POLYSEMOUS NOUNS AND COPREDICATION

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A mi hermano, a mis padres y a mi abuela María,

a quienes siempre tengo presentes.

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(Quino, 1992)

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Resumen

La polisemia es un recurso lingüístico que empleamos de manera habitual. De hecho, la mayor parte de las palabras que utilizamos a diario son polisémicas. Desde el punto de vista de la lingüística y la filosofía, elucidar qué es la polisemia no es tarea fácil. Una definición ampliamente aceptada es que una palabra es polisémica cuando tiene varios sentidos relacionados entre sí y cuyo uso es tan habitual que se ha convencionalizado. Por ejemplo, palabras como *colegio* o *botella* tienen más de un significado convencional: la palabra *colegio* puede referir tanto a un edificio -en la oración *el colegio se incendió*-, como a un grupo de personas -por ejemplo, *el colegio celebra el fin de curso*- y la palabra *botella* puede utilizarse para hablar de un recipiente -por ejemplo, *se me rompió la botella*- o para hablar del contenido del recipiente -*se derramó la botella*-.

La polisemia genera varias preguntas que aún no tienen una respuesta bien consolidada. El primer problema que plantea es la diferencia entre polisemia y la homonimia. Algunos experimentos en psicolíngüística (Beretta *et al.* , 2005, Frazier & Rayner, 1990, Klepousniotou, 2002) sugieren que los sentidos de algunas palabras polisémicas facilitan el acceso a otros sentidos de la misma palabra; en cambio, en los casos de homonimia, lo que encontramos es inhibición, es decir: los significados "compiten" por ser seleccionados.

Un segundo problema que se plantea es cómo los sentidos de las palabras polisémicas son almacenados o representados en nuestro almacén léxico. Por un lado, la teoría del léxico de sentidos separados (SEL) propone que cada significado de una palabra tiene asociado una representación, a la cual accedemos cada vez que interpretamos esta palabra (Katz, 1972). Por el contrario, las teorías de la Representación Única (One Representation Theories) proponen que varios sentidos de una palabra polisémica pueden compartir una misma representación (Beretta *et al.* , 2005, Falkum, 2011, Frisson & Frazier, 2005, Rodd *et al.* ,

2002). Partiendo de esta última idea, son varias las teorías que explican cómo se almacenan los sentidos de una misma palabra polisémica en el léxico mental y cómo accedemos a ellos cuando interpretamos la palabras. En esta tesis se hace una clasificación de estas teorías.

En primer lugar, desde la perspectiva de las teorías de la Representación Única, es común defender una hipótesis de la infraespecificación semántica, según la cual, cuando los oyentes se encuentran con una palabra polisémica, a lo que acceden es a un significado infraespecífico que se especifica en el contexto si se requiere (Frisson, 2015). En esta misma línea, las teorías del "core meaning" afirman que hay un significado general y abstracto que define y delimita los significados que puede tener una palabra (Klepousniotou *et al.* , 2008, Ruhl, 1989). Por ejemplo, según esta hipótesis, la palabra *romper* (ver Spalek 2015) tiene un significado general y abstracto que resume todos sus posibles sentidos relacionados -incluyendo el de "cortar" en *romper la cuerda* y el de "quebrantar" en *romper la ley-*. Estas teorías parten de la idea de una "semántica delgada" (Thin Semantic Theories) en la que el significado infraespecífico tiene el menor contenido semántico posible y tiene que ser especificado en el contexto para que sea un concepto completo.

Frente a las teorías del core meaning, las teorías literalistas explican muchos casos de polisemia a través de mecanismos generativos, partiendo de un significado literal previamente convencionalizado (Copestake & Briscoe, 1995, Falkum, 2015). Por ejemplo, según estas teorías, la palabra *botella* tiene un significado literal -el sentido "recipiente"- a partir del cual se genera el sentido "contenido del recipiente" en la oración *se derramó la botella*.

Dentro de las teorías delgadas del significado, hay quienes proponen que el significado general es tan delgado que no tiene contenido semántico. Este significado delgado funciona como un indicador (Carston, 2013, Falkum, 2011)-

o como una instrucción (Pietroski, 2008) que facilita el acceso al concepto específico (el significado correcto de la palabra).

Por otro lado, muchos optan por una teoría rica del significado (Rich Semantic Theories), en la que los sentidos de las palabras polisémicas deben entenderse como aspectos interrelacionados dentro de una estructura conceptual compleja (Ortega-Andrés & Vicente, 2019, Pustejovsky, 1995). En este caso, cada sentido de la palabra *colegio* (el edificio, la institución, los trabajadores de la institución, etc.) es un aspecto de la estructura léxica de la palabra *colegio*.

Finalmente, a medio camino entre las teorías ricas del significado y las teorías delgadas, existen algunas teorías híbridas que sostienen que los sentidos de las palabras polisémicas son conceptos almacenados que forman un complejo polisémico (Carston, 2016) o una red de conceptos (Recanati, 2017).

De las conclusiones de la primera parte de la tesis se infiere que todas las teorías dan buenas explicaciones a distintos tipos de polisemia. De este modo, es muy probable que, siendo la polisemia un fenómeno sumamente heterogéneo, dependiendo del tipo de polisemia que estemos tratando, haya que postular una teoría u otra. Las teorías de la semántica rica ofrecen una adecuada explicación de las palabras polisémicas que típicamente copredican. La copredicación ocurre cuando dos sentidos de un sustantivo polisémico son utilizados en una misma oración y hay un predicado para cada uno de esos sentidos. Por ejemplo, en el caso de la palabra *escuela*, tenemos los sentidos: "escuela-participantes" y "escuela-edificio". Ambos son utilizados en la oración: *la escuela celebraba el día del euskera cuando se incendió*.

El problema sobre cómo se representa la polisemia ha conllevado el desarrollo de varios debates distintos e interrelacionados. Entre ellos se encuentra el hecho de que algunas palabras polisémicas generan oraciones copredicativas. Este fenómeno ha sido utilizado como test para determinar cuándo una palabra

es polisémica y cuándo no, sin embargo, no todas las palabras polisémicas copredican (ver Copestake & Briscoe 1995, Cruse 1986, Jezek & Vieu 2014, Moldovan 2019).

El análisis de la polisemia realizado en esta tesis demuestra que hay muchos tipos de polisemia y que no todas las palabras polisémicas generan oraciones copredicativas. Mi propuesta en esta tesis es que los límites que diferencian a la polisemia y a la homonomia deberían entenderse de manera gradual. Por un lado, tenemos palabras polisémicas cuyos sentidos son tan cercanos que acceder a uno implica la activación del otro, lo que explica su tendencia a formar estructuras copredicativas. Por otro lado, tenemos significados de palabras homónimas que compiten por ser seleccionados. Entre un fenómeno y otro puede haber distintas formas de polisemia, que deben explicarse mediante mecanismos semánticos diferentes.

Además, la diversidad de resultados en los experimentos sobre la aceptabilidad de las oraciones copredicativas (Duek Silveira Bueno, 2017, Frisson, 2015, Murphy, 2017) sugiere que no todos sentidos de nombres copredicativos tienen la misma facilidad para formar oraciones copredicativas y que hay diversos factores que pueden afectar a que los sentidos de una palabra polisémica generen o no oraciones copredicativas: el orden en que aparecen los predicados, las relaciones ontológicas entre los sentidos, etc.

En esta tesis se argumenta a favor un modelo de interpretación de oraciones copredicativas basado en la Teoría de los Paquetes de Activación (Ortega-Andrés & Vicente, 2019). Esta teoría propone que acceder al significado correcto de algunas palabras polisémicas es un proceso de activación-selección, en el que los aspectos de la estructura conceptual se activan unos a otros formando paquetes de activación. Cuando se interpreta una oración copredicativa, varios sentidos de un mismo paquete de activación son seleccionados. El nombre que copredica

compila dos sentidos diferentes de los que se predican propiedades diferentes. Por ejemplo, en la oración *la escuela celebraba el día del euskera cuando se incendió*, la palabra *escuela* refiere tanto al edificio como al grupo de personas que había en el colegio. Se predica del grupo de personas que celebraba el día del euskera y del edificio que se incendió. Esta hipótesis contribuye a responder a dos preguntas: ¿cómo se interpretan las oraciones copredicativas? y ¿por qué algunos sentidos de palabras polisémicas tienen una mayor tendencia a formar oraciones copredicativas que otros? Aquellos sentidos que forman patrones de activación estables generan paquetes de activación y tienen una mayor tendencia o probabilidad de formar oraciones copredicativas.

En los últimos años, las oraciones copredicativas se han utilizado como argumento en contra de las teorías clásicas de las condiciones de verdad (Chomsky, 2000, Collins, 2017, Pietroski, 2005). El estudio del significado lingüístico ha sido llevado a cabo bajo la hipótesis tradicional de que las oraciones tienen un contenido proposicional que puede contener sus condiciones de verdad. El argumento contra la teoría tradicional se basa en la idea de que en las oraciones copredicativas se predican propiedades que no se predican normalmente de un mismo objeto. Asumiendo la idea de que los nombres refieren a conjuntos de particulares en el mundo, no tendríamos respuesta a la pregunta sobre cuál es la denotación de la palabra *escuela* en la oración *la escuela celebraba el día del euskera cuando se incendió*. No existe nada en el mundo que celebre el día del euskera y que se incendie. Si *escuela* sólo refiriese al grupo de personas que celebraba el día del euskera, entonces la oración tendría que ser falsa o no tener condiciones de verdad, ya que no hay un grupo de personas que se incendie.

La denotación de las palabras que copredican ha sido ampliamente debatida desde la perspectiva de los dot objects. Los dot objects son significados compuestos por al menos dos sentidos unificados (Asher & Pustejovsky, 2005,

Pustejovsky, 1995). Por ejemplo, la palabra *libro* tiene dos sentidos ("contenido informacional" y "objeto físico") que forman el dot object info • objeto. Hay quienes han argumentado que los dot objects son entidades mereológicas compuestas por subentidades constitutivas (Arapinis, 2013, Gotham, 2016). En tal caso, la denotación de la palabra *escuela* sería una entidad compleja formada por el grupo de personas y el edificio. Por el contrario, en esta tesis se parte de la Teoría de los Paquetes de Activación (Ortega-Andrés & Vicente, 2019) para proponer que la palabra *colegio* no denota una entidad compleja, sino que va asociada a una estructura conceptual compleja. Los dos sentidos de la palabra son aspectos de esa estructura que refieren a entidades diferentes. De modo que el contenido proposicional de una oración copredicativa esconde una estructura más compleja en la que se predican al menos dos propiedades diferentes de dos objetos diferentes.

La tesis se divide en tres partes. La Parte I está dedicada a estudiar las teorías de la representación de los sentidos de los nombres polisémicos. En la Parte II se estudia la copredicación. El objetivo principal de la Parte II es responder a tres preguntas: (i) ¿por qué unas palabras polisémicas copredican y otras no?; (ii) ¿cómo se interpretan las oraciones copredicativas?; (iii) ¿cuál es la denotación de los nombres copredicativos? Para ello, se analizan las aportaciones que la Teoría de los Paquetes de Activación puede hacer a las teorías de la semántica rica en los debates en torno a estas preguntas. Por último, la Parte III de la tesis resume las conclusiones generales que se extraen de ella, así como las contribuciones y límites de las propuesta.

Abstract

Polysemy is a very common phenomenon that we habitually use. From the philosophical and the linguistic perspective, polysemous words have been defined as those that have at least two related and conventionalised senses. For example, the words *school* and *bottle* have more than one sense: the word *school* may refer to a building *-the school caught fire-* or to a group of people *-the school was celebrating the end-of-year party*. The word *bottle* may refer to the container *-I broke the bottle-* or its content *-I drank the bottle-*.

One of the main questions that have been discussed in the literature is how to distinguish polysemy from homonomy. According to some experiments in psycholinguistics (Beretta *et al.* , 2005, Frazier & Rayner, 1990, Klepousniotou, 2002), senses of polysemous words are typically accessible after one of them has been selected, and they typically show little frequency effects. In contrast, meanings of homonymous words inhibit each other; they "compete" to be selected.

A second problem that concerns polysemy is how it is represented in the lexicon. Sense Selection Lexicon Theories (SEL) claim that all different senses of a word are stored in separated entries or representations in the lexicon (Katz & Fodor, 1963, Katz, 1972). Contrary to SEL, One Representation Models claim that the different senses of a polysemous word are stored in the same representation (Beretta *et al.* , 2005, Falkum, 2011, Frisson & Frazier, 2005, Rodd *et al.* , 2002). Building on this approach, there are many theories that explain how senses of a polysemous words are stored in the lexicon. In this thesis, I contribute an exhaustive classification of these theories.

First, form the perspective of One Representation Theories, underspecification theories claim that when hearers encounter a polysemous word, they do not opt for a particular sense. Rather, they access an underspecified representation,

which is enriched only if the context requires it (Frisson, 2015). In this light, "core-meaning theories" claim that the underspecific meaning is a very abstract and general meaning that is shared by all the senses of a word and that must be specified in context (Rabagliati & Snedeker, 2013, Ruhl, 1989). For example, the word *break* has a general abstract meaning that summarizes all the possible related senses that the word has, including "to smash" in *the vase broke* and "to escape from" in *to break jail* (Spalek, 2015). These theories are thin semantic theories of word meaning, which means that they claim that the general meaning has minimal information and needs to be specified in context.

In contrast to core-meaning theories, literalist theories propose that some senses of polysemous words are generated from a conventional sense, which is activated by default (Copestake & Briscoe, 1995, Falkum, 2017). For example, the word *bottle* may have one literal meaning "the container" and one derived sense "content".

Within thin semantic theories, some have claimed that the thin underspecific meaning is so thin that it has no semantic content. This meaning is a pointer (Carston, 2013, Falkum, 2011) or an instruction (Pietroski, 2008), which gives access to the full specific concept (the correct meaning of the word).

Second, rich semantic theories claim that the common meaning of a polysemous word is rich. Some rich semantic theories contend that the common representation is an underspecific rich semantic structure (Ortega-Andrés & Vicente, 2019, Pustejovsky, 1995). Thus, each sense of the word *school* (building, institution, participants, etc.) is an aspect in the lexical structure of the word.

Finally, some hybrid theories are halfway between thin semantic theories and rich semantic theories. They claim that senses of polysemous words are concepts stored together in a polysemy complex (Carston, 2019) or in a set of concepts (Recanati, 2017).

One of the main conclusions of the first part of the thesis is that no extant theory seems yet able to account for all classes of polysemy. On the contrary, all theories may give plausible explanations to different kinds of polysemy. Rich semantic theories may give a good account for polysemous words that allow copredication. Copredication is the phenomenon in which the same polysemous nominal expression comes along with simultaneous predications for two (or more) different meanings or senses of the word in a sentence (Ortega-Andrés & Vicente, 2019). For example, the word *school* has (at least) two senses: the sense "building" and the sense "group of people". These senses are used in the sentence: *the school caught fire and was celebrating 4th of July when the fire started*. Availability of copredication has been taken to support access to the related senses of a polysemous word, while failed copredication tests indicate that one of the senses is currently not available. Thus, copredication has been used to distinguish polysemy from other phenomena, yet not all polysemous words generate copredicative sentences (see Copestake & Briscoe 1995, Cruse 1986, Jezek & Vieu 2014, Moldovan 2019).

In this thesis I argue that there are many different kinds of polysemous words and not all senses of a polysemous word generate copredicative structures. My proposal is that the distinction between polysemy and homonomy should be understood as a continuum. At one end, some senses of some polysemous words are so closely related that they activate each other, forming activation packages that facilitate copredication. At the other end, meanings of homonymous words inhibit each other.

Moreover, the huge diversity of results in the experiments about copredication (Duek Silveira Bueno, 2017, Frisson, 2015, Murphy, 2017, Schumacher, 2013) suggest that not all senses of copredicative words have the same tendency to copredicate and that many factors may facilitate copredication, for instance:

predicate ordering and ontological relations between senses.

The Activation Package Theory gives a plausible explanation to the interpretation of copredicative sentences (Ortega-Andrés & Vicente, 2019). Thus, interpreting these words is an activation-selection process. Aspects of the conceptual structure tend to activate each other forming activation packages. When the copredicative sentence is interpreted, various senses of the same package are selected. The copredicative noun compiles two different senses and each predicate in the copredicative sentence predicate different properties to different things. For example, in the sentence *the school caught fire and was celebrating 4th of July when the fire started*, the word *school* refers to the group of people and to the building. The predicate *caught fire* refers to the building and the predicate *was celebrating 4th of July* refers to the group of people. The Activation Package theory contributes to answering two questions: how copredicative sentences are interpreted? and why some senses of copredicative words have a greater tendency to copredicate? Those senses that form stable activation patterns generate activation packages and have a greater tendency to copredicate.

In recent years, copredicative sentences have been used against standard truth conditional semantics (see Chomsky 2000, Collins 2017, Pietroski 2005). Assuming that nouns refer to sets of particulars in the world, it is not clear what the denotation of the word *school* could be in the sentence *the school caught fire and was celebrating 4th of July when the fire started*. If we restrict the meaning of *school* to refer just to the group of people, it ceases to be clear what the truth conditions of the sentence could be, given that the group of people did not catch fire.

Many semantic theories have explained copredication in terms of dot objects. Dot objects are complex meanings involving several aspects unified by a ● (Asher

& Pustejovsky, 2005). For example, the word *book* has two senses ("informational content" and "physical object") that conform the dot object info• physical object. Mereological theories claim that the denotation of the word is a mereological compound that has (at least) two constitutive parts (Arapinis, 2013, Gotham, 2016). In contrast, the Activation Package Theory claims that copredicative nouns are compilatory terms that have several denotations and each denotation may be a simple entity (Ortega-Andrés & Vicente, 2019). Thus, copredicative sentences hide a more complex propositional-content structure, in which (at least) two different properties are predicated about two different objects.

This thesis is divided into three Parts. In Part I, I study the representation of senses of polysemous words. I present different theories about how senses are represented and accessed. In Part II, I study copredication. I answer three questions: (i) why do some polysemous words copredicate while others do not?; (ii) how do we interpret copredicative sentences?; (iii) what is the denotation of copredicative words? For that purpose, I analyse the contributions of the Activation Package Theory to these debates. Finally, in Part III, I present the general conclusions of the thesis.

Chapter 1

Introduction

1.1 Some notions: polysemy and copredication

1.1.1 What is polysemy?

Polysemy is a very common phenomenon in language. Actually, most open-class words we normally use are polysemous: they are associated with several related senses. Take the following examples (adapted from Ortega-Andrés & Vicente 2019):

(1)   a. The manifesto was signed by the **University**.

       b. I have a meeting with Laura at the **university**.

(2)   a. The **letter** is on the table.

       b. The **letter** sounds a bit threatening.

(3)   a. **Brazil** is a republic.

       b. **Brazil** have won five World Cups.

       c. **Brazil** is the largest country in South America.

(4)   a. The **school** caught fire.

        b. The **school** is celebrating its end-of-year-party tomorrow.

The nominal phrases *university, letter, Brazil* and *school* have different but related senses: in (1) there are two different senses of the word *university*: in (1a) the word *University* refers to the representatives of the institution, whereas in (1b) it refers to a building. In (2a) we are talking about a physical object that is on the table, while in (2b) we are talking about what that letter says: its informational content. In (3a) the word *Brazil* refers to a political institution; in (3b) to a football team, and in (3c) to a geographical region. In (4), we have two different senses of the word *school*: as a building in (4a), and as a group of people that is celebrating the end-of-year-party in (4b).

The definition of polysemy as words that have several related senses is too broad. A consequence of the breadth of the term is that linguists and philosophers have distinguished between many different kinds of polysemy. The examples I have given in (1)-(4) are of a very particular kind of polysemy: they are conventional, regular and inherent. Inherent polysemous words are those that typically allow copredication, which occurs when in a sentence the same inherent polysemous word is used to refer to at least two different related senses and at least two apparent incompatible properties are predicated about them (see subsection 1.1.5).

The given definition is useful for differentiating polysemy from other lexical phenomena (like homonymy). In this section I explain some relevant notions that have to be clarified in order to understand polysemy and copredication.

1.1.2   Homonymy and polysemy

The distinction between polysemy and homonymy has been widely discussed by linguists, philosophers and psychologists. The reason is that it is not clear what the difference between them is. Traditionally, the main difference between polysemy and homonymy is that senses or meanings of homonymous words are not related (apart from historically), while senses of polysemous words are related (see Falkum 2011). For example:

(5)   a. The **banks** of the river had overflowed.

   b. He is a clerk at the **Bank** of Washington.

   c. I saw Lucía at the **bank**.

There are two different meanings of the word-form *bank* in (5): in (5a), *bank* refers to a slope of land that borders a stream, a river or a lake. In (5b), it refers to an institution and in (5c) it refers to a building. While the two senses of the word *bank* in (5b,c) are related -there is the institution and the institution building-, they are not related in the same way to the meaning of *bank* in (5a):

Bank$_1$: (a) slope of land that borders water.

Bank$_2$: (a) an institution; (b) a building.

The words *bank$_1$* and *bank$_2$* are homonymous: they have the same word-form (phonetics and spelling), but different meanings that are unrelated. In contrast, the word *bank$_2$* is polysemous, because the two senses of the word (a and b) are related: the building is the place where the events and activities that involve the institution take place.

However, the distinction is not so strict. It is always possible that someone may intuitively see a relation between two senses while some other people do not

see that relation. The classification between more related senses and less related senses does not seem to be so categorical. What is clear is that a word form can have a huge range of different meanings, and some of them are going to be "semantically closer" than others.

Moreover, there appears to be a difference between how we process, store and represent the closely related senses of a polysemous word and the meanings of homonymous words[1] (Frisson, 2009, Klepousniotou & Baum, 2007, Klepousniotou *et al.* , 2008, Pylkkänen *et al.* , 2006). According to some experiments in psycholinguistics and experimental pragmatics, the senses of a polysemous term are typically accessible after one of them has been selected, and they typically show little frequency effects. In contrast, meanings of homonymous words inhibit each other (Klepousniotou *et al.* , 2008, Pylkkänen *et al.* , 2006). Many psycholinguists conclude that homonymous meanings are represented in different word representations and senses of polysemous expressions are stored in one single word representation (Beretta *et al.* , 2005, Foraker & Murphy, 2012, Klein & Murphy, 2002, Klepousniotou, 2002, Rodd *et al.* , 2002). These conclusions are actually very relevant for the debate about how senses of polysemous words are stored or represented in the lexicon, because it seems that closely related senses of a word are accessed differently from senses that are unrelated (meanings of homonymous words). However, we still do not know how related senses are represented, nor what makes them more accessible than the different meanings of homonymous words.

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[1]It is very common in the bibliography (see for instance: Frisson 2015) to distinguish between meanings and senses. Thus, related uses of the same polysemous word that have been lexicalised are called "senses", while the lexicalised uses of the same homonymous word that are not related are called "meanings".

1.1.3 Conventional polysemy

The distinction between conventional and non-conventional polysemy is similar to the distinction between semantic polysemy and pragmatic polysemy (see: Falkum 2011, Gibbs *et al.* 1989). It is based on the idea that conventional senses are those that have been lexicalised or encoded in the mental lexicon after a process of conventionalisation (Carston, 2016). Once they have been lexicalised, they only have to be selected from a list of senses when the interpreter encounters the word. On the contrary, when the hearer encounters a new use of a word, its meaning has to be pragmatically generated (see: Carston 2012, Recanati 2004, 2017). The generation of the new pragmatic sense has been explained using different pragmatic mechanisms, for instance, Carston (2012), Falkum (2011) follow a relevance theoretic account: when a interpreter encounters a new sense of a word, they infer (by lexical broadening or lexical narrowing) the new relevant sense from the previously encoded meaning (that is a lexicalised concept) and the contextual information in accordance with the hearer's expectations of relevance. The new sense is called an ad hoc concept, which, in lexical narrowing, is more specific than the one that was previously lexicalised, and denotes a proper subset of the linguistically-specified denotation. On the other hand, in lexical broadening the ad hoc concept is broader, denoting a proper superset of the linguistically-specified denotation.

One characterisation of pragmatic polysemy is that contextually derived instances of polysemy are senses that are not lexicalised, that is, they have not been conventionalised yet (Falkum, 2011). Following this idea, the label "conventional polysemous word" is not essential to the words themselves: most open-class words are conventionally polysemous because they have many different related and conventional senses. However, many polysemous words can "get" a new related sense. For instance, the word *millennial* is used to refer to

people reaching young adulthood in the early 21st century. However, before this use of the word was conventionalised, it was used to denote a period of a thousand years. Moreover, a sense that is new for one person can already be lexicalised for another. For example, we could imagine a person that does not know that the word *Brazil* not only refers to a country, but also to a football team. This person knows that Brazil is a country in South America and they also know what the World Cup is. Now, imagine that someone says to this person the following:

(3b) Brazil has won five World Cups.

Even when most speakers in our community know the meaning of the word *Brazil* in (3b), so it is a conventional sense of the word, our imaginary person does not know this use of the word. The construction of ad hoc concepts involves taking the encoded concept (BRAZIL-country) and its associated logical and encyclopaedic information, together with a set of contextual assumptions, as input to an inferential process of constructing hypotheses about the speaker-intended meaning: in this case, the interpreter uses what they know about the country Brazil and about World Cup for generating the new ad hoc concept BRAZIL-football team.

Most of the interpreters in the group knew the sense "football team", so they did not have to generate the new sense, which was already lexicalised. Therefore, while for some speakers the use of the word *Brazil* in (3b) would be a case of pragmatic polysemy, for others, it would be conventional.

1.1.4 Regular polysemy and inherent polysemy

The polysemous words in the examples (1)-(4) are conventional and regular polysemous words. According to Apresjan (1974, 16) the polysemy of a word *a* with the senses Ai and Aj is regular if there exists at least one word *b* with the

related senses Bi and Bj, being semantically distinguished in exactly the same way as Ai and Aj. Let us consider again (1) and compare it with (4):

(1) a. The manifesto was signed by the **University**.

   b. I have a meeting with Laura at the **university**.

(4) a. The **school** caught fire.

   b. The **school** is celebrating the end-of-year party tomorrow.

In (1a) the word *University* has the meaning "people that work or represent an University-institution"; while in (4b), *school* means the group of people that work/represent the school-institution. In (1b), the word *university* means the University-institution building and in (4a) *school* also means the school building. Those are different regular polysemous words that have two senses that are related in the same way.

One of the main mechanisms for generating polysemy is metonymy, that is, the meaning of a term is transferred from one referent to another, by virtue of the contiguity relation between the two referents. These contiguity relations can be of a very variable nature as the container for the contents, a part for the whole, a cause for an effect, etc. (Robert, 2008). Here are some illustrations:

(6) The **ham sandwich** left without paying.

(7) Teresa is reading another **Agatha Christie**.

(8) Miquel is just a **pretty face**.

(9) Estefanía is bringing the **loudmouth** with her to the cinema this evening.

(10) Luis drank this **glass**.

Pustejovsky (1995) [2] makes a distinction between regular polysemous words -author/work shifts: *Myriam has a Picasso in her living room* and *Begoña loves reading Almudena Grandes*; metaphorical uses of animal properties: *Marta is a chameleon* and *Iñigo is a fox*; content/container: Elena drunk the whole bottle; *the bottle is on the table*; etc.- and some others that are idiosyncratic or accidental. Most cases of "accidental polysemy" words have been labelled by many others as cases of homonomy. Thus, according to Asher (2011), for instance, the word *bank* -recall the sentences in (5)- is a classic representation of accidental polysemy. There are many kinds of regular polysemous words. For example:

(11)   a. Myriam has a **Picasso** in her living room.

        b. Begoña loves reading **Almudena Grandes**.

(12)   a. Marta is a **chameleon**.

        b. Íñigo is a **fox**.

(13)   a. Elena drunk the whole **bottle**.

        b. Javi spilt the **cup**.

Sentences in (11)-(13) contain regular polysemous words. In (11) the names of authors are used for referring to their works; in (12), properties of animals are used to describe humans; in (13) the containers are used to refer to their contents. There is a regularity and a systematicity in how these words are used to refer to different things (see also: Atkins *et al.* 1992, Copestake & Briscoe 1995).

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[2]He differentiates between two other kinds of polysemy: in some cases, different senses of polysemous words preserve their lexical category, while in others they change their lexical category. For example, the word *book* has at least two senses with different lexical categories: it can be a noun (referring to the book we read) or a verb (referring to the act of booking a reservation). However, *book* as a noun also has two different senses: the object and the content that it transmits. Polysemous words whose related senses do not change their lexical category are logical polysemous words.

On the other hand, accidental polysemous words do not show systematicity. They are difficult to classify because there is not a set of words that show a regular and systematic behaviour that can be studied as a rule. Pethő (2007) gives a classification of regular and non-regular polysemous words. He shows that some metonymical polysemous words -like the container/content example in (13)- are non-regular and that there are metaphorical polysemous words that are actually systematic - the sentences in (12) seem to be an example-. According to his idea, the word *mouth* is an example of non-systematic metonymy: it can refer to at least the mouth cavity and the lips. Other examples of irregular polysemy may be the word *phone*, which not only refers to the telephone, but can also refer to the telephone game[3]. Pethő (2007) also shows some examples of pseudo-systematic polysemy -like body parts/parts of clothes examples- and queasy systematic polysemes -like the word *money*-, which can be used as liquid assets or as currency.

Now, why do some polysemous words show these regular patterns and others do not? Some researchers put the focus on the conceptual structure: the senses of polysemous words can be derived according to conceptual relations we find salient (Papafragou, 1996, Wilson & Carston, 2007); while others have focused on the role of linguistic conventions, and suggest that senses are arbitrary and opaque, so they must be memorised and stored within the lexicon (Klein & Murphy, 2001). The problem with the latter theory is that it is not able to explain the apparent patterns in regular polysemy.

One problem for the idea that conceptual structure constrains polysemy is that, while conceptual factors like noteworthiness may help to explain the senses we use, they have trouble explaining why we do not use many other senses. It is easy

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[3]In American English, it is a children's game in which players form a line or a circle, and then the first player comes up with a message and whispers it to the ear of the second person in the line. The second player repeats the message to the third player, and so on. When the message reaches the last player, they announce what they heard to the entire group.

to see some relevant relations between many different things, so why do some relations generate polysemous senses and others do not?

The theory predicts that polysemy works across different languages. Actually, there are many cases of polysemous words that seem to work in many languages, for instance, all related senses we have used in (1)-(4) are also polysemous in Spanish. Srinivasan & Rabagliati (2015) investigated whether 27 distinct patterns of polysemy found in English are also present in 14 other languages. On the one hand, they found that almost all patters of polysemy are presented across languages; on the other hand, they also found variation across languages in how patterns are instantiated in specific senses. Thus, their conclusion was that the different senses of words are learned conventions, but conceptual structure makes some types of relations between senses easier to grasp than others, so that the same patterns of polysemy evolve across languages.

Pustejovsky (1995) also distinguishes between regular polysemous words that are merely regularly polysemous, and inherently polysemous words. According to Pustejovsky, a term is inherently polysemous if the different senses are somehow "inherent" to the entity that the term denotes. The idea is that different senses of the word emerge from what the denotation is. Thus, for example, in (4), the two senses of *school* are different ways or facets of what a school is:

(4)   a. The **school** caught fire.

       b. The **school** is celebrating the end-of-year party tomorrow.

Other regular polysemous words do not seem to generate the intuition that they refer to different facets of the same object. For example, the word *chameleon* refers to an animal, but it can also refers to a person that has a very adaptative personality (see Carston 2012). It is quite common to use animal words for describing human characters (for instance: being a rat; a fox; etc.). Therefore,

we could say that all these words are regular polysemous words (following Apresjam's definition). However, we would never say that the chameleon (the animal) has two different parts, aspects or facets in the way that we could say it about the word *school*. Thus, *chameleon* is a regular polysemous word, but it is not inherent.

These considerations are not the only reason for speaking about inherent polysemy. The main property that all inherent polysemous words seem to share is that they all tend to pass copredication tests.

1.1.5   What is copredication?

Copredication is the phenomenon in which the same polysemous nominal expression comes along with simultaneous predications for two (or more) different meanings or senses of the word in a sentence (taken from: Ortega-Andrés & Vicente 2019). Here there are some examples of copredicative sentences:

(14) The **books** are thick and interesting.

(15) The **school** caught fire and was celebrating 4th of July when the fire started.

(16) The **city** has 500,000 inhabitants and outlawed smoking in bars last year.

In (14), *books* refers to the physical object, but also to the content or information that it transmits. In (15), the word *school* refers to the building but also to the people inside the building. In (16), the predicate *has 500,000 inhabitants* requires that its argument (*the city*) denotes something different than what the predicate *outlawed smoking in bars last year* requires. It seems that the word *city* refers to the population and to the council. The arguments of sentences that copredicate seem to denote two different things because the sentences predicate apparently incompatible properties.

Other regular polysemous words that copredicate in some particular cases are, for example, the content/container or author/work examples. Recall sentences (11) and (13):

(11)   a. Myriam has a **Picasso** in her living. room.

       b. Begoña loves reading **Almudena Grandes**.

(13)   a. Elena drunk the whole **bottle**.

       b. Javi spilt the **cup**.

The peculiarity of these words is that the "ontological intuition" that they refer to different aspects of the same thing is not so obvious. We may have the intuition that the content and the object of the book are two ways of thinking about the same thing, yet it is not so intuitive that the bottle and the liquid (beer for example) are two aspects of the same thing or that the author and their work are two facets of the same object. However, there are some particular cases in which these words copredicate:

(17) Aitor put down **the beer** and drank it a few minutes later (adapted from: Schumacher 2013).

(18) **Juana Doña** was a communist activist writer and is still in Spanish libraries.

The word *beer* in (17) refers to a liquid but also to the container that contains it. In (18) the name *Juana Doña* refers to the author and her work. The reason why some words copredicate and others do not does not have a definitive answer. Copredicative sentences generate many puzzles for linguists and philosophers. I am concerned about three main questions: (i) how related senses of inherent polysemous words are represented; (ii) how copredicative sentences are interpreted; (iii) what is the denotation of nouns that copredicate.

In the following sections I briefly explain the relevance of these three issues and how different theories respond to them.

1.2 Representation and storage

One of the problems that concerns polysemy is how it is represented in the lexicon. It has been thought that all different senses of a word are stored in separated entries or representations in the lexicon (Katz & Fodor, 1963, Katz, 1972). According to this theory, interpreting the word consists of selecting the correct representation from the lexicon. The hypothesis has been criticised because it does not give an account of more creative polysemous words (see Pustejovsky 1995). Almost every word is polysemous, which means that open class words have several related senses. Thus, if each particular sense of the word is represented in a different representation and the speaker needs to select the correct one from all the possibilities, then the speaker must necessarily possess a huge capacity to store all different senses. The hypothesis makes it very difficult for speakers and interpreters to distinguish between those senses that are already stored as part of the meaning of a word and those that are created in context (see Falkum & Vicente 2015). Recall from the previous section that there are many different kinds of polysemous words. Some of them are conventional while others are not, and some of them show systematicity while others do not. According to the Sense Separated Lexicon theory (SEL), all these senses are different representations and when the interpreter accesses the correct sense of the word, they have to select the most appropriate one from all the possibilities.

Moreover, as I have already explained, some empirical investigation suggest that there is a difference between how polysemy and homonymy are represented in the lexicon (see Frisson 2009, Frisson & Pickering 2001, Klepousniotou & Baum

2007, Klepousniotou *et al.* 2008, Pickering *et al.* 2006, Pylkkänen *et al.* 2006).

Contrary to SEL, One Representation Models claim that the different senses of a polysemous word are stored in the same representation. Now, within the One Representation hypothesis, there are many explanations for the processing of polysemous words. For instance, literalist theories propose that some senses of polysemous words are generated from a conventional sense, which is activated by default (Copestake & Briscoe, 1995).

There are different ways of explaining the sense- generation process. Theories that explain semantic shifts by internal mechanisms have been previously called rule based approaches (see Falkum & Vicente 2015). For instance, the word *bottle* normally refers to a container. However, when it appears in the sentence *drink the bottle*, its meaning cannot be to drink the container, but it means to drink the drinkable substance it contains. The mechanisms that are required for generating these senses are internal to the lexicon -and they will be explained in chapter 4-.

Contrary to rule basic approaches, lexical-pragmatic theories try to explain polysemy by pragmatic mechanisms. According to these theories, there is an inferential/modulation mechanism that allows the interpreter to access the specific sense of the word from contextual/conceptual information. Thus, for instance, some pragmatic theories of polysemy propose that interpreting the correct sense of a polysemous word involves taking the previously encoded concept and its associated encyclopaedic information, together with a set of contextual assumptions, as input to the inferential process, which consist of constructing a hypothesis about the speaker's intended meaning (see Carston 2013, Falkum 2011).

On the other hand, according to underspecification theories of word meaning, when hearers encounter a polysemous expression, they do not opt for a particular sense, but rather access an underspecified representation, which is enriched only

if the context requires it (Frisson, 2015).

Underspecification theories of word-meaning do not agree about what that underspecific meaning is. Some have maintained that the underspecific meaning is a "core meaning" (Rabagliati & Snedeker, 2013, Ruhl, 1989), that is, a very abstract and general meaning that is shared by all the senses of a word and that must be specified in context. One example of a core meaning that intends to summarize all possible senses of the word is that which Spalek (2012) proposes for *romper* (*break* in Spanish). According to her, the meaning of *romper* is so underspecific that it can vary in context from "disintegration" to "ceasing". Recanati (2004, 2012) has also maintained an underspecification hypothesis. As an example, he proposes that the standing meaning of the word *cut* may be "effect a linear separation affecting the integrity of (some object) by means of an edged instrument" (Recanati, 2012, 185).

Alternative underspecification accounts have claimed that the underspecific meaning is not a definition or a core meaning, but something not conceptual, like a pointer or a schematic meaning (Carston, 2012, 2013, 2015) or an instruction for accessing and assembling concepts (Pietroski, 2005). Underspecific theories are normally associated with thin semantic theories of the lexicon, which maintain that the underspecific representation is so meagre that it needs to be specified in context to become a full-fledged concept (see Falkum & Vicente 2015). However, it is not true that underspecification theories have to commit to the idea of a thin meaning. Actually, some rich semantic theories also propose an underspecification theory. According to these rich semantic accounts, words stand for semantically rich structures and the specific sense has to be generated by internal mechanisms (for example: Ortega-Andrés & Vicente 2019, Pustejovsky 1995). I term "rich semantic theories" those that maintain that the encoded information associated with the word is rich, so the representation of the lexical

meaning contains more information than what is needed in a specific context. The information is detailed and precise and includes what is mostly considered conceptual or encyclopedic knowledge (see Hogeweg 2012).

Within a rich semantic theory, Pustejovsky (1995) proposes a Generative Lexicon (GL), which is a system where every lexical item has a semantic structure of four levels: eventual structure, qualia structure, argumental structure and lexical inheritance. In this view, polysemy is normally generated by internal mechanisms. This hypothesis is considered an underspecification hypothesis, because even when the needed information is already located in the lexicon, the polysemous senses must be generated inside the lexicon from limited information that is located in the qualia structure. In this theory, the explanation about how related senses of a polysemous word are generated tries to be purely internal to the linguistic system. Thus, the role of context in communication is minimal.

Contrary to rich semantic theories, many pragmatic theories propose a thin semantic approach (Carston, 2013, Falkum, 2011). However, the distinction rich and internal vs. thin and pragmatic should not be taken very strictly. Actually, they answer two different questions: (i) how much semantic/conceptual information is contained in the lexical representation associated with polysemous words; (ii) how the senses of some polysemous words are generated. The debates between SEL vs. One Representation Theory and Rich vs Thin semantic approaches try to respond to (i); and the debate between pragmatic theories and internal lexical rules theories is about question (ii).

Some theories propose pragmatic mechanisms but do not seem to agree with thin semantic theories. For instance, Carston (2019) has proposed that related senses of the same polysemous word form a polysemous complex. In her approach, each sense is an atomic concept that is related to the other concepts forming the polysemy-complex. When the interpreter accesses the specific

conventional sense of the word, they select the relevant concept of the complex. For example, the word *chameleon* in (12a) *Marta is a chameleon* does not mean an animal, but a person that has the ability to change their personality. Interpreting the sense of the word *chameleon* may require that the previously lexically encoded concept CHAMELEON is narrowed to the new concept CHAMELEON* (denoting a particular kind of person: someone that is good at changing her appearance or personality depending on the surroundings). The two concepts are different senses of the word and are now part of the same polysemy complex.

In this thesis, I propose a rich semantic theory about the meaning of polysemous words, that is, a theory in which the representation of the meaning of polysemous words offers a range of aspects that correspond to potential conventionalised senses of the word itself. The hypothesis postulates that some senses of polysemous words form activation packages, which means that they activate each other when they are interpreted. The theory explains the interpretation of words that copredicate (Ortega-Andrés & Vicente, 2019, Vicente, 2019). For a better understanding of the interpretation of the representation and interpretation of these words, it is necessary to look at the empirical research. In the next section, I introduce some experimental results about copredication.

1.3 Empirical research about copredication

Even when research into the difference between polysemy and homonymy is extensive, there is not that much about inherent polysemous words in copredicative sentences. Even then, existing evidence about copredication suggests that senses of inherent polysemous words are represented in the same representation, while in other cases of polysemy, senses are represented separately. For instance, Frisson (2015) runs two experiments: first, a sensicality

task in which he finds that switching from one sense to another is cognitively costly, no matter the dominance/frequency of each sense. The experiment suggests that there is some processing cost in the selection of the second sense of some copredicative sentences. In the second experiment, Frisson (2015) also shows that switching from the subordinate (less frequent sense) to the dominant sense (more frequent sense) results in longer reading times than switching from the dominant sense to the subordinate sense. These results contradict what is expected from homonymy and suggest that inherent polysemous words not only are interpreted differently from homonymy, but that there are also other factors that must affect the interpretation of the word.

Moreover, some multivariative pattern analyses (MVPA)[4] show some differences when participants read inherent polysemous words of the kind *book* in comparison to other words that refer to abstracts and concrete objects (see Tao 2015). According to the results of the experiments, interpreting the word *book* in Italian shows an effect in a neural region in the ATL, which has been previously associated with conceptual thinking. On the contrary, when other words like *chair* -that refers to concrete objects- or *idea* -that refers to abstract objects- are interpreted, there is no evidence of any effect in these areas.

Inherent polysemous words of the kind *lunch* show an important effect in the right ATL, compared to *book*. This is surprising because the right hemisphere is not normally associated with linguistic task. However, it is true that in previous experiments on polysemy (Pylkkänen *et al.* , 2006) it has been shown that in the interpretation of some phrases with polysemous words -for instance: *liberal paper*- there is M350 longer latency in the right hemisphere than in the left. Moreover, it has been previously suggested that this area (right ATL) is associated

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[4]MVPA refers to a set of methods that analyse neural responses as patterns of activity, thus affording investigation of the varying brain states that a cortical field or system can produce, thus increasing the amount of information that can be decoded from brain activity (Haxby, 2012).

with social thinking (Snowden *et al.* , 2004, Zahn *et al.* , 2007). As Tao (2015) argues, the result makes sense because lunches and dinners are very commonly conceptualised as social events.

Tao (2015) considers this evidence to be in favour of GL. According to his reading of the results, for interpreting inherent polysemous words such as *book* or *lunch* we access the specific conceptual knowledge associated with the word because the interpretation process involves accessing an underspecified complex structure -that contains conceptual/semantic information-, and when we put it in context, the representation instantiates to a more specific one. Actually, these findings seem to fit very well with almost every rich semantic account that postulates an underspecific meaning and that proposes that interpreting the inherent polysemous words requires accessing conceptual knowledge from the beginning.

In any case, it is difficult to explain the results by SEL. SEL would not have any answer to why inherent polysemous words show different results in comparison to other words that do not copredicate.

Duek Silveira Bueno (2017) runs some acceptability tests with copredicative sentences. Her experiments suggest that sentences that use different meanings of homonymous words in copredicative sentences were ranked lower than sentences that used polysemous words. Consider the following examples:

(19) The jug of lemonade Maider broke was too sweet (adapted from: Duek Silveira Bueno 2017).

(20) The jug of lemonade Maider drank had lemons painted on it (adapted from: Duek Silveira Bueno 2017).

In copredicative sentences with container expressions -like (19),(20)-, sentences that shift from container to content -see (19)- were ranked with better

scores than when the copredicative sentence shifts from content to container -see (20)-, which suggests that the sense "container" is easier to access once the sense "content" has been selected than vice versa. These results are in line with what Schumacher (2013) claims about container/content shifts. Schumacher (2013) runs an ERP study with sentences that present a meaning shift content/container and container/content. The experiment shows a positive deflection[5] in container for content shifts -for instance: the word *bottle* used to refer to the content "beer"-, which is interpreted as reflecting extra processing cost.

According to Schumacher (2013) it is possible that interpreting the sense "container" once the sense "content" has been selected is easier because the content depends ontologically on the container, so they are aspects of the same lexical concept. However, it is more costly to access the sense "content", once the sense "container" has been already selected, because the container does not depend on the content. This hypothesis has been interpreted by Ortega-Andrés & Vicente (2019) as favouring the idea that inherent polysemous words stand for knowledge structures that contain possible senses of the inherent polysemous words. According to this theory -that I will call Activation Package Model-, aspects in the structure are organised by ontological dependency relations. The model aims to explain copredicative sentences: how senses of inherent polysemous words are represented and how it is possible that we predicate different properties about apparently different entities. Both questions are going to be addressed in Part II of the thesis. That said, it seems appropriate to introduce the debate that the question generates in this introduction. The following section presents a brief explanation of the puzzle.

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[5]The late positive component is a positive-going event-related brain potential (ERP) component that has been important in studies of explicit recognition memory.

1.4 The puzzle of the denotation

As I have already explained, copredicative sentences normally predicate incompatible properties about what the inherent polysemous words refers to. In the case of *school*, for example, the properties that the building school has -for instance, its colour, its size, etc.- are incompatible with the properties that the school, understood as teachers, pupils or representatives, has.

(15) The **school** caught fire and was celebrating 4th of July when the fire started.

In (15) the predicate *caught fire* requires that the word *school* refers to the building and the predicate *as celebrating 4th of July* requires that the word *school* refers to a group of people. There is nothing that has all these incompatible properties at the same time. The question that emerges is the following: if there is nothing in the world that is both a building and a group of people, then what is the denotation of the word *school* in (15)?

One reason why giving an answer to the puzzle of denotation is important is that copredicative sentences have been used against standard truth conditional semantics (see Chomsky 2000, Collins 2017, Pietroski 2005). The reasoning behind the critique can be analysed in terms of the following argument:

P1 According to the standard view of truth conditional semantics, the truth conditions of a statement rely in part on the correspondence between words and the real world.

P2 Nouns that allow copredication very often lack an equivalent in the real world: there is nothing in the world that can satisfy (15) because there is no entity that can be a building and a group of agents. So the sentence should always be false or lack true value.

P3 However, it seems that (15) could be true. Thus, the truth conditions of copredicative sentences like (15) do not depend on the existence of an external entity that fits with the attributed properties.

C The standard view of truth conditional semantics is wrong.

In sum, the conclusion of the argument is that nominals that copredicate do not refer to entities in the world because the predicated properties cannot be truly predicated about any real entity. Therefore, either copredicative sentences cannot be counted as true, or the truth conditions of a statement do not rely on the correspondence between its content and the external world.

There are different possible reactions to this argument. One option is to say that the apparent lack of reference in copredicative sentences is just a matter of contextual sensitivity (Liebesman & Magidor, 2017). For example, according to some pragmatic proposals, the attribution of the property "celebrating 4th of July" to a building is a result of pragmatic meaning transfer (Brandtner, 2011, Nunberg, 2004). Others propose that the actual denotation of the word, for instance, the building, inherits the properties from other entities: the building celebrates 4th of July by virtue of being the building of the institution that celebrates 4th of July.

On the other hand, most semantic theorists have explained copredication in terms of dot objects, which are combinations of both aspects (or meanings) of the word. For instance, Asher (2011) proposes that the denotation of copredicative nouns are bare particulars that we conceptualise as having different properties. An alternative within the dot object approach is that of mereological theories. According to these hypotheses, the denotation of *school* in (15) would be something that is both a group of people and a building. It may be a sum of parts (Cooper, 2005); a complex entity (Arapinis, 2013) or a composed entity (Gotham, 2014).

Contrary to mereological approaches, the Activation Package Model proposes that inherent polysemous words stand for knowledge structures that give a range of possible denotations. Copredicative sentences hide propositional sentences of more complex structures in which each property is predicated to a different denotation of the word. Thus, sentence (15) is interpreted as (15'):

(15) The school caught fire and was celebrating 4th of July when the fire started.

(15') The school$_1$ [PHYSICAL REALISATION OF INSTITUTION-SCHOOL] caught fire and the school$_2$ [GROUP OF OCCUPANTS [OF THE SAME PHYSICAL REALISATION OF THE INSTITUTION-SCHOOL]] was celebrating 4th of July when the fire started.

The truth conditions of sentence (15) are defined by (15'), so the sentence would be true in the case that the building that physically realised a particular school institution caught fire when the group of people that that was in the building and that typically participate in the activities of the institution was celebrating 4th of July. The word *school* compiles two senses: the building and the group of people and each sense has its own denotation.

1.5 Outline of the thesis

The thesis is divided into three parts. Part I is dedicated to the representation of senses of polysemous words. I present different theories about how senses are represented and accessed. First, in chapter 3, I explain the distinction between One Representation Models and Separate Sense Representation Models (SEL). I discuss what some results on experimental pragmatics and psycholinguistics suggest and how they are relevant for the debate. Secondly, in chapter 4, I compare

and classify some different proposals about representation and I discuss whether they explain the empirical evidence given in chapter 3.

Part II studies inherent polysemous words and copredicative sentences. The goal of this part is to argue that the Activation Package Model -previously explained in chapter 4- explains the empirical results about copredicative nouns. Thus, chapter 5 is an introduction to what copredication is and what the general puzzles it generates are. In chapter 6, I explain some empirical results about the acceptability of copredicative sentences and how the Activation Package Model explains the interpretation process of copredicative sentences. I argue that the hypothesis is compatible with the results of the experiments. First, I explain how the Activation Package Model is compatible with some experiments about neural activity (Tao, 2015) and I discuss the results of the eye movement study that Frisson (2015) ran and, secondly, I discuss the ordering predicate effect in the acceptability of copredicative sentences (see: Duek Silveira Bueno 2017, Murphy 2017, 2019).

In chapter 7, I address the puzzle of denotation. I analyse and discuss different responses to the question: "what is the denotation of copredicative nouns?". First, I discuss two pragmatic theories that argue that copredication is the result of pragmatic mechanisms. Thus, I discuss the idea that copredication is the result of a meaning shift (Nunberg, 2004); and some arguments in favour of the thesis that copredicative nouns are not polysemous (Liebesman & Magidor, 2017) Secondly, I dispute some mereological approaches of dot objects, including the hypothesis of co-constitutive entities (Arapinis, 2013) and the revised mereological approach (Gotham, 2016). Finally, I explain how the Activation Package Model solves the puzzle. I claim that the answer to the question that arises from the given proposal is that each specific sense of the copredicative noun that is referred to in the copredicative sentence has a single denotation. The entities that are denoted

by the inherent polysemous word are simple entities.

In Part III, I present the general conclusions and remarks of the thesis. Thus, first I summarize all the main points of each chapter in the thesis. Secondly, I present some open questions and limitations of the investigation. Finally, I explain the aims that have been achieved in this thesis.

Part I

Representation and storage of polysemous words

Chapter 2

Introduction to Part I

As was previously presented in chapter 1, there is an open question about how some polysemous words are stored or represented in the lexicon. Many experiments in psycholinguistics suggest that different senses of the same polysemous word are accessed more easily than meanings of the same homonymous word. This fact has been used for claiming that related senses of polysemous words share a lexical representation and meanings of homonymous words are stored in different lexical representations. However, there is no agreement about this conclusion. The reason is that while some studies argue in favour of SEL (Foraker & Murphy, 2012, Klein & Murphy, 2002, 2001), others have presented evidence of sense overlap and "single representations" for different senses of a polysemous word (Beretta *et al.* , 2005, Frazier & Rayner, 1990, Frisson & Pickering, 2007, 2001, Pickering & Frisson, 2001, Pylkkänen *et al.* , 2006). The general conclusion seems to be that the more related the senses are, the easier it is to access one from the other.

Within One Representation accounts, there are different theories that may explain how related senses are stored and interpreted. Most of them claim that related senses share an underspecific meaning. Thus, accessing the

underspecific meaning is the first step that facilitates accessing the specific sense of the polysemous word. Meanings of homonymous words do not have a common underspecific meaning, so selecting the correct meaning of the word requires a process of disambiguation that explains the "inhibitory effect" that the experiments show. Even when there are many different underspecification theories, all of them claim that the general representation that is common to all the senses of the word has to be specified for selecting the correct sense of the word. What remains unclear is what this underspecific meaning is and how the correct sense is accessed from it.

Most psychological results have been interpreted in terms of discussing core meaning theories, which propose that the common meaning contains the general semantic information that is shared by all potential specific senses of the polysemous word (Pritchard, 2019, Recanati, 2004, Ruhl, 1989, Spalek, 2012). These theories are "thin semantic theories", because they claim that the underspecific meaning has to be minimal or very general to be shared by all different uses of the polysemous word.

On the other hand, literalist theories claim that some specific senses are generated in the context from a literal meaning -which is directly accessed by default (see Copestake & Briscoe 1995, Recanati 2004). Therefore, in this case, there is no underspecific meaning. The new sense is generated from a fully specific meaning that has been previously lexicalised. Now, how is the new sense generated? There is a debate between pragmatic theories of polysemy (Falkum, 2011, Recanati, 2004) and internal rule based approaches (Asher, 2011, Chatzikyriakidis & Luo, 2015, Copestake & Briscoe, 1995).

Within a literalist approach, some lexical pragmatic theories claim that the correct sense is inferred or modulated from a literal meaning by pragmatic mechanisms (see Falkum 2011). Not all lexical pragmatic theories propose a

literalist theory. Some pragmatic theories claim that there is an underspecific meaning that is so thin that it has no semantic content at all (Carston, 2012) and that gives access to the specific sense of the word, while others propose that the common representation is a polysemy complex that contains all conventionalised senses of the polysemous word (Carston, 2019).

Internal rule based approaches claim that the mechanisms for interpreting the specific sense of the polysemous word are internal to the lexicon. Within a literalist theory, the correct sense is generated from the literal meaning following a derivative rule (Copestake & Briscoe, 1995). Within a core meaning approach, the specific sense is internally generated from the core underspecific meaning. Thus, for instance, Spalek (2012) contends that the general meaning of verbs is so abstract and underspecific that it has to be enriched depending on the argument of the verb. For instance, the verb *break* does not mean the same in *break the law* and in *break the rope*. The argument coerces the meaning of the verb, so it gets a more specific sense.

Many internal lexical rules based approaches propose a rich semantic lexicon, which means that interpreting the correct sense of a polysemous word requires accessing a rich amount of general knowledge associated with the meaning of the word. According to rich underspecific theories, the underspecific meaning of polysemous words is a representation that is conceptually rich. When the polysemous word is interpreted, first, the general underspecific meaning is accessed; and second, the specific sense in selected or generated by internal mechanisms. For instance, the Generative Lexicon (Pustejovsky & Batiukova, 2019) suggests that the specific sense is generated by internal mechanisms (as internal rule based approaches propose), but the Activation Package Model (Ortega-Andrés & Vicente, 2019) claims that the correct sense is selected from all the possibilities.

Not all rich semantic theories agree with the general thesis of underspecification. Alternative theories have been put forward to claim that interpreting the specific sense is not a process of generation or activation-selection. Thus, for instance, Hogeweg (2012) agues that interpreting the correct sense of the polysemous word in each occasional use consists of suppressing the features (encoded in the representation) that contradict the context in which the word appears[1].

In this part of the thesis I organize the theories that participate in the discussion in four different debates about the interpretation and storage of senses of polysemous words: One Representation Theories vs. Separate Sense Lexicon accounts; core meaning approaches vs literalist approaches; lexical-pragmatic theories vs. internal-rule based approaches; and thin semantic accounts vs. rich semantic accounts. The aim of Part I is to characterize these theories that contribute to these debates and to see whether they fit with the evidence given by the empirical results. For that purpose, chapter 3 presents some empirical studies that should be considered for a better understanding of the debates about the storage and interpretation of senses of polysemous words. In chapter 4, I organize and discuss some contemporary theories about the presentation and storage of sense. I show how different theories explain the evidence of the empirical results explained in chapter 3.

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[1]This theory has been labelled as an "overspecification account" of word meaning (Hogeweg, 2012, Zeevat *et al.*, 2017). The labelling is controversial because it is not clear what "overspecification" actually means. In principle, it seems that the process of "specificating" the underspecific sense should consist of inferring or generating the correct sense of the word. However, as I have already said, there is no agreement on the use of the term "overspecification" and, the distinction between "rich underspecification theories" and "overspecification theories" does not seem very useful in itself. Therefore, I am not going into detail as regards what concerns this classification.

Chapter 3

Analysis of empirical results: SEL and One Representation

The aim of this chapter is to analyse the conclusions of different experiments. Thus, first, I present some studies whose results have been considered to favour Separate Sense Lexicon (SEL).

In section 3.1, I present some experiments about frequency effects in the interpretation of polysemous words. I argue that their conclusions do not only contradict core meaning approaches, but any other One Representation Model. However, it does not mean that we should dismiss One Representation Models, because there are some other experiments that show evidence that suggests that at least some kinds of polysemy are represented in the same representation.

In section 3.2, the discussed experiments favour the One Representation Model. I propose that the general evidence suggests that more closely related senses of polysemous words are represented together in the same representation. Thus, I present some experiments that test the frequency effect of different kinds of polysemous words.

In section 3.3, I explain one experiment that compares the reading times in

the interpretation of mass/count shifts and count/mass shifts and one experiment about content/container shifts. The results of the experiments suggest that these words differ in the way they are interpreted from other polysemous words. It may be the case that in some cases, one of the senses is "derived" from the other by a lexical rule.

3.1 Evidence for the Separate Senses account

According to One Representation Models, senses of polysemous words are represented together, so they should not compete for activation. Actually, the hypothesis postulates that senses of polysemous words facilitate the interpretation of the other senses that are encoded in the same representation. Klein & Murphy (2001) run five experiments that test whether there is inhibition between senses of polysemous words. They use phrases that include a polysemous word and a modifier. For example, *paper* (polysemous word) is paired with the modifiers *wrapping, shredded, liberal* and *daily*. If there is an inhibitory effect between senses of polysemous words, as occurs with homonymy, it seems difficult to maintain any One Representation Model.

Each experiment consist of a similar task, but with some relevant differences. Thus, the first experiment is a memory task: participants see a list of phrases that they have to study and, after that, they have to read some sentences with a capitalised word and decide whether the word had appeared in the first part of the study. An example of one phrase in the first part is *daily paper*. In the second part, they see either a repeated phrase, a non-repeated phrase that uses the same sense or a new phrase with a non-consistent sense: *daily paper*; *liberal paper* or *wrapping paper*.

In experiments 2-5, participants have to make sense/non-sense judgments on

the phrases. Thus, instead of a list of phrases that they have to memorize, they see one phrase that could be either *daily paper* or *wrapping paper*. After reading that phrase, they see the phrase *liberal paper* and they have to decide whether the latter expression is consistent with the phrase that they have seen first. For example, the phrase *liberal paper* is consistent with *daily paper*, because in both phrases the word *paper* refers to the newspaper, but it should not be consistent with *wrapping paper*.

Experiments 3 and 4 add homonymous words, and in experiment 4 some "non-words" are added and participants also have to say whether the expression that appear is a word or not. Finally, in experiment 5, a new condition (neutral prime) is added: it consists of 6 new polysemous words (*glasses, class, box, sign, trunk* and *drive*). The idea is that if there is a faster response to the other conditions than to the neutral conditions, it indicates that senses of the same polysemous word facilitate the interpretation of the others. However, if there is inhibition between senses, the response will be slower in comparison with the neutral condition.

The studies show that using a word in a specific sense facilitate comprehension for a phrase that uses the word in the same sense, yet when they use the word in a different sense, there is inhibition in comprehension. Moreover, using a word in the same sense is a good memory cue, but using the word in a different sense is not. These results suggest that different senses compete to be interpreted.

Klein and Murphy claim that it is difficult to explain the results from a core-meaning approach. Remember that core meaning approaches propose that there is an underspecific meaning that has to be accessed before interpreting the specific meaning of the word. Their argument against core meaning approaches is the following: if there was a core meaning, there would not be any "consistency effect" in the selection of the word in the second phrase, because the interpreter would have to access the core meaning in any case. Moreover, if polysemous

words share a core meaning and homonymous words do not share a core meaning, the same consistency effect for homonymy and polysemy would not be expected.

The results of these experiments are also difficult to explain by other One Representation Models. The reason is that if different senses of the same polysemous word are stored in the same representation, they should not compete for selection, but they all should facilitate the activation of each other. As we will see in the following chapter, it is not just core meaning approaches which postulate that senses of polysemous words are represented in the same representation. Thus, for instance, there are some rich semantic theories that agree with this thesis. The main idea of rich semantic accounts is that interpreting the senses of a polysemous word requires accessing a rich amount of world knowledge, which means that general knowledge about the real world is involved in the interpretation of the correct sense of the word. From the general hypothesis of a rich representation theory, senses of the same polysemous word should not show any inhibitory or frequency effects because they are part of the same rich lexical representation. These theories will be explained in detail in chapter 4, although it is important to make clear now that the evidence of the given results (Klein & Murphy, 2001) is not only difficult to explain by core meaning approaches, but by all One Representation Models, including rich semantic accounts.

On the other hand, it has to be noted that the experiments from Klein & Murphy (2001) have been criticised by Klepousniotou (2002), Klepousniotou *et al.* (2008) because they do not distinguish between different kinds of polysemous words. It is true that the polysemous words that Klein & Murphy (2001) use for the experiments were very different to each other: *book, tin, run, see, paper, chicken, television, sheet, corn, oak, shower, drinker, atmosphere, coat, cold, fortune, hall, letter, nail, navy, orange, production, cotton* and *filling*. According to Klepousniotou *et al.* (2008), polysemous words should

be classified depending on how closely related their senses are. They replicate the study considering this factor and suggest that the more closely related (high-moderate-low overlapping polysemous words) the senses are, the more likely they are to be part of the same representation[1].

Moreover, there are other different studies that present evidence for One Representation Models. For instance, Beretta *et al.* (2005) run an experiment that consist of a visual lexical decision task with MEG recordings, in which the properties of ambiguous words are manipulated. Participants have to decide (by pressing one button or another) as quickly as possible whether each stimulus item is a real word or not. Their results suggest that homonymous words are accessed slower than polysemous words and words that have more related senses are accessed faster than words that have few related senses.

Given the contradictory conclusions of the experiments (see Beretta *et al.* 2005, Klein & Murphy 2002, 2001, Klepousniotou *et al.* 2008, Pylkkänen *et al.* 2006, etc.), Foraker & Murphy (2012) ran four different reading task experiments that try to answer the question about whether related senses of polysemous words are stored in the same lexical representation. The experiments they run test the frequency effect of senses of polysemous words by reading time measurements. If One Representation Models are correct, in the case of homonymous words, whose meanings are supposed to be encoded in different lexical representations, there should be a frequency effect: the dominant sense (more frequent sense) is expected to be easier to access, while the subordinate sense (less frequent sense) should show some processing cost in comparison with the more dominant sense. On the other hand, if senses of polysemous words facilitate their activation, they should not show any frequency effect -as One Representation Theories predict.

In the experiments, participants have to read pairs of sentences, in which the

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[1]Their experiment is presented in section 3.2

first sentence provide a context for the polysemous word, ending the sentence with the polysemous word -for instance *cotton*, and the second sentence (the target sentence) starts with an NP that was closely associated with the dominant sense (the more frequent sense) or the subordinate sense (less frequent sense). The experiments show a frequency effect in the interpretation of words with these senses, which has been interpreted as evidence against the "core meaning" model. However, again, the evidence is difficult to explain by any One Representation Theory.

For a better comprehension of the conclusions that follow from these experiments, let us look at them into details. Table 3.1 presents an example of the stimuli that were used in the first experiment:

Context sentence	Sense completion	First sentence	Target sentence
Dominant Context	Dominant sense	The fashion designers discussed the <u>cotton</u>.	The fabric was not what they had been hoping for
Dominant Context	Subordinate sense	The fashion designers discussed the <u>cotton</u>.	The crop was not what they had been hoping for
Subordinate Context	Dominant sense	The farm owners discussed the <u>cotton</u>.	The fabric was not what they had been hoping for
Subordinate Context	Subordinate sense	The farm owners discussed the <u>cotton</u>.	The crop was not what they had been hoping for
Neutral Context	Dominant sense	They discussed the <u>cotton</u>.	The fabric was not what they had been hoping for
Neutral Context	Subordinate sense	They discussed the <u>cotton</u>.	The crop was not what they had been hoping for

Table 3.1: Materials

For the target sentences, the results are the following: (i) following the dominant context, the dominant sense is read quicker than the subordinate sense; (ii) following the subordinate context, the subordinate sense is read quicker than the dominant sense; (iii) following the neutral context, the dominant sense is read significantly faster. These results suggest that there is a frequency effect in the interpretation of the polysemous word, which does not seem to support the hypothesis that the two senses are (in principle) interpreted with equal ease, as One Representation Models propose. Experiments 2 and 3 confirm these suggestions. Foraker & Murphy (2012) incorporate a context, a polysemous word, and a disambiguating region in a single sentence, which allows a test of whether interpreting a polysemous word within one sentence is the same as processing across sentences:

(21) The fashion designers discussed the <u>cotton</u> after the fabric ripped a second time.

(22) The fashion designers discussed the <u>cotton</u> after the crop failed a second time.

(23) The farm owners discussed the <u>cotton</u> after the fabric ripped a second time.

(24) The farm owners discussed the <u>cotton</u> after the crop failed a second time.

(25) They discussed the <u>cotton</u> after the fabric ripped a second time.

(26) They discussed the <u>cotton</u> after the crop failed a second time.

Experiment 2 investigates one-sentence materials (21-26) using self-placed reading, while Experiment 3 uses an eye-tracking. The results are similar to Experiment 1: the biasing context is effective and consistent conditions are read faster than the inconsistent ones. The eye tracker experiment shows that the

neutral context conditions are read quicker than the other conditions. There are no early differences in the polysemous region itself, which means that the selection of the sense may not happen at the moment the polysemous word is read, but at the moment it is disambiguated. However, there is an effect in sense dominance: shorter durations in the dominance sense than in the subordinate sense.

Does this mean that senses of polysemous words are not stored together? The results of the experiments seem to go in that direction, yet they contrast with other findings about reaction time comparing polysemy and homonymy (Frisson, 2015, Frisson & Frazier, 2004). Thus, the frequency effect in polysemy remains an open question. It is still possible that not all polysemous words are equally encoded or represented. As Foraker & Murphy (2012) propose, it may be the case that different forms of polysemy are not represented and processed in the same way. If that is the case, polysemy is not a question of all or nothing: not all cases of polysemy happen to be represented together and some cases behave more similarly to homonymous words. For testing this idea, it would be necessary to classify different polysemous words in groups, which is something that Foraker & Murphy (2012), Klein & Murphy (2001) did not do in their experiments. In the following section, I explain some evidence that supports the thesis that at least in some cases of polysemy, related senses seem to share the same lexical representation.

3.2   Evidence for the One Representation Model

Klepousniotou *et al.* (2008) criticize the fact that in the experiment run by Klein & Murphy (2001) -see previous section-, the ambiguous words are rated without considering how related the senses are. They run an experiment using a similar method to that of Klein & Murphy (2001): participants have to

judge whether ambiguous words embedded in word pairs (e.g., *tasty chicken*) made sense as a function of a cooperating, conflicting, or neutral context. However, they distinguish between three kinds of polysemous words: (i) highly overlapping meanings; (ii) moderate overlapping polysemy and (iii) low-overlapping polysemy. It is difficult to see the actual reason why two senses are considered high overlapping senses and the two senses of other words do not overlap highly. According to Klepousniotou *et al.* (2008), core meanings contain semantic features. Overlapping refers to the amount of semantic features that two senses of the same word share. The difference between homonymy and polysemy is considered, in this respect, a continuum: the meaning of homonymous words are not overlapping meanings; senses of polysemous words that do not share many semantic features are called moderate overlapping senses; and senses that share many features are highly overlapping senses. In table 3.2, which exemplifies the materials in the experiment, there is a classification with some examples:

		Dominant sense		Subordinate sense	
Overlapping	Ambiguous word	Modifier 1	Modifier 2	Modifier 1	Modifier 2
Low overlapping	appeal	sex	universal	legal	pending
Moderate overlapping	atmosphere	tense	informal	upper	polluted
High overlapping	article	history	well-written	submitted	popular

Table 3.2: Materials

Moreover, Klepousniotou *et al.* (2008) manipulate dominance effects as a factor between subjects. The dominant target group of participants see first a phrase (prime pairs) that may have dominant senses, neutral or subordinate. After that, they see a phrase (target phrase) that always has a dominant sense. Cooperating contexts are always formed by a dominant prime pair followed by a corresponding dominant target pair. Conflicting contexts are formed by a subordinate prime pair followed by a dominant target pair.

The procedure of the experiment is similar to Klein & Murphy (2001)'s experiment. Participants have to read pairs of words that have one word in common and, after that, they have to judge whether the pairs of words make sense (whether they were consistent) or not.

The results are very different from what Klein & Murphy (2001) find. Participants are significantly more accurate for low-overlapping words when these are presented with cooperating contexts (97%) in comparison with neutral contexts (88%) and conflicting contexts (79%). For moderate-overlapping words, participants are significantly more accurate when these are presented with cooperating contexts (96%) in comparison with conflicting contexts (85%) but not neutral contexts (91%). Finally, there are no significant differences in accuracy for high-overlapping words, whether participants are presented with cooperating (97%), conflicting (91%), or neutral (92%) contexts.

After a further test of the effects of dominance, the analyses reveal different effects of dominance for high-overlapping senses: when the prime pair is a subordinate sense and the target pair biased is a dominant meaning, there is little processing cost for high-overlap target pairs. Moreover, when the prime pair has a dominant meaning and the target pair has a subordinate meaning, high-overlapping words are comparable with the other word types (moderate-low overlapping) in showing a cost. Nevertheless, the cost is numerically smaller for

the high-overlapping words than for the other word types.

In sum, it seems that high-overlapping polysemous words differ from moderate and low-overlapping ambiguous words in comprehension. Klepousniotou *et al.* (2008) analyse different possible compatible theories with these results. According to them, it may be the case that high overlapping polysemous words are contained in the same representation. For example, the polysemous word *article* may include all possible semantic features associated with any possible sense of the word. On the contrary, moderate and low overlapping words may be in different lexical representations.

The second proposal that should be considered is that high-overlapping words have a core meaning representation that maps to their dominant meaning. Subordinate meaning would only be selected or generated via semantic rules in a subordinate context. They also consider the possibility that Separate Sense Lexicon theories could explain the results. The reason why conflicting conditions are easier to resolve could be that the alternative meanings are highly related by some semantic/psychological links. However, it is not clear why these senses would be linked while others are not. In conclusion, the results seem to fit better with a One Representation Model, at least for high overlapping senses. Now, we do not need to commit with the idea that senses of the same representation share many semantic features -as Klepousniotou *et al.* (2008) propose. It is possible that senses of some cases of polysemy happen to be in the same lexical representation, without having to commit with the idea of a core meaning that contains semantic features -we will see some other proposals in chapter 4-.

There are some other experiments that suggest that very closely related senses are in the same representation. For instance, Frisson (2015) runs two experiments: a sensicality task and an eye tracker study, whose results contradict SEL. The

sensicality task is based on the Klein & Murphy (2001) study[2]. The aim of Frisson's experiment was to extend the results of Klein & Murphy (2001). First, he wants to replicate the experiment using only polysemous words whose senses are more clearly related. Second, he wants to investigate whether sense dominance plays a role in the consistency effect -as Klein and Murphy show. According to Frisson, if senses of polysemous words were stored in the same way as meanings of homonymous words, then we should expect that frequency affects polysemy in the same way as it does with homonymy: switching from a dominant sense to a subordinate sense should result in differential priming effects.

The experiment consists of a list of 24 pairs of adjective + polysemous nouns presented in pairs with the prime constructions and the target constructions expressing a coherent interpretation. Adjectives select one sense of the word: either abstract (*scary book*) or concrete (*bound book*). The abstract sense is considered the dominant or the more frequent sense[3]. Participants have to choose whether they made sense or not by pressing buttons. Table 3.3 shows the materials in each condition (Frisson, 2015):

Item	Consistent dominant	Consistent Subordinate
Album	jazz-outdated	used-scratched
Atmosphere	impersonal-combative	dry-polluted
Book	well-plotted-scary	hardcover-bound
Booklet	entertaining-devious	stapled-flimsy
Catalogue	clothes-foolish	coloured-bulky

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[2]In this section, I analyse the sensicality task. The eye tracker will be explored in detail in PART II. The reason is that the eye tracker uses copredicative sentences as stimuli. Part II is dedicated to exploring experimental work on inherent polysemy and copredication, so it makes sense to include the analysis of its results to that part of the thesis.

[3]They count the number of concrete and abstract interpretations in the first twenty classifiable examples from the 100 million word British National Corpus.

CD	brilliant-depressing	second-hand-damaged
Dictionary	college-comprehensive	portable-cumbersome
Encyclopaedia	well-written-inaccurate	leather-bound-wrapped
Environment	companionable-aggressive	visible-contaminated
Film	childish-romantic	spliced-overexposed
Headline	ambiguous-silly	illegible-large
Journal	political-reputable	spotted-unopened
Letter	personal-insane	dog-eared – stained
Manuscript	concise-revised	ancient-concealed
Message	boring-rude	red-faded
Newspaper	liberal-dull	torn-soaked
Notice	thoughtful-tedious	little-scrawled
Novel	simplistic-modern	paperback-expensive
Pamphlet	informative-timely	small-smudged
Poem	assigned-famous	torn-hidden
Report	surprising-disputed	folded-missing
Screenplay	violent-absurd	handwritten-thick
Syllabus	reworked-incorrect	enlarged-misplaced
Tabloid	misinformed-outrageous	ripped-discarded

Table 3.3: Materials

The experiment does not show any significant difference between switching in one direction or the other, which means that dominance has no effect in processing the words. However, it shows that there is a cost in switching in either direction. Frisson interprets these results as being more consistent with One Representation approaches than with SEL. If these senses were represented in the same way as

the meaning of homonymous words, there would be some frequency effect.

From a One Representation Model perspective, these results about the representation of polysemy could be explained in different ways. For example, following an underspecification account, Frisson (2009) proposes that when interpreters encounter a homonym, all its non-related meanings receive activation, so they compete to be accessed and context can reorder access by making the subordinate meaning more accessible. However, the less frequent meaning is more difficult to access. The reason is probably that the wrong meaning has been previously selected, so there is "competition" between them. However, more related senses of polysemous words seem to be accessed differently (see also: Frisson & Pickering 1999, 2007).

According to Frisson (2009), when a polysemous word is interpreted, the same underspecified meaning is initially activated for all senses of a polysemous word and the frequency of the senses does not play any role at the access stage. His view explains the findings for homonymous words by assuming that these words have two (or more) underspecified meanings. However, it has to be considered that there is a frequency effect in polysemy -as Foraker & Murphy (2012) show. Comparing the results given in this section to what I analysed in the previous section (Klein & Murphy, 2001), it seems that depending on the kind of polysemy we are studying, there is going to be frequency effect or not. Thus, we can conclude that not all kinds of polysemous words are stored in the same way.

In the next section, I summarize one experiment that studies whether there is any inhibitory effect in mass/count senses and content/container which exemplify derivational polysemy.

3.3 Derivational cases: mass/count senses and content/container

Frisson & Frazier (2005) run two eye tracker experiments, whose purpose is to investigate the processing of mass nouns used as count nouns and of count nouns used as mass nouns. We have seen in the previous section that some experimental work suggests that not all polysemous words are expected to show the same processing cost. Thus, it seems that in some cases of polysemy there is inhibition, as occurs with homonymous words, while in others there is not. One plausible explanation is that some senses of polysemous words, those that are more closely related, are stored in the same representation, but senses that are not so closely related are stored in different representations. Are all closely related senses interpreted simultaneously in the representation? It is interesting to test whether derivational cases of polysemy show the same effect as other polysemous cases. The main debate in this section is between SEL and One Representation Theories, yet we must also consider the hypothesis that certain polysemous words may be the result of applying certain rules to literal meanings. For instance, Copestake & Briscoe (1995) contend that some of these cases should be explained by internal rule based mechanisms and Falkum (2015) claim that they are generated from the literal meaning by pragmatic inference and ad hoc sense construction -these ideas will be explained in more detail in chapter 4.

In this section I analyse the experiments run by Frisson & Frazier (2005) about count/mass polysemous words. Both experiments use the same nouns (for example: *beer* or *pear*). Experiment 1 studies the interpretation of these words when they are used as a countable noun. Thus, for example, in the case of the word *beer*, the countable reading of the noun is derived from the uncountable reading of the word. We "make it" countable when we use it in plural. It is for this reason

that they are called "derivational cases". Experiment 2 studies the same words but they are used as mass nouns. The results show that the preceding context helps in the processing of the sentences. Moreover, the experiments show some differences between countable-mass and mass-countable shifts.

Each experiment consists on 28 sentences, with four versions each. Participants have to read the sentences and press a button when they finish. After each sentence, there is a comprehension question that they have to answer by pressing 'yes' or 'no'.

In the first experiment, the sentences have a count noun syntax. Two of them (a and b) have a mass noun (for example: *beer*) that appears in plural -which indicates, by definition, that they should be interpreted as count nouns- and the other two (c and d) have a count noun that also appears in plural, which also means that they should be understood as count nouns. Sentences (a and c) have a neutral context and sentences b and d have a helping context. See table 3.4:

Mass noun, neutral context	(a) Yesterday, I bought imported *beers* at the counter of the local supermarket
Mass noun, helping context	(b) Yesterday, I bought **three** imported *beers* at the counter of the local supermarket
Count noun, neutral context	(c) Yesterday, I bought imported *pears* at the counter of the local supermarket
Count noun, helping context	(d) Yesterday, I bought **three** imported *pears* at the counter of the local supermarket.

Table 3.4: Materials

In the second experiment, the word appears in singular and the helping context indicates that the word should be interpreted as a mass noun. See the following

table (3.5):

Mass noun, neutral context	(a) Yesterday, John wanted imported *beer* after the rich main course. His girlfriend didn't want anything.
Mass noun, helping context	(b) Yesterday, John wanted just a small amount of *beer* after the rich main course. His girlfriend didn't want anything.
Count noun, neutral context	(c) Yesterday, John wanted imported *pear* after the rich main course. His girlfriend didn't want anything
Count noun, helping context	(d) Yesterday, John wanted just a small amount of *pear* after the rich main course. His girlfriend didn't want anything.

Table 3.5: Materials

The first experiment shows that turning a mass noun into a count noun is costly when the preceding context does not dictate how the noun should be understood. Interpreting sentence (a) is costly in comparison to the other sentences in experiment 1 (see table 3.4).

The second experiment shows that helping context facilitates the interpretation of the noun (both countable and mass nouns). Count nouns that have a helping context show fewer regressions (that is, the number of eye movements that cross the regions' left boundary and immediately follow the first fixation) than count nouns preceded by a neutral context. On the other hand, count nouns that were preceded by neutral contexts required extra processing time. There is also an advantage for mass nouns overall, yet as Frisson and Frazier already put it, it could be a consequence of a frequency effect of the singular form. In sum (recall table 3.5.):

- Helping contexts (b) and (d) aid in the interpretation of the polysemous noun.

- There are less regressions in the first fixation of count nouns in sentences like (d) than in sentences like (c).

- The later times (re-readings and total time spent in a region) were more costly for sentences (c) than (d).

It seems that the previous context has an important effect in the processing of the sentences. Moreover, there seems to be an advantage in the interpretation of mass nouns. As Frisson and Frazier note, this is an apparent difference with other polysemous words like *book*.

Considering the possibility that count/mass polysemous words are derived from a lexical derivational rule (Copestake & Briscoe, 1995), Frisson & Frazier (2005) argue that it is possible that in these cases speakers do not make an immediate commitment to one sense or the other. If that is the case, then we should expect from derivational nouns an asymmetry between the derived and the non-derived sense and an immediate commitment to the non-derived sense. Other polysemous words, like *book*, do not seem to have derivational senses, which means that it is not the case that the sense of the word *book* as content is derived from the sense of *book* as a physical object, so we should not expect this asymmetry. This asymmetry has also been suggested in other experiments -for instance, Schumacher (2013) shows that interpreting container words as content shows a negative effect in MEG recordings, while interpreting a content word as a container does not show this effect [4]. See the following examples of content-container sentences:

(27) Julian drank four bottles.

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[4]This experiment will be discussed in more detail in Part II.

(28) Albertus smashed the beer.

In sentence (27) the word *bottle* is used to refer to the content, while in (28) the word *beer* is used to refer to the container.

Schumacher (2013) run an experiment using content for container and container for content sentences in German. Here are some original examples (in German) with their translation into English:

(29)   (a) Was hat Heinz hastig getrunken?

           'What did Heinz drink hastily?'

       (b) Er hat **den Becher** hastig

           'He drank *the goblet* hastily'

(30)   (a) Was hat Rolf wie seinen Aufgapfel gehürtet?

           'What did Rolf guard jelously?'

       (b) Er hat **den Becher** wie seinem Augapfel gehütet

           'He guarded the goblet jelausly'

(31)   (a) Was hat Asterix an seinem **Gürtel** festgeschnallt?

           'What did Asterix fasten to his belt?'

       (b) Er hat **den Zaubertrank** an seinem Gürtel festgeschnallt

           'He fastened the magic potion to his belt'

(32)   (a) Was hat Miraculix vor dem Eintreffen der Römer gebraut?

           'What did Miraculix brew before the arrival of the Romans?'

       (b) Er hat **den Zaubertrank** vor dem Eintreffen der Römer gebraut.

           'He brewed the magic potion before the arrival of the Romans'

Example (29) shows a meaning shift from container to content; example (30) is the control sentence of (29); example (31) shows a meaning shift from content to container and example (32) is the control sentence of (31). Thus, the word *den Becher* (the goblet) is normally used as the container of a drinkable substance, however, in (29b) it refers to the content that Heinz drank. In (30b) the word *Becher* refers to the recipient. In (31b), the word *Zaubertrank* (magic potion in German) refers to the content and the container that he has fastened to his belt, but it normally refers to a liquid. In (32b) the word *Zaubertrank* refers to the recipient.

Content for container sentences show a late positivity[5], which is interpreted by Schumacher (2013) as a processing cost. The experiment suggests that the sense "content" is more accessible from the sense "container" than viceversa. Thus, it is possible that words that refer to contents -like *beer*- have a sense that refers to their container -for instance: "bottle"- encoded in the same representation. However, words that refer to the container -like *bottle*- may not have an encoded sense "content", so it is generated from a previous lexicalised sense.

Therefore, one plausible conclusion is that there are two ways of representing polysemous words: one for derivational senses and a different one for senses that are directly accessed from an underspecific meaning.

3.4 Conclusion

In this chapter I have discussed the empirical evidence resulting from the debate between One Representation Models and SEL.

In contrast to One Representation Theories, I have presented two frequency

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[5]The late positive component is a positive-going event-related brain potential (ERP) component that has been important in studies of explicit recognition memory. Late positivity has also been associated with implausibility. However, Schumacher did a second correlation analysis on the off-line plausibility scores and ERP difference scores. These correlations did not reach significance, which excludes the implausibility of the sentence.

studies by Klein & Murphy (2001) and Foraker & Murphy (2012) that show that there is inhibition between senses of polysemous words. The reason why this idea is so difficult to explain by One Representation Theories is that if two senses of the same polysemous words are represented in the same representation, it is expected that they do not compete to be selected.

However, it may be the case that different kinds of polysemy are differently stored and interpreted. The experiments I have presented in section 3.1 do not classify between different kinds of polysemous words. Klepousniotou *et al.* (2008) replicate one of the experiments, but they distinguish between different kinds of polysemous words. They differentiate between high overlapping senses, moderate overlapping senses and low overlapping senses. Low overlapping senses do not have many common semantic features, while high overlapping senses have many semantic features in common. This means that the latter are very closely related, while the former are less semantically related -as homonymous words. They find that high overlapping senses show less frequency effect, which suggests that they may be represented in the same representation. Thus, it is possible that some senses of polysemous words are stored separately, while more closely related polysemous words are stored in the same representation.

I think it is important to recall that Foraker & Murphy (2012), Klein & Murphy (2001), Klepousniotou *et al.* (2008) only consider the core-meaning approach as an alternative to SEL. However, there are other possible theories, for instance, rich semantic theories -which propose that polysemous words stand for complex structures- and literalist theories - which propose that one sense is derived from a lexicalised more conventional sense.

I have presented one experiment that uses polysemous words that have two senses: an abstract sense and a concrete sense (Frisson, 2015). The experiment shows no inhibitory effect between these senses. Thus, he concludes that the

result suggest that these senses share an underspecific core-meaning. However, non of the materials that Frisson (2015) used are derivational. In order to contrast this hypothesis, I have presented one experiment that tests mass/count polysemy (Frisson & Frazier, 2005). The experiment shows some differences between mass-count shifts and count-mass shifts. The results suggest that the derived sense is not directly interpreted from the underspecification meaning, so there is an asymmetry between one sense and the other. This idea confirms what Schumacher (2013) shows in her experiments about content and containers.

In conclusion, it seems that even when there is evidence in favour of both SEL and One Representation Model, considering all the analysis from different experiments in the debate, it is very likely that different kinds of polysemous words are stored differently in the lexicon. Thus, it could be the case that different theories of representation give good explanations for different words. In chapter 4, I present a classification of some One representation Models of polysemy and I discuss whether they can explain the empirical evidence I have explained in this chapter.

Chapter 4

Theories of representation

The aim of this chapter is to classify and discuss theories about representation and interpretation of polysemy and to investigate whether they explain the empirical results that were presented in the previous chapter. These theories can be classified depending on different questions: (i) are senses of polysemous words part of the same lexical representation?; (ii) is there a common underspecific representation?; (iii) how is the specific sense of the polysemous word accessed?; and (iv) what kind of information is stored in the lexical representation corresponding to a polysemous expression?

We have seen that SEL and One Representation Theories give different answers to the first question. Thus, according to SEL, senses of the same polysemous word are stored separately. In contrast, One Representation Theories claim that senses of the same polysemous word share one representation. The other three questions generate three main debates related to how polysemous words are represented.

From the perspective of One Representation Theory, it seems that in some cases, closely related senses of the polysemous word are directly selected or accessed from an underspecific meaning and many other senses

are derived or generated from fully specific senses that are already lexicalised. Underspecification theories claim that polysemous words stand for a general common meaning that is underspecific with respect to the occasional sense of the word that is used in a particular context (Falkum & Vicente, 2015, Frisson, 2015). The difference between core-meaning approaches and underspecific meaning approaches is not clearly cut. Falkum & Vicente (2015) claim that core-meaning approaches should be understood as a kind of an underspecific account, which makes sense because some other theories that will be presented here -like thin semantic theories and underspecification rich semantic theories- contend that the general meaning is underspecific and that the specific senses are accessed from the common underspecific meaning. However, they do not define this underspecific meaning in the terms of core meaning approaches.

Thus, what seems clear is that we should distinguish between core meaning approaches and literalist approaches:

- Literalist theories of polysemy: senses of the polysemous words are generated in context after accessing a literal fully specific meaning.

- Core meaning approaches: the lexical meaning of polysemous words is an abstract underspecific meaning that is shared by all the senses of the word and that needs to be accessed before the specific senses are accessed.

Depending on the kind of generative mechanisms these theories postulate for accessing the correct sense of the word, we should distinguish between internal generative mechanisms or lexical pragmatic mechanisms:

- Internal mechanisms: the specific sense of the polysemous word is generated/created by internal linguistic mechanisms. Some literalist theories claim that one sense is generated by internal rules from the literal meaning and many rich semantic accounts contend that some specific

senses are generated by generative internal mechanisms from a rich lexical structure.

- Pragmatic mechanisms: the new specific sense of the polysemous word is generated by pragmatic mechanisms from the literal sense or from the underspecific meaning of the word.

Finally, depending on the amount of knowledge we think that the general common meaning has, and on how senses are stored in the representation, we should differentiate between three kinds of theories:

- Thin semantic theories: they content that the general meaning of the word contains minimal information.

- Hybrid theories: they claim that senses are concepts stored together forming a net or a complex of concepts. These theories are halfway between thin semantic theories and rich semantic theories.

- Rich semantic theories: they propose that the common meaning of the polysemous word is rich. Some rich semantic theories propose that the common representation is an underspecific rich semantic structure.

Given that there is a huge diversity of theories that answer to different questions, the goal of explaining and discussing all of them is not a simple task. In order to give the best explanation of the main ideas of all the theories, the chapter is structured as follows:

In section 4.1, I expose some literalist theories of polysemy that postulate that the sense of the polysemous word is generated from a previously lexicalised literal meaning. I discuss two kind of theories: lexical-rule based theories of polysemy and lexical-pragmatic theories.

In section 4.2, I explain different theories that content that the general representation that is common to all senses of the word is a core-meaning.

In section 4.3, I focus on those thin semantic theories that postulate that the common representation is a pointer, which has no semantic content.

In section 4.4, I explain some hybrid pragmatic theories that claim that senses of words are concepts that are lexicalised in a conceptual net and that must be accessed by pragmatic mechanisms.

In section 4.5, I focus on two kinds of rich semantic structures: the qualia structure of the Generative Lexicon (Pustejovsky, 1995) and the rich informational structures from the Activation Package Model (Ortega-Andrés & Vicente, 2019).

4.1 Literalist theories of polysemy

According to literalist theories, polysemy resolution consists of generating the specific sense from a lexicalised meaning that is accessed by default. In a first step, a concrete and semantically determined representation, which captures only one of the possible meanings of the expression, is accessed: the literal meaning. Once this literal meaning is accessed, speakers are driven towards other senses which are more consistent with contextual demands. These approaches may give better explanations to the results given in section 3.3 about mass/count and content/container polysemy, which suggest that there is some regular asymmetry in derivational cases. It may be the case that one of the senses (the derivated sense) is generated from a previously lexicalised sense.

Different literalist theories postulate different kinds of generative mechanisms. Here I am going to differentiate between two basic approaches: internal generative mechanisms and lexical pragmatic approaches.

4.1.1   Coercive and rule based internal mechanisms

Coercive and rule based generative approaches content that some senses of polysemous words are generated by internal mechanisms. Asher (2011) suggests that regular polysemy is best treated in terms of coercion, which takes as its input a literal meaning, and forced by a type-mismatch when composing it with the other lexical meanings in the sentence, delivers a different meaning as output. What characterizes coercion is that the mechanisms always convert an argument to the expected type (meaning). For a better understanding, consider the following example:

 (33) Bob's idea weighs five pounds.

Normally, the verb *weigh* predicates something about a physical object, however, in sentence (33), the second argument of the verb *weighs* is the noun *idea*, which does not refer to a physical object. The meaning-shift of the verb is a result of a coercive mechanism that shifts its meaning to a new one that fits with the phrase *Bob's idea*.

Apart from coercion, Copestake & Briscoe (1995) uses other internal rule based mechanisms for explaining many regular cases of polysemy. The rules are seen as coming with specific interpretive predictions based on previously lexically stored information. Thus, for instance, the lexical rules change the value of a COUNT or MASS feature in the representation of the polysemous noun, thereby altering its denotation accordingly. These meaning-shifts could be explained by two rules: UNIVERSAL GRINDER (Pelletier, 1975) and UNIVERSAL SORTER or PORTIONING (Bunt, 1985). UNIVERSAL SORTER or PORTIONING is used to create a count noun with properties appropriate for an individuated entity from a mass noun denoting a substance. Thus, for example, the word *beer* (which is normally a mass noun) has its sense "liquid"

by default. When it appears in the sentence *three beers*, its meaning is shifted by UNIVERSAL SORTER to "bottle", making the word countable.

UNIVERSAL GRINDER is used to create a mass noun with properties appropriate for an unindividuated substance from a count noun denoting a physical object. For instance, in the sentence *after the accident, there was rabbit all over the road* (Copestake & Briscoe, 1995), the word *rabbit*, whose literal meaning is a farm animal- is used as a mass noun.

These approaches may satisfactory explain some sense-derivations -like mass/count shifts- of some polysemous words -like *beer* and *bottle*. However, these mechanisms have been criticised by Falkum (2015), who proposes that the generation of some senses is a pragmatic matter. I explain her critiques in the following section.

4.1.2 Lexical-pragmatic mechanisms

Falkum (2015) criticizes internal lexical theories because they show a lack of flexibility in their interpretation. The three meanings of the word *rabbit* in C_1-C_3 should be easy to access from the context of utterance. Consider the sentences in (34):

(34) C_1 My friend Teresa has a hamster at home and I ask her: *Will a hamster bite if it senses rabbit on my hands?*

 C_2 My friend Aitor (who likes to go hunter) tells me: *At this time of year I prefer using rabbit* (referring to electronic rabbit calls').

 C_3 A biology teacher says in class: *rabbits are smaller than hares*

Falkum argues that it is difficult to account to all possible senses of the word *rabbit* by internal lexical rules. Her conclusion is that even when internal semantic rules could be real, they only would be able to account for some interpretations of

polysemous words (like mass-count shifts) and a considerable number of senses are derived pragmatically.

A second problem that Falkum (2015) sees is that the rules inevitably overgenerate. As an example, she uses the sentence *Sam enjoyed but later regretted the rabbit* (Copestake & Briscoe, 1995). The common interpretation of the sentence is that Sam enjoyed eating the rabbit (meat) but later he regretted eating it (the meat). The verb *enjoyed*, which normally refers to an event, has as argument the noun *rabbit*, which typically refers to an animal, but in this case it refers to the meat of the animal; the verb *regretted* normally refers to an event, but in this case its argument is the noun *rabbit*, which again refers to the meat. Her argument is that there are too many shifting-meanings in this sentence, so there are too many internal rules to apply. The sentence is so ambiguous that it is not clear how hearers determinate when one rule has prevalence over the others when they interpret the sentence. Thus, it seems that we have to appeal to some sort of pragmatic mechanism to do it. Even when it is possible that internal generative rules exist, Falkum (2015) argues that we need to use pragmatic devises for explaining how speakers actually interpret some sentences.

Falkum (2017) and Recanati (2004) claim that these polysemous words have a literal meaning and a pragmatic meaning that is generated from the literal one. For instance, the word *rabbit* normally refers to an animal, yet it can be used to mean something different. Recanati contends that these senses are pragmatically generated by contextual modulation from the literal sense of the word *rabbit*, which is "animal".

According to Falkum (2017), the senses of the word *rabbit* in (34) are the result of a process of ad hoc concept construction. In the examples given in (34), the noun *rabbit* is linguistically unspecified with regard to its count or mass properties. In each case (C_1-C_3), the hearer looks for a particular kind of

implication. For instance, in C_1 the correct interpretation of the word *rabbit* has to achieve relevance for the hearer by offering an explanation as what could a hamster sense that makes it bite. The speaker would be looking for this particular implication (the reason why the hamster could bite). Thus, they will construe an ad hoc concept that satisfies the context-specific expectation of relevance (in this case: the smell of a rabbit) basing on the encyclopaedic entry of the words together with other contextual assumptions. They have to rely on the hearer's knowledge about the already established sense together with their capacity for relevance-driven meaning modulation to infer the new sense of the word (an ad hoc concept). Consider the following examples:

(35)   a Jesús is a chameleon.

         b Carolina is a child.

In an appropriate context, the interpretation of the word *chameleon* in (35a) may require a process of ad hoc sense generation, so the lexically encoded concept CHAMELEON may be narrowed to CHAMELEON* (denoting a particular kind of person: someone that is good at changing her appearance or personality depending on the surroundings). In (35b), the encoded concept CHILD is broadened to an ad hoc concept CHILD*, whose denotation includes adults who behave in certain childlike ways. The inferential process stops when the specific expectations of relevance (formed on the basis of the presumption of 'optimal relevance' conveyed by all utterances) are satisfied. The process leads to interpret sentence (35b) as meaning that Carolina is an adult that behaves as a child.

It is important to have in mind not all senses seem to be equally accessed. Thus, Recanati claims that some polysemous words that have a literal meaning and a pragmatic meaning that is generated from the literal one -as the literalist theories propose-, yet some very close related senses are already lexicalised together in the

lexicon, so they only need to be activated from a common core meaning. Core meaning theories are explained in the next section.

4.2 Core-meaning approaches

Core meaning approaches claim that different related senses of polysemous words have a common representation that contains semantic information that is shared by all conventionalised senses of the word (Ruhl, 1989). The main reason why core meaning approaches have become so popular is that they seem to explain why some close related senses facilitate the activation of each other, while meanings of homonymous words (that do not have a common "core meaning") inhibit each other.

Even when the core-meaning thesis has been so broadly discussed, there is no agreement about what this core meaning is. It would be an abstract meaning that summarizes the commonalities between different senses (Klepousniotou *et al.* , 2008, Recanati, 2004, Spalek, 2012). However, from the semantic perspective, there are too many explanations for the interpretation process. In this section, I discuss some core-meaning theories.

4.2.1 Set of features and rules

Klepousniotou *et al.* (2008) describe the core meaning as "a memory structure encompassing all semantic features that are common across multiple senses of a polysemous word". For instance, the core meaning of the word *rabbit* might include the features +ANIMATE, +FARM ANIMAL, +EDIBLE, +MEAT, etc. This way to approach has a limited reach, because, as Foraker & Murphy (2012) argue, the word *rabbit* retains the four features described in (34) and the senses of the word *rabbit* in (34) do not share all the features described for *rabbit*. Recall

the following sentences:

(34) C_1 My friend Teresa has a hamster at home and I ask her: *will a hamster bite if it senses rabbit on my hands?*

C_2 My friend Aitor likes to go hunter and tells me: *at this time of year I prefer using rabbit* (referring to electronic rabbit calls').

C_3 A biology teacher says in class: *rabbits are smaller than hares*

If we think that the core meaning consists of a set of semantic features, it is not an easy task to decide which general features should be part of the underspecific representation. Thus, it is very difficult to give a set of semantic features that could account to the huge sense-variability of a polysemous word. Bendix (1971) and Weinreich (1972) represent the meaning of an item in the form of schematic sentences or functions that consist of the semantic components necessary and sufficient to distinguish the meaning some words from the meanings of other words in the lexicon. Deciding which are these features is also a very difficult task to accomplish. For a better understanding, consider the following example: the core-meaning of the word *book* would contain the semantic features of being an informational content and of being a physical object, but it would also need to be distinguishable from other things that also refer to info-contents + physical-objects (like letters, newspapers, journals, etc). Thus, the core meaning would have some features that distinguish books from all these other things (like the kind of information that they transmit or their physical appearance). In sum, it is not so easy to differentiate which features are necessary and sufficient for understanding all possible related senses of a word.

Moreover, not all theorists agree with this idea, for instance, according to Bierwisch & Schreuder (1992), lexical information consists of collections of basic elements of the linguistic structure: phonetic features, semantic primes and

formal features that determinate language-internal properties with only partial and indirect interpretation in extra-linguistic domain (see Bierwisch 1997).

On the other hand, the core meaning may also consist of a set of rules (Blutner, 1998, 2004, Caramazza & Grober, 1976). Blutner (1998, 2004) claims that the core meaning only has the restrictions to concepts, which are interpreted by abduction rules; and Caramazza & Grober (1976) contends that there is a set of instruction rules that operate to produce the various surface specific senses. The application of an instruction rule is constrained by the relation that the final semantic representation (the specific sense) has with the stored world knowledge that the subject has. For example, the word *line* in the phrase *line your paper* has the instruction REALISE CONCEPT AS A VERB. In the expression *draw a line under the title of the book*, the word *line* has the instruction REALISE AS UNIDIMENSIONAL EXTENSION. When the word is interpreted in a particular context, these rules get more and more specific. For example, another rule of the word *line* in the second phrase would be REALISE UNIDIMENSIONAL EXTENSION AS VISUALLY PERCEPTIVE. The specification process continues until the correct sense of the word is interpreted.

4.2.2 General abstract meanings and schemas

To make things even more complicated, the core meaning has also been interpreted as a very general and abstract definition that accomplish to the requirements of all the senses of the word. Thus, polysemy is the result of an abstract core meaning from which other senses are generated. This thesis can be supported by pragmatic theories (Recanati, 2004) and by internal rule based approaches (Spalek, 2012).

Spalek's theory about verbs is a combinatorial rich paradigm that starts with

the identification of the core meaning of the verb -that is, the general underspecific meaning that is common to all conventional uses of the word and that continues through different combinatorial patterns (see Spalek 2012). She argues that the specific meaning of verbs is generated by internal lexical constrains that shift the general non specific meaning of the word, depending on the argument of the verb[1]. As an argumentative example, she gives an analysis of the meaning of the verb *romper* (*break* in Spanish). Her proposal is that when the hearer interprets the word, they access the underspecific meaning, which express "ceasing, breaking or going against an entity or event". When the verb *break* appears in *break the law*, it means something different from *break the window*. The noun *law* refers to an abstract object, which cannot be broken in the same way as a window. Thus, *breaking the law* means "going against the law" and *breaking the window* may mean "to divide it into parts".

Following a pragmatic perspective, some philosophers have claimed that the common meaning is a general schema. For instance, Recanati (2012) proposes that in some cases the specific meaning is generated by free enrichment and modulation from this schema. For example, the word *city* can refer to the people that lives in the city and the buildings and streets. In the sentence *the city sleeps*, the NP *the city* activates the schema and the sense "people", which fits with the verb *sleeps*, is pragmatically accessed from the schema.

Pritchard (2019) also proposes the common meaning is an analogical schema. Knowing the meaning of a word involves "analogical cognition", that is, it consists of appreciating the structure of a situation and of the ability to discern

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[1]There is a huge debate about what the internal structure of verbs is and how their meanings change depending on their argument (see: McKoon & Macfarland 2000, Rappaport-Hovav 2014, Rappaport-Hovav & Levin 2002). I do not wish to delve into details in this debate because the main purpose of the thesis is to explore the meaning of polysemous nouns and the debate is focussed on the semantics of verbs. However, it makes sense to briefly explain some ideas in order to understand how the debate contribute to answer the questions about the representation of polysemy

this structure in different situations. See the following example (table 4.1) of analogical cognition (taken from Pritchard 2019):

Base:	Target:
AA	BB CD
XYX	ZZW UVU

Table 4.1: Example of analogical cognition

AA in the base is perceptually similar to BB in target, but it is not similar to CD. XYX is similar to UVU but it is not similar to ZZW. The reason is that in AA and BB there is repetition of the same letter and in XYX and UVU there are two repeated letters and one different letter (there is a relation of symmetry). The second task is a relational-match-to-sample test, which cannot be solved by looking for perceptual symilarity.

The type of knowledge that the hearer uses when they understand a word is a schema that represents a relational structure. When the word is used, this relational schema plays a direct role in our thought and thereby facilitates the easy perception of analogical sameness across instances.

The approach seems very appropriate to explain the polysemy of some words that refer to actions or relational situations. For instance, the word *motor* generally refers to something that stores energy and imparts motion. When we use the word to refer to body organisms or a car engineering, we focus our attention on the relational structure of the word and on the similarity between these situations. It is for this reason that we apply the word across items that may bear little or no perceptual relation to another.

When we use the word *negotiation* to refer to the discussion between a parent and their child, a buyer and a seller, or between nations, we are also

focusing in an analogical schema that is common to all these situations. Thus, understanding these words involves understanding the "sameness" across those items or situations to which the words can be truly applied. However, as Pritchard (2019) already points out, the approach has a limited scope. Thus, taking some of the examples we have already studied in section 3, the two senses of the word *book* ("abstract content" and "physical object"), which are very closely related senses and do not show any inhibitory effect, may not share a common analogical schema in the way Pritchard (2019) describes it, even when they are somehow related -it seems that the information is "contained" or "physically expressed" in the physical volume.

Although they disagree on which elements should be considered part of the core meaning, all the proposals mentioned in this section share the thesis that senses of polysemous words are accessed from a common thin representation -they propose that the meaning of polysemous words consist on an abstract representation or a limited set of common semantic features.

Some theorists claim that the common meaning is even thinner than that. Thus, one path for maintaining an underspecification proposal consists on minimize the general meaning to something that is so thin that has no semantic information, it is a pointer that gives access to a concept. These theories are explained in the next section.

4.3 Thinner theories of word-meaning: pointers

Thin semantic theories about word meaning are those that claim that lexical, or standing meanings of words are impoverished with respect to their occasional meaning (Falkum & Vicente, 2015). The idea is that lexical underspecific meanings only contain the necessary information for constraining the range of

concepts (or specific senses) that words can express (Carston, 2012). According to some theories, the thin underspecific meaning is even thinner, it is a pointer that works as an instruction for how to access and assemble concepts. For a better understanding, consider the following examples:

(36)   a. I love this book.

        b. I love the end of this book.

        c. I love the illustrations of this book.

The general meaning is understood as a psychological or linguistic tool that gives access to the real meaning of the word (the concept). In (36a) the word *book* could mean either the physical object, the content or both. In (36b) and (36c) we have the following specific senses of *book*:

BOOK$_1$: book as the informational content in (36b)

BOOK$_2$: book as a physical object in (36c).

When the hearer encounters a polysemous word, they first access the underspecific meaning that is associated with several concepts (for instance: INFORMATIONAL CONTENT and VOLUME). In contrast, homonymous words do not share this underspecific meaning. When the hearer has to interpret the homonymous word, they have to disambiguate the underspecific meaning and, after that, they infer the correct concept that is used.

Pietroski (2008) proposes that understanding an expression is a matter of recognizing that expression as a certain concept–construction–instruction. For instance, the word *dog* provides instructions for accessing one or more concepts that are already available for natural use. When the word in interpreted, the hearer access the underspecific meaning that helps to access the concept DOG. The concept DOG is the actual specific sense of the word.

From the Relevance theoretic perspective (see Carston 2013, 2015, Falkum 2011), only ad hoc concepts are fully specific meanings of words. Polysemous words have a single underspecific abstract meaning distinct from senses' representations, which consist on a concept-schema, pointer or indicator, whose function is to constraint the process of accessing or constructing the fully specific meaning. Thus, the schematic meaning points to a conceptual region in the encyclopedic entry from which it is attached a package of information[2]. The information needed to create a new ad hoc concept is taken from the conceptual package and from the contextual information. The different senses of the word are ad hoc concepts that have undergone a process of conventionalisation; they are located in a single entry in the lexicon (see Carston 2012).

Thin semantic theories have been criticised because they do not explain why it seems to us that we understand the meaning of a word immediately when we use it. Thus, as Pritchard (2019) points out, if we first access a pointer, then our immediate grasp of the word does not involve understanding the concept, it is nothing more than grasping the pointer [3].

Moreover, if we embrace the Relevance theoretic account, the schematic meaning has no apparent role to play in interpretation. Carston (2016), who has recently showed some scepticism towards the underspecification hypothesis, has already noticed this problem. In a conversational context, when a speaker says *Could you please give me the book?*, the hearer has to interpret, on the basis of the concepts that they have, the context and relevance expectations, that what is referred as *book* has to be a physical object, because informational content cannot be given in the way they are asking for it. Thus, they first have to access a pointer and then access their concept $BOOK_2$. When the polysemous word is

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[2]The idea of encyclopedic entry is already envisaged in the standard Relevance theoretic view of concepts (Wilson & Sperber, 2002).

[3]For a more detailed argumentative discussion see Pritchard 2019, who evince some other reasons for doubting about theories that propose that word meaning is a pointer or instruction.

conventional (and both senses are already lexicalised), the speaker has enough information for selecting the concept $BOOK_2$ without accessing the schematic meaning. Thus, it is not clear what the role of that pointer or schematic meaning is. It seems unlikely that during the interpretation process the hearer has to access a non-conceptual meaning that does not give any new information to constraint the hearer. Carston (2019) proposes a hybrid pragmatic theoretic account, which I will explain in the following section.

4.4 Hybrid pragmatic theories: set of concepts

Some theorists claim that senses of polysemous words are concepts lexicalised together in a set of concepts or a polysemy complex (Carston, 2019, Recanati, 2017). For instance, Recanati (2017) proposes that some senses of polysemous words are selected by "conventional modulation". Conventional senses of polysemous words are stored together. When the polysemous word is interpreted, the senses are conventionally modulated from the core meaning. Conventional modulation is not a simple selection process in which the conventional sense is directly selected when the polysemous word is encountered. The underspecific core meaning (remember section 4.1) has to be accessed and the fully specific sense is modulated from it. In the case of derivational polysemy, a sense of a polysemous word is derivated from another by modulation chains.

Recanati defines polysemy as a "two-sided phenomena". There are two different ways of interpreting polysemy: some senses can be generated from others according to modulation patterns; while some other senses are conventionalised and stored in memory. According to this approach, the fundamental difference between sense generation and sense selection is that generation is productive: new senses can be generated in a creative manner. As a

result, words can take on an indefinite variety of possible senses.

Carston (2016, 2019) also proposes a hybrid theory. Senses of polysemous words are concepts stored in a "polysemy complex"[4]. On the other hand, the input elements of grammar and syntax are thin and abstract roots stored in a different lexicon. Thus, she distinguishes between the Conceptual Lexicon -that contains the senses of polysemous words stored in polysemy complexes- and the Linguistic Lexicon -that contains the underspecific thin roots that are the inputs to grammar and syntax. The idea of a polysemy complex seems closer to a rich semantic account of polysemy than to a thin semantic account, yet category-less roots from the L-lexicon are thin and underspecific and have to be accessed in order to select the correct sense of the word. It is for this reason that the proposal of polysemy complexes is hybrid between rich semantic proposals and thin semantic proposals.

According to Carston (2019), many senses of a polysemy complex are originally generated from pragmatic processes. The new ad hoc sense may be conventionalised, so it can be retrieved directly from the lexicon and it functions as potential input to pragmatic processes of meaning modulation[5]. For example, suppose that both senses of the word *book* (informational content and physical object) are conventional. When the hearer interprets the word *book*, they access the polysemy complex and select the correct sense based on the contextual information. In this case, there is no ad hoc sense generation, because the concept was already lexicalised. Conventionalised senses of the polysemy complex are interrelated via chains of (often) very context-sensitive inference, and can differ from one another in arbitrarily many ways. Their derivation depends on different kinds of ordinary and unpredictable world knowledge.

The senses of a polysemous words are, according to Carston, atomic concepts.

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[4]I have to thank Robyn Carston for all the discussions about this theory, which have been very helpful for the understanding of the nature of the polysemy complexes.

[5]It has to be noted that a sense that is conventionalised or lexicalised for one speaker can be novel for another speaker.

Thus, they are only constrained by whatever encyclopedic premises are most accessible and relevant in the particular context. Lexicalised senses of the same polysemous word are interrelated concepts that have associated encyclopedic entries. Carston does not take side in respect what the relation between the clusters of concepts and the actual conceptual encyclopedic knowledge is. There are at least three possibilities: it could be the case that each particular concept has its own encyclopedic information stored, it may be that there are some aspects that are shared by all concepts of the same cluster or it could also be a common encyclopedic storage for all senses of the polysemous word. I have arrived to the conclusion that the most plausible explanation is that each concept has its own encyclopedic storage and that some features are shared by some concepts of the same cluster. Recall sentence (35b):

(35b) Carolina is a child.

In (35b) the word *child* does not mean that Carolina is an infant, but an adult that behaves as a child. Thus, the sense CHILD* -which refers to an adult that behaves as a child- is an ad hoc sense that has been conventionalised. Both senses of the polysemous word are part of the same polysemy complex. They share some general information: both denote people that cannot take full responsibility for their own decisions and behaviour and that behave as they were still developing psychologically. However, one sense denotes adults while the other denotes children. Therefore, it seems that even if each particular sense has its own encyclopedic entry, some pieces of information must be shared.

As we have seen, the polysemy complex appears to be very rich. However, the hypothesis remains in halfway between thin semantic theories and rich semantic theories. In the following section I explain some theories that propose that senses of polysemous words are aspects of a rich semantic structure.

4.5 Rich Semantic Structures

Many rich semantic theories claim that polysemous words stand for a lexical structure that contain general world information that needs to be accessed before selecting the correct sense of the polysemous word. Following this idea, Zeevat *et al.* (2017) contends that the general meaning of a polysemous word is composed of a set of (moderately) universal semantic features and natural classifications of experience. Terms such as *animal*, *tree* or *tool* are represented as a set of objects with information about the degree of prototypicality (see Hogeweg 2012, Osherson & Smith 1981) and are organised in the same way as categorical frames[6] (Zeevat *et al.* , 2017).

According to Hogeweg (2012), the relation between words and meanings is the result of a process of optimisation [7], which means that, accessing the correct sense of a polysemous word consists of a process of suppressing those semantic features that are in conflict with the context. For example, when hearers interpret the expression *the stone lion*, the representation of the word *lion* inherits some of the features from the representation of the concept "animal" -like "being organic", or "being a mammal"-, which are in conflict with being made of stone. Incompatible features have to be suppressed, so some activated features are selected to create a

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[6]Frames are ways in which we organize the knowledge of what we perceive, remember, think, etc. They should be understood as systems of related concepts. For understanding one of these concepts, it is necessary to understand the whole structure in which it fits (Fillmore & Baker, 2015). Frame semantic theories are very close to cognitive semantic models, which do not postulate a settled position about polysemy. Some theories -like radial categories (see Lewandowska-Tomaszczyk 2007)- may be considered to be closer to a sense selection approach; others describe polysemy as a matter of "isolating" different parts of the potential "total meaning" of the word in different circumstances (see: Croft & Cruse 2004, Cruse 2000); while others claim that words are cues that gives access to the lexical knowledge of words, which is part of a dynamical cognitive system (see Elman 2009).

[7]The Optimality Theory (OT) of word meaning claim that the observed forms of language arise from the optimal satisfaction of conflicting constraints (see Smolensky & Legendre 2006). Smolensky & Prince (1993) introduced OT as a framework for linguistic analysis. In this theory, it is possible that the same representation integrates conflicting features that are part of a connectionist cognitive system.

coherent representation.

Some rich semantic theories propose that selecting the correct sense of the word requires accessing an underspecific rich concept that contains the potential conventional senses of the words. Accessing the correct sense may consist of generating the sense of the word by internal generative mechanisms (Pustejovsky, 1995) or it could be an activation-selection process (Ortega-Andrés & Vicente, 2019), depending on the type of word that is interpreted. In this section, I examine two theories that propose an underspecific semantic structure: the Generative Lexicon (Pustejovsky & Batiukova, 2019) and the Activation Package Model (Ortega-Andrés & Vicente, 2019).

4.5.1 The Qualia structure

The main example of a rich semantic structure is the qualia structure of nouns, which contains categorical information about four different aspects that allow us to understand what an object is: the constitutive aspect (which makes explicit the relation between an object and its constituents); the formal aspect (which distinguishes the object within a larger domain, so we can understand what typically distinguishes these objects from others); the telic aspect (the purpose or function of the object) and the agentive aspect (factors involved in the origin of the object and how the particular object was created). This classification comes from the Aristotelian theory of the four causes to characterize the possible kinds of objects. In Pustejovsky's approach, causes are called "qualia", and together they provide the lexical meaning of the noun that refers to the kind. For a better understanding, see Fig. 4.1:

$$
\begin{bmatrix}
\textbf{book} \\
\text{ARGSTR} = \begin{bmatrix} \text{ARG1} = \texttt{y:information} \\ \text{ARG2} = \texttt{x:phys\_obj} \end{bmatrix} \\
\text{QUALIA} = \begin{bmatrix} \text{FORM} = \texttt{hold(x,y)} \\ \text{TELIC} = \texttt{read(e,w,x.y)} \\ \text{AGENT} = \texttt{write(e',v,x.y)} \end{bmatrix}
\end{bmatrix}
$$

Figure 4.1: Argument and Qualia structure: *book*

The word *book* has two related senses or aspects that are part of the meaning of the word. Those aspects are different arguments in the lexical structure (see the argument structure represented with ARGSTR in Fig. 4.1). The argument structure of a noun defines the information in the formal qualia. For example, the information given in the qualia structure of the word *book* depends on the two arguments that the noun has: the physical object and the informational content. We have to distinguish between those polysemes, whose senses are directly accessed from the qualia structure -for instance: the two senses "informational content" and "physical object" of the word *book*-, and those polysemes whose senses are internally generated. Senses from inherent polysemous words[8] -like *book*- are directly selected from the qualia structure. Many other cases of polysemy are explained in terms of internal semantic mechanisms that connect the information given in a rich semantic structure (the qualia structure). Thus, lexical items are provided with mechanisms for fitting to novel environments: type coercion; selective binding and co-composition.

Coercive mechanisms always convert an argument to the expected type (recall section 3.1.1). Consider, for example, the sentence *she began a book*. The verb *begin* normally requires an event. Therefore, the word *book* does not satisfy the

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[8]Recall from the introduction (Chapter 1) that inherent polysemous words are those that typically pass copredication tests. According to Pustejovsky (1995) senses of inherently polysemous are somehow "inherent" to the entity that the term denotes.

type by the predicate *begin* because it is not an event, but an entity. The telic qualia of the word *book* is "to be read" (it is the purpose why the book was created) and the agentive quale of the word *book* is "to be written" (it is how the book came into its existence). These pieces of information are used to generate the new meaning of the sentence. The verb coerces the noun into an event-denotation ("reading the book" or "writing the book"). Thus, the expression *I began the book* actually means "I began reading the book" or "I began writing the book".

The mechanism "selective binding" uses the information given in the qualia structure of words to change the meaning of the words. For example, the phrase *a long record* means a record whose playing-time is long. Very commonly, the adjective *long* works as an event predicate, so it is able to select (selective binding) an aspect of the qualia structure of the noun (the telic qualia of the word *record* is "play") and modifies it to the telic event: the record playing event. Thus, the phrase *a long record* means "a long record playing event".

Finally, the third mechanism is co-composition, which occurs when a new non-lexicalised sense of the words in a phrase is generated from the composition of the qualia information of multiple elements in the phrase. For example, the word *bake* has the qualia "changing the state". When it appears with a noun of natural kind, like *potato*, the meaning of *baking a potato* is "to change the state of a potato". However, when *bake* appears with *cake*, whose agentive qualia is "baking" and which is not a natural kind, the phrase *bake a cake* means to "create the cake" and not to change its state. This shift is a result of co-composition of two particular aspects in the qualia structure of *bake* and *cake*: the agentive qualia of *bake*, which is the act of baking, and the agentive qualia of *cake*, which is also the act of baking. Both structures are unified in a new structure, so the sentence means "to create a cake".

GL has been criticised because the information given in the qualia structure

is not appropriate for explaining the generation of some senses. Actually, these mechanisms make some wrong predictions. For example, following the co-composition rule, when the verb *bake* appears with the word *pizza* it should change its meaning to "create the pizza", because the pizza is not a of natural kind, yet *to bake the pizza* very often means to change its state from "frozen" to "baked" (see also: Falkum 2011). It is for this reason that Falkum proposes that the interpretation of such sentence is a pragmatic matter: depending on the context, *baking a pizza* could mean "to change the state of the pizza" if it is a frozen pizza, or it could mean "to create the pizza" if the speaker is actually making a home made pizza.

Moreover, according to GL, the meaning of an evaluative adjective like *interesting* in the sentence *there is an interesting book* is generated in linguistic context by a process of selective binding, which makes available a selective interpretation of an event expression contained in the lexical representation (or the 'qualia structure') of the word *book*. Thus, the sentence would mean: "the book is good for reading". Falkum (2015) argues that this explanation cannot apply to words that are not artefacts, for instance: *good children, good weather*, etc. Children and fathers are not expected to have a telic qualia (a reason or purpose why they were created).

It is important to keep in mind that GL does not deny that context has some role in shifting the meaning of words. There are some specific cases in which the context and world knowledge may affect how the meaning of a word is coerced. For example, even when the word *bake* typically means "to change the state" when its argument is a natural kind, it still possible that in some specific cases, it does not have that meaning.

Considering the limitations of the qualia structure, Del Pinal (2018) proposes a multidimensional semantics that tries to account to some cases that do not seem so

easy to explain from Pustejovky's approach. According to this multidimensional theory, most lexical items stand for two structures instead of one: the E-structure and the C-structure. The E-structure determines the extension or denotation, while the C-structure contains the kind of information that qualia structures contain (Pustejovsky, 1995) plus information about stereotypical appearance: how the entities tend to be perceived, what their typical material is, the purpose they were created for and what their typical function is. A full understanding of the meaning of most nouns requires that we grasp their dual structure. For a better understanding, first, consider the double structure of the word *lion*:

[[LION]]

E-structure: λx LION(x)

C-structure:

C: λx SUBSTANCE LION(x)

P: λx PERCEPTUAL LION(x)

T:

A: λx $\exists$e [BIOLOGICAL BIRTH LION (E,X)]

The E-structure is what determines the expression of the meaning of the word. It contains the operators that engine composition. For that purpose, the E-structure takes the information from the C-structure, so the specific meaning of the word that is composed changes in each case. There are different mechanisms (like dimension operators and core enrichment operators) that take some aspects of the C-structure to make composition possible. Thus, imagine that instead of an animal-lion, the word *lion* is used to refer to a statue -for instance in the sentence: *the stone lion-*. In that case, the conceptual pieces of information that refer to the substance or the material are not useful for interpreting the meaning of the word

lion. The E-structure takes the perceptual aspect from the C-structure and uses it to modulate the meaning of the word from the sense "animal" to a new one.

Thus, the idea of making the informational structure even richer, so it contains some information about the stereotypical object, may help to explain more cases of sense derivation. Ortega-Andrés & Vicente (2019) claim that there is no principled reason why the aspect of the qualia structure have to be the ones that Pustejovsky (1995) proposes. Actually, Pustejovsky himself concedes that some entities are not characterised by the four features. For example, if a concept is an artefact, it has a function (a telic qualia); however, if it is a natural kind concept, it does not have a function, so it does not have a telic qualia, consequently, there is no event that could be selected in the qualia structure. The Activation Package Model (Ortega-Andrés & Vicente, 2019) complements the thesis of rich underspecific structures by proposing the notions of activation packages and realisation relations, which are explained in section 4.5.2

4.5.2 Knowledge structures as activation packages

The Activation Package Model (see Ortega-Andrés & Vicente 2019) also proposes that senses of some polysemous words are aspects of rich semantic structures, which consist of bodies of knowledge stored in long-term memory (Vicente, 2019). Such stored information is intended to capture the prototypical knowledge that we have, as well as how the different aspects of the informational structure relate to each other. For example, if we think about the lexical representation of the word *school*, it typically is an institution whose purpose is to educate people. The structure includes information about the kind of entity a school is, as well as information about its physical and temporal realisation or implementation, the kind of people that take part in it, and its organisational structure. Figure 4.2 represents the kind of information that could be encoded in the lexical entry of the

word *school* (Ortega-Andrés & Vicente, 2019):

$$
School : \begin{bmatrix}
\text{Formal: Institution = x} \\
\text{Telos: educating (e, x, y, z)} \\
\text{Participants: } \begin{bmatrix} \text{Students = y} \\ \text{Teachers = z} \end{bmatrix} \\
\text{Social Realisation: } \begin{bmatrix} \text{Organisation (x): } \begin{bmatrix} \text{Rules} \\ \text{Staff} \end{bmatrix} \\ \text{Representation (x): } \begin{bmatrix} \text{Director} \\ \text{Student Rep.} \\ \text{Sport team} \\ \text{...} \end{bmatrix} \end{bmatrix} \\
\text{Temp. Realisation: } \begin{bmatrix} \text{Process (x) = e: } \begin{bmatrix} \text{Temp. Org.} \\ \text{Timetable} \\ \text{Academic course} \end{bmatrix} \end{bmatrix} \\
\text{Phys. Realisation: } \begin{bmatrix} \text{Building (x): } \begin{bmatrix} \text{Outside} \\ \text{Inside} \\ \text{Occupants = participants (y, z)} \end{bmatrix} \end{bmatrix}
\end{bmatrix}
$$

Figure 4.2: Knowledge structure: *school*

Different aspects of the structure are senses of the word *school*, which are realisations (a way in which the school is real) of the prototypical school. The realisations are things that the school -understood as an institution whose purpose is to educate people- requires to be actualised in the world. This means that the aspects of the structure are in explanatory ontological realisation relations with the formal and the telic qualia. For example, a school is an institution (formal qualia) and its telos is to educate people (telic qualia). The institution depends somehow on its realisations: schools typically need a building and a social realisation, they also need to be socially organised and represented; and a temporal realisation, so it is temporally organised: the period of time students are at school, the scholar calendar, etc. The telos "educate people" requires at least two groups of participants: the students (who are educated) and the teachers (the educators). Thus, the knowledge structure associated with the word *school* is organised on the

basis of what we typically think that a school is and how it is actualised in the real world.

What characterizes the Activation Package Model is that it explains the interpretation of some polysemous words in terms of activation patterns. Some senses of the lexical structure activate each other forming an activation package. Senses that belong to the same activation package facilitate the activation of the others, so they do not compete to be selected. When the polysemous word is interpreted, all senses of the activation package are activated and the correct sense of the word is selected.

Not all senses of the same activation package activate each other with the same strength. The activation patterns are based on relations between the aspects of the structure, which means that some senses of the same polysemous words are expected to receive more activation from others depending on how they are related. These relations are conceptual links between aspects in the lexical structure that mirror how the objects that aspects refer to are related in the real world. For instance, the senses of the word *school* are in the following relations:

(I) The participants of the institution (students and teachers) are those that normally participate in the events and activities associated with the institution.

(II) The social organisation is formed by some rules and representative roles that regulate the events.

(III) The temporal organisation sets a timetable for those particular events in which the participants of the institution normally participate.

(IV) The physical realisation is the place where the events associated with the institution occur. The participants of those events and activities are

occupants of the inside of the building when they participate in those activities.

Considering (II) and (IV), there is an agential relation such that the participants of the organisation are normally located in the building. This agential relation may generate an activation pattern. The aspect "social organisation" forms an activation package with the rules because there is no possible organisation without rules. The aspects "institution", "social organisation" "participants" and "participants" form an activation package because there is no possible institution without the agents that work in it and because the participants are the people that are committed with the rules of the social organisation. Generally, the participants are in the building when they participate in these activities, which also explain why the sense "participants" and the sense "building" may also form an activation package. Moreover, the building is the place where all the events and activities of the institution take place, so the sense "building" also forms an activation package with the aspects "institution" and social organisation" [9].

Interpreting the meaning of a polysemous word like *school* in a sentence is a process of activation and selection. It ends when the specific sense of the word that is used is selected. There is a double activation process: when the interpreter encounters the word *school*, the whole structure is accessed, which means that all aspects in the structure can be selected. The predicational ambient and the extralinguistic context select the appropriate aspect in the structure. For example, consider sentence (37):

(37) The school [BUILDING] caught fire.

In (37), the predicate *caught fire* describes a property that has to be predicated of a physical object. The predicate gives the information that allows the interpreter

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[9]These relations explain why some senses have a greater tendency to copredicate than others. I will analyse these ideas in more detail in Part II.

to select from the structure the aspect "building". When one sense is selected, other aspects in the same activation package are highly activated. This process explains why senses of some polysemous words facilitate accessing other senses -recall from chapter 3 that the results of some experiments suggest that senses of some polysemous words -like *book*- facilitate the selection of other related senses od the same word (Frisson, 2015) and senses of some other polysemous words -for example *cotton*- seem to compete to be selected (Foraker & Murphy, 2012). Thus, the theory has a limited scope: senses of some cases of polysemous words do not form activation packages, so when one sense is selected, the other does not receive activation from it. In contrast, senses of some other kinds of polysemous words -like *school* or *book*- may activate each other, forming an activation package that facilitate the selection of the other sense, so they may be able to be selected at the same time.

Both GL and the Activation Package Model seem to give very good explanations of inherent polysemous words, that is, polysemous words whose senses typically copredicate -such as *school* and *book*-. The hypothesis of the Activation Package Theory is that senses that typically form activation packages have a greater tendency to copredicate. Part II is entirely dedicated to these words.

4.6   Conclusion

This chapter, together with chapter 3, presents an analysis of different kinds of theories about the representation of polysemy. In the first section, I explained literalist theories, which claim that some senses are derived or generated from a literal full specific meaning. Thus, it seems that rules based approaches are successful explaining some cases of polysemy that appear to be generated by regular semantic mechanisms (Asher, 2011), while there are some examples that

seem to be generated by contextual mechanisms (Falkum, 2017).

In section 4.2, I explained core meaning approaches. First, I have explained some theories that postulate that the core-meaning consists of a set of features or rules (Klepousniotou *et al.* , 2008). Secondly, I have presented some theories that claim that the core menaing is an abstract schema (Recanati, 2017).

In section 4.3, I have presented some thin semantic accounts that contend that the common underspecific meaning is so thin that has no semantic content (Carston, 2012, Pietroski, 2008). This underspecific meaning is a pointer that gives instruction to how to assemble concepts, so, the specific senses of words are these concepts.

In section 4.4, I have explained two hybrid theories of polysemy: on the one hand, Recanati (2017) postulates a core meaning account that defines polysemy as a two side phenomena: it is generative and also conventional. On the other hand, Carston (2016, 2019) has very recently argued that senses of polysemous words are stored in polysemy complexes.

In section 4.5, I have presented some rich semantic theories about polysemy, which claim that word meaning contain general conceptual knowledge that plays an important role in the interpretation of polysemous words (Ortega-Andrés & Vicente, 2019). These theories may give better explanations of inherent polysemous cases like *book*.

We can conclude that there are different kinds of polysemy. Different theories can give good explanations about specific kinds of polysemy, even when they may have some issues for explaining other types.

Part II

Inherent polysemous words and copredication

Chapter 5

Introduction to Part II

Copredicative sentences have been previously described (see the introduction) as those in which the same inherent polysemous word is used to refer to (at least) two different senses and at least two apparently incompatible properties are predicated about them. It seems that there are some senses of polysemous words that very frequently allow for copredication, yet other polysemous words do not generate copredicative sentences (see Moldovan 2019, Viebahn 2018). Here are some examples of typical cases of copredication[1]:

- Institution/building/people:

  (38) The **school** caught fire [BUILDING] and was celebrating [PEOPLE] 4th of July when the fire started -repeated in chapter 1-.

  (39) The **bank** is just around the corner [BUILDING] and specialises [INSTITUTION] in sub prime loans (Asher, 2011).

- Area/political institution/people/sport team:

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[1]I do not intend to give an exhaustive classification of all kinds of inherent polysemous words. The examples given are just some of many other kinds of possible combinations. I have tried to present a considerable variability of cases to show that there are some senses that tend to copredicate.

(40) **Brazil** is a large [AREA] Portuguese-speaking [PEOPLE] republic [POLITICAL INSTITUTION] that is very high in inequality rankings but always first in the FIFA ranking [SPORTS TEAM] (Ortega-Andrés & Vicente, 2019).

- Local administration/inhabitants/architecture

(41) **London** is so unhappy [INHABITANTS], ugly [ARCHITECTURE] and polluted [AREA] that **it** should be destroyed [ARCHITECTURE] and reconstructed [ARCHITECTURE] 100 miles away (Chomsky, 2000).

(42) The **city** [INHABITANTS] has 500 000 inhabitants and outlawed [LOCAL ADMINISTRATION] smoking in bars last year(Asher, 2011) -repeated in chapter 1-.

- Authors/works:

(43) **Brecht** was a communist writer [AUTHOR], but is still performed [WORK] in theatres all over the world (Ortega-Andrés & Vicente, 2019, Weiland-Breckle & Schumacher, 2017).

(44) **Hannah Arendt** was Jewish [AUTHOR] and widely read [WORK].

- Producer/product[2]:

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[2]Newspaper cases have been broadly discussed because they seem to present a double inherent polysemy: on the one hand, the word *newspaper* has the two info-content senses (*the newspaper is very interesting and very well decorated*), yet on the other hand, the word has the institution senses (*the newspaper was selling very well when it caught fire*). Some theorists have postulated that the word has two lexical entries (Arapinis & Vieu, 2015); while others suggest that they are aspects of the same lexical structure, which contains a tripartite argument structure (Pustejovsky, 1995). The question has not been resolved yet. For more discussion about this debate see also: Antunes & Chaves (2003), Dölling (forth)

(45) The **newspaper** has been attacked by the opposition [PRODUCER] and publicly burned by demonstrators [OBJECT-PRODUCTS] (Ortega-Andrés & Vicente, 2019).

(46) The **newspaper** contains some really useful information [CONTENT-PRODUCT] about restaurants and concerts but publishes [PRODUCER] a lot of useless junk as well (Asher & Pustejovsky, 2006).

- Social object/group of people:

(47) The **club** that was founded in 1987 [SOCIAL OBJECT] knows each other very well [GROUP OF PEOPLE].

- Content/container:

(48) The **bottle** was dropped [CONTAINER] by the baby and then cleaned by the father [CONTENT] (adapted from: Schumacher 2014).

- Informational content/physical object:

(49) The **books** [OBJECT] are thick and interesting [CONTENT] (Ortega-Andrés & Vicente, 2019) -repeated in chapter 1.

(50) This **book** is witty [CONTENT] and beautifully decorated [OBJECT] (Antunes & Chaves, 2003).

- Food/event:

(51) **Lunch** was delicious [FOOD] but took forever [EVENT] (Asher & Pustejovsky, 2006).

- Aperture/object-glass:

(52) Sandra crawled through [APERTURE] the broken **window** [OBJECT-GLASS].

(53) Agustín crawled through [APERTURE] the missing **window** [OBJECT-GLASS].

Some of these sentences could be interpreted as copredicating an abstract sense and a concrete sense (Murphy, 2019). For example, in (38) the building caught fire (concrete) and the group or institution was celebrating 4th of July (abstract) and in (39) the physical object (concrete sense) is thick and the content is interesting (abstract). Other copredicative cases -like (49)- are not so easy to understand in terms of concrete-abstracts senses. Thus, in (49) the bottle-container was dropped and the liquid it contained was cleaned. There is no reason to think that the beer is more abstract than the bottle or viceversa.

The fact that some words allow for copredication and others do not has been a matter of discussion in the debate about how senses of polysemous words are stored in the lexicon (see Frisson 2009). As far as the processing literature is concerned, numerous studies have investigated the comprehension of polysemy[3] and copredication has been used as a diagnostic test for polysemy (Copestake & Briscoe, 1995, Cruse, 1986, Jezek & Vieu, 2014), which means that the availability of copredication is taken to reflect straight-forward access to the different related senses, while failed copredication tests indicate that one of the senses is currently not available.

One outcome from this research has been that polysemous expressions comprise different classes and that different types of polysemous words seem to be stored differently. This conclusion in taken from the fact that some polysemous words show easy retrieval of different senses (Frisson & Pickering, 1999, Weiland-Breckle & Schumacher, 2017), while others show a priority of

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[3]Recall the experiments that have been presented in chapter 3.

one sense over another reflected in enhanced processing costs for the latter (Schumacher, 2011, 2013). It is for this reason that it has been proposed that senses that highly overlap do not compete to be interpreted, so they show no frequency effect (see chapter 3).

The question about which senses allow copredication has not been so easy to answer. The incompatibility of the two apparently polysemous senses is heavily context-bound and is thus a question of degree rather than an all-or-nothing matter, which means that copredication should not be used as a test for determining whether a word is polysemous or not. The word *dissertation*, for example, clearly copredicates in sentence (54) but not in (55) [4]:

(54) ? Judy's dissertation is thought provoking and yellowed with age.

(55) Judy's dissertation is still thought provoking although yellowed with age.

Copredicative sentences have been tentatively explained by appealing to the notion of a 'dot-object'[5] (Asher, 2011, Pustejovsky, 1995), a complex meaning involving several 'aspects' unified by a •, which has been typically used for explaining the type compositionality of copredicative sentences (Gotham, 2016, Luo, 2012). For instance, the word *book* has two copredicative aspects: informational content•physical object. According to GL, the two aspects are represented as aspects of the qualia structure of the word (recall chapter 4).

Assuming that the meaning of the sentence derives from the meaning of its parts and the way they are combined, dot types (or dot objects) allow the respective nominals in copredicative sentences to refer to (apparently) different things in the

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[4]Sentences that are not clearly felicitous are marked with *?*

[5]The notion of 'dot object' has been used to explain other phenomena that involve anaphoric structures. For instance, Recanati (2018) studies the hypothesis of dot objects to explain metafictional uses of fictional names: *Sherlock Holmes is a fictional character created by Conan*, in which the name *Sherlock Holmes* could have two senses: the flesh and blood individual and the fictional character that exists as an abstract object.

same sentence when the nominal is only mentioned once. Be that as it may, there is controversy in the literature over the metaphysical status of dot-objects.

The phenomenon of copredication poses a serious challenge to standard truth conditional semantics (Chomsky, 2000, Collins, 2017, Pietroski, 2018). Assuming that nouns refer to sets of particulars in the world, it is not clear what the denotation of the word *Brazil* could be in sentence (40):

(40) Brazil is a large [AREA] Portuguese-speaking [POPULATION] republic [SOCIAL ORGANISATION] that is very high in inequality rankings but always first in the FIFA ranking [SPORT TEAM] (Ortega-Andrés & Vicente, 2019).

If we restrict the meaning of *Brazil* to refer just to the institution, it ceases to be clear what the truth conditions of (40) could be, bearing in mind that the political institution is not first in the FIFA ranking. Therefore, what is the denotation of the word *Brazil* in (40)? In this debate, the focus lies on the question of whether the ontology of certain kinds can be made compatible with the phenomenon of copredication and standard truth conditional semantics. Asher (2011) proposes that dot objects are complex concepts and that the denotation of copredicative words are bare particulars. These particulars are individuated when we conceptualise them as one aspect of the dot object. For example, in the sentence *this book is interesting* the word *book* denotes a bare particular. The word stand for a complex concept (the dot object), which has two aspects: the informational content and the physical object. The predicative ambient individualises the bare particular as one aspect or the other depending on the context in which the word appears. Thus, the predicate *is interesting* individualises the particular as the informational content.

In contrast, mereological theorists of dot objects have claimed that copredicative nouns denote complex entities (Arapinis, 2013, Gotham, 2016). The

two aspects of the word *book* are sub-entities that constitute the whole complex entity. Other theorists have proposed that they give a range of possible denotations -in most of the cases: simple entities (Ortega-Andrés & Vicente, 2019). Thus, the word *book* stand for a complex conceptual structure that has (at least) two aspects: the informational content and the physical object. Each aspect in the structure ha its own denotation.

In this part of the thesis I focus on three main problems: (i) the acceptability of copredicative sentences; (ii) the interpretation of copredicative sentences; and (iii) the metaphysical concerns about the denotation of copredicative nouns. In order to answer these questions, Part II of the thesis is structured as follows:

In chapter 6, I present some evidence that studies the answer to the question of acceptability and I argue that the Activation Package Theory offers some ideas that plausibly help to understand how copredicative words are interpreted and how the theory may explain the empirical evidence. Thus, first, I present some general ideas that the Activation Package Theory proposes about how copredicative sentences may be interpreted. Second, I present some evidence about neurological activity in the interpretation of some copredicative nouns that supports rich underspecific theories of polysemy (recall the qualia structure and the knowledge structure in chapter 4). Third, I set forth the empirical investigation about order effects in abstract-concrete senses. Finally, I present some empirical evidence about content/container copredicative sentences and I argue that the thesis of Activation Packages may explain these results.

In chapter 7, I discuss some theories that answer the question of the denotation of copredicative nouns. First, I discuss the hypothesis that that copredicative nouns are not polysemous. Second, I analyse mereological theories of dot objects. Finally, I present the contributions from the Activation Package theory to the debate.

Chapter 6

Acceptability and interpretation of copredicative sentences

The Generative Lexicon and the Activation-Package model propose rich semantic accounts of word meaning which, contrary to other theories that I have presented in Part I, give specific explanatory models for copredication and inherent polysemy words. They claim that senses of inherent polysemous words are aspects in a complex structure that are selected when the word is interpreted.

In GL, senses or aspects of the inherent polysemous word are encoded together in the qualia structure as two or three aspects of the same dot object (Pustejovsky, 1995). The Activation Package Model contributes to this idea with the thesis that the aspects that typically copredicate form activation packages in the knowledge structure, which means that they typically activate each other forming activation patterns (Ortega-Andrés & Vicente, 2019). Activation patterns are based on explanatory ontological dependency relations between the aspects of the knowledge structure. Thus, the theory predicts that senses that form stronger activation patterns present a greater tendency to form acceptable copredicative sentences.

I claim that the notions of activation packages and explanatory dependency realisation relations contribute to the debate about the acceptability of copredicative sentences and meet the empirical results about the interpretation of copredication (Duek Silveira Bueno, 2017, Frisson, 2015, Murphy, 2019, Schumacher, 2013, Tao, 2015). Thus, the empirical evidence suggests that some senses form more stable and robust activation patterns of copredication, which depend on diverse factors like, for instance, predicate ordering (see Duek Silveira Bueno 2017, Murphy 2019. Murphy (2017) runs some acceptability judgements experiments about copredication that suggest that concrete-abstract copredicative sentences are more likely to be considered felicitous than abstract-concrete sentences. The hypothesis, however, contradicts some previous results with copredicative words of the concrete-abstract and abstract-concrete types. Thus, Frisson (2015) runs an eye tracker experiment that suggests that abstract-concrete copredicative sentences show some processing cost in comparison with concrete-abstract sentences. Therefore, as will be argued later, it remains an open question whether predicate order affects the acceptability of copredicative sentences.

On the other hand, empirical research about content/container shifts (Schumacher, 2013) and copredicative sentences of the container-content type (Duek Silveira Bueno, 2017) suggests that the "content" sense is less available to be interpreted that the "container" sense. As Ortega-Andrés & Vicente (2019) already claim, these results match the idea of ontological dependency relations, which predicts some asymmetry in the activation patterns between the content and the container.

The chapter is structured as follows:

In the first section, I explain how the Activation Package Theory (Ortega-Andrés & Vicente, 2019) contributes to answering the question of the

acceptability in copredicative sentences.

In section 6.2, I explain some experiments on neurological activity that support the hypotheses of rich semantic structures.

In section 6.3, I discuss the thesis that predicate order affects the acceptability of copredicative sentences of the abstract-concrete/concrete-abstract type.

In section 6.4, I study the derivative case of content-container and I show how the Activation Package Model explains some empirical evidence about it.

6.1 Activation patterns and dependency relations

The Activation Package Theory aims to answer the question about why some senses copredicate and others do not in terms of activation patterns. Thus, some senses in the knowledge structure (recall chapter 4) tend to activate each other, forming activation packages that explain why some senses are easier to access than others (Ortega-Andrés & Vicente, 2019). Senses that belong to the same activation package typically form felicitous copredicative sentences. For instance, the two senses of the word *book* (informational content and physical object) are aspects of the same rich informational structure. They form an activation package that explains why they typically copredicate.

Why is it that some senses form activation packages and others do not? According to Ortega-Andrés & Vicente (2019), dependency and realisation relations between aspects in the structure explain the activation patterns between senses of the same activation package. Here there is an example of the possible informational structure of the word *book*:

$$\text{Book:} \begin{bmatrix} \text{Formal: content-information} = x \\ \text{Telos: being read (e, y, x)} \\ \text{Participants: Reader} = y \\ \text{Phys. Realisation: Physical object} = v \\ \\ \text{Text Realisation} = s: \begin{bmatrix} \text{Genre} \\ \text{Narrative style} \\ ... \end{bmatrix} \\ \\ ... \end{bmatrix}$$
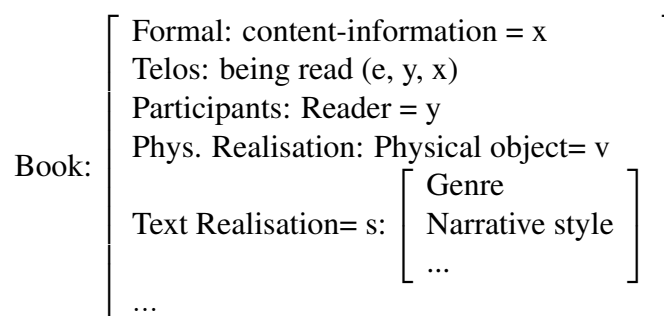
Figure 6.1: Knowledge structure: *book*

In the structure, the formal qualia is an informational content whose telos is to be read. Reading is an event (e) that requires an object (x) -the content or information that is read- and a reader (y). In order to be read, the book also needs a physical realisation, which can appear in many different formats: a paper-book, a digital book, etc. These aspects typically activate each other when the speaker encounters the word *book*, forming an activation package.

According to the Activation Package Model, the difference between felicitous copredicative sentences and infelicitous sentences lies at the level of activation that a certain sense of the word has. The reason why copredication does not work in some cases is that the senses involved fail to enter into a co-activation relation. Consider the following example:

(56) The book was well written but too thick so I did not buy it.

In sentence (56), the word *book* means "narrative style" and "physical object". The predicate *was well written* selects the aspect "style", which activates some aspects that are part of the same activation package, including the physical realisation of the book. The informational content of a book is written in a certain narrative style and it also requires a physical object that instantiates it, which means that the "content" sense of the book is in some kind of

explanatory dependency relation with both the physical realisation and the text realisation. Thus, aspects that are in these ontological dependency relations tend to form activation patters that facilitate the interpretation of other senses, forming activation packages. Now, let us go to the activation-selection process involved in the interpretation of sentence (56) step by step:

S I: The word *book* in (56) is heard/read and the lexical structure of the word *book* (fig. 6.1) is activated.

S II: The predicate *was well written* selects the aspect "narrative style".

S III: The selection of the aspect "narrative style" highly activates other senses following activation patterns, including "physical object".

S IV: The predicate *(was) too heavy* requires a physical object, because we do not normally attribute weight properties to abstract contents. Normally, the object is the physical instantiation of the abstract object (the content). Thus, the sense "physical object" is selected and the selection of this aspect can generate a different package, because it may highly activate other senses.

S V: The sentence ends so the selected aspects are interpreted as senses of the word *book*. The copredicative sentence is, then, interpreted as follows:

(56') The book [NARRATIVE STYLE OF THE CONTENT] was well written but [THE PHYSICAL OBJECT THAT PHYSICALLY INSTANTIATES THE SAME CONTENT] (was) too thick so I did not buy the book.

When the word *book* is interpreted, the whole structure is activated, which means that the conceptual information related to the prototypical books needs to be accessed. Like in GL, the aspects that are taken into consideration are those that characterize a certain kind. These aspects are typically available to

be the objects of predication. For example, if we consider different kinds of things that are informational contents, whose purpose is being read (not only books, but also letters, sms, e-mails, newspapers, etc.), there are some different factors to think about. The prototypical book normally has a number of pages; books and newspapers are different from letters, not only because of the format, but also because of the kind of content they transmit: what the letter transmits has been written to a particular reader and it conveys very specific kind of information; newspapers have copies (physical objects) that are published daily by an institution. All these cases have in common that their formal qualia is "informational content" whose telos is "reading" and that they have a physical realisation (that may have different properties or aspects depending on the format) and a text realisation (that may also have different aspects depending on the kind of text is written).

The knowledge structure of different words (see chapter 4) contains very different pieces of information that must be activated when the words are interpreted. This idea is shared by both GL (see Asher & Pustejovsky 2005) and the Activation Package Theory (Ortega-Andrés & Vicente, 2019). The knowledge structure associated with an institution includes information about its telos, its social realisation, and its physical realisation. Knowing what a social institution is involves knowing what it is for, how it is organised, and what kind of physical entity hosts it. Further specific knowledge derives from the particular telos of the institution. Thus, the proposal predicts that the school-institution requires (or has a dependency relation with) its realisations for existing. When the aspect "institution" is selected, it activates (most of) its realisations. For example, in order to be an institution, the school needs a social realisation, which means that the aspect "institution" may activate the aspect "organisation", forming an activation package. However, it is not so clear that the selection of the sense

"building" necessarily implies the activation of the sense "organisation", because the building does not necessarily require the existence of a social organisation. A sketch of the plausible activation pattern is represented in Fig 6.2:
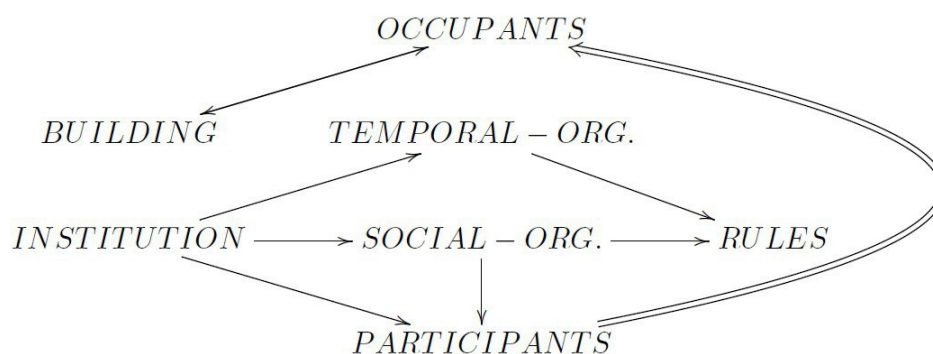
Figure 6.2: Activation patterns

I have excluded from the sketch many aspects from the knowledge structure of the word (recall chapter 4). The reason is that it is difficult to predict how the activation pattern would work in very precise terms. For example, it is not so easy to consider whether the representatives of the institution will activate the institution or vice versa. There are other aspects that are more ontologically linked by dependency relations, for example, the aspects "institution" and "social organisation" are closer than "organisation" and "building": buildings do not require social organisations for their existence and social organisations do not necessarily require a building. These aspects form activation patterns because they are in an agential relationship such that the participants of the organisation are normally located in the building when they are organised. This agential relationship may generate an activation pattern in some particular cases, yet it is not going to be as strong/common as in the case of institution-organisation, because institutions are not possible in any way without any social organisation. Therefore, this schema predicts that copredication is going to be easier or

more common between institution and organisation than between building and organisation.

Moreover, the social organisation activates the rules because there is no possible organisation without any rules. The institution and the social organisation also clearly activates the participants because there is no possible institution without the agents that participate or work therein. The participants generally are the occupants of the building, which also explains why the organisation may also activate the building.

Given that informational structures of different words are very different, the realisation relations that link the aspects may generate diverse activation patterns that could be reflected in the interpretation process of these sentences. It is expected that copredicative nouns show different activation patterns and that they activate different pieces of knowledge. Thus, even when the words *book, lunch, school* and *city* have an abstract and a concrete sense (content+object, event+object, social organisation + building, political institution + geographical area), the dependency relations between these aspects in the knowledge structure are nonetheless dissimilar. The physical object (volume) of the book physically realises some informational content; the lunch-food is made to be eaten in an event-lunch, the participants of the social organisation fulfil some specific tasks in the building and the political institution also carry out some tasks that affect the people that inhabit the geographical area. These concrete-abstract relations are of a distinctly different nature, therefore, the activation patterns are expected to be different in each case. The idea matches the results of some neural activities that suggest that different neurological areas are activated when the words *lunch* and *book* are interpreted (Tao, 2015). The evidence that supports this idea is tested in the next section.

6.2 Neural activity and rich underspecific semantic structures

Tao (2015) examines with fMRI which areas in the neural activity patterns -associated with the abstract and concrete interpretation of inherent polysemous words- can be differentiated during the interpretation of inherent polysemous words. The aim of the experiment is to test whether the activation areas are the same when speakers interpret inherent polysemous words of the type *book* that have two senses (information and physical object) as other words that refer to informational contents -for instance: *story*- or to physical objects -for example: *desk*. The materials in the study consist of four copredicative nouns in Italian (see table 6.1) -*book, magazine, catalogue* and *sketch*- with verbs that coerce the meaning of the polysemous words into one sense or the other -*consult the book* vs. *open the book*-. The semantic contribution of the verbs is also controlled, so we ca verify that the contrast in the inherent polysemous word is not solely due to differences in verbs between conditions:

Abstract sense		
Inherent polysemes	Simple	verb-control
consultare il **libro** consult the book	avere la idea have the idea	consultare l'experto consult the expert
consultare la **rivista** consult the magazine	avere l'opinione have the opinion	presentare la domanda present the request
consultare il **catalogo** consult the catalogue	cambiare la storia change the story	presentare il problema present the problem
presentare il **libro** present the book	cambiare il giudiziu change the judgement	presentare il programma present the plan
presentare il **disegno**	cambiare la idea	spiegare il motivo

present the sketch	change the idea	explain the motive
spiegare il **libro**	dare il giudiziu	spiegare la parola
explain the book	give the judgement	explain the expression
spiegare il **disegno**	dare la idea	spiegare la ragione
explain the sketch	give the idea	explain the reason
Concrete sense		
aprire il **libro**	avere it tavolo	aprire il pacco
open the book	have the table	open the parcel
aprire il **catalogo**	avere la sedia	aprire la busta
open the catalogue	have the chair	open the envelop
raccogliere il **libro**	avere la serivania	raccogliere il fiore
pick up the book	have the desk	pick up the flower
raccogliere la **rivista**	cambiare l'armario	raccogliere la moneta
pick up the magazine	change the closet	pick up the coin
raccogliere il **catalogo**	cambiare il tavolo	raccogliere la palla
pick up the catalogue	change the table	pick up the ball
regalare il **libro**	cambiare la serivania	regalare il biglietto
give (as a present) the book	change the desk	give (as a present) the ticket
regalare il **disegno**	dare la sedia	regalare il flore
give (as a present) the sketch	give the chair	give (as a present) flower

Table 6.1: Materials

The experiment shows that inherent polysemous words can be differentiated in the ventral anterior temporal lobe (vATL), which has been previously associated with high-level conceptual representation and semantic processes (see Patterson & Lambon-Ralph 2015, Patterson *et al.* 2007). On the other hand, the region has also been identified as the key region for modality-independent semantic representation (see Peelen *et al.* 2012, Pobric *et al.* 2010). In the present

experiment, simple contrasts (for example, the words *chair* and *story*) can not be differentiated in that area. As Tao (2015) suggests, one plausible explanation of the results is that the interpretation of the word involves accessing an underspecific complex structure -which contains conceptual/semantic information-, and when we put the word in context, the representation instantiates to a more specific sense. This thesis fits with the hypotheses of underspecific rich semantic structures. The fact that words that refer only to informational contents and only to physical objects (simple contrast conditions) are not distinguishable in the vATL can be explained as follows: interpreting words that do not have senses that copredicate does not involve a complex mechanism in this semantic-conceptual area, so it may be the case that interpreting these words does not require accessing many aspects in a rich semantic structure.

The described result is easily explainable by GL and the Activation Package Model. According to these theories, the interpreter has to access an underspecific meaning that contains general conceptual knowledge. From the Activation Package Theory perspective, both senses of the inherent polysemous word are in the same informational structure that contains general information about books and other objects that have a content and a physical realisation. The conceptual information that is also encoded in the structure gets activated when the interpreter encounters the word *book*.

A second question arises: is this the case for all inherent polysemous words? Tao (2015) runs a second experiment with the word *lunch*, which is also a typical inherent polysemous words. In this experiment, Tao investigates a different category of inherent polysemous words: meal words that refer to food and to events related to the food. Inherent polysemous words that refer to events and food are semantically different from the *book*-types. If rich semantic accounts are right, it is expected that the conceptual information encoded in the lexical structure

of the word contains different conceptual and categorical information.

The material consists of three words in Italian in the category food/event: *pranzo, cena* and *aperitivo (lunch, dinner,* and *aperitif)*. As in the other experiment, the experiment has three contrasts: simple contrast; inherent polysemy contrast and verb-control contrast. In the simple contrast Tao (2015) uses six sentences with a non-inherent polysemous word that refers to events (travel) and six sentences with a non-inherent polysemous word that refers to food (*pizza*):

Abstract sense		
Inherent polysemes	Simple	verb-control
anullare la **cena** cancel the dinner	pagare il viaggio pay the trip	annullare la decisione cancel the enrollment
annullare l'**aperitivo** cancel the aperitif	pagare la gita pay the trip	annullare l'iscrizione cancel the enrollment
prenotare il **pranzo** reserve the lunch	pagare la fiesta pay the party	prinotare il concerto reserve the concert
prenotare la **cena** reserve the dinner	pagare la festa prepare the travel	prenotare il concerto reserve the place
organizzare la **cena** organize the dinner	preparare la festa prepare the party	organizzare il corso organize the course
organizzare l'**aperitivo** organize the aperitif	prepare l'incontro prepare the meeting	organizare la giornata organize the day
Concrete sense		
confezionare la **cena** pack the dinner	pagare la pasta pay (for) the pasta	confezionare il pacco pack the package
cuccinare il **pranzo** cook the lunch	pagare la pizza pay (for) the pizza	confezionare il regalo pack/wrap the present

cuccinare la **cena**	pagare il risotto	cucinare il piatto
cook the dinner	pay (for) the risotto	cook the dish
portare la **cena**	preparate il pane	cucinare la ricetta
bring the dinner	prepare the bread	cook the recipe
portare il **pranzo**	preparare il risotto	portare l'acqua
bring the lunch	prepare the risotto	bring the water
portare l'**aperitivo**	preparare la pasta	portare la camicia
bring the aperitif	prepare the pasta	bring the shirt

Table 6.2: Materials

The experiment shows some differences between the areas that get activated in the interpretation of food/event polysemous words and the content/object polysemous words: the ATL effect appears in the right ATL instead of the left. It is normally expected that linguistic processes have a more reliable effect in the left hemisphere. The relationship between the left and right ATLs has been a matter of debate. Pylkkänen *et al.* (2006) measure the M350 component (equivalent of the EEG N400 component) with a priming paradigm. They find facilitatory effect in the left hemisphere for the related senses of a polysemous word (*lined paper* and *liberal paper*). By contrast, the M350 in the right hemisphere has a longer latency, suggesting that the two senses might shadow each other in the right hemisphere. Their conclusion is that both hemispheres work in a qualitatively different manner in polysemy comprehension. This hypothesis explains the effect in the experiment that Tao runs, yet it does not explain why the effect is much more relevant for the type food/event than for type content/object. Moreover, as Tao (2015) explains, Lambon-Ralph *et al.* (2010) give evidence for the idea that both left and right anterior temporal lobe regions contribute to the representation of semantic memory.

On the other hand, the left and right ATL show different effects in tasks that have been associated with social cognition. For instance, Snowden *et al.* (2004) show that patients with semantic dementia and with predominant left temporal lobe atrophy recognize names better than faces, whereas patients that have right temporal predominance present the reverse pattern. Moreover, Zahn *et al.* (2007) find a right superior ATL (sATL) activation among a number of social cognition areas when healthy subjects read pairs of words containing abstract social knowledge (e.g. *brave-honour*).

Tao (2015) suggests that the reason why he finds the activation at the right ATL may be that the words used in his experiment (*lunch, aperitif* and *dinner*) involve social events. Concepts such as "dinner" and "lunch" contain a social component, therefore, it makes sense that an area that is normally associated with social ability shows a higher discriminatory effect in the interpretation of these words than in the case of words that refer to texts. Actually, from the perspective of the Activation Package Theory, the content requires a physical realisation, yet dinners and lunches (understood as food) do not require the social event, even when thinking about a dinner leads to thinking about the event of "eating dinner", otherwise the dinner would just be food.

One last remark that must be discussed is that there is an effect in the left pvTLs, which has been associated with concrete object representation (see: Chao *et al.* 1999, Haxby *et al.* 2001). The effect is found in the simple-contrast in the first experiment (words like *chair*) but absent in the inherent polysemy contrast (*book*). In the second experiment, there is a significant distinguishing effect in the "food" sense of the inherent polysemous words. Thus, why does the concrete-inherent polysemy condition of the type *book* not show any such concreteness effect while the present experiment does? Tao suggests that the concrete and the abstract interpretations of book-type words are closer to each

other than in the event-food case, which makes sense because the abstract sense of a word like *lunch* refers to an event and the abstract sense of the word *book* refers to an informational object. Thus, *consult the book* may be "more concrete" than *organise the lunch*. Informational objects and events may be considered abstract with respect to physical objects (food or volumes), but, as I explained in the previous section, they are abstract in very different ways.

Tao runs a third experiment using MEG and including a third category: "institution", which also has (at least) one concrete and one abstract sense ("building" and "organisation"). In this case, he uses ten concrete and ten abstract verb-noun phrases from each inherent polysemous word category: (i) *book, magazine, catalogue, sketch, diary*; (ii) *lunch, dinner, aperitif, banquet, feast*; (iii) *hospital, office, school, church, hotel*.

The experiment shows that the left ATL exhibits a gamma-band power[1], which increases to the abstract condition of inherent polysemous words compared to the concrete condition after 400ms. This effect is not present in the simple conditions. It is interesting to note that gamma-band has been associated with various linguistic combinatorial mechanisms involving world knowledge (Hagoort *et al.*, 2004) and perceptual and conceptual feature binding (Friese *et al.*, 2012).

As Tao (2015) argues, the fact that the gamma-band activity pattern diverges after 400ms poststimulus suggests that the selection of the specific sense occurs after the underspecific meaning of the word is initially accessed and meets the verb context. The result is in agreement with the hypothesis that interpreting the word involves accessing the rich structure before selecting the specific context-relevant sense.

Why does the gamma-band activities associated with the concrete and abstract senses of inherent polysemous words diverge after 400ms? Tao (2015) does

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[1]Gamma-band activity is a pattern of neural oscillation in humans that comprises an EEG frequency range, from 30 to 200 Hz, and is distributed widely throughout cerebral structure.

not give a definitive answer to the question. His hypothesis is that there is a greater amount of activated semantic knowledge in the abstract condition that may require an extra operation, namely the coercion process, happening in the later period. However, it may also be the case that selecting abstract senses of these words requires accessing extra conceptual information in comparison to concrete senses. Thus, selecting the abstract sense of these words may involve a greater activation process in which more aspects in the structure get activated. For example, accessing the abstract sense of the word *book* in the sentence *explain the book* may involve the activation of many aspects of the structure of the word *book* (recall Fig. 6.1): the content of the book, the narrative style, the genre, etc. Accessing the abstract sense of the word *lunch* in *organize the lunch* may involve thinking about the place, the time, the people that will go to the lunch, etc. Accessing the abstract sense of the word *school* in *help the school* may involve thinking about the institution, the participants of the institution, the financials and the social organisation [2].

The relation concrete/abstract of copredicative nouns has also been investigated for studying whether more typical cases of copredication are also affected by the order in which these senses appear. I discuss the debate about sense order and the relation concrete-abstract in copredicative senses in the next section.

6.3 Order effects in abstract-concrete senses

Many cases of copredication that were presented in chapter 5 have been studied as concrete/abstract senses (Duek Silveira Bueno, 2017, Murphy, 2019, Tao, 2015). Actually, it is true that in many copredicative sentences one of the senses seems to

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[2]These phrases (*explain the book*; *organize the lunch* and *help the school*) have been taken from Tao (2015, 120-124).

be abstract with respect to the other. Recall the following sentences from chapter 5:

(42) The city has 500 000 inhabitants [INHABITANTS] and outlawed [POLITICAL INSTITUTION] smoking in bars last year (Asher, 2011).

(47) The club that was founded in 1987 [SOCIAL OBJECT] knows each other very well [GROUP OF PEOPLE].

(49) The books [OBJECT] are thick and interesting [CONTENT] (Ortega-Andrés & Vicente, 2019) -repeated in chapter 1-.

(50) This book is witty [CONTENT] and beautifully decorated [OBJECT] (Antunes & Chaves, 2003).

(51) Lunch was delicious [FOOD] but took forever [EVENT] (Asher & Pustejovsky, 2006).

In (42) one may consider that the sense that refers to inhabitants is concrete with respect to the political institution; in (47) the group of people is also concrete with respect to the social object; in both (49) and (50) the informational content is abstract and the physical object is concrete; and in (51) the food is concrete and the event is abstract.

There seems to be some systematicity in these cases: senses that are in some kind of abstract-concrete relation may show some tendency or facilitation to form acceptable copredicative sentences. They may also require that different conceptual aspects get activated -recall the results of the third experiment in the previous section (Tao, 2015). However, it is important to have in mind that the relation abstract-concrete would not be the same in all copredicative sentences. As I have already mentioned, the relation concrete-abstract in the case of books is quite different from the case of lunches, in which the abstract sense refers to an

event. For example, lunch-events can be disaggregated in many other lunch-events that are concrete with respect the whole lunch-event and the lunch-food is present many of those "sub-events". Speaking about concreteness-abstractness in this case is very different from speaking about the relation concrete-abstracts between a physical object and the information it transmits in the *book*-type.

In principle, following the thesis of the generative qualia structure (Pustejovsky, 1995, Pustejovsky & Batiukova, 2019), senses of inherent polysemous words are not expected to show predicate ordering effects. Thus, senses of inherent polysemous words are aspects of a dot object, so they appear as different aspects of the argument structure and the qualia structure of the word. For instance, according to Pustejovsky & Batiukova (2019, 199), both types of dot objects (food ●event) can usually be simultaneously activated by two predicates in the same sentence. Therefore, there is no reason why some senses may be more accessible than others, because lunches are food and events at the same time.

However, taking into consideration the notion of activation patterns and bearing in mind that the food (concrete object) is made to be eaten (abstract event), it would not be surprising to find some asymmetrical activation pattern between these aspects. Thus, it is possible that thinking about lunches as food (concrete sense) may make the interpreter think about the act of eating the food; on the contrary, thinking about the social event might not make the interpreter directly think about the particular food these people are eating (the concrete aspect of the food) [3], but on many other aspects that are related with the event "lunch": the people that are eating, the place, the time, the organisation, etc.

In the book-type case, it is also possible that seeing a physical book makes us think about its possible informational content, however, when someone tells

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[3]This hypothesis has been the result of very interesting discussions with Agustín Vicente, whose ideas are present throughout the thesis, and with Guido Löhr, who has very promising hypotheses about the acceptability of copredicative sentences and situation models that I am looking forward to seeing published.

us the plot of a novel, we may not directly think about the physical book that instantiates the content, but it may make us think about the way it mat be written, the characters, etc. Therefore, there may be some commonalities between the two word-types: the concrete sense facilitates thinking about the abstract sense and the abstract sense may generally involve more general conceptual thinking.

Murphy (2017, 2019) runs a set of experiments that study the effect of predicate ordering in acceptability tests about copredicative sentences with concrete-abstract senses. In these experiments, participants have to read a set of copredicative sentences using the words *book*, *lunch* and *city* and judge them on a scale of 1-7. He finds that copredicative sentences got better scores when the first sense is abstract than when it is the concrete sense. For a better understanding, let us see one of the experiments in more detail. Here are some examples of the materials:

(57) a. Stewart thought that the **creased** and **expensive** bill was being talked about.

     b. Stewart thought that the **expensive** and **creased** bill was being talked about.

     c. Stewart thought that the **creased book** and **expensive bill** were being talked about.

     d. Stewart thought that the **expensive book** and **creased bill** were being talked about.

Sentence (57a) is a copredicative sentence of type concrete-abstract; sentence (57b) is a copredicative sentence of type abstract-concrete. Sentences (57c) and (57d) are not copredicative: they use two different words. In sentence (57c) the senses appear in concrete-abstract order and in sentence (57d) the order is abstract-concrete.

As expected, sentences with two names (non copredicative sentences) get better punctuations than copredicative sentences. Moreover, concrete-abstract sentences get better punctuations than abstract-concrete sentences, whether they are copredicative sentences or not. These results are interpreted by Murphy (2019) as evidence in favour of the thesis that copredication is easier to interpret when the first sense that appears is concrete. This idea is along the same lines as the speculations about lunches and books made before. However, the results contradict some evidence we have about concrete-abstract objects (Frisson, 2015), according to which concrete-abstract book-type sentences show some processing cost in comparison to abstract-concrete sentences.

Frisson (2015) runs two experiments: a sensicality task with 24 pairs of adjectives plus nouns constructions[4] and an eye-movement study with 90 sentences in three different conditions (neutral condition, sense repetition and switch sense condition). Here are some examples of the sentences Frisson uses in the second experiment:

(58) a. Mary told me the book was scary and that she valued it a lot.

   b. Mary told me that the book was bound and she valued it a lot.

(59) a. Mary told me that the science-fiction book was scary and that she valued it a lot.

   b. Mary told me that the gift-wrapped book was bound and that she valued it a lot.

(60) a. Mary told me that the bound book was **scary** and that she valued it a lot.

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[4]This first experiment was analysed in Chapter 3. In the first experiment, the results do not show any significant difference between switching from the less frequent sense to the more frequent sense or vice versa, hence, dominance has no effect in processing the words. However, it shows that there is a cost in switching in either direction. This result has been interpreted to be more coherent with an underspecification account than to a Sense Separate Theory.

      b. Mary told me that the scary book was **bound** and that she valued it a lot.

The sentences in (58) exemplify the neutral condition, in which there is no switch or repetition of senses; (59) exemplify sense repetition: (59a) repeats the informational content sense of the word *book* (the dominant or more frequent sense), and (59b) the physical object sense (the subordinate or less frequent). In the sentences in (60) there is sense switching: from physical object to informational content in (60a), and from informational content to physical object in (60b).

The main discovery of the experiment (the eye tracker) is that there is some processing cost in the selection of the second sense of some copredicative sentences involving book-type polysemes. Switching from the subordinate (concrete) to the dominant sense (abstract) results in longer reading times than switching from the dominant sense to the subordinate sense. The dominance effect seems to be the opposite to what has been found in the case of homonymous words -recall chapter 3-, which suggest that (i) there are some senses that are easier to process than others and that (ii) the reason why this effect occurs cannot be explained in terms of frequency.

The comparison shows that switching from the subordinate to the dominant sense results in longer reading times than switching from the dominant sense to the subordinate sense. Thus, there is an observable difference between sentences like (61a) and (61b) with respect to the time that readers spend in the disambiguation region of the sentence (at the adjective in bold font): readers spend longer in (61a) than in (61b), that is, when the switch is from the less frequent to the more frequent sense. The same occurs on the disambiguating target region, which indicates that the greater the bias is for the abstract sense, the smaller the inhibition is in the switch condition.

Frisson suggests that the effect is probably due to pragmatic reasons. According to him, it is possible that the sense is activated, but that the expectations of the hearer make other kinds of information more salient (for instance, the hearer may be expecting to know more about the physical object just identified: where it has been put, how it looks, etc.). On the other hand, if there is a difference between *the bound book is scary* and *the bound book that we saw yesterday is scary*, such difference might show that it matters how abrupt the transition from one sense to the other is. This may also be related to some initial pragmatic/expectation effect that may go down as processing ensues. Adding a relative clause such as *that we saw yesterday*, which does not refer to any intrinsic physical property of the book, may have the effect of changing the expectations/predictions.

Ortega-Andrés & Vicente (2019) argue that there are reasons to think that there is no "inhibition" effect in (61). According to them, if there was an frequency effect between senses of the word in the switch context, the effect would be similar to what occurs in homonymy: switching from the more frequent sense to the less frequent sense should present more processing cost than switching from the less frequent sense to the more frequent sense. Therefore, the reason why there is some processing cost may not be a frequency effect but something else. However, it is still an open question why the acceptability tests that Murphy (2017) run show so different results. The results in the experiments (Frisson, 2015, Murphy, 2019) could be a consequence of alternative reasons. For a start, the conditions of these experiments are different. The copredicative sentences that Frisson (2015) use were of the book-type, while Murphy (2017) uses different word-types (all of them with abstract /concrete senses). Thus, it is still possible that different word types in different sentences show different results in this respect.

Duek Silveira Bueno (2017) runs acceptability tests with social object/group of people copredicative sentences -recall sentence (47): *the club that was founded*

in 1987 [social object] *knows each other very well* [group of people]- and compares the acceptability rankings with copredicative sentences of the type *book*. Surprisingly, Duek Silveira Bueno (2017) does not find any order effect in the committee-type sentences and she does not mention any significant effect in the order of senses in the book-type. In the Duek Silveira Bueno (2017) experiments, three factors are manipulated: (i) whether the senses selected by the two predicates match (non copredicative sentences) or mismatch (copredicative sentences); (ii) the order of the selecting predicates; (iii) the type of nominal: homonymous words, polysemous word type-*book* (physical object/informational content), committee noun (social object/participants). In table 6.3, I present an example of the *committee*-type condition:

Social organisation/committee	
Match Social object-social object	That one committee that was created last year has very strict bylaws.
Match Participants-participants	That one committee that gathered in the main room this morning knows each other very well. .
Mismatch Social object-participants	That one committee that was created last year knows each other very well.
Mismatch Participants-social object	That one committee that knows each other very well was created last year.

Table 6.3: Materials

In the second part of this experiment, the matching condition is reversed: predicates selecting for the sense "social object" in mismatching conditions appear in main clause position in the matching social object condition, and those selecting for the sense "participants" in matching conditions appear internally to

the relative clause in the human matching condition (bold letters):

(61) That one committee that has very strict by laws **was created** last year.

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

For the purposes of this chapter, the fact that *book*-type condition shows some differences in comparison to *committee*-examples is interesting. Copredicative examples with *committee* nouns get less punctuation than the other polysemous words. This result confirms the hypothesis that not all inherent polysemous words show the same facility for copredication. There seem to be some cases that are easier to copredicate than others. Thus, book-type copredicative sentences are very common and these senses may form more robust activation packages than others.

Finally, ordering effects in abstract-concrete senses remains an open question. From the Activation-Package perspective, ordering effects may be different for the words *city, lunch, book* or any other kind of abstract-concrete copredicative noun. However, these are all speculations about the plausible explanations of the empirical results. More research about ordering effect for different abstract/concrete copredicative words would be needed for making any robust thesis about it.

How about other copredicative cases? Ontological explanatory relations can be used to explain many irregularities from copredication. For instance, Ortega-Andrés & Vicente (2019) explain the asymmetry of drinkable-container cases by appealing to the order in which they appear in relation to the ontological relations between the aspects. In the next section I present some empirical evidence that examines these cases.

6.4 Activation patterns in content/container shifts

We have seen in chapters 3 and 4 that some polysemous words seem to be derivative: one sense is the literal previously encoded sense that is activated by default, while the other is generated in the context using the literal sense as an input. For a better understanding, recall the following examples:

(27) Julian drank four bottles.

(28) Albertus smashed the beer.

In sentence (27), Julian did not drink the bottle (the container) but the beer that the bottle contained. In sentence (28), the word *beer* is used as referring to the bottle-container. These senses sometimes generate copredicative and anaphoric structures:

(63) The blond beer was smashed.

(64) Laura drank the bottle of beer before Alberto smashed it.

In the given sentences, what is smashed is the container (the bottle) and what is drunk is the content (the beer). According to Ortega-Andrés & Vicente (2019), the sense "content" is expected to receive less activation from the sense "container" than viceversa, because bottles do not depend on the existence of a possible drinkable substance or content to be a bottle. Therefore, meaning shifts "drinkable substance-bottle" are expected to be easier to process than meaning shifts "bottle-drinkable substance". It has been shown in some experiments that there is some processing cost in the second cases compared to the first (Schumacher, 2013), which fits with the idea of activation patterns. Thus, in chapter 3 (section 3.3) we saw that Schumacher (2013) runs a ERP experiment using

simple, non-copredicative sentences in German, comparing container/content and content/container polysemes.

The first ERP study shows a positive deflection in shifting sentences of container to content, which Schumacher interprets as reflecting extra cost resulting from a reference shift from the original meaning of the word to a new interpretation. Contrary to the results about container for content, the ERP of content-for-container does not show any processing cost. Thus, it seems that the underlying operations are different in each case.

According to Schumacher (2013), the results of content-container shifts can be explained by meaning selection mechanisms that should not require extra processing cost. The extra processing cost in container-content can be explained by a different process: the activation of the "content" sense of the container-word may involve a reconceptualisation triggered by a type mismatch. Now, how do we explain the fact that shifting from container to content requires reconceptualisation but shifting from content to container only requires selection? According to Pustejovsky & Batiukova (2019), the word *bottle* is a dot object of the type container•content, defined as a container with a narrow neck and no handle/content of such container (Pustejovsky & Batiukova, 2019, 202). Therefore, it would be expected that the word *bottle* activates the aspect "content". Moreover, the qualia structure of the word *beer* (see Fig. 6.3) does not contain any aspect that refers to the container, so it seems to me that there is no principle reason why interpreting content-container shifts is easier that interpreting container-content shifts:

$$\left[\begin{array}{l} \text{Beer (x)} \\ \text{QS} \left[\begin{array}{l} \text{F: liquid substance (x)} \\ \text{C: ingredients of (w, x)} \\ \text{T: drink (y, x)} \\ \text{A: brew (z, x)} \end{array} \right] \end{array} \right]$$
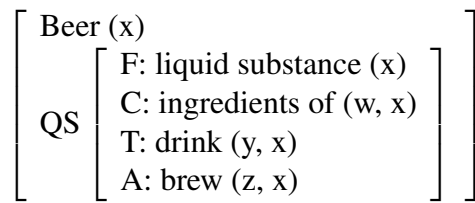
Figure 6.3: Qualia structure: *beer* (Pustejovsky & Batiukova, 2019, 368)

Following the Activation Package Theory, Ortega-Andrés & Vicente (2019) claim that the activation of the sense "drinkable content" highly activates the sense "container". The reason is that the drinkable content needs a container to be drunk. In contrast, when the word *bottle* is interpreted, the sense "drinkable content" is less accessible to be selected. This happens because drinkable substances need to be contained in a particular container to be drunk, so the word *beer* has in its knowledge structure the aspect "container" because the drinkable substance needs a recipient (container). If this hypothesis is true, then it is expected that copredicative sentences of type content-container are more likely to be acceptable than container-content copredicative sentences. Actually, as Schumacher (2013) notes, there seems to be a correlation between these results and the acceptability of copredicative and anaphoric sentences. Consider the following sentences (Schumacher, 2013):

(65) a. Peter stellte das Bier hin und trank es einige Minuten später.

   "Peter put down the beer and drank it a few minutes later"

   b. Peter stellte das Bier hin und ward es einige Minuten später versehentlich.

   "Peter put down the beer and accidentally knocked it over a few minutes later"

(66) a. ?Tim trank noch ein Glas, das mundgeblasen war.

"Tim drank yet another glass that was mouthblown"

b. Tim trank noch ein Glas, weil es so schön prickelte.

"Tim drank yet another glass because it sparkled so nicely"

c. ? Tim trank das mundgeblasene und prickelnde Glas.

"Tim drank the mouthblown and sparkling glass"

In (65a) the word *Bier* is primarily used to refer to the container (which is put down, in the predicate *stellte das Bier*) and to the content. In (65b) the two senses of the word *Bier* are used to refer to the container, so it is not a copredicative sentence. Both sentences are felicitous in German and English. Considering the sentences in (66), which are of the type container-content pairs, it seems that switching from one sense to the other gives non-felicitous sentences such as (66a) and (66c), in contrast with (66b), in which both predicates apply to the "content" sense.

Duek Silveira Bueno (2017) runs three acceptability experiments that test copredicative sentences with container words[5], which suggest that content-container sentences are higher ranked than container-content senses. This empirical evidence confirms the results of Schumacher (2013) and the predictions of Ortega-Andrés & Vicente (2019).

Duek Silveira Bueno (2017) uses coordinated sentences (two predicates apply to the same NP, which refer to the same sense in both cases) and copredicative sentences (the NP refers to two different things in the sentence) using homonymous words, polysemous words (type abstract/concrete) and with container phrases, which could be a container-phrase with countable content or a

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[5]Duek Silveira Bueno (2017) runs four acceptability tests about copredicative sentences, in which participants rank the sentences from -2 (very bad) to 2 (very good.) Three of the experiments are about container nouns, while the fourth experiment is about social objects-organisations. The last one is presented in the previous section.

container-phrase with mass content. In order to test whether the order of the senses has an impact or not, the order of the predicates is changed: abstract-concrete vs concrete-abstract and content-container vs. container-content. In the following table (6.4), there is an example of container conditions[6]:

Container phrase - Mass contents	
Match Container-container	The jug of lemonade my grandfather broke had lemons painted on it.
Match Contents-contents	The jug of lemonade I drank was too sweet.
Mismatch Container-contents	The jug of lemonade my grandfather broke was too sweet.
Mismatch Contents-container	The jug of lemonade I drank had lemons painted on it.
Container phrase - Count contents	
Match Container-container	The tupperware of cookies made of blue plastic is sealed shut.
Match Contents-contents	The tupperware of cookies I baked this morning is all chocolate chip.
Mismatch Container-contents	The tupperware of cookies made of blue plastic is all chocolate chip.

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[6]The sentences have been taken from Duek Silveira Bueno (2017, 67-68). It is important to note that the sentence *the tupperware of cookies I baked this morning is all chocolate chip* (condition: count content, mismatch content-container) is not a mismatch example; both predicates *I baked this morning* and *is all chocolate chip* refer to the content of the tupperware and not to the container. A container-content sentence would be: *the tupperware of cookies I baked this morning is sealed*. Because I do not have access to the actual materials, there is still the doubt of whether the mistake is present in the manuscript or not. If the mistake actually appears in the materials in the experiment, then the results should not be taken in consideration. Fortunately, Duek Silveira Bueno (2017) runs a third experiment that test again the copredication of these kinds of sentences and, in that case, the materials of this condition are labelled correctly.

Mismatch	The tupperware of cookies I baked this morning is all
Contents-container	chocolate chip

Table 6.4: Materials

As expected from what we already know about the representation of homonymy, the results of the experiment show that homonyms are judged significantly worse in the mismatching conditions than in the matching ones. There is some cost of copredication for the polysemy condition, even though the distinction between the match condition (non copredicative) and the mismatch condition (copredicative sentences) is much smaller than for homonyms. This result is interesting to test whether senses of polysemous nouns and meanings of homonymous words are stored in separate representations -recall chapter 3-. According to a theory that proposes that "content" and "container" senses are stored in different lexical representations, copredicative sentences should get the same score as homonymous words. Thus, the results contradict the Separate Sense Lexicon hypothesis for copredicative words.

In the polysemous conditions (for example: *the novel*, *the DVD*...)[7] she detects no difference between the abstract-abstract condition (*the novel that got some great reviews was a terrifying thriller*) and the mismatching abstract-concrete (*the novel that got some great reviews was found in the sale bin*) and concrete-abstract (*the novel that got soaked in coffee got some great reviews*) conditions. However, there is a preference for concrete-concrete sentences (*the novel that got soaked in coffee was found in the sale bin*). These results are interesting to the discussion of the previous section about the order effect in abstract-concrete polysemous words.

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[7] I do not have access to all the materials of the experiments. These are the NPs that Duek Silveira Bueno (2017) uses in her examples. However. I do not know which words are actually used in the experiment. According to Duek Silveira Bueno (2017, 81) abstract senses are informational objects, organizations, events or units of measure.

However, they do not lead to a definite conclusion.

Moreover, it seems that mismatching conditions are considered worse than matching conditions across the board, which means that, in general, copredicative sentences get worse punctuations. However, the differences in acceptability between these conditions fall on a gradient spectrum. Homonyms are at the high end of the spectrum, with large differences between matching and mismatching conditions. Polysemes of the kind concrete-abstract have the smallest differences between matching and mismatching conditions, which suggests that these words form more robust and stable forms of copredication.

As regards containers sentences, it is interesting that the order in which the senses appear in the copredicative sentences is relevant: when the content is uncountable (for example a drinkable substance), container-content copredicative sentences get better scores than content-container copredicative sentences. On the other hand, when the content is countable (for instance: cookies), content-container sentences get lower scores than container-content sentences. Given these results, it seems that countable contents are easier to access from "container" words than uncountable contents. But most importantly, the difference between the copredicative condition and non-copredicative condition in count nouns is non-significant, while in mass contents it is relevant.

Duek Silveira Bueno (2017) modifies the materials to test whether the container words in isolation, without contextual support of copredication, show different results. First, she modified Thus, the sentence *the pot of curry Chris carried was very fragrant* is presented as *the pot Chris carried was very fragrant*. The polysemy condition is also modified by adding an of-phrase specifying the kind of propositional content carried by the noun: *the DVD* (from the first experiment) is presented as *the DVD of tutorials*. Results show that container words behave quite differently in isolation: both copredication conditions are

judged very significantly lower than the matching container-container condition, which suggests that the previous context has an important effect in the acceptability of copredicative sentences of the container-type. This result is not surprising from the Activation Package Theory: it is expected that when the participant reads *the pot of curry*, the word *curry* facilitates the activation of the sense "content". In contrast, when the participant reads the NP *the pot*, the "content" sense receives less activation because the sense "content" does not receive high activation from the container word by itself.

Duek Silveira Bueno (2017) argues that in the first experiment, the item construction is focused only on the possibility of copredication, so many predicates do not strictly select one of the two senses. For instance, in the sentence *the pot of curry that Chris carried was very fragrant*, the relative clause (*that Chris carried*) is supposed to select the content, but there is no grammatical crash in the sentence, even when it is pragmatically odd. It is for this reason that she runs a third experiment that guaranteed that each predicate was only compatible with one of the readings.

It is a very interesting point that the results about the effect of count/mass contents in the first experiment are different from what Duek Silveira Bueno (2017) discovers in this last experiment, in which the pattern of acceptability for container phrases we observe is not affected by the count/mass status of the content-noun. This is a very surprising fact, which, according to Duek Silveira Bueno (2017), means that the effect of contents type found in the previous experiment is due to orthogonal distinctions that should be investigated in depth in the future[8].

As in the first experiment, the results show a distinction between the two copredicative conditions, displaying a sensitivity to the order of selection.

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[8]Given that the sentences presented in the first experiment were labelled incorrectly, it remains as an open question whether this is the reason why the results are different.

Content-container sentences receive higher ratings than container-content, which also means that the sense "container" may be more accessible from the "content" meaning than vice versa. It should be noted that participants rate the non-copredicative condition container-container as significantly more acceptable than content-content. Thus, it is not only that copredicative sentences of the type container-content are less acceptable than content-container, it is also possible that the sense "container" is more available to be interpreted from the NP used in the experiments (*the container of diamonds*). Thus, the sense "content" activates the sense "container", because it gets activated highly; on the contrary, it seems that the selection of the sense "container" does not recuperate the sense "content" so easily because it does not get such a strong activation.

Therefore, order effects in abstract-concrete copredication cases are not clear -recall section 6.3-, yet it seems that we have enough evidence to postulate that there is some predicate ordering effect in other cases like drinkables and container sentences.

6.5 Conclusion

In this chapter, I have presented some data that suggest that some inherent polysemous words find it easier or have a greater tendency to form copredicative sentences than other polysemic words. Moreover, it has been argued that underspecific rich proposals about polysemy (recall chapter 4) give plausible explanations of the representation and interpretation of copredicative sentences. Both GL and the Activation Package theory give plausible explanation of copredicative sentences. The Activation Package Theory contributes to the comprehension of the acceptability of copredication with the notions of explanatory ontological dependency relations and activation packages, which may

help to make some predictions about which senses of inherent polysemous words may be more likely to copredicate. I have presented some empirical evidence about neurological activation (Tao, 2015) that suggest that the interpretation of copredicative nouns involves accessing general knowledge, which matches the idea of rich underspecific knowledge structures. Although some variations were observed between the two categories *lunch* and *book* and between abstract and concrete senses, all the experiments highlighted the anterior temporal lobe (ATL), which is the key brain region in representing high-level concept knowledge.

I have also discussed whether there is order predicate effect in these words(Duek Silveira Bueno, 2017, Frisson, 2015, Murphy, 2019) which, it seems to me, that it remains an open question. I have given some plausible ideas that following the Activation Package Theory would explain some of the results that we have about the words *book* and *lunch*. However, given the contradictory results about these facts, the empirical evidence is difficult to be explained by any theoretical approach about copredication. GL predicts no processing cost in the interpretation of these copredicative sentences, while the Activation Package Model does not predict that all abstract-concrete senses show the same results.

Furthermore, we have seen that in the case of copredicative sentences with container words, there is a difference depending on which sense is interpreted first: thus, an ERP study about content-container and container-content shifts suggest the sense "container" is easier to access from the sense content than vice versa(Schumacher, 2013). Moreover, it seems that content-container copredication is more acceptable than container-content copredication (Duek Silveira Bueno, 2017). All these results confirm the argument of Ortega-Andrés & Vicente (2019) that, in the lexical structure of these words, the activation of the sense "drinkable" highly activates the sense "container", based on ontological dependency realisation relations. However, the sense "content" gets less activation

from container words, which can be explained because containers do not always require a content.

Chapter 7

The denotation of copredicative nouns

We have already seen that, very commonly, copredicative sentences predicate incompatible properties about the entities that are referred by the inherent polysemous words. For example, if we think about the word *school* -which, as we have already seen, has many related senses that copredicate-, and many properties that the building has -for instance, its painted colour, its size, its material, the year it was built, etc.- are incompatible with the denotation of the word *school* as teachers and pupils, for instance: we cannot predicate about the students that they need a fresh coach of paint. However, what characterizes inherent polysemous words is that they actually allow these apparent categorical mistakes. Recall the following example of a copredicative sentence:

(15) The school caught fire and was celebrating 4th of July when the fire started.

In (15), there are two different properties predicated about the school: it caught fire and it was celebrating 4th of July. The predicate *was celebrating 4th of July* requires an agential argument, because inanimate objects like buildings do not

normally celebrate festivals. The property is predicated about a group of people. However, what caught fire is not the group of people, but a physical object, in this case, a building.

Traditionally, it has been proposed that the truth conditions of sentences depend on the correspondence between their content and what occurs in the real world. The meaning /representational content of a sentence in a natural language determinates its truth conditions. However, copredication generates a puzzle associated this idea. If there is no such a thing in the world that has the properties that are predicated in (15), then what is the denotation of the word *school* in (15)? This argument has been used by Chomsky (2000), Collins (2017), Pietroski (2018) and many others to criticize traditional truth conditional semantics. The issue is that apparently the word does not have any content -we do not know what entity it is about-. If the truth conditions of (15) rely on the existence of something (the school) that caught fire and that was celebrating 4th of July, then (15) should always be false, because there is no such a thing in the world that has these two properties at the same time. However, it seems that (15) could be true in some specific contexts. For example, (15) would be true if the students and teachers of a particular school were celebrating 4th of July and the building caught fire. Therefore, they say, the truth conditions of sentences should not rely on the correspondence between the content of the sentence and real world. According to Chomsky, we should abandon referential semantics:

Contemporary philosophy of language follows a different course. It asks to what a word refers, giving various answers. But the question has no clear meaning. The example of "book" is typical. It makes little sense to ask to what thing the expression "Tolstoy's War and Peace" refers, when Peter and John take identical copies out of the library. The answer depends on how the semantic features are used when we think and talk, one way or another. In general, a word, even of the simplest kind, does not pick out an entity of the world, or of our "belief space". Conventional assumptions about these matters seem to me very dubious (Chomsky, 2000, 16-17).

One reaction to Chomsky's critique is to claim that there is no categorical mistake in copredicative sentences, so the properties that are predicated in copredicative sentences are not contradictory or incompatible. In this vein, Liebesman & Magidor (2017) propose that copredicative nouns actually have only one sense. Thus, the word *school* can refer to groups of people or to buildings depending on context and predicational ambient, but it never denotes both objects at the same time. They argue against the idea that copredicative words in sentences like (15) are polysemous; on the contrary, these words have one only sense that changes depending on the context.

Most semantic theories have explained copredication in terms of complex types or dot objects that combine the two aspects of the word and that -after some semantic mechanisms- allow the two conflicting predicated properties to apply to the same argument (Asher, 2011, Luo, 2012, Pustejovsky, 1995). The notion of dot object was introduced by Pustejovsky when he proposed the GL. GL does not answer the question about the denotation of copredicative words. However, the theory has been taken by many others who develop different theories of the denotation of copredicative words. For example, Asher (2011) proposes a conceptual model, according to which the denotation of copredicative nouns is

a bare particular that we conceptualise as a complex object. On the other hand, mereological theories propose that the denotation of the word is a mereological compound that have several parts (Arapinis, 2013, Gotham, 2016). The Activation Package Theory claims that the copredicative word is a compilatory term that has several denotations and each denotation is a simple entity (Ortega-Andrés & Vicente, 2019). It may be possible to study copredicative nouns in terms of dot-concepts (for example, instead of a complex object, we could have a complex concept of lunch, the complex concept of city, etc), without presupposing that there is a complex entity about which these concepts are concepts of. Following the Activation Package Theory, these concepts would be complex structures that do not stand for one denoted entity, but they offer a range of possible denotations.

The aim of this chapter is to study the metaphysics behind the question of the denotation of copredicative nouns. I explore some theories that have answered the question of the denotation and I discuss the metaphysical commitments and the open questions they have to answer. For that purpose, the plan of the chapter is the following:

In section 7.1, I discuss the idea that copredicative nouns are not polysemous and that they have one only denotation.

In section 7.2, I analyse some mereological theories about dot objects and I explore the metaphysical brainteasers that follow from these theories.

Finally, in section 7.3, I explain the response that the Activation Package Model could give to the metaphysical questions that concerns the question of the denotation of copredicative nouns.

7.1   Are copredicative nouns polysemous?

Within the debate about the denotation of copredicative nouns, one plausible way to study copredication is following a one sense approach (Brandtner, 2011, Liebesman & Magidor, 2017, Nunberg, 2004). These theories claim that inherent polysemous words in copredicative sentences have only one sense and, therefore, they have one single denotation. For instance, Brandtner (2011) uses meaning transfer mechanisms (Nunberg, 2004) to explain the generation of copredicative sentences. Consider the following sentence adapted from Brandtner (2011), Nunberg (2004):

(67) Hannah Arendt was Jewish and widely read.

In (67), the meaning of the sentence is that Hannah Arendt is Jewish and her work is widely read; we know that there is a functional relation between the writings and the author: the author has written them. This process can be used to create the property of being the person whose writings are widely read. If we understand (68) as involving this property, there are two properties modifying one person. Consequently, the property of being "widely read" is transferred to the author of the book.

Meaning transfer is not the only mechanism that has been used for claiming that copredicative nouns have one only sense. Liebesman & Magidor (2017) use a one sense approach for claiming that copredicative nouns are not polysemous. In sentence (68) we predicate about *Hannah Arendt* that she is widely read because the author inherits the property of being read from the pieces of text that she wrote by virtue of being the author of those texts. For a better understanding of property inheritance mechanisms, let us think about a different example (adapted from Liebesman & Magidor 2017):

(68) *The Second Sex* is on the top shelf.

C we are in a bookstore, where there are many copies of *The Second Sex*, all
located on the top shelf.

In C, there is no particular physical object that instantiates *The Second Sex*,
but many of them. Thus, it seems that the content of the sentence (68) is that
the informational content is on the top shelf. However, in principle, this is not a
property that we can predicate about abstract contents, but only about physical
objects. Consequently, what is the meaning of the sentence? According to
Liebesman and Magidor, the answer is simple: sentence (68) means that the
info-content *The Second Sex* is on the shelf by virtue of its physical instantiations
that are actually located on the shelf. The informational content inherits the
locative property of the physical object.

I think there are some reasons for doubting that copredicative nouns are not
polysemous. For a start, we have seen in the previous chapter that there are
some empirical studies (Tao, 2015) that suggest that interpreting copredicative
words require more conceptual thinking than interpreting other words. Thus,
for example, interpreting the word *book* implies the activation of neural zones
(vATL) that have been associated with conceptual and semantic thought, while
interpreting other words that refer to concrete and abstract things (like *chair* and
opinion) does not involve the activation of these zones. These results suggest that
there is a difference in how we interpret copredicative words in comparison to
non-copredicative words that refer to the same kind of things. If there is nothing
special about copredicative nouns, then why is it the case that they show so many
differences in processing in comparison with other words?

Liebesman & Magidor (2017) give some arguments against the thesis that
nouns that copredicate are polysemous words, which I discuss in the following.

7.1.1 Discussing numeric quantificational sentences

Quantificational sentences with copredicative nouns have been used very frequently as an argument for the polysemy of the word *book*[1]:

(69) There are three books on the shelf.

The argument goes as follows: consider a context in which we have three copies of the same informational content. If the word *book* refers to the physical copies, the sentence is true. However, if the word *book* refers to informational contents, the sentence is false. Truth conditions of the sentence are different depending on what the word refers to. This seems to be a good reason for thinking that each use of the word is a different sense. Contrary to this intuition, Liebesman & Magidor (2017) argue that the argument does not give enough evidence for the polysemy of the word *book*, because there are very similar sentences that we do not treat as if the NP was polysemous. For example, imagine a context in which a canvas has been painted with three different shades of red. Now, consider the following sentence:

(70) Three colours are on the canvas.

The word *colours* here can be interpreted as referring to two different things: on the one hand, we could say that each shade of red is a different colour, so the sentence (70) would be true. On the other hand, we could say that each shade of red is the same colour (red), so the sentence would be false. If the word *book* behaves similarly to the word *colours*, and we do not treat the word *colours* as polysemous, then why should we treat *book* as polysemous?

There is, however, a main difference between the word *book* and the word *colour*: the things we can predicate about abstract informational contents are

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[1]In sections 7.2 and 7.3 I broadly discuss numeric quantificational copredicative sentences and show how different theories explain their truth conditions.

normally considered not to be the same as physical objects. Thus, predicating that informational contents are on the shelves seems, at least in principle, inadequate, yet the property "be on the canvas" is not more appropriate to the colour red than to the shades of red. In fact, Liebesman and Magidor argue that informational contents can be located in places -like on the shelf- only by virtue of the fact that they are physically instantiated by the volume. Even when Liebesman and Magidor claim that this is not a categorical mistake -because we can predicate about the informational book that it is on the top shelf- they have to give an explanation based on property inheritance in order to account for the two possible readings of (69). On the contrary, Liebesman and Magidor do not need to appeal to property inheritance to explain sentence (70). If the words *books* and *colours* were similar, the explanation they give of quantificational sentences would be the same. However, predicating that the informational content is on the top shelf requires additional mechanisms. Actually, I think that quantificational sentences make explicit a crucial reason for doubting one sense approaches. Consider the following sentence:

(71) There are three red very well written books.

In sentence (71), the adjective *red* normally refers to a physical object, while the property "being very well written" normally applies to an abstract informational content. Thus, according to one sense theories, the word *books* denotes either a set of three physical volumes that are well written by virtue of being the physical instantiations of the content, either a set of three informational contents that are red by virtue of being the content of the physical objects. If the denotation of the word *books* in (71) is a set of physical objects, the question that arises is the following: how many informational contents are we counting? The sentence would be true if there were three red volumes that contain some informational content, no matter how many contents they have: they could be

three copies of the same novel, three different well written novels or two copies of one novel and a third different one. However, it seems that the first intuition is that sentence (72) would only be true if there were three red volumes that instantiate three very well written informational contents[2].

In conclusion, quantificational coprediative sentences are a special matter not only because the truth conditions change depending on what sense they quantify, but also because there is something special (normally considered a categorical mistake) about copredicative nouns that requires additional explanation. Other quantificational sentences with words like *colour* do not require additional explanations.

7.1.2   Proliferation of ambiguity

According to Liebesman and Magidor, treating words like *book* and *school* as polysemous leads to a proliferation of ambiguity. Thus, the word *book* would not have only two senses, but several of them. For example, imagine the situation described in S_1:

S_1 there are three volumes (v_1, v_2, v_3) on a shelf, each of them contains the same four informational contents (i_1, i_2, i_3, i_4). Two of the volumes (v_1 and v_2) are in Spanish and the third one (v_3) is in German.

If we study the word *book* as polysemous, in S_1, the word *book* could have three different meanings in (72)-(74): physical copy, informational content and language version, and all the following sentences would be true in different contexts:

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[2]I go into detail about this idea in the following sections. I have not tested speakers intuitions about the truth conditions of this sentence, yet it is a shared intuition by many others (Chatzikyriakidis & Luo, 2015, Gotham, 2016) that the sentence would only be true if there are three red volumes that instantiate three well written books. Actually, as I will show in section 7.2, this is a contentious issue for Asher (2011) as well, whose theory also predicts that sentence (71) is ambiguous.

(72) I have three books.

(73) I have four books.

(74) I have two books.

Sentence (72) would be true in a context in which the word *book* would refer to the volumes; sentence (73) would be true in a context in which the word *book* refers to informational contents and sentence (74) would be true in a context in which the word *book* refers to language versions. According to Liebesman and Magidor we do not want to claim that these uses are different meanings of the word because, if that was the case, the range of possible meanings would be endless.

However, it seems to me that this "proliferation of ambiguity" does not disappear just by explaining polysemy in terms of context sensitivity. We still have some words that have several conventional uses. Thus, let us consider the hypothesis that inherent polysemous words are not polysemous: they have one only sense that can have different uses. In that case, the word would still have many conventional contextual uses that generate different truth conditions. Therefore, there is no clear advantage gained by not calling them "polysemous". Moreover, they are clearly different from other senses of the word that do not typically copredicate. If we try to reduce inherent polysemy to context sensitivity, we have to add a new sub-category, because these uses of the word have some particular properties: (i) they have been conventionalised (recall the introduction); (ii) they are able to copredicate and (iii) they behave differently in terms of processing (recall chapters 3 and 6). Accordingly, what is the advantage of not calling them polysemous words?

7.1.3 Sentences that predicate properties for both senses

There are some other sentences which predicate properties about books and that must be true for both senses of the word:

S_2 In a course of history of the book, students learn general facts about the evolution of books from a text book and then they use this information to examine some particular copies. The teacher says sentence (75).

(75) Each week you will be assigned a single book, on which you will be required to submit a report: on odd weeks, your book will be a theoretical book on the history of book making, while on even weeks, our special collections librarian will assign you a volume from historical collection to examine.

In (75), the meaning of the word *book* ranges from physical to informational books, so the books that are mastered on odd weeks are informational books and the ones that are mastered on even weeks are physical books. The word *book* here is used as a general sense, so as to designate both physical and informational books. This is what occurs in the first occurrence of the word *book* in sentence (75), without any restriction to either physical or informational books. The fact fits very well with the proposal of context sensitivity: the word *books* has a general meaning that refers to both denotations and specificity to one particular use or the other is a matter of context sensitivity. It shows that inherent polysemous words are somehow similar to words that have a general sense and a more specific sense -like colours-. However, the fact does not give any evidence against the polysemy of the word *book*.

The case could also be explained without rejecting the idea of polysemy. For example, according to the Activation Package Model, the word can be used to refer to different senses at the same time: including more general senses -like the

general concept "book"- or specific realisations of the book -like the volume or the content. It is for this reason that the case does not show any particular advantage in favour of a one sense theory of copredication.

7.1.4   Negative sentences

The last objection is that there are no true readings for some negative sentences. For example, suppose that the speaker is pointing to a copy of *The second sex* and they say sentence (76):

 (76) This isn't a book!

The argument is that if the word *book* was ambiguous, there should be at least one reading in which the sentence (76) would be true. However, this is not the case: it is very difficult to say (76) in the given context and to consider it true. However, it is not clear why this fact is more problematic for the polysemy view than for the context-sensitivity view. How would a one-sense model explain the fact that (76) does not have a true reading? Again, what is the advantage of postulating that the word *book* has one only sense that has two different related and conventional uses?

Moreover, the reason why we do not intuitively think that (76) has a true reading can be explained by pragmatic reasons. One plausible explanation for this fact is that both habitual senses of the word *books* happen to co-occur, which means that we normally look at them at the same time. Thus, normally, when we look at a physical book, it is physically instantiating its content. Therefore, contexts in which sentence (76) have a true and a false reading are not very common.

Now, consider a similar situation but with a homonymous word: a person that is pointing at a bank (financial institution) says *this is not a bank*, meaning that

it is not a land at a river's edge. In this case, the sentence has a true reading -a reading in which *bank* is interpreted as a river's edge-, but, again, nobody would interpret the sentence in that way, so it sounds more like a joke. It seems to me that saying that the there is not a true reading of (76) is not enough reason for rejecting the idea that the word is polysemous.

In this section, I have given some reasons for doubting the thesis that copredicative nouns are not polysemous. From a polysemy-perspective, there have been different theories that try to answer the question of the denotation of copredicative nouns. For instance, some dot-objects approaches claim that the denotation of nouns that copredicate are mereological complex entities. In the following section, I discuss these theories.

7.2 Dot objects and mereological theories

According to the idea of dot objects, words that copredicate have a complex meaning (or type) formed by two aspects. For instance, the word *book* has the two senses: informational content and physical object. Dot objects were proposed to explain copredicative sentences, and they seem to be very useful for type-semantic theories in the task of explaining how predicates in copredicative sentences match with one only word that refers to two different senses (Asher & Pustejovsky, 2006, Chatzikyriakidis & Luo, 2015). Concerning the ontological question about the denotation of copredicative words, there is no agreement about what these dot objects are. Thus, according to Asher (2006, 2011) dot objects are conceptual entities and the denotation of copredicative nouns are bare particulars. On the contrary, mereological theories of dot objects have proposed that dot objects are complex objects and the denotation of copredicative nouns is a complex entity (Arapinis, 2013, Cooper, 2005).

A classical mereological account for copredicative nouns is proposed by Cooper (2005). According to his proposal, books are objects that have two parts: volumes and contents. Thus, books can be interesting in virtue of their part that is an informational content and they can be thick or heavy by virtue of their physical part[3]. The hypothesis has the advantage of explaining very intuitively how we attribute apparently contradictory properties to the same thing. For a better understanding, consider the following example: we can say that a chair is black by virtue of its black legs, even when other parts of the chair are not black; we can also call a table *the round table* even when only one of its parts (the table board) is actually round. These approaches may seem to be the best solution to the problem of the denotation of nouns that copredicate. Thus, in (14), for example, it is not difficult to think about books as something in the world that has two parts: a physical part that contains the information and an abstract or informative part that tells the content of the book.

(14) The books are thick and interesting.

The hypothesis gets less intuitive when we think about other kinds of entities. For example, institutions are social organisations, but they are also the people that work for the institution, the rules of the institution, sometimes the time-organisation of the institution, the building, etc. According to classical mereological approaches of dot objects, all these different aspects of the institution are parts or subentities that form the complex/composed entity that the institution is. Arapinis (2013) gives a set of requirements for dot objects of the type institution: composed objects (dot objects) are those whose parts are in particular coincidental relations.

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[3]Cooper (2011) proposes a different account for copredication. He postulates a record type theoretical approach to semantics that follows ideas from the Generative Lexicon such as qualia. The theory does not commit with a mereological theory about the denotation of copredicative words.

7.2.1   Institutions as constitutive entities

Arapinis and Vieu (Arapinis, 2013, Arapinis & Vieu, 2015) take the notion of material constitution that Baker (1999) proposes and extend it by introducing the idea of "agential constitution". When certain things with certain properties are in certain circumstances, new things with new properties come into existence:

> When a large stone is placed in certain circumstances, it acquires new properties, and a new thing —a monument to those who died in battle— comes into being. And the constituted thing (the stone monument) has effects in virtue of having properties that the constituting thing (the stone) would not have had if it had not constituted a monument. The monument attracts speakers and small crowds on patriotic holidays; it brings tears to people's eyes; it arouses protests. Had it not constituted a monument, the large stone would have had none of these effects. When stones first came to constitute monuments, a new kind of thing with new properties—properties that are causally efficacious—came into being (Baker, 1999, 146-147).

Extending the idea of material constitution that Baker maintains, Arapinis & Vieu (2015) propose that the constituents of an institution are unified into a single co-constituted entity when they coincide (materially, agentively and temporally) with each other: the building has to coincide spatially, because it materially constitutes the whole, so it physically occupies a space; the agents and the rules have to coincide agentially and temporally with the other parts. Thus, an institution is co-constituted by the people that work for the institution, the normative rules that these people have to commit to and (optionally) the building. In sum, for co-constituting the whole, those parts have to be in the following coincidential relations:

(I) The group of people (agents) that work for/in the institution are committed to some rules when they are in a specific building (agential coincidence);

(II) those rules have to be committed to by the agents while they are in the building (temporal coincidence);

(III) the building is the place in which the agents are committed to the rules (material coincidence).

Only when the co-constitutive parts are in the coincidential relations described in I-III with the other constitutive parts, will they co-constitute the institution. Thus, the agents are in co-constitutive relation with the institution when they are in the agential coincidence relation with the other two constitutive blocks (rules and building); the building co-constitutes the institution when it is in material coincidence with the agents and the rules; and the rules co-constitute the institution when they are in temporal coincidence with the building and the agents. The coincidential relations between the subentities explain why only some senses of a polysemous word copredicate. Thus, the agents are in agential co-constitutive relations with the institution when they are in agential coincidence relations with the other two constitutive blocks (rules and building); the building co-constitutes the institution when it is in material coincidence with the agents and the rules; and the rules co-constitute the institution when they are in temporal coincidence with the building and the agents. According to this hypothesis, copredication only works for senses whose denotation are constitutive parts of the same complex entity. The coincidential relations between the subentities explain why those different senses of the word copredicate. In conclusion, the theory gives an intuitive explanation of the denotation of institutions. However, it still has some open questions that should be considered.

One open question is how to generalise the theory of complex co-constituted

entities to other kinds of dot objects. If we try to think about books as complex co-constituted entities (as Arapinis and Vieu do with institutions), the dot object "book" (info•physical object) would have (at least) two different aspects: the content of the book -the information that is expressed- and the physical object that somehow contains the informational content. What is the coincidential relationship between them?

On the one hand, we may think that there is an agential relationship: readers and writers use the physical object as a way of materially communicating and transmitting the information of the book. However, the relation is not explanatory of agential co-constitution in the same way as institutions are: people that read the book are not co-constitutive parts of the book.

On the other hand, we may think that the physical object and the informational content are in material coincidence, so it would be similar to the relation between the art-piece and the marble stone in a statue. Can we say that these parts of the statue coincide materially? A plausible answer would be that when we look at the statue, we look at both pieces as a whole and we cannot distinguish between them as independent things. The same occurs with the book: readers read the whole book (info•physical object). It seems that for each kind of complex entity, the relation between aspects has to be defined differently.

The ontology that results from the idea of co-constitutive entities would have many different kinds of dot objects. If the conditions under which the parts co-constitute these complex entities are different in each case, then postulating the existence of complex entities forces us consider metaphysical puzzles that do not have an obvious answer. For instance, the proposed coincidental relations (recall I-III) suggest that the parts of the institution have to be somehow spatially co-located for constituting the whole. Thus, the agents, the building and the rules constitute the institution when the agents are committed to the rules in the

building. However, it is not clear whether the group of people that commit to the rules in the building is an entity itself. The group of agents can be divided into two different groups. For example, imagine that there is a strike and most of the workers in the institution are at a demonstration, while there is a small group of agents in a meeting inside the building. In that case, it would be difficult to individuate the agents in the institution as one only entity. Consider the following sentences:

(77) a. The company was at the demonstration.

b. The company met in the boardroom.

Following Arapinis and Vieu's account, in (77) the word *company* should refer to the agents in the company. Thus, the word *company* denotes the same co-constitutive sub-entity in both sentences. The problem is that these two sentences seem to be contradictory: the same entity cannot be in two places at the same time. A plausible intuition is to claim that the Arapinis and Vieu theory predicts that (77a) says that the group formed by of all the agents in the company was at the demonstration and (77b) says that the whole group met in the boardroom. In that case, both sentences are necessarily false. However, it seems that the sentences have a true reading. Thus, if some of the representatives were at the demonstration and at the same time, some workers could be in the meeting, it seems that we could have a true reading for both sentences.

One way to explain the fact that both sentences have a true reading is to postulate that the constitutive entity is formed by two different groups of agents: one group is at the demonstration while the other is in the boardroom. However, the group referred to in sentence (77a) would not be in any coincidental relation (recall I-III) with the other parts. According to Arapinis & Vieu (2015) agents co-constitute the whole when they are committed to the rules of the institution

inside the building. It is true that material coincidence is optional: not all institutions require a building, even when they typically have one. Thus, an institution that does not have a building would only be co-constituted by the agents and the rules. In these cases, coincidental relations have to be different from (I)-(III): the agents have to be the ones that are committed to the rules and the rules have to be the ones that are committed by the agents, but there is no material coincidence. However, following (I)-(III), it seems that when the institution has a building and it is one of its co-constitutive blocks, the material coincidence is necessary for the dot object to exist. If material coincidence between the building and the agents is a requirement for co-constitution (as Arapinis and Vieu propose), then how can we say that the company is at the demonstration in (79a)?

The theory could be revised, so the agents would not need to be in the building for constituting the institution, but just be the ones that are normally in the building when they work for the institution. The sub-entity of the group of agents would be individuated as the group of people that is normally in these coincidence relations (I-III) with the other parts. The entity is divided into two groups: one group of agents is in the demonstration and the other group is at the meeting. Thus, in (77a) the word *company* refers one part of the co-constitutive entity: the agents that are at the demonstration. In (77b), the word *company* refers another group of the co-constitutive entity: the agents that are in the meeting. Now, how many parts do the constitutive entity formed by the agents have? Sometimes, certain predicates can be applied to a plurality, or a group, on the basis of enough of the members of that plurality/group contributing to the satisfaction of the predicate - e.g. *the children sang a carol* when not all of them were actually singing- and sometimes they cannot. Now, the strange thing about the case is that the group is supposed to be defined as a part of a constitutive entity, while there is another part of the constitutive entity located in a different place. The proposal requires

some specifications that could explain the relations between the people that are the agents in the institution and the social organisation of the institution.

A second question that arises is whether the complex entity would exist even without one of its co-constitutive parts. The answer is not clear because the persistence conditions of dot objects have not been defined specifically; that means, there are no established conditions under which the complex entity would still exist (this argument has been already explained in many places, (see: Ortega-Andrés & Vicente 2019, Vicente 2019). Consider again the following example:

(41) London is so unhappy, ugly and polluted that it should be destroyed and rebuilt 100 miles away (Chomsky, 2000).

In (41), what is unhappy is the population of London, the architecture is ugly, the area is polluted and what should be destroyed and rebuilt is the architecture of the city.

According to the idea that the denotation of the word *London* is a complex object, its different senses in (41) stand for different aspects or parts of the whole London. Intuitively, it seems that the alleged whole would survive (or would be back in existence) even if only one of its parts (its reconstructed buildings and streets) survives or comes back into existence. However, if the whole is co-constituted by its parts, forming an entity, it should not exist when only one of its constitutive parts persists. In (41), if we suppose that the buildings and streets are destroyed and the population decides not to move to the new London (100 miles away), then these three statements in (78) could be true:

(78)   a. London has been destroyed.

       b. London is still ugly.

c. London refused to move to its new location and ended up settling down in a different place.

In (78a) the word *London* refers to the old streets and buildings, in (78b) it refers to the new streets and buildings and in (78c), it refers to the population of the old London, the streets and buildings of the new London and the population of the new London. It seems that someone that maintains that denotations of terms like *London* are complex objects also has to commit to the view that the whole would persist even when some of its co-constitutive parts are pulled apart. The consequence is that the complex entity would be able to persist in several different entities, as happens with the different denotations of the word *London* in (78), giving rise to too many Londons.

The persistence conditions and the individuation conditions of constitutive objects are all open questions about the theory of constitutive entities, and they show some metaphysical questions that emerge from the hypothesis. Actually, individuation criteria are related to one last puzzle for mereological theories that has not been addressed yet: the counting puzzle. The question of how we count the sub entities that form the complex entity has been broadly discussed (Asher, 2011, Chatzikyriakidis & Luo, 2015, Gotham, 2016, Liebesman & Magidor, 2017, Mery *et al.* , 2018). The theories I have already explained do not give any answer to this puzzle. I dedicate subsection 7.2.2 to discuss it.

7.2.2   The counting puzzle

The counting puzzle has been proposed as a counter-argument to mereological theories that postulate that dot objects are simple sums of parts. For example, consider the following situation [4]:

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[4]There are different versions of this argument and discussion (see Asher 2011, Chatzikyriakidis & Luo 2015, Gotham 2016, Liebesman & Magidor 2017, Mery *et al.* 2018)

S$_3$ I have three copies (A, B, C) of the same volume that contain three different books or novels (informational contents) by Margaret Atwood: *Oryx and Crake* (OC); *The Handmaid's Tale* (HT) and *Alias Grace* (AG). The three contents (OC, HT, AG) are interesting and the three copies (A, B, C) are heavy.

Situations like S$_3$ generate a puzzle about the truth conditions of some sentences. Consider (79):

(79)   (a) There are (at least) three interesting books.

(b) There are (at least) three heavy books.

(c) There are (at least) three interesting and heavy books.

What counts as three books in (79) differs: (79a) can be true if there are three informative books in only one volume or if there are three different physical objects and each of them has one different and interesting book-content; (79b) can be true if each of the three volumes is heavy and has the same interesting content. For (79c) to be true, there have to be three books individuated both physically and informatively, the three objects have to be heavy and the three contents have to be interesting.

Intuitively, there should be only three books in S$_3$, yet following a mereological theory -in which the complex entity is a sum of two sub-entities-, we have to count nine books (p+i): A+OC, A+AG, A+HT, B+OC, B+AG, B+HT, C+OC, C+AG, C+HT.

If we had two books in S$_3$ instead of three, the truth conditions of (79) would be problematic. Consider S$_4$:

S$_4$ I have two physical books (A and B). Each of them contains two different books (informational contents) by Margaret Atwood: *Oryx and Crake* (OC)

and *Alias Grace* (AG). The two contents (OC and AG) are interesting and the two copies (A and B) are heavy.

In S_4, there is one volume (A) that contains two informational objects (OC and AG) and one volume (B) that contains two informational contents (OC and AG). Intuitively, the sentences in (79) should be false in S_4, because there are not three books, but only two. However, if we count books as sums, (79c) is true in S_4 -because there are more than three books that are interesting and heavy: A+OC, A+AG, B+OC, B+AG-, even when intuitively we think that (79c) should be false. Let us see the reasoning in more detail: according to the classical mereological account according to which the denotation of the word *book* in (79c) is a set of three sums (info objects + physical objects), the truth conditions of (79c) are the following:

(79c) There are (at least) three interesting and heavy books.

   i. There is a plurality of (at least) three books (p+i) such that:

   ii. every member is interesting and heavy.

In S_4 there are four sums p+i that are heavy and interesting. Therefore, (79c) is true in S_3. However, we have the intuition that in S_4 we should not count four books (info+content) but only two different books. Thus, according to our intuitions, (79c) should be false in S_4.

In contrast to mereological theories, Asher (2011) proposes that the denotation of words are bare particulars that we conceptualise when we predicate certain properties about them. Thus, the predicate conceptualises the dot object -which is not a complex entity but a concept- as one aspect or the other. The word *book* is subject to two distinct criteria of individuation depending on the aspect under which it is considered:

   i. I-criterion: informational objects with a physical realisation.

   ii. P-criterion: physical object with informational content

In quantificational sentences like (79) we do not quantify over books, but over aspects of the concept. Therefore, according to Asher, books have to be counted differently depending on the individuation criteria (i-criterion, p-criterion) we use. In a situation in which we have one physical volume that contains seven Jane Austen novels together and three copies of the Bible on a shelf, we would count four books with the P-criterion and eight books with the I-criterion, because the number of objects physically individuated is three, while the number of objects informationally individuated is eight. The objects of the dot type are individuated relatively to one of their constituent types or aspects. Now, consider again (79) in S_3:

(79) (a) There are (at least) three interesting books.

      (b) There are (at least) three heavy books.

      (c) There are (at least) three interesting and heavy books.

S_3 I have three copies (A, B and C) of the same volume that contain three different books or novels (informational contents) by Margaret Atwood: *Oryx and Crake* (OC); *The Handmaid's Tale* (HT) and *Alias Grace* (AG). The three contents (OC, HT and AG) are interesting and the three copies (A, B and C) are heavy.

In (79a), using the I-criterion, we count three informational contents, therefore (79a) is true in S_3. In (79b), using the P-criterion, we count three physical objects, so it is also true in S_3. What does occur with (79c)? According to Asher (2011, 157), books can be counted as informational objects or physical objects but they cannot be counted coherently as both. Ergo, it seems that we need extralinguistic

information to interpret the sentence (79c). One plausible solution would be that the sentence has to be individuated depending on the context (Asher, 2011, 159).

However, this proposal gives some controversial predictions about the truth conditions of (79c). Let us suppose that the criteria of individuation in (79c) depends on contextual information: if we individualise books as physical objects, we would count three physical objects, but we do not quantify over informational content, so the sentence could be true in any case that there are three physical copies, no matter how many informational contents they contain. Thus, there could be, for instance, three copies of *The Handmaid's Tale*, or two copies of *Alias Grace* and one *Oryx and Crake*. On the other hand, if we individualise the books informationally, (79c) could be true in a context in which we have three different contents (*Oryx and Crake, The Handmaid's Tal* and *Alias Grace*) no matter the number of volumes we have. Thus, there could be one only volume that contains three novels and sentence (79c) would have a natural true reading.

It is not clear whether sentence (79c) should be considered true in a situation in which we have one very heavy volume that contains three interesting contents. Not all theories about dot objects agree with this consequence. Chatzikyriakidis & Luo (2015), Gotham (2012) already argue that the more immediate reading of the sentence is that there are three copies and three informational contents. Actually, Asher (2011) himself suggests that numeric quantifiers in copredicative sentences should quantify over both aspects of the word when he analyses sentence (80):

 (80) John picked up and mastered three books (Asher, 2011, 175)

According to Asher, sentence (80) means that there are three books such that John picked up the physical instantiations and mastered the informational objects. Given the fact that the quantifier applies to both of them, books should be individuated both physically and informationally, yet this conclusion

challenges some initial ideas of Asher's ontology about the identity criteria -because according to Asher, books cannot be individuated both physically and informationally at the same time-.

Following a type-semantic theory, others have proposed a different criteria to individualise dot objects. Chatzikyriakidis & Luo (2015), Gotham (2016) propose that the copredicative noun has its own individuation criteria, which determinates whether the two objects are the same or not. They claim that the only correct interpretation of sentence (79c) should be that there are three volumes and three informational contents. If it is true that these theories (Chatzikyriakidis & Luo, 2015, Gotham, 2016) can easily account for our first intuitions about the truth conditions of quantificational copredicative sentences, then this is an advantage that they have, compared to Ashers theory, which needs to add some additional assumptions on accommodation to correct the predictive results of his ontology.

Chatzikyriakidis & Luo (2015) do not intend to give an answer to the question of the denotation of copredicative words, even when they seem to agree with the idea of dot objects as concepts. Their aim is to propose a semantic composing theory that restricts the interpretation of sentences like (79c). On the other hand, following a mereological theory, Gotham (2014, 2016) proposes a mereological theory of dot objects This mereological theory is discussed in the next section.

7.2.3 The revised mereological theory

Gotham (2014, 2016) proposes a revised mereological theory that introduces the requirement that the individual books that are counted have to be different from each other in a definite way. Recall sentences (79):

(79)   (a) There are (at least) three interesting books.

(b) There are (at least) three heavy books.

(c) There are (at least) three interesting and heavy books.

According to Gotham (2014), the books A+AG and A+OC are physically equivalent -because there is only one physical book (A)-, while the books A+AG and B+AG are informationally equivalent, because there is only one informational book (AG). In (79a), every member is informationally distinct and physically equivalent; in (79b) every book is physically distinct and informationally equivalent; and in (79c) every book is physically and informationally distinct. That explains why in (79a) we count three informational books; in (79b) we count three physical books and in (79c) we count three books that are physically and informationally distinct.

The difference between his proposal and other mereological theories is that Gotham introduces relations of distinctiveness and equivalence into the lexical entry of the words. Those relations are used to individuate objects as one part or the other. For example, in the case of the word *book*, there are two ways to distinguish between two different kinds of equivalence: physical equivalence and abstract equivalence:

- Two objects are physically equivalent if and only if they both have an identical physical part.

- Two objects are informationally equivalent if and only if they both have an identical informational part.

The revised mereological theory also claims that the denotation of copredicative nouns are complex objects that have (at least) two parts. One important point of the theory (that will be discussed later) is that every property that the parts have is inherited by the complex object. Thus, every property that the physical part (p) has is also a property of the dot object (p+i) and every property

that the informational content (i) has is also a property of the dot object. Books qua physical+informational sums have the properties of their components. As Liebesman & Magidor (2018) notice, this thesis needs some additional restrictions for pure properties. For example, the physical part of the complex entity has the property of being purely physical. This property cannot be inherited by the sum p+i, because the complex entity has an informational part that is not physical.

Liebesman and Magidor argue that even if Gotham restricts property inheritance in the case of pure properties, the problem does not get solved, because there are some properties that we want to apply to ordinary books and that will still be inherited:

(81)   a. Three brand new books are on the shelf.

        b. Two old books are on the shelf.

In a context in which there are three brand new copies of *A Room of One's Own* on the shelf, (81a) has a true reading, because the sum would inherit the property of being new. Let us consider now that there is one new copy of *Alias Grace* and one brand new copy of *A Room of One's Own* on the shelf, then (81b) has a true reading, because two informational contents are old. Thus, the sum sometimes inherits the property of being old and sometimes inherits the property of being new from the content but both properties cannot be inherited at the same time. One plausible explanation is that the adjectives *old* and *new* are ambiguous, so in some cases they express physical properties and in other cases they express informational properties. In one sense, the word *old* expresses the property of having an old physical component and, in another sense, it expresses the property of having an old informational component.

Let us go back to sentences in (79). The predicate *is heavy* individualises the book physically, while the predicate *is interesting* individualises the book

informationally. Thus, in (79a) books were informationally distinct, and in (79b) books are physically distinct. Here we have both sentences with their respective truth conditions:

(79a) There are (at least) three interesting books

      i. There is a plurality of at least three books such that:

     ii. every member is informationally distinct from every other member;

    iii. every member is informative.

 (79) There are (at least) three heavy books

      i. There is a plurality of at least three books such that:

     ii. every member is physically distinct from every other member;

    iii. every member is heavy.

In (79c), where the two senses of the word *book* copredicate, the books are both physically and informationally distinct, so they have to be counted as three distinct books. The truth conditions of (79c) in this case are the following:

(79c) There are (at least) three interesting and heavy books.

      i. There is a plurality of at least three books such that:

     ii. every member is physically and informationally distinct from every other member;

    iii. every member is interesting and heavy.

Even when the theory seems to give a plausible explanation to the truth conditions of sentences in (79), its solution to other problematic cases is not so neat. Liebesman & Magidor (2019) discuss the explanation that Gotham could

give to sentences (82) and (83), whose truth conditions depend on whether we accept that informational contents can have the property of being on tables or not. Consider the following sentences (adapted from Liebesman & Magidor 2019):

(82) There is one book on the table: *Little Women*.

(83) Every book Emely Bronte wrote is on the shelf.

Liebesman & Magidor (2019)'s argument runs as follows: (82) means that the book *Little Woman* is on the table. However, according to Gotham's theory, the predicate individuates the denotation of the word *book* and being on the table is -at least intuitively- a property of physical objects, so the word *book* should refer to one volume, but the sentence says that the content *Little Woman* is on the table. Thus, how do we individuate the book in sentence (82)? Now, consider sentence (83). We know that Emily Bronte has only one written book. Suppose that there is only one copy of that book on the shelf. In that case, sentence (83) would be intuitively true, yet if informational contents cannot have the property of being on shelves, then the sentence has to be literally false, because not all physical copies are on the shelf.

On the other hand, if we think that informational contents can have the property of being on shelves and tables, then we can explain sentences (82) and (83) but we will have trouble with the counting puzzle. Consider the following sentence:

(84) Two books are on the shelf.

Gotham's hypothesis is that the predicate *are on the shelf* individuates books both physically and informationally. According to Liebesman and Magidor, in (84) we would count four books, because the informational contents and the physical objects are not physically equivalent (they do not share any

physical part). The reasoning behind this argument was based on the following considerations: the predicate *are on the shelf* individuates the books physically and informationally, which means that there are two distinct physical books and two distinct informational contents. Therefore, we count four books on the shelf: sentence (84) would only be true if there are two physical objects and two informational contents on the shelf. However, intuitively, it seems that (84) could also be true if there were two physical copies of the same informational content. One easy and plausible solution is to appeal to meaning transfer mechanisms [5]. Sentences (82) and (83) would be similar to sentence (85):

(85) I am parked out back.

In sentence (85), what is parked out back is not the person but the car. There is a salient relation between them that explains the meaning-shift: the subject is the owner of the car (see Nunberg 2004). Meaning shift allows us to "create" a new property by enriching the predicate and shifting it to a new predicate that applies to owners.

According to this idea, in (82) the property "being on the table" is attributed to the informational part of the book *Little Women* by virtue of its/their physical instantiations that are on the table. Thus, the content of sentence (82) would be that the volumes of the informational content are on the table. The content of sentence (83) would be that there is a volume on the shelf of every book Emely Bronte wrote.

In the end, it seems that mereological theories have to postulate external mechanisms -not based on dot type theory- to explain some quantificational cases. The hypothesis actually seems to solve the case, yet given all the metaphysical

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[5]This hypothesis was explained by M. Gotham in a talk given in the 11th Semantics and Philosophy in Europe colloquium, University of Warsaw. I have to thank M. Gotham himself for providing his slides to me. They are now available on his website.

puzzles that arise, it would be easier to leave aside a mereological ontology of dot objects. It may be useful to use the notion of dot objects, not as objects that actually exist, but as representations of possible semantic type combinations of aspects that form conceptual structures. In that case, copredicative nouns do not denote complex entities, but they stand for complex concepts that could be decompilated in different senses. Thus, it may possible that these senses in the structure form activation packages.

7.3 Activation Packages and decompilatory terms

It has been already explained in previous chapters that the Activation Package Model about inherent polysemous words proposes that nouns that copredicate stand for conceptual knowledge structures. According to the theory, knowledge structures contain aspects that are senses of the inherent polysemous word. These knowledge structures can be understood as concepts: they are bodies of knowledge that include general information about objects (see Vicente 2019). Thus, for example, the knowledge structure of the word *book* contains information about what a book is and about different ways it appears to us in the world.

When we see a book we categorize it as a book based on the general and prototypical information that we have about books. They are typically entities that contain written information in several pages and have a particular form and material. The concept offers different possibilities for denotation, depending on what kind of information the thinker focuses on and is, yet brought to working memory. Therefore, the word *book* has different denotations depending on the speaker (and the prototype the speaker has about books) and the sentence in which it appears. The speaker has to select the correct sense from a variety of possible senses. When the inherent polysemous word appears in a copredicative sentence,

it actually has two (or more) denotations Recall the lexical structure of the word *book* proposed in chapter 6 (fig. 7.1):

$$
\text{Book:} \begin{bmatrix} \text{Formal: content-information} \\ \text{Telos: being read} \\ \text{Participants: Reader} \\ \text{Phys. Realisation: Physical object} \\ \text{Text Realisation=} \begin{bmatrix} \text{Genre} \\ \text{Style} \\ ... \end{bmatrix} \\ ... \end{bmatrix}
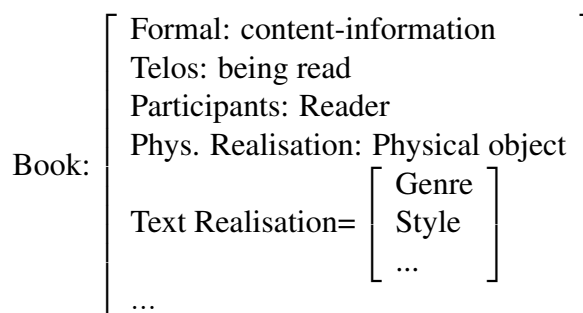$$

Figure 7.1: Knowledge structure: *book*

The realisations of the formal qualia in the structure of the word *book* are different senses and plausible denotations of the word:

(86) a. The book [INFORMATIONAL CONTENT] is interesting

   b. The book [NARRATIVE STYLE] is very well written.

   c. The book [NARRATIVE STYLE] is full of metaphorical language.

   d. The book [PHYSICAL OBJECT] is yellow.

The word *book* in (86a) refers to the information or the content itself; in (86b) and (86c) it refers to the aspect "narrative style", how it is written; and in (86d) it refers to the physical realisation.

Inherent polysemous words are, according to Ortega-Andrés & Vicente (2019), compilatory terms that have several possible denotations. The potential denotation of a word type is explained in terms of the information stored in the knowledge structure associated with such a word-type. For a better understanding, consider again the following sentences:

(14) The books are thick and interesting.

(15) The school caught fire and was celebrating 4th of July when the fire started.

In (14) the word *book* refers to two different aspects stored in the structure of the word *book* (see Fig. 7.1): the readable content (that is the formal quale) and its physical realisation (a set of written pages or a volume). Each aspect denotes a different set of entities. Thus, the aspect "readable content" denotes a particular content that is expressed in the books; while the aspect "physical object" denotes a set of physical objects that are the physical realisations of these informational contents. In (15), the word *school* has two related senses: it refers to the physical realisation and to the building. Each aspect has its own denotation: the participants are the group of people that normally participates in the events and activities of the school as an institution and the building is the place that physically realises the institution, in which the activities of the institution normally occur.

When the copredicative sentence is interpreted, the copredicative noun is "decompilated" by a process of activation-selection (recall chapter 6) that ends when the correct senses of the word in the particular copredicative sentence are selected. One consequence of the approach is that copredicative sentences hide more complex propositional-content structures (see also Ortega-Andrés & Vicente 2019, Vicente 2019). For example, sentences (14) and (15) would be interpreted as meaning the same as the following paraphrases:

(14) The books are thick and interesting.

(14') The books$_1$ [PHYSICAL REALISATIONS OF CONTENT-BOOKS] are thick and the books$_2$ [THE SAME CONTENT-BOOKS] are interesting.

(15) The school caught fire and was celebrating 4th of July when the fire started.

(15') The school$_1$ [PHYSICAL REALISATION OF INSTITUTION-SCHOOL] caught fire and the school$_2$ [GROUP OF OCCUPANTS [OF THE SAME PHYSICAL REALISATION OF THE INSTITUTION-SCHOOL]] was celebrating 4th of July when the fire started.

In (14) and (14') the word *book* refers to two different aspects of the structure of "book" (see Fig 17.1): the readable content (that is the formal quale) and its physical realisation (a set of written pages or a volume). When the hearer encounters (14), the aspects represented in the structure are activated. The predicate *are thick* selects the physical realisation of the book. The selection of this sense highly activates other senses from the same activation package and the adjective *interesting* selects the aspect content-information. The process ends when the two senses are selected and the sentence is interpreted as (14').

It is important for the interpretation of the sentence that the building and the participants are aspects or realisations of the same object. For example, sentence (14) is true if there is a set of books$_1$-physical volumes that are thick and that are realisations of the set of informational contents (books$_2$) that are interesting. Similarly, sentence (15) is true only if there is a school-institution, whose participants (school$_2$) were celebrating 4th of July and, during the celebration, the building of the institution (school$_1$) caught fire. It seems that aspects have individuating criteria encoded. Depending on the predicational ambient and other previously selected aspects in the activation package, the denoted object has different individuation criteria. For example, the predicate *caught fire* selects the "building" aspect of the structure. Thus, the school is individuated as the particular building or buildings that physically realise the school-institution; the predicate *was celebrating 4th of July* individuates the school as the particular group of participants that normally participate in the activities of that school-institution and that were celebrating 4th of July in the

physical realisation of the school. Now, recall sentences in (77):

(77)   a. The company was in the demonstration.

         b. The company met at the boardroom.

According to the Activation-Package model, the word *company* in the sentences in (77) has different denotations. In (77a) the word *company* denotes a person or a group of people that represents the company in the demonstration (social representatives). Thus, when the whole structure is activated, the aspect "social representation" is selected.

In (77b), the word *company* denotes a group of people that are the participants of the institution and that are at the meeting. Thus, social representatives have to be in the relation of representing the institution and participants have to be in the relation of participating in the activities of the institution. Sentence (77a) could be true if there is a person or a group of people at the demonstration that socially represent the company. Sentence (77b) has the true reading that a group of participants (workers) of the company that met in the boardroom.

The activation-selection process implicates that the copredicative sentence is a shorthand of a coordinated sentence (see Ortega-Andrés & Vicente 2019, Segal 2012, Vicente 2019). Sentential meanings determinate which contents, and which truth-conditions, an utterance of a sentence may have. They specify a definite number of situations in which the sentence will be true. Speakers and hearers have to select from among the different possibilities given in the structure of the word. Therefore, understanding the truth conditions of copredicative sentences derives from a process of sense de-compilation (recall steps I-V in chapter 6) and the assignment of each predicate to its respective denotation. Now, let us see the propositional content sentences (14) and (15):

(14) The books are thick and interesting.

(14') The books$_1$ [PHYSICAL REALISATIONS OF CONTENT-BOOKS] are thick and the books$_2$ [THE SAME CONTENT-BOOKS] are interesting.

(15) The school caught fire and was celebrating 4th of July when the fire started.

(15') The school$_1$ [PHYSICAL REALISATION OF INSTITUTION-SCHOOL] caught fire and the school$_2$ [GROUP OF OCCUPANTS [OF THE SAME PHYSICAL REALISATION OF THE INSTITUTION-SCHOOL]] was celebrating 4th of July when the fire started.

The speaker express something like (14') or (15') by using a word that refers to both senses. The word *books* denotes the physical realisation of the specific content and the informational content it transmits. The denotation of the word *school* is the building that physically realises one particular institution and also the group of people that normally participates in the activities of the same institution.

7.3.1 Activation Packages and the counting puzzle

We saw in section 7.2.2 that numerical quatificational copredicative sentences generate a puzzle for mereological theories of dot objects. In this section I show that the theory of denotation that emerges from the Activation Package Theory gives some plausible predictions about how to interpret these sentences. Consider again sentences (79) in S$_3$ and S$_4$:

(79)   a. There are at least three interesting books.

       b. There are at least three heavy books.

       c. There are at least three interesting and heavy books.

S$_3$ I have three copies (A, B, C) of the same volume that contain three different books or novels (informational contents) by Margaret Atwood: *Oryx and Crake* (OC); *The Handmaid's Tale* (HT) and *Alias Grace* (AG). The three contents (OC, HT, AG) are interesting and the three copies (A, B, C) are heavy.

S$_4$ I have two physical books (A and B). Each of them contains two different books (informational contents by Margaret Atwood: *Oryx and Crake* (OC) and *Alias Grace* (AG). The two contents (OC and AG) are interesting and the two copies (A and B) are heavy.

Each sense has its own individuation criterion and it changes depending on the predicational ambient. Thus, sentence (79a) means that there are three informational contents that are interesting, but we do not know how many physical objects there are. Sentence (79b) means that there are three volumes (physical objects) that are heavy, but we do not know how many informational contents they contain. Sentence (79c) means that there are three informational contents that are interesting and three volumes that are heavy and that the three volumes are physical realisations of the informational contents. In (79c), the lexical structure of the word *book* is activated and the aspect "informational content" is selected. Thus, books are individuated as three informational contents. The selection of the "informational content" aspect highly activates the activation package and the "physical object" aspect is selected, so books are individuated as three volumes. In short, when the sentence is interpreted, the predicates *is interesting* and *is thick* select the two senses in the structure and they are individuated as three physical objects and three informational contents. Sentence (79c) would be paraphrased as follows:

(79c') There are (at least) three interesting books [informational content] and (at

least) three physical instantiations [of the same informational contents], that
are heavy.

According to these ideas, it is expected that sentences in (79) would generally
be considered true in contexts in which the following conditions are met:

(79a) There are at least three interesting books.

    a. There is a plurality of at least three informational contents

    b. each informational content is interesting

(79b) There are (at least) three heavy books.

    a There is a plurality of (at least) three physical books

    b each physical book is heavy

(79c) There are (at least) three interesting and heavy books

    a. There is a plurality of (at least) three informational contents

    b. each informational content is interesting

    c. there is a plurality of (at least) three physical books that instantiate the
       informational contents.

    d. each physical instantiation is heavy.

Therefore, (79a), (79b) and (79c) are expected to be true in S_3. On the other
hand, in S_4, sentences in (79) would be false, because there are not three physical
books or three informational contents. A consequence of this theory is that
sentence (79c) is not expected to be generally true in a context in which there are
three copies of the same volume that contains one novel. Thus, it may be possible
to create a context in which sentence (79c) generates this particular true reading,

yet intuitively speaking, it seems that our first interpretation of the sentence is that there are three volumes and three contents, which means that another plausible reading of sentence (79c) could be that there are three heavy volumes and each volume contains three different interesting informational contents.

7.3.2 Locative properties about informational contents

According to the Activation Package Model, when the hearer encounters the word *book*, the whole structure of the word is activated. The predicate *is on the table* requires a physical object, so the aspect "physical object" is selected. In principle, that would mean that the book is individuated as a physical object. Now, recall sentences (82)-(83):

(82) There is one book on the table: *Little Woman*.

(83) Every book Emely Bronte wrote is on the shelf.

In (82) the denotation of the NP *one book* is one physical object, so how is it possible that the physical object referred to is *Little Women* (the content)? Considering that Emily Bronte has only written one book, how could we refer to physical copies in (83)? Generally speaking, sentence (82) intuitively means that there is one volume on the table and its content is *Little Women*. In this case, the predicate *is on the table* selects the physical realisation. The next step (see steps I-IV in chapter 6) is that the selection of the aspect "physical object" highly activates the senses that conform the activation package, so the aspect "informational content" is available to be selected. *Little Woman* selects the "informational content" aspect in the structure. Thus, the sentence is interpreted as follows:

(82') There is one $book_1$ [PHYSICAL OBJECT] on the table that physically realises the $book_2$ [INFORMATIONAL CONTENT] *Little Woman*.

According to the Activation Package Model, in (82) the word *book* activates the lexical structure and the predicate *Emely Bronte wrote* selects the "informational content" aspect and individuates the book as the informational content that she wrote. The selection of this sense highly activates other senses and the predicate *is on the shelf* selects the physical object. The sentence is interpreted as (82') and it is true if there is at least one copy of that informational book on the shelf:

(84') Every informational content Emily Bronte wrote has a physical realisation on the shelf.

Now, let us think about sentence (87):

(87) *Sexual Personae: Art and Decadence from Nefertiti to Emily Dickinson* is thick.

If the predicate *is thick* selects the "physical object" aspect, then how is it possible that we can say sentence (87)? Sentence (87) does not mean that a particular physical object is thick, but that any physical realisation of the content *Sexual Personae* is thick. Thus, there is a type mismatch between both senses: the predicate *is thick* normally requires a physical object, yet the argument is an informational content. The mismatch is easily solved because both senses form an activation package, so when the NP *Sexual Personae* activates the structure, and the "informational content" aspect is selected, the "physical object" aspect is also activated. The predicate *is thick* selects the aspect "physical object" from the activation package. Thus, *Sexual Personae* in sentence (87) actually refers to any possible physical realisation of the content *Sexual Personae*:

(87') Any physical realisation of the content *Sexual Personae* is thick.

In (87') *any physical realisation* does not mean that every physical realisation of the book has to be thick, because there could be some versions that are not thick. It means that typically the physical realisation of the novel *Sexual Personae* is thick.

In summary, it is not the case that informational contents can be on shelves or tables, but their physical realisations can be on tables and shelves. We can predicate about informational contents locative properties by virtue of their physical realisations. Even when physical objects and informational contents are different entities, they stand for aspects in the structure that form activation packages. Thus, the selection of one aspect allows the highly activation and selection of the other and the properties we predicate about them are easy to recuperate.

7.4   Conclusion

Chapter 7 is dedicated to discussing the ontological commitments that derive from the question of the denotation of copredicative sentences. Thus, I have focused on three possible reactions to the argument about the denotation of copredicative words.

First, I have discussed those theories that postulate that copredicative words are not polysemous. I have given reasons for doubting that there are not many advantages in claiming a one sense approach to copredication.

Second, I have presented some mereological theories of dot objects. The main focus has been on two theories: the theory of co-constituted entities and Gotham's revised mereological theory. Gotham's theory has the advantage of giving a formal demonstration that may solve the counting puzzle. However, it is still an open question whether the theory would answer the metaphysical and ontological

open questions that arise when we postulate a mereological ontology. Despite this, given that these are working hypotheses, it is open to the mereological theorist to be non-committal about which composite objects form the dot object.

Moreover, dot objects may be taken as complex types that explain how we compose two different aspects of the same complex concept without having to commit to a mereological ontology.

The Activation Package Theory gives a plausible explanation to the question of the denotation of copredicative words. The theory proposes a psychological approach to explain how speakers and hearers interpret the propositional content of copredicative sentences that may solve some of the ontological puzzles that other theories have, like the counting puzzle and the attribution of locative properties to abstract objects without having to appeal to external mechanisms.

Part III

General conclusions and remarks

Summary

The present thesis examined the phenomena of copredication from a polysemous perspective. The main idea that we can conclude from all the investigation and that remains present throughout this thesis is that the difference between homonomy, polysemy and inherent polysemy should be understood as a continuum. Thus, it seems that meaning of homonymous words are semantically so distant that they inhibit each other when they are accessed, while senses of inherent polysemous words are so close that they activate each other, so they are able to copredicate.

With the purpose of giving the most clear, transparent and explicative answers to the main research questions, the thesis has been divided as follows: Part I is specifically focussed on the study the representation or storage of senses of polysemous words. In Part II, I have investigated inherent polysemous words, that is: nouns that typically copredicate. Part III is dedicated to presenting the final conclusions and remarks.

In Part I, I have given a classification of different theories that study polysemous words and I have analysed how different theories may explain the empirical evidence. In chapter 3 I have analysed some empirical research that discusses SEL and One Representation Theories of polysemy. The empirical research suggest that not all cases of polysemy are represented in the same way. Thus, more related senses of polysemous words may be stored in the same representation, so they do not compete to be accessed. On the other hand, more distant senses may show some inhibitory effect, as do the meanings of homonymous words.

Moreover, we may distinguish between cases of polysemy in which senses are accessed from an underspecific meaning, and derivative cases, in which one sense may be derived from the other. For instance, mass/countable and content/container shifts. The experiments show different processing effects

between mass-count shifts and count-mass shifts, which suggest that the derived sense is not directly interpreted from the underspecification meaning, so there is an asymmetry between one sense and the other. Moreover, it seems that shifting from content to container is easier that shifting to content from container.

Chapter 4 studies different One Representation Theories of polysemy. I propose a classification of these theories depending on how the senses are stored and how they are accessed when the polysemous word is interpreted in a sentence. Corresponding to the conclusions of chapter 3, we have seen that different theories may give better explanations of different kinds of polysemous words. Literalist theories give a very plausible idea about how some senses may be generated from a previous literal one, as the results of derivative polysemy like mass/count and content/container suggest.

Within literalist theories there are different possible ways of explaining how the new sense is generated. In regular cases -like mass/count polysemy- the better explanation may be based on internal rules (Copestake & Briscoe, 1995). However, lexical pragmatic theories have very convincing arguments about the generation of some senses like *rabbit* (Falkum, 2011).

Core meaning theories seem more appropriate to those cases in which the sense is not generated but is accessed from a common abstract meaning. For instance, Pritchard (2019) proposes an analogical schema that seems to account for the polysemy of some words like *motor* or *negotiation*, but inherent polysemous words like *school* and *book* are easier to explain by rich underspecification theories, like those that Ortega-Andrés & Vicente (2019) and Pustejovsky (1995) propose.

Inherent polysemous words like *book* and *school* are studied in Part II, in which, following the idea of activation packages, I have presented how the hypothesis may address three main questions: (i) why some senses of polysemous

words copredicate and others do not; (ii) how copredicative sentences are interpreted; (iii) what is the denotation of copredicative nouns.

In chapter 6, the acceptability of copredicative sentences is studied. One of the main conclusions of this chapter is that copredication is not a matter of all or nothing, but that some senses of inherent polysemous words typically copredicate and others do not. It has been shown that the underspecification rich structures (GL and the Activation Package Model) give a better explanation for the empirical results of copredication. Now, the Activation Package Theory contributes to the question by proposing that the ontological explanatory relations between aspects in the structure may be a fundamental factor in the acceptability of copredicative sentences, which explains why some senses are more likely to copredicate than others and explains the order effect in some cases, like content/container.

The order effect in other cases of copredication remains an open question. The Activation Package Theory postulates that different types of polysemous words stand for different knowledge structures, in which the aspects in the structures present different realisation relations, that affect the acceptability of the copredicative sentences.

Finally, in chapter 7, I have discussed the ontological issues that arise from theories about the denotation of copredicative sentences. Some open ontological questions emerge from mereological theories of dot objects. It has been proposed that copredicative nouns do not have one denotation but, on the contrary, they offer a range of possible denotations. Thus, each aspect in the structure is a possible denotation of the word. I have claimed that the Activation Package Theory may solve some of the ontological puzzles by not ontologizing the idea of dot objects.

Open questions for future research

Even when the difference between polysemy and homonomy has been broadly discussed and there is good evidence for the distinction, particular cases of polysemy have not been so extensively investigated. Throughout this thesis, I have argued that we have evidence that supports the idea that different theories of polysemy contribute to the understanding of the representation of different kinds of polysemy, yet more research could be done about how to make all these ideas compatible within a broader theory about the meaning of words.

Moreover, as regards copredication, there are many open questions that have not been resolved. Sense-order effects on acceptability of copredicative sentences is a good example. The experiments suggest that container copredicative sentences are actually affected by the order in which the selecting predicates appear. Given that the Activation Package Theory predicts that different types of copredicative sentences may show different effects, I suggest that future research on this topic investigates order effects in different cases of inherent polysemy words.

Furthermore, even when the Activation Package Theory solves many ontological puzzles by psychologizing complex objects, deeper investigation about the truth conditions about some sentences would actually help to make more robust conclusions about the interpretation hypotheses of copredicative sentences. Thus, the proposed theory makes some apparently accurate predictions of the truth conditions of copredicative sentences, yet it is still a pending task to test speakers intuitions about these sentences, especially quantificational copredicative sentences.

Finally, it is important to have in mind that all theories about copredication that have been considered are work-in-progress hypotheses, so it is understandable that they still have some open questions that must be resolved. The aim of this

thesis has not been to present arguments against those theories that do not give a definite answer to certain problems, but to make explicit the limits of many of these theories and to show some paths that could be followed in order to resolve them. The Activation Package Theory is also a work-in-progress theory and, as we have already seen, a lot of work still has to be done for a complete understanding of copredication. The theory happens to offer some plausible solutions to some of these open questions. The most important contribution of this thesis has been to propose a tentative hypothesis that can explain many open questions about inherent polysemous words.

What has been achieved

In this thesis, I have carried out an analysis and classification of some theories about polysemy and it has been shown how the theories may explain the results about some experiments. This project has lead to the conclusion that different theories of word meaning offer a good explanations about different kinds of polysemy. This conclusion has some implications for the kind of semantic theory that must be offered, because, according to the arguments given in this thesis, we should postulate different semantic theories about representation and storage depending on which kind of polysemous words we are studying.

As has been already said, we have concluded that the difference between homonomy, polysemy and inherent polysemy should be understood as a spectrum in which homonomy is at one end of the spectrum and inherent polysemous words are at the other end. Therefore, it makes sense to study copredication from the perspective of a rich semantic approach, but we should not presume that this should be the case for all words.

Given the empirical results about copredicative nouns that have been

presented, it seems that we have enough evidence to postulate a theory about rich underspecific conceptual structures. Both the Activation Package Theory and the Qualia structure of the GL give good explanations of the interpretation of copredicative theories. Now, the Activation Package Theory offers an activation-selection hypothesis and contributes with the idea of explanatory ontological relations.

Finally, investigating the question of the denotation requires answering many questions that arise, like the counting puzzle in quantificational copredicative sentences and the predication of locative properties to abstract objects. These questions have been broadly investigated from the semantic perspective. In this thesis, I have studied the philosophical and ontological consequences that arise from some semantic theories about copredicative nouns. Thus, for instance, the individuation and persistence conditions are significant issues that must be considered when we propose an ontological theory, even when the aim we are trying to accomplish not purely ontological or metaphysical.

The Activation Package Theory claims some important theses that contribute to the advancement of the understanding of language. Thus, from an interdisciplinary point of view, it is important that current linguistic research considers the contributions. The philosophical study of language offers many resources to the common debates between different fields and it seems to me that the denotation of copredicative words is a meeting place for both fields of research.

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