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SANTA CRUZ

SORTING A COMPLEX WORLD: AN EXPERIMENTAL STUDY OF POLYSEMY AND COPREDICATION IN CONTAINER AND GROUP NOMINALS

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Karen Duek Silveira Bueno

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The Dissertation of **Karen Duek Silveira Bueno**
is approved:

Professor Adrian Brasoveanu, Chair

Professor Donka Farkas

Associate Professor Pranav Anand

Tyrus Miller
Vice Provost and Dean of Graduate Studies

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Abstract: Sorting a complex world:

An experimental study of polysemy and copredication in container and group nominals

Karen Duek Silveira Bueno

This dissertation is an investigation of the nature of the ambiguity of two classes of nominal expressions in English: container phrases, such as *bottle of wine* and *box of toys*, which are said to be interpreted as primarily a predicate true of the container (*Ana broke that bottle of wine*) or a predicate true of entity standing in a containment relation to that container (*Ana drank that bottle of wine*), and committee nominals, such as *committee of linguists* or *gang of clowns*, which are said to be interpreted as primarily a predicate true of an abstract social object (*That committee was founded last year*) or as a predicate true of the individuals standing in a membership relation to that social object (*That committee met this morning*).

Through a series of acceptability judgment experiments, I show that both types of phrases support copredication, being able to enter into multiple predication relations which require, via selectional restrictions, that they make available both types of interpretations simultaneously (Ana broke the bottle of wine that Lea drank/ The committee that was founded last year met this morning). In this way, they are shown to display behavior similar to well known cases of nominal polysemy (Ana burned the book that Lea translated).

Based on these results, I argue that these two cases, previously analyzed in isolation, belong to a broader landscape of meaning flexibility, and that the specialized meaning shift operations previously proposed are both inadequate, because they predict the unacceptability

of copredication, and unnecessary, if these can be analyzed under general frameworks of polysemy and coercion.

The dissertation explores the possibility of doing so under two such frameworks: Asher?s (2011) system of complex types, and Dolling?s (1995) system of meaning shifts between sortal domains, pointing to the ways in which they can be successfully applied to the case of container and committee nominals, but also their limitations, particularly with regards to their predictive and explanatory power and calling attention to the question of understanding, beyond the question of what formal mechanisms are necessary to account for copredication, what property may characterize the relations, such as containment and membership, which underlie systematic meaning flexibility.

Chapter 1

Introduction

Formal semanticists are not particularly known for their sharp sense of humor, but there is one joke most students that have ever attended a formal semantics class might have heard. It goes like this: "What is the meaning of life? Life'." It is somewhat funny because it is somewhat true. The question semanticists hear is, what is the meaning of the linguistic expression *life*? The answer seems empty: *life'* is a notation indicating, in essence, that the conceptual content of that expression - its *intension* - is not fleshed out in its linguistic representation. It is to be found elsewhere.

In truth, that is only partially the answer formal semantics gives to the general question of what is the meaning of a content nominal. That is, the meaning of *cat* is not simply *cat'*, though it includes it. The linguistically relevant parts of the meaning of that expression are seen as those that speak to how this expression is able to combine with others compositionally

to yield sentence level meanings.

A common view, carried through from Montague's (1973) work, is that the meaning of common nouns such as *cat* can be modeled using set theoretic tools: *cat* is the set of cats that exist in our model of the world - its *extension*. Equivalently, it can be modeled as a function between two primitive domains: the domain of entities that exist in our model of the world, and the domain of truth values - True or False.

The truth values represent an assessment of whether the claim that is being made about the properties of those entities is congruent with our knowledge and beliefs about the world as represented in our model.

The two primitives - entities and truth values - form a system of types, that limit the domain of the variables in our functions. An expression can then be of type *e*, if it denotes an entity, of type *t*, if it denotes a truth value, or it may be of a type constructed recursively out of those primitives, for instance, of type <e,t> if it denotes a function from entities to truth values, or of type <e<e,t> if it denotes a function from entities to a function from entities to truth values, and so forth.

A noun like *cat* can then be represented as the following function, of type <e,t>. That is, its term x must be of the type *e*, it must be in the domain of entities, and if the denotation of that variable is also in the set denoted by *cat'*, the function returns the truth value True.

(1) *cat*: λx.cat'(x)

This view of meaning of *cat* or most other common nouns, therefore assumes that very little about the concept of *cat* is a relevant part of its linguistic meaning, since it assumes that this plays no role in its combinatoric possibilities beyond driving its type specification. We need to know that *cat* denotes a one-place function, and that its variable must be of type e, and that is enough.

Indeed, this view has proven enough to spring forward an understanding of a number of distinct semantic phenomena in this framework in the past half century or so.

This dissertation is an exploration of an area in which some of these assumptions prove to be an obstacle, in particular in what concerns what kind of information about how we common sensically conceive of entities is encoded in the meaning of linguistic expressions. The assumption we have run through so far is that it is enough to refer to an unstructured domain of entities in understanding the combinatoric possibilities of linguistic expressions. No further information is needed about what ontological sort of entity a particular expression speaks of, or how those sorts relate to one another.

Logically, some principle must determine what entities may be in the set that is the extension of *cat*. They must, at a minimum, be physical, material entities, as opposed to abstract ones. They must also of course be animate entities. We may sharpen these restrictions a lot further, but the crucial question is whether any of this information affects how that expression interacts with others compositionally.

There are at least two related ways in which it does. The first, a more basic one, is that in-

formation about what sort of entities nominal expressions denote affects the well formedness of predication relations, via the satisfaction of sortal selectional requirements.

Given the simplifying assumptions laid out before, our system is able to predict the ill formedness of the predication relation in (2a), but not that in (2b).

(2) a. #John said that the cat.

b. #The table died.

(2a) is ill formed because the predicate *say* requires an internal argument of the propositional type, but *the cat* is of type *e*. In (2b), *die* requires an argument of type *e*, *the table* is of the right type, so the predication relation should be well formed. Under those assumptions, (2b) is indeed well-formed, it is just false in a model of the actual world.

This state of affairs is of course a direct consequence of the way the simplifying assumptions distinct linguistic from non-linguistic phenomena. The fact that *die* selects for an argument denoting an entity of the animate sort is simply not encoded in its linguistic representation.

However, it would also be reasonable for instance to say that (2b) is ill formed, because any entity that satisfies *table*, given its intension, will not be able to satisfy *die*. That is, *table* requires that the entities in its extension be of the inanimate sort, and *die* requires that the entities in its extension be of animate sort. Those requirements are contradictory - no entity can be both inanimate and animate, hence the predication relation is ill formed.

Moreover, we may argue that the issue with (2b) is not a matter of contingent falsity - a state of affairs dependent on the circumstances of the world of evaluation in the same way that a sentence like *Ana is in the kitchen* may be false if Ana is in fact in the garden. In order for (2b) to be well formed and true, either *table* or *die* would simply have to have very different intensions.[1]

Here we see then that information about what sort of entities may be in the extension of linguistic expressions do affect how they can interact compositionally. Mismatches in sortal requirements lead to anomaly. It is possible to maintain this even if one is still inclined to distinguished between the two cases illustrated in 2a) and (2b) as different types of anomaly. By itself, being able to predict and account for this sort of anomaly may not seem like much of a gain in face of the degree of complexity it will add to the linguistic system.

The second way in which we may observe the role of sortal information in compositional process, however, which is revealed by the first, crucially illuminates interesting issues related to the types of meaning flexibility found in natural language and the types of compositional mechanisms necessary to deal with them. This is observed in the behavior of classes of nominals which have been taken to be systematically ambiguous[2]

This is the main question this dissertation engages with.

Nominal ambiguity is of course pervasive in natural language, and is not an uniform phe-

[1] I am assuming here that is the case in fictional discourse, if for instance we have an animate table character.

[2] I use the term ambiguity here as a theoretical neutral term. It is meant as an umbrella term for different sorts of meaning multiplicity, and not, as it is sometimes used in the literature, to mark a distinction between meaning multiplicity as multiple syntactic or semantic representation and vagueness, or underspecification.

nomenon. I take as a starting point, necessarily reductive, two main recognized classes of nominal ambiguity: **homonymy** and **polysemy**.

I understand a homonym to be a nominal expression that has multiple potential interpretations, but where those interpretations are not conceptually related to one another, and the ambiguity is not systematic across an identifiable class.

A noun such as *bat* is a homonym. It is a nominal predicate and its term can be interpreted as an animate entity - the flying mammal - or it can be interpreted as an inanimate entity - the baseball bat kind of bat. These two interpretations are illustrated below, as shown by the compatibility of the nominal and sortal selectional restrictions of the predicates *be pregnant*, selecting for an animate entity denoting argument, and *be made of pine wood*, selecting for an inanimate entity denoting one.

(3) a. That bat is pregnant.

b. That bat is made of pine wood.

There is no clear relation between the flying mammal and the baseball bat. The ambiguity is likely a historical accident in the development of English. There is no reason to expect to find this same ambiguity cross linguistically.

So what sort of entity does a nominal like *that bat* denote? There is an easy solution to homonyms: we may say each interpretation corresponds to completely independent semantic objects, which accidentally share a phonological form. The ambiguity only needs to be resolved as a matter of deciding which semantic object is intended for any particular instance

of use of the expression.

In the other major class, I will start with an understanding of a polyseme to be a nominal expression that has multiple potential interpretations, but where these are clearly conceptually related to one another. Moreover, the ambiguity is systematic across a whole a semantic field: all nouns in that class are ambiguous and their multiple interpretations are also related in a systematic way. That is, all nouns in the class are ambiguous in the same way.

A noun such as *book* is a polyseme. It is a nominal predicate and its term seems to at times be interpreted as a physical entity - a bunch of pieces of paper bound together, or as an abstract entity - a piece of information. Of course, the piece of information is precisely that information that is communicated by the graphical representation of language printed on the physical book (or an image representing something else).

Once again, we illustrate the ambiguity by inserting the nominal in contexts in which they must satisfy distinct selectional requirements, where *burn* selects for a material entity denoting argument, and *translate* for the abstract, information sort entity.

(4) a. That book was burned.

b. That book was translated into 7 languages.

This same behavior can be observed for the entire semantic field of "readable" objects:, *magazine*, *newspaper*, *journal*, etc. Likewise for other kinds of objects that we conceive of as containing some sort of information, such as *records*, *vynil*, *cassetes*, *DVD*, *VHS*.

What sort of entity does a nominal like *the book* denote? One option is to say that polysemes are just like homonyms: there are two semantic objects, which share a phonological form. One denote a physical object sort entity, and that is the one that satisfies the selectional requirements if *burn*, and one denotes a information sort entity, and that is the one that satisfies the requirements of *be translated*. The other ways in which those are related may be encoded somewhere else, but we are still dealing with two different semantic objects.

In essence then, meaning flexibility in natural language amounts to meaning multiplicity. This option is critically undermined when we consider how polysemes and homonyms behave in copredication environments.

Copredication sentences are sentences where some ambiguous nominal enters into two or more predicational relations, but there is a mismatch between the selectional restrictions of those predicates. One predicate selects for the ambiguous nominal under one interpretation, and another for a distinct, often incompatible interpretation.

Copredication sentences with homonyms, as illustrated in (5) are reported to be anomalous:

(5) That bat that is pregnant is made of pine wood.

Each of those predicational relations, as we have seen before, are independently well formed.

We can make sense of the failure of copredication if we understand that any single instance of the nominal *that bat* must be interpreted as either the flying mammal bat or baseball bat.

The problem is that the copredicational environment demands that it be interpreted in one way in the relative clause - *that is pregnant* - and in another way in the main clause - *is made of pine wood*.

If polysemes are no different from homonyms, then copredication should also be anomalous, since any single instance of a nominal like *that book* must either be interpreted as the physical object or the piece of information. But that is not the case, as illustrated in (6).

(6) That book that you burned was translated into 7 languages.

The copredication tests shows clearly that the ambiguity of polysemes must not be treated in the same way as homonyms, that is, as a matter of identifying which semantic object any particular instance of the nominal corresponds to. The challenge is then to understand how polysemes may satisfy contradictory sortal selectional requirements simultaneously. What properties do these nominal have that allow this behavior, and what mechanisms are employed to deal with it?

This problem is not new, and has been the object of considerable attention, mostly in traditions others than the standard montegovian compositional semantics ones. Though formal compositional semantics has at times engaged with particular cases of systematic ambiguity in the nominal domain, it has done so on a case by case basis, and most often not through the lens of polysemy.

In this dissertation I explore two empirical domains - container pseudo-partitive phrases in English such as *bottle of wine* and *box of books* and committee nominals, such as *team* and

committee.

Previous approaches have recognized the ambiguity and created specialized means of dealing with it, without considering how they fit in a broader landscape of meaning flexibility.

I argue that once the question of what type of ambiguity these types of expressions display, in particular by asking about their behavior in copredication environments, it becomes clear that the specialized means created to deal with them are not only unnecessary, since they may be understood through the same mechanisms proposed for systematic polysemy, they are inadequate.

I investigate the question of the nature of the ambiguity of container phrases and committee nominals through a series of acceptability judgment experiments focusing on the status of those nominals in copredication environments when compared with the behavior or homonyms and polysemes. The results confirm the intuition that copredication is unacceptable with homonyms and acceptable with *book*-type polysemes, though it also reveal a small cost of copredication even for polysemes. We use these results as baselines for comparison for the behavior of container phrases and committee nominals.

In both cases, the experimental results point to a high degree of acceptability of copredication. In face of this new empirical data, I argue for the need to consider how these particular cases fit in a broader landscape of meaning flexibility, and consider what it would take in order to treat container and committee ambiguity with the same tools used in previous general approaches to polysemy. I consider in particular those treatments articulated in the

works of Nicholas Asher (2011) and Johannes Dölling (1995). Both approaches crucially incorporate information about ontological sorts into both the lexical representation of linguistic expressions and in the mechanisms used to verify or accommodate sortal selectional requirements.

The dissertation is structured in the following way.

In chapter 2, the main empirical observations regarding the behavior of container pseudo partitive phrases in English are introduced, including both previous data points and new considerations about the possibility of copredication. We discuss at this point the predictions of previous approaches regarding the copredication data given how the relation between the two interpretations at hand is represented.

Chapter 3 reports on a series of acceptability judgment experiments designed to assess the status of copredication sentences with container phrases. It shows that copredication is largely judged acceptable, though it also reveals a number of interesting distinctions between *book*-type polysemy and the case of container phrases.

Chapter 4 introduces the empirical landscape for committee nominals, as a subtype of collective nominals. In a parallel fashion to chapter 2, we consider both data points from previous literature and new considerations about the possibility of copredication, as well as what predictions previous accounts make about that possibility.

In chapter 5, we report on similar acceptability judgment experiments targeting the behavior of committee nominals. Results regarding the behavior of homonymy and polysemy are

replicated from the experiments reported in chapter 3. Moreover, copredication with committee nominals is also shown to be largely acceptable, with overall patterns quite similar to those found for container phrases.

Chapter 6 considers the theoretical implications of the experimental results. I explore the possibility of treating container and committee ambiguity on a par with other well known classes of polysemy by attempting to extend the general frameworks for meaning flexibility articulated in Asher (2011), for container phrases, and Dölling (1995) for committee nominals. Chapter 7 concludes pointing to future directions.

Chapter 2

The ambiguity of container phrases is a type of polysemy

2.1 Introduction

Container phrases in English, such as *bottle of wine* or *box of books* have been observed (references) to display ambiguous behavior. In certain contexts container phrases behave as predicates true of the container, while in others they behave as predicates true of the contents. This can be shown by noting that container phrases may serve as arguments for predicates that select specifically for one type of predicate or the other, as illustrated in (7), which contrasts the predicates *break* and *drink*, selecting for concrete objects and liquid objects respectively.

(7) a. Ana broke a bottle of wine.

b. #Ana broke the wine.

c. Ana drank a bottle of wine.

d. #Ana drank the bottle. [1]

This chapter will be devoted to examining the properties of container phrases under each of these interpretations, with particular interest in investigating the nature of the ambiguity of container phrases. That is, we will be interested not only in understanding the semantic contribution of the container phrase in different contexts, but also in how some of its distinct readings are related to one another.

The question is particularly relevant because, as we will see, current accounts treat the ambiguity of container phrases as an instance of structural ambiguity, where different readings arise from representations that are distinct both syntactically and semantically. Such approaches place the ambiguity of container phrases under the broad umbrella of homonymy: expressions for which distinct senses compete amongst each other and are not available simultaneously. Homonymous expressions do not support co-predication: sentences in which a single instance of the expression enters into multiple predication relations whose selectional requirements are incompatible are ill-formed.

However, container phrases seems to have a larger range of empirical behaviors, allowing co-predication to be well-formed, behaving therefore more like other ambiguous expressions

[1]This sentence is acceptable if *bottle* is coerced to stand for its contents, or if some sort of ellipsis is involved, eliding the *of*-phrase.

under the broad umbrella of polysemy: expressions for which ambiguous senses can be conceived as different aspects of a complex entity, and are available simultaneously.

In what follows, we first provide a close examination of the empirical properties of container phrases under each of the readings it seems to give rise to, summarize previous approaches to the problem, in particular those in Rothstein (2009, 2011) and Partee and Borschev (2012), and raise the question of what predictions these approaches make for where in a typology of meaning flexibility container phrases stand.

We lay therefore the background against which the experimental studies in chapter 2 should be contextualized, where the questions of the acceptability of co-predication with container phrases, and consequently that of the nature of their ambiguity, is taken up explicitly.

2.1.1 Defining the class of container nouns

In delimiting our object of investigation as container phrases we have so far relied on a tacit, intuitive notion of what constitutes a container noun. However, it is worth discussing the conditions of membership for that class more explicitly. Nouns that belong to the sort *container* have particular properties of interest that are not shared by nouns of other sorts, but which nonetheless denote sets of objects that are able to contain other objects.

Let us consider a first intuitive attempt at determining what properties an object must have in order to be classified as a container, and therefore be in the extension of a container nominal. One might simply say that containers are concrete artifacts which are able to

contain other objects or substances. In order to do so, that artifact must have certain physical properties, in particular, it must have an inner part which is hollow.

This alone won't suffice, however, to distinguish between container nouns such as *box* and other nouns such as *house*. Many objects are able to contain and are not, at that same intuitive level, categorized as containers. *House* denotes a set of objects whose dimensions delimit the boundaries of an internal space that may contain a number of other objects, yet is not thought of as a container.

It seems that the crucial distinction here has to do with the function an artifact is designed to perform. Container nouns denote sets of entities which are artifacts designed to contain, typically for purposes of storage or transportation. Nouns which denote sets of objects with the physical properties necessary to contain but for which that is not their primary intended function behave differently from container nouns when they head pseudo-partitives in English. Consider the contrast between (8a) and (8b) below:

(8) a. ?A house of furniture

b. A box of furniture

To the extent that (8a) is well-formed, the meaning of *houses* must be shifted from a predicate true of individuals to a unit of measurement, so that (8a) is equivalent to (9a): a quantity of furniture which is equivalent in volume to the volume of the inner part of a prototypical house.

(9) a. A houseful of furniture

b. A boxful of furniture

A great number of nouns can participate in pseudo-partitive constructions if that accommodation process applies, likely the same domain of nominals that can undergo *-ful* suffixation, which is highly productive in English with nouns of quite different sorts, as illustrated in (10):

(10) a. a carful of groceries

b. a handful of rice

c. a sinkful of dishes

These *-ful* pseudo-partitives are in fact comparable with pure measure phrases, with nouns such as *liter*, *kilo* and *meter*. As we shall see, however, container phrases have a broader range of interpretation than measure phrases.

While container phrases have measure interpretations, they also have interpretations in which the container noun is not interpreted as a unit of measurement, but as an individual. The latter possibility seems to be blocked for the construction with nouns such as *house*. (11a) does not seem to have an interpretation that can be paraphrased as *Ana painted two houses, which were filled with furniture*. Yet (11b) can be interpreted in precisely that way, and be paraphrased as *Ana broke two glasses, which were filled with wine*.

(11) a. Ana painted two houses of furniture.

b. Ana broke two glasses of wine.

In Borschev and Partee (2004) and Partee and Borschev (2012) similar observations are made for the genitive construction in Russian, for which examples like (12) are judged to be ill-formed.

(12) a. # bassejn vody 'swimming pool of water'

b. # vaza vody/cvetov 'vase of water/flowers'

c. #sejf/papka dokumentov 'safe/folder of documents'

Based on such data, they argued that the semantics of container phrases is closely tied to the ontological sort of the head noun, and the possible meaning shifts that nouns belonging to that sort are subject to. I believe this is an important point, and it is one that we shall return to at various points of the discussion.

Given the role given to the sortal specification of container nouns and the importance of delimiting that sort, Borschev and Partee (2004) propose (13) as the conditions of membership for the sort CONTAINER, in the form of meaning postulates:

(13) Meaning postulates for the sort CONTAINER in its relational sense (container(x), substance(y)) (B&P 2004)

a. sort: physical object(x), substance(y)

b. form: x has an inner part and when it is used to keep a substance y, y is inside of x

c. usage: x can be used to hold substances of the sort y, can be filled by some substance to some extent (full, almost full, half-ful, almost empty, etc)

d. volume of x: it is the volume of its inner part and so the volume of the substance that x can contain

e. status: x is used in order to make use of the substance y it contains

These meaning postulates delimit the sort CONTAINER in many of the dimensions we have discussed. It specifies that in order to belong to the sort an object x must be a physical object with a particular form (*has an inner part*), which allows x to container another object y. Moreover, that is the function of x, as specified by its status and usage.

On the other hand, these postulates restrict the sort by defining it in relation to substances only. Of course, containers are not limited to containing substances, they may also contain concrete objects. Depending on the material a container is made of it may not even be able to hold substances, as anyone who has tried to fill a cardboard box with water may attest.

This may seem like a trivial point, but I make it to call attention to an overemphasis on the relation between containers and substances which tacitly permeates the discussion of container phrases in the literature, with the exception of Rothstein (2011), where the issue of possible distinctions between container phrases with mass and count content nominals is taken up more explicitly.

As we will see, generalizing to take into account the case of count contents is helpful in

revealing certain pragmatic felicity conditions for certain uses of container phrases. These rely on an understanding of the individuating role of the containment relation. That relation will have distinct effects for notional mass nouns, such as *water*, and count nouns such as *book*, given that count nominals, but not notional mass ones, introduce their own criteria of individuation independent of the individuating role of the container.

Given these observations, for the remaining of this chapter I will limit attention to pseudo-partitive phrases headed by true container nouns: those that denote sets of objects of the CONTAINER sort and which therefore meet the conditions of the sort both in terms of their physical properties and intended function. We will keep in mind that the sortal specification of container nouns seems to play an important role in the semantics of container phrases.

In the next sections we turn to an empirical description of the range of interpretative possibilities of container phrases, focusing on container pseudo-partitives in English, but drawing as well from observations based on similar container constructions in other languages from the literature.

2.2 A basic two-way split: Container vs. Contents

As has been observed in the literature for some some time (Selkirk 1977, Carlson 1997, Chierchia 1998, Landman 1999, Rothstein 2009, 2011, Partee and Borschev 2012), container pseudo-partitives give rise to at least two distinct interpretations, in different environments.

The main distinction is about what sort of entity the container phrase is a predicate of: while in some environments it behaves as a predicate true of the container, in others it behaves as a predicate true of the contents.

As in the case of systematic polysemy discusses in chapter 1, one of the principal diagnostic tools for the ambiguity at this level is the well-formedness of predication relations, based on the satisfaction of selectional requirements.

2.2.1 Selection

The examples below, where the pseudo-partitive phrase occupies the internal argument position of the predicates *break*, *drink* and *add* illustrate ability of container phrases to satisfy different sorts of selectional requirements.

Break is a predicate that requires its internal argument to denote a concrete object, and is ill-formed otherwise, for instance if the phrase in that position denotes a portion of a substance, as illustrated in (14a).

Given that the example in (14b) is well-formed, *the glass of water* must be able to denote a concrete object; the sentence is interpreted as asserting that Ana broke a glass, which contained some amount of water in it.

(14c) shows that under this interpretation (14b) is paraphrasable by substituting the container phrase with a DP headed by the container noun and modified by a relative clause that adds information about its contents.

(14d) shows that under this interpretation (14b) is not paraphrasable by substituting the container phrase by a pseudo-partitive headed by the container noun suffixed with *-ful*, since *a glassful of water* denotes a portion of a substance, and hence cannot satisfy the selectional requirements of *break*.

(14) a. #Ana broke the water.

b. Ana broke the glass of water.

c. Ana broke the glass, which had water in it, that was on the table.

d. #Ana broke a glassful of water.

On the other hand, *drink* requires that its internal argument denote a liquid substance, as illustrated by the ill-formednes of (15a) where that position is occupied by *the bagel*, denoting a concrete object. Note that, to the extent that (15a) can be well-formed, it seems that in ordered for the sentence to be interpreted as involving a drinking event, *bagel* must be somehow coerced into denoting a liquid object.

A situation described by that would for instance involve blending some amount of bagel into a bagel smoothie, which indicates that *drink* in fact only describes events of ingesting liquid substances.

Given that (15b) is well-formed, *the glass of water* must be able to denote a portion of water as well.

(15) a. #Ana drank a bagel.

b. Ana drank a glass of water.

c. Ana drank some water, which was in a glass, that was on the table.

d. Ana drank a glassful of water.

The examples so far have considered only container pseudo-partitives in which the content noun denotes a substance, rather than a collection of objects, such as *box of books*, *crate of shoes* or *bucket of pebbles*, that is, where the content noun is a count nominal in bare plural form. We may ask then whether the same ambiguity is manifested in this case, such that container phrases are systematically ambiguous between the sort of the container noun and the sort of the contents noun.

Naturally, given that in those cases both the container and the contents are concrete objects, tests that rely on expressions that select either only objects or only substances, such as *break*/*drink* will be inappropriate.

If count container pseudo-partitives are ambiguous as well, the distinction between their multiple interpretations will be brought up if we consider predicates that are sensitive to the distinction between sorts of objects along the same dimension that the container noun and particular contents nominal in the container phrase are distinguished. Alternatively, we may use predicates which distinguish between collections/pluralities and atomic entities, since for a container phrase such as *box of books* there will be a singular container but a collection of entities of the contents sort.

Let us consider first predications that are well-formed with container nouns but which are

not compatible with the sort of the contents nominal. In (16) we look at the predication *carry two kilos*, which, like *holds a maximum of 5 pounds*, speak of the containers capacity for containment.

The example in (16a) shows the infelicity of composing *carries two kilos* with the DP *this book*, which does not typically define a space of containment for concrete objects, the sort of object for which weight can be measured in kilos. (16b) shows that the predication is well-formed with the container noun *box*, and that the same is true for the pseudo-partitive *box of books*.

(16) a. #This book carries two kilos.

b. This box carries two kilos.

c. This box of books caries two kilos.

Conversely, let us consider predications that are well-formed with the content noun that participates in container phrase, but ill-formed with the container noun. In (17) we explore the distinction between the container *crate* and the contents *oranges* along the artifact/natural object dimension, in particular plants/crops, which is what *harvest* requires.

While *harvest* may have its selectional requirements satisfied by the container phrase *crate of oranges*, in (17a) it is ill-formed with a DP headed *book*, an artifact, just as *crate*.

I use *book* in (17b) to show the selectional restrictions of *harvest* in a clear case. (17c), where the container noun itself occupies the same position, is well-formed if *crates* may

be coerced into the appropriate type, which is a productive accommodation process for container nominals we have left aside for the time being. I will continue to do so at the moment.

(17) a. Ana harvested three crates of oranges in 20 minutes.

b. # Ana harvested three books.

c. #Ana harvested three crates.

(18) explores the distinction between container and contents noun along the animate/inanimate dimension. *Vaccinate* selects for an argument of the animate sort, and is well-formed with the container phrase *crate of puppies*, in (18a). (18b) hows that *vaccinate* is ill-formed when that argument is of the inanimate type. (18c) is again only well-formed if some accommodation process applies, as in (17c).

(18) a. That crate of puppies on the right was vaccinated last week.

b. #That book was vaccinated last week.

c. #That crate was vaccinated last week.

Polysemous nouns such as *book*, *magazine*, *encyclopedia* may also provide a way to test the possibility of interpreting count pseudo-partitives as primarily predicate true of the contents, because under their abstract object interpretation they are clearly distinguished from containers along the abstract/concrete dimension.

Consider the predication *translate into seven languages*, which selects nominals denoting

sets of objects that have propositional/textual content. (19a) shows that the predication is well-formed with the DP *that book*, when it is interpreted as an abstract propositional object. (19b) establishes the incompatibility between the container noun by itself, in an out of the blue context or in a context in which it is clear that the box holds no contents at all, and that predication. The crucial question concerns the status of (19c), where the container pseudo-partitive occupies the same position.

(19) a. That book was translated into seven languages.

b. #That box was translated into seven languages.

c. That box of books was translated into seven languages.

Informally, the speakers I have consulted with report a degraded acceptability of (19c), in contrast with (19a). However, a manipulation which can increase the acceptability of sentence in which the predication targets the sort of the count contents, rather than the container, is to avoid a mismatch between morphological number subject-verb agreement and the morphological number features of the content nominal. In the examples considered so far, the pseudo-partitive as a whole is singular, or morphologically unmarked for number, while the count content nominal must be a bare plural.

There are then two strategies that can be used to avoid the mismatch: make the container nominal plural, which will then guarantee that the pseudo-partitive phrase as a whole is marked as plural, as in (20a), or make use of modals and auxiliary forms that make no morphological distinction between singular and plural, as illustrated in (20b).

(20) a. Those boxes of books were translated into seven languages.

b. That box of books might have been translated into seven languages.

Another manipulation that seems to increase acceptability is to embedded those sentences in a context in which there are multiple boxes of books, and they can be individuated, as well as contrasted, based on the number of languages the books in each box have been translated into. This is illustrated in (21).

(21) That box of books on the right was translated into seven languages, but the one on the left was translated into eight.

Why should contrast have an effect on the acceptability of these sentences? One possibility is that this effect is related to a pragmatic competition between the use of the pseudo-partitive versus a simpler use of the content nominal by itself, that is, a competition between *those books* and *that box of books*.

If predication targets only the content nominal, than the use of the container phrase might be dispreferred because the container and the containment relation can be seen as irrelevant. The contrastive context in (21) might then make the sentence more acceptable because individuating groups of books by the boxes in which they are contained , and using that individuating unit to contrast different groups of books, makes the containment relation relevant, which in turn makes the use of the container phrase more acceptable.

This effect might be stronger for count container pseudo-partitives than substance ones,

because count nominals already introduce an independent principle of individuation, that is, the containment relation provides only an additional way to refer to the content objects as an individuated group. I will return to this matter shortly when we consider other contextual factors that influence the acceptability and interpretation of sentences including container phrases.

In sum, it seems then that the ambiguity that was mainly observed with respect to substance container pseudo-partitives is also present for object ones: container pseudo-partitives can be interpreted either as primarily an object of the container sort, and therefore satisfy the selectional restrictions of predicates that target objects of that sort, but they may also be interpreted as primarily a quantity of an object of the contents sort, and satisfy the selectional requirements of predicates that target that sort.

2.2.2 Contextual plausibility/world knowledge

Container phrases may also be disambiguated contextually, in cases where the predication relation is compatible with both the sort of the container and the contents, but one interpretation is more plausible given world knowledge or the felicity of responses to questions and requests.

Take for instance the examples in (22), uttered by a worker in a library, where books are both routinely stored and transported in standard-size boxes, and stamping books is a routine task.

The question in (22a), which interrogates about the quantity of books that has been stamped, can be answered as in (22b), where the quantity is counted in book-units, or as in (22c), in *box*-units. If the average number of books that fit in a box is known, the answer in book-units can be inferred.

In this context it is also clear that a precise number of books that have been stamped in irrelevant, so it is enough to be able to infer an approximate number of books based on the volume of a box.

(22) a. Q: How many books have you stamped today?

b. A_1: 60 books.

c. A_1: 3 boxes (of books).

It is still true though that the response in (22c) is interpreted as the quantity of books which was stamped, not the boxes themselves. Naturally, the selectional restrictions of *stamp* are not incompatible with *boxes*. In this sense, this is a different test from the one we have been using so far which relies on that sort of incompatibility.

But both the extra-linguistic context and the fact that (22c) is uttered as a response to (22a) make the interpretation in which what was stamped was the boxes, and not the books in them, implausible and incoherent.

The fact that this implausible or incoherent interpretation is not the only one available is in itself additional evidence for the ambiguity of container pseudo-partitives.

Rothstein (2009) also points to ways to disambiguate the two interpretations contextually. For instance, (23) can in principle be interpreted as a request that Peter bring two glasses containing water or some quantity of water equivalent to the volume of two prototypical glasses. The selectional properties of *bring* cannot be used to disambiguate the sentence, since it is compatible with both readings.

Nonetheless, in most contexts if Peter's response to the request is to simply bring a bottle containing two glassfuls of water, that response seems to mismatch the speaker's request. This contexts favors an interpretation in which *two glasses* refers to two concrete glasses filled with water - the container reading.

(23) Peter, please bring two glasses of water for our guests.

The example below, from Partee and Borschev (2012), illustrate a context in which it is the contents reading which is more plausible. Although of course the response in (24b is not compatible with a situation in which there are three bowls filled with soup in the pot, given world knowledge of typical situations in which the sentence would be uttered that would be quite odd. Again, that odd interpretation is not the only one available, and the sentence is more readily interpreted as claiming that there is an amount of soup left in the pot which would be enough to fill three bowls.

(24) a. Is there more soup?

b. There are three bowls of soup left in the pot.

These examples show importantly that which reading container phrases gives rise to is not necessarily dependent on the nature of the local predication relation it enters into. Another way to say this is that it is not the case that there is one reading which is triggered only as a means to satisfy the selectional requirements of a predicate taking the container phrase as argument.

We have seen contexts that are in principle compatible with both the container and contents reading but which at times make the container reading more plausible and at times the contents reading. This is an important property because it distinguishes the ambiguity of container phrases from clear cases of coercion, which as discussed in chapter 1, are only triggered in order to solve a type mismatch.

Further, given our assumptions about the nature of selectional restrictions and the mechanisms by which they are satisfied, following Asher (2011), we may conclude at a minimum that container phrases must at times contribute to composition an element of the container type and at times of the contents type.

This is a minimum requirement for understanding the nature of the ambiguity of container phrases. We consider in turn in more detail what the semantics of the container phrase must be under each of its interpretations, as well as how many distinct readings must be recognized.

2.3 The container reading

I will call a container reading an interpretation under which the container phrase is interpreted as a predicate true of the sort of objects denoted by the container noun.

Let us start probing into the properties of the container reading by considering the distinctions between (25a) and (25b). While (25a) does not entail that the glass contains anything at the time of the breaking event, (25b) does entail that the glass contained water when it was broken. (25b) seems to entail both the existence of some quantity of water and that it stood in a containment relation with the glass.

(25) a. Ana broke that glass.

b. Ana broke that glass of water.

2.3.1 The containment relation

Rothstein (2009) identifies the relation with an abstract predicate CONTAIN, without further discussion of its properties. Partee and Borschev (2012) argue however that for Russian, their object language, a vague containment relation is too weak, and that in the Russian genitive construction the relation must be one of "containment to a large degree", closer to FILL in English.

They point out that the intuition is related to the availability of other constructions in Russian, in particular in this case the availability of (26), which seems to have weaker

requirements on the extent to which the glass is filled with milk.

(26) stakan s molokom
glass with milk-INSTR
glass with (containing) milk

It might be possible then that this intuition reflects the effect of pragmatic competition between these available forms, rather than the need to build in a restriction on the extent to which a container is filled into the semantics of the container phrase. Moreover, if the containment relation is part of the meaning of the container noun in the construction, then the container nominal need not dictate that the relation must be stronger than CONTAIN.

In English too one might hesitate to refer to a glass that contains a negligent amount of milk as a *glass of milk*. If for instance I ask you for two glasses of water for me and my friend, and it is clear that I intend to use them to drink water, and you respond to this request by bringing me two glasses each filled a third of the way with water, I would be justified in thinking you were being at best uncooperative.

But what precise amount would be deemed appropriate seems rather context dependent. A glass filled a third of the way is wine is precisely what one expects to receive when ordering *a glass of wine* at a restaurant. I will assume then that a weak CONTAIN relation, which is flexible enough to be strengthened in context, will suffice.

What must be built in is that a containment relation must hold between the concrete container and its contents at the time of the event being described.

2.3.2 What is counted

In convergence with that we have observed based on selection - that in the contexts that give rise to the container reading the container phrase is a predicate true of the container - in these contexts, when the container phrase is combined with a numeral, what is counted is the number of containers involved.

(27) Those two bags of toys don't have a handle

(27) makes reference to two individual bags, which have no handles, and only indirectly to two quantities of toys, in virtue of the containment relation. Because what is counted are concrete containers, two properties follow, as discussed in Partee and Borschev(2012): (i) the containers may be of different sizes and (ii) fractional numbers force a "fractional container" interpretation.

Since the container phrase refers to concrete containers, and not simply an abstract prototypical container, the containers may vary in a number of dimensions, such as size, color or material. The potential discrepancy in size highlighted because of the correlation between size and the use of the container noun as a unit of measurement. As we will see, when the container noun is interpreted as a unit of measurement, that unit must be constant, just like pure measure nouns like *liter*.

Under the container reading, biased by the predication *have handles*, (28) is perfectly coherent, because concrete containers are not required to be of the same size in order to be

counted as containers.

(28) Those two bags of toys don't have handles. The little one used to have one but it broke. The large one never did.

Similarly, Partee and Borschev (2012) suggest that because the container reading counts concrete containers, the use of fractional numbers may be odd. (29) seems to require that Ana painted a half-bottle, say, a bottle broken in half.

(29) Ana painted two and a half bottles of wine.

There is however, as Partee and Borschev point out, a reading that does not require the container to be interpreted abstractly but which also does not require a "fractional container". This reading is particularly salient in (30): it can be read to mean that Ana removed all of the contents of two boxes, but for one box she only removed half of its contents. This possibility is also available for (29).

(30) Ana emptied two and a half boxes of books.

2.3.3 Anaphoric possibilities

Finally, when a container phrase is interpreted under the container reading, both container and contents become available as antecedents for anaphoric elements. In (180a) the pronoun *it*, the subject of the *because* clause, refers to the bottle which was broken, but in (180b) it

refers to the wine that was contained in the bottle which was broken.

(31) Ana broke that bottle of wine

a. It's a shame because it was made of a very rare type of glass.

b. It's a shame because it had been aged for 10 years.

2.4 The contents readings: measure vs. concrete portion

I will call a contents reading an interpretation under which the container phrase is interpreted as a predicate true of the sort of objects denoted by the contents noun.

Just as in the case of the container reading, we may first ask about distinctions between the contents reading of the container phrase and the use of the content nominal on its own. The contrast between (32a) and (32b) reveals a crucial aspect of the contents reading, namely that it refers to a quantity of water *as it is individuated by the container*.

This is part of what leads Rothstein, I believe, to assimilate container nouns, classifiers and measure nouns. Given that mass nouns do not introduce criteria of individuation independently, they may not be counted unless some are supplied, contextually or compositionally. (32a) is well-formed for instance if a unit of measurement is contextually given.

(32) a. #I drank one water.

b. I drank one glass of water.

There are two main logical possibilities for how the container noun may supply the means for individuation for the contents nominal:

i. Through the containment relation with a concrete container entity, with which the contents overlap spatiotemporally, and which defines what counts as a container-unit of the contents via its physical boundaries

ii. If the container noun is interpreted as an abstract unit of measurement, akin to pure measure nouns such as *kilo*, *liter* and *meter*. This may happen in one of two ways:

   a. If that meaning has been lexicalized for a particular container noun, such as *cup* in English, or

   b. A unit of measurement is derivable based on the volume of a prototypical or context-dependent container

Rothstein' only recognizes one of these possibilities, namely (ii), where container nouns are interpreted as abstract units of measurement, and are treated very similary to true measure phrases. Every instance of a contents reading is therefore a measure reading for her. Partee and Borschev(2012) discuss all possibilities.

The one that corresponds to a lexicalized unit of measurement that the container noun corresponds to is fairly limited to a few nouns. In English for instance, *cup* in certain contexts corresponds to a fixed unit, and can measured by conventional objects designed for that purpose which may not even be recognized as cups themselves. Partee and Borschev

(2012) recognize this as a distinct reading for the noun *cup*, which they call the Standard Measure reading.

As it does not present particularly distinct empirical behavior from the measure reading that is available to all container nouns, which Partee and Borschev (2012) call the Ad-hoc Measure reading, and its interest is outside the scope of our main object of inquiry here, I refer the reader to Partee and Borschev (2012) for discussion on this point, and leave it aside here.

2.4.1 The containment relation

The main divergence between (i) and (ii) concerns whether or not a concrete container is involved. Another way to put it is that the main divergence is connected to the type of containment relation involved. While under the contents reading that corresponds to the possibility in (i) a phrase such as *a bottle of water* can be paraphrased as "the amount of water that fills/is contained in a bottle", under (ii) it would be more accurately paraphrased with a modalized containment relation: "the amount of water that *would* fill a bottle".

It seems clear that in many contexts the use of a container phrase does not entail the involvement of a concrete container. We have already seen such an example, when the contents readings were introduced, in (24), repeated below as (184a):

(33) a. Is there more soup?

b. There are three bowls of soup left in the pot.

This is productively the case in the context of recipes, also in Rothstein's example in (34), where it is clear that no concrete glass is necessary, since what is relevant for the recipe is simply the amount of a certain ingredient.

(34) Add two glasses of water to the soup.

Rothstein (2009) argues that the felicity of use of distributive markers such as *each* can be reveal the existence of a measure reading of container phrases, for which no concrete container is involved. The claim is that *each* is felicitous with a container reading, as in (35a) but infelicitous with a measure reading, as in (35b).

(35) a. The two glasses of wine on that tray cost 2 euros each.

b. #The two glasses of wine in that soup cost 2 euros each.

In Rothstein examples the modifying PPs already make on of the interpretations more plausible on their own - *on the tray* makes the *wine in the glass* interpretation more plausible, since wine is not very often served by itself on trays, and *in the soup* makes the *glassful of wine* interpretation more plausible, since in the context of recipes what is relevant is that the right amount of an ingredient is used, not the particular measuring instrument.

The felicity of use of *each* in these cases has of course to do with how relevant it is that the amount of wine be individuated in two portions in each context, since *each* relies on that individuation in order to distribute over the portions.

On the other hand, Partee and Borschev(2012) point out that definite nominals, in particular

demonstrative ones as in (36a), are biased towards a concrete portion reading, because the definiteness suggests that the milk is contained in two particular glasses.

(36) a. Drink these two glasses of milk.

b. Drink two glasses of milk.

There is nothing in principle incompatible between a demonstrative+cardinal and the measure interpretation, but the infelicity likely arises due to the irrelevance of individuating two distinct portion of milk, which can then picked up on by the demonstrative in (36a). On what grounds should these portions of substances of equal volume be distinguished if not for their spatiotemporal properties, that is, by what container they are contained by? The same effect arises for pure measure phrases, like (37), which may be biased towards an interpretation in which there are two distinct containers of milk, each containing one liter. Of course, it is also compatible with a situation in which there is a single container with two liters of milk in it, and the speaker is simply indicating that the amount of milk she is pointing corresponds to two liters.

(37) Drink these two liters of milk.

The example (38), adapted from Partee and Borschev (2012), makes a similar point. Though the predication in the relative clause *be on the table* is not in principle incompatible with a measure reading, the most plausible interpretation is one in which the amount of wine that Ana drank had been inside a concrete glass, and the glass plus the wine had been on the table, not simply some wine splashed directly on the table, nor a glass-amount contained in

some other container.

(38) Ana drank the glass of wine that was on the table.

2.4.2 What is counted

We have seen that under the container reading, numerals are interpreted as counting the number of containers involved. Because what was counted were concrete containers, we saw two properties that followed: (i) the containers may be of different sizes and (ii) fractional numbers give rise to a "fractional container" reading. We may similarly ask what is counted under both contents readings.

(39) is a contents reading counterpart of (28): the predicate *cook* selects for the sort of the contents nominal and is incompatible with the sort of the container, and the *one* anaphora in *a big one* and *a small one* gives us a context in which the two portions of soup being cooked are of different sizes:

(39) He cooked two pots of soup, a big one for us and a small one for the cat.

This is then an example of a contents reading in which what seems to be counted are portions of soup as individuated by concrete containers, which may vary in size. Since under a measure interpretation *pot* is some unit of measurement, in that reading *two pots of soup* is interpreted as a quantity of soup equivalent to two of those units, but the unit is constant, say 1 quart. The measure interpretation relies on fixing the value of *pot* as a

unit of measurement based on the volume of a contextually-dependent or prototypical single pot.

(40) introduces the container phrase in a context where the measure interpretation is preferred, that is, no concrete containers seems to be involved, and *cup* is simply a unit of measurement. However, in order to interpret the *one* anaphora in the following sentence as taking *cup of broth* as antecedent, it seems that such an interpretation needs to be revised to allow the two cups to be of different sizes.

(40) He added two cups of broth to the soup. A big one first and a small one later.

The same point can be made with examples such as (41a), where the size adjective modifies the pseudo-partitive as a whole, or perhaps attaches only to the container noun. (41a) is ambiguous since it may either refer to a little glass, filled with vodka, a small quantity of vodka equivalent in volume to the volume of a context-dependent/prototypical small glass or a small quantity of vodka contained in a concrete little glass.

(41) a. Drink a little glass of vodka.

b. Drink a green glass of vodka.

(41b) is less readily ambiguous, since the measure interpretation depends on *green glass* being a particular unit of measurement, say if there is a prototypical green glass from which the unit of measurement can be derived. [2]

[2]The situation is similar to the discussion in Krifka et al (1995) about the generic use of definite nominals in English, which seems to require what they call well-established kinds.

Consider now the effect of fractional numerals with the contents readings. In (42a) where no concrete containers are involved, the "fractional container" interpretation does not arise, as expected.

(42) a. Ana drank two and a half a bottles of wine.

b. Ana drank those two and a half bottles of wine.

Note though that in (42b) the container phrase is still interpreted under a contents reading, given the selectional restrictions of *drink*, but the definite determiner *those* makes more plausible a situation in which concrete containers are involved, since definiteness seems to rely on individuation. In this case, the same "fractional container" effect seems to arise, where the context must have two normal bottles and one half-bottle.

2.4.3 Anaphoric possibilities

Since a measure reading does not entail the existence of a container, we should expect that under that interpretation the container phrase does not introduce a discourse referent for the container. In those contexts then the more straight forward prediction is that no expression anaphorically dependent on the container phrase should be able to be interpreted

The examples in (1), due originally to Barbara Partee, show the contrast between the definite with a well-established sort of bottle in (1b) versus (1c), and the lack of contrast between those in generic statements with bare plural subjects in (1d).

(1) a. The bottle has a narrow neck.

b. The Coke bottle has a narrow neck.

c. ?? The green bottle has a narrow neck.

d. OK Green bottles/Coke bottles have narrow necks.

as a concrete container.

The first sentence of (43a) is best interpreted as involving a concrete portion reading, given the definiteness of the demonstrative *that*. Yet the pronoun *it* in the second sentence must be interpreted as *jar*, in order to satisfy the selectional restrictions of *sealed*.

Notice the contrast with (43b), where the first sentence is best interpreted as involving a measure reading of the container phrase, and anaphora to *jar* is odd.

(43) a. Don't eat that jar of kimchi. It wasn't sealed properly.

b. There is a jar of kimchi in that dish. #Ana opened it yesterday.

Rothstein(2009) observes a distinction between anaphoric possibilities between the container reading and the measure reading. In (44) the container phrase *two cups of wine* is introduced under a container reading, and it can be picked up anaphorically by the plural pronoun *they* in subsequent discourse. In (45) however, where the container phrase is introduced under a measure reading, that possibility seems to be blocked.

(44) There are two cups of wine on this tray.

a. They are blue.

b. They (each) contain 100 milliliters.

c. They (each) cost 2 Euros.

(45) There are two cups of wine in this soup.

a. #They are blue.

b. #They (each) contain 100 milliliters.

c. #They (each) cost 2 Euros.

d. It adds flavor/??They add flavor.

As we have been discussing, (45) corresponds to one of the possible contents reading - the measure reading - but we have also seen contexts in which the container phrase is interpreted as primarily of the contents sort but does not receive a true measure interpretation - the concrete portion reading, where a concrete container is involved. That is the case for (46), where the demonstrative *those*, as we have seen, biases towards a concrete portion interpretation. Here anaphora to the container seems to be available, just as in (45).

(46) Ana drank those two glasses of wine.

a. They were blue.

b. They (each) contained 100 milliliters.

c. They (each) cost 2 Euros.

In sum, we have argued, following Partee and Borschev (2012), for the need to recognize two distinct readings for container phrases when they behave as predicates true of the sort of objects denoted by the contents nominal. Under one interpretation, the measure reading, the container noun is interpreted as an abstract unit of measurement. It is therefore compatible with fractional numerals, but incompatible with a situation in which a plural container nominal must correspond to units of different sizes, and it does not make the container

nominal available for anaphoric dependencies where the pronoun is interpreted as a concrete container.

On the other hand, under the concrete portion interpretation, the container noun is interpreted as a concrete container. It is therefore incompatible with fractional numerals, but compatible with a situation in which a plural container nominal corresponds to concrete containers of different sizes, and a pronoun interpreted as a concrete container may be anaphorically dependent on the container nominal.

2.5 Co-predication

The concrete portion reading is then in a sense the mirror image of the container reading. Under both interpretations the container phrase seems to refer to the same object, a container plus its contents, but under each interpretation one of the aspects of that object is highlighted, and targeted in predication. To put it differently, the container phrase seems to allow us to see the container and the contents as a single complex object when the containment relation holds. These readings seem to differ only with respect to their sort, and therefore allow us to isolate that factor.

This is the ambiguity we will focus on for the remaining of this work. We will be concerned with the nature of the ambiguity between the container and concrete portion readings, and will leave aside the measure reading for the time being. It is worth noting however that measure phrases, including those with pure measure nominals, seem to be productively

ambiguous between a measure and an individual interpretation, as has been observed by Brasoveanu (2008) and Matushansky and Zwarts (2017). Whether that ambiguity is of the same sort as the ambiguity between the container and concrete portion readings of container phrases is a matter that must be left for future work.

Instead, we will focus based on the observations made so far on a suggestion made by Partee and Borschev (2016) about the possibility that the container and concrete portions readings do not in fact correspond to distinct representations for the container phrase, but rather that they may be integrated into a single representation if the container phrase is polysemous. If so, they may be assimilated to other cases of systematic polysemy, such as the *book* class, and analyzed using the same formal mechanisms, such as Asher's (2011) dot-types.

Whether the concrete portion reading and the container reading can be seen was two aspects of a complex object introduced by the container phrase depends crucially on whether co-predication is supported.

As discussed in chapter 1, we may recognize two main types of ambiguous nominal expressions in natural language, under the umbrella of homonymy and polysemy. Behaviorally, homonymy and polysemy were distinguished based on the possibility of non-zeugmatic co-predication, that is, the well-formedness of sentences in which a single instance of the nominal in question enter into multiple predication relations, which impose contradictory selectional restrictions on that nominal.

The examples in (202) illustrates a co-predication environment, in this case relative clause

modification, with the polyseme *book* and the homonym *date*.

(47) a. Ana mastered [*info*] the book that she picked up [*physical*]

b. #Ana responded to [*animate*] her date that she pitted [*inanimate*]

Accordingly, the well-formedness of co-predication with container pseudo-partitives should inform how this particular type of ambiguity is to be accounted for. That is, if container pseudo-partitives support co-predication, any account for which any single instance of the nominal is only able to satisfy the selectional restrictions of predications that either require it to be interpreted as primarily an object of the container sort *or* primarily an object of the content sort will be inadequate.

The example in (48) test the possibility of co-predication for the Container+Contents and Concrete Portion readings of *glass of wine*. In (48), the relative clause predication, *have a chip on the rim*, requires the pseudo-partitive phrase *that glass of wine* to be interpreted as a concrete object, namely the container, while the main clause predication, *be a cabernet*, requires that it be interpreted as an object of the sort of the content noun, here very specifically that it be *wine*.

(48) That glass of wine that had a chip on the rim [*container*] was a cabernet [*contents*].

The next chapter reports on a series of acceptability judgments designed to test the acceptability of precisely this sort of co-predication. Before turning to that, I will first discuss what extant accounts of container pseudo-partitive ambiguity predict the status of such sen-

tences should be, given how the ambiguity itself is accounted for. I will focus on the work of Rothstein (2009) and Partee and Borschev (2012), where the question of the nature of the ambiguity of container phrases is faced explicitly, despite the fact that Rothstein (2009) does not recognize the concrete portion reading.

2.6 Predictions for co-predication from previous accounts

Rothstein (2009, 2011), following Landman (2004), treats container phrases as two-way ambiguous, between the container reading (individuating reading in their terminology) and the measure reading.

Landman's (2004) proposal is that these readings arise from *distinct syntactic representations*. In particular, under the container reading, the container noun is the head of the noun phrase, while the measure reading arises when the container noun is a modifier of the contents nominal. In both cases, *of* is taken to be inserted late, in order to satisfy surface constraints, and no PP node is projected.

Rothstein's (2009) main goal is to provide support for the syntactic ambiguity approach espoused in Landman (2004) for English by providing evidence for syntactic reflexes of the ambiguity in Modern Hebrew. The following illustrate Landman's (2004) analysis as applied to the phrase *three glasses of wine*, according to Rothstein (2009).

Under the container reading, *glass* is a relational noun denoting the relation between entities which are glasses and the entities that they contain. The numeral *three* denotes here a

counting function characterizing plural objects with three atomic parts, and is an attributive adjective syntactically. Given the restriction on mass and bare plural complements, Rothstein (2009) assumes that the complement of the relational sense of *glass* is a kind-denoting DP.

Rothstein (2009) claims that choice is made for simplicity, but note that then the relation expressed here is between a concrete entity *glass* and the kind WINE. The containment relation is then not intuitively straight-forward, since it is unclear what it would mean for a glass to contain the kind WINE and not an entity that instantiates that kind.

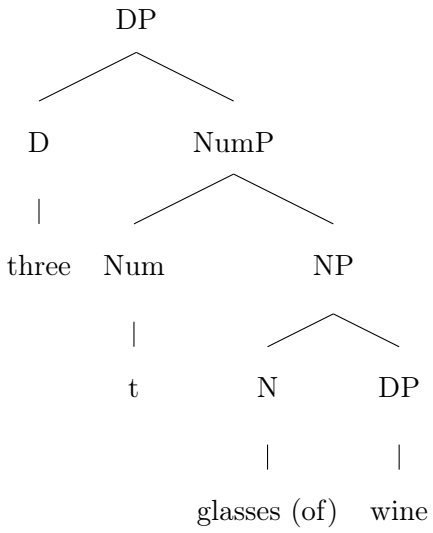
(49) The container reading (Rothstein 2009)

a. *glasses*: $\lambda x.\lambda$ y. [glasses(x) & contain(x,y)]

three: $\lambda Q.\lambda x.Q(x)\&|x| = 3$

three glasses of wine: $\lambda x.glass(x)\&contain(x, \text{WINE})\&|x| = 3$

b.



In Rothstein (2011) that issue is addressed by making use of the $^{\cup}$ operation, following

Chierchia (1998), which maps a kind into the set of entities (both singular and plural) which instantiate that kind. The containment relation is then modified as well, such that an entity stands in the containment relation to a kind P_k if all its atomic parts contain instantiations of that kind.

Finally, the meaning of the plural *glasses* is also modified, following Link(1983), where *glasses* is derived from *glass* via the plural operation PL(P) = {x: ∃Y⊆P: x = ⊔Y}, yielding PL(GLASSES) = {x: ∃Y⊆GLASS: x = ⊔Y} or the equivalent function λx. ∃Y⊆GLASS: x = ⊔Y . To arrive at the relational meaning of *glass*, the previous denotation is shifted via the type-shifter REL, shifting the function λx. ∃Y⊆GLASS: x = ⊔Y into λzλx. ∃Y⊆GLASS: x = ⊔Y & CONTAIN(x,y).

Therefore the meaning of *glasses*, and the container phrase as a whole, are given as below. The resulting meaning for *three glasses of wine* is then the set of entities in GLASSES which have three atomic parts which all contain instantiations of the kind WINE.

This will correctly support the observations that under the container reading the container phrase is a predicate true of the container, that what is counted is the number of containers, that these may be of different sizes, and that a fractional numeral will result in a "fractional container" interpretation.

(50) The container reading (Rothstein 2011)

a. *glasses*: λx. ∃Y⊆GLASSES: x = ⊔Y

b. *glasses of wine*: λzλx. ∃Y⊆GLASSES: x = ⊔Y & CONTAIN(x,y) ($^{\cup}$WINE$_k$) =

λx. $\exists$Y$\subseteq$GLASSES: x = $\sqcup$Y & CONTAIN(x,z) & x$\in^{\cup}$WINE$_k$

c. *three glasses of wine*: λx. $\exists$Y$\subseteq$GLASSES: x = $\sqcup$Y & CONTAIN(x,z) & z$\in^{\cup}$WINE$_k$ & CARD(x) = 3

Under the measure reading, the container noun is said to form a complex predicate with the numeral, giving the measure property of having the value n container-units on the scale for which the measure noun is defined for. For containers, this is likely a scale of volume. The combined numeral and container noun in turn modifies the head noun, the contents nominal, via intersective modification. Container nouns are here then treated on a par with pure measure nouns, such as *liter* and *kilo*.

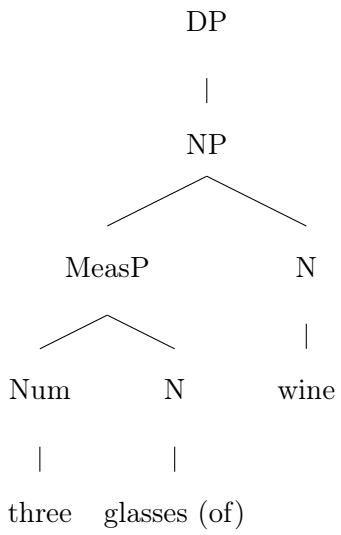
In Rothstein (2011), the unit of measurement meaning for a container noun is derived from the standard one-place predicate denotation via an operation that is introduced either by an overt suffix *-ful* or a null counterpart of it. Rothstein notes in footnote 2 that, as discussed by Partee and Borschev(2010) and earlier in this chapter, container nouns without suffixation by *-ful* and other classes of nouns from which a unit of measurement can be derived by that suffixation operation do not behave exactly equally, but do not discuss the matter further.

(51) a. *glass(flu)*: λn.λx. MEASvolume(x) = <GLASS, n>

three glasses: $\lambda x.x\text{MESS}(x)\&Meas(x) =< 3, Glass - ful >$

three glasses of wine: $\lambda x.[\text{WINE}(x)\&Meas(x) =< 3, Glass - ful >$

b.



The final denotation for the container phrase as a measure phrase is then the set of quantities of wine which have the measure value <GLASS,3> on a scale of volume. This will correctly support the observations that under the measure reading the container phrase is a predicate true of the contents, that what is counted are quantities of the contents given the measure value provided by the container nominal and numeral, that the in the plural case those quantities must be of equal size/volume, and that fractional numerals will not give rise to a "fractional container" interpretation.

There is therefore for Rothstein (2009) no interpretation of the container pseudo-partitive for which it denotes a quantity of the contents, so that it able to satisfy the selectional restriction of a predicate that selects for an entity of that sort, but which also involves a concrete container. That is, the analysis does not recognize the concrete portion reading.

The only interpretation for Partee and Borschev's (2012) example (39), repeated below as (191), should be one that that involves a big and a small *pot-ful*, two distinct units of

measurement for *pot*. Perhaps this interpretation is also available, but the most natural one seems to describe an event of cooking two portions of soup in two concrete pots of two different sizes.

(52) He cooked two pots of soup, a big one for us and a small one for the cat.

Since for Rothstein (2009) each reading of the container pseudo-partitive corresponds to a distinct syntactic and semantic representation, it is also clear that no single instance of the nominal should be able to satisfy the selectional restrictions of multiple predicates which are each compatible with only one of the readings. It predicts clearly that co-predication between should be ill-formed, even if there is a way to obtain the desired properties for the concrete portion reading from the semantics given to the measure reading.

The situation is somewhat similar when it comes to the analysis presented in Partee and Borschev (2012). In providing an analysis of the Russian Genitive of Measure construction, illustrated in (196) and whose ambiguity resembles closely that of the container construction in English, Partee and Borschev (2012) propose distinct meanings for each of the readings discussed in chapter 1, as well as a series of meaning-shifts which progressively derive those readings from the simple sortal interpretation of a container noun such as *glass*. These shifts are however not formalized.

(53) a. stakan moloka
glass-NOM.SG milk-GEN.SG
glass of milk

b. jaščik jablok
box-NOM.SG apple-GEN.PL
box of apples

The lexical meanings for the container noun *stakana* 'glass' under each interpretation are given bellow in (54):

(54) a. Container+Contents *stakan*: Type <e, <e,t »

$\lambda y.\lambda x.$ [glass(es) (x) & $\exists$z [z $\sqsubseteq$ y & z fills x]]

b. Concrete Portion *stakan*: Type <n,<e,t»

$\lambda n.\lambda x.\exists y.$ [glass (y) & x fills y & |y| = n]

c. Ad-hoc Measure *stakan*: Type <n,<e,t»

$\lambda n.\lambda x.$ [glass (y_i) & x would y_i n times, where y_i is a free variable

d. Standard Measure *stakan*: Type <n,<e,t»

$\lambda n.\lambda x.$ [stakan-units(x) = n]

Since container nouns in the Container+Contents reading on the one hand, and in the three other interpretations - Concrete Portion, Ad-hoc measure and Standard measure, have different semantic types, the pseudo-partitive phrase as a whole is also given two distinct syntactic representations. That is, in addition to the multiple lexical entries given to container nouns, the container phrase ambiguity also corresponds to a structural ambiguity, as in Rothstein's (2009) approach.

The container reading for Partee and Borschev(2012) has the same syntactic structure as for Rothstein(2009, 2011), but the containment relation is captured differently. The lexical

entry for the relational meaning of the container noun specifies, as discussed earlier, that the contents must fill the container, distinguishing the container phrase from an expression such as *glasses with milk*.

Moreover, though for Partee and Borschev(2012) the contents nominal is also kind-denoting, rather than using an operation which instantiates the kind, Partee and Borschev(2012) incorporate a partitivity relation between the kind-denoting expression and the variable that is interpreted as the entity which stands in the containment relation.

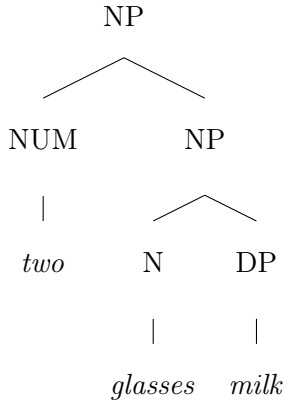
(55) The container reading

a. *glass*: $\lambda y.\lambda x.$ [glass(es) (x) & $\exists$z [z $\sqsubseteq$ y & z fills x]]

b. *milk*: MILK_e (a kind-denoting term)

c. *glass of milk*: $\lambda x.$ [glass(es) (x) & $\exists$z [z $\sqsubseteq$ MILK_e & z fills x]]

(56)



This denotation also supports the observations that under the container reading the container phrase denotes a predicate true of the container, that what is counted is the number of containers, that as concrete containers these may be of different sizes, and, consequently,

the fractional numeral facts.

The concrete portion reading has the same syntactic structure as the measure reading in Rothstein, where the container noun combines with the numeral and modifies the content nominal, which heads the container phrase. The main distinction is with respect to the denotation of the container noun itself, and that of the contents nominal, which is not kind-denoting, but a simple one-place predicate of type <e,t>.

(57) The concrete portion reading

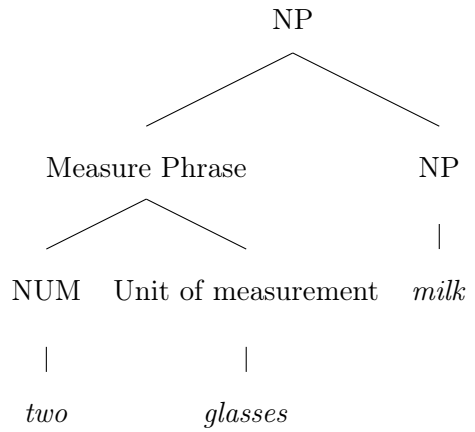
a. *glass*: λn.λx.$\exists$y [glass(es)(y) & x fills y & |y|=n]

b. *two*: 2

c. *two glasses*: λx.$\exists$y [glass(es)(y) & x fills y & |y|=2]

d. *two glasses of milk*: λx.[MILK(x) & $\exists$y [glass(es)(y) & x fills y & |y|=2]

(58)



Like the measure reading, here the container phrase is a predicate true of the contents, but unlike the measure reading, what is counted is the number of glasses which contain milk, allowing for containers of different sizes, and explaining the fractional numeral effect.

For the same reasons as for Rothstein(2009, 2011), it is clear then that under this approach co-predication should be ill-formed. In an example such as (59) for instance, repeated below, either the selectional restrictions of the relative clause predication will be satisfied, in which case the pseudo-partitive is interpreted as a container, *or* the restrictions of the main clause predication will be satisfied, in which case it is interpreted as a quantity of wine, but these cannot be both satisfied simultaneously.

(59) That glass of wine that had a chip on the rim [*container*] was a cabernet [*contents*].

2.7 Conclusion

In this chapter I have presented the main empirical observations, both new and from the literature, that form the desiderata for any understanding of the nature of the ambiguity of container phrases in English. We have seen that container phrases are ambiguous between a predicate true of the sort of object the container noun belongs to and a predicate true of the sort of object the contents nominal belongs to.

Moreover, in the latter case, there is a further ambiguity with respect to the status of the container nominal, namely whether it denotes an abstract unit of measurement, or concrete containers standing in a containment relation with the contents. These are distinguished by how they interact with numerals - what sort of entities are counted - and whether they are congruent with situations in which the quantities of contents that are individuated may be of different sizes, corresponding to different sizes of containers. In addition, in cases where

concrete containers are involved, these may enter into anaphoric relations.

We have diagnosed the ambiguity by showing that the container phrase is able to satisfy the selectional requirements of predicates selecting either for the sort of the container or the contents nominal, and also that in contexts in which the selectional properties of the local predication the container phrase enter into are not enough to disambiguate it, world knowledge and contextual plausibility may heavily bias one particular interpretation.

Of particular interest to us here is the nature of this ambiguity. Previous accounts, such as Rothstein (2009, 2011) and Partee and Borschev (2012), identify it as a case of both syntactic and semantic ambiguity. Such an approach predicts that for any one instance of a container phrase, only one interpretation may be available.

In this sense, they predict that in an environment in which a container phrase enters into multiple predication relations simultaneously, all predications must match with respect to the sort of predicate they require the container phrase to be. In other words, these approaches predict that co-predication with container phrases should be ill-formed.

This prediction seems to be incorrect for at least one case, those in which the container phrase must, for one predication relation, be interpreted under the container reading, and for another, under the concrete portion reading. Partee and Borschev (2012) are aware of this possibility, and the inability of their approach to predict the well-formedness of co-predication if it is indeed so.

They suggest that if it is the case that those sentences are well-formed, the semantics of

container phrases, at least as far as these two readings are concern, might approximate other cases of ambiguity which support co-predication, namely lexical polysemy of the sort observed for nouns like *book* and *magazine*, where both their concrete object sense and abstract content sense are available simultaneously, because they correspond to different *aspects* of a single complex entity.

It is indeed possible to conceive that under the container and concrete portion readings, the container phrase characterizes the same set of objects: *two boxes of books* characterizes a set of boxes of cardinality two which stand in a containment relation to a certain quantity of books, or it characterizes a certain quantity of books stands in a containment relation to a set of boxes of cardinality two.

In order to explore the viability of this intuition, the next chapter presents a series of experimental studies which investigate the status of co-predication with container phrases, and compares it to the case of lexical polysemy, as well as with homonymy, which is a type of ambiguity said not to support co-predication.

On the one hand, our interest is to observe to what degree the behavior of container phrases approximates that of lexical polysemes in co-predication environments. It is clear that if co-predication is acceptable, an approach that treats the ambiguity as arising from competing syntactic and semantic representations must be discarded in favor of one in which distinct aspects of a complex entity may be independently targets in local predication relations.

On the other hand, it will also be of interest to observe to what degree container phrases differ

from lexical polysemes, even if co-predication is acceptable. If container phrases exhibit the same sort of ambiguous behavior, then we must ask how it comes about compositionally in this particular grammatical construction, and how this type of phrasal polysemy fits in a general picture of nominal meaning flexibility.

Chapter 3

Experimental evidence for the polysemy of container phrases

3.1 Experiment 1: establishing the acceptability of co-predication

The main goal of experiment 1 is to inquire into the acceptability of co-predicational sentences with container phrases. As discussed in chapter 1, the acceptability of co-predication serves as a diagnostic test for determining the nature of the ambiguity of a nominal expression. In particular, it has been shown to distinguish between homonymy (*dead bat/broken bat*) and polysemy (*heavy book/translated book*).

Accordingly, in order to investigate the behavior of container phrases in co-predication environments, in experiment 1 we also aim to establish the acceptability profile of co-predication

with well studied cases of lexical homonymy and polysemy. These will in turn serve as baselines against which to compare the behavior of container phrases.

Though I am unaware of previous studies assessing the acceptability of co-predication with different classes of ambiguous nominals directly using global, offline measures, the most closely related studies are those in Frazier and Rayner (1989).

Through eye-tracking reading tasks, Frazier and Rayner (1989) found that the distinction between homonymy and polysemy is reflected in real-time behavioral measures. Their stimuli manipulated whether the material that disambiguates the noun towards a particular sense was presented prior to the noun or following it, as illustrated in (60). The clause containing the noun itself was always neutral, the local predication relation being compatible with either senses of the homonym or polyseme.

(60) a. Of course the pitcher pleased Mary, being so elegantly designed.

b. Of course the pitcher pleased Mary, throwing so many curve balls.

c. Being so elegantly designed, the pitcher pleased Mary.

d. Throwing so many curve balls, the pitcher pleased Mary.

In the example (60), the homonym *pitcher* is introduced in the clause *the pitcher pleased Mary*, compatible with both the inanimate, artifact sense of *pitcher* and the animate, human baseball player sense of the noun. In (60a) and (60b), that clause is presented first, and the expression remains ambiguous until the second clause is encountered.

There, the predication is only compatible with one of the senses: in (60a) *being designed* requires the inanimate sense, and in (60b) *throw curve balls* requires *pitcher* to be interpreted in its animate sense. Participants therefore only had the means to determine the intended sense of the ambiguous nominal at a point that followed its presentation. Frazier and Rayner (1989) call this the late disambiguation condition.

In conditions (60c) and (60d), on the other hand, the order of clauses is reversed, so that the clause that contains the homonym is presented in a context that is already only compatible with one of its senses. These correspond to the early disambiguation conditions.

Frazier and Rayner (1989) found that in late disambiguation conditions reading times were higher at the region containing the homonym than in early disambiguating ones. In contrast, reading times for that region did not differ for polysemes between early and late disambiguation environments.

The relative slowdown for homonymy is interpreted as the cost of committing online to a particular sense as soon as the ambiguous expression is encountered, a step which seems to be obligatory for homonyms but not for polysemes.

Put differently, upon encountering a homonym in early disambiguation conditions, those for which at that point there is no contextual information to support disambiguation in favor of a particular sense, participants still committed to one interpretation.

Which sense one commits to might be conditioned by factors such as frequency asymmetries between senses, or a preference given the local predication relation, even if it does not rule

out any of the readings.

If this relatively uninformed choice ends up clashing with the sense required by the following clause, a reanalysis process is triggered. This reanalysis is reflected in slower reading times at that region and a higher probability of regression.

Participants were not subject to a similar pressure to commit to a particular sense in the case of polysemes occurring in a neutral environment. Therefore, they also did not risk incurring into the cost of reanalysis in late disambiguation conditions.

Rather, Frazier and Rayner (1989) argue that these results support a view in which the meaning of polysemes may remain unspecified if previous context does not bias commitment to a particular sense, and subsequently there will be no need to retract that commitment at a later point.

Of immediate interest to us, what the results from Frazier and Rayner (1989) suggest is that the multiple sense of polysemes remain available for further operations when the polyseme is introduced in a neutral context, in a way that the multiple senses of homonyms are not.

The co-predication test, which is used throughout the experiments reported here, gets to a related but different question, namely whether the multiple senses of polysemes and homonyms remain available when they are introduced in a local context which is not neutral, but rather compatible with only one of the senses.

3.1.1 Experimental design and materials

We test the availability of the senses of homonyms, lexical polysemes and container phrases using a relative clause co-predication frame, where the nominal of interest is the subject of the main clause, and is also modified by a relative clause. Internally to the relative clause it may occupy either the subject or object position. All items therefore fit the following schematic: Nominal [$_{RC}$ Pred$_1$] Pred$_2$.

Three factors were manipulated, in a 2x2x4 factorial design:

i. Whether the senses selected by the two predicates match or mismatch

ii. The order of the selecting predicates (RC or main clause)

iii. The type of nominal: homonymy, polysemy, container phrase with count contents, container phrase with mass contents)

The example items below illustrate materials for each of the four nominal types (see Appendix A for full materials).

(61) **Polysemy**

a. Match & Abstract-abstract

The novel that got some great reviews was a terrifying thriller.

b. Match & Concrete-concrete

The novel that got soaked in coffee was found in the sale bin.

c. Mismatch & Abstract-concrete

The novel that got some great reviews was found in the sale bin.

d. Mismatch & Concrete-abstract

The novel that got soaked in coffee got some great reviews.

(62) **Homonymy**

a. Match & Inanimate-inanimate

The date that tasted bitter was bought just yesterday.

b. Match & Animate-animate

The date that walked in late was very rude to Jane.

c. Mismatch & Inanimate-animate

The date that tasted bitter was very rude to Jane.

d. Mismatch & Animate-inanimate

The date that walked in late was bought just yesterday.

(63) **Container phrase - Mass contents**

a. Match & Container-container

The jug of lemonade my grandfather broke had lemons painted on it.

b. Match & Contents-contents

The jug of lemonade I drank was too sweet.

c. Mismatch & Container-contents

The jug of lemonade my grandfather broke was too sweet.

d. Mismatch & Contents-container

The jug of lemonade I drank had lemons painted on it.

(64) **Container phrase - Count contents**

a. Match & Container-container

The tupperware of cookies made of blue plastic is sealed shut.

b. Match & Contents-contents

The tupperware of cookies I baked this morning is all chocolate chip.

c. Mismatch & Container-contents

The tupperware of cookies made of blue plastic is all chocolate chip.

d. Mismatch & Contents-container

The tupperware of cookies I baked this morning is all chocolate chip.

In total there were 68 items: 16 in the homonymy, polysemy and container+count contents conditions, and 20 for the container+mass contents condition. Every item was passed through the corresponding 4 conditions (2 orders*2 senses). In addition participants rated 70 fillers items.

In polysemy and homonymy conditions, we used the nouns and biasing predicates used in Frazier and Rayner (1989) whenever possible. Modifications were made whenever translating their items into our co-predication frame resulted in an unnatural sentence.

All homonyms had one animate and one inanimate sense, and all polysemes had a concrete and an abstract sense. The majority of items entered either the physical object-informational

object alternation (*newspaper*, *pamphlet*), but the set also includes items that undergo the meal-event alternation (*dinner*, *lunch*), location-organization (*city*, *library*), and currency-bill (*dollar*).

In the container phrase conditions, all container nouns belonged to the CONTAINER sort, satisfying the conditions discussed in chapter 1.

Finally, for those conditions, the predicates chosen heavily biased the interpretation of the container phrase towards either the container or concrete portion readings. In some cases the bias stemmed from strong selectional restrictions and an incompatibility with one of the readings, while in others the interpretation was biased by contextual or word knowledge factors.

For instance, predicates like *hold*, *carry* or *bring* taking the container phrase as argument are much more plausibly interpreted as holding or carrying the container, plus its contents, given world knowledge, and especially if the contents nominal is mass. But the reading that what is held or carried is a portion of the contents cannot be ruled out on linguistic grounds. The results we report for study 1 must take this point into consideration, and study 3 will address it directly.

3.1.2 Predictions

Homonyms are expected to be judged less acceptable in mismatching conditions than matching conditions, while polysemes should be judged equally acceptable in matching and mis-

matching conditions. We therefore expect an interaction between sense matching and nominal type.

For container phrases, we consider two hypotheses, with opposing predictions:

i. STRUCTURAL AMBIGUITY HYPOTHESIS (Partee and Borschev (2012):

   The container and concrete portion readings arise from distinct syntactic and semantic representations. Since any one instance of the nominal may only correspond to one of those representations, only one reading should be available at a time. Consequently, co-predication will be unacceptable. Judgements should be similar to co-predication with homonyms.

ii. SYSTEMATIC POLYSEMY HYPOTHESIS:

   The container and concrete portion readings arise when distinct aspects of a complex object (in the sense of Asher 2011) is targeted. Since any one instance of the nominal has a complex object representation, and targeting one aspect in predication enriches composition without shifting the meaning of the nominal itself, multiple readings may be available simultaneously. Consequently, co-predication will be acceptable. Judgements should be similar to co-predication with lexical polysemes.

There is in addition a particular caveat that must be pointed out for container phrase conditions, which is specific to the relative clause co-predication frame used here. Given that container phrases are syntactically complex, there is a potential attachment ambiguity with regards to the level at which the relative clause is inserted into the structure.

The string *cup of coffee that Ana drank* may correspond to two different syntactic structures: the relative clause may attach to a high node, modifying the whole phrase, or it may attach low, modifying the contents nominal only.

This possibility is viable when the predication relation in the relative clause selects for the sort of the contents nominal (*coffee that Ana drank*), but will result in ill-formedness when the relative clause selects for the sort of the container noun (*#coffee that Ana broke*).

When the relative clause selects for the contents nominal then, if the relative clause attaches low, this condition will not instantiate a case of co-predication. If this is the structure from which participants interpret this condition (contents-container), then the structural ambiguity hypothesis predicts it should be as acceptable as the two matching conditions (contents-contents and container-container), and distinct from the other mismatching condition (container-contents).

On the other hand, the systematic polysemy hypothesis does not predict any distinction between the two mismatching conditions, even if the relative clause is attached low, for the same reason it does not predict a distinction between matching and mismatching conditions in general, at least in terms of grammaticality. In both situations participants should be able to arrive at a well-formed semantic representation and interpretation.

Note, however, that the task in experiment 1 is not, and could not be, a grammaticality test. Rather, as an acceptability test, judgments may be influenced by a number of factors beyond grammaticality, such as frequency, or pragmatic felicity, to name a couple. The

systematic polysemy hypothesis predicts well-formedness, though on its own it says nothing about whether the operations needed to tease apart aspects of a complex object and enrich composition should be costly in a way that influences acceptability judgments.

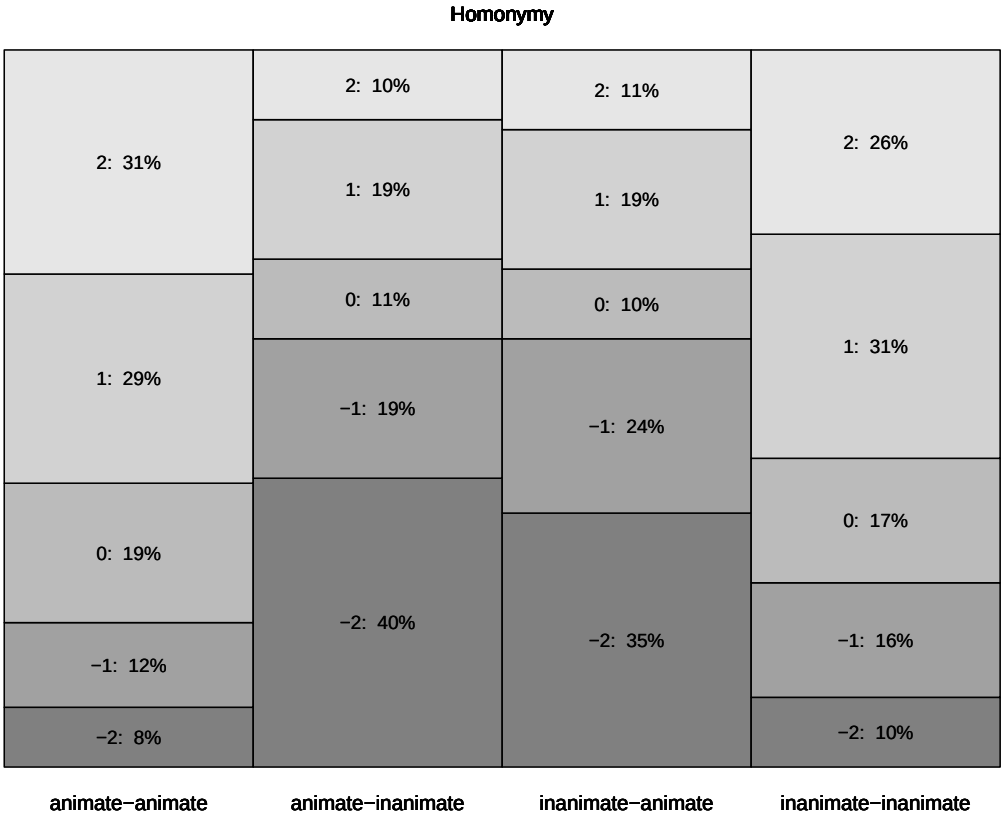
If anything, the hypothesis says that any distinction one finds between matching and mismatching conditions, or amongst mismatching conditions, or between different classes of polysemes, should find an explanation beyond semantic well-formedness.

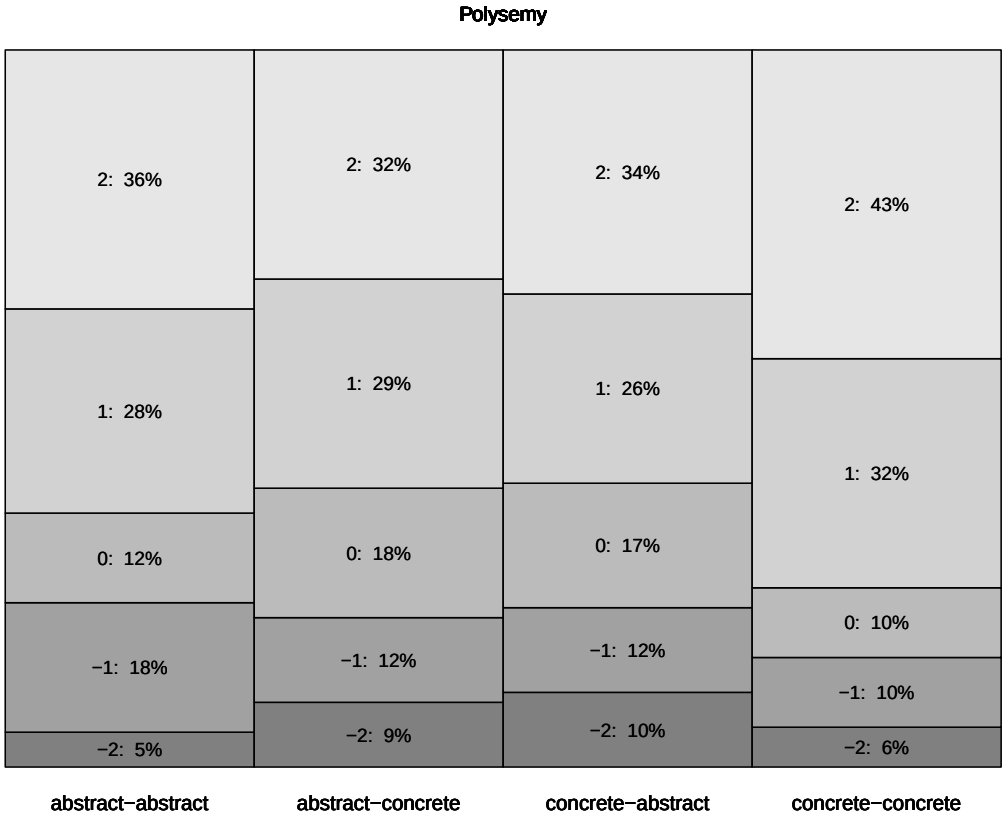
3.1.3 Participants and procedure

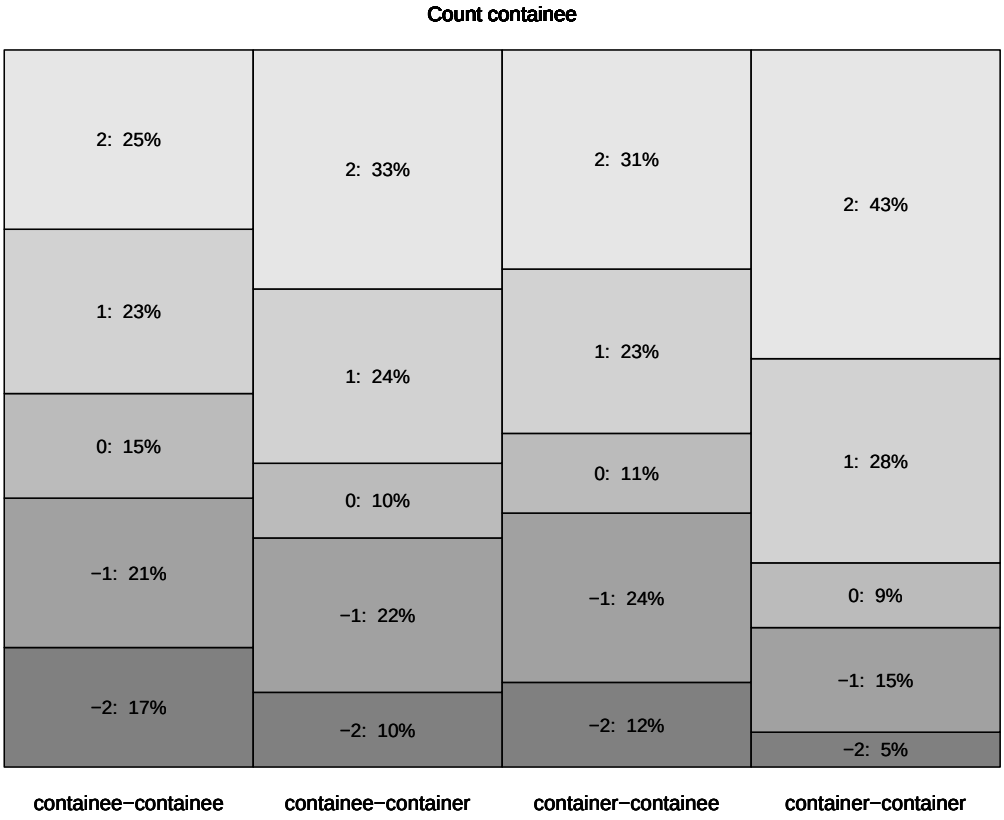
Thirty-six native speakers of English participated in the study. All participants were undergraduate students at UCSC and were compensated with course credits. All participants completed the study online. They were instructed to rate the sentences presented in isolation on a 5-point Likert scale from -2 (very bad), -1 (fairly bad), 0 (neither good nor bad), 1 (fairly good), 2 (very good). Every speaker saw each item once in one of the 4 conditions, which were randomly selected for every item and rotated for every participant (latin square design). Each speaker rated 138 stimuli (68 items+70 fillers); the order was randomized for each speaker.

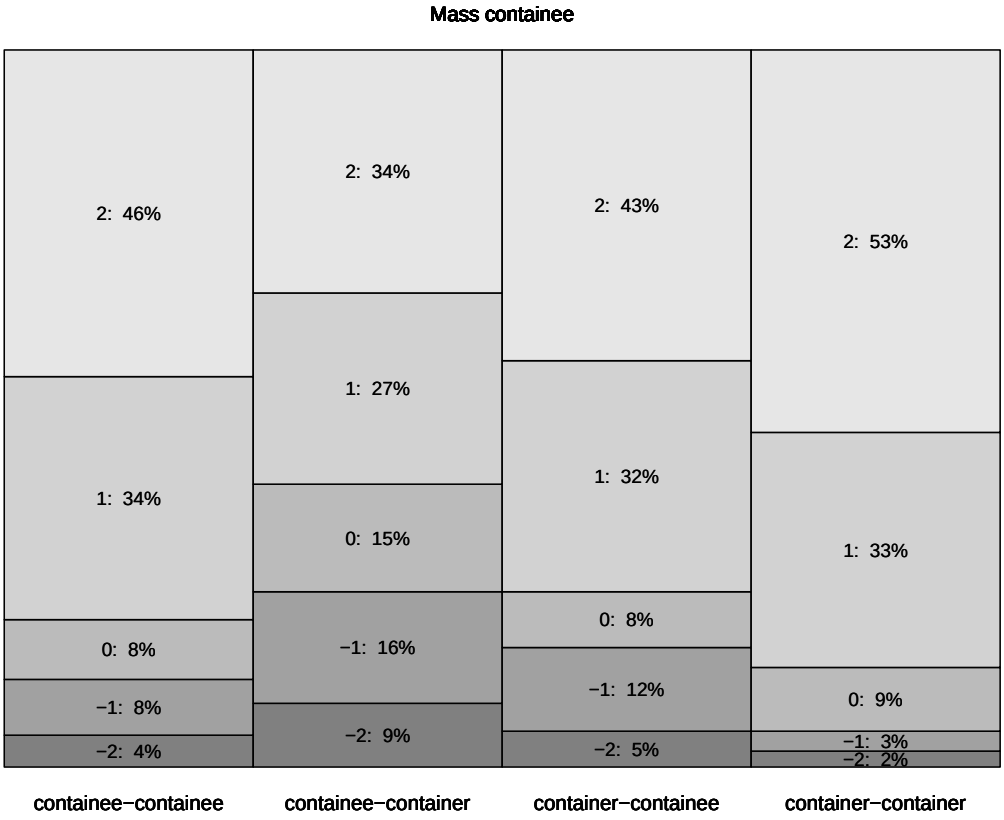
3.1.4 Results and analysis.

Graphical summaries of the Experiment 1 data are provided in the figures below.


Homonymy
2: 31%
1: 29%
0: 19%
−1: 12%
−2: 8%
2: 10%
1: 19%
0: 11%
−1: 19%
−2: 40%
2: 11%
1: 19%
0: 10%
−1: 24%
−2: 35%
2: 26%
1: 31%
0: 17%
−1: 16%
−2: 10%
animate−animate
animate−inanimate
inanimate−animate
inanimate−inanimate


Polysemy
2: 36%
1: 28%
0: 12%
−1: 18%
−2: 5%
2: 32%
1: 29%
0: 18%
−1: 12%
−2: 9%
2: 34%
1: 26%
0: 17%
−1: 12%
−2: 10%
2: 43%
1: 32%
0: 10%
−1: 10%
−2: 6%
abstract−abstract
abstract−concrete
concrete−abstract
concrete−concrete


Count containee
2: 25%
1: 23%
0: 15%
−1: 21%
−2: 17%
2: 33%
1: 24%
0: 10%
−1: 22%
−2: 10%
2: 31%
1: 23%
0: 11%
−1: 24%
−2: 12%
2: 43%
1: 28%
0: 9%
−1: 15%
−2: 5%
containee−containee
containee−container
container−containee
container−container



Since our response data is ordered categorical, we used mixed-effects ordinal probit regression models to analyze it. All the models we report here included the full fixed-effect structure unless otherwise specified (main effects of our experimental manipulations, plus their interactions), and crossed random intercepts for subjects and items.[1]

As expected, homonyms were judged significantly worse in the mismatching conditions than in the matching ones. This can be observed by examining the top panel of Figure [refexp1$_h$om$_p$ol], e.g., the percentage of unacceptable -2 and -1 ratings given to the mismatching vs. matching conditions.

[1] All the data summaries / plots / analyses in this paper have been generated / completed using `R` and the packages `ggplot2` and `Ordinal`.

This is confirmed by the statistical analysis of the data. The reference levels for both the first sense (the sense selected by the relative clause) and the second sense (the sense selected by the matrix VP) were set to ANIMATE.

There was a main effect of INANIMATE for both the first sense ($\beta = -1.07, SE = 0.13, p = 0.00$) and the second sense ($\beta = -1.18, SE = 0.14, p = 0.00$), and a significant INANIMATE×INANIMATE interaction ($\beta = 2.11, SE = 0.19, p = 0.00$), which basically reversed the cumulative effect of the two main effects, thereby bringing the acceptability of the inanimate-inanimate condition back to the high level of the reference condition (animate-animate).

For polysemy, we set the reference levels for both the first and the second sense to ABSTRACT. The main effects of switching to CONCRETE were non-significant for both the first sense and the second sense (the estimates were almost identical in the two cases: $\beta = -0.12, SE = 0.13, p = 0.35$). That is, we detected no difference between the abstract-abstract (reference) condition and the mismatching abstract-concrete and concrete-abstract conditions. There was however a significant CONCRETE×CONCRETE interaction ($\beta = 0.51, SE = 0.19, p = 0.006$).

This result, in conjunction with an inspection of the data summaries in Figure [refexp1$_h$om$_p$ol], indicates that mismatching conditions are slightly worse than matching conditions for polysemes also, but this difference is much smaller than for homonyms – as shown by the much smaller main & interaction effects for polysemy relative to homonymy.

The picture that seems to emerge is that mismatching conditions are worse than matching conditions across the board, but the differences in acceptability between these conditions fall on a gradient spectrum.

Homonyms are at the high end of the spectrum, with large – and introspectively available – differences between matching and mismatching conditions. Polysemes are the low end of the spectrum, with small – and introspectively not (or less) available – differences between matching and mismatching conditions.

We can strengthen our confidence in this hypothesis by grouping the matching conditions together, and also the mismatching conditions, pooling the homonymy and polysemy data, and estimating a mixed-effects probit model with two fixed effects: (*i*) SAME-SENSE (reference level) vs. DIFFERENT-SENSE, and (*ii*) HOMONYMY (reference level) vs. POLYSEMY.

All fixed effects (the main effects and their interaction) are significant in this model. There is a main effect of POLYSEMY ($\beta = 0.32, SE = 0.13, p = 0.01$) indicating that even in the matching conditions (the baseline), polysemes are relatively more acceptable.

There is a large negative main effect of DIFFERENT-SENSE ($\beta = -1.01, SE = 0.10, p = 0.00$) indicating that zeugmatic sentences significantly decrease acceptability for homonyms, as expected.

Finally, there is a significant positive interaction of POLYSEMY×DIFFERENT-SENSE ($\beta = 0.83, SE = 0.13, p = 4 \times 10^{-10}$), which almost – but not quite – reverses the negative main effect of DIFFERENT-SENSE observed with homonyms. These results are compatible

with the hypothesis outlined above that the differences in acceptability between matching and mismatching conditions fall on a gradient spectrum, with homonyms at the high end of the spectrum (large differences) and polysemes at the low end of the spectrum (small differences).

For all container phrases (both those with a count contents and those with a mass contents nominal), we selected CONTAINER as the reference level for both the first predicate (the restrictive relative clause) and the second predicate (the matrix VP).

Mass-contents phrases exhibit the same overall pattern as homonyms and polysemes: mismatching conditions are worse than matching conditions. And the difference between these classes of conditions falls roughly in the middle of the spectrum between homonyms and polysemes. This can be observed by comparing the data summaries for mass contentss in the lower panel of Figure [refexp1$_c$ount$_m$ass] with the corresponding summaries in Figure [refexp1$_h$om$_p$ol].

The results of statistical analysis are compatible with this: there is a main effect of CONTENTS TYPE for both the first sense ($\beta = -0.79, SE = 0.12, p = 1.9 \times 10^{-10}$) and the second sense ($\beta = -0.41, SE = 0.12, p = 0.001$), and a significant CONTENTS TYPE×CONTENTS TYPE interaction ($\beta = 0.91, SE = 0.17, p = 1.9 \times 10^{-7}$).

All of these effects have the same direction as the corresponding homonymy and polysemy ones, and their magnitudes are intermediate between the corresponding homonymy and polysemy effects.

Count-contents phrases exhibit a slightly different pattern: there is a main effect of CONTENTS TYPE for both the first sense ($\beta = -0.36, SE = 0.13, p = 0.006$) and the second sense ($\beta = -0.46, SE = 0.13, p = 0.0004$), but no significant CONTENTS TYPE×CONTENTS TYPE interaction ($\beta = 0.19, SE = 0.18, p = 0.30$); see also the top panel of Figure [refexp1$_c$ount$_m$ass].

This is compatible with count container phrases exhibiting a polysemous behavior since zeugma / copredication does not lower acceptability. What we seem to observe is an across-the-board preference for the container sense, which is slightly more pronounced for the second predicate (the matrix VP) than for the first predicate (the restrictive relative clause).

The contrast between count and mass contents phrases is further confirmed when we group the matching conditions together, and also the mismatching ones, pool the count and mass data, and estimate a mixed-effects probit model with two fixed effects: (*i*) SAME-SENSE (reference level) vs. DIFFERENT-SENSE, and (*ii*) COUNT (reference level) vs. MASS.

We see that there is a positive main effect of MASS ($\beta = 0.65, SE = 0.13, p = 1.1 \times 10^{-6}$), which might be due to independent issues like the pattern of agreement with the matrix verb (see the discussion paragraphs below).

But most importantly, we see that the main effect for DIFFERENT-SENSE ($\beta = -0.09, SE = 0.09, p = 0.32$) is non-significant, indicating that there is no difference between matching and mismatching conditions for count contents, while the interaction MASS×DIFFERENT-SENSE is significant ($\beta = -0.32, SE = 0.13, p = 0.009$), indicating that there is such a difference for mass contents.

3.1.5 Discussion

Taken together, the results of experiment 1 confirm the validity of the co-predication test in distinguishing the two cases of lexical ambiguity at hand.

As expected, speakers judge co-predication with homonyms very poorly, and the contrast against matching conditions was quite sharp. Somewhat less expectedly, we still observe some cost of co-predication for polysemes, even though the distinction between regular predication and co-predication was much smaller than for homonyms. The contrast between homonymy and polysemy is sharp enough to warrant their use as baselines against which to compare the behavior of container phrases.

Beyond the status of co-predication, the data shows participants had a bias for one of the senses in all conditions. For polysemy, a preference for the concrete sense of the nouns produced lower ratings for the matching conditions that selected for the abstract sense.

As mentioned previously, the nouns used in the polysemy condition participate in a number of alternations. What is coded as the abstract sense may stand for informational objects, organizations, events or units of measure. Thus it is possible that we could find lower ratings for the abstract matching conditions in some of these classes, but not others. It is also possible that the presence of the effect for polysemy is simply an artifact of the particular lexical items chosen here and do not reflect a systematic bias for the concrete senses. This would the case if the bias is driven by frequency asymmetries, for instance, which was not controlled for.

Similarly for homonyms, there was a general preference for the use of the animate sense of the nouns in our materials. This was likely due to the fact that nouns appeared in subject position, which itself is known for heavily biasing in favor of animate nouns in the general case.

With respect to the second goal of study 1, to compare the status of co-predication with container phrases and lexically ambiguous nominals, our results show that container ambiguity patterns more closely with polysemy than homonymy.

Unlike homonymy, no main effect of sense matching was found for container phrases. Generally, this indicates that the relevant readings of the container construction are available simultaneously.

It suggests therefore that accounts assuming distinct syntactic and semantic representations for those readings are unable to capture the full range of behavior for container phrases.

Moreover however, the patterns of acceptability for container phrases were more diverse than initially expected. In particular, none of the family of approaches predicted a sensitivity to whether the contents nominal was a mass or bare plural count noun.

In both cases moreover we observe a directionality effect in mismatching conditions, meaning that acceptability was modulated by the relative order in which senses were selected.

More surprisingly, the relative preference for a particular order was different for mass and

count content nominals. When the contents nominal is count, it was more acceptable to first select for the concrete portion and then for the container.

Recall that there are two attachment site possibilities for mismatching conditions where the relative clause selects for the contents sort. The relative clause could attach lower in the structure and modify only the second nominal, not exemplifying a case of co-predication. If there is indeed a general preference for low attachment in this case, then this effect for count nouns could be explained as simply a cost of co-predication. That is, container-contents conditions are rated lower than contents-container because only in the second is there a true mismatch in selectional demands imposed on the same expression.

For mass contents, however, this same type of explanation is not available. Here the results are the opposite of what we could expect if the contents-container condition did not involve co-predication, and co-predication itself was somewhat costly. This is because speakers judged this precise condition to be less acceptable than co-predication sentences selecting first for the container and then for the contents.

Before we can conclude with any confidence that the source of these unpredicted distinctions is in fact the mass/count status of the contents nominal, a few potential confounds need to be addressed. Firstly, there was a systematic number mismatch in the count phrases. While container nouns were kept singular, content nominals were always plural. This meant that cases where the main predicate selected for the contents but showed singular morphology had a somewhat odd agreement pattern, illustrated in (65).

(65) The tupperware of cookies I baked this morning is all chocolate chip

In (65) even though the main predication selects for *cookies*, the copula shows singular agreement morphology with the entire subject. It is possible that the directionality effect for counts had to do with lower ratings for container-contents conditions due to the odd agreement.

Second, mass and count conditions involved both different container nouns (with some overlap), and also different predicates. We address the first issue in experiment 2, and the second in experiment 3.

3.2 Experiment 2: container nouns in isolation

Experiment 2 had two main goals. The first was to clarify the source of the difference between count and mass contents nominals observed in experiment 1, by eliminating the confound introduced in count conditions due to the agreement morphology in the main clause, as discussed above.

The second goal was to investigate the source of ambiguity in the container construction. We ask in particular whether the container noun in isolation can support co-predication, comparing it to the pattern of accceptability ratings observed for the full construction in the first experiment.

3.2.1 Participants and procedure

Thirty native speakers of English judged the acceptability of the item sentences on the same 5-point Likert scale as experiment 1, from -2 (very bad), -1 (fairly bad), 0 (neither good nor bad), 1 (fairly good), 2 (very good). All participants were undergraduate students at UCSC and were compensated with course credits. The procedure was identical to experiment 1.

3.2.2 Design and materials: The effect of number

To address the first goal, count contents items were modified to make the phrase uniformly plural. An item that contained the phrase *box of books*, for instance, would be presented instead as *boxes of books*. Other than changing the verb agreement morphology to match the features of the subject, all else was kept equal. (66) provides an example item.

(66) a. Match & Container-container

The jars of cookies James almost broke looked almost empty.

b. Match & contents-contents

The jars of cookies James almost broke had been half eaten.

c. Mismatch & Container-contents

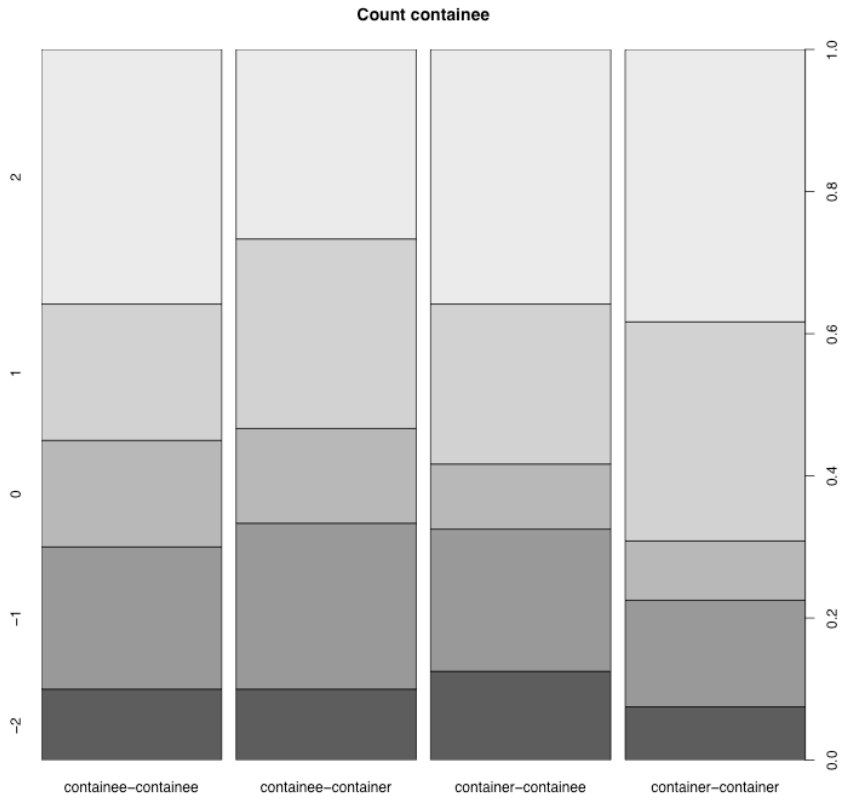
The jars of cookies James baked looked almost empty.

d. Mismatch & contents-container

The jars of cookies James baked had been half eaten.

3.2.3 Results and analysis

Graphical summaries of the results are presented in the figures below.



The data was analyzed using mixed-effects ordinal probit regression models, including the full fixed-effect structure (main effects of experimental manipulations, plus their interactions), and crossed random intercepts for subject and items.

No effect reached significance in this model. There was no main effect of FIRST SENSE ($\beta = -0.35, SE = 0.23, p = 0.14$), no main effect of SECOND SENSE ($\beta = -0.25, SE = 0.18, p = 0.16$) and no significant FIRST SENSE X SECOND SENSE interaction ($\beta = -0.38, SE = 0.30, p = 0.20$)

3.2.4 Design and materials: The source of polysemy

The second manipulation in experiment 2 asks whether the container noun by itself, without contextual support, exhibits the same properties as the container constructions as a whole. That is, we ask if the container can satisfy the type presuppositions of predicates selecting for container or contents, independently of the larger context.

Assuming that an item like *book* is always polysemous between object and some indefinite informational content, the role of the *of*-phrase in something like *book of essays* is simply to specify the identity of the content.

By the same token, if container words are similarly independently polysemous between container and some indefinite contents, and the *of*-phrase only provides the identity of the content, then we expect the container noun to display the same profile as container phrases.

This would suggest the container noun is also lexically complex, and that it is the source of the polysemy of the phrase it heads. Under the systematic polysemy hypothesis, this mean the container word itself requires its term to be a complex object.

Note that the question is at least superficially independent of the fact that containers remain the same type of object whether or not they hold any contents, unlike the *book* type polysemy. A bucket is not a different type of object when it is empty. A book, on the other hand, is only a book if it holds a certain type of informational content. Otherwise, it is a different type of object, say a notebook, or just some sheets of paper bound together. It is clear that

because with *book* polysemy both aspects of the object are so intrinsically connected, the lexical item will be polysemous in all contexts.

There seems to be no a priori reason to believe that container nouns may not be interpreted as the entity they might contain without specifying its identity, simply because containers have a conceptual life of their own. However, *book* and *bucket* differ crucially with respect to their pattern of entailments. There is no entailment that if a bucket exists, its contents aspect exists as well. For *book*, if a book x exists, then its informational aspect y exists and its physical aspect z exists. If this is a critical property determining what items get lexicalized as complex objects, then the prediction is that container words should not support co-predication in isolation.

In experiment 2 we modify the mass contents items from experiment 1 by removing the *of*-phrase, but keeping all else equal. The modification is illustrated in table 7 below. The item *The pot of curry Chris carried was very fragrant* from experiment 1, is presented in experiment 1 as *The pot Chris carried was very fragrant.* The results of interest are whether the sentence is judged acceptable in mismatching co-predication conditions and matching contents conditions.

In addition we modify the materials used in the polysemy condition in experiment 1, adding an *of*-phrase specifying the kind of propositional content carried by the noun. For instance, where in experiment 1 the polyseme *DVD* appeared in isolation, in experiment 2 it is substituted by the full phrase *DVD of tutorials.*

(67) Table 7: Example materials - Co-predication with container word only

Selection	Order	Item
Match	Container-container	The pot Chris carried fell on the floor and broke.
Match	contents-contents	The pot Mary cooked was very fragrant.
Mismatch	Container-contents	The pot Chris carried was very fragrant.
Mismatch	contents-container	The pot Mary cooked fell on the floor and broke.

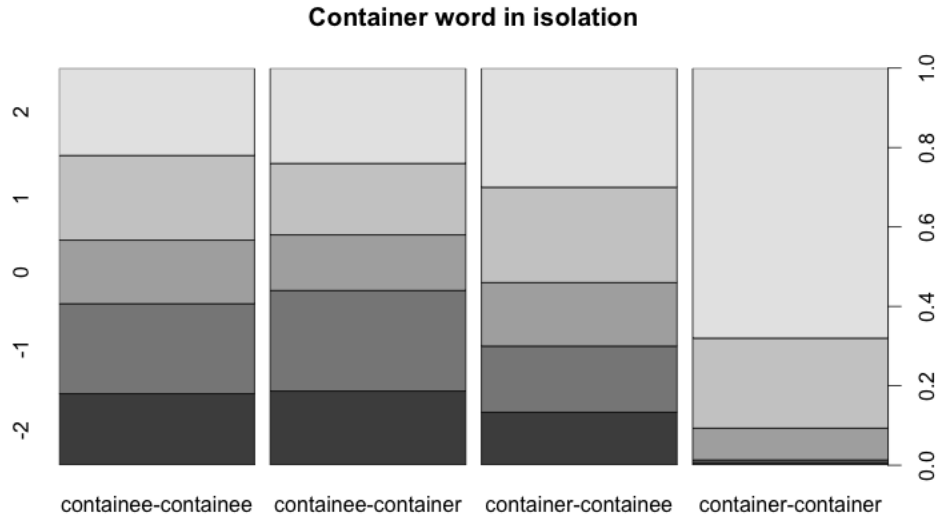
(68) Table 8: Example materials - Polyseme + of-phrase

Selection	Order	Item
Match	Abstract-abstract	The DVD of tutorials that Jensen was supposed to be watched today was voted best in its category.
Match	Concrete-concrete	The DVD of tutorials that Jensen lost on Monday had a red and blue cover.
Mismatch	Abstract-concrete	The DVD of tutorials that Jensen was supposed to be watched today was lost on Monday.
Mismatch	Concrete-abstract	The DVD of tutorials that Jensen lost on Monday was supposed to be watched today.

3.2.5 Results

Container words behaved quite differently in isolation from their container phrase counterparts. Both co-predication conditions were judged very significantly lower than the matching container-container condition, showing the same profile as homonyms in experiment 1. Additionally, the contents-contents condition received much lower ratings than the container-container one.

Though in experiment one there was already a bias for the container matching sentences, mean ratings for contents matching were still relatively high. Here, the distinction is striking, indicating that the contents reading is at least very hard to access in the container word without contextual support. The rate of acceptability of the matching contents condition is even significantly lower than one of the mismatching ones, namely where the container reading is selected in the relative clause.

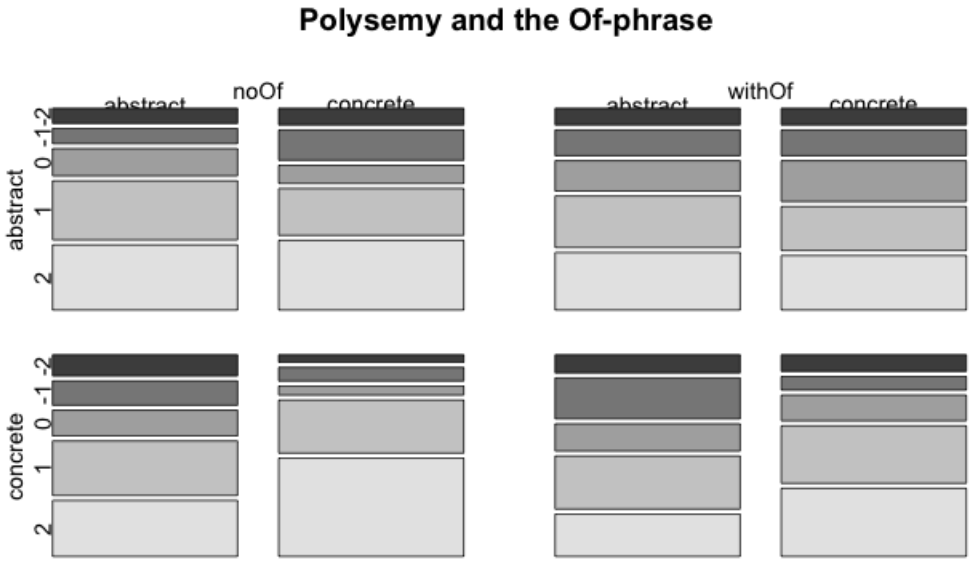


The following table shows the output of the ordinal probit regression model with random intercepts for subjects and items. It confirms the main effects of switching the selection of either relative clause or main clause from contents to container, and the highly significant advantage for container versus contents matching conditions, indicated by the interaction effect.

(69) Container word (reference level: contents)

Effect	Estimate	Std.Error	z value	Pr(>|z|)
RC container	-1.72	0.14	-11.60	<2e-16***
MC container	-1.36	0.14	-9.28	<2e-16***
RC & MC container	1.36	0.19	7.1	<2e-12***

The acceptability of polysemes, and the overall pattern between matching and mismatching conditions, was not influenced by the presence or absence of the *of*-phrase. There was no main effect of the *of*-phrase, and no interaction between it and other factors. Just like in experiment 1, sentences containing polysemes were not distinguished based on the order of sense selection. The preference for the concrete matching condition was also replicated.



(70) Polysemy means with and without *of*-phrase

***Of*-phrase**	**abstract-abstract**	**concrete-concrete**	**abstract-concrete**	**concrete-abstract**
With *of*	0.59	0.80	0.51	0.33
Without *of*	0.79	1.21	0.67	0.55

(71) Polysemes and the of-phrase (reference levels: contents and presence of *of*-phrase)

Effect	**Estimate**	**Std.Error**	**z value**	**Pr(>|z|)**
RC container	-0.20	0.14	-1.42	0.15
MC container	-0.07	0.14	-0.49	0.61
No *of*-phrase	-0.15	0.14	-1.07	0.28
RC & MC container	0.78	0.20	3.83	0.00***
RC container & No *of*	-0.05	0.19	-0.27	0.78
MC container & No *of*	-0.04	0.19	-0.02	0.98
RC & MC container & No *of*	-0.28	0.19	-0.94	0.34

3.2.6 Discussion

The results of the first manipulation of experiment 2 show that the number mismatch in count container phrases was not the source of the distinction between mass and count contents conditions in experiment 1. Rather, once agreement was controlled for, the distinction was sharpened. In experiment 2 the directionality effect between mismatching conditions, which was already much smaller for count nouns than mass in experiment 1,

disappeared.

However, while in experiment 1 count container phrases showed no difference between container and contents matching conditions, in experiment 2 there was a significant preference for container matching sentences. In this aspect, count and mass conditions were approximated, though the size of the effect was still smaller for count nouns.

In sum, resolving the agreement confound in experiment 1 did yield the same pattern observed for mass nouns. Therefore the distinction must have been caused by different factors. Experiment 3 addresses other potential sources of divergence.

Experiment 2 also showed that container words in isolation cannot be interpreted simultaneously as both the physical container and an object of the contents sort. If co-predication requires a complex type element, then these data indicates that container words are not lexically specified as such, unlike *book*. Our results are also hard to reconcile with having a freely available shifting operation from containers to contents if that operation need not be licensed by particular contextual conditions.

This could be expected since container words undergo a metonymic shift to their contents quite easily in the appropriate context. If the shift can apply locally only in one of the argument positions, sentences like those in table 6 would be judged acceptable. It is clear then that context must play a role in extending the interpretative possibilities of the container noun. Consider the following bit of discourse:

(72) Orlando brought us two cups of tea. Helena drank and cleaned her cup very quickly.

Here, intuitively, co-predication of *her cup* is quite natural. If container nouns have a relational denotation, one possibility is that *cup*, may only take an implicit argument if it is discourse old. In experiment 2, all sentences were presented without any previous context. But the relational account predicts both that the contents should not be available for predication and that co-predication should be ungrammatical.

Another possibility is that what allows the container word to stand in for its contents in the proper context is a coercion operation. There are indeed interesting similarities between the container-contents alternation, and aspectual coercion under verbs such as *enjoy* and *begin*. Without contextual support, certain aspectual coercions are much more acceptable than others.

The contrast is illustrated in the example below, where identifying a *book*-related event to meet *begin*'s requirement is easier than doing the same for a noun like *kitchen*. In a context that establishes for instance that Nate has been remodeling his house room by room, the sentence becomes natural, suggesting that conventionalized associations between nouns and types of events facilitates coercion out of context.

(73) a. Nate began the book last night.

b. #Nate began the kitchen last night.

Similarly, containers conventionally associated with particular types of contents are more amenable to the shift without contextual support, as illustrated in the contrast between *bottle* and *container*. The contrast is eliminated inside container phrases.

(74) a. Karl tasted the bottle before serving it.

b. #Karl tasted the container before serving it.

(intended: tasted the contents of the container)

Though no particular portion of substance or collection of objects is an inherent aspect of a container noun, it is clear that what unifies the class is that their function is to contain other objects. This is a crucial membership condition, and part of what defines the concept commonsensically. Thus the potential relation between container and contents is what is an inherent part of its meaning and it is arguably what licenses its use in the container phrase, and the metonymic shift container for contents when context provides sufficient support.

For our narrower purposes, it suffices to show that container words are not ambiguous in the same way as polysemes. We thus accumulate evidence that the *of*-phrase is not an argument of the container word in container phrases. Its role seems to be more complex than simply supplying the precise identity of one of the constituent types, as is plausible for *DVD of tutorials*.

Indeed, co-predication with polysemes was shown to be equally acceptable regardless of whether the precise identity of the informational object is given linguistically. We take the discrepancy between container words and *book*-type polysemes as an indication that container words are not, simply by virtue of denoting containers, polysemous on their own.

We conclude furthermore that the source of polysemy for container phrases is not (solely)

lexical. We will pursue an analysis that constructs a complex type from the container phrase construction. Recall however that in experiment 1 container phrases do not behave identically to lexical polysemes.

These results might indicate that lexical and constructed complex types have different properties, particularly with respect to how accessible one constituent type is after the other has been targeted. There were nonetheless potential confounds in experiment 1 which must be addressed in order to clarify the observed divergences internal to the container phrases conditions.

3.3 Experiment 3: strengthening selectional requirements

Because experiment 1 was a first exploration of speaker's judgments, the item construction focused only on the possibility of co-predication, without controlling for the particular types of predicates used in the sentences. Many of the predicates did not strongly select for one of the readings, but were more plausibly associated with either the contents or the container in the context of the sentence.

For instance, the item *The pot of curry [that Chris carried] was very fragrant* was designed to be in the condition in which the predicate in the relative clause selected for the container. But while it is clearly pragmatically odd to interpret *carry the pot of curry* as an event of carrying only curry, there is no grammatical clash between the selectional restrictions of *carry* and *curry*. In experiment 3 predicates are more closely controlled for so that they are

always grammatically incompatible with either the container or the contents.

To guarantee that each predicate was indeed only compatible with one of the readings, we tested the predicate with the container and contents words separately. (75a) was an item designed for the mismatching, container-contents condition. (75b) shows that the container selecting predication in the relative clause, *miss a lock*, rejects the contents, *gold*, as argument. Likewise, the main clause predication, *mined in East Africa*, can combine only with the container word, given the anomaly of (75c).

(75) a. The container of gold that was missing a lock might have been mined in East Africa.

b. #The gold that was missing a lock

c. #The container that might have been mined in East Africa

Moreover, in experiment 1 the mismatching conditions did not strictly manipulate only the order of sense selection, since the predicates were not exactly mirrored. For instance, the reverse mismatching condition for *The pot of curry that Chris carried was very fragrant* was *The pot of curry Mary cooked fell on the floor and broke.*

Although both *be fragrant* and *cook* select for the contents reading, it is possible that they imply different secondary restrictions, blurring the effect of selection itself. Since the order of sense selection turned out to be a significant factor in experiment 1, in experiment 3 the items are constructed using the same predicates for the two mismatching conditions container-contents and contents-container, varying only the order of presentation. (76) illustrates the

mismatching contents-container condition for the same item set.

(76) The container of gold that might have been mined in East Africa was missing a lock.

Finally, while there was some overlap between the containers used in mass and count conditions, they were mostly distinct sets. In experiment 3 the items for mass and count conditions differ only in the status of the contents nominal. To avoid the number agreement issues for the count condition seen in experiment 1, here the matrix predicate is always either passivized or modalized, avoiding the morphological mark of number. (77) provides an example item set.

(77) Table 8: Example materials for Experiment 3

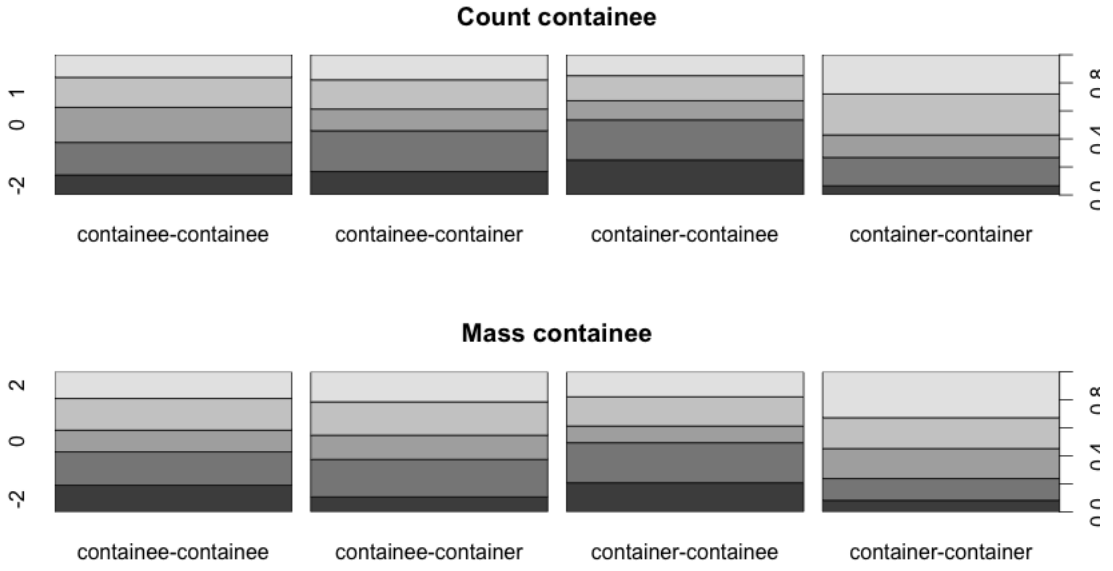
Selection	contents	Order	Item
Match	Mass	Container-container	The container of gold that was missing a lock has a velvet interior.
Match	Mass	contents-contents	The container of gold that might have been mined in East Africa could be 24 carat.
Mismatch	Mass	Container-contents	The container of gold that was missing a lock might have been mined in East Africa.
Mismatch	Mass	contents-container	The container of gold that might have been mined in East Africa was missing a lock.
Match	Count	Container-container	The container of diamonds that was missing a lock has a velvet interior.
Match	Count	contents-contents	The container of diamonds that might have been mined in East Africa could be 24 carat.
Mismatch	Count	Container-contents	The container of diamonds that was missing a lock might have been mined in East Africa.
Mismatch	Count	contents-container	The container of diamonds that might have been mined in East Africa was missing a lock.

3.3.1 Participants and procedure

Forty-two native speakers of English recruited through the internet participated, without compensation. As in the previous studies, they were instructed to rate the sentences on a 5-point scale from -2 (very bad) to 2 (very good). The procedure was the same as in experiments 1 and 2. There were 32 item sets and each participant saw each item once, in one of the four conditions, which were randomly selected for each item and rotated per participant.

3.3.2 Results

Unlike in experiment 1, the pattern of acceptability for container phrases we observe in experiment 3 is not affected by the count/mass status of the contents noun. There was neither a main effect of the type of contents, or an interaction with any of the other factors. This suggests that the effect of contents type found in experiment 1 was due to orthogonal distinctions. For the remaining of the analyses, the data from the two types of contents nominals is collapsed. The data is analyzed with similar interaction ordinal probit regression models, whose output is shown below. Only a main effect of mismatching reaches significance.



(78) Mean ratings per condition

Mean ratings	**Container first**		**contents first**	
Match	container-container	0.535	contents-contents	0.002
Mismatch	container-contents	-0.223	contents-container	0.062

(79) Container phrase by type of contents and sense matching (reference levels: matching and mass)

Effect	**Estimate**	**Std.Error**	**z value**	**Pr(>|z|)**
Mismatching	-0.27	0.08	-3.23	0.00 **
Count contents	-0.02	0.08	-0.35	0.72
Mismatching & Count	-0.08	0.12	-0.66	0.50

Considering the identity and order of sense selection, the first effect to note is the divergence between the two matching conditions. Experiment 3 replicates the finding that participants rate the matching condition selecting for the container reading significantly more acceptable than the one selecting for the contents. This is shown in the significant interaction in the table above.

Secondly, the results continue to show that speakers distinguish between the two mismatching conditions, displaying a sensitivity to the order of selection. Sentences in which the contents sort is selected for in the relative clause receive higher ratings than those first targeting the container reading. This effect is parallel to what was observed in experiment 1 for mass contents, and unlike count ones, where the directionality was reversed.

A second noteworthy difference between the results from experiments 1 and 3 is that in experiment 3 mismatching container-contents conditions are rated significantly lower than the matching contents-contents. However, the difference between mismatching contents-container conditions and contents-contents was not significant. The output of the model below shows (i) the main effect of shifting the sense selected in the relative clause from contents (the reference level) to container, (ii) the main effect of the same shift in the main clause and (iii) a significant interaction of combining both shifts.

(80) Ordinal probit regression model for Experiment 3: container phrases

Effect	**Estimate**	**Std.Error**	**z value**	**Pr(>|z|)**
Relative clause	-0.17	0.06	-2.90	0.00**
Matrix clause	-0.39	0.06	-6.50	$\sim$ 0.00 ***
NP	-0.07	0.05	-1.18	0.23
RC & MP	0.64	0.11	5.44	$\sim$ 0.00 ***
RC & NP	0.01	0.11	0.16	0.87
MC & NP	0.04	0.12	0.40	0.68
RC & MC & NP	0.15	0.24	0.65	0.51

The example items below illustrate the relevant contrasts:

(81) container-container >

[contents-contents]

The container of gold that was missing a lock has a velvet interior

BETTER THAN

The container of gold that might have been mined in East Africa could be 24 carat.

(82) contents-contents >

[container-contents]

The container of gold that might have been mined in East Africa could be 24 carat

BETTER THAN

The container of gold that was missing a lock might have been mined in East Africa.

(83) contents-contents =

[contents-container]

The container of gold that might have been mined in East Africa could be 24 carat

EQUAL TO

The container of gold that might have been mined in East Africa was missing a lock.

3.3.3 Discussion

Broadly, the more stringent controls employed in experiment 3 confirms the status of the acceptability of co-predication with container phrases observed in experiment 1. The rate of acceptance of co-predication still stands somewhere in the middle of a continuum whose ends are homonymy and lexical polysemy.

Speakers do not find that accessing multiple readings of the container phrases leads to ungrammaticality, but they accept it to a lesser extent than keeping the interpretation of the container construction fixed throughout the sentence.

Crucially, the comparison with homonymy and polysemy comes down to the degree to which the acceptability of ordinary predication and co-predication diverge.

In the case of homonymy, this degree is quite high. The acceptability of co-predication is as low as ungrammatical controls. For polysemy, if the effect is present at all, this relevant difference is rather small, indicating only a slight preference. A direct comparison with container phrases is made difficult by a few factors. First, recall that given the multinominal structure of the container phrase, only one of the mismatching conditions is unambiguously

a case of co-predication.

Only when the relative clause must attach to a high node, modifying the complex NP, are both predications guaranteed to impose selectional requirements on the same expression. But even if the second mismatch condition is discarded from the analysis, the relative difference between true co-predication and the matching cases is still smaller than for homonyms. This dispreffered condition is also judged more acceptable than ungrammatical fillers.

Thus as a whole the comparison with the edge cases of lexical ambiguity still suggests that the ambiguity of container phrases is closer to polysemy than homonymy. Nonetheless, the necessary modifications made to materials in experiment 3 help clarify the more fine-grained aspects of the complex pattern of acceptability observed in experiment 1.

One of the surprising effects in experiment 1 was the effect of the mass/count status of the contents noun. The distinction was unexpected, and indeed was not predicted by the accounts discussed, given the well-observed parallel between mass and plural nouns in English.

Intuitively, the function of the construction is the same in both cases. The container seems to always supply an individuation criteria to the contents. If the contents is associated with a criterion of its own, in the case of the plural count nouns, then the effect is one of 'repackaging'. In *two boxes of toys*, the DP is now only counted box-wise. If the contents is not associated with its own criterion, as is the case for mass nouns, then again the contents is counted based on the container's criterion.

It is likely therefore that the construction might be more often used with mass nouns, in order to make counting mass nouns possible. However, it is unclear that this would switch the directionality of effect of order of sense selection in mismatching conditions.

The results of experiment 3 failed to replicate that distinction, suggesting that it was caused by factors other than the quantization of the NP. One possibility is that the effect is only observed when predicates do not strongly select for either reading. Our data cannot support this hypothesis, since the predicates in experiment 1 were not controlled for this property. Materials included a mix of predicates that are compatible with either or only one of the readings, appearing in different positions.

It is also possible that the effect was related to the use of different container nouns, a distinction we eliminated in experiment 3.

We may only conclude that once selection is stringently restricted as in experiment 3, speakers do not take into account the status of the contents noun in their ratings.

Consider now how the predictions of the structural ambiguity and systematic polysemy hypothesis fare with respect to our results, and how they may be interpreted in each case. There are four effects to be explained:

I. Container-container is rated higher than contents-contents (Distinction between matching conditions)

II. Contents-container is rated higher than container-contents (Distinction between mis-

matching conditions)

III. Container-container is rated higher than contents-container

IV. No distinction between contents-contents and contents-container.

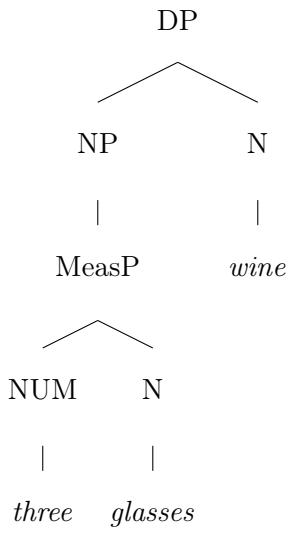
The first effect is not predicted or easily explained by the structural ambiguity approach. In the container matching cases, the relative clause must attach high, and therefore the container phrase is disambiguated at that point to the relational structure that gives rise to the container reading. At the matrix clause, the selectional requirements of the predicate are compatible with the direction of disambiguation determined previously, so the sentence as a whole is grammatical.

For the contents matching sentences, if the default structure given to container phrase is the one where the container is a relational noun, then the relative clause should attach low, modifying only the contents. However, the selectional requirements of the main clause predication will not be able to be satisfied, since this structure maps only to the container readings for the container phrase as a whole. This would predict ungrammaticality, or at the very least that the contents-contents condition should be as poorly acceptable as the container-contents co-predication cases, since there too we would observe the same mismatch at the main clause. But that is not the case.

Alternatively, the relational structure may not be the default. In that case, encountering the contents-selecting relative clause disambiguates the phrase towards the structure that gives rise to the concrete portion reading, proposed by Partee and Borschev(2012), repeated

below. Here the NP headed by the contents noun *wine* includes the container noun as modifier:

(84) Structure of the container phrase under the concrete portion reading

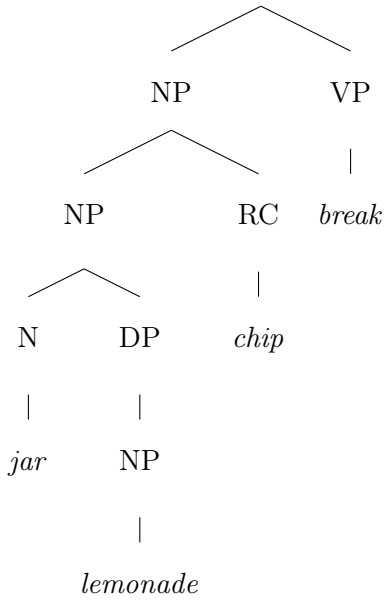


The prediction is that the main predicate's requirements will be met, and that the sentence will be well-formed. Indeed it would be equally as well-formed as the container matching cases, predicting no distinction between the two matching condition. To account for the container advantage, the relational structure must indeed be preferred by default, engendering the need for reanalysis at the main clause in the contents-contents conditions.

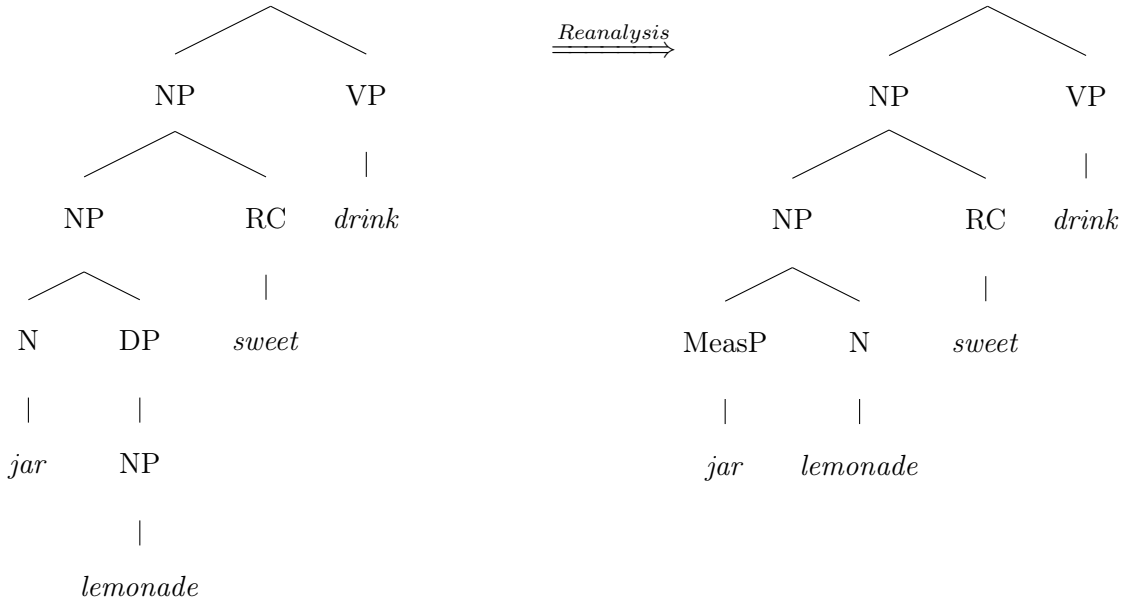
This reanalysis would then be the source of the lower offline acceptability ratings. Our data does not rule out this possibility, since experiment 3 does not provide access to real time data about participant's reactions to these type of sentence.

(85) Matching conditions under Structural Ambiguity

a. **Container-container**



b. **contents-contents**



The second effect, namely the fact that co-predication sentences that select for the contents reading in the relative clause are rated higher, could also receive an explanation in terms of an overall bias for the container structure. In contents-container conditions, the relative clause can attach low, in a structure compatible with the container bias. Since the main

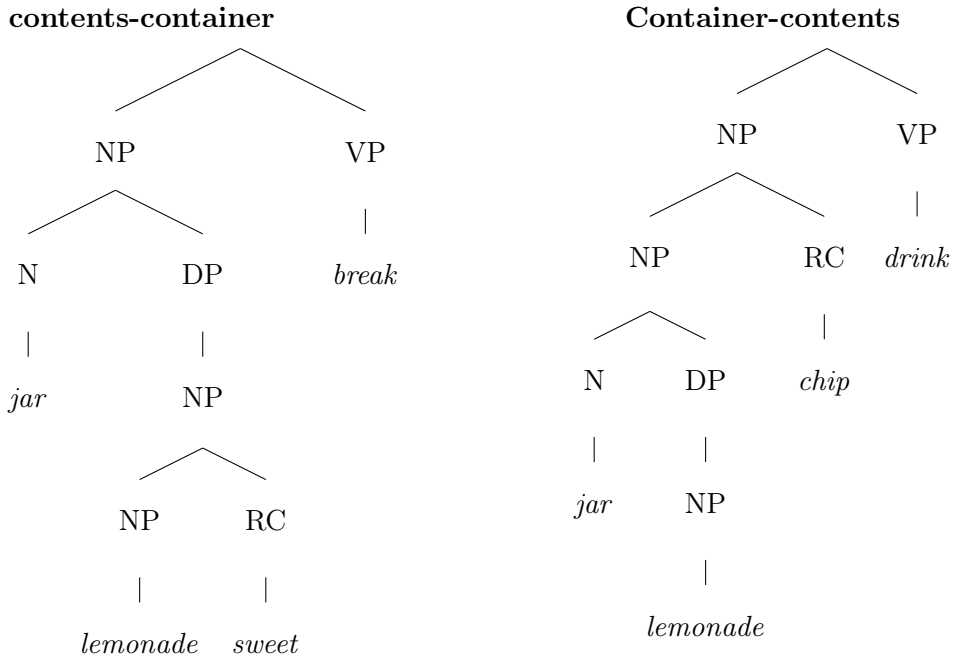
clause selects for the container, no conflict arises at that point.

However, when the relative clause selects for the container, it must attach high, making the contents reading unavailable for the rest of the derivation. This means that the requirements of the contents-selecting main predication will be unreconcilable with the current representation.

Here there is no possible reanalysis to rescue the sentence. If the container phrase is reanalyzed to treat the container as a modifier, there will be a clash at the relative clause, which requires the container to be the head. If it remains a relational structure, the matrix clause clashes, since it requires the contents to be the head.

Consequently, this condition should be simply ungrammatical, since there is no parse for it. It should be rated as poorly as ungrammatical fillers and the mismatching homonyms conditions. But these predictions is not borne out. There is certainly a cost, but the ratings for container-contents are still better than for clearly ungrammatical sentences, and for homonymy co-predication.

(86) Mismatching conditions under Structural Ambiguity



This leads us to the third and fourth effects, which compare contents-container mismatching to both matching conditions. Since the approach treats contents-container as a case of uniform predication, it predicts that it should be as acceptable as the matching conditions.

But while participants indeed judge this mismatch as acceptable as the contents matching condition, they judge it less acceptable than the container matching one.

Recall that in order to explain the distinction between the two matching cases, structural ambiguity must claim that the depression in ratings for the contents matching is due to the need for reanalysis. Since there is no such need in the mismatching contents-container case, we would in fact predict the exact opposite pattern.

It should not differ from the container matching sentences, since both cases do not involve

reanalysis, but it should differ from contents matching. Both of these predictions are disconfirmed.

(87) Predictions of Structural Ambiguity

Condition	**Reanalysis**	**Acceptability**
Container-container	No	High
contents-contents	Yes	Mid
contents-container	No	High
Container-contents	N/A	Very Low

Overall then the structural ambiguity approach fares rather poorly in accounting for speakers' intuitions about the interpretative possibilities of the container phrase.

It is clear that, by design, the systematic polysemy hypothesis will perform better in at least one aspect, namely in predicting that co-predication will not lead to ungrammaticality. More needs to be said to explain the more fine-grained aspects of the pattern, which depends on flashing out what an analysis of container phrases as complex objects similar to lexical polysemes would entail.

In chapter 5 we propose an analysis based on Asher (2011) which approximates the semantics of container phrases in the relevant aspects to those of lexical polysemes, namely with respect to the nature of their ambiguous behaviors.

We may anticipate here however that doing so will not be sufficient to explain all of the distinctions in acceptability we have found in this series of experiments between the different

matching and mismatching conditions, nor amongst those two sets. We will at that point then both highlight the points for which a complex object analysis of container phrases accounts for a larger range of empirical behaviors and its limitations.

We will consider whether those limitations should inform modifications to the semantics of those phrases or are revealing of effects of different sources which influence the degree to which speakers accepted the sentences presented to them in the context of this experiment.

Chapter 4

The ambiguity of committee nouns as a type of polysemy

4.1 Introduction

The main driving question of this chapter concerns the nature of the ambiguity of nominal phrases headed by committee nouns, such as *team*, *congregation*, *battalion* and *committee*, henceforth called *committee nominals*. The ambiguity I will be concerned with here is in many ways not the same ambiguity that the majority of previous works on committee nouns in formal semantics has been concerned with. I will then first identify both ambiguities in order to distinguish them before moving on to a careful consideration of the ambiguity I will focus on.

In that literature (in particular, Landman 1989, Barker 1992), the focus has been on the ambiguous behavior of committee nominals with respect to their semantic number properties. The observation is that committee nominals seem to pattern with singular count nominal phrases in some contexts, but with plural count nominal phrases in other contexts. The data below illustrates the type of data that motivates the observation:

(88) a. The committee was established in 1984.

b. The institution was established in 1984.

c. #The members of the committee were established in 1984.

(88a) illustrates an environment in which the committee nominal *the committee* patterns with the singular count nominal *the institution* in (88b) with respect to the acceptability of their predication relation *with be established in 1984*. (88c) shows that, in that context, *the committee* is not equivalent to *the members of the committee*, since (88c) is not well formed, but (88a) is. *The committee* also seems to introduce the same phi-features as the singular count nominal in (88b), since it controls singular agreement morphology on *was*. If we assume that other definite singular count nominals denote a contextually unique/salient atomic entity, then in such environments that seems to be the sort of denotation a definite committee nominal has as well.

(89) a. The committee gathered at noon.

b. The members of the committee gathered at noon.

c. #The woman gathered at noon.

(89a) illustrates an environment in which the committee nominal patterns with plural count nominals, and unlike singular count ones, given the ill-formedness of (89c). Here (89a) and (89b) are both acceptable, and seem to have very similar truth conditions. In (89a) *the committee* can be said to denote a plural entity, namely the one that collects the individuals standing in a membership relation to the committee at the world and time of evaluation.

This is so because in (89a) *the committee* is able to compose successfully with the predicate *gather*(intransitive), which as (89b) and (89c) shows is well formed with plural nominals but not singular count ones. *Gather* belongs to a class of *collective predicates* which impose semantic number related selectional requirements, a matter to which we turn attention more closely momentarily, and which in conjunction with reciprocal (*argue*) and distributive (*be tall*) predicates establish relations of plural predication with both plural count nominals and committee nominals.

At this moment, my point is simply that the literature in the formal semantics tradition has been largely interested in how a committee nominal may participate in plural predication, in questions of how their meaning in these environments may be similar or unlike that of pluralized nominals, and whether the formal status given to plurals may be extended to committee nominals, such that they may be treated on a par. Subsequently, the interest has also been in discussing what is the case if those formal means of understanding the meaning of plurals cannot be adequately extended to committee nominals because the two classes have important distinct properties, and if so what sort of meaning committee nominals may

have that both differentiate them from plurals but accounts for their participation in plural predication.

These questions are all clearly relevant and of interest to the understanding of plurality and plural predication in natural language, but they are not the questions I wish to engage with here.

Rather, I want to focus on a different aspect of the ambiguous behavior of committee nouns that may be brought to light by considering the same data points we have already seen.

(90) a. The committee was established in 1984.

b. #The members of the committee were established in 1984.

c. #The woman was established in 1984.

d. The institutions were established in 1984.

Earlier, the contrast between (90a) and (90b) was used as an illustration that in (90a) *the committee* does not seem to denote a plurality, tacitly assuming that when it does, that is equivalent to what *the members of the committee* denotes. (90a) and (90b) are not equivalent, but moreover (90b) is ill formed. (90b) is not acceptable because *the members of the committee* cannot satisfy the selectional requirements of *be established*, since it denotes an ANIMATE plural entity. The same mismatch leading to ill-formedness can be seen in (90c), with the animate denoting *the woman*, a singular count nominal. Similarly, (90d) is well formed because *the institutions* denotes an inanimate entity, in this case a plural one.

I use the contrast between (90a) and (90b) to show that in certain contexts committee nominals denote entities belonging to the INANIMATE ontological sort, since it is able to satisfy the selectional restrictions of a predicate such as *be established*.

Let us likewise reconsider the data in (89), repeated below as (91):

(91) a. The committee gathered at noon.

b. The members of the committee gathered at noon.

c. #The woman gathered at noon.

d. The women gathered at noon.

e. #The tables gathered at noon.

Earlier, the contrast between (91a) and (91c), and the lack of contrast in acceptability status between (91a) and (91b) were used as supporting evidence that committee nominals may participate in plural predication. Regardless of how plural predication may be understood formally, we may conclude that there is some requirement that a predicate such as *gather* imposes on its argument that is related to semantic number and that committee nominals, like plurals, are able to satisfy it.

But note in addition that whatever number related *gather* imposes, it also requires that its argument denote an entity belonging to the ANIMATE sort. (91e) shows that the mismatch between the meaning of *the tables* and the requirements of *gather* leads to ill formedness, unless of course *the tables* is personified and the entity it denotes is granted agency and self-directed mobility.

There is then an aspect of the ambiguity of committee nouns that concerns the sort of entity in their denotations in different environments, animate in some and inanimate in others. That aspect is distinct, but not independent from the number related ambiguity also observed. When a singular committee nominal denotes an entity of the INANIMATE sort, it also seems to always denote an atomic entity. When a committee nominal denotes an entity of the ANIMATE sort, it also most often seems to denote some kind of plurality, or at least, behaves alike plurals in plural predication.

I qualify this last statement by saying *most often* because at least some committee nominals seem to be able to refer to a single entity of the animate sort. For instance, it is conceivable that a committee may at any point consist of a single member, exclusively responsible for all the social functions of that committee. If this is the situation, then in a sentence such as (92a) *the committee* may be interpreted as an entity of the animate sort and satisfy the restrictions of *meet with the candidate* but the status of (92b), where *gather* requires in addition that that animate entity be plural, is not so clear.

(92) a. The committee met with the candidate this morning.

b. ?The committee gathered this morning.

For the remaining of this chapter I will be concerned with the nature of the ambiguity of committee nouns with respect primarily to the sort of entity that inhabit their denotations. In order to do so, I will first discuss what delimits the class of committee nouns, as a subtype of collective nouns more generally, as a point of entrance for understanding what the different readings of committee nominals are: what sort of entity more precisely does a committee

nominal denote when it denotes an inanimate or animate entity, and what is the relation between the two?

4.2 Defining the class of committee nouns

What nouns belong to the class whose behavior we want to investigate and what properties do they share which define that class? Many of the nouns that I am interested in here have been discussed in the literature under the name of *group nouns*, though the class we will discuss specifically is likely a subset of those.

Barker (1992) offers a syntactic definition of the class in English ([1]), where group nouns are such that (i) they can take regular plural morphology, and are therefore are count nouns in English, and (ii) they may take an *of*-phrase as argument if it has a plural complement, but not a singular one. Examples are provided in (93) and (94).

(93) a. a group of (two) women

b. *a group of woman

c. ?a group of a single woman

(94) a. a collection of (a hundred) records

b. *a collection of record

[1]Note that this syntactic definition is indeed English specific and therefore cannot be simply applied to other languages. The definition is then not particularly useful is cross-linguistic considerations about the semantic properties of group nouns are brought to the table

c. ? a collection of a single record

Barker considers the unacceptability of examples such as (93b) and (94b), where the complement of the *of*-phrase is a bare singular count noun, but not examples such as (93c) and (94c) where the complement of the *of*-phrase is a singular count nominal, but not bare. The ungrammaticality of (93b) and (94b) is predictable in English, since bare singular count nouns never occupy argument positions (**Ana saw duck/Duck is in the garden*).

To ask whether the complement of the *of*-phrase taken by group nouns must be plural if the noun is count, we must ask about the status of phrase such as (93c) and (94c), where a singular DP that is known to occupy other argument positions in English is used rather than a bare singular.

If those are ungrammatical, then indeed the requirement that the complement of the *of*-phrase be plural excludes from the class of group nouns, as desired, other nouns in English which can take *of*-phrases as complement, but which make no restriction with respect to the number properties of the noun inside that *of*-phrase, such as *picture*, in (95). (95b), with a bare singular count complement in the *of*-phrase is of course also ungrammatical, for the same reasons as (93b) and (94b). But (95c), with an indefinite singular count DP, is perfectly grammatical.

(95) a. a picture of (two) dogs

b. *a picture of dog

c. a picture of one dog

There is indeed some contrast between (93c) and (94c) on the one hand and (95c) on the other. (93c) and (94c) are odd, but they do not seem to ungrammatical, and not *syntactically* ill formed. The degree to which such phrases are odd also seems to vary for different nouns. As discussed briefly earlier that for at least some committee nominals it seems possible that a single individual stands in a membership relation to the group at the time and world of evaluation. I have said this seems to be the case for *committee*. (96a) and (96b) seem indeed less odd than (93c) and (94c).

(96) a. a committee of a single linguist

b. a team of a single player

However, group nouns do seem more clearly to not be able to take of-phrases with *definite* singular count nominal complements, as shown in (97) and in that sense they do contrast with nouns such as *picture* and other visual representation nouns such as *drawing*, *painting* or *symbol*.

(97) a. # a group of the woman

b. # a collection of the record

c. # a committee of the linguist

d. # a team of the player

e. a picture of the dog

Note that this requirement by itself does not exclude count container phrases from the class

it is meant to define, since it makes no distinction between bare plural count complements of the *of*-phrase or indefinite and definite plural count complements. Group nouns seem to be acceptable in both cases, but container phrases seem odd with bare plural complements, and not indefinite or definite plurals.

(98) a. a committee of women

b. a committee of five women

c. a committee of the women

d. a committee of those women

(99) a. a bucket of pebbles

b. ?a bucket of three hundred pebbles

c. ?a bucket of the pebbles

d. ?a bucket of those pebbles

(99c) may in fact be acceptable in a partitive reading, which may also be the reading one gets for (98c), that is, we are speaking of a committee whose members are a subset of the plurality denoted by *the women*, or a bucket whose contents is a subset of the plurality denoted by *the pebbles*. This reading may be clearer if the complement of the of-phrase in those cases are modified by a restrictive relative clause, as in (100).

The most prominent reading of the container phrase in (100b) is a measure reading, as in that context it is compatible with fractional numerals (*half a bucket of the pebbles that were*

piling up out back) but seem odd with definite demonstratives (*that bucket of the pebbles that were piling up out back*. I leave the matter of differentiating container nouns from group nouns aside for the moment.

(100) a. A committee of the women that gather here on Sundays spoke at the rally.

b. I carried in a bucket of the pebbles that were piling up out back.

In sum, a syntactic definition of the class of group nouns as envisioned by Barker (1992) would claim that group nouns (i) can take regular plural morphology, and are therefore count nouns in English and (ii) can take *of*-phrase as complements. The nominal complement of the of-phrase must be either plural, in which case it may be either a bare plural or a more complex DP, or it may be singular, in which case it must be indefinite. Whether or not a group noun taking an of-phrase with a singular count indefinite complement is judged to have a coherent meaning depends on the lexical particularities of the group noun involved.

Though it will not, I believe, affect the status of this attempt to define the class of group nouns by their syntactic behavior, I will briefly push on the matter of the possibility of group nouns taking of-phrases with singular complements, or the possibility of singleton membership more generally, because it might be revealing of a range of variation in behavior for nouns in that class that is relevant nonetheless, and will help define the subclass of group nouns I have been calling committee nouns.

The single member possibility seems less available for nominals such as *tribe*, for instance.

This might be related to the particular kind of inanimate, social object a tribe is conceived of, that is, to requirements that are quite specific to the kind/category *tribe*, what the conditions of membership for a group that is tribe must be. In this case, membership in a tribe is not voluntary, since it is based on kinship and community relations between members.

The nature of the relations amongst members and between members are the group likely affect whether the group may exist independently of its members and whether it may continue to exist as a group if an individual stands in a membership relation to the group but not in the right kind of relation of co-membership with other individuals.

The strangeness of a sentence such as (101) also points to the fact that tribes are different kinds of social objects than committees, since it seems that the way in which a tribe comes into existence cannot be accurately described by *be established*, which applies to social objects that come into existence by an agentive, voluntary social contract, which may be terminated voluntarily as well.

(101) #The tribe was established in 1984.

In contrast, membership in a tribe is not common-sensically thought of as an agentive, voluntary, potentially temporary property in contemporary Western conceptions of a tribe. We might then want to distinguish nouns such as *tribe* com others like *committee*. There is however a danger that no categories may be found if such criteria are applied, because every collective noun may impose idiosyncratic conditions of membership, or distinct combinations of properties for that membership condition, such that a number of different categorizations

are possible.

It may well be that better subtypes of collective nouns may be arrived at if they are based on issues such as existence dependence, voluntary or involuntary membership, the possibility of temporary membership, or others, but because at the moment it is not clear to me how these finer grained categories interact with the main issue at had, namely the nature of the animate-inanimate ambiguity, beyond informing our understanding of why particular predication relations fail (*tribe-be established*), I will not pursue this matter further.

In response to Barker (1992), Pearson (2011) argues that such a broad syntactic definition obscures a significant distinction in linguistic behavior between what she calls *committee* nouns and *collection* nouns. In particular, she argues that the sort of behavior we have been ascribing to group nouns in general characterizes only nouns like *committee*, *team* and *family*, which involve a particular notion of membership and typically involve animate members. This is contrasted with group nouns that select for inanimate members, and tend to appear more often with an overt *of*-complements, such as *bunch (of flowers), deck (of cards) and pile (of dishes).*

The argument is based on the claim that collection nouns are ill-formed in plural predication environments and in combination with count determiners in partitives. Let us first consider the case of count determiner in partitives with group nouns in general. Pearson claims that (102a) with a committee noun is grammatical, while (102b) with a collection noun is not, and that the contrast is due to the fact that collection nouns make available access to members. While the contrast is perhaps true in British English, I have been unable to replicate those

judgments with American English speakers, who judge both cases ill-formed.

(102) a. ?Many/Several/Three of the committee left early.

b. #Many/Several/Three of the pile of dishes fell.

According to Pearson, collection nouns in plural predication also behave differently from committee nouns, given examples such as the ones below:

(103) **Collection nouns and plural predication**

a. #The pile of dishes belongs together.

b. The bunch of flowers costs $1 (≠ The flowers in the bunch cost $1 each)

c. The list of books is similar (≠ The books on the list are similar to each other)

Yet it cannot simply be the case that collection nouns never allow access to members. In (**??**), *dead* is restricted to entities of the LIVING ORGANISM sort. As a collection, *bunch of flowers* is an abstract object. Similarly, in (104b) *inappropriate* can be interpreted as referring to the content of the books in the list, and not to the list itself, though perhaps both interpretations are possible. (104c) does not necessarily claim that the piles of records were arranged in the 60's or 70's, but can also be interpreted naturally as a claim that the records on those piles were recorded in those decades.

(104) **Collection nouns and selectional restrictions**

a. That bunch of flowers is dead.

b. That list of books is inappropriate for third graders.

c. The pile of records on the left is from the 60's and the pile of records is from the 70's.

Given these observations, I will not make the same distinction Pearson makes, but the remainder of the paper will continue to focus only on committee nouns, which I assume furthermore have the following properties.

First, the collective that committee nominals denote have properties which are independent of its members, such as organizational structure, norms and ownership of resources. Second, members are not grouped by spatiotemporal proximity, spacial configuration or spatial overlap, but because they perform some social function in behalf of the collective or have a certain role in that collective or are otherwise simply formally affiliated with it by publicly claiming to subscribe to the same ideology, as is often the case for the majority of political party members or labor union members. Third, members of those collectives are persons, or at least animate entities, conceived of as capable of agentive behavior.

In the section that follow I will consider a range of data that makes clear the ambiguous behavior of this subclass of collective nouns by considering their behavior in predication relations where they serve as arguments, with respect to the sortal selectional requirements, their ambiguity in contexts where the local predication they enter into does not restrict the interpretation of the committee nominal with respect to animacy, and their ambiguous anaphoric possibilities in English.

Having done so, we will subsequently be able to ask about the nature of this ambiguity,

in particular about how their behavior compares to that of nominals belonging to the two main types of ambiguity we have recognized, namely homonymy and polysemy.

4.3 The social object interpretation of committee nominals

4.3.1 Selection

As before, I will consider that the most transparent way to diagnose this ambiguity is by observing what type of selectional restrictions committee nominals are able to satisfy in predication relations.

Let us take for example predicates such as *be established*, *have 3 members* and *be composed of 100 men*. All of these predicates require their arguments to belong to a particular type of abstract entities, namely social objects. In (105) this is illustrated with non-committee nous which are also of the sort social object, such as *school*, and *factory*. Their restrictions may not be satisfied by entities of the person sort, as illustrated by the ill-formedness of (105c) and (105d), where the social object nominal is substituted by a phrase headed by a noun of the person sort (*teacher/workers*).

(105) a. The school was established last year.

b. The factory is composed of 100 men and 100 women.

c. #The teacher from the school was established last year.

d. #The workers from the factory are composed of 100 men and 100 women.

Committee nouns are able to satisfy the selectional restrictions of those predicates, as shown by the well-formedness of the examples in (106). Moreover, in this context committee nominals must not denote an entity of the person sort, given the ill-formedness of (106c) and (106d), where a committee nominal such as committee is substituted by the phrase *the members of the committee*.

(106) a. The committee was established last year

b. The tribe is composed of 100 men and 100 women.

c. #The members of the committee were established last year

d. #The members of the tribe are composed of 100 men and 100 women.

4.3.2 Contextual plausibility/World knowledge

In the examples below we have chosen predicates whose selectional restrictions are incompatible with expressions denoting entities of the person sort. Here we show that given the appropriate context biasing an interpretation of a committee nominal as a social object entity, that reading arises even when the expression the committee nominal is in a local predication with is also compatible with expressions denoting entities of the person sort.

Take for instance predicates of permission such as *forbid, allow, admit*. These are able to stand in well-formed predication relations with both expressions denoting entities of the social object or person sort. An entity of the social object sort is able to give or withhold

permission by having it be part of it's by-laws, formally or informally defined. A social object is also to define it's own social norms. This is illustrated again with non-committee nouns of the sort social object in (107).

(107) a. The school forbids the use of skirts for boys.

b. The factory allows smoking breaks.

c. The people in charge of the school forbid the use of skirts for boys.

d. The people in charge of the factory allow smoking breaks.

Note that if social objects have norms of their own (107a) does not require interpreting *the school* as t*he people in charge of the school*, a polysemy alternation institution names have quite productively.

Neither do they entail each other. (107a) may be true even if all individuals currently in charge of the school personally disagree with the school rules, but do not change it. Likewise, (107c) may be true even if the school rules make no mention of the use of skirts for boys, but the people in charge impose their authority on the matter nonetheless, regardless of the rules.

The same is true for committee nouns. Both readings are available, but they are distinct and do not entail each other. The final interpretation is decided upon given contextual or world knowledge information.

(108) a. The board of directors forbids the use of skirts for boys.

b. The night guard crew allows smoking breaks.

In (108) the more likely interpretation is one in which the rules set by the board of directors forbid the use of skirts for boys, because the board of directors as a body is a social object that has the authority to do so. Moreover, not all members of the board of directors must individually forbid the use of skirts by boys in their own beliefs.

(108b) is more likely to be interpreted to mean that the individuals who compose the night guard crew, by their personal authority, or by the decision to not impose their authority, allow workers to take smoking breaks. It is less likely however that the night guard crew as a body, as a social object, would have the authority to set the rules of behavior of the factory, since they are also workers.

4.3.3 Anaphoric possibilities

If indeed committee nominals may denote entities which are abstract and inanimate, we might expect that in English committee nominals can establish binding and coreference relations with the pronoun *it*, which presupposes that the entity it refers to is a non-person.

Indeed, that is possible, as illustrated in (109).

(109) a. The committee is composed of 3 members. It is responsible for determining the yearly budget.

b. The committee cut it's own budget by 30 per cent.

4.4 The members interpretation of committee nominals

4.4.1 Selection

Just as in the case of committee nominals being interpreted as entities of the social object sort, we may diagnose the possibility of interpreting a committee nominal as an entity of the person sort by observing its ability to satisfy certain selectional requirements in predication.

We must then choose predicates which select for arguments of the person sort in particular, or at least for the animate sort, and which are incompatible with arguments denoting entities of the inanimate, abstract, social object sort. The following predicates fulfill this condition, and are moreover categorized with respect to their status as distributive, collective or ambiguous predicates, given their interaction with plurality denoting expressions.

We categorize the predicates used here under this dimension for completeness, and because this has been a large focus on the literature concerning the empirical behavior of committee nouns.

Note however that the point we are making here is in principle orthogonal to that, since we are interested only in the sort of entity those predicates select for, and not how the predication relation is established when that entity is plural, that is, collectively, distributively, or either.

(110) Ambiguous predicates

a. #The idea built a house in 2 months. abstract

b. #The table built a house in 2 months. inanimate

c. The school built a house in 2 months. institution

d. The women built a house in 2 months. person

e. The team built a house in 2 months. committee

(111) Distributive predicates

a. #The idea was very polite

b. #The table was very polite

c. The school was very polite

d. The women were very polite.

e. The gang was very polite.

(112) Collective predicates

a. #The ideas gathered at noon.

b. #The tables gathered at noon.

c. The schools gathered at noon.

d. The women gathered at noon.

e. The committee gathered at noon.

An important note for the examination of the examples above is that in the examples in (c), the noun *school*, which is of the institution sort, may be subject to a meaning shift,

productive for the entire sort, and be interpreted as an entity of the person sort, which is associated with the institution.

Crucially, that entity also has the authority to act in behalf of the institution for the purpose at hand. If this shift obtains, then the examples in (a) are well formed. This is the case in (111a) and (112a). In (111a) a spokesperson for the school is said to have been polite. In (112a) some plurality of individuals representing the schools for that meeting are said to have gathered at noon.

(110a) may also be interpreted to mean that the school as an institution had a house built for it, by actual construction workers, by paying for it, though this seems to be a fact about the predicate itself, and what involvement as individual must have in the event of the building of a house to be claimed the builder.

All examples in (110)- (112) have the same structure. The example in (a) combines the predicate with a subject denoting an abstract entity, in (b) a concrete but inanimate entity, in (c) an institution (d) an entity of the person sort and in (e) we find a committee nominal.

In all cases we find that these predicate are incompatible with expressions denoting entities of the abstract or inanimate sort. The examples in (c) are well formed if interpreted given the meaning shift from institutions to persons. (c) is straight-forwardly well formed.

The examples in (e) are also well-formed, showing that in these predicational contexts committee nominals are able to satisfy a selectional requirement for the PERSON sort.

Unlike the interpretation of the examples in (c) however, there is no requirement that the entity of the person sort that the committee nominal refers to in these contexts have a particular type of authority within the social group associated with the social object.

In fact, by default, in the example with the distributive predicate *be polite*, (e) *The gang was very polite* seems to be interpreted as either all members of the gang involved in the event were very polite, or a sufficient number of them were. It may also be true in case a representative of the gang was polite, but that is not necessary, as in the case of *school* in (c).

The vagueness with respect to whether all members or just some members of the group must be in the extension of the predicate in other for the sentence to be true is not a property exclusive to committee nominals. The issue is known in the literature as the matter of group credit (REFERENCE). The point is that group credit and the institution-person shift are not the same thing. Group credit is diffused, not dependent on authority necessarily, and who must be in the extension of the predicate seems to be largely decided by the predicate itself, not the power structure of the social group.

4.4.2 Contextual plausibility/World knowledge

As we have seen in the last section, when committee nominals enter into predication relations with predicates whose selectional requirements are compatible with both social objects and person, the resulting sentence is ambiguous. Some interpretation may however be preferred given properties of the context and the world knowledge of interpreters.

The example in (113) illustrated the point again, now with the predicate *be rich*. (113a) and (113b) involve arguments of the person sort, and are well formed. (c) has a non-committee social object denoting nominal.

A social object may be rich if the resources that belong to the social group as an independent body are plentiful, regardless of whether or not the individuals associated with that social object are also rich.

(113) a. The parents from that school are very rich.

b. The women are very rich.

c. That school is very rich.

(114) shows the independence of those readings, and the lack of entailment in both directions.

(114) a. That board is so rich, it's a wonder the members of the board are so poor.

b. The members of that board are so rich, it's a wonder the board is so poor.

Given that *be rich* is compatible with expressions denoting entities both of the social object and person sort, based on this factor, the first sentences in (115) are ambiguous between those interpretations of the committee nominal. The predicates in the second sentences are likewise compatible with both readings.

(115) a. That committee is so rich. They threw a party on a yacht last weekend.

b. That committee is so rich. It has lots of Swiss bank accounts.

They are disambiguated, first, by the presupposition features on the pronoun in the subject position of the second clause: *they* in (115a), presupposing a plural animate referent, and it in (115b), presupposing a single inanimate referent. In addition, they build on particular views of what it means for individual persons to be very rich and what it means for an institution to be very rich, such that (a) is overall more coherent when interpreted as referring to the members of the committee, and (b) as the committee as a social object.

4.4.3 Anaphoric possibilities

The example in (115a) also illustrate a point about the anaphoric possibilities of committee nominals. If they are indeed able to denote an entity of the person sort, than they should be able to enter into anaphoric relations with pronouns which in English presuppose personhood, namely *she*, *he* and *they*. (116) shows again that the pronoun they may be coreferent with that committee.

(116) That committee is so rich they have never done a load of laundry in their lives.

4.5 Co-predication: the nature of the ambiguity of committee nominals

We may now consider what type of ambiguity committee nominals display. In an immediate way, committee ambiguity seems more similar to polysemy than homonymy. If one of the properties that distinguish polysemy and homonymy, broadly construed, is that the senses of a polyseme are systematically conceptually related while the senses of a homonym are not, then committee ambiguity is clearly more like polysemy. The senses of committee nominals are conceptually related via a membership relation and that relation is systematic throughout the whole class, that is, it is not a property of some committee nominals but not others.

But beyond conceptual similarities, we may also ask whether committee nominals share linguistic behavior with polysemes that distinguish both from homonymy. As in chapter 2, we use the co-predication test as the main empirical behavior that diagnoses polyesemy. We may then also apply the test to committee ambiguity. The test will consist of a sentence where a committee nominal enters into multiple predication relations simultaneously. Those predications must impose distinct sortal selection requirements on the committee nominal.

In particular, while one predicate will require the committee nominal to be interpreted as an entity of the SOCIAL OBJECT sort and be incompatible with an entity of the PERSON sort, another predicate makes the opposite, contradictory demands: the committee nominal

must be interpreted as an entity of the PERSON sort, and interpreting it as an entity of the SOCIAL OBJECT sort would lead to ill formedness.

(117) below is constructed to fulfill those conditions:

(117) The committee [that was established in 1984] gathered at noon.

As we have seen, *be established* is compatible with the SOCIAL OBJECT interpretation, but not with the PERSON one. Conversely, we have seen that *gather* is compatible with the PERSON interpretation, but not the SOCIAL OBJECT one, given its animacy requirement.

The well formedness status of sentences such as (117) is the sort of information one must consider in order to address whether committee ambiguity behaves like polysemy, homonymy, or display rather a behavior that is to be distinguished both from polysemy and homonymy, as a class that is more profitably categorized as a third type of ambiguity. Determining whether committee nominals support co-predication is therefore also crucial to the understanding of the relation between their multiple interpretations

The next chapter reports on acceptability judgment experiments designed to address these questions, obtaining empirical data in other to assess it.

Before moving on to that though, we may also it is worth discussing what answers have been given to the question of the nature of committee ambiguity in previous works, and whether those proposals predict that committee nominals should be able to support co-predication or not, given the ways in which the relation between the two interpretations is modeled.

What hypothesis follows then from current approaches?

The status of co-predication with committee nominals is not explicitly reported or commented on in most of the works I will review (Landman, Barker, DeVries), except for Pearson (2011), who touches upon the matter quickly and reports that the example in (118) is degraded.

(118) ?The committee was founded in 1911 and gathered in the hall today.

For Landman, Barker and DeVries, who do not report or comment on the status of co-predication, I will derive their predictions based on how the relation between interpretations is represented. I will therefore be more interested here in how previous accounts differ with respect to these questions than in how they differ amongst themselves with respect to how they engage with issues related to the number properties of committee terms.

4.6 Predictions for co-predication from previous accounts

In order to assess what predictions previous accounts make about the possibility of co-predication, we must first ask what it would take, what features should a proposal have, in order to predict co-predication with committee nominals to be well formed? We can envision at least two family of approaches.

First, co-predication is made possible if the two interpretations of a committee nominal arise from a single representation, which may locally satisfy the selectional restrictions of

predicates selecting for one or the other sort, but which remains globally complex.

That is, the mechanism by which a committee nominal comes to locally satisfy the selectional restrictions of a predicate requiring an argument of the SOCIAL OBJECT sort or of the PERSON sort does not shift the meaning of the committee nominal itself, so that, for any predication relation, no matter how many there are, the nominal both satisfies selectional restrictions for the simpler sort (social object *or* person) and remains complex (social object*person). In other words, the nominal itself is never disambiguated, and the relation between the two interpretations is an integral part of the representation of the nominal.

Alternatively, co-predication can be predicted to be well formed if the relation between the two interpretations of a committee noun is such that either may be derived from the other by a meaning shift operation which nonetheless does not apply over the nominal, but rather to the selecting predicate.

That is, a committee nominal may at a basic level denote an entity of the social object sort, but be mapped to their members, say via some function. If this is how the relation is represented linguistically however, co-predication is only predicted to be well-formed if the non-basic meaning does not enter the computation substituting the basic meaning of the committee nominal, but somehow in addition to it. That operation must in fact not be a meaning *shift*, but an *enriching* operation. If that is not so, then any one instance of the nominal will only be able to satisfy one type of selectional restriction, either due to its basic or derived meaning, since a meaning shift operation essentially amounts to having the two interpretations stand in competition with one another.

What all accounts I will discuss here share is that each interpretation arises from a distinct semantic representation. These may be related or derived from one another in various ways, but for any one instance of a committee nominal, these representations stand in competition with one another.

In this sense, although the systematic conceptual relation between the sense of a committee nominal is recognized in such accounts, approximating it to polysemy, their treatment is also approximated to that of homonymy with respect to whether multiple representations arise from multiple representations, or from a single one. As we have seen, this last question is at the heart of the distinction that the co-predication test reveals.

For Barker (1992), for instance, group nominals denote atomic entities with no particular special property that distinguishes them from other atomic elements inherently. This is their basic meaning, corresponding to what we have been calling the social object sort interpretation. Following Link (1983), the domain of individuals is treated as a join semilattice constructed via the join operator $\oplus$, which determines a partial order based on the part-of relation . For any elements a and b, $a \ \ b$ (a is dominated by b) iff $a \oplus b = b$. An element a is an atom iff it does not dominate any other entity, that is, it has no proper parts.

The only distinction between the entity denoted by group nominals and other atomic entities in Barker (1992) is simply that they are associated with a proper sum corresponding to their members via the membership function f. This is the same function that associates an individual human for instance with its body parts, and is superimposed over the algebraic structure built via the join operator. The two interpretations are therefore distinct and the

relation between them is not represented directly in the representation of the nominal, but rather as a species of meaning-shift function.

The membership function may apply over a group nominal and return the sum of its members whenever access to the members seems to be required, for instance if this is necessary to satisfy a predicate's selectional restrictions. Once it does however, the atomic entity denotation is no longer available - that is, the meaning shift applies before the nominal composes with a selecting predicate.

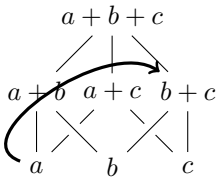


Figure 4.1: a, b and c are atoms, and the atom a is mapped via the membership function f to the sum of its members $b + c$, which are not its proper parts.

(119) a. *committee*: λx[x $\in$ {Committee A, Committee B, Committee C}]

b. f(*Committee A*): λx[x = Ana$\oplus$Mary$\oplus$Lea]

DeVries (2012) treatment of group nouns is similar to Barker's and Landman in that it proposes that the ambiguity arises from the use of a shifting operation. It is distinguished however in that the basic interpretation of group nouns is a set of atomic, group individuals, and the derived interpretation, given by Landman's upsum operator, is an impure atom, that is, an atom that is associated with parts but not in the Boolean structure, as plurals.

The main point of departure in DeVries is that at no point do group nominals denote a sum individual. In that sense, they are never equated to plurals. The semantic composition

therefore has no access to members of groups. The principal motivation for the approach comes from the claim that apparent access to members turns out to be restricted to the case of composition with predicates that are lexically distributive. In environments where distributivity cannot be attributed to lexical properties of the predicate, but rather to a covert or overt distributive operator, DeVries claims that access to group members is not available.

This is the case for instance in (120), where the VP coordination seems to only apply to the members of the group as whole, preventing a split reading, in which some members are drawing and some are sleeping, though that is possible with plurals.

(120) a. #The child is drawing and sleeping.

b. The children are drawing and sleeping.

c. #The class is drawing and sleeping.

Therefore whenever groups are interpreted as entities of the social object sort, their denotation is shifted to an impure atom via the upsum operator from Landman (1989), but in the case of plural predication they are interpreted as sets of individuals, and apparent access to those individuals is only indirect, through lexical distributivity, modeled via the use of predicate pluralization.

Landman (1989) represents a groups-as-sums approach, where the basic meaning of a group nominal is akin to plurals, and not an atomic entity. Landman also assumes that the domain of individuals is modeled as a join semi lattice. In Landman a group nominal denotes a sum,

and it dominates the individual members that compose that group. Moreover however, a proper sum may be mapped to an atomic entity via the upsum operation ↑. In this sense, in a context in which a predicate may require that interpret a group noun in its atomic, social object aspect, the new entity formed via ↑ can be summed as the desired denotation for the group term.

(121) a. *Committe A*: λx[x = Ana⊕Mary⊕Lea]

b. ↑*Committee A*: λx[x ∈ {{Ana, Mary, Lea}}]

Despite those differences, the predictions the accounts put forth by Landman and DeVries make with respect to the possibility of co-predication are the same as Barker's, since it involves (i) a meaning shift operation and (ii) that operation shifts the meaning of the nominal itself, such that multiple interpretations stand in competition. That is, Barker, Landman and DeVries all predict co-predication with committee nominals should be ill formed.

Alternatively, Pearson (2011) proposes that group nouns are predicates of individual concept, namely an intensional object of type <se,t>, but whose extension is a plurality. The account is partially based on the behavior of group nouns in interaction with universal quantifiers over world-time pairs and individual level predicates - *always* and *have big feet* in the example below - which seem to be ill-formed with individual denoting subjects (**??**), but well-formed with individual concepts (122b), kinds (122c) and group nouns (122a).

(122) a. That family always has big feet.

b. The president of the USA always has big feet.

c. Elephants always have big feet.

d. #John always has big feet.

A noun like *committee* is then treated as a set of functions from world-time pair index s to the set that form the members of the committee at s. The proposal thus accounts for the fact that groups may have different members at different times, without altering their identity as a group. It furthermore expresses the distinction between the group interpretation and the member interpretation at the type level: while the group interpretation is functional, the member interpretation is a plural individual. Group nouns will then combine directly with predicates that select for their atomic denotation, such as *be established last year*, taken to be of type <se,t>.

(123) $[\![\text{committee}]\!]_{<se,t>} = \{\lambda s\text{: } \exists x_{<s,e>} \exists Y_e$ (x is a committee at s &
$\forall y(y \in Y \leftrightarrow$ y is a member of x at s)). Y$\}$

Pearson's semantics for group nouns is based on Krifka's (2000) semantics for configuration nouns such as *outfit*, but there is an important difference between the two proposals. In Pearson the group term is existentially bound, and that in fact results in truth conditions that seem to be too weak. A noun like *committee* is treated as a set of functions from world-time pair indices *s* to a plural individual, and presupposes that there is *some* entity at *s* which is a committee and for which all atomic parts of the plural individual the function returns are members of that committee at *s*. Therefore it is able to return a plural individual

whose parts are members of *any* committee at s, failing to track each committee as a unique partial function.

Unlike Barker (1992) and Landman (1989), in Pearson the derived interpretation for groups is not arrived at by shifting its denotation directly, but by ascribing the mechanism that grants access to the members of the group to the mechanisms that create and constraint plural predicates instead, following Schwarzschild (1996). In it a singular VP α is only compatible with pluralities as arguments by making use of a *cover* over the whole domain of individuals.

(124) **Cover**: C covers A iff:

(1) C is a set of subsets of A

(2) Every member of A belongs to some set of C

(3) $\emptyset$ is not in C.

A singular predicate such as *tall*, has a plural translation $\text{Part}(\text{Cov}_i)(\text{tall})$ for any index i, where the Part operator guarantees that an entity u is in the denotation of the plural predicate just in case every variable v whose value is in the cover of the domain in index i and is a subset of u is in $[\![\text{tall}]\!]$.

(125) a. **Plural VP rule**: if α is a singular VP with translation α', then for any index i, $\text{Part}(\text{Cov}_i)(\alpha')$ is a translation corresponding plural VP.

b. $\textbf{Part}_{\text{DEF}}$: Let α and β be variables whose values are object language expressions

of type <e,t> and let u, v be variables whose values are entities in D* [= the set consisting of D(the set of all atoms in the domain) and all sets of subsets of D.]

For all α, β, u:

$u \in [\![Part(\beta)(\alpha)]\!]$ iff $\forall v[(v \in [\![\beta]\!] \wedge v \subseteq u) \rightarrow v \in [\![\alpha]\!]$

Suppose that the members of a committee A in s are Ana, Mary and Lea, so that [[committee]](s) = {a, m, l}, and that $[\![\text{Cov}_i]\!]^{s,g}$ = {{a}, {m}, {l}}. Then:

(126) a. $[\![\text{Committee A is tall}]\!]^{s,g} = 1$ iff [[Committee A]](s) $\in$ Part(Cov_i)(tall)

b. [[Committee A]](s) $\in$ Part(Cov_i)(tall) iff

$\forall v[(v \in \{\{a\}, \{m\}, \{l\}\} \wedge v \subseteq \{a, m, l\} \rightarrow v \in [\![\text{tall}]\!]$ iff

tall(a), tall (m) and tall(l)

Pearson(2011) claims that one desirable consequence of her approach is that it predicts that a sentence such as (127) will be degraded, because it will require coordinating constituents of different types.

(127) The committee $[\![\text{was founded in 1911}]\!]^{<se,t>}$ and $[\![\text{gathered in the hall today}]\!]^{<e,t>}$

However, the account predicts more than slight degradation unless some general mechanism that rescues coordination of expressions of different types is introduced, and the introduction of this rescue operation is costly. Without these extra provisions the sentence is predicted to be simply semantically ill-formed. The issue is more serious, since speakers in general do not find (127) degraded and moreover, the possibility of combining a group noun with multiple

predicates imposing contradictory requirements is not restricted to coordination environments. The examples below illustrate modification by restrictive (128a) and non-restrictive (128b) relative clauses, adjectival phrases (128c) and depictive small clauses (128d).

(128) **Co-predication frames beyond coordination**

a. The committee that was **founded** in 1911 **gathered** in the hall today. [*restrictive RC*]

b. The committee, which was **founded** in 1911, **gathered** in the hall today. [*restrictive RC*]

c. The **newly-established** committee **gathered** in the hall today. [*adjectival modification*]

d. The committee **gathered** in the hall **drunk**. [*secondary predication*]

Also note for (128a) and (128b) that the order is irrelevant, so that the relative clause and main predicates can be switched without affecting the sentences' status. This is important because while for Pearson (2011) it might be possible to derive (128a) by getting the plural extension of the committee and then composing it with the plural predicate, in (129), where the plural predicate is in the relative clause, by the time the DP combines with the predicate that selects for an intensional object that requirement can no longer be met.

(129) The committee that gathered in the hall today was founded in 1911.

The strategies available can be summarized in the following way: (i), as Barker, take groups to be essentially a set of atomic individuals, and link them to the sum of their members

through a membership function; (ii) as Landman and DeVries, take groups to be essentially a set of plural individuals, and link them to atomic individuals via a function that constructs atomic entities out of set-denoting referential NPs, or (iii) as Pearson, treat groups as sets of functions from indices of evaluations to plural individuals, and allow them to enter composition either as the function itself or its output at a particular index. We have shown that all of these proposals predict that committee nominals should not be able to support co-predication.

The following chapter asks then whether such predictions are met, namely whether speakers find co-predication with committee nominals largely unacceptable. We will see that this is not the case, especially when the status of co-predication with committee nominals is compared to the same type of sentences with homonyms. As in the experiments reported in chapter 2, co-predication with homonyms is judged fairly unacceptable, in stark contrast with non co-predicational cases. For committee nominals, co-predication is judged fairly acceptable, and the contrast between co-predication and non co-predication is much smaller than for homonyms. Again as in the case of container phrases however, the contrast is still larger than for lexical polysemes.

The results reported in the next chapter will then point to the need to offer a quite different approach to the semantics of committee nominals, where the matter of how the relation between their distinct meanings must involve a different type of mechanism than the sort of meaning shifts more familiar to the treatment of systematic ambiguity from the literature we have considered so far.

Chapter 5

Experimental evidence for the polysemy of committee nouns

5.1 Introduction

The main goal of the experiments reported in this chapter is to evaluate the acceptability status of co-predicational sentences involving committee nouns, that is, sentences in which a committee nominal is required to be simultaneously interpreted as an entity of the abstract, inanimate, SOCIAL OBJECT sort, and an entity of the of the animate, HUMAN sort. These requirements are imposed by the predication relations the committee nominal enter into, in the form of selectional restrictions.

As discussed in chapter 3, the status of such sentences have crucial implications for how the

ambiguity of committee nouns is to be accounted for. In particular, extant approaches, such as Barker (1992), Landman (1989) and Pearson (2009) amount to a view in which those interpretative possibilities stand in competition with one another, and therefore unable to arise simultaneously for any single instance of the nominal.

Alternatively, if speakers find co-predication with committee nominals acceptable, an adequate account must assume some mechanism by which both interpretations are made available for any one instance of the nominal.

5.2 Experimental Design and Materials

As in the previous experiments, we test the acceptability of co-predication with homonyms, polysemes and committee nouns by constructing sentences which include the ambiguous nominal expression in the subject position of the main clause and is modified by a relative clause.

Three factors were manipulated, in a 2x2x3 factorial design:

i. Whether the senses selected by the two predicates match or mismatch

ii. The order of the selecting predicates

iii. The type of nominal: homonymy, polysemy, committee noun)

The example items below illustrate materials for each of the three nominal types in Experi-

ment 1. Homonymy and polysemy items are identical to those in previous experiments.

(130) **Polysemy**

a. Match & Abstract-abstract

The novel that got some great reviews was a terrifying thriller.

b. Match & Concrete-concrete

The novel that got soaked in coffee was found in the sale bin.

c. Mismatch & Abstract-concrete

The novel that got some great reviews was found in the sale bin.

d. Mismatch & Concrete-abstract

The novel that got soaked in coffee got some great reviews.

(131) **Homonymy**

a. Match & Inanimate-inanimate

The date that tasted bitter was bought just yesterday.

b. Match & Animate-animate

The date that walked in late was very rude to Jane.

c. Mismatch & Inanimate-animate

The date that tasted bitter was very rude to Jane.

d. Mismatch & Animate-inanimate

The date that walked in late was bought just yesterday.

(132) **Committee noun**

a. Match & Social object-social object

That one committee that was created last year has very strict bylaws.

b. Match & Human-human

That one committee that gathered in the main room this morning knows each other very well.

c. Mismatch & Social object-human

That one committee that was created last year knows each other very well.

d. Mismatch & Human-social object

That one committee that knows each other very well was created last year.

In committee noun conditions, all nouns were selected based on the criteria discussed in chapter 3, that is, those nouns in English (i) take regular plural morphology, and are therefore count nouns, (ii) may take of-phrase complements, (iii) belong to a subtype of collective nouns, for which the main collectivizing principle is what we may call functional membership, that is, membership in the collective is dependent on the social function or roles members have or perform vis-à-vis the collective, in contrast to collective nouns for which the main collectivizing principle is structured in terms of spatiotemporal configuration (*pile, bunch*) and co-participation in an event (*swarm, crowd*), (iv) denote collectives composed only of individuals of the PERSON sort. Compliance with criterion (iii) was assessed introspectively. (133) presents a list of all committee nominals used in the present experiments.

(133) a. committee

b. team

c. tribe

d. sorority

e. congregation

f. clan

g. squad

h. crew

i. battalion

j. department

k. parish

l. cult

m. caste

n. platoon

The predicates chosen for their SOCIAL OBJECT selecting properties were mostly incompatible with animate arguments, and included predicates of creation/destruction (*be created/formed/founded/dismantled*), predicates that speak of the collective's composition (*consist of/be composed of/lose members*), and predicates that speak of the collective's organization (*has subdivisions/strict by-laws/is headed by*).

Two types of predications were chosen for their PERSON selecting properties for this experiment. One consisted of collective predicates such as *gather*, which were used in matching conditions where both the relative clause and main clause selected for an argument of the

HUMAN sort, but was never used in mismatching conditions. These are incompatible with inanimate arguments, and with singular, non-collective nominals.

(134) a. #Those tables gathered at noon.

b. #That boy gathered at noon.

The other type consisted of predicates selecting for animate arguments, such as *know* in combination with the reciprocal expression *each other*. These again are incompatible both with inanimate arguments and with singular nominals.

(135) a. #Those tables know each other very well.

b. #That boy knows each other very well.

The status of reciprocal *each other* with a committee nominal antecedent is unclear. Some speakers report a degraded status for sentences such as (136a) in comparison with (136b). They were used because although the well formedness of committee nominals with collective predicates and lexically reciprocal predicates may arguably be modeled without assuming that, as in DeVries (2014), under the members interpretation, the denotation of a committee nominal allows access for other compositional operations to the individual entities that stand in a membership relation to the social object.

If indeed reciprocal anaphoric expressions like *each other* may not take committee nominals as antecedents we might expect that sentences which involve both establishing that anaphoric relation and co-predication with respect to the social object/person sort dimension should

be quite unacceptable.

(136) a. ?That committee clearly knows each other very well.

b. The members of that committee clearly know each other very well.

Experiments 1 and 2 differed only with respect to the position in which the predicates used in mismatching conditions appeared in matching conditions. Concretely, in Experiment 1, predicates selecting for the SOCIAL OBJECT sense of committee nominals that occupied the relative clause position in the social-social matching condition were used in the mismatching condition (in both relative clause and main clause positions). The predicates that select for the HUMAN sense of committee nouns in the mismatching conditions (in both relative clause and main clause positions), appear only in main clause position in the human-human matching condition.

In experiment 2 those orders were reversed: predicates selecting for the SOCIAL OBJECT sense in mismatching conditions appeared in main clause position in the matching SOCIAL OBJECT condition, and those selecting for the HUMAN sense in mismatching conditions appeared internally to the relative clause in the HUMAN matching condition.

The following examples illustrate this manipulation. In experiment 1 the mismatching conditions for this item used the predicates *be created* and *know each other*. *Be created* appears in the relative clause in the social-social matching condition, and *know each other* in the main clause in the human-human matching condition.

(137) Experiment 1 example item

a. That one committee that was **created** last year [SOCIAL OBJECT] has very strict bylaws [SOCIAL OBJECT].

b. That one committee that gathered in the main room this morning [HUMAN] **knows each other** very well [HUMAN].

c. That one committee that was created last year knows each other very well. [SOCIAL OBJECT-HUMAN]

d. That one committee that knows each other very well was created last year. [HUMAN-SOCIAL OBJECT]

In experiment 2 the same predicates are used, so that mismatching conditions are identical. However, in the matching social-social condition *be created* appears in the main clause, and *know each other* is in the relative clause for the matching human-human condition.

(138) Experiment 2 example item

a. That one committee that has very strict bylaws [SOCIAL OBJECT] was **created** last year [SOCIAL OBJECT].

b. That one committee that **knows each other** very well [HUMAN] gathered in the main room this morning [HUMAN].

c. That one committee that was created last year knows each other very well. [SOCIAL OBJECT-HUMAN]

d. That one committee that knows each other very well was created last year. [HUMAN-SOCIAL OBJECT]

A comparison between judgments given to matching conditions in both experiments allows us to take into account any effects of the order in which predicates appear if speakers react differently based on this factor. Such an effect could be due to a default preference to one of the interpretations of the committee nominal, in which case perhaps sentences in which the first predicate encountered selects for the preferred reading and the second predicate for the more marked one could be rated differently from the reverse order of presentation.

The potential effect could also be related to the different discourse/pragmatic status of restrictive relative clauses and main predications, and the particular ways in which that interacts with the meaning flexibility of committee nominals, since we observed no order effect for homonymy or polysemy in previous experiments making use of the same design.

5.3 Predictions

We consider two hypothesis for the behavior of committee nouns in co-predication environments:

i . SENSE COMPETITION HYPOTHESIS (Barker 1992):

Committee nouns denote sets of entities of the SOCIAL OBJECT sort. When composed with a predicate that selects for an entity of the HUMAN or ANIMATE sort, a meaning-shift operation applies over the nominal and returns the plural individuals that stand in a membership relation to that social object. Given that such meaning-shift operation applies over the nominal itself, any single instance of committee noun may only be

interpret either as a social object entity or as the plural human individuals that are its members. Consequently, in a co-predicational environment in which one predicate selects for the SOCIAL OBJECT sort and another for the HUMAN sort, only one of those selectional restrictions may be satisfied. Co-predication is thus predicted to be unacceptable. Judgments should be similar to those given for co-predication with homonymy.

ii . SYSTEMATIC POLYSEMY HYPOTHESIS:

The SOCIAL OBJECT and HUMAN interpretations of committee nouns arise when distinct aspects of a complex object, in the sense of Asher (2012) are targeted. Since any single instance of a committee noun introduces such complex object, and the mechanisms through which its constitutive aspects are teased apart in order to satisfy selectional requirements enrich composition, introducing a new entity rather than shifting the meaning of the nominal itself, multiple readings may be available simultaneously. Consequently, in a co-predicational environment in which one predicate selects for the SOCIAL OBJECT sort and another for the HUMAN sort, all selectional restrictions may be satisfied. Co-predication is thus predicted to be acceptable. Judgments should be similar to those given for co-predication with polysemes.

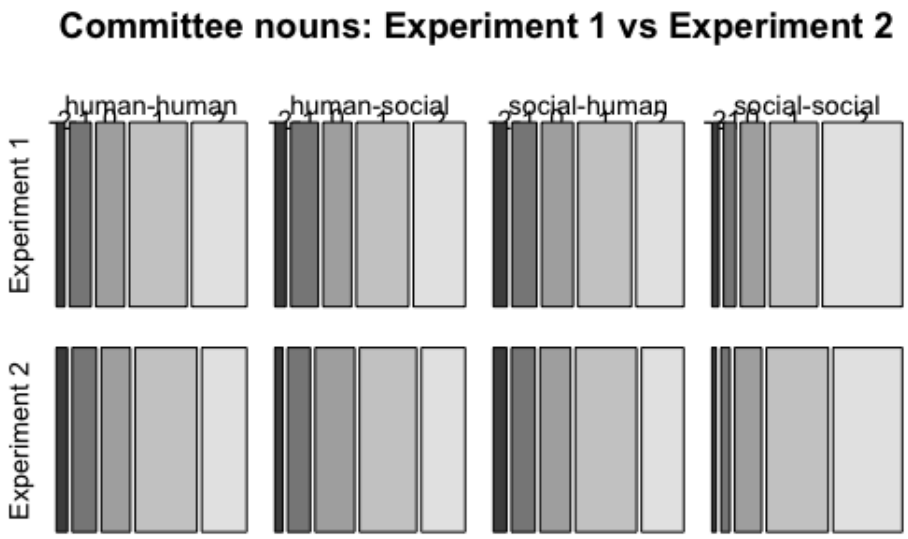
5.4 Participants and procedure

81 native speakers of English participated in experiment 1 and 81 in experiment 2. All participants were undergraduate students at UCSC, and completed the study for course

credit or extra-credit on a UCSC hosted installation of A. Drummond?s IBEX platform. They were instructed to rate the sentences presented in isolation on a 5-point Likert scale: -2 (very bad), -1 (fairly bad), 0 (neither good nor bad), 1 (fairly good), 2 (very good). The participants were rotated through the 4 lists of items described above. Each participant rated 144 stimuli (48 items + 96 fillers), the order of which was randomized for each participant.

5.5 Results and analysis

To test whether the position in which those predicates appear in the matching conditions affected the sentence's rate of acceptability between Experiment 1 and 2, we grouped together only the committee noun items for both experiments, and coded them by the experiment they were rated in. The percentage of acceptability rates per condition and per experiment can be inspected in figure # below:



We estimate a mixed-effects probit model with two fixed effects: (i)SENSE MATCH(reference level) vs. SENSE MISMATCH and (ii)EXPERIMENT 1 vs. EXPERIMENT 2.

Only one fixed effect is significant in this model. There was a main effect of SENSE MISMATCH (β = -0.34, SE= 0.06, p= 2.62), indicating that mismatching conditions were relatively less acceptable than matching ones.

There was however no main effect of EXPERIMENT (β= -0.11, SE=0.11, p=0.32), and no significant interaction of SENSE MATCHING X EXPERIMENT (β=0.07, SE=0.08, p=0.36). These results indicate that the position in which predicates appear in the matching conditions did not significantly affect overall acceptability rates.

We may strengthen our confidence in this results by estimating a second mixed-effects probit

model where we substitute SENSE MATCHING as a fixed effects, which collapses both matching conditions, for a full SENSE COMBINATION fixed effect (SOCIAL OBJECT-SOCIAL OBJECT (reference level) vs. HUMAN-HUMAN vs. SOCIAL-HUMAN vs. HUMAN-SOCIAL).

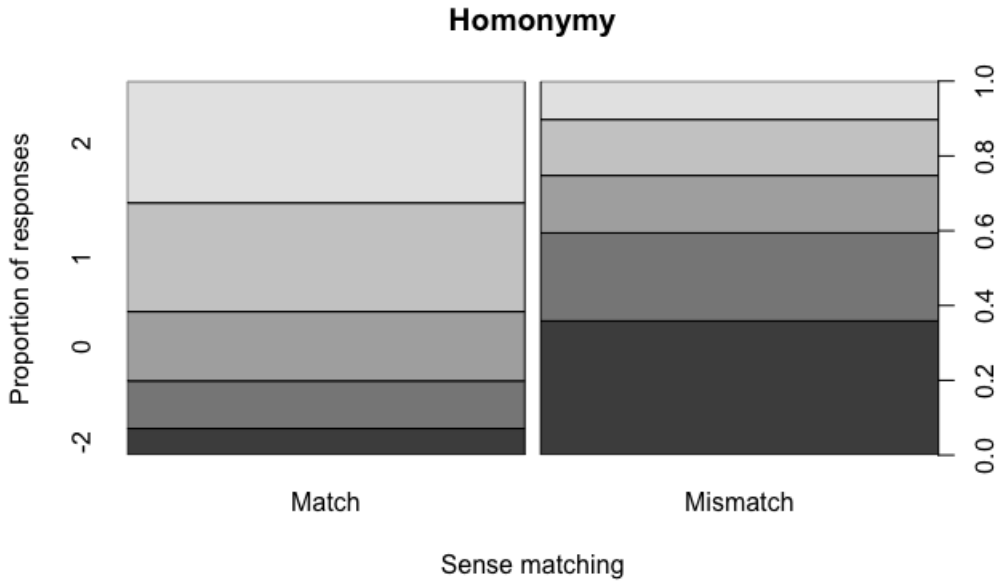
Again, in this model there was no main effect of EXPERIMENT (β= -0.60, SE= 0.13, p=0.60), and no significant SENSE COMBINATION X EXPERIMENT interactions (HUMAN-HUMAN*EXPERIMENT 2 (β=-0.08 , SE=0.12 , p= 0.48), HUMAN-SOCIAL*EXPERIMENT 2(β= 0.02, SE=0.12 , p=0.83), SOCIAL-HUMAN*EXPERIMENT 2(β= 0.04, SE= 0.12, p=0.71).

Given that the only difference between Experiments 1 and 2 were the order of appearance of the selecting predicates in matching conditions, and these results indicate that that distinction in order did not significantly affected rates of acceptability, for the remaining of the analysis we therefore group together the results of both experiments.

5.5.1 Comparing the effect of sense mismatching across nominal types

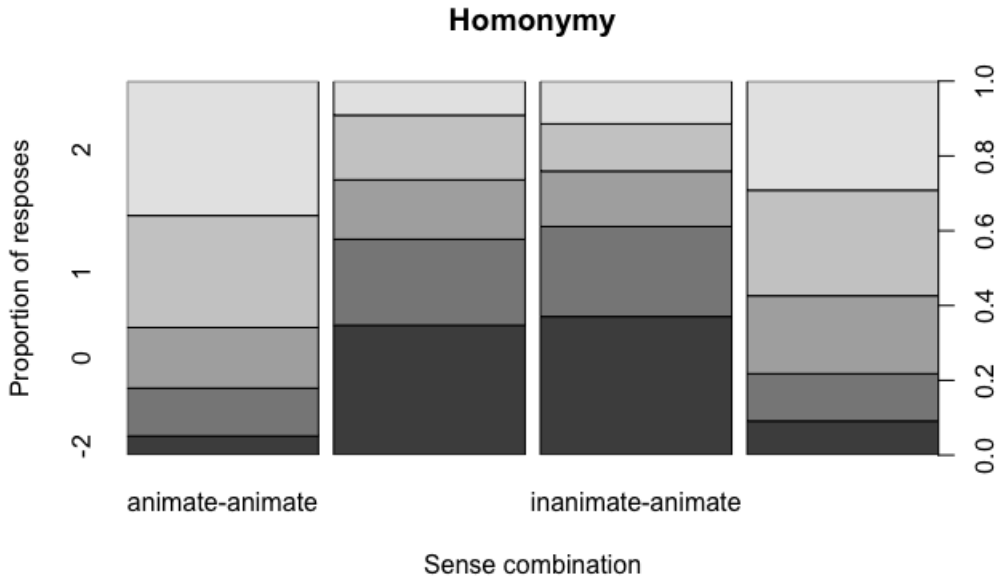
As expected, and in congruence with the results from the experiments involving container phrases, homonyms were again judged significantly worse in mismatching conditions than in the matching ones.

This can be observed in Figure #, which groups the ratings for the two matching conditions on the one hand and two mismatching ones on the other, showing the difference in the percentage of unacceptable -2 and -2 ratings given to both sets of conditions.



This difference is confirmed in the statistical analysis of the data, estimated through a mixed effects probit model. The reference level is set to SENSE MATCHING. There was a large negative effect of SENSE MISMATCH (β= -1.11, SE= 0.04, p <2e-16).

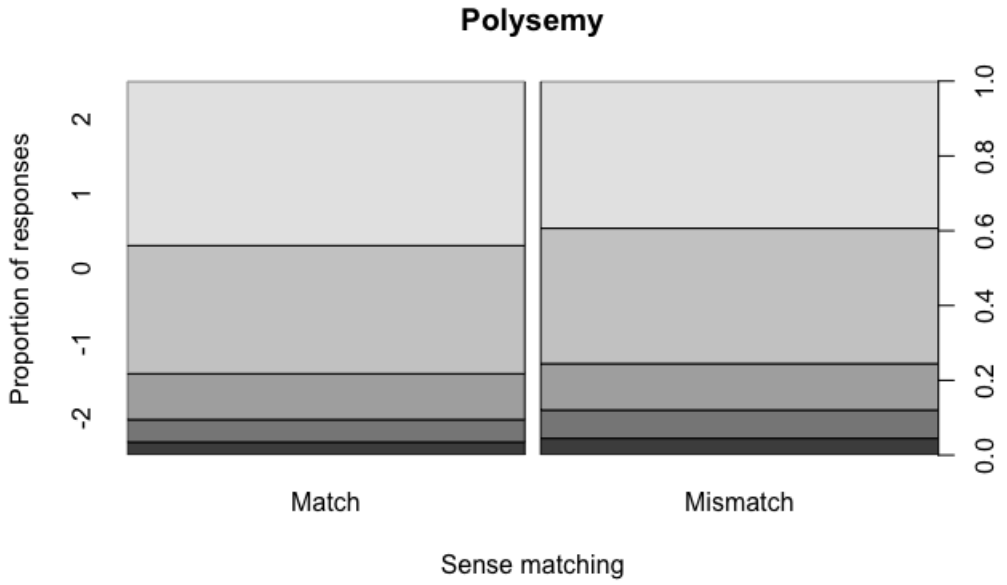
Figure # shows the percentage of ratings for each of the four conditions for homonyms.



We estimate a second mixed effects probit model with two fixed effects: (i) RELATIVE CLAUSE SENSE (animate vs inanimate) and (ii)MAIN CLAUSE SENSE (animate vs inanimate). In both cases the reference level is set to ANIMATE. All fixed effects were significant in this model. There was a main effect of INANIMATE for both the relative clause sense (β= -1.27, SE= 0.06, p= <2e-16) and the main clause sense (β= -1.20, SE= 0.06, p <2e-16), indicating that both mismatching conditions (inanimate-animate and animate-inanimate) were rated significantly lower than the matching animate-animate condition.

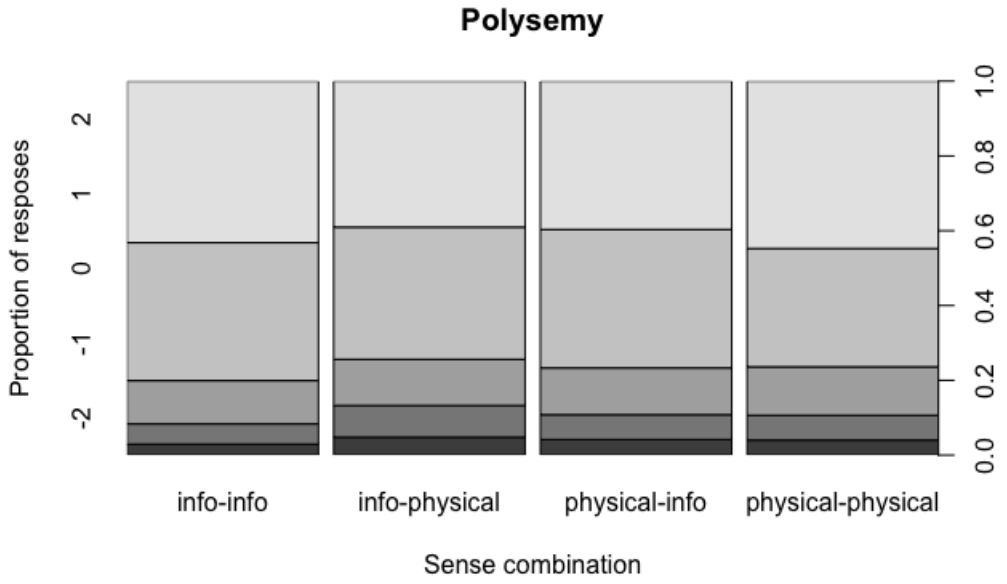
There was also a positive INANIMATEXINANIMATE interaction (β= 2.23, SE= 0.09, p= <2e-16), which essentially reversed the cumulative negative effect of the two main effects, bringing the acceptability of the matching inanimate-inanimate condition to the same high level as the matching animate-animate one.

The polysemy conditions also behaved as expected given our theoretical assumptions and in congruence with the results from our previous experiments. Mismatching conditions received overall slightly lower ratings than mismatching ones, as can be observed in Figure #.



The difference is confirmed as significant in a model where the reference level is set to SENSE MATCHING. There is a significant effect of SENSE MISMATCH (β= -0.14, SE= 0.04, p=0.001). However, as can also be observed through the inspection of the graphical summaries of the data, this difference is much smaller than in the case of homonyms.

Figure # shows the percentage of ratings for each of the four conditions for polysemes.



We again estimate a second mixed effects probit model with two fixed effects: (i) RELATIVE CLAUSE SENSE (concrete vs abstract) and (ii)MAIN CLAUSE SENSE (concrete vs abstract). In both cases the reference level is set to ABSTRACT.

All fixed effects were significant in this model, to different degrees of strength.

There was a small main effect of CONCRETE for both the relative clause sense (β= -0.14, SE= 0.06, p=0.02) and the main clause sense (β= -019, SE= 0.06, p=0.001), indicating that both mismatching conditions (concrete-abstract and abstract-concrete) were rated slightly lower than the matching abstract-abstract condition.

There was also a significant positive CONCRETEXCONCRETE interaction (β= 0.28, SE= 0.09, p=0.001), which essentially reserves the cumulative effect of both main effects, bringing the matching concrete-concrete condition to virtually the same high level as the reference

abstract-abstract condition.

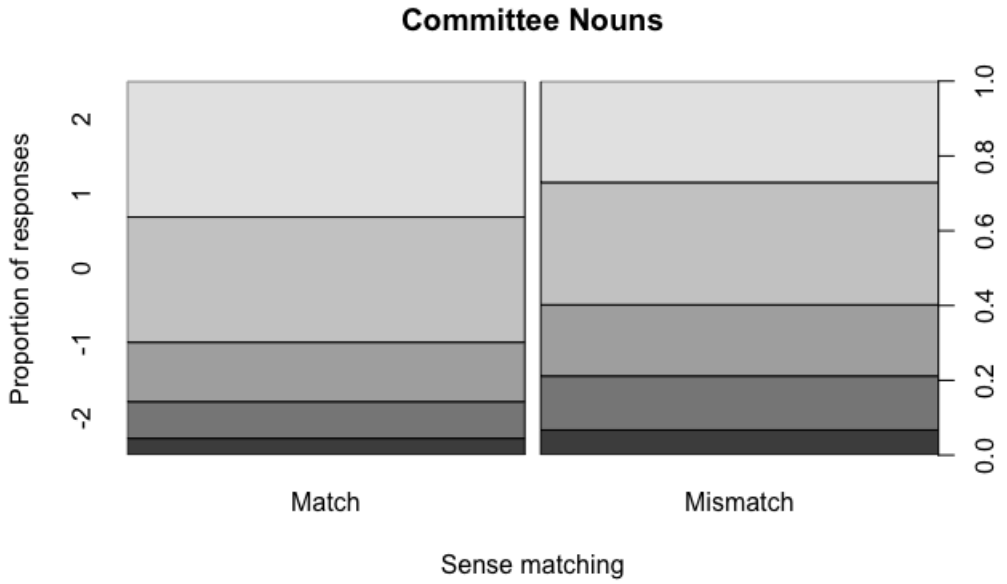
In this aspect, the results from the previous examples are replicated: mismatching conditions are rated significantly less acceptable than matching conditions for both polysemy and homonymy, but the size of that effect is much larger for homonyms than polysemes.

To confirm that indeed this difference in effect size is significant, we pool together polysemy and homonymy conditions and estimate a mixed effects probit model with two fixed effects: (i)SENSE MATCH vs SENSE MISMATCH and (ii) HOMONYMY vs POLYSEMY. Reference levels were set of SENSE MATCH and POLYSEMY.

There was no significant main effect of SENSE MISMATCH in this model (β= -0.11, SE= 0.06, p=0.06), but a small significant effect of HOMONYMY, indicating that even in the matching conditions homonyms were rated slightly lower than polysemes.

Crucially, there was a large negative SENSE MISMATCHXHOMONYMY interaction (β= -1.07, SE= 0.08, p <22e-16), confirming that the distinction between mismatching conditions for homonyms were significantly worse than for polysemes.

For committee nouns, we also find that mismatching conditions were rated significantly lower than matching ones, as can be observed in Figure #.



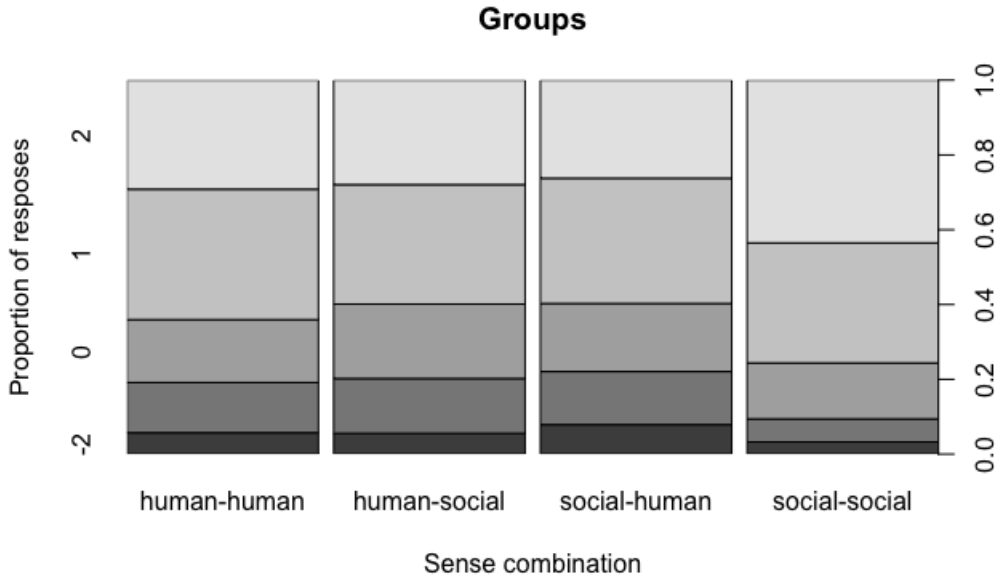
In a mixed effects probit model with SENSE MATCH vs SENSE MISMATCH as a fixed effect, there was a significant negative effect of SENSE MISMATCH (β= -0.30, SE= 0.04, p <22.4e-12). The effect was therefore much smaller than for homonyms, but slightly larger than for polysemes.

We confirm this point by estimating a mixed effects probit model with two fixed effects: (i)SENSE MATCH vs SENSE MISMATCH and (ii)COMMITTEE NOUNS (reference level) vs POLYSEMY vs HOMONYMY. All fixed effects were significant, to different degrees of strength. There was a main effect of SENSE MISMATCH (β= -0.28, SE= 0.084 p <21.5e-11), as well as a small negative main effect for HOMONYMY (β= -0.19, SE= 0.09, p=0.03) and a positive main effect of POLYSEMY(β= 0.24, SE= 0.00, p=0.008), indicating that even for matching conditions homonyms were rated slightly lower than committee nouns, and polysemes slightly higher.

There was moreover a significant negative SENSE MISMATCHXHOMONYMY interaction (β= -0.88, SE= 0.06, p <22e-16), indicating that indeed although committee nouns were also rated less acceptable in mismatching conditions than in matching ones, the degree to which these conditions differed in committee nouns conditions was significantly smaller than for homonyms.

Similarly, there as a significant positive SENSE MISMATCHXPOLYSEMY interaction (β= 0.16, SE= 0.06, p=0.008), indicating that the degree to which committee noun mismatching conditions were rated lower than mismatching ones was larger than for polysemes. However, the difference between committee nouns and polysemes was also smaller than for committee nouns and homonyms.

Figure # shows the percentage of ratings for each of the four conditions for committee nouns.



We estimate a second mixed effects probit model with two fixed effects: (i) RELATIVE CLAUSE SENSE (social object vs human) and (ii)MAIN CLAUSE SENSE (social object vs human). In both cases the reference level is set to SOCIAL OBJECT.

All fixed effects in this model were significant. There were negative main effects for HUMAN both in the relative clause position (β= -0.50, SE= 0.06, p=1.1e-15) and main clause (β= -0.56, SE= 0.06, p <22e-16). These results indicate that both mismatching conditions (human-social and social-human) were rated lower than the reference mismatching condition (social-social).

There was also a positive HUMANXHUMAN interaction (β= 0.62, SE= 0.08, p=6.2e-13), which was not large enough to reserve the cumulative negative effect of the two main conditions, indicating a significant difference between the two matching conditions (social-social and human-human).

The latter effect is confirmed in a mixed effects probit model with all sense combinations as a fixed effect (HUMAN-HUMAN(reference level) vs SOCIAL-SOCIAL vs HUMAN-SOCIAL vs. SOCIAL-HUMAN).

There was a positive main effect of SOCIAL-SOCIAL (β= 0.44, SE= 0.06, p=1.7e-12), indicating that this matching condition was indeed rated significantly higher than the reference matching human-human one.

There was also a small negative main effect of SOCIAL-HUMAN(β= -0.12, SE= 0.06, p=0.04), indicating that this mismatching condition was rated lower than the reference level matching

human-human one, but no significant main effect of HUMAN-SOCIAL(β= -0.06, SE= 0.06, p=0.32), indicating that though rates for this mismatching condition were lower than for the matching human-human condition, that difference did not reach significance.

The overall picture that emerges for the pattern of acceptability of items involving committee nouns is thus then, when aggregated, matching conditions were rated slightly higher than mismatching ones, to a degree that is smaller than for homonyms, but higher than for polysemes.

However, that aspect of the analysis must be qualified by the observation that only one of the matching conditions, namely the SOCIAL OBJECT one, was rated higher than both mismatching conditions. The comparison between the matching HUMAN-HUMAN condition and the mismatching conditions show only a small difference with SOCIAL-HUMAN, but no difference between it and the HUMAN-SOCIAL condition.

Moreover, we observe a significant difference between the two matching conditions, where SOCIAL-SOCIAL was rated higher than HUMAN-HUMAN.

5.6 Discussion

Overall, the results from experiments 1 and 2 combined replicated the validity of the co-predication test as a means to tease apart homonymy and polysemy. It shows that the distinction is not between a negative effect of co-predication for homonyms and no effect of co-predication at all for polysemes, but a difference in the degree to which co-predication

affects acceptability in comparison to environments in which the selectional restrictions imposed on an ambiguous nominal are congruent.

In all cases we find again that mismatching conditions, when aggregated against the aggregated matching conditions, engender a negative effect across nominal types. That effect is significantly larger for homonyms than for polysemes and committee nouns on the one hand, but we also find a distinction between polysemes and committee nouns on the other hand, placing committee nouns slightly below polysemy in a scale that takes homonymy as its lower point and polysemy as the higher one.

There are however a few caveats for the comparison of matching and mismatching conditions in the case of committee nouns. Though there was no significant distinction between the two mismatching cases for committee nouns, aggregating the ratings for the two matching conditions masks a significant distinction between those, as well as a distinction with respect to how each matching case compares with the mismatching cases.

Speakers rated the matching conditions in which both predicates selected for the SOCIAL OBJECT sense of a committee noun higher than those in which both predicates selected for the HUMAN sense of the nominal. (139) illustrates the comparison - (139a) is rated higher than (139b).

(139) a. That one committee that was created last year has very strict by-laws. [*social object-social object*]

b. That one committee that gathered in the main room this morning knows each

other very well. [*human-human*]

There are multiple potential sources of this effect. It could be simply that there is a cost to selecting the HUMAN sense of a committee noun which affects acceptability. One may interpret this effect as suggesting that the SOCIAL OBJECT interpretation is primary, and that shifting it to the HUMAN interpretation involves a costly process.

Alternatively, it could be that the effect is more specifically related to the use of the reciprocal *each other* with committee nouns. As mentioned, informally, some speakers have reported that they find sentences in which reciprocals take committee nouns as antecedents, such as (140a) independently degraded. However, the same speakers also reported a variation in judgments for different group nouns, with nouns such as *family* reported more acceptable as antecedents of reciprocal *each other* (140b).

(140) a. That one committee clearly knows each other very well.

b. That one family clearly hates each other.

If this is the source of the effect, than it suggests that there is some incompatibility between the requirements of the reciprocal and the semantics of committee nouns. If the well formalness of a sentence involving *each other* relies for instance on its antecedent denoting a plural entity with transparent atomic parts, the degraded status of (140a) may suggest that this is not the sort of entity that *committee* denotes.

As it stands, the design of our experiments does not allow for an analysis that teases apart

each of these potential sources. There is indeed some variation in the acceptability of HUMAN-HUMAN condition by item, and a by-item analysis could shed light on this effect, though any conclusions based on it would be post-hoc.

The experiment design also does not allow us to isolate the effect of *each other* on its own, since every experimental item in which it appears either also includes another collective *human* selecting predicate, or a SOCIAL OBJECT selecting predicate.

Still, it is worth noting that even though all of the conditions in which at least one of the predicates selected for the HUMAN sense of the committee noun were rated lower than the matching SOCIAL OBJECT-SOCIAL OBJECT condition, their ratings were still relatively high. Crucially, they were still rated higher than the mismatching homonymy conditions and ungrammatical fillers.

That is, if there is a cost to interpreting a committee nouns as an entity of the HUMAN sort, that cost is relatively low and does lead to ratings comparable to ill-formed sentences. Likewise, if providing *each other* with a committee noun antecedent simply led to semantic ill-formedness, we would expect ratings to be much more severely degraded than they were.

Keeping this caveat in mind, let us consider now how both of our hypothesis fare in explaining the empirical results.

Recall that the under the SENSE COMPETITION HYPOTHESIS, mismatching conditions should be judged unacceptable, since no well-formed semantic representation in which all selectional

requirements are met can be constructed. Their ratings should then pattern like the ratings given to homonymy conditions. This prediction is confidently not confirmed.

While for homonyms there was a large negative effect of co-predication, as indicated by the lower ratings for mismatching conditions, the effect was overall much smaller for committee nouns, comparable in size to that observed for polysemes.

This is the case even taking into consideration the potential negative effect of the reciprocal in mismatching conditions, and even if we compare mismatching conditions only to the SOCIAL OBJECT matching condition.

Not only are these results not predicted by a sense competition hypothesis, they are difficult to account for under such an approach without significantly enriching it. To explain the overall high acceptability of co-predication with committee nouns, one would need to appeal for instance to some independent process of accommodation which speakers can resort to when faced with the impossibility of satisfying all selectional restrictions in a given sentence, which rescues the sentence from unacceptability.

This process must moreover apply successfully for the case of committee nouns, but not for homonyms. This point is not difficult to grant on intuitive grounds, since informally homonyms in co-predication environments really do seem to involve introducing an expression that refers to a single entity which is then required to simultaneously refer to two, distinct entities. But moreover it must be the case that there is no way to rescue such sentences.

We can ask then what sort of accommodation would be involved in rescuing co-predications with committee nouns if, without such process, it suffers a similar fate as those with homonyms. Moreover, some explanation of what licenses it in the former case, but not the latter would be needed.

Further, since we have also found a difference in acceptability between polysemes and committee nouns, this process of accommodation must be assumed to be somewhat costly in the latter case.

In sum, the bulk of the explanation of the pattern of results found in our experiments would fall on the details of some additional process that rescues the acceptability of co-predication for committee nouns and which is, though in principle not incompatible with a sense competition hypothesis as laid out, independent from it.

In a sense then, fleshing out what such an accommodation process would entail and how it works would consist in a third hypothesis. And since it may be independent from the sense competition hypothesis, it may also be proposed in its absence.

Alternatively, we may ask how the SYSTEMATIC POLYSEMY HYPOTHESIS fares in predicting and accounting for our experimental results. As in the case of container phrases, this hypothesis by design predicts that co-predication sentences should be acceptable, that is, ratings should be relatively high overall, and contrast significantly with both mismatching conditions with homonyms and ungrammatical fillers. This was indeed the case.

Moreover however, on its own the systematic polysemy hypothesis does not predict a distinc-

tion between co-predication with committee nouns and with polysemes, contrary to factual observations. To explain the distinction one must therefore appeal to differences between those classes of nominals that lie beyond their ability to satisfy multiple incongruent selectional requirements.

One possibility we have mentioned in the case of container phrases, and which may also apply for the case of committee nouns, is related to a pragmatic competition between the committee noun itself and the possibility of referring to the members of the social object less ambiguously (*the committee* vs. *the members of the committee*). That is, because there is a less ambiguous way to refer to the members of a committee than by making use of *the committee*, the members interpretation may be more marked in certain contexts.

This competition between less ambiguous forms seems at least less salient for polysemes like *book* (*this physical book is heavy/ the contents of this book were translated into 7 languages*).

Likewise, the distinction between the two matching conditions found in our experiments is not predicted or easily explained by the systematic polysemy hypothesis, especially if the source of that effect is some general cost of interpreting the committee noun as an entity of the HUMAN sort. The hypothesis on its own does not predict that any of the senses of a polysemous expression should be preferred or dispreferred, since no sense is treated as primary or secondary.

Future experimental work would firstly then address the question of whether there is a cost

of interpreting a committee nominal as an entity of the person sort that is independent of its ability to serve as antecedent for the reciprocal *each other*. In that same vein we may ask whether there are differences in acceptability for sentences involving different types of plural predication with committee nominal arguments, comparing lexically collective, reciprocal and distributive predications with sentences in which collectivity, reciprocity or distributivity are enforced by other operations.

Chapter 6

Theoretical implications of experimental results

6.0.1 The updated empirical landscape

Given the experimental results presented in the previous chapters, we may update our view of the empirical landscape, and therefore of the properties any account of the semantics of container phrases and committee nouns must explain.

As we have seen, what the results of the acceptability judgments reported for copredicational sentences with both container phrases and committee nominals show is that, when it comes to their abilities to satisfy sortal selectional restrictions in predication relations, container phrases and committee nominals behave similarly to polysemes: multiple distinct, perhaps

contradictory requirements may be satisfied simultaneously within the scope of a single sentence.

The update for the starting point of observations about the type of ambiguity displayed by those two types of nominals can then be simple.

For container phrases, we observe that (i) simple contexts (those in which the container phrase enter into only one predication relation) where the selectional requirements imposed on its term by a local predicate is that they be of the container sort or a super-sort of container, say concrete material objects, that requirement can be satisfied; (ii) in simple contexts where the selectional requirements imposed on its term by a local predicate is that they be of the sort of the contents nominal or a super-sort of it - in the case of *glass of wine* for instance, of the liquid object sort, that requirement can be satisfied, and (iii) in contexts where a container phrase enter into multiple predication relations where one imposes the container sort requirement and another a contents sort requirement, both requirements can be satisfied.

The parallel observations are now made for committee nominals. In what concerns how it behaves in predication relations, we observe that (i) simple contexts (those in which the committee nominal enter into only one predication relation) where the selectional requirements imposed on its term by a local predicate is that they be of the social object sort, that requirement can be satisfied; (ii) in simple contexts where the selectional requirements imposed on its term by a local predicate is that they be of the person sort, that requirement can be satisfied, and (iii) in contexts where a container phrase enter into multiple predication

relations where one imposes the social object sort requirement and another a person sort requirement, both requirements can be satisfied.

The update is of course only the third point of observation. This modest update has important theoretical implications. As we have seen in previous chapters, it is enough to role out previous analyses that under predict the range of behaviors of both type of nominal phrases.

Before updating our desiderata for any account of the semantics of those phrases, it is worth it to point out some of the limitations of the experimental data, and the ways in which the generalizations sketched here based on the data may be further validated or challenged.

6.0.2 Limitations of the experimental data

First, note that all the experiments reported here used a single type of sentence as frame for testing the acceptability of copredication, namely a frame that includes relative clause modification. While I generalize from these results a conclusion about the acceptability of copredication broadly, this assumes that if copredication is shown to be acceptable in the relative clause frame then it should also be acceptable in all frames, for instance also in a coordination frame.

I will keep this assumption at the moment, but I do not assume that different copredication frames would not yield distinct patterns of acceptability, even if all of them are largely acceptable. Different frames will be associated with different pragmatic factors influencing

acceptability, for instance. Attention to the specificities of each frame may then we useful in assessing their acceptability, and thinking about how surrounding context may interact with it.

For instance, I have noted previously that in the case of restrictive relative clause modification, acceptability may be modulated by embedding the sentence in a contrastive context, that is, one where multiple container entities or committee entities are present and may be differentiated based on their contents or properties of their members. Therefore, in those contexts, the material in the relative clause may be a means to identify and pick out an intended referent based on, say, the properties of the container, while the main clause makes a statement about the properties of the contents. This is a context in which copredication in this particular frame seems more natural.

In other frames acceptability may be modulated by other contextual factors. Copredication by coordination for instance may be more natural in contexts where any properties of the complex container plus contents objects or the committee and members are relevant or are listed without priority. (*The committee was founded in 1989 and gathered this morning for the 10th time*).

It will be interesting then for future research to broaden the scope of the investigation of the acceptability of copredication by including other possible frames and considering this kind of sensitivity to context.

These remarks lead to a second limitation of the experiments reported here, namely that

sentences were presented in isolation, without any supporting context. As usual then, the reader may embedd it in an implicit context to assess its acceptability, but different participants may choose different contexts, and the experimenter has no access to that.

Even though all conditions were presented in isolation, not only the target ones, it is possible in principle that the lack of supporting context has different effects for different conditions. If acceptability of copredication for container phrases and committee nominals in the relative clause frame for instance is increased given a contrastive context, the difference in behavior observed between polysemy and those conditions could be attenuated if that context is given explicitly, assuming it does not increase polysemy copredication acceptability in the same way.

I have speculated before that this difference in sensitivity between *book*-polysemy on the one hand and container and committee nominals on the other may be related to a kind of pragmatic competition effect that may be present for the latter but not the former. Namely, while a container phrase such as *the box of toys* can be interpreted as either primarily a container, the box, or primarily a collection of toys, the contents, the use of the phrase competes with the use of simpler nominals headed by each of those nouns, *the box* and *the toys*.

For *book*-type polysemy, there is no simpler nominal that denotes only the book as physical object or as information that stand in competition in the same way.

Relatedly, it is worth pointing out that though I have used the experimental data to gen-

eralize some conclusions about the behavior of polysemy in copredication, the experimental items included of course quite a limited number of nouns, and most importantly, of polysemy classes, which were unevenly represented. Most items included nouns in the *book* class, though we also included a few items in other classes.

The working assumption was that polysemes of different classes could be pooled together with respect to the acceptability of copredication. This assumption should not go unexamined. In future work, it would be desirable to control for the polysemy classes of the nouns used in the experimental items more strictly, including equal number of items for distinct classes, so that the question of whether different polysemy classes yield different acceptability patterns may be engaged with.

While these are all important reservations, and each assumption should be scrutinized in the future, at present I will proceed with the generalizations that container phrases and committee nominals do support well formed copredication.

6.0.3 Desiderata

Returning then to the empirical observations we are interesting in with respect to the behavior of container and committee nominals in predication relations, we may ask what an account of their semantic contributions must do in order to predict and explain them. Simply put, those nominals must contribute to composition a semantic object that may enter into predication relations that impose incompatible sortal requirements individually, and they must be also to do so simultaneously. That is, an account that predicts copredication

to be well formed.

In a way then, the update to our desirata is as simple as our update to the empirical landscape. What we desire is that any proposal accounts for how container and committee nominals may enter into predication relations with distinct selectional restrictions without predicting as a consequence that it will only be able to do so one at a time.

Logically, since these are in essence about the well formedness of those predication relations based on the satisfaction of selectional requirements, the answers to that question must be couched in an understanding of what those selectional requirements are, how they may be satisfied and crucially, what that satisfaction entails about the expression that satisfies it.

There is an assumption that has run through our discussion so far. Whenever we see for instance that a committee nominal entered into a well formed predication relation with a predicate that requires its term to be of the person sort, we have concluded that in that context the nominal itself is interpreted as denoting an entity of the person sort. The conclusion stems from the assumption that the selectional restriction is satisfied directly - the sort specification of the term introduced by the nominal expression is directly compatible with the requirements of the predicate.

This seems like a benign assumption, but it is at the heart of the problem of copredication, because if the only way for a nominal expression to satisfy sortal selectional requirements is for their own requirements on its term to be compatible with those of the predicate, then

we will be forced to shift the sortal specifications of the nominal itself in order to satisfy different selectional restrictions. As we have seen, shifting the interpretation of the nominal itself undoubtedly predicts the ill-formedness of copredication.

In the following section I explore the possibility of extending the framework articulated in Asher (2011) for the treatment of polysemy and copredication to the case of container phrases, and discuss its limitation for the treatment of committee nominals. Having done that, I discuss a second possibility, based on work by Dölling(1995), for the treatment of committee nominals.

6.1 Assessing the possibility of applying Asher's (2011) polysemy framework

Given the experimental results for the positive acceptability of co-predication for both container phrases and committee nominals, in this section I discuss the possibility of providing a semantics for those expressions that uses the same types of representations and compositional mechanisms that have been used for better studied classes of polysemous nominals, such as the ones used in the polysemy conditions materials in the acceptability judgment studies.

In particular, I will examine the possibility of extending the framework developed in Asher (2011) for the treatment of polysemy and coercion. Polysemy is of course a phenomenon that has been discussed for a very long time, and numerous other approaches have been proposed

in a number of different linguistic theory traditions. A careful review and summary of the variety of approaches to polysemy in general, followed by an exploration of how these could be extended to container phrases and committee nominals would however much exceed the scope of this dissertation.

I choose to focus on the proposal by Asher (2011) here because the account is particularly compatible with the view of linguistic meaning most familiar to formal semantics, and hence with the previous account for the semantics of container phrases and committee nominals I have taken into consideration so far, and also makes use of a typed lambda calculus. In this sense, it has the potential to inform a new approach to that type of meaning flexibility which incorporates a richer view of the relevance of information about ontological sorts to semantic well formedness, that is, to the compositional process, while nonetheless preserving successful features of previous accounts.

I have focused and reserved attention to the aspects of the behavior of container phrases and committee nominals related to the sort of entity they denote and how multiple interpretations are related to one another, but clearly a full understanding of their semantic properties must beyond that provide a means to model their behavior in interaction with compositional operations beyond predication relations, such as quantification, for instance. For that, the formal apparatus in use in the tradition that follows Montague (1973) has been largely successful. Hence, it would be quite useful to preserve them, and Asher (2011) is likely the most in depth and formally detailed approach to polysemy to share much of those same assumptions and formal mechanisms. The next sections present Asher (2011)'s framework

and points more concretely to these points of convergence.

6.1.1 Polysemy under Asher(2011)

Asher (2011) develops a system for understanding how systematic ambiguity gives rise to well-formed co-predication sentences by taking as a starting point the problem of integrating information about sorts and sort selection into the compositional process.

Information about the ontological category nouns belong to is encoded at the level of types, in a system where types are treated as concepts. Asher argues against the purely set-theoretic notion of types in the Montagovian tradition, which leads to a homogeneous domain of individuals. Asher's main argument comes from the need to recognize subtypes of entities, such as abstract subtypes, concrete subtypes, etc, as part of the type system itself. This is built on the assumption that selectional restrictions are to be modeled as presuppositions at the type level, and that those presuppositions are more fine grained than the standard type system can capture.

In particular, Asher argues that once subtyping relations are recognized, the extensional set-theoretic view of types is no longer viable. In particular, a critical intuition is no longer captured once subtypes are identified with subsets. Since physical objects are a subtype of entities, physical object properties should be a subtype of all first-order properties. But the set of functions from physical objects to truth values is not a subset of the set of functions from entities to truth-values, since they have different domains. In a model where the set of entities has three elements, {a, b, c}, and the set of physical objects has two elements,

{b, c}, no element of the set of functions {{<b,1>, <c,1>}, {<b,0>, <c,0>}, ...} will be an element of the set {{<a, 1>, <b,1>, <c,1>}, {<a, 0>, <b,0>, <c,0>}, ...}. Therefore its intersection will be empty.

The alternative hypothesis pursued is that types are *concepts*. Just like concepts and unlike properties, types are taken to be mind-dependent representations of external properties and individuals, and as such will have an internal semantics. Types specify their rules of application, which amount to membership conditions determining when an object falls under a particular concept or licenses certain inferences. The satisfaction of application conditions for types is modeled as a system of proofs. The type APPLE for instance will be a function that applies to an individual and returns a proof that the object falls under that type if it meets the application rules; otherwise it returns a refutation that the object is of the APPLE type.

The following shows the system of simple types. Primitive types include the superordinate categories of entities, truth values and events, but also an in principle unbounded number of subtypes corresponding (at least) to basic level concepts. The presuppositional type Π carries the type presupposition of terms for particular argument positions. Three simple but non basic types are defined. Functional types are built via a rule identical to the montagovian one. In addition, the system introduces a rule for disjunctive types, well-formed when both disjuncts share a superordinate type, and quantificational types.

(141) **Asher (2011) system of simple types**

- **Primitive Types**: E, T, PHYSICAL OBJECT, etc.

- **Presuppositional Type**: Π
- **Disjunctive Types**: If σ, τ and ρ are types and $\sigma \sqsubseteq \rho$ and $\tau \sqsubseteq \rho$, then $(\sigma \vee \tau)$ is a type
- **Functional Types**: If σ and τ are types, so is $(\sigma \Rightarrow \tau)$
- **Quantificational Types**: If σ is a simple type, and τ is any expression denoting a type and x is a variable ranging over types, then if $\exists$ X $\sqsubseteq \sigma$ τ is a type. A term t is of this quantificational type if there is a subtype X of σ such that t is of type τ[X].

The internal semantics of types says nothing about reference or truth or any other mind-independent notions. Therefore, Asher (2011) constructs also a two-level model of lexical meaning: lexical items continue to be modeled simply as lambda terms (unlike previous work in Generative Lexicon where lexical entries have a very rich structure, such as Pustejovsky (1995)), but they also include fine-grained information about the required types of lambda bound variables. This is done by adding to lexical entries a λ bound variable π, of the presuppositional type Π, which encodes the typing requirements of predicates to its arguments. The type of propositions is thus $(\Pi \Rightarrow \mathrm{T})$, such that a proposition is evaluated with respect to a context that satisfies all of the type presuppositions. Consequently, if some presupposition cannot be satisfied via Binding or Accommodation, the proposition cannot be evaluated.

The lexical entry for the noun *tree* would then as follows, where $\mathrm{ARG}_1{}^{tree}$: P says that *tree* presupposes that its first argument be of the physical type P, that is, it imposes that

condition on x. $\pi*$ $\text{ARG}_1{}^{tree}$: P says that *tree*'s presupposition is appended via $*$ to the presupposition parameter argument, in addition to the constraints π already encodes.

(142) λx:E $\lambda\pi$ tree(x, $\pi * \text{ARG}_1{}^{tree}$: P)

Given the entry illustrated above, a noun like *tree* will be able to serve as argument of a predicate that selects for entities, physical objects and perhaps other more specific subtypes of physical objects. It will not, correctly, satisfy a predicate that selects for abstract objects, such as *report*. (143) is the rule that governs binding type presuppositions. If a type γ is a subtype of the type α, and an argument of a predicate P is presupposed to be both of type γ and α at different places, then the presupposition is bound by simplifying it to the most specific type, γ.

(143) Binding Presuppositions

$$\frac{\gamma \sqsubseteq \alpha, \text{ARG}_i^P : \alpha, \text{ARG}_i^P : \gamma}{\text{ARG}_i^P : \gamma}$$

Whenever a type presupposition cannot be bound, but may be accommodated, the requirement can be added to π at the relevant term. If a predicate P presupposes a term of type α for a certain argument position, but a different element imposes the presupposition that it be of type β, that term can now be required to be of both types as long as α and β are not inconsistent. The rule is shown below in (144):

(144) Type Accommodation

$$\frac{\alpha \sqcap \beta \neq \bot, \text{ARG}_i^P : \alpha, \text{ARG}_i^P : \beta}{\text{ARG}_i^P : \alpha \sqcap \beta}$$

Polysemes like *book* must be different from *tree* in precisely this respect. The variable bound in *book* must be able to satisfy presuppositions for physical object or abstract object types. And although these are both subtypes of entities, they are not in a subtyping relation with one another. It follows that the type of the term for *book* must be a more complex object

.

It will be a complex type composed of two simpler types, namely a physical object, and an abstract informational object. The crucial property that distinguishes complex types is that the term introduced by the complex object can be disjoint from the terms it contributes as arguments to other elements in the sentence, even though the former are related to the latter. That is, *book* remains complex on its own, even after it combines with a predicate like *heavy*, selecting for a physical object type. I will discuss more concretely what kind of formal expression a dot-type is in the following sections, but for the moment it suffices to examine how they are manipulated in composition.

Asher's (2011) implementation accomplishes the desired result by modifying the logical form itself whenever a type presupposition cannot be bound or accommodated. This will often be the case when complex types are involved, since most predicates do not presuppose a complex-typed argument. By the intervention of particularized functors, a variable of the constituent type required by the predicate is introduced, serving as the term for the predicate. Crucially, that variable establishes a relation to the complex typed one, which Asher names *Object Elaboration*, or o-elab. If x is an elaboration on y, if o-elab(x,y) is valid, then x is an aspect (a constituent type) of y.

Consider the derivation for the sentence in (145). *Book* requires a term of the complex type PHYSICAL OBJECT • INFORMATIONAL OBJECT, or P • I. Once the DP is completed, that variable is bound and will also occupy the argument position of the adjective, as shown in (ii). *Heavy* presupposes a term of the simple type P.

(145) The book is heavy

(i) **book**: λy:P • I $\lambda\pi$ book(y, $\pi * \text{ARG}_1^{book}$: P • I)

(ii) **the book**: $\lambda Q \lambda\pi_1 \exists! v$ (λy:P • I $\lambda\pi$ book(y, $\pi * \text{ARG}_1^{book}$: P • I) [v] $\wedge$ Q(π_1)(v))

$\xrightarrow{\beta-reduction}$

$\lambda Q \lambda\pi_1 \exists! v$ (book(v, $\pi * \text{ARG}_1^{book}$: P • I) $\wedge$ Q(π_1)(v)

(iii) **heavy**: λu:E $\lambda\pi_2$ (heavy(u, $\pi_2 * \text{ARG}_1^{heavy}$: P)

When *heavy* combines with the quantifier, the variable v is required to be both of type P and P • I, but these types are inconsistent. It is thus at this point, shown in (146), that the terms for *book* and *heavy* must be untangled.

(146) (iv) **the book is heavy**: $\lambda\pi \exists! v$ (book(v, $\pi * \text{ARG}_1^{book}$: P • I $* \text{ARG}_1^{heavy}$: P) $\wedge$ heavy(v, π))

In order to do so and resolve the mismatch for v, Asher (2011) introduces a specific functor, which takes properties of the complex type P • I and returns a property of one of its constituent types, here physical objects. The functor moreover ensures that the the physical object variable is not independent, but an aspect of the *book* type, via o-elab.

(147) **Functor B**: λQ: (P $\bullet$ I) $\Rightarrow$ ($\Pi \Rightarrow$ T) λv:P $\lambda\pi$ $\exists$w: P $\bullet$ I (Q (w)(π) $\wedge$ o-elab(v, w, π))

The functor is applied to the result of applying Abstraction over *book* and its arguments:

(148) a. (v) $\lambda y \lambda \pi_2$ book(x, π_2)

b. (vi) λQ λv:P $\lambda\pi$ $\exists$w:P $\bullet$ I (Q(π)(w) $\wedge$ o-elab(v, w, π)) [$\lambda y \lambda \pi_2$ book(x, π_2)] $\xrightarrow{\beta-reduction}$ λv:P $\lambda\pi$ $\exists$w:P $\bullet$ I (book(w, π) $\wedge$ o-elab(v, w, π))

Once that is integrated back into the original formula, the variable x is now only required to be of type P, while the term for *book* remains of type P $\bullet$ I. This will be the key to allowing co-predication, since a functor similar to B, but which returns a property of the other constituent type, I, may apply locally at a different point of the derivation. The following shows the final logical form for the sentence:

(149) (vii) **the book is heavy**: $\lambda\pi \exists! x$:P $\exists v$:P $\bullet$ I (book(v, π) $\wedge$ o-elab(x, v, π) $\wedge$ heavy(x, π))

Note that crucially, the term bound by *book* remains of the complex type, so the process can repeat itself with a functor introducing a term of the other type whenever necessary. This is the key to making co-predication possible in Asher's system, which does not limit the number and sorts of o-elab functors available. For each complex type we may define as many functors as needed: if it includes two constituent types, then there will be one functor A and one functor B targeting each of the types, totaling four. Likewise, each complex type

will be associated with its own set of functors. The illustration provided in this section uses the type PHYSICAL OBJECT • INFORMATIONAL OBJECT, but the mechanism extends to other familiar polysemy alternations. Co-predication with a polyseme like *lunch*, of type FOOD • EVENT, will make use of the same operations.

6.1.2 Container phrases and committee nominals as dot types

Extending Asher's approach to container phrases and committee nominals would then consist in two steps: (i) assigning their term a dot-type and (ii) being able to use the same mechanisms for type presupposition satisfaction as for polysemes (O-elab). I will focus here mostly on the first step, given that the second one should in principle follow straight forwardly for any dot-typed expression.

Container phrases

The container pseudo-partitive supports co-predication and therefore contributes to the semantics of the sentence a variable of a complex type. What should this type be? Since the container phrase is complex, the question also passes through assessing whether the dot-type is contributed by the container nominal on it's own, and projected up to the entire phrase, or whether it is constructed compositionally. Given the results of experiment 2 in chapter 2, where the container nominal on its own, presented out of context, could not support co-predication to the same extent as the container phrase in experiment 1, let us consider that neither the container or containee nominals are complex types on their own, but that

the pseudo-partitive in English constructs a type whose constituents are the types of the nominal phrases contained in it.

A phrase like *bucket of water*, for instance, could contribute a variable of complex type BUCKET • WATER, whose inhabitants are objects that have *bucket* and *water* as aspects, associated through a containment relation.

The idea of constructing complex types outside of the lexicon is not novel. Asher (2011) proposes that restricted predication of the sort illustrated in (150) does precisely that. The *as*-phrase constructs the *boss* aspect of the expression in subject position and makes that aspect available for predication by *strict*. The complement of *as* will be a variable that will serve as argument for the main predication, and it will be of a type that can be constructed as an aspect of the term introduced by the subject. In other words, the subject's term is coerced into a complex type, such that one of its constituents is the type specified by the complement of *as*.

(150) Louise as a boss is strict.

This constructed type is however different from lexical ones in that its constituents are not entirely determined. While one constituent type will be identical to the one in complement of *as*, the other one is left unspecified. This is because, as Asher argues, the as-construction implies that the subject has a number of aspects other than the one being overtly mentioned, but leaves the precise identity of other potential aspects unspecified. The logical form for the example in (150) would then be:

(151) $\lambda\pi\exists$x:BOSS (o-elab(x, y, π) $\wedge$ boss(x, π) $\wedge$ strict(x, π),

where y: ? $\bullet$ BOSS

Asher assumes further that the complement of *as* contributes a property, and not a quantified DP, to the interpretation of the sentence. The argument is based on evidence that in English, only definites, indefinites and possessives can occur in this position, but not universal or proportional quantifiers. Further, in languages where predicative nouns appear bare, such as French and Spanish, they must also be bare in the *as*-construction.

(152) a. David as a doctor is incompetent

b. David as the winner of the race is happy

c. David as Fred's father is mean

d. # David as every (any) doctor is incompetent

e. # David as most things is incompetent

(153) a. Gabi comme (*une) médicin

b. Gabi como (*una) avogada

In the logical form provided above, the type presupposition of the variable introduced by *boss* is not, as might be expected, simply HUMAN. Rather the presupposition is as specific as it can be. It would be undesirable of course to have *boss* have such specific requirements ordinarily. Simple predications like *David is my boss* would be infelicitous, given that the term introduced by the subject will be of a type that cannot be accommodated because it

is not a subtype of the type BOSS. In the *as*-construction, the type of the complement must indeed be at that level of specificity.

The main predication will only hold of the subject qua *boss*, and not qua any other aspect it might have, for which *boss* is a subtype of. It must be the case then that this shift in specificity level is a function of the *as*-construction itself. Asher implements this feature by adding to the lexical entry of *as* the function TY^+, which takes a property and returns the most specific type it imposes on its complement. The full lexical entry for *as* is given in (154). [1]

(154) **as**: $\lambda P \lambda Q \lambda \Phi \lambda \pi\ \Phi(\pi * ?\ \bullet\ \mathrm{TY}^+(P))\ (\ \lambda u \exists \mathrm{v}\colon\ \mathrm{TY}^+(\mathrm{P})\ (\mathrm{P}(\pi)(\mathrm{y}) \wedge \text{o-elab}(\mathrm{y}, \mathrm{x}, \pi) \wedge \mathrm{Q}(\pi)(\mathrm{y})))$

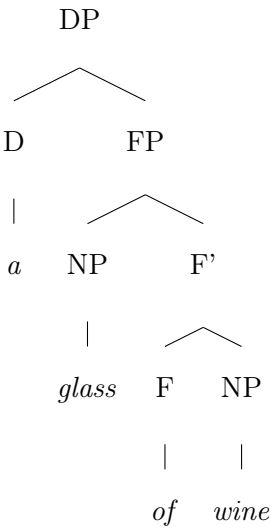
The tools used to construct a complex type for the *as*-construction could also be applied fruitfully to the case of container pseudo-partitives. It seems clear however that the pseudo-partitive complex type would not also be undetermined - there is no implication that *a glass of wine* has more aspects than simply *glass* and *wine* and whatever aspects each of those have in turn.

But there are a number of similarities between the two constructions that are worth exploring. It seems that in the pseudo-partitive as well, the nominal arguments do not contribute full DPs. That this is true of the containee nominal seems clearer: in English the position is restricted to bare plural and mass nouns. The case is harder to make for the container noun

[1] Asher in fact assumes a syntactic structure where the as-phrase modifies an entire IP, from which the subject is extracted to a left periphery position. I refer the reader to the details of the analysis of restricted predication in Asher (2011), as they will not be relevant for our purposes here.

if what is assumed is a structure in which it takes the *of*-phrase as complement. We have seen however that this assumption makes co-predication impossible in its own right. Let us at least provisionally assume a structure in which the pseudo-partitive contains a functional projection FP taking the container and containee NPs as arguments.

(155)



Treating both nominals in the pseudo-partitive as properties, the application of the TY^{+} function extracts the most specific typing requirements each of the nominals can make. Its output may then be used in the denotation of the complex type constructor head F, standing in for the constituent types, as desired. Just as in the case of restricted predication, in the pseudo-partitive it is the container noun which is coerced into a complex type, elaborated on by the containee. The type constructor head takes the container and containee NP as arguments and returns a property of a complex type that has their types as constituents. In addition it binds the variable contributed by the containee noun, and established the Object elaboration relation between containee and the complex type, as shown in (156).

(156) **Complex type constructor head**:

$\lambda Q \lambda P \lambda \pi \lambda w$ P($\pi*$ TY^{+}(P) $\bullet$ TY^{+}(Q))(w) $\wedge$ $\exists$x: TY^{+}(Q) Q(x, π) $\wedge$ o-elab(x, w, π)

What follows illustrates a concrete example for the phrase *glass of wine*. Since the container noun is coerced, *glass* itself no longer requires a term of simple type. The containee noun, on the other hand, still introduces a discourse referent of its own, although through existential closure it is not available for further predication relations.

(157) a. **glass**: $\lambda y \lambda \pi_2$ glass(y, π_2)

b. **wine**: $\lambda z \lambda \pi_3$ wine(z, π_3)

(158) **of wine**: $\lambda P \lambda w$ P($\pi*$ TY^{+}(P) $\bullet$ WINE)(w) $\wedge$ $\exists$x: WINE wine(x, π) $\wedge$ o-elab(x, w, π)

glass of wine: λw glass(w, $\pi*$ GLASS $\bullet$ WINE) $\wedge$ $\exists$x: WINE wine(x, π) $\wedge$ o-elab(x, w, π)

a glass of wine: $\lambda Q \lambda \pi_1 \exists$v glass(v, π_1*GLASS $\bullet$ WINE $\sqcap$ COUNT $\sqcap$ E) $\wedge$ $\exists$x:WINE wine(x, π_1) $\wedge$ o-elab(x, w, π_1) $\wedge$ Q(π_1)(v)

Let us now consider how this DP behaves as an argument of a predicate whose type presupposition is the type PHYSICAL OBJECT, such as *break*. Once the VP combines with the DP, it is the complex typed variable v which will be given to *break*, giving rise to the same sort of type presupposition conflict as cases involving *book*. Following the same strategy here,

functor B applies to the lambda abstracted *glass of wine* in order its term disjoint from that of *break*. (159) shows a functor for the most fine-grained complex type possible for the pseudo-partitive *glass of wine*, though it could plausibly be made more general to cover all CONTAINER • ENTITY types.

(159) **functor B for GLASS • WINE**:

λP: (GLASS • WINE) $\Rightarrow$ ($\Pi \Rightarrow$ T) λy: GLASS $\lambda\pi$ $\exists$w: GLASS • WINE (P(π)(w) $\wedge$ o-elab(y, w,π))

The functor applies to the result of abstracting over the pseudo-partitive, returning a property of an entity of type GLASS and quantifying over the complex typed variable.

(160) a. **glass of wine**: $\lambda z \lambda \pi_2$ (glass(z, π_2) $\wedge$ $\exists$x (wine(x, π_2) $\wedge$ o-elab(x, z, π_2)) (v) (π_1)

b. λP: (GLASS • WINE) $\Rightarrow$ ($\Pi \Rightarrow$ T) λy: GLASS $\lambda\pi$ $\exists$w: GLASS • WINE (P(π)(w) $\wedge$ o-elab(y, w,π)) [λz: GLASS • WINE $\lambda\pi_2$ (glass(z, π_2) $\wedge$ $\exists$x (wine(x, π_2) $\wedge$ o-elab(x, z, π_2))] $\longrightarrow$

λy: GLASS $\lambda\pi$ $\exists$w: GLASS • WINE (glass(w, π) $\wedge$ $\exists$x (wine(x, π) $\wedge$ o-elab(x, w, π) $\wedge$ o-elab(y, w, π))

Once (160) is reintegrated into the original logical form, the term for *break* is, as desired, of a simple type, resolving the initial typing conflict. Crucially, the container aspect now has an independent semantic representation, capturing the fact that only *glass* undergoes the change of state from whole to broken, with no implication that the containee is subject to a similar process.

(161) **A glass of wine broke**

$\lambda\pi_1\exists$v glass(v, π_1) $\wedge$ $\exists$x:WINE wine(x, π_1) $\wedge$ o-elab(x, w, π_1) $\wedge$ break(v, π_1) $\longrightarrow$

$\lambda\pi_1\exists$w: GLASS $\bullet$ WINE (glass(w, π_1) $\wedge$ $\exists$x (wine(x, π_1) $\wedge$ o-elab(x, w, π_1) $\wedge$ o-elab(v, w, π_1)) $\wedge$ break(v, π_1)

Because the type of term for the pseudo-partitive as a whole is preserved, this approach predicts that any of its aspects may be teased apart for local predication relations as often as required. The system imposes no a priori restrictions on when functors A and B may apply. Therefore co-predication is predicted to be acceptable, just as in the *book* case. A version of (161) which includes a modifier targeting the containee, such as (162), will require two applications of the appropriate functors.

(162) A tasty glass of wine broke.

In the discussion above we have omitted the fact that the NP includes a lambda-bound variable for modifiers for simplicity sake, since in the absence of modifiers this variable is removed by combination with the trivial modifier. Below we reintroduce it to the lexical meaning of *glass of wine* so that it may take *tasty* as one of its arguments and impose its type requirements on it.

(163) **glass of wine**: $\lambda Q\lambda w\lambda\pi$ Q (π * ARG$_1^{glass}$: GLASS $\bullet$ WINE)(w) glass(w, π* GLASS $\bullet$ WINE) $\wedge$ $\exists$x: WINE (wine(x, π)) $\wedge$ o-elab(x, w, π)

tasty: $\lambda P\lambda u\lambda\pi_2$ (tasty(u, π_2 * ARG$_1^{tasty}$: EDIBLE) $\wedge$ P(π_2)(u))

tasty glass of wine: $\lambda w\lambda\pi$ tasty(w, π * ARG$_1^{tasty}$: EDIBLE * ARG$_1^{glass}$: GLASS $\bullet$

WINE)∧ glass(w, π ∗ ARG_1^{glass}:GLASS • WINE) ∧ ∃x: WINE (wine(x, π)) ∧ o-elab(x, w, π)

Since *tasty* presupposes that its term be of a type EDIBLE, when it modifies the complex typed NP GLASS • WINE, a typing conflict must be resolved. Their terms must be made disjoint by the application of functor A, which preserves the pseudo-partitive's presuppositions.

(164) Apply functor A

$\lambda T \lambda j$: GLASS • WINE $\lambda\pi_3$ ∃k: WINE (T(π_3)(k) ∧ o-elab(k, j, π_3)) [$\lambda z \lambda\pi_4$ tasty(z, π_4)]

λj: GLASS • WINE $\lambda\pi_3$ ∃k: WINE (tasty(k, π_3) ∧ o-elab(k, j, π_3))

(165) Reintegrate

tasty glass of wine: λw:GLASS • WINE $\lambda\pi$ ∃k:WINE (tasty(k, π) ∧ o-elab(k, w, π) ∧ glass(w, π) ∧ ∃x: WINE (wine(x, π)) ∧ o-elab(x, w, π)

(166) Combine with determiner

a tasty glass of wine:$\lambda Q \lambda\pi_1$∃v ∃k:WINE (tasty(k, π_1) ∧ o-elab(k, v, π_1) ∧ glass(v, π_1) ∧ Q(π_1)(v))

At the main predication, the same steps will be necessary in order to make disjoint the terms for *glass of wine* and *break*, though here this will be done via the application of functor B.

(167) **a tasty glass of wine broke**:

$\lambda\pi_1\exists$v $\exists$k:WINE (tasty(k, π_1) $\wedge$ o-elab(k, v, π_1) $\wedge$ glass(v, π_1) $\wedge$ broke(v, π_1)

(168) Apply functor B

λP: (GLASS $\bullet$ WINE) $\Rightarrow$ ($\Pi \Rightarrow$ T) λv: GLASS $\lambda\pi$ $\exists$w:GLASS $\bullet$ WINE P(w)(π) $\wedge$ o-elab(v,w,π))[$\lambda r\lambda\pi_3$ $\exists$k:WINE (tasty(k, π_3) $\wedge$ o-elab(k, r, π_3) $\wedge$ glass(r, π_3)]

λv: GLASS $\lambda\pi$ $\exists$w:GLASS $\bullet$ WINE $\exists$k:WINE (tasty(k, π) $\wedge$ o-elab(k, w, π) $\wedge$ glass(w, π) $\wedge$ o-elab(v, w, π))

Finally, after (168) is reintegrated each of the aspects of the container construction is independently predicated of, and related to the complex type via Object Elaboration. The final formula states that there exists a complex object which is a glass containing wine, and, as previously, only *glass* undergoes a change of state, and only the concrete portion of wine has the property of being tasty.

(169) . $\lambda\pi_1$ $\exists$w:GLASS $\bullet$ WINE $\exists$k:WINE (tasty(k, π_1) $\wedge$ o-elab(k, w, π_1) $\wedge$ glass(w, π_1) $\wedge$ o-elab(v, w, π)) $\wedge$ broke(v, π_1)

Committee nominals

As for the case of container phrases, to provide a dot-type representation for committee nominals we must ask both what the constituent types of the dot-type are and whether the dot-type is contributed by the committee noun itself or whether it is constructed compositionally. Recall that the ability to take an of-phrase whose nominal complement specifies

the individuals that stand in a membership relation to the collective was one of the defining properties of collective nouns. Recall too that the subclass Pearson identifies as collection nouns, which include nouns such as *bunch*, *pile*, *collection*, *deck*, seem to require that the of-phrase complement be either recoverable from context or overtly present. Committee nominals on the other hand seem more able to appear without an overt of-phrase in out of the blue contexts.

This might be related to the fact that committee nominals, due to the sort of collective they denote, already restrict membership to a much larger extent than collection nominals. Individuals in a membership relation to committee nominals must be person, as we have seen, since membership is defined based on social relations. *Bunch*, *pile*, *collection* on the other hand collectivize largely based on spatiotemporal proximity and configuration, and hence do not restrict what sorts of entities can stand in a membership relation to them beyond perhaps their status as physical objects. When committee nominals do appear with an overt of-phrase, the complement nominal seems to need to specify properties of the members beyond personhood, which are relevant in context or noteworthy (for instance, *a team of teenage zombies*, *a committee of 500 incompetent mathematicians*). Committee nominals are then closer to certain terms of venery, such as *flock (of birds)* or *shoal (of fish)*.

We may ask then whether when the of-phrase is present overtly, the more specific type contributed by the complement nominal influences the kind of selectional restrictions a particular committee phrase may satisfy. For that we must select predicates which select for

an argument of both the person sort and a further property, either a subtype of person or a property that can be combined with but is orthogonal to personhood. That is, we must find predicates that have very specific selectional restrictions for subtypes of persons, or ones that select for other linguistically relevant properties in addition.

The first kind is not very easy to find. One possibility might be predicates that seem to be common sensically gendered in particular ways, such as *be pregnant*, *be bachelors*, *be mothers/fathers*. In order to use these predicates as a means to test a committee phrase we must however assume that they encode a gender requirement semantically, which seems somewhat dubious for English. Nonetheless, if we assume that, we may ask about the well formedness of examples such as (170) below:

(170) a. That team of young women that came over last night might have been pregnant.

b. That committee of 6 young men looked like elegant bachelors.

Clearly, the most transparent orthogonal property to personhood for the complement nominal of these of-phrases that could be used for this sort of test is their number properties, since predicates in English clearly select based on number properties, as we have discussed previously. This leads us to an important question about the status of properties such as number (and gender) in Asher's type system. That is, should the dot-type we assign to a committee nominal also encode information about semantic number at the type level? Is number related selection to be treated in the same way as what we have been calling sortal selection?

In establishing the argument for treating semantic, sortal selection as a linguistic, and not just world-knowledge, property, Asher (2011) briefly mentions that some predicates do seem to require that its argument be a plurality. This type of selection is not distinguished from the kinds we have seen so far at that point. In fact, Asher assumes that along side very general types such as PHYSICAL OBJECT and ABSTRACT OBJECT, MASS, COUNT and PLURALITY are also general types. In the discussion of restricted predication, for instance, where an *as*-phrase gives rise to predication on particular aspects of the denotation of the expression it modifies, Asher treats conjoined DPs and plural definite DPs in (171) as being of the complex type COLLECTION•SET OF INDIVIDUALS.

(171) a. John and Mary as a couple are a pain to have at a party, though John and Mary are individually fine.

b. The students are individually well behaved, but as a group they are not well behaved.

That is, while *John and Mary* and *The students* are basically of the type SETS OF INDIVIDUALS, the modification by *as a couple* or *as a group* enriches their meaning in context to include the type COLLECTION.

In a similar vein, Asher discusses the ambiguity between distributivity and collective predication in a sentence like (172) as a matter of coercion, implying a map between groups and their members. Coercion is triggered by predicates, which in addition to imposing particular type requirements license a map between types in order to satisfy those requirements whenever there is a conflict.

(172) Three students lifted the piano.

In Asher's system both of the cases just mentioned, and also the treatment of group ambiguity if it is to be treated on a par with collective/distributive ambiguity or even if its treated as a complex type, rely on the availability of PLURALITY or SET OF INDIVIDUALS as a type. It is worth to examine more closely what doing so entails.

Most predicates are compatible with both singular and plural arguments. Let's take a particularly permissive predicate, such as *see*, and assume that the only presupposition it imposes is that its second argument be some sort of physical entity [2]. Since both a singular count and a plural DP may satisfy those requirements, they must both be subtypes of physical entities. Let us assume then that the COUNT type and the PLURALITY type will have mirrored subtypes, which are also subtypes of physical entities. Somewhere down the hierarchy we will find for instance MAMMAL under COUNT and MAMMALS under PLURALITY. What is then the relation between the type MAMMAL and MAMMALS? It is hard to see how there could be any direct relationship between those.

Imagine then a predicate with more fine-grained restrictions than *see*, like *give birth*, which might require its argument to be a mammal. It is also compatible with both singular and plural DPs. What then is its type presupposition? There is no type that corresponds simply to the kind *mammal*, unless KIND is also a general type. But the same issues get multiplied there, since then the relation between kinds and instances is just as obscured as between atomic and sum individuals of the same sort. Thus while Asher's system gives us a way to

[2]Perhaps see is also compatible with events, as in "*Ana saw Lea sleeping*". I am making a simplifying assumption here for ease of exposition.

understand co-predication and coercion, its foundational assumptions conflate ontological and mereological dimensions of meaning in such a way that it not clear how to extend the treatment of polysemous expressions that are ambiguous between simple sorts, like *book*, to those that involve some sort of plurality, such as group nouns.

One possibility at this moment is to simply assume that information about the mereological status of a particular entity, and the success of plural predication, is not encoded at the same level as ontological sorts, that is, it is not part of the type system we have been considering so far. This might very well be too much of a simplifying assumption, and I will not pursue it in detail here. If it is adopted however, then we might say that committee nominals contribute a dot-typed term of the general type SOCIAL OBJECT • PERSON. we may furthermore either assume that that is contributed by the committee nominal itself, or that when no overt of-phrase is present there is still an implicit argument occupying that position, which contributes an entity of the person sort but specifies no other properties. In that way, committee nominals may be approximated to both container phrases and collection nominals.

6.1.3 Limits to Asher's (2011) predictive and explanatory power

Asher (2011) then provides the formal grounds to capture the fact that a local predication relation need not change the type of a dot object globally, thus offering the grammar a licit way to construct co-predications. It is, however, a very powerful system. Any restrictions on what types can be constituents of a complex type are relegated to conceptual restrictions

on our common sense metaphysics. While it seems clear that restrictions must apply at that level, it is much less obvious that they should not also be encoded linguistically.

The systematicity of polysemy, one of its critical properties, must arise only from systematic features of conceptual structure. Given that languages often choose to encode parts of the conceptual system differently (i.e. in the verbal domain, spatial notions such as *path* are sometimes part of the lexical meaning and sometimes not), cross-linguistic similarities with respect to the classes of polysemy are a somewhat arbitrary matter of what the language has chosen to lexicalize.

Rabagliati and Srinivassan's (2014) a survey of 14 languages and 26 types of attested polysemy alternations reveal a striking low degree of variation. Sixteen alternations were found in all of the languages surveyed. Out of the 10 which were not attested in all languages, 4 were only not found in 1 language and 3 alternations were not found in only 2 of the 14 languages. This indicates that the principles that drive the lexicalization of polysemes are also systematic, and therefore that at least part of the responsibility should fall on the grammar side of the interface with the conceptual system. So when can and does language chose to represent elements that can refer to entities in different ontological categories in a unique expression? As it stands, Asher's framework does not offer any insight into this question.

A natural follow-up to this question is whether the various sorts of multi-aspect expressions should be expected to behave differently in co-predication. There is indeed a sense in which these should all be treated equally, in that they make distinct aspects available for predica-

tion in all syntactic configurations and without the need of specific contextual support. But there are other dimensions along which polysemy can be subdivided. Crucially, the relationship between the aspects of classes of complex types may be quite varied. These relations are precisely what tells polysemy apart and is the source of its systematicity. Nothing in the system as it stands relies on the identity of these relations, or is sensitive to it.

The complex type MEAL • EVENT, for *lunch*, is equivalent to the type PHYSICAL OBJECT • INFORMATION, for *newspaper*, and ORGANIZATION • LOCATION, for *city*. If evidence turns out to show that not all lexical polysemy classes behave alike, the current theory has no choice but to claim that the distinction is due to external factors, such as particular features of the context. This might well be true, but nothing in the representation of *city* or *newspaper* or *a bucket of pebbles* tells us why or how one should be more sensitive to properties of the discourse that may affect the acceptability of co-predication.

Because Asher's system does not constraint what sorts of objects can be modeled as dot types and does away with a structured lexicon, it has quite limited predictive and explanatory power. In particular, although the system encodes that distinct aspects must stand in a certain relation to one another, it says nothing about what types of relations do in fact mediate the relationship between aspects and objects. There is no principled restriction on what those relations may be, and hence no power to predict what sorts of expressions should display the type of ambiguous behavior that polysemes do. Because it also does not define the class of relations that we observe mediating the relationship between distinct aspects of a complex object, it also does little to explain why we observe polysemous behavior in those

cases but not in others.

6.2 Assessing the possibility of applying Dölling (1995)'s polysemy framework

We have considered previously analyses of the semantics of group nouns that largely treat their ambiguity properties as a class of its own, though connections are made to measure phrases in Barker (1992) and individual concepts in Landman (1989) and Pearson (2011). In the next section we consider proposals by Dölling (1995) in which the kind of shift that seems to be involved in the interpretation of groups is incorporated into a general theory of type and sortal shifts in natural language. Looking ahead, we will see that while the answer to the question of how meaning multiplicity is represented is somewhat different in those approaches, the answer to how that multiplicity is explored in composition will encounter similar problems when faced with copredication data.

6.2.1 Dölling (1995)

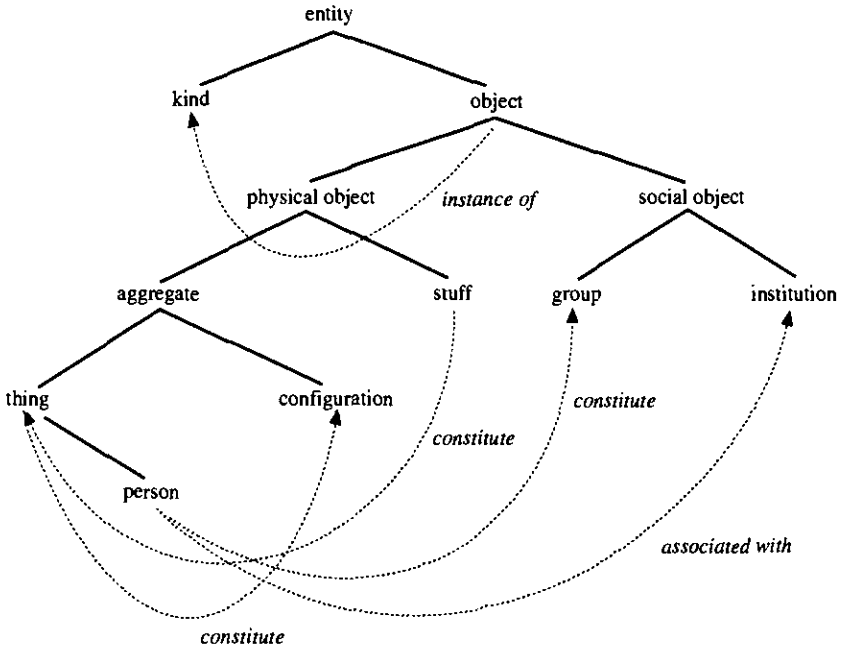
In Dölling (1995), knowledge representation of a particular type, namely of the ontology of the common sense world in terms of conceptual categories, is integrated into a single system with lexical representations and semantic composition operators. The starting point is the observation that much of the information about an expressions categories which guides the well-formedness of semantic composition is not encoded in a model that assumes a

homogeneous domain of individuals, as in standard Montagovian semantics. Such systems, where all individual denoting expressions are of the same semantic type e, rely on a set-theoretic representation of common nouns, as in Bennett (1974).

This approach proved problematic for the treatment of plurals, since common nouns and plurals ended up both denoting a set of individuals, and only singular nominal phrases denoted an individual. Maintaining these assumptions required then systematically multiplying the denotation of verb phrases, to be of type <et> when taking singular NPs, but of type <et,t> otherwise. Alternatively, singular NPs could be taken to also denote sets, albeit singleton sets. Dölling reminds us of two arguments against this view. The first is that it seems ontologically inadequate for both plurals and singulars, since the system ends up ascribing properties of concrete individuals to sets, which are abstract entities. The second, more empirically grounded, is that the approach is inadequate for the treatment of mass nouns, if they must be represented as sets of atomic entities as well. In sum, the problem arises when differences between sorts of entities are reduced to a difference between sorts of sets.

Issues of this sort were what motivated the proposal in Link (1983), where the domain of individuals is structured in a particular way to account for plurals as different kinds of individuals in the ontology. Dölling (1995) is a step forward in that same direction. The domain of individuals is not only structured by the two-way distinction between atomic and plural individuals, but recognizes distinct sorts of atomic and plural individuals in a structure that encodes knowledge about common sense ontological categories. As illustrated

in the figure below, the domain of entities is first subdivided into subdomains of objects and kinds. Those domains have mirrored subdomains. For instance, the object domain has the subdomains physical object and social object, and the kind domain will have the subdomains kind of physical object and kind of social object. Moreover, each of the entity domains has two subdomains, one for atomic entities and one for plural entities of that sort.



Knowledge of ontological category guides predication in the following way. Predicates are no longer simply properties of individuals, they can be predicate of things (like *cup*), or properties of quantities of matter, like *gold*, or properties of configurations, like *pile*.

These assumptions are instantiated in a two stage interpretation model. In the first stage composition is based on lexical semantic information and some semantic operators. In the second, world knowledge, including ontological knowledge, refines that representation.

Dölling (1995) assumes a one-sorted language of representation **L**, in which for any sort α there is a predicate that denotes the set of entities of sort α, including at least the following. All predicates denote sets of atomic individuals and sets of plural individuals. The domain of objects, things, stuff, configurations, groups and institutions are subdomains of the domain of objects, and the domain of persons is a subdomain of the domain of things.

(173) **Domain defining sort predicates**

a. U (entity)

b. O (object) & OK (kind of object)

c. T (thing) & TK (kind of thing)

d. S (stuff) & SK (kind of stuff)

e. C (configuration) & CK (kind of configuration)

f. G (group) & GK (kind of group)

g. I (institution) & IK (kind of institution)

h. P (person) & PSK (kind of person)

Distinct domains are also organized by different part-whole relations. The part-whole relation that structured U is $\leq_U$, and pluralities are formed based on the sum operation $\oplus_U$, such that:

(174) **Parthood relation for U**

$(\forall xy)[x \leq_U y \leftrightarrow x \oplus_U y = y]$

The plural operator ^{pl} and the singular operator ^{sg} restrict a set of entities to the subset of

plural and the subset of atomic entities.

(175) a. SING: $\forall x\ [^{sg}Px \leftrightarrow Px\ \&\ AT_U x]$

b. PL: $\forall x\ [^{pl}Px \leftrightarrow Px\ \&\ \neg AT_U x]$

For the domain of kinds the part-whole relation is *subkind*. This relation will differ from the more general part-whole relation between atoms and sums in that it is not the case that for every kind atom there is a sum that includes it which is a kind as well (e.g. the sum of the kind *cat* and *chair*). Similar observations hold for the domains of things, configurations, groups and institutions. The domain of persons is particularly exceptional in that it cannot adequately be grasped in terms of mereology, given the common sense notion that a person's identity cannot be defined in terms of the sum of its parts.

6.2.2 Domain mapping relations

A number of relations link elements of one domain to another. For ease of presentation, I will focus here on the relation between kinds and objects, INSTANCE OF, and the constitution relation between things and stuff CONSTITUTE, and groups and persons, GROUP MEMBERSHIP. INST is defined by the following axioms. That is, an entity x is an instance of an entity y only if x is an object and y is a kind (176a). Every object is an instance of some kind (176b). The sum of two objects which are instances of the same kind is an instance of that kind as well (176c), and (176d), if an entity x is an instance of a kind y which in a subkind relation with the kind z, then x is also an instance of z.

(176) **INSTANCE relation between KIND and OBJECT domains**

a. $(\forall xy)$ [x INST y $\rightarrow$ Ox & OKy]

b. $(\forall x)$ [Ox $\rightarrow(\exists y)$ [OKy & x INST y]

c. $(\forall xyz)$ [x INST z & y INST z $\rightarrow$ (x $\oplus_U$y) INST z]

d. $(\forall xyz)$ [x INST y & y SUBK z $\rightarrow$ x INST z]

Dölling assumes that the basic denotation of common nouns is kind-referring, and that the predicate interpretation is derived from it via INST. The basic lexical meaning of nouns is represented as kind concepts with subscripts indicating their semantic sort, such that the nouns *cup, pile, pupil* for instance are represented as cup_{TK}, pile_{CK} and pupil_{PSK}.

(177) INST

λy: P_K(y)λx: P_O(x) [x INST y]

The CONSTITUTE relation between the domain of THINGS and STUFF and the the MEMBERSHIP relation between GROUPS and PERSONS are quite similar, in part because they rely heavily on some unspecified notion of what it means to constitute or be a member. The axioms below hold that an entity x CONSTITUTES an entity y only if x is a substance and y is a thing. Additionally, if x is an entity in the domain THING, then there is some entity y in the domain STUFF that constitutes x.

(178) **CONSTITUTE relation between THING and STUFF domains**

a. $(\forall xy)$[x CONSTITUTES y $\rightarrow$ S(x) and T(y)]

b. $(\forall x)[T(x) \rightarrow (\exists y)[Sy \ \& \ y \ \textsc{constitutes} \ x]\ ]$

Similarly, the axioms above state that an entity x is a member of an entity y only if x is in the plural domain of persons and y is in the domain of groups. Moreover, for every entity in the GROUP domain there is some plural entity in the domain of persons that stands in a member relation to it. This last condition seems a bit a too strong as it stands, since groups may have a single member, or not have any members at all at some point in time.

(179) **MEMBER relation between GROUP and PERSON domains**

a. $(\forall xy)[x \ \textsc{member} \ y \rightarrow {}^{pl}PS(x) \text{ and } G(y)]$

b. $(\forall x)[G(x) \rightarrow (\exists y)[{}^{pl}PS(y) \ \& \ y \ \textsc{member} \ x]]$

6.2.3 Polysemy and Coercion in Dölling

Polysemy involves an expression that has a somewhat underspecified representation, such that it may apply to various ontological domains. The context *restricts* its meaning. For instance, a noun like *newspaper* will have an underspecified interpretation because it belongs to two ontological classes, physical object and institution. The linguistic context may force a specification of its representation based on the sortal selectional restrictions of the predicate it combines with. In (180a), *went bankrupt* requires the institution interpretation and in (180b) *wet* requires the physical object one, so in each case the representation of newspaper is specified to belong to one or the other category.

(180) a. The newspaper went bankrupt.

b. The newspaper was soaking wet.

Coercion on the other hand involves *extending* the meaning of an expression. Coercion operations apply over specified meanings, which are shifted into a new domain. Only as a result of the operation that expression will be associated with multiple related meanings. Moreover, coercion operations are based on systematic relations between ontological categories. For instance, institutions are related to persons via the *associated with* relation. Thus although *newspaper* does not itself belong to the category of person, in a context such as (181), where the predicate *telephoned* demands that its argument belong to the person sort, a coercion operation shifts the sort of *newspaper* to accommodate the predicate's requirements. Crucially, not by restricting its meaning, but by extending it.

(181) The newspaper telephoned.

The interpretation of group nouns is taken to involve coercion, in that a noun like *team* is represented simply as belonging to the semantic sort of groups: team$_{GK}$. Therefore as a predicate, *team* is simply a set of individuals, atomic and sums, that are instances of the kind of group that team is: λx:Gx [x INST team]. Once it is composed with a determiner it will compose straight-forwardly with predicates selecting group individuals, or individuals in a super domain of the domain of groups, that is, social objects, objects, or entities. Let us assume that a predicate like *be-founded* requires its term to range over individuals in the domain of institutions: λy: Iy [be-founded(y)]

In order to be interpreted however as a plurality of persons who are members of that team, in Dölling the NP itself will undergo a *coercion* operation, linking the domain of groups to the domain of persons, which the system calls shift. A number of shift operations are defined based on two place relations between sort predicates, such as the association relation between institutions and persons, ASSOCIATION, the constitution relation between things and stuff, CONSTITUTE. The SHIFT operation that takes us from team as a group to a plurality of persons is defined as follows:

(182) SHIFT: (λx: ^{sg}Gx) (λP: P$\subseteq$ PS) ($\exists$y: y^{pl}PS $\wedge$ y MEMBER x) [Py]

For the Group membership relation, $\in_G$, the following condition holds, where CONSTITUTE is a predicate of constitution for the group domain. Before providing an example derivation, note that the definite determiner *the* for Dólling is built upon a generalized operator of definite description, δ, shown below. This non-standard assumption is needed given the that shift applies over the entire DP and itself introduces a predicate variable to be bound by the VP predication.

(183) a. $\delta P =_{def} \iota x[Px \wedge \forall y[Py \rightarrow y \leq_U x]]$

b. *the*: (λP: P$\subseteq$U)[δP]

The derivation of (184a), where collective predication requires *team* to be shifted in this way, is illustrated bellow. Since nouns denote kinds, the first step is to shift it to denote properties via the application of INST, which returns the set of individuals, atomic and sums, that instantiate that kind. The singular operator SING then further restricts its denotation

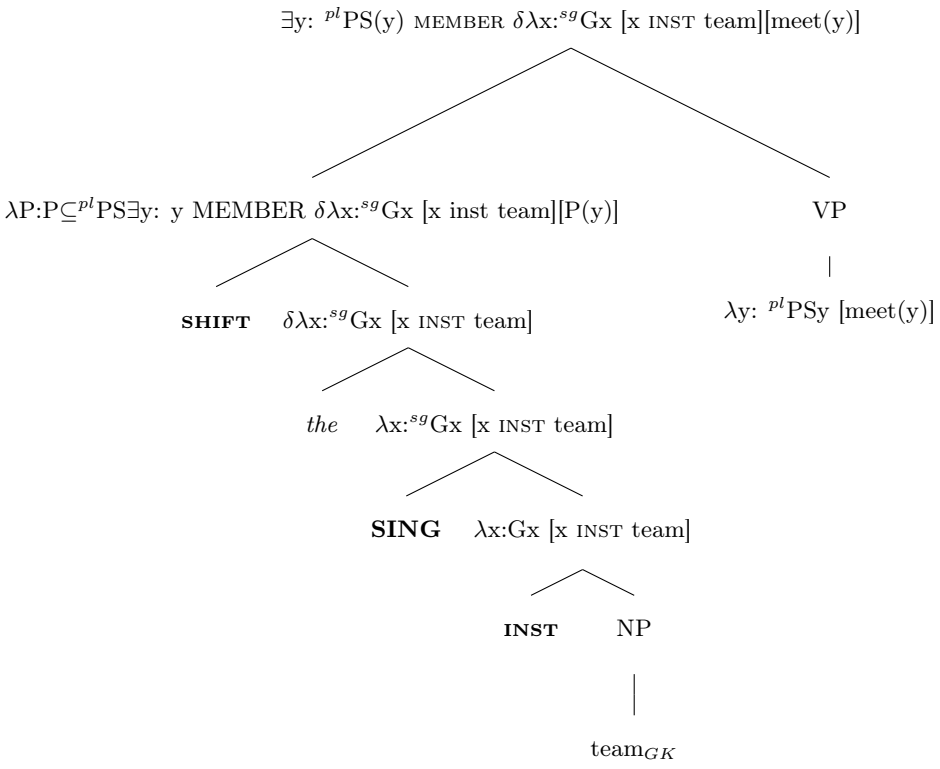
to only atomic individuals. After it composes with the definite determiner, SHIFT returns a function from a predicate in the plural domain of persons to truth values, under the condition that the term that satisfies that predicate is in a MEMBER relation to a contextually unique team.

(184) a. The team met.

b. *team*: team_{GK}

c. *the*: $(\lambda \text{P: P} \subseteq \text{U})[\delta \text{P}]$

d. *meet*: $\lambda \text{y: } ^{pl}\text{PSy [meet(y)]}$



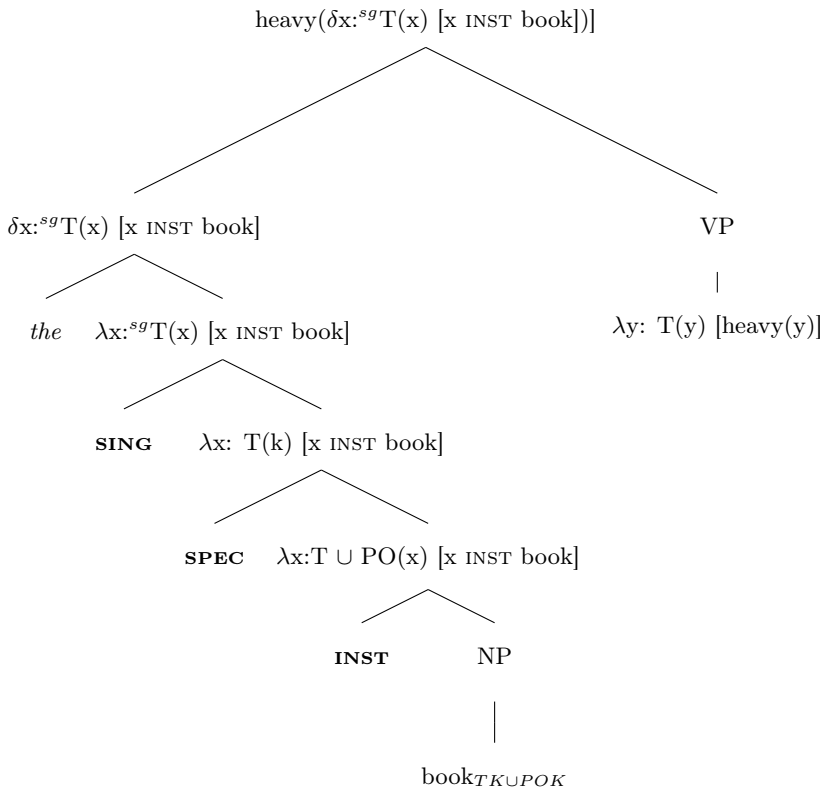
This is in contrast with polysemous expressions such as *book*, whose basic denotation indicates that their semantic sort is itself more complex. Dölling represents the fact that expressions like *book* is at once in the domain of things and propositional objects by indicating that they are in the union of those domains. The status of abstract objects as a whole is not explicitly given in the structure Dölling provides, where the domain of objects is split into only physical objects and social objects.

Let us amend that structure such that the domain of objects is first subdivided into physical objects and abstract objects, and that social objects are a subdomain of abstract objects. Other abstract object subdomains might be propositional objects (PO), for instance. Then, *book* may be represented as book$_{TK \cup POK}$.

In order to compose *book* with a predicate like *heavy*, which predicates only of physical objects, the richer meaning of the noun must be specified for that particular context. This is done via the application of one of the the operators SPEC, which selects only one of the domains that a polysemous expression belongs to. The SPEC operator relevant for this case is defined below.

(185) SPEC: λP: P$\subseteq$T$\cup$POK (λx: Tx)[Px]

Once this is done, *book* is no longer polysemous, it is simply a set of book-as-physical-object individuals. It can therefore satisfy the sortal restrictions of a predicate like *heavy*.



Note that in both cases here, either *team* as coercion or *book* as polysemy, the sort-shifting operations shift and SPEC (i) apply DP internally and (ii) do not preserve the original meaning of the expression they apply over. The account will thus suffer from the same limitations we have already seen when faced with co-predication data. Namely, once either SPEC or SHIFT apply, if a second predication relation demands that the expression be interpreted either in its original meaning, for groups, or as belonging to one of the other domains that a polysemous noun originally belongs to before it is simplified, those sortal restrictions will no longer be able to be met.

Thus while Dölling develops a system which integrates more fined grained knowledge representation of ontological categories into the interpretation mechanism, and does so in a way that preserves much of the apparatus that formal semantics has been developing for the treatment of nominal meaning, such as the mereological approach to plural and mass expressions and the use of type-shifting operators, the way in which that system is implemented fails to account for the empirical range of meaning flexibility in natural language.

Recall that the main obstacles for deriving well-formed co-predication sentences in Dölling's system was that (i) type and sort-shifting operations apply over the nominal itself and (ii) they do not preserve the original, pre-shift, meaning. Therefore, once a polysemous noun like *book* has been shifted into a simple predicate of book-as-physical-object, the book-as-propositional-content meaning is no longer available for any further predication relations. It cannot be shifted a second time to satisfy the second predicate without making the first predication ill-formed.

A similar problem is well known in the analysis of the ambiguity between collective and distributive interpretations of plural NPs in context. Although in that literature the connection with co-predication broadly is not always explicitly made, in coordinate environments the predication in each conjunct may mismatch with respect to this property. In (186), *meet* predicates of *the women* collectively, but in the second conjunct *had-an-expresso* distributes over the it.

(186) The women gathered and had an expresso.

Well-established treatments for distributivity deal with such cases by positing a covert distributive operator D as a predicate modifier. D maps a predicate over atoms to a predicate over pluralities. It does not shift the meaning of the plural NP from a sum individual to a set of atomic individuals. Rather, it universally quantifies over the atomic parts of that sum.

(187) $\text{D } (\text{P}_{<et>}) = \lambda \text{x} \forall \text{y} \in \text{x } [\text{P(y)}]$

(188) a. The women met and had an espresso.

b. $\text{D(have-an-espresso)} = \lambda \text{x} \forall \text{y} \in \text{x} \exists \text{z} [\text{espresso'(z)} \wedge \text{have(y,z)}]$

c. $\text{meet'(G)} \wedge \forall \text{y} \in \text{G } \exists \text{z} [\text{espresso'(z)} \wedge \text{have'(y,z)}]$

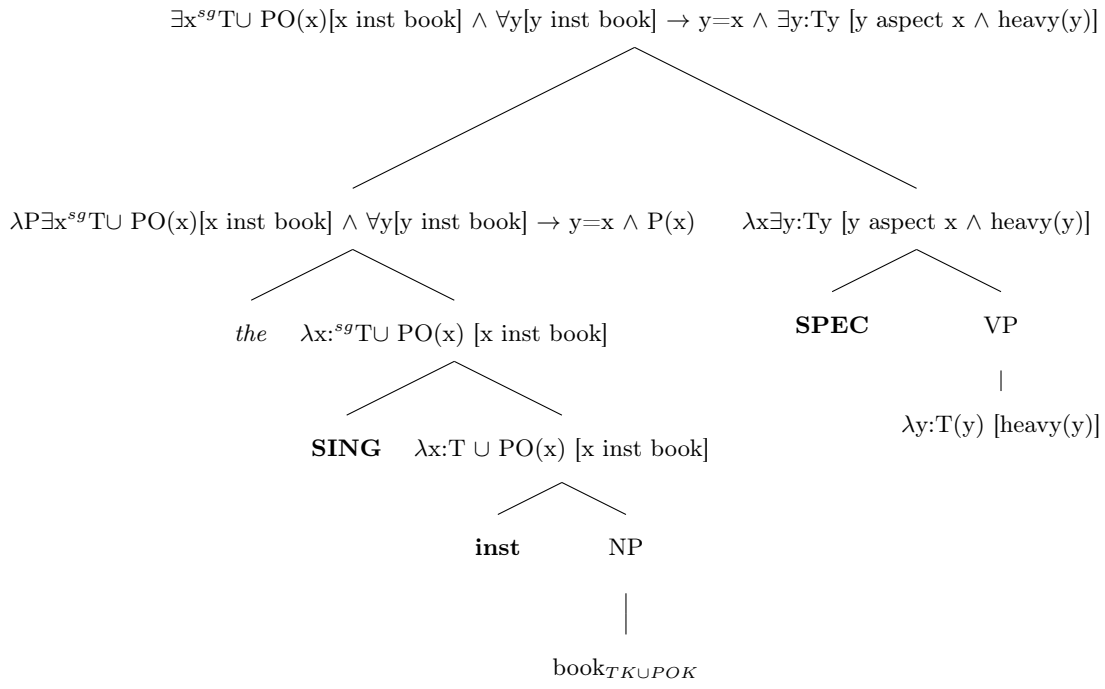
In effect, shifting the denotation of the predicate via D rather than the plural subject is what allows it to serve as argument to both conjuncts. D manipulates the selectional restrictions of the predicate it modifies. Other predicate modifiers with similar functionalities have been proposed. The treatment of noun incorporation in Chung and Ladusaw(2004), which motivates the proposal of RESTRICT as a mode of composition, can be thought of in a similar light. RESTRICT allows a property-denoting argument to compose directly with an entity-selecting predicate by treating the property as a derived restriction on the predicate's term corresponding to the direct object. After composing with *dog*, in the schematic *Jim dog-fed*, *feed* requires its argument to be of the sort *dog*.

Then, either that term is existentially bound later, guaranteeing saturation, or the predicate takes a distinct entity-denoting argument. In either case, RESTRICT shifts the selectional restrictions on that argument position through composition.

In what follows we modify Dölling's SPEC and SHIFT operators in much the same way, treating them as predicate modifiers. Moreover, the operations themselves are modified in order to preserve the original denotation of the NP, by introducing a new variable which is determined to be in as ASPECT relation it. We return to what this relation amounts to below.

SPEC is now a function from a property P to a function from complex sort entities to truth value, such that there is an entity standing in a ASPECT relation to the complex object which satisfies P.

(189) SPEC template: $\lambda P \lambda x \exists y$ [z ASPECT x $\wedge$ P(y)]



Recall that polysemous expressions in Dölling are said to be in the union of two or more sort predicates whose intersection is empty. If we wish to maintain that approach, then intuitively, x is an aspect of y if y is a polysemous expression in the union of sort predicates P∪Q and x is in either P or Q. Moreover, x and y must be instances of the same kind, to avoid spurious relations between subtypes.

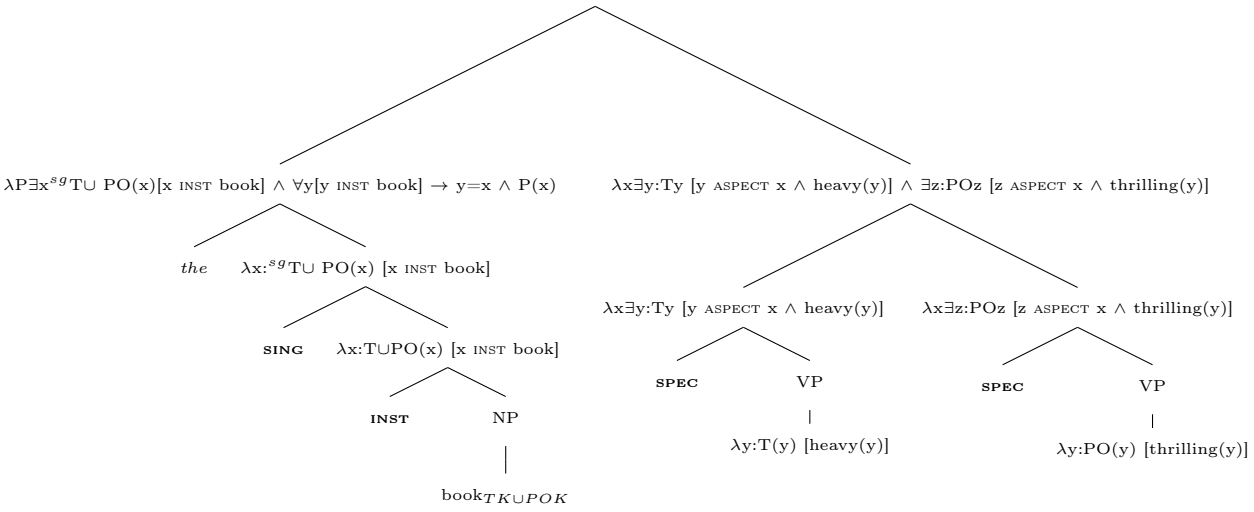
(190) ASPECT(first attempt):

∀xy [x ASPECT y → ∃z:OKz [x INST z & y INST z] & P∪Q(y) & P(x) ∨ Q(x),

where P and Q are sort predicates and P∩Q = ∅

In what follows we show how this modification allows the well formed derivation of the co-predication in (191):

(191) a. The book was heavy and thrilling.

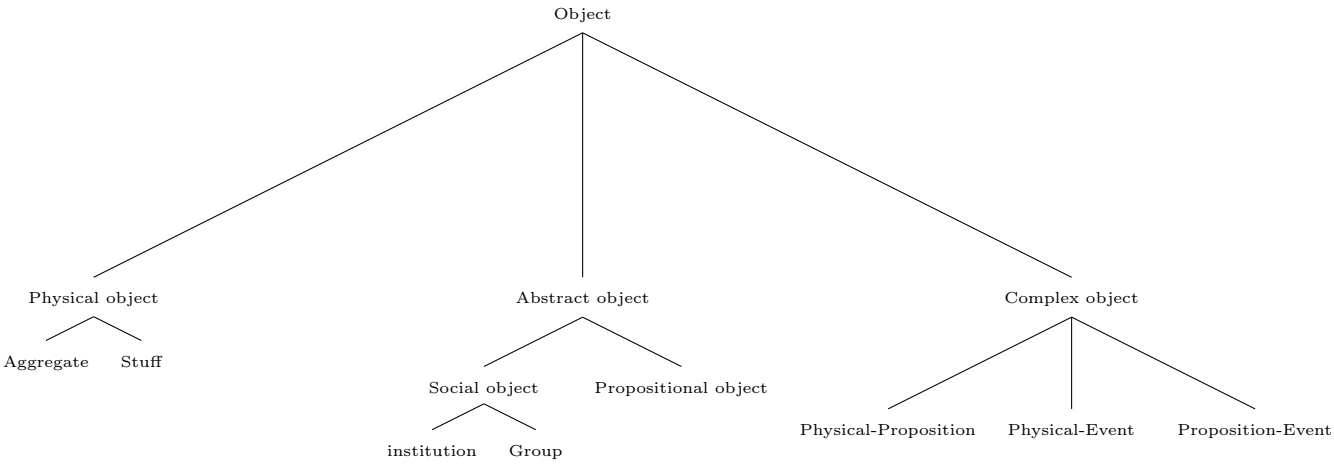


Allowing the sort shifting operators to apply over predicates rather than arguments is then enough to derive well-formed co-predication. SPEC applies locally and introduces a new variable of the appropriate sort in each conjunct, but these must be both related to the same complex entity.

However, note that the ASPECT relation as we have defined it is unlike the other operators in the system, which map individuals in distinct domains to one another. This is because polysemes are treated as belonging to the union of two different domains. To put it differently, there is no simple domain in the ontology that corresponds to complex objects of the *book* kind, entities which are conceptually both physical and abstract, and that are defined precisely as being so: a book is a book only if it is a sort of physical object that contains information of a propositional sort. It is in essence complex, but the reference of a DP headed by *book* is contextually determined, depending on what aspect of that object is

being targeted.

If we wish then to capture this intuition in this framework, and approximate the aspect relation to the other mechanisms that explore sortal information in composition, we must augment our ontology to recognize an independent domain of complex entities, a subtype of the object sort alongside physical objects and abstract objects. This move would also allow us to identify entire polysemy classes in the ontology, having *book*, *newspaper* as subtypes in the domain of PHYSICAL-PROPOSITIONAL objects, *lunch*, *dinner* as subtypes in the domain of PHYSICAL-EVENT, *play*, *lecture* as subtypes in the domain of PROPOSITIONAL-EVENT, etc. [3]



The ASPECT relation can then map entities in the domain of complex objects to the domain of one of its constituent sorts, and be fully parallel to the relations that link distinct domains, such as CONSTITUTE between things and stuff, and INSTANTIATE, between kinds

[3]These would of course not be unlike the dot-types of Pustejovsky (1995) and Asher (2011), since they are motivated by the same intuition. They are, however, formally different from Asher's, where dot-types are product types, largely due to the implementation of types as proofs.

and objects.

(192) a. ASPECT(general): $\forall xy$ [x ASPECT y $\rightarrow$ O(x) & CO(y)]

b. $\forall xyz$ [CO(x) $\rightarrow \exists y \exists z$ [P(y) & Q(z) & y ASPECT x & z ASPECT x]

It is possible as well that aspect will be simply a template for various more specific relations. This is because the definition above is quite general, and does not specify which domains can be linked to the COMPLEX OBJECT domain via ASPECT. At the moment, it is difficult to generalize in a constrained way, to capture the right sort of relations, so we might imagine then an ASPECT for each class of complex object, rather than for the domain as a whole. For instance, the PHYSICAL - PROPOSITIONAL complex domain can be related to its constituent domains via the following specialized version of ASPECT:

(193) ASPECT(PHYSICAL-PROPOSITIONAL)

$\forall$XY [X ASPECT$_{PhysProp}$ y $\rightarrow$ Phys(x) $\vee$ Prop(x)& Phys-Prop(y)]

$\forall xyz$ [Phys-Prop(x) $\rightarrow \exists y \exists z$ [Phys(y) & Prop(z) & y ASPECT x & z ASPECT x]

Generalizing in a better way over the specialized ASPECT relations is a desirable goal for the future, since it gives us a window into what restricts the possible classes of polysemy. That is, what relations mediate the construction of complex objects? What privileges those relations, such as containment, membership and constitution, which are all related to individuation conditions?

It seems nonetheless that these individuation relations are privileged *in language*. There are many other relations that do not seem to underlie polysemy, and yet can be reasonably taken to be crucial for the ways in which sorts are characterized. Take for instance the functional part-whole relation. A bicycle, in virtue of being a bicycle, has a number of parts with particular functions: it must have a handle, a seat, a frame, wheels and a chain. Complex living beings such as mammals, in virtue of being mammals, have internal organs, a skeleton, blood. But these part-whole relations do not license the use of the same name to refer both to the a bicycle's handle and a bicycle as *bicycle*, in the way that the relation between a bounded heap of pages and the content of an essay allow both to be referred to as *book*.

While unifying aspect with other sort-shifting relations is desirable, it also calls attention to the fact that in our system right now some of these relations underlie both polysemy and coercion that shift sorts within the entity domain. For instance, if we think of one the relations that mediate between the two aspects of *book* as containment (the physical object contains the propositional object), that is the same relation that mediates between containers and the stuff they contain, though the first case is treated as a primitive complex object, and the second as a derived one. The distinction in our system is simply that polysemes always introduce a complex, unspecified meaning, while coercion must be triggered by sortal mismatches.

But coercion also does not result in making other interpretations for the nominal that are possible in principle unavailable for other predication relations within a sentence, as

illustrated in (194) below. In (194a) *finish* triggers complement coercion on *book*, such that the nominal is interpreted as some event in which the book is relevant, such as reading or writing, but in the main clause *book* is still interpreted as an entity, because it satisfies the sortal restrictions of *burn*. The same is true in where the main clause predicate selects for the abstract reading of the noun. In (194c) all three interpretations - physical object, propositional content object and event - must be available simultaneously.

(194) a. Ana burned the book that she finished last week.

b. Ana translated the book that she finished last week.

c. Ana translated and burned the book that she finished last week.

6.2.4 Revised Dölling on groups

Having set up the general framework, we may now return to our main empirical problem, namely how to represent the ambiguity of group nouns and derive their behavior in context. For clarity, let us review our desiderata. A representation of group nouns must allow (i) that they be interpreted as abstract, social institution individuals, (ii) that they be able to be associated with a plurality of human individuals through a membership relation and (iii) that the membership relation be encoded in such a way as to make both interpretations available within a single sentence.

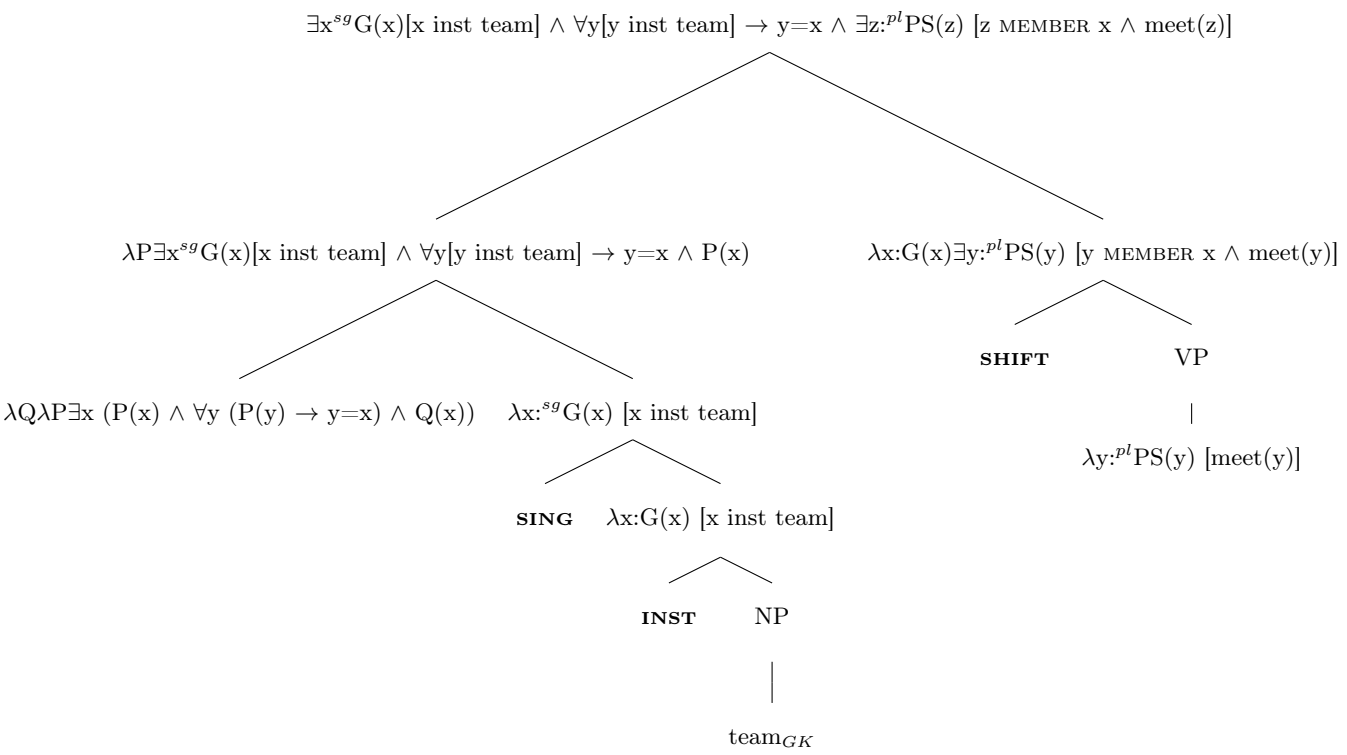
For Dölling the source of the meaning flexibility of group nouns is the availability of a productive coercion operation mapping the domain of groups to the domain of persons.

That is, the atomic, abstract interpretation of a noun like *team* is basic, and the plurality one is derived in the context of a sortal mismatch. We have seen before that, as defined, the SHIFT operation wrongly predicts infelicitous co-predication for the same reasons as the application of SPEC, namely because it shifts the nominal itself. We therefore modify SHIFT in the same way so that it is defined as a predicate modifier, taking us from a predicate over persons to a predicate over groups, introducing again a new variable of the sort required by the predicate and relating it to the group.

(195) SHIFT: λP:P$\subseteq$PSλy:^{sg}Gy$\exists$x:^{pl}PSx [x MEMBER y $\wedge$ P(x)]

(184a), repeated bellow as (196) is now derived as shown in the figure below. As before, nouns denote kinds, and come to denote properties via the application of INST, which returns all individuals, atomic and sums, that instantiate that kind. The singular operator SING then further restricts its denotation to only atomic individuals. I am assuming a Russelian, quantificational, translation of the definite determiner *the*, rather than Dölling's δ. We can opt here for that definite description translation precisely because the sort-shifting operator applies over the predication, though nothing hinges on this particular treatment. The next section discusses some further advantages of this treatment in the interaction of sort-shifting and quantification.

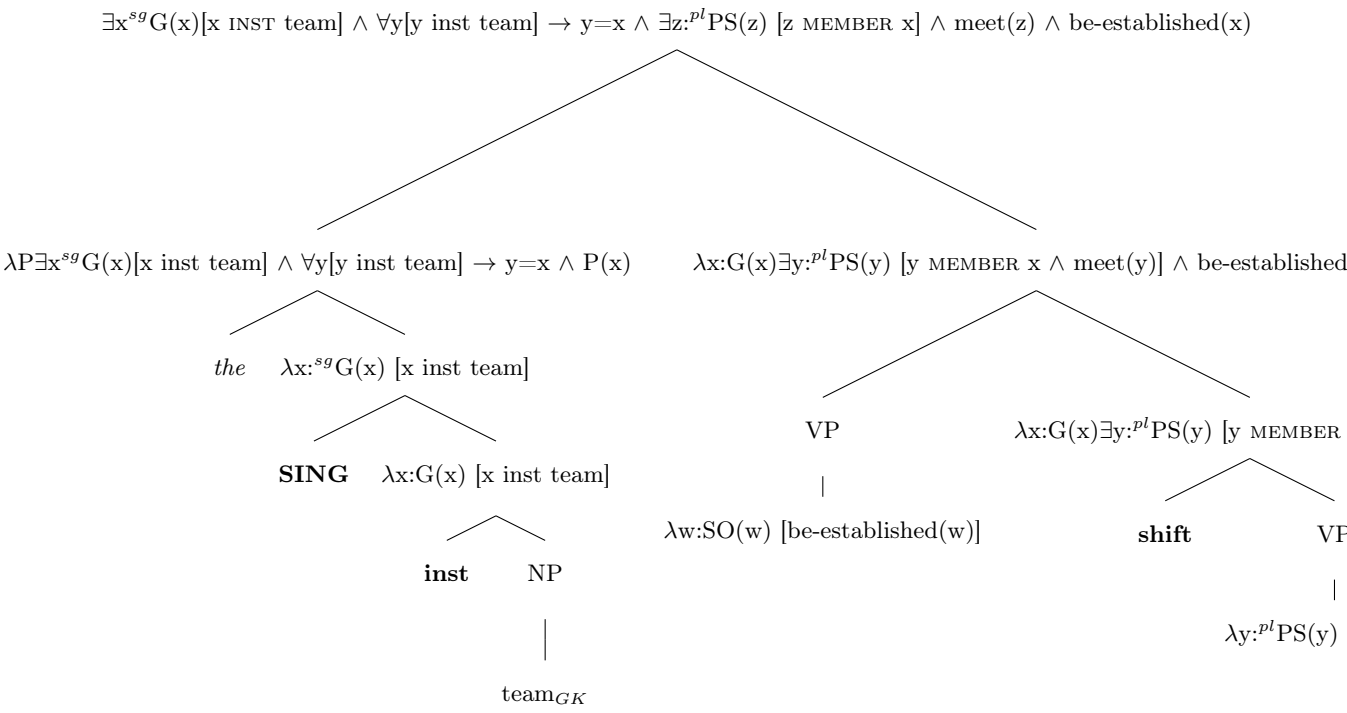
(196) The team met



At the outcome of the derivation above *meet* is predicating over a plurality directly, but I am making no commitment at this point about whether a predicate like *meet* imposes other conditions lexically, or whether it interacts with covert operators. The crucial point is simply that after SHIFT introduces the plural individual corresponding to the sum of the members of the team, one can import one's favorite analysis for plurals from this point on.

By the same reasoning as the polysemy cases, it is now possible to integrate another predicate into the sentence without requiring that its sortal restrictions meet those of other predicates, since SHIFT relates a predicate's term to the nominal without altering the nominal's denotation. Therefore *meet* can be coordinated with a predicate selecting for a singular group individual, such as *be-established*, as desired.

(197) The committee was established last year and met for the first time this morning.



Be-established is translated as restricted to the domain of SOCIAL OBJECTS, or SO. Once it is coordinated with the shifted *meet*, we have indicated most specific restriction for the coordination, namely the sort GROUP. Since GROUP is a subdomain of SOCIAL OBJECT, the restriction of *be-established* can be satisfied. Admittedly, however, we have not defined a systematic way to determine the sortal specification of coordinations in general, or even more broadly how sortal specifications interact outside of functional application. In Asher (2012), type specifications interact in the type presupposition parameter, and are bound or accommodated via the same mechanisms used for presupposition binding and accommodation outside of the type system. In Dölling's system however that interaction is not fully spelled out. Though the issue is important, I will leave it aside for now as a promissory note

so that we can focus attention on the case of group nouns for the time being.

6.2.5 Beyond co-predication: returning to the original data

The account proposed in the last section therefore enables us to capture the behavior of group nouns in co-predication environments. In this section we ask whether it is also able to account for the properties of group nouns outlined in section 1.

(198)

Atomic behavior	**Example**
a. Properties not shared with members	*The team had four members*
b. Compatibility with *Every* and *Each*	*Every/Each team left late.*
c. Compatibility with *Whole* and *Entire*	*The whole/entire team quit last year*
d. Antecedent to singular pronoun	*The team lost. It was unprepared.*
e. Lack of distributivity with coordinate VPs	*The team is singing and dancing.*

Properties (a-b) are predicted under the proposal since group nouns' basic interpretation is atomic, that is, they are kinds whose criteria of individuation defines atomic individuals of the social institution sort. Under that representation, they are therefore expected to pattern like count nouns of other sorts. Hence an individual group will have properties independent of their members, properties appropriate for abstract social objects but not for human individuals.

As sets of atomic individuals, they will also be able to be quantified over by universal operators. However, *every* and prenominal *each* never look inside groups, meaning they do not seem able to quantify over the members of the groups. *Every team* is not ambiguous between *every individual team* and *every member of the team*. Intuitively this seems right, since access to the members requires interpreting the group as a plural individual, and *every* and *each* do not compose with plurals. Under no interpretation is *the team* treated as *the set of members of the team*, it is equivalent only to *members of the team*, in the coerced contexts.

Recall though that in the proposal sketched previously, access to the sum of individual members of a group is not automatically available. It is triggered by a sortal mismatch, which invokes a shift operator and which only introduces a plural individual locally in the VP predication. The quantifier takes the basic denotation of the NP in its restrictor. In the example in (b) in the table above, even though *every* and *each* quantify over a atomic individuals, the VP requires that we interpret the group as the sum of its members, since abstract social objects cannot satisfy the animacy requirements of *leave*. This is unproblematic for us since the plural individual, which is in a MEMBER relation with the group, is only introduced in the nuclear scope, bound by an existential quantifier.

We therefore predict that indeed *every* and *each* should not only be compatible with groups, but that they never have access to the plural individual in these configurations, even though the VP forces coercion to take place, as desired. In Dölling's original proposal, where SHIFT applies over the DP, it would be impossible for the group noun to be both compatible with

every and satisfy the VPs sortal requirements, for the same reasons that co-predication was unavailable.

The issue is in fact more severe. Given the way that the host of shift operators are defined in Dölling, their interactions with quantificational operators are at best unclear. His definition of the SHIFT operator that maps groups to members is repeated below. It is a function from a predicate of singular groups to a predicate of pluralities. In the examples provided SHIFT applies over the DP containing the definite article. This is viable only because of the non-standard translation Dölling assumes for the definite determiner, which does not take the VP as its nuclear scope. But unless all determiners are treated in similar non-standard ways, SHIFT will not be able to apply over the full DP, since they will not be properties of singular group individuals.

(199) SHIFT: (λx: ^{sg}Gx) (λP: P$\subseteq$ PS) ($\exists$y: y^{pl}PS $\wedge$ y MEMBER x) [Py]

Alternatively perhaps in quantified DPs SHIFT applies bellow the determiner. This by itself will also not fix the compositional problem without assuming non-standard quantifiers, since the quantifier will itself introduce a predicate variable for the VP, and the one introduced by SHIFT (P above) will not be bound. Assuming as we do that *shift* applies over VP instead bypasses these issues and allows the use of standard generalized quantifiers if desired.

With respect to property (c), the compatibility with modification by *whole* and *entire*, while groups pattern like singular count nouns in being admissible at all, the resulting interpreta-

tion is quite different. **The whole students* is ungrammatical, it cannot be equivalent to *all students*. *The whole student* quantifies over parts of the student, however we would like to define that parthood relation. Now, *the whole team* is sometimes equivalent to *all the members of the team*, which is expected under Dölling's account since the parthood relation in the domain of groups is group membership. Through this parthood relation we gain access to the members of the group whilst treating the group noun itself as a singular individual. This seems to be precisely what *whole* does: it selects for singular count nouns and quantifies over their parts, whatever they happen to be. An approach like Barker's, for instance, has difficulty accounting for this because it only gains access to members by shifting the meaning of the noun to the sum of its members through the membership function f, but once the shift takes place the NP is no longer singular, so it cannot satisfy the restrictions of *whole*.

The last property, namely the apparent lack of distributivity in VP coordination with group DP subjects, observed by DeVries (2014), does not follow from our proposal. In one sense, it is true that if groups are interpreted as atomic individuals, the conjuncts would have to be true of that one individual simultaneously, thus we would expect that indeed a sentence like in (c) cannot be true in a situation where some members of the team are dancing and some are singing. However, *sing* and *dance* should invoke the coercion operation mapping the group to its members. Once shift applies, we in fact expect groups to behave exactly like plurals - the sentence should be equivalent in this respect to *The members of the team are singing and dancing*. Yet, it isn't. DeVries took this as indication that group nouns simply do not make the plurality of members available to computation.

The problem, however, is that groups seem to be distinguished from plurals in some distributivity constructions, though not others. This leads us to the original data showing how groups pattern with pluralities, summarized again in the table below.

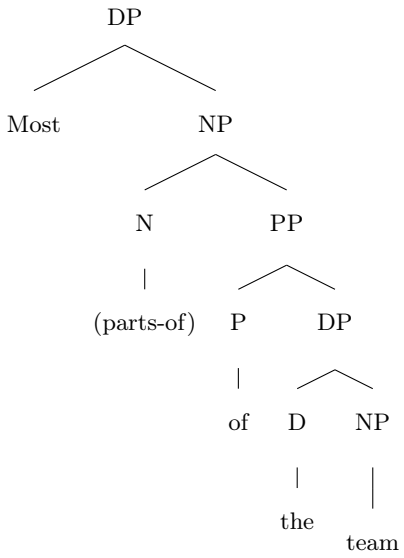
(200) Summary of Plural Behavior

a. Collective predication and modifiers	*The team gathered in the park/built a house*
b. Distributivity predication and (some) operators	*The team was very tall/had an espresso eac*
c. Reciprocal predication and pronouns	*The team disagreed all the time/was nice to*
d. Count determiner in partitives	*Many/Several/Most of the team quit last ye*
e. Antecedent to plural anaphor	*The team lost. They were unprepared.*

If collective predicates like *gather* require arguments to be sum individuals, then our approach accounts for the well-formedness of (a) straight-forwardly. After SHIFT applies, the argument of *gather* will be of the right sort, related to the group individual via the MEMBER relation. The same should be true of the lexically distributive predicate in (b) and the lexically reciprocal one in (c).

The compatibility with count determiners in partitives, illustrated in (d), is less trivial, since internally to the partitive the group DP should simply denote an individual group. However, *most of the team* seems to quantify over members of the team. This suggests that something in the structure and interpretation of the partitive construction itself connects groups and their members. Note that **most team*, where the quantifier composes directly with the morphologically unmarked group noun does not have the same interpretation. This is another piece of supporting evidence for applying SHIFT over predicates, and not the group

noun itself, or *most team* could have the same interpretation as *most members of the team*. Chierchia's (1997) analysis of the partitive construction might offer a way to access the members of a group without the use of the coercion operator over the noun. That analysis assumes a null nominal head that mediates between the determiner and the PP, which is interpreted as a part-of or component-of relational noun.



If the relevant parthood relation in the group domain is group membership, and the the head in the partitive construction can be sensitive to different parthood relations for different sortal domains, then it will be able to work with groups through much the same way it does with plural nouns, without requiring that we treat the group DP complement of P as a sum individual. Note that when the complement DP in a partitive is a singular count noun, as in *most of the chair* it seems intuitively right that *most* quantifies over parts of the chair, though that parthood relation is also not the same that connects plurals and their parts.

The consequence here is that we have two avenues to access members of a group - because of its constituent parts, for operations that target constituent parts directly, and because the noun can force an interpretation of the predicate it combines with that introduces a sum individual corresponding to its constituent parts. The source is the same in both cases, but the mechanisms interacting lexical and ontological knowledge of groups into linguistic representation are diverse.

Returning now to the restriction on certain kinds of distributivity over groups, DeVries (2014) argues that group nouns are generally incompatible with Q-distributivity, namely, distributive readings that rely on the presence of overt distributive operators, as opposed to those that arise due to lexical properties of predicates, or P-distributivity. The coordination data is therefore taken as only one illustration of that restriction. She also notes the distinction between plurals and groups in the context of distributivity that relies on the presence of a quantificational object, and reciprocal readings derived by the presence of *each other*.

(201) a. The students bought a book. (possible: = Each student bought a book)

b. The class bought a book. (claimed not possible = Each student in the class bought a book)

c. The students called each other.

d. #The class called each other.

e. The teacher told the class to be nice to each other.

It is unclear however just how representative those examples are of the entire class and what the precise source of degradation is. There seems to be some variation with respect to examples like (201b). DeVries (2014) claims that distributivity over groups in those contexts becomes acceptable to the extent that it is possible to construe the indefinite not as quantificational, but as a property, such that distributivity in these cases is equated to lexical distributivity. The same is true for numerical objects (202b). In (202a) the distributive reading is certainly not only possible, but the most salient one.

(202) a. The team is wearing a blue shirt.

b. The team received four prizes.

DeVries' (2014) treats these as special cases in order to maintain an analysis under which access to the members of the group is not possible. That is, distributivity with indefinites and numerical objects will be given by the possibility of treating these objects as non-quantificational, higher-order properties, and extending the possibility of lexical distributivity beyond one-place predicates. Treating these cases as exceptional is a necessity in her account, because it must follow from her proposal that sentences like (202) simply do not have a distributive reading otherwise. In other words, the analysis is too restrictive without these extra assumptions.

For the current account, the problem is reverse. We predict, based on combinatorics alone, no distinction between (201b) and (202), just as there is no contrast between the corresponding sentences with plural subjects. To the extent that such a distinction is to be captured by

the semantics of group nouns, we would overgenerate. Allowing the distinction to arise due to contextual factors might in fact be advantageous. This is because access to members is less likely attributable to P-distributivity in the presence of binominal *each*. The same is true of reciprocal pronouns.

The only context in which it seems that group NPs cannot be interpreted as the sum of the group's members is VP coordination. But the split reading in coordinations does not seem to simply require a semantically plural subject. Consider the contrast between the plural definite description on the one hand and the proportional and partitive DPs bellow.

(203) a. The boys were drawing and sleeping.

b. #Most boys were drawing and sleeping.

c. #Several of the boys were drawing and sleeping.

To the extent that (203b) and (203c) reveal some extra condition on such split readings and the interaction of the distributive operator with other elements in these contexts, it seems that there is a possibility that the unavailability of these readings for groups cannot be attributable to their group status alone. I leave a more in depth examination of these facts to a future point.

Finally, we have seen that group nouns seem to serve as antecedents to both singular and plural pronouns. In fact, group terms may be picked up by a singular pronoun even when they are interpreted as the sum of its members for the sake of the predication in the sentence

that introduces it, as in (204b). The reverse is also possible in (204a), where it is introduced in a sentence in which the group is treated as atomic, but it is picked up by a plural pronoun because the predication in that sentence requires a plural argument.

(204) **Mismatches in number in anaphoric relations**

a. The committee was established last year. **They** met for the first time this week.

b. The committee voted to impeach the president. However, **it** doesn't legally have that power.

In the noun denotation is itself shifted, these facts are as hard to explain without further assumptions as the co-predication data. It seems that those sentences would simply introduce a discourse referent of the sort necessary for the initial sentence.

What kind of discourse referents group nouns do introduce is an interesting question I will continue to pursue. These facts do suggest however that we should preserve the ambiguity of group terms even after their meaning is indirectly specified for the purposes of meeting local selectional requirements. Moreover, the question is relevant for the discourse status of polysemy and coercion more generally, as indicated by the examples below.

(205) **Polysemy, coercion and anaphora**

a. The book was burned before it was finished. (it = coerced event)

b. The school announced budget cuts after it was renovated. (it = physical building)

c. That chicken was feisty but it turned out to be delicious (it = "ground" noun)

Carlson (1977) notes a similar behavior for bare plural DPs in English, which can be interpreted as a kind in one sentence and in a following sentence be anaphorically related to a pronoun that must be interpreted as an instance of that kind, as in (206a). In the first sentence *widespread* demands that *bears* be interpreted as a kind individual, but in the second sentence *they* must be interpreted as instances of the kind *bear*, in order to satisfy the requirements of *be seen*. Bare plurals in English nonetheless behave differently from group nouns, since *bears* can not be picked up by a singular pronoun, even in a sentence where the pronoun must be interpreted as the kind individual, as in (206b).

(206) a. Bears are widespread. They can even be seen in my backyard.

b. Bears are widespread. #It is not in danger of being extinct.

One way to understand the behavior of group terms in anaphoric relations is to rely on the same mechanisms that are known to underlie bridging anaphora, illustrated in (207a), where the uniqueness/familiarity presupposition of the definite *the tire* seem to be accommodated due to world-knowledge of the part-whole relation between *car* and *tire*. But while this relation licenses the accommodation of the definite presupposition, it does not seem to license the use of a pronoun picking up only a part of its antecedent, since (207b) is infelicitous.

(207) **Bridging**

a. That car is not going to go very far. The tire is flat.

b. That car is not going to go very far. #It is flat.

Chapter 7

Conclusions

The main narrower aim of this dissertation has been to inquiry into the nature of the ambiguity of container pseudo partitive phrases and committee nominals in English. In particular, as a starting point I have been interested in the question of how these cases fit into a broader landscape of nominal meaning flexibility with respect to how the multiple interpretations that an ambiguous expression gives rise to are related to one another and whether those interpretations arise from representations that stand in competition with one another for any single instance of the expression.

The question is at the onset articulated in such a way because the observation seems to be that ambiguous expressions are themselves interpreted in one way or another in different contexts, which are distinguished based largely on the types of predication relations those expressions are able to enter into successfully, given their ability to satisfy selectional

restrictions.

That is, at the start we assume that an ambiguous nominal such as *that book* is itself interpreted as an entity of the physical sort in (208a) because the predicate *be burned* requires its argument to denote that sort of entity. Conversely, we have articulated the question assuming that *that book* can also be itself taken to denote an entity of the information sort because it is able to satisfy the selectiional requirements of *be translated* in (208b).

(208) a. That book was burned.

b. That book was translated into 7 languages.

That was also at the onset the way in which observations about the behavior of container phrases and committee nominals were articulated. That is, in certain contexts they denote one type of entity - a container sort or social object sort, respectively, and in others another type - of the sort of the contents nominal, or of the person sort.

The assumption that runs through this formulation is that in order to satisfy those selectional restrictions, the nominal expression has to denote the sort of entity that is directly compatible with them. Hence, the expression itself denotes different sorts of entities in different contexts. There is no indirect way to satisfy those requirements.

We have seen how this assumption must be challenged given the behavior of polysemes such as *book*. Observing their behavior in copredication, we have seen that systematic meaning flexibility challenges the view that observing a nominal expression satisfying a certain type of selectional restrictions directly allows the inference that they themselves denote the sort

of entity required by the predication relation.

In simple terms, what we have concluded is that a polyseme like *book* does not at times denote an entity of the physical sort and sometimes an entity of the information type, but that it denotes an entity that has both a physical aspect and an information aspect to it, and that different predicates can target different aspects simultaneously.

A sentence such as (208a) asserts something about the physical aspect of the book in question, while (208b) asserts something about its information aspect. We have seen how in frameworks such as Asher's (2011) compositional mechanisms that allow this relativized predication to come about can be formalized.

The main lesson however is just this: observing that a nominal expression is able to enter into predication relations that impose distinct selectional requirements should not immediately lead one to posit distinct representations and interpretations for the expression itself. Crucially, this road will be inadequate for nominal expressions that are able to support copredication. In other words, meaning flexibility is not always meaning multiplicity.

Container phrases and committee nominals proved fruitful empirical grounds for investigation because they had been previously been analyzed in a formal semantics tradition in works that strongly withhold, tacitly, this precise assumption about meaning flexibility. Because committee nominals, for instance, can be observed satisfying the selectional requirements of predicates such as *be founded*, they sometimes denote an entity of the social object sort (and is moreover interpreted as an atomic entity if unmarked for number), and because they can

be observed satisfying selectional requirements of predicates such as *gather*, they sometimes denote an entity of the person sort (and is moreover not an atomic entity, since it participates into plural predication). Similar observations were made about container phrases.

Against the background of a more sophisticated understanding of meaning flexibility with respect to polysemes of the *book* type, however, we have been able to reformulate both observations and questions about the cases of container phrases and committee nominals.

Container phrases and committee nominals can be seen satisfying distinct types of sortal selectional requirements. We may then ask whether they do so because they may themselves denote entities of different sorts in different contexts. One reliable way to ask this question is to ask about their behavior in copredication environments.

We have shown that both container phrases and committee nominals support copredication. This has immediate implications for how we may account for their behavior: any account that employs meaning shift operations targeting the nominal itself, or which relies on distinct lexical entries, will always predict copredication to be illformed.

Given our results, the natural follow up was to ask whether container phrases and committee nominals can be analyzed using the same tools used for dealing with copredication for polysemes. Here, we have considered two mains proposals, that of Asher (2011), and a slightly modified version of Dölling (1995). Assessing the possibility of using those formal tools to analyze the cases of container phrases and committee nouns is productive both because, if successful, it eliminates the need for specialized means of dealing with those cases,

incorporating them into a broader typology of meaning flexibility and because it broadens the empirical coverage of such frameworks, illuminating particular challenges.

The case of container phrases and committee nominals in English is also interesting because it calls attention to the matter of the ambiguity of pseudo-partitives in English more generally, where I am including pure measure phrases (*kilo of ice cream*), part phrases (*slice of cake*) and collective nominals beyond committee ones (*pile of dishes, collection of records, swarm of bees*), which are interestedly ambiguous on their own, but which together also can contribute to a better understanding of what sorts of relations underlie meaning flexibility.

Recall from our first intuitive characterization of polysemy that one of the main properties that distinguished it conceptually from homonyms, independent of their behavior in copredication, is that what we then called different senses or meanings of a polyseme are systematically related to one another, whereas the different meanings of a homonym are not. In engaging with the question of the role of sortal information in natural language meaning, we are able to refine this matter by saying that there are systematic relations between the sorts of entities that a polyseme seems to denote in different contexts. That is, for *book, magazine, newspaper*, there is a systematic relation between the sort of physical objects and the sort of information objects when the information referred to is graphically represented on that physical object, it is "contained" in it.

Likewise, there is a systematic relation between the sort of social object and the sort of persons when the persons referred to are members of the social object, and a relation between the sort of containers and essentially any sub sort of physical objects when the physical

objects referred to are in a containment relation with the container.

In Asher's (2011) system, those relations are represented in the model of complex types itself. In Dölling (1995) those are maps between nodes in a sortal hierarchy. But, I believe, a serious question remains: what is special about these relations? Why do we observe meaning flexibility mediated by these, but not other relations, such as possession, or functional part-whole relations?

Logically, in order to answer these questions, we first need an inventory of the relations that we observe mediating meaning flexibility empirically. If the copredication test is reliable as I have been assuming, we may now add to that inventory both containment and the sort of membership involved in the case of committee nominals. I refer primarily at this point to relations between different sorts of entities. We also find of course the same type of meaning flexibility with nominals that relate a sort of entity to a sort of event, for instance (*a long/delicious lunch*).

Once there is a better understanding of what relations do mediate meaning flexibility, then we may ask whether there are properties that unify these, and that distinguish them from other relations that lack those properties. If successful, such a project has the potential of leading the way to a more explanatory and predictive theory of meaning flexibility in the nominal domain. This is, I believe, the central goal for future work engaging with these questions.

Chapter 8

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