1, \dots, x_n , $R^s(x_1, \dots, x_n) = 1$ or 0, then $x_i = e$ or $x_i = e'$ for some $i \in \{1, \dots, n\}$, $e' < e$.

An event-dependent situation w_e contains all and only the information that directly involves e . Any such event-dependent situation will contain the information that the predicate is true of the relevant arguments and thus the information given by the verb about how the arguments participate in the described event. That is, if V is the verb and x_1, \dots, x_n its arguments, it will always be the case that $[V]^{w_e}(e, x_1, \dots, x_n) = 1$. This is the main information adverbial part structure modifiers rely on when displaying the part structure of an entity in w_e .

All the parts of an event e must be present in w_e . This is because the part-relation $<$ connects e to its parts, and given the identity and existence condition on situations in (24–26), there will always be a unique situation supporting all the propositions ‘about’ the described event (including those about the event’s parts).

Event-dependent situations are not limited to *individually* and *entirely*, but also secondary predicates such as *tired* in (31) relate in particular ways to the event described by the verb:

- (31) John left tired.

(31) says that John was tired at the time of his leaving, that is, in the situation that is about the event of his leaving.

5.4. *Situated Part Structures and the Application of Predicates*

Let us now turn in greater detail to the role of reference situations for the application of predicates. The way an entity is divided into parts in the reference situation may be crucial for the way a predicate applies to the entity. First, this accounts for the fact, discussed also in Gillon (1987) Moltmann (1990), and Schwarzschild (1996), that distributive interpretations of predicates generally relate to a contextually given division of a collection into parts (individuals or subcollections), as in (32):

- (32) John evaluated the students.

(32) may mean that John evaluated the individual students or else that he evaluated subcollections of students in a contextually given division of the group of students.

The way a collection is divided into parts may also be important for the application of a part-structure-sensitive predicate such as *distinguish* in (33).¹¹

- (33) John cannot distinguish the students.

Distinguish is sensitive to the part structure of an argument because a sentence such as (33), in which *distinguish* takes a plural argument, can be understood in a variety of different ways, depending on the part structure of the collection of students. (33) may mean, for example, that John cannot distinguish any one student from any other student or else that John cannot distinguish one relevant subgroup of students from another relevant subgroup. Thus, *distinguish* in (33) applies not just to the group d of students, but rather to a pair consisting of d and a reference situation s , where s will give information about what the relevant parts of d are (e.g. whether they are individual members or certain subgroups) and hence what exactly John is unable to distinguish.

Reference situations are central in my account of adnominal part structure modifiers, and they interact in a certain way with predication. Reference situations may form part of the semantic value of NPs so that NPs will stand not just for entities, but pairs consisting of an entity and a reference situation. This is required because predicates like *distinguish* apply not simply to groups, but also take into account the reference situation, which may provide a division of the group into subgroups. Reference situations convey what the relevant part structures of entities are. The truth conditions of (33) can thus be paraphrased roughly as in (34), where s' is a reference situation and *sum* an operation of group or sum formation (mapping the extension of *students* in s' , the set of groups of relevant students in s' , to the maximal group of students in s'):

- (34) For a world w and a reference situation s' ,
 $[distinguish]^w(\text{John}, \langle \text{sum}([students]^{s'}), s' \rangle) = 1$ iff
 John distinguishes in w each part of $\text{sum}([students]^{s'})$ in s'
 from any other part of $\text{sum}([students]^{s'})$ in s' .

There are a number of proposals concerning the treatment of distributivity, for example Landman (1989), Link (1983), Roberts

¹¹ This has been overlooked by Gillon (1987) and Schwarzschild (1996), which is why their accounts are limited in application.

(1987), van der Does (1993), Schein (1995), Schwarzschild (1996), and Moltmann (1997a) to name just a few. In this paper I propose a somewhat different account of distributivity than in Moltmann (1997a), for reasons discussed in Appendix A. On this account, a predicate may be associated with a distributivity operator for each of its argument positions and thus form a complex predicate with it.¹² A predicate like *heavy*, on the distributive reading, will be represented as $[D_1 \text{ heavy}]^w$, where D_1 is the distributivity operator. The distributivity operator makes crucial reference to the reference situation since it involves a quantifier ranging over the parts of group argument in the reference situation. Thus, we have:

- (35) For an entity d and a situation s ,
 $[D_1 \text{ heavy}]^w(d, s) = 1$ iff $\forall d' (d' <_s d \rightarrow$
 $[\text{heavy}]^w(d', s) = 1)$.

One important area where the notion of an integrated whole plays a role semantically is conditions on the application of certain kinds of predicates to arguments, namely first part-structure-sensitive semantic selectional requirements and second distributivity (cf. Moltmann 1990, 1997a). If an entity is an integrated whole, a predicate (or reading of a predicate) making reference to the parts of an argument, but not the whole, will not be applicable. The predicates in (36) are examples of predicates that make reference to the parts of an argument, but not the whole:¹³

- (36) a.??John compared/counted/enumerated/listed the class.
 b. John compared/counted/enumerated/listed the class members.

The examples in (36a) are unacceptable or at least have a different reading from those in (36b).

The prevention of part-structure-sensitive predicates applying to individuals is achieved by what I called the *Accessibility Requirement* (cf. Moltmann 1990, 1997a, 1998):

¹² The observation that the argument position of any predicate, including prepositions, allows for a distributive interpretation is due to Gillon (1987).

¹³ See Moltmann (1990, 1997a) for detailed arguments that semantic selectional requirements such as the Accessibility Requirements are indeed conditions on the part structure of an argument in a situation rather than syntactic restrictions to plural or mass NPs, as opposed to singular count NPs.

(37) *The Accessibility Requirement*

A predicate or reading of a predicate making reference to the parts, but not the whole, of an argument can apply to an entity d in a situation s only if d is not an integrated whole in s .

The Accessibility Requirement excludes predicates making reference to the parts as well as the whole of an argument because of predicates like *rearrange*, *break apart*, and *organize*, which can apply to collections that have integrity (cf. Moltmann 1990, 1997a). The Accessibility Requirement also applies to distributive readings of predicates.

The distributivity operator clearly makes reference to the parts of an argument and hence is subject to the Accessibility Requirement. When *the collection of boxes* refers to an entity d in a reference situation s , d will be specified as an integrated whole in s , and hence the distributivity operator will be inapplicable.

6. THE MEANING OF *INDIVIDUAL(LY)*

What is the lexical meaning of *individual(ly)*? There are three obvious conditions associated with *individual(ly)*. First, *individual(ly)*, when applying to a group d , specifies that the individual members of d are relevant parts of d . Moreover, it excludes that subgroups of d are relevant parts. Finally, it presupposes that d is not an integrated whole (thus excluding an application to collective singular count NPs). Before we look at how these conditions manifest themselves empirically, let us first see how they can be appropriately formalized.

A first approximation to the meaning of *individual(ly)* is that it is a function mapping a property of groups (the intension of a plural noun) onto a relation between groups and situations that hold between a group d and a situation s just in case d is not an integrated whole in s and all the members of d are essential integrated wholes. If we take those relations formally to be functions from pairs consisting of an entity and a situation to truth values, 1, 0, or # (undefined), then we will have:

- (38) For a property P , an object d , and a situation s ,
- $$[\textit{individual(ly)}]^s(P)(\langle d, s \rangle)$$
- $$= 1 \text{ if } \neg \text{INT-WH}(d, s) \ \& \ P^s(d) = 1 \ \& \ \forall d' (d' <_s d$$
- $$\quad \longrightarrow \text{INT-WH}(d')),$$
- $$= 0 \text{ if } \neg \text{INT-WH}(d, s) \ \& \ \neg(P^s(d) = 1 \ \& \ \forall d' (d' <_s d$$
- $$\quad \longrightarrow \text{INT-WH}(d'))),$$
- $$= \# \text{ otherwise.}$$

Thus, *individual(ly)* expresses a function that when applied to a property maps a pair consisting of an entity d and a situation s to the truth value 1 just in case d is not an integrated whole in s and all of d 's parts in s are essential integrated wholes. Since proper subgroups cannot be essential integrated wholes (but only accidental ones), it follows that no proper subgroup can be a part of d in the situation s . (38) also includes the condition that *individual* cannot apply to singular count nouns (singular count nouns do specify entities as integrated wholes in any situation).

(38), however, is not quite adequate yet. Before looking at the relevant type of example, let us note that *individual(ly)* not only applies to groups, but also to individuals, as in (39):

- (39) a. An individual student solved the problem.
 b. John worked on the problem individually.

Intuitively, *individual(ly)* here emphasizes the (essential) integrity of the entity it applies to, and it also specifies that the entity does not form part of an (accidental) integrated whole in the context in question. Thus, for the meaning of singular *individual* the following function from properties of individuals to relations between individuals and situations seems adequate:

- (40) For a property of individuals P , an object d , and a situation s ,
- $$[\textit{individual}_{\text{sing}}]^s(P) (\langle d, s \rangle)$$
- $$= 1 \text{ if } \text{INT-WH}(d) \ \& \ P^s(\langle d, s \rangle) = 1 \ \& \ \neg \exists d' (d <_s d' \ \& \ \text{INT-WH}(d', s)),$$
- $$= 0 \text{ if } \text{INT-WH}(d) \ \& \ \neg (P^s(\langle d, s \rangle) = 1 \ \& \ \neg \exists d' (d <_s d' \ \& \ d \neq d' \ \& \ \text{INT-WH}(d', s))),$$
- $$= \# \text{ otherwise.}$$

That is, *individual* as a singular expresses a function that, when applied to a property, maps a pair consisting of an object d and a situation s onto 1 just in case d is an essential integrated whole and not part of a larger integrated whole in s .

It is then natural to take *individual* when applying to a property of groups (rather than a property of individuals) to simply act as the plural (in the semantic sense) of *individual* when applying to singular count nouns. This will yield the following group property as the general meaning of *individual(ly)*, a meaning which may also apply to individuals – that is, groups formed from a single entity:

- (41) For a property P , an object d , and a situation s ,
- $$\begin{aligned}
 & [individual(ly)]^s(P)(\langle d, s \rangle) \\
 & = 1 \text{ if } \exists X (X \subseteq \{x \mid [individual_{\text{sing}}]^s(P)(\langle x, s \rangle) = 1\} \ \& \\
 & \quad X \neq \emptyset \ \& \ d = \text{sum}_{<s}(X)), \\
 & = 0 \text{ if } \exists X (X \subseteq \{x \mid [individual_{\text{sing}}]^s(P)(\langle x, s \rangle) = 0\} \ \& \\
 & \quad X \neq \emptyset \ \& \ d = \text{sum}_{<s}(X)), \\
 & = \# \text{ otherwise.}
 \end{aligned}$$

(41) is not quite equivalent to (38), since (41) says that the group members should not be part of an integrated whole composed of members of the same group, whereas (38) says that the group members should not be part of any integrated whole in the relevant situation. Which of those two conditions is correct? It appears that the second, more general condition is sometimes required, for example in (42):

- (42) The children solved the problems individually.

(42) may mean that the children solved the problems without collectively working on them (which would be captured by (38)). But it may also mean that the children solved the problem without cooperating with anybody, adults included, which would not be captured by (38), but only by (41). Thus, the choice of the second, more systematic definition of the meaning of *individual(ly)*, which accounts for the application of *individual(ly)* to both groups and individuals, is justified.

The condition of essential integrity in (40) guarantees the application of *individual(ly)* to collections and it also accounts for the connection of *individual(ly)* to the noun *individual*. By contrast, the condition against accidental integrity of a larger entity in (40) is crucial for explaining why *individual(ly)* influences the application of predicates in adnominal position and why it has particular readings in adverbial position.

We can now turn to deriving the readings that *individual* with this meaning may display as an adjectival modifier. In this function, *individual* has basically either of two semantic effects. The first is to enforce a strictly distributive interpretation as in (43a–c):

- (43) a. The *individual* boxes are heavy.
 b. John liked the *individual* paintings (but not the exhibition as a whole).
 c. Mary cannot remember the *individual* students (but only the class as a whole).

Strict distributivity means that the predicate must apply to all the individual group members and may not just distribute down to subgroups. With one additional pragmatic assumption, the strict distributivity effect follows from the way distributivity is conceived and from the kind of part structure that *individual(ly)* specifies. All and only the individual group members will be the situated parts of the group, and thus the distributivity operator will range only over these individual members.

But why, with the predicates in (43), does distributivity *have* to apply? *Individual* could just specify the situated part structure of the group, with the predicate applying collectively. The reason is an obvious pragmatic one: the use of *individual* must make a difference to the interpretation of the sentence. With a collective interpretation of the predicate, the use of *individual* could not make any difference to the understanding of the sentence. Only with a distributive interpretation will *individual* exclude some readings (distribution over subgroups) and trigger another (distribution over group members). This pragmatic principle concerning reference situations can be more formally given as in (44) (restricted for simplicity to one-place predicates):

(44) *Pragmatic Condition on Reference Situations*

For a predicate P , a world w , an object d , and a reference situation s , the application of P to w and $\langle d, s \rangle$ is appropriate just in case if $[P]^w(\langle d, s \rangle) = 1$, then for some situation s' , $s \neq s'$, $[P]^w(\langle d, s' \rangle) = 0$, and if $[P]^w(\langle d, s \rangle) = 0$, then for some situation s' , $s \neq s'$, $[P]^w(\langle d, s' \rangle) = 1$, provided that for some property Q , $Q^s(\langle d, s \rangle) = 1$.

(44) says that if the reference situation has any information content regarding the entity in question, then some other reference situation should yield a different truth value for the same predicate relative to the same world. One case where (44) would not be applicable, of

course, would be one in which the reference situation is the empty situation s_0 .¹⁴

Evidence that a merely pragmatic principle is at play is the fact that *individual* does not *have* to trigger a distributive reading: even predicates for which the distributive/collective distinction is not applicable, such as locational predicates, can be acceptable with *individual*:

- (45) The individual bedrooms are located on the second floor.

There is another way in which *individual* may influence the evaluation of the predicate besides by enforcing a distributive interpretation. It manifests itself with predicates whose lexical meaning is sensitive to the part structure of the argument, for example *distinguish*, *compare*, *rank*, and *list*. When applying to a group d , these predicates say something about the parts d has in the relevant situation. The important observation is that with such predicates, *individual* has a different semantic effect, enforcing a particular part-structure-related reading. Compare (46a) with (46b) and (47a) with (47b):

- (46) a. John cannot distinguish the students.
 b. John cannot distinguish the individual students.
- (47) a. John compared/ranked/listed the students.
 b. John compared/ranked/listed the individual students.

(46a) has a reading involving only subgroups of the students, let's say when John cannot distinguish the MIT students from the Harvard students. But (46b) lacks such a reading. (46b) can be true only if John cannot distinguish any single student from any other student. Similarly, (47a) has readings involving subgroups of students, whereas (47b) may involve the individual students only. Thus, the second semantic effect of *individual* consists in evaluating a group

¹⁴ Note, though, that restrictive relative clauses, whatever their content, do not influence the application of the predicate. Thus, *individually* below does not trigger a distributive interpretation, but allows for the collective predicate *form a nice collection*:

(1) The cups that are standing individually on the cupboard form a nice collection. Intuitively, adnominal restrictive modifiers only provide information that helps to identify the referent of the NP. By contrast, adnominal part structure modifiers induce a perspective on the event of the NP that serves to, in some way, influence the evaluation of the predicate.

argument with respect to its members, rather than some division into subgroups.

The same lexical meaning of *individual* in (41) also covers occurrences of the adverbial *individually*, as in (48) and (49):

- (48) a. The students solved the problem individually.
 b. The people left the room individually.

- (49) The cups were standing individually on the cupboard.

Individually applies with that same meaning to a different situation, namely the situation w_e for e being the described event. It then specifies that the members of the group in question are not part of a larger integrated whole in that situation. This will lead to the individual-action reading of (48a), the noncoordinated-action reading of (48b), and the spatial-separation reading of (49). Given the notion of R -integrated whole, *individually* prevents any proper subgroup of the relevant group participant to be an integrated whole with respect to a relevant relation R involving the event e or a part of it as an integrated whole. In other words, *individual(ly)*, when applying to an entity d in a situation w_e , has the following implication:

- (50) For a property P , a world w , a group d , and an event e , $[\textit{individually}]^{w_e}(P)(\langle d, w_e \rangle) = 1$ then for all d' , d'' , $d' <_s d$, $d'' <_s d$, $d' \neq d'' \neq d$, for no appropriate relation R , $R^w(e', d', d'') = 1$ for any $e' < e$.

It only depends on the nature of e what sort of relation *individually* prevents from holding among the members of the group d . For example, no two individual members may be coagents of some subevent of the complex event of problem-solving in (48a), be coordinated when performing some subevent of the complex event of leaving the room in (48b), or be spatially close during the state of standing on the cupboard in (49).

Of course, there is a constraint on what relations are appropriate that connect two group members to an event: it can be co-participation in a group of cooperative actions, but not in a group of uncooperative actions, and co-participation in a state that is continuous in space, but not in one that is spatially discontinuous. That is, only those relations can be appropriate that involve an event that is an integrated whole.

Events that are integrated wholes include single actions, groups of actions that are coordinated in some way or another, and states that are continuous in space. It excludes groups of disconnected actions or unconnected spatio-temporal locations. Thus, the following condition obtains for appropriate relations R taking an event e as an argument for defining R -integrity:

- (51) A relation R taking an event e as argument is appropriate for R -integrity in a situation s only if INT-WH(e, s).

This analysis obviously makes crucial use of the notion of an accidental integrated whole for preventing the formation of subcollections in the situation in question.

7. THE MEANING OF *WHOLE*

Like *individual*, adnominal *whole* (on its part-related reading) has two sorts of semantic effects, one targeting a distributive application of a predicate and one targeting the evaluation of a part-structure-sensitive predicate.

The first effect of *whole* is to allow for a distributive reading that might otherwise not be available, as on one reading of (52a) and of (53a):

- (52) a. The whole collection is expensive.
 b. The collection is expensive.
- (53) a. John gave the whole class an A.
 b. John gave the class an A.

The distributive reading triggered by *whole* consists in that the predicate applies to every actual part of the entity in question. Thus, (52a) (on the relevant reading) implies that every piece in the collection is expensive and (53a) (on the relevant reading) that every student in the class got an A.

The distributive reading that *whole* triggers with collective NPs is not quite the same as the distributive readings available with definite plural NP (without *whole*). Definite plural NPs allow for a distributive reading where the predicate distributes just over the elements of a contextually given partition of the relevant collection, as is possible in

(54a). The distributive reading triggered by *whole*, by contrast, requires distribution over all the actual members of the collection, as in (54b):

- (54) a. The students got an A.
- b. The whole group of students got an A.

I take this to mean that *whole* involves mapping a collection to the sum of all its actual parts, not just its contextually determined parts, a condition observable in the same way with individuals.¹⁵

In (52a, 53a), the presence of *whole* is required for the distributive reading to be available. Without *whole*, a distributive reading would lead to a violation of the Accessibility Requirement because the singular count nouns *collection* in (52a) and *class* in (53a) specify the NP referent as an integrated whole. But this means that *whole* somehow has the effect of specifying that the entity in question is not an integrated whole, by discarding some of the information expressed by *collection* or *class*. I take this to mean that in examples such as (52a) and (53a) (on the relevant reading), *whole* maps collections onto the mere sum of their members. That is, the predicate, instead of applying to a collection, applies to the mere sum of all the proper parts of the collection. This in itself does not yet enforce a distributive interpretation. However, as in the case of some occurrences of adnominal *individual*, the triggering of a distributive interpretation can be explained pragmatically: the requirement that a redundant use of *whole* be avoided.

Whole also induces a distributive application of a predicate over all the actual parts of an object, as in (55):

- (55) a. John ate the whole cake.
- b. John knows the whole poem.
- c. The whole house was destroyed.

Again the examples make clear that the parts the predicate distributes over are not the parts an entity has in the situation of reference, but all its actual parts.

¹⁵ This is a problem for the account of Morzycki (2001), who takes *whole* to involve distribution of the predicate over what amounts to a contextually determined partition of the entity in question. His account thus does not guarantee distribution of the predicate over all the actual parts of the entity in the case of a distributive reading.

The explanation for the case of individuals would be analogous: *whole* has the function of breaking up an individual into its actual parts and ‘restoring’ it as the mere sum of those parts. As a result a distributive interpretation becomes available on which the predicate applies to all the actual parts, which are now present in the situation of reference.

Thus, *whole* on one reading induces a distribution of the predicate over all the actual parts of the entity in question. Formally, this means that *whole* expresses the following function from properties to relations between entities and situations:

(56) For a property P , an entity d , and a situation s ,

$$\begin{aligned} & [whole]^s(P) (\langle d, s \rangle) \\ & = 1 \text{ if } \neg \text{INT-WH}(d) \ \& \ \exists d'' (P^s(\langle d'', s \rangle) = 1 \ \& \\ & \quad d = \text{sum}_s(\{d' \mid d' <_s d\}) \ \& \ \forall d' (d' < d'' \longrightarrow d' <_s d'')) \\ & = 0 \text{ if } \neg \text{INT-WH}(d) \ \& \ \neg (\exists d'' (P^s(\langle d'', s \rangle) = 1 \ \& \\ & \quad d = \text{sum}_s(\{d' \mid d' <_s d\}) \ \& \ \forall d' (d' < d'' \longrightarrow d' <_s d'')) \\ & = \# \text{ otherwise} \end{aligned}$$

That is, *whole* applied to a property P leads to a relation between entities d and situations s such that d is the sum of all the parts of some entity d'' with the property P which is such that all the actual parts of d'' are also the parts d'' has in s , and moreover d is not an essential integrated whole.

The second semantic effect that *entire* and *whole* may have arises with part-structure-sensitive predicates. The following examples illustrate the relevant kind of reading:

- (57) a. John listed/enumerated/counted the whole class.
 b.??John listed/enumerated/counted the class.

Whole in the examples in (57a) does not yield a distributive reading, but rather allows the part-structure-sensitive predicate *compare* to apply to the class in a collective way, by involving the individual members of the act of listing, enumerating, or counting.

A somewhat different, though related case are examples with collective predicates where the function of *whole* is not to make the predicate applicable, but rather to allow for a certain reading of the predicate:

- (58) a. The map covers the whole table.
 c. The whole group of soldiers surrounded the palace.
 d. The whole police force was distributed over the region.

The semantic effect of *whole* in (58a) is not to trigger a distributive reading of the predicate, but rather to induce a particular reading of *cover* applied collectively, namely a reading on which every part of the table is covered by some part of the map. Similarly, *whole* in (58b) ensures that every soldier was involved in the surrounding of the palace and in (58c) that every policeman was involved in covering the region.

(56) also covers the semantics of adverbial *entire(ly)* (and *wholly*). Let us first consider the complete-involvement reading exemplified by (59):

- (59) The clouds have entirely disappeared.

Suppose e = the event of the clouds's disappearing. Then *entirely* in (59) specifies that the clouds are not an integrated whole in w_e and that every actual part of the group of clouds is present in w_e . The first condition is not relevant here; but the second condition is crucial. It requires that every part of the group of clouds be in w_e , which means every part must stand in a direct relation to e or a part of e (since all the parts of e are in w_e as well). A thematic relation expressed by the verb is of course the best candidate for such a relation. In the present case, this is the relation THEME, and so we have (60), for an event e , world w , group d (the clouds), and reference situation s :

- (60) $[entirely]_{w_e} ([disappear])(\langle d, s \rangle) = 1$ if for every $d' < d$, for some $e' < e$, THEME(d' , e').

In that way, *entirely* ensures 'complete distributive' participation of the relevant participant in the event.

In the same way, the complete-spatial-coverage reading of *entirely* in (20b), repeated here as (61), can be derived:

- (61) The blanket was lying entirely on the floor.

In (61), *entirely* specifies that every part of the blanket was lying on the floor. This follows from the condition imposed by *entirely* – namely, that every part of the blanket be in the situation w_e , where e is the state of lying on the floor. This condition is fulfilled just in case every part of the blanket stands in the relation expressed by the verb to some substate of e .

Let us now turn to the more difficult task of analysing the whole-related reading of *whole*, the reading on which *whole* means *as a whole*. Recall the availability of that reading in the examples in (5a, b), repeated here as (62a, b):

- (62) a. The whole/entire collection is expensive.
 b. John gave the whole/entire class an A.

In some cases, the whole-related reading is in fact the only reading available, for example with an object whose form is considerably more important than its parts, such as an idea, an argument, or a structure:

- (63) a. John dislikes the whole idea.
 b. John finds this whole line of argument incomprehensible.
 c. John changed the whole structure.

It is also the only possible reading of *whole* when a predicate requires the preservation of the structure of an object, as in (64):

- (64) a. John repeated the whole sentence.
 b. John pronounced the whole name.
 c. The orchestra performed the whole symphony.
 d. Mary translated the whole sentence.

For (64a) to be true, John could not have repeated every part of the sentence, (lets, say every word that occurs in it), in a different, order. (64a) thus requiries a whole-related, rather than a part-related, reading of *whole*. Similarly for the phonemes of the name in (63b). The performance in (64c) does not involve each part of the symphony, but rather also the structure of the symphony as a whole, and similarly for the translation in (64d).

It is not just essential conditions of integrity that *whole* may put into focus, but also accidental features of a whole, for example in (65):

(65) John won't like this whole collection of stuff.

It appears that the two readings of *whole* are not a mere accidental fact about a lexical item of English. Rather, they seem to arise systematically for the corresponding expressions across Indoeuropean languages (evidenced already by the fact that medieval philosophers cared about them). Thus, the two readings should be traced at least to closely related underlying meanings.

I want to propose that the second reading in fact arises from almost the same meaning of *whole* as given in (56). The difference is that on the whole-related reading, *whole* will involve another part relation, a part relation according to which also conditions of form or other properties of integrity count as parts of an entity. From a philosophical point of view, it is in fact not entirely implausible that conditions of form may also count as parts of an individual. At least there are views in the philosophical literature according to which this is the case. Most prominently there is Aristotle's view of hylomorphism, according to which (at least on a common interpretation) an individual is a combination, perhaps even the mereological sum, of its material parts and its form.¹⁶ A more extreme view is the more recent one according to which individuals are to be identified with the set of all their concrete (particularized) properties (which would include properties of form) (Williams 1953).

I will adopt roughly the general Aristotelian view, but in the sense that there will be two part relations: the *Aristotelian part relation* as a part relation involving both conditions of form and ordinary parts and the part relation as I used it so far, which I will call the *ordinary part relation*. Individuals will then in some way be a composition of a property *P* of form (or some other sort of integrity) and a set of ordinary parts *X*, formally $P \oplus \text{sum}(X)$. I will take the properties of form or other integrity to be primitive and

¹⁶ See Haslanger (1994) for that view. But for a different interpretation of Aristotle's view, see Lowe (1999).

also elements of the domain D of entities. They are ordered by a part relation $<_p$ (where $P <_p P'$ means ‘ P is a less specific property than P' ’). Then the following conditions hold for the Aristotelian part relation $<_a$:

- (66) *The Aristotelian Part Relation*
 $x <_a y$ iff either $x < y$ or else for some property P , $x = P$ and $P <_p P'$ for some property P' such that $y = P' \oplus z$, for some entity z .¹⁷

For the whole-related reading, the meaning of *whole* is then to be rewritten as follows:

- (67) For a property P and situations s and s' ,
 $[whole]^s(P) (\langle d, s \rangle)$
 $= 1$ if $\neg \text{INT-WH}(d)$ & $\exists d'' (P^s(\langle d'', s \rangle) = 1$ &
 $d = \text{sum}_s(\{d' \mid d' <_s d''\})$ & $\forall d' (d' <_a d'' \rightarrow d' <_s d'')$),
 $= 0$ if $\neg \text{INT-WH}(d)$ & $\neg (\exists d'' (P^s(\langle d'', s \rangle) = 1$ &
 $d = \text{sum}_s(\{d' \mid d' <_s d''\})$ & $\forall d' (d' <_a d'' \rightarrow d' <_s d''))$),
 $= \#$ otherwise.

Individual and *whole* can be used to form other expressions than adnominal and adverbial modifiers, and the semantics of those expressions gives good support for the kinds of meanings that I have proposed. First, *whole* and *individual* obviously occur as nouns. In this case, the condition that an entity be an integrated whole is not a precondition for applying *whole* to an individual, but rather its sole lexical content. In the case of the noun *individual*, the condition that an entity be an essential integrated whole is again an identifying lexical content, and the additional condition that the entity not form an integrated whole with a larger entity should now be construed as a condition independent of a situation. *Whole* can also occur as a predicate, as in (68):

¹⁷ On Aristotle’s view, apparently, an individual is taken to be a compound of its material and its form. *Whole* on its whole-related reading does not necessarily involve material parts, though, but may involve parts whose material constitution may vary across different possible worlds or different times:

(1) The whole ship once consisted of wood, but now it consists mainly of metal.

(68) The glass is still whole.

In (68), *whole* means ‘intact’, ‘not broken’, that is, being in a state of integrity of a certain sort. Also nominalizations formed with *individual* and *whole* are suggestive of the proposed meanings. Thus, *individuality* indicates the particular characteristics that make an individual an integrated whole; and *wholeness* indicates some form of integrity as well.¹⁸

8. CONCLUSIONS AND FURTHER REMARKS ON REFERENCE SITUATIONS

In this paper, I have presented an analysis of two expressions, *individual* and *whole*, that makes significant use of situations, carriers of partial information that display the part structure (perhaps only accidental part structure) of entities in a certain way. Situations differ in their role in the meaning of a sentence which in turn is reflected in systematic differences in their information content (reference situations and event-dependent situations). In the case of adnominal *individual* and *whole*, the display of a part structure in a reference situation serves to influence the way the predicate applies to the entity in question.

The concept of a part structure in a situation is a concept that is quite natural for entities, like collections, entities that have flexible, nonessential part structures. Part structure modifiers, which exploit this concept, provide an interesting alternative way of making universal statements to that of ordinary quantification.

The analysis of course raises the question whether reference situations serve any independent purposes other than that of the semantic analysis of *individual* and *whole* (and also distributivity and semantic selectional requirements). Several other possible uses of reference situations come to mind. First, reference situations may be viewed as situations containing information necessary for the iden-

¹⁸ There is one other use of *whole*, and that is as a modifier of a predicate:

- (1) a. The number given was wholly accurate.
 b. John was not wholly sincere.

In (1) *wholly* clearly does not involve the parts of an individual. Instead, it seems to quantify over respects in which the property expressed by the predicate may hold, or better it quantifies over properties that are in a sense parts of the property expressed by the predicate. This might be another case in which *whole* would involve quantification over parts that are properties.

tification of the referent of an NP (in the case of incomplete descriptions) or, in the case of a quantificational NP, its quantification domain (cf. Recanati 2004). Reference situations might also provide the modes of presentations needed for the semantics of sentences embedded under attitude verbs. Finally, reference situations may carry the information needed in addition to an object itself, for the evaluation of predicates such as *like* or *earn* as in (69):

- (69) a. John likes the poet G, but not the businessman G.
 b. The poet G earns less than the businessman G.

Another use of reference situations one might think of are *as*-phrases, as in (70):

- (70) John as a businessman earns a lot.

Interestingly, *as*-phrases also allow for predicates relating to the part structure of an entity, as in (71):

- (71) The boxes as a whole/as a group/as a collection cost a lot.

However, I do not think that *as*-phrases are on a par with modifiers whose function is to influence the reference situation. In the latter case, the connection between the reference situation and the way the predicate applies to the argument is a pragmatic one. With *as*-phrases, by contrast, the connection seems semantic in nature. This is because with *as*-phrases such a connection is obligatory, as seen in the following contrast:

- (72) a. John the businessman was praised.
 b. John as a businessman was praised.

While it is still possible in (72a) that John was praised in another function than that of being a businessman, his being a businessman must be the basis for his being praised in (72b). *As*-phrases thus constitute a different, though certainly related phenomenon to that of part structure modifiers.¹⁹

¹⁹ Gendler Szabo (2003) presents an analysis of *as*-phrases as in (69a) according to which the event or state described by the main predicate is to be a part of the event or state characterized by the *as*-phrases. This analysis obviously is not extendable to *as*-phrases with part-structure-related predicates.

APPENDIX A

A remaining problem to be addressed is the interaction of *whole* with negation, as in (1):

- (1) John did not eat the whole cake.

This phenomenon is quite puzzling: on the one hand, we have seen convincing evidence that *whole* does not act as a quantifier; on the other hand, just with negation *whole* shows true quantificational behavior. It even exhibits the typical focus properties of universal quantifiers. Thus, on its wide-scope reading, *whole* in (1) needs to be focused, just as *every* needs to be focused in (2) on the reading on which it takes scope over *not*:

- (2) John did not see every student.

The scope interaction of *whole* with negation is easy to represent on the analysis of distributivity that I have proposed in this paper. It just needs to be admitted that negation may form a complex predicate together with the verb. Thus, on the wide-scope reading of *whole*, (1) would be represented as in (3a) and on the narrow-scope reading as in (3b):

- (3) a. [D_2 not eat] (John, ⟨the whole cake, s ⟩)
 b. [not D_2 eat] (John, ⟨the whole cake, s ⟩)

I did not say much about the motivations of this account. A partial motivation for it is in fact just its application to the scope interaction of *whole* with negation. The latter can hardly be accounted for on the view of distributivity I gave in Moltmann (1997a) according to which predicates have a disjunctive meaning, with one disjunct representing the distributive and the other disjunct the literal meaning. This account was motivated by the possibility of conjunctions of distributive and collective modifiers as in (4):

- (4) Yesterday, John and Mary lifted the box individually and together.

(4) simply means that John and Mary were involved in a complex event of lifting the box, part of which involved John and Mary individually and part of which involved John and Mary collectively.

The motivation for locating distributivity in the lexical meaning of a predicate rather than a distributivity operator came from the general lack of scope interactions of distributivity with other operators in the sentences, as in (5):

(5) The students wrote exactly two essays.

(5) only has a reading on which the students together wrote a total of two essays. Only with some predicates do indefinites allow for a narrow-scope reading:

(6) The students wrote an essay.

This was accounted for by allowing a verb to form a complex predicate with an indefinite (*wrote an essay*). The present account postulates the same possibility for the formation of a complex predicate with an implicit distributivity operator and with negation.

Not only does my earlier account not provide a way of representing the scope interaction of *whole* with negation, it is more importantly inadequate in the postulation of a disjunctive reading: a sentence such as (6) is not neutral with respect to a distributive or a collective interpretation, but rather one needs to know whether the speaker intended the one or the other reading to understand an utterance of it.

APPENDIX B

A Fragment of English with Part Structure Modifiers

This is a sketch of a modeltheoretic semantics for a fragment of English that consists in (one-place) nouns, the determiner *the*, *individual(ly)*, and *whole (wholly)*, and intransitive and transitive verbs.

A model will be a structure

$$\langle W, (s_0, S, <), (P, <_p), (D, <, \text{sum}, <_a, \oplus), \\ \{(D(s), <_s) \mid s \in S\}, E, \{1, 0, \#\} \rangle$$

satisfying the following conditions:

- (1) a. $W \subseteq S$
- b. $s_0 \in S$ and $D(s_0) = \emptyset$
- c. $\forall s \in S, \exists w \in W, s < w$

- (2) $\langle (D, <, \text{sum}), (D(s), <_s) \rangle$ is a situated part structure for any $s \in S$.
- (3) $\langle (P, <_p), (D, <), (<_a, \oplus) \rangle$ is an Aristotelian part structure.

The interpretation of simple expressions:

for one-place nouns N :

$[N]$ is a function from S to functions from $D \times S$ to $\{1, 0, \#\}$.

Verbs will have an additional argument position for events. Thus,

for intransitive verbs V :

$[V]$ is a function from S to functions from $D \times (D \times S)$ to $\{1, 0, \#\}$,

for transitive verbs V :

$[V]$ is a function from S to functions from $D \times S$ to functions from $D \times (D \times S)$ to $\{1, 0, \#\}$.

The interpretation of complex expressions:

ordinary adnominal restrictive modifiers:

for an adjective A and a noun N ,

$[A N] = \text{mod}([A], [N])$ = the function f from S to functions from $D \times S$ to $\{1, 0, \#\}$ such that

$f(s)(\langle d, s \rangle) = 1$ iff $[A]^s(\langle d, s \rangle) = 1$ and $[N]^s(\langle d, s \rangle) = 1$.

adnominal part structure modifiers:

for an adnominal part structure modifier A and a noun N ,

$[A N] = \text{adnom-part-str-mod}([A], [N])$ = the function from S to functions from $D \times S$ to $\{1, 0, \#\}$ such that $[A N](s)(\langle d, s \rangle) = 1$ iff $[A]^s([N])(\langle d, s \rangle) = 1$.

adverbial part structure modifiers:

for an adnominal part structure modifier A and an intransitive verb

V , $[V A] = \text{adv-part-str-mod}([V], [A])$ = the function from W to functions f from $D \times (D \times S)$ to $\{1, 0, \#\}$ such that $[V A](w)(\langle e, \langle d, s \rangle \rangle) = 1$ iff $[A]^{w_e}([N])(\langle e, \langle d, s \rangle \rangle) = 1$.

determiners in subject position:

for *the* occurring in subject position with singular nouns:

$[\text{the}_{\text{subj}}]$ = the function f from situation s to functions that map properties to functions g that map intensional relations to relations between situations and possible worlds, that is, for $s \in S$:

$f(s)([N])$ = the function g such that

$g([\text{VP}]) = \{\langle s, w \rangle \mid \{x \mid [N]^s(\langle x, s \rangle) = 1\} = 1 \ \& \ \{x \mid [N]^s(\langle x, s \rangle) = 1\} \subseteq \{x \mid [VP]^w(\langle x, s \rangle) = 1\}\}$.

for *the* occurring in subject position with plural nouns:

$[the_{\text{subj}}]$ = the function f from situation s to functions that map properties to functions g that map intensional relations to relations between situations and possible worlds, that is, for $s \in S$:

$f(s)([N])$ = the function g such that

$$g([\mathbf{VP}]) = \{\langle s, w \rangle \mid \{x \mid x = \text{sum}(\{x' \mid [N]^s(\langle x', s \rangle) = 1\}) \subseteq \{x \mid [VP]^w(\langle x, s \rangle) = 1\}\}\}.$$

determiners in object position:

for *the* occurring in object position with singular nouns:

$[the_{\text{obj}}]$ = the function f from situations to functions mapping properties to functions h that map two-place relations to properties, such that for $s \in S$: $f(s)([N])$ = the function h such that

$h([V])$ = the function g such that for $w \in W$:

$$g(w) = \{\langle x', s' \rangle \mid |\{x \mid [N]^s(\langle x, s \rangle) = 1\}| = 1 \ \& \ \{x \mid [N]^s(\langle x, s \rangle) = 1\} \subseteq \{x \mid [V]^w(\langle x', s' \rangle)(\langle x, s \rangle) = 1\}\}.$$

for *the* occurring in object position with plural nouns:

$[the_{\text{obj}}]$ = the function f from situations to functions mapping properties to functions g that map two-place relations to properties, that is, for $s \in S$:

$f(s)([M])([V])$ = the function g such that for $w \in W$:

$$g(w) = \{\langle x', s' \rangle \mid \{x \mid x = \text{sum}(\{x \mid [M]^s(\langle x, s \rangle) = 1\}) \subseteq \{x \mid [V]^w(\langle x', s' \rangle)(\langle x, s \rangle) = 1\}\}.$$

I take existential quantification over events to be part of the interpretation of the finite morphology of the verb. Thus, whereas an intransitive verb V expresses a relation between events and objects, V_{finite} expresses a property of objects.

for an intransitive verb V and situation s' ,

$$[V_{\text{finite}}]^s = \{\langle x, s \rangle \mid \exists e [V]^{s'}(e, \langle x, s \rangle) = 1\}.$$

for a transitive verb and situation s' ,

$[V_{\text{finite}}]^{s'}$ = the function mapping a pair $\langle x', s'' \rangle$ with an object x' and a situation s'' to

$$\{\langle x, s \rangle \mid \exists e [V]^{s'}(\langle x', s'' \rangle)(e, \langle x, s \rangle) = 1\}.$$

We can now give the meaning of a few sentences, leaving it up to the reader to compute their fully explicit meaning:

$$[The \text{ students } leave_{\text{finite}} \text{ individually}] = \{\langle s, w \rangle \mid \{x' \mid x' = \text{sum}(\{x \mid [students]^s(\langle x, s \rangle) = 1\}) \subseteq \{x \mid [leave_{\text{finite}} \text{ individually}]^w(\langle x, s \rangle) = 1\}\}$$

$$[The\ cloud\ disappeared\ entirely] = \{\langle s, w \rangle \mid |\{x \mid [cloud]^s(\langle x, s \rangle) = 1\}| = 1 \ \& \ \{x \mid [cloud]^s(\langle x, s \rangle) = 1\} \subseteq \{x \mid [disappear_{finite}\ entirely]^w(e, \langle x, s \rangle) = 1\}\}$$

$$[The\ man\ liked\ the\ individual\ paintings] = \{\langle s, s', w \rangle \mid |\{x \mid [man]^s(\langle x, s \rangle) = 1\}| = 1 \ \& \ \{x \mid [man]^s(\langle x, s \rangle) = 1\} \subseteq \{x \mid [the\ individual\ paintings]^s([like_{finite}](w)(\langle x, s \rangle) = 1)\}$$

$$[The\ whole\ collection\ disappeared] = \{\langle s, w \rangle \mid |\{x \mid [whole]^s([collection])(\langle x, s \rangle) = 1\}| = 1 \ \& \ \{x \mid [whole]^s([collection])(\langle x, s \rangle) = 1\} \subseteq \{x \mid [disappear_{finite}]^w(\langle x, s \rangle) = 1\}\}$$

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