



University College London

PhD Thesis

*Linguistic Representation and
Processing of Copredication*

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I, Elliot Murphy, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

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Abstract

This thesis addresses the lexical and psycholinguistic properties of copredication. In particular, it explores its acceptability, frequency, cross-linguistic and electrophysiological features. It proposes a general parsing bias to account for novel acceptability data, through which Complex-Simple predicate orderings are degraded across distinct nominal types relative to the reverse order. This bias, *Incremental Semantic Complexity*, states that the parser seeks to process linguistic representations in incremental stages of semantic complexity. English and Italian acceptability data are presented which demonstrate that predicate order preferences are based not on sense dominance but rather sense complexity. Initial evidence is presented indicating that pragmatic factors centred on coherence relations can impact copredication acceptability when such copredications host complex (but not simple) predicates. The real-time processing and electrophysiological properties of copredication are also presented, which serve to replicate and ground the acceptability dynamics presented in the thesis.

Impact Statement

This thesis reports theoretical and experimental research into the type-theoretic, acceptability and electrophysiological properties of a rare form of polysemy, copredication, and so its economic impact will likely be determined based on which particular empirical outcomes are embraced most widely by the psychology, cognitive neuroscience and linguistics communities. The considerable range of methodologies employed increases the likelihood that researchers will attempt to replicate and expand on the experimental findings presented here. By enhancing our understanding of the electrophysiological basis of complex semantic operations involved in copredication, potential clinical and TMS interventions could be implemented. Improving our understanding of how certain nominals should be classified, and of how they can be processed with the aid of coherence relations, could impact educational programs, tailoring the presentation of particular teaching materials around the presence and strength of coherence relations in order to ease language learning.

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Contents

Abstract	3
Impact Statement.....	4
Acknowledgements	5
List of Tables and Figures.....	10
1. Introduction	13
1.1. A General Outlook on Copredication.....	13
1.2. Thesis Outline.....	15
2. Theoretical Accounts of Copredication.....	18
2.1. Objective I: Defining Copredication	19
2.1.1. Polysemy.....	19
2.1.2. Copredication.....	22
2.2. Objective II: Accounts of Copredication.....	25
2.2.1. Accounts Supporting the One Representation Hypothesis	26
2.2.2. Accounts Supporting the Sense Enumeration Lexicon Hypothesis.....	35
2.3. Evaluation: Predicate Ordering and Coherence as Factors in Copredication Acceptability	41
2.3.1. Number of Senses in Copredications.....	42
2.3.2. Predicate Ordering	44
2.3.3. Coherence Relations	47
2.3.4. A Copredication Hierarchy	52
3. Acceptability Properties of Copredication	57
3.1. Psycholinguistic Models of Polysemy	58
3.1.1. Sense Enumeration Lexicon Hypothesis	58
3.1.2. One Representation Hypothesis.....	59
3.1.3. Empirical Review	61
3.1.4. From Polysemy to Copredication	64

3.1.5.	Initial Findings About Copredication	66
3.1.6.	Copredication and Coercion	66
3.2.	Acceptability Properties: Empirical Predictions	68
3.2.1.	Effects of Copredication	70
3.2.2.	Effects of Sense Ordering	70
3.2.3.	Effects of Nominal Type.....	75
3.2.4.	Effects of Coherence.....	76
3.2.5.	Outline of Experiments.....	78
3.3.	Experiment 1: Foundations of Copredication	79
3.3.1.	Methods	80
3.3.2.	Results.....	85
3.3.3.	Discussion.....	87
3.4.	Experiment 2: Sense Order Effects	88
3.4.1.	Methods	89
3.4.2.	Results.....	90
3.4.3.	Discussion.....	91
3.5.	Norming Studies.....	92
3.5.1.	Study 1: Sense Frequency and Adjective Coordination	92
3.5.2.	Study 2: Adjective Co-Occurrence and Sense Relatedness.....	97
3.6.	Experiment 3: Revisiting Sense Order Effects.....	100
3.6.1.	Methods	100
3.6.2.	Results.....	102
3.6.3.	Discussion.....	105
3.7.	Experiment 4: Syntactic Factors in Sense Order Acceptability	106
3.7.1.	Methods	107
3.7.2.	Results.....	109
3.7.3.	Discussion.....	111
3.8.	Experiment 5: Cross-Linguistic Properties of Copredication	112
3.8.1.	Methods	113
3.8.2.	Results.....	116
3.8.3.	Discussion.....	119
3.9.	Summary and Implications: Incremental Complexity.....	120
4.	Anaphora and Complexity in Copredication.....	124

4.1.	Experiment 6: Higher Copredicated Types	125
4.1.1.	Methods	127
4.1.2.	Results.....	132
4.1.3.	Discussion.....	135
4.2.	Experiments 7 and 8: Pronominal Reference in Copredication	140
4.2.1.	Methods: Experiment 7.....	142
4.2.2.	Results: Experiment 7	143
4.2.3.	Methods: Experiment 8.....	146
4.2.4.	Results: Experiment 8.....	146
4.2.5.	Discussion.....	149
4.3.	Experiment 9: Isolating Complexity in Copredication.....	151
4.3.1.	Approaching Complexity.....	151
4.3.2.	Experimental Design.....	155
4.3.3.	Methods: Frequency Experiment.....	158
4.3.4.	Methods: Acceptability Experiment	159
4.3.5.	Results: Frequency Data	162
4.3.6.	Results: Acceptability Data	162
4.3.7.	Discussion.....	165
4.4.	Summary and Implications: <i>Copredication Licensing Effect</i>	167
5.	Processing Properties of Copredication	172
5.1.	Measures of Processing in EEG	173
5.1.1.	Event-Related Potentials.....	173
5.1.2.	Neural Oscillations	176
5.2.	Experiment 10: Event-Related Potential and Phase-Coupling Properties of Copredication.....	178
5.2.1.	Methods: Acceptability Judgements.....	180
5.2.2.	Methods: EEG.....	181
5.2.3.	Results: Acceptability Judgements	186
5.2.4.	Results: EEG.....	187
5.2.5.	Discussion.....	193
5.2.6.	Future Directions	196
6.	Conclusion.....	198
6.1.	Factors in Copredication Design	206

6.1.1. Syntactic Factors.....	206
6.1.2. Lexical Factors.....	209
6.1.3. Ordering Factors	216
6.2. Future Directions	218
6.2.1. Representational Basis of Copredication.....	218
6.2.2. Developmental Basis of Copredication	222
6.2.3. Incremental Semantic Complexity: A General Cognitive Principle?.....	228
6.2.4. Capturing Coherence	231
6.2.5. Prototype Structure of Complex Polysemous Nominals	233
6.3. Evaluation.....	236
Appendix	239
References	318

List of Tables and Figures

Table 1: Model of coherence relations.....	52
Table 2: Sample experimental materials (E1).....	80
Table 3: Average scores for all conditions across nominal types.....	86
Table 4: Sample experimental materials (E2).....	89
Table 5: Average scores for the fill-in-the-blank norming study.....	96
Table 6: Average scores for the phrase acceptability norming study (coordination).....	96
Table 7: Average scores for the phrase acceptability norming study (co-occurrence)...	99
Table 8: Average scores for all conditions across the three nominal types (E3).....	104
Table 9: Sample experimental materials (E4).....	108
Table 10: Average scores for all conditions across the three nominal types (E3).....	111
Table 11: Average scores for the fill-in-the-blank norming study (E5).....	116
Table 12: Average scores for all conditions across the three nominal types (E5).....	118
Table 13: Summary of experimental design and results (E1-5).....	122
Table 14: Sample experimental materials (E6).....	126
Table 15: Average scores for all conditions across the three nominal types (E6).....	134
Table 16: Average scores for all conditions across the three nominal types (E7).....	145
Table 17: Average scores for all conditions across the three nominal types (E8).....	149
Table 18: Sample experimental materials (E9).....	157
Table 19: Average scores for the fill-in-the-blank norming study (E9).....	162
Table 20: Average scores for all conditions across the three nominal types (E8).....	165
Table 21: Summary of experimental design and results (E6-9).....	168
Table 22: Sample experimental materials (E10).....	181
Table 23: Average scores for all conditions across the three nominal types (EEG).....	187
Table 24: ANOVA F-values at the target word (E10).....	192
Table 25: Summary of correlational analyses for coherence.....	231

Table 26: Main prototype effects and their mutual relationships.....	235
Figure 1: Average acceptability scores for the four experimental conditions (E1).....	86
Figure 2: Scatter plot mapping acceptability against predicate coherence (E1).....	87
Figure 3: Average scores for the four experimental conditions (E2).....	91
Figure 4: Average scores for the four experimental conditions (E3).....	103
Figure 5: Scatter plot mapping acceptability against predicate coherence (E3).....	105
Figure 6: Average scores for the four experimental conditions (E4).....	110
Figure 7: Average scores for the four experimental conditions (E5).....	118
Figure 8: Average scores for the four experimental conditions (E6).....	133
Figure 9: Scatter plot mapping acceptability against predicate coherence (E6).....	135
Figure 10: Average scores for the four experimental conditions (E7).....	145
Figure 11: Average scores for the four experimental conditions (E8).....	148
Figure 12: Average scores for the four experimental conditions (E9).....	164
Figure 13: Scatter plot mapping acceptability against predicate coherence (E9).....	165
Figure 14: A representation of different types of cross-frequency coupling.....	177
Figure 15: BioSemi ActiveTwo 64-channel layout.....	184
Figure 16: Average scores for the four experimental conditions (EEG experiment).....	187
Figure 17: Grand average waveforms for the abstract target conditions (E10).....	189
Figure 18: Grand average waveforms for the concrete target conditions (E10).....	190
Figure 19: Scalpmaps for the three time windows (E10).....	191
Figure 20: Grand average waveform for all four conditions at Cz (E10).....	191

“I am not yet so lost in lexicography, as to forget that words are the daughters of earth, and that things are the sons of heaven”.

Samuel A. Johnson, *Dictionary of the English Language* (1755)

1. *Introduction*

1.1. A General Outlook on Copredication

Passed on December 30th 1819, the Newspaper Stamp Duties Bill and the Blasphemous and Seditious Libels Bill (part of the Six Acts) defined a *newspaper* as something containing “Public News, Intelligence or Occurrences, or any Remarks or Observation thereon”. If such an object was published at least once every 26 days and cost less than six pence, it was taxed four pence. This definition seems precise enough, but the British government may not have been aware of the semantic paradox inherent in this choice of definition: How can information be taxed? A more comprehensive definition might involve aspects of the newspaper such as its institutional structure, without which it would never exist to be taxed in the first place.

This peculiar property of ascribing multiple, semantically different sense types to a single nominal has come to be known as *copredication*. A standard example is ‘The book was interesting but weighed a ton’, which simultaneously refers to physical and informational senses without having to use the nominal more than once. As Asher (2011: 63) aptly summarises: “Books are both informational and physical in some sense even though we can select each one of these aspects within a predication. We can also access both meanings simultaneously” (for seminal discussion of this ambiguity, see McCawley 1968). Given its potential significance for a considerably large number of topics in psycholinguistics and philosophy of language, copredication is a relatively neglected topic.

More specifically, copredication is standardly defined as “a grammatical construction in which two predicates jointly apply to the same argument” (Asher 2011: 11, Cruse

2000). The nominal within the DP takes multiple semantically distinct predicates.¹ Copredication occurs when “two or more equally connected predicates have different selectional restrictions for the same argument” (Kinoshita et al. 2018: 155).² Theories of copredication often discuss the concepts manipulated by copredicated sentences in purely ontological terms, speculating about the structure of the concepts in abstraction from grammatical organisation or processing properties of language (e.g. Arapinis 2013). Philosophers typically argue that *concrete* entities (able to be perceived through the senses) exist contingently, whereas *abstract* entities (not able to be perceived through the senses) exist necessarily, however both entity types can exist side by side. Companies can be *demolished* but also *criticised*, cities can be *sunny*, *upland* and *liberal*, bills can be *paid* and *folded*, and newspapers can be *read*, *held*, *sued*, *located outside the city* and *unable to offer John a job*. Mixing an abstraction with concreteness appears to be part of the productive nature of the lexicon.³ Indeed, an informal definition of copredication might be ‘category mistakes which are nevertheless felicitous’ (in contrast to infelicitous category mistakes like ‘Saturday is hungry’). Unlike Fregean and Russellian logicians, who were primarily interested in language’s role in judgment formation, nineteenth-century semanticists and semasiologists saw these forms of polysemy as an integral part of linguistic creativity; Bréal (1897) saw it as reflecting most clearly the conceptualising capacities of humans (see also Erdmann 1900).

More recently, Spelke (2009, 2016), Strickland (2017) and others have proposed that various innate ‘core knowledge systems’ create new concepts during development through novel *compositions* of these elementary modes of structuring conceptual knowledge; that is, Spelke proposes that many concepts denoted by complex nominals are *composed* from distinct core knowledge systems. These include knowledge about

¹ Cases like ‘The man both agreed and disagreed’ do not involve copredication, then, since the predicates are not of semantically different types even if they lead to an overall semantic contradiction.

² Copredication only applies to the nominal domain: distinct verb senses cannot be simultaneously accessed. Although we will not pursue this particular topic in this thesis, this asymmetry may arise from predicates (verbs and adjectives) selecting nominals; nominals do not select the sense of a predicate (although see Pustejovsky 1991: 422 for discussion of “cospecifications”, or cases where arguments are able to select the predicates that govern it).

³ Thus Bueno (2017: 225): “[T]he domain of objects is first subdivided into physical objects and abstract objects, and [...] social objects are a subdomain of abstract objects. Other abstract object subdomains might be propositional objects (PO), for instance”.

place (Spelke 2016), number (Hyde & Spelke 2001), social relations (Spelke & Kinzler 2007), geometrical properties (Dillon et al. 2013), and the behaviour of physical objects (Baillargeon 2001). Spelke (2016: 295) claims that for complex cognitive domains like social cognition, “as in the domains of number and geometry, children may come to combine representations from different core domains to create new concepts and systems of knowledge”. Indeed, the capacity that separates us from non-humans, for Spelke (Ibid), is “our pervasive and unstoppable penchant for forming new and more powerful concepts in any domain”. The notion that cross-modular conceptual combinations may contribute to the formation of copredications, and that these constitute uniquely “powerful concepts” in natural language, is certainly an intriguing one.

In much of the current literature, this abstract/concrete distinction is furthermore claimed to be a fundamental metaphysical one. Moltmann (2013) states that reference to abstract objects is exceedingly rare in ordinary discourse. Departing from this approach, this thesis will attempt to provide a classification of copredication via the integration of linguistic and psycholinguistic investigations. For instance, parsing biases will be argued to be a major factor influencing copredication acceptability, departing from a number of recent theories which instead place the explanatory burden largely (or wholly) on conceptual structure.⁴

Concerning simultaneously abstract and concrete objects, Elbourne comments (2011: 26): “We still have to explain how it is that we can say something apparently straightforward and true ... using self-contradictory concepts”. Thankfully, there has in fact been some suggestive work in this direction. A number of researchers have recently cleared the ground for a *formal* account of certain aspects of copredication – but much remains unsystematically explored, such as the factors involved in copredication acceptability.

1.2. Thesis Outline

We have so far covered some general background. The goal of providing a comprehensive (cognitive, type-theoretic, psycholinguistic...) account of copredication is much too

⁴ I should stress that the term ‘licensing’ (which is itself ambiguous across theories of syntax, semantics, pragmatics...) will be taken to mean *yielding a relatively acceptable structure*, given that acceptability has long been known not to be a binary consideration (Lau et al. 2017).

broad, and achieving this will initially require covering relatively small ground. Given this, what are the more specific goals of this dissertation? We will be primarily concerned with cases in which an argument *shifts between polysemous senses in copredication*, and the apparent constraints on this shifting.

To illustrate this phenomenon, consider the copredications below (the examples in (1) are taken from Asher 2011: 63, with ‘#’ marking degraded acceptability):

- 1) a. The city has 500,000 inhabitants and outlawed smoking in bars last year.
b. #The city outlawed smoking in bars last year and has 500,000 inhabitants.
- 2) a. The White House is being repainted and issued a statement concerning taxes.
b. #The White House issued a statement concerning taxes and is being repainted.

As we will discuss in the next chapter, relatively little is known about this phenomenon, both in terms of its acceptability dynamics and also why it occurs. For instance, is it a purely pragmatic phenomenon? Is sense shifting permissible only in certain ‘directions’ or with certain orderings? Do similar contrasts obtain for other nominals permitting copredication?

In order to address this, the following chapters will centre on a series of acceptability judgement and processing experiments examining a range of copredications. These experiments will be used to gain insight into the potential principles governing the interpretation of copredicated structures. The most general empirical discovery is that acceptability is degraded when semantically complex polysemous senses follow semantically less complex senses, and that this dynamic is not specific to copredication.⁵ I will suggest that certain contemporary theoretical debates concerning copredication can be reduced to parsing preferences. I will put forward a general parsing preference termed *Incremental Semantic Complexity* to account not only for a range of data explored in the theoretical literature (as in (1) above), but also the experimental results presented in this thesis. This preference is such that the parser prefers constructions which adhere to a Simple-to-Complex sense order (in terms of semantic complexity). One of the consequences of this preference is that it predicts sentences adhering to a Complex-to-Simple sense order to be less acceptable, and costlier to process, than sentences showing the reverse order. Crucially, this preference is general to a range of sentence structures

⁵ The notion of semantic complexity will be expanded on in Chapter 2.3.4.

which both exhibit or lack copredications, allowing us to re-frame the implementation of certain copredications whilst also exposing a more general effect on how sentences with varying semantic complexity are interpreted.

In this thesis, I will largely focus on nominals that have one PHYSICAL sense, and it is only the other sense(s) which differ in their abstract sense (Falkum 2011 already noted this binary distinction in her thesis). For instance, *book*, *lunch* and *city* all host the same concrete sense of PHYSICAL (PHYSICAL ARTEFACT, FOOD or BUILDING; all sub-types of PHYSICAL), but they vary in their abstract sense (INFORMATION, POLITY/PEOPLE, EVENT).

Chapter 2 selectively reviews and evaluates a range of accounts of copredication, and culls a specific set of curious phenomena to be subject to experimental investigation in subsequent chapters.

Chapter 3 will document a series of acceptability judgement experiments providing initial evidence in support of a parsing preference termed *Incremental Semantic Complexity* (e.g. contrasting Concrete-Abstract with Abstract-Concrete orders; or *ripped and educational book* with *educational and ripped book*). This effect is found to obtain quite generally even in non-copredicated structures.

Chapter 4 will continue the line of inquiry established in the previous chapter and focus on the most semantically complex cases of copredication, in addition to anaphora. It is concluded that standard copredication involving adjectival conjunction is more acceptable than anaphoric copredication. In addition, a further acceptability judgement experiment suggests that the Concrete-Abstract parsing preference documented in Chapter 3 is likely due to a more general Simple-Complex preference.

Chapter 5 will present a reading comprehension experiment involving scalp electroencephalography (EEG) which revealed no significant processing differences between copredication and ‘non-copredication’ (i.e. constructions derived from the copredication items but which include an additional nominal ‘blocking’ copredication). These findings, along with those reported in Chapters 3-4, support a particular model of polysemy storage.

Lastly, Chapter 6 will review the psycholinguistic and theoretical implications of the experiments and provide a conclusion.

2. *Theoretical Accounts of Copredication*

This chapter will aim to achieve the following objectives:

- (I) State the scope of copredication.
- (II) Provide a selective overview of existing theoretical accounts of copredication.

Fulfilling (I) will first require a general overview of polysemy, since I will be assuming that copredication emerges from a particular form of polysemy. In order to fulfil (II), the theoretical accounts discussed will be chosen based on their relative prominence and influence in the field, although a small number of very recent accounts will also be discussed to establish a degree of contemporary context. The semantic and/or pragmatic processes claimed to generate and process copredications will be discussed, allowing us to cull a selection of interesting properties of copredication which are ripe for experimental inquiry, and which will later be used to construct a number of empirical predictions for the experiments reported in later chapters.

More generally, for both (I) and (II), in terms of descriptive detail and for expository reasons centred on relevance to the core arguments of this thesis, little in the way of semantic formalisms will be discussed, and only those details pertinent to developing an understanding of copredication acceptability will be presented.

With respect to the specific lexical items that will be discussed, we will focus on three main types of copredication-licensing nominals: *book*-type, *lunch*-type and *city*-type nominals. These permit various combinations of the four most commonly discussed sense types in the literature, as will be reviewed: PHYSICAL, INFORMATION, EVENT and INSTITUTION (Arapinis 2013, 2015, Asher 2011, Jezek 2016, Pustejovsky 1995, Pustejovsky & Batiukova 2019). For instance, a *dinner* can be long (*event predicate*, referring to the full duration of the event) and delicious (*physical predicate*, referring to

the food), while a *village* can be hidebound (*institution predicate*, referring to some property of its social organization) and ancient (*physical predicate*, referring to its concrete constitution). There are also some claims in the literature that *author*-type meaning shifts involve copredication, as in ‘Tim’s grandmother had read Dickens before she met him at a Christmas party’ (Schumacher 2013: 2). However, these meaning shifts are typically seen as unacceptable, as in ‘Joyce is on the top shelf and he’s had a haircut’. Due to these potential difficulties in initial formulation and clarification, possible copredications involving personhood will not be our concern here (but see Strawson 2009). Therefore, we will proceed as if discussion of copredication is effectively synonymous with discussion of PHYSICAL, INFORMATION, EVENT and INSTITUTION combinations.⁶

In the final section of this chapter, we will introduce ‘coherence relations’, which pertains to the degree of semantic coherence that discourse segments exhibit. In particular, I will focus on two specific types of coherence relations: *causal connection* (as in, ‘The newspaper was sued and it was deeply offensive’, where one can readily infer a causal relation between being offensive and being sued) and *extensional overlap* (as in, ‘The school banned videogames at lunch and had approximately 200 gamers’, where a shared feature of GAME/GAMING helps make the predicates cohere). Lastly, the single factor of *sense order* will be present throughout all subsequent chapters, and will form the basis of the core conclusions of this thesis.

2.1. Objective I: Defining Copredication

2.1.1. Polysemy

In this section, we will be developing a definition of copredication by assuming it to be a particular form of polysemy. As such, a brief foray into polysemy types will be presented as a means of reaching this goal.

Many words in natural language are ambiguous (for instance, the second edition of the Oxford English Dictionary, published in 1989, lists 615,000 definitions for 231,000

⁶ Even in the most technical forms of Modern Type Theory, Xue and Luo (2012) assume that the three most common types involved in copredication are EVENT, PHYSICAL and INFORMATION (see also Luo 2012a,b).

words; Srinivasan et al. 2019), but forms of ambiguity range across word types.⁷ Polysemous words are single phonological forms coding multiple semantically related senses, e.g. *key to the puzzle*; *key to the safe* (Gries 2015). ‘Standard’ polysemy includes words with multiple meanings of the same semantic category, as in the polysemy between *man* (individual) and *man* (species). This is in contradistinction to homophones and homonyms, which are single phonological forms coding multiple semantically unrelated meanings, e.g. when *pupil* is used to refer to a portion of the eye, or (Lyons 1977). We will adopt the distinction common in the literature such that homonymous “[m]eanings are unrelated, whereas [polysemous] senses are related” (Frisson & Pickering 2001: 150).⁸

Polysemy is much more widespread than typically appreciated. For instance, consider Travis’s (1997: 90) sentence “The leaf is green” when a red leaf is painted green. When spoken by a child looking at a red leaf painted green, this sentence is true, but when spoken by a botanist it is false.⁹ The word *leaf* can bear multiple senses (and is hence polysemous) not because it is an indexical (shifting its meaning based on context) or because its meanings are coerced or because of pragmatic processes, but simply because it is polysemous between its physical features and mode of origin.¹⁰

It is also worth considering the work of Srinivasan and Rabagliati (2015), who found that 27 distinct cases of polysemy in English (e.g. ANIMAL FOR MEAT, MATERIAL FOR ARTEFACT) are also present in 14 other languages, suggesting that polysemy arises from conceptual constraints rather than arbitrary, language-specific conventions. Since conceptual structure appears to make some sense relations easier to interpret and learn

⁷ An estimated 40% of frequent English words are polysemous (Durkin & Manning 1989), and approximately 4% of words are homonyms (Dautriche 2015).

⁸ It is also possible for certain words to cross these dimensions: *bill* can act as a homophone between the bill of a duck and a dollar bill, but can also act as a polyseme (*dollar bill* or *electric bill*), while *bank* is homophonous between the financial meaning and the riverbank meaning, but can also act as a polyseme (*sue the bank* or *build the bank*).

⁹ Perhaps a clearer example would be a generic statement like “A leaf is green”, since Travis’s case refers to a token leaf (at least, on the most natural reading).

¹⁰ As Vicente (2015: 54) points out: “Polysemy seems to be a relatively neglected phenomenon within philosophy of language as well as in many quarters in linguistic semantics. Part of this neglect is due to the fact that philosophical and a good part of linguistics semantics have been focused on sentential, truth-conditional, meaning, instead of on lexical meaning for a long time. But another part has to do with ... the idea that, barring homonymy, each word-type has a unique simple denotation”.

than others, it may be that polysemy is a linguistic adaptation which makes language acquisition less difficult for children, lending it an evolutionary as well as a conceptual rationale (see also Piantadosi et al. 2012 for a discussion of the communicative function of ambiguity).

While polysemy may be widespread, what is commonly and synonymously termed ‘logical’, ‘complex’ or ‘inherent’ polysemy has been somewhat sidelined (Apresjan 1974, Pustejovsky 1995, 2001, Ostler & Atkins 1992).¹¹ This form of polysemy occurs when different senses are deemed an essential, inherent part of an entity and are not ‘accidental’ (Asher 2011); the examples below demonstrate that the same nominal can be used to independently refer to wholly distinct semantic senses, with (3) denoting both informational and physical senses, and (4) denoting both event and personhood senses – it is only when *both* of these distinct senses are associated with the same nominal that copredication is said to arise:

- 3) a. Mary doesn’t believe the book.
b. John sold his books to Mary.
- 4) a. The phone rang during my appointment.
b. My next appointment is John.

Cases of complex polysemy appear to have two core diagnostics: *copredication* (a) involving coordinating distinct senses, and *anaphoric binding* (b) involving pronominal reference to the same nominal but involving a distinct sense (superscript = sense type):

- 5) a. The book was interesting^{INFO} and weighed a ton^{PHYS}.
b. That book was brilliant^{INFO}. Put it^{PHYS} back on the shelf.

Indeed, Norrick (1981: 112-115) proposed that a sound test for complex polysemy was what he termed the ‘coordination test’, which simply involves structures such as (5a). It is important to stress that these two diagnostics are for complex polysemy itself, whereas

¹¹ One of the notable exceptions is Pustejovsky’s (2008: 73-74) distinction between inherent and selectional polysemy: “Inherent polysemy is where multiple interpretations of an expression are available by virtue of the semantics inherent in the expression itself; selectional polysemy is possible when a novel interpretation of an expression is available due to contextual influences”.

copredication (as in 5a) is a specific instantiation of this polysemy. It is this particular instantiation to which we will now turn our attention.

2.1.2. Copredication

Copredication involves associating semantically related senses, but senses of distinct semantic types, which are associated with a single polysemous word to derive its meaning, such as in *book* (the informational content can be read whilst the physical features are being touched) and *lunch* (which can last for a given duration whilst also being a physical substance). Books and lunches therefore seem to be PHYSICAL OBJECT-INFORMATION and PHYSICAL OBJECT-EVENT composites. Copredication has been analysed as an unusual, complex form of polysemy, involving constructions which “ascribe two properties that ... can’t be jointly instantiated” (Liebesman & Magidor 2019: 1). As such, even though they involve complex polysemous nominals, the examples above in (3) and (4) do not involve copredication since only one polysemous sense is referred to.

Perhaps above all else, what copredication is can most readily be captured in the following way: Copredication is about *conflict*. The intuitive notion of conflict is deeply rooted in all definitions of, and perspectives on, copredication.¹² Semantic theories see copredication as a conflict in type selection, whereas pragmatic and philosophical theories see it as a conflict in referential relations.¹³

In this thesis we will assume (as in much recent literature; Asher 2011, Gotham 2015a) that copredication involves associating multiple predicates hosting senses of distinct semantic types (i.e. PHYSICAL OBJECT, EVENT, INSTITUTION, INFORMATION) with a single nominal (e.g. *translation*, *newspaper*).¹⁴ Jezek and Melloni (2011: 15) note that “what exactly counts as a co-predication is still controversial in the linguistic[s] literature”, but

¹² The semantically odd nature of copredication seems to be exposed by the fact that question-answers like “What is high in inequality and also very good at football? Brazil” come across as pun-like, as if the distinct senses are better suited to a joke than a true statement about the world.

¹³ My thanks to Matthew Gotham for this point of generalisation.

¹⁴ It should also be noted, for reasons of comprehensiveness, that within the core three types of copredication (*book*-, *lunch*- and *city*-types) stand *pathology* copredications. These are effectively a form of *lunch*-type copredications involving physical and process senses; (i) is taken from Arapinis and Vieu (2015: 290):

- (i) The inflammation is acute and visible to the naked eye.
- (ii) Walt’s tumour is large but in remission.

we will assume that any syntactic structure involving such an association between multiple, distinct senses and a single nominal representation is a case of copredication. This definition is unrelated to acceptability, such that there are copredications which are acceptable but also others which might be deemed unacceptable but are nevertheless classified as copredications (just as how there are also acceptable and unacceptable relative clauses). As will soon become clear, copredications appear to vary considerably in their acceptability based on a number of potential factors, and this observation will motivate our concentration on acceptability dynamics in the following chapter.

In this sense, we are also broadening the scope from the original conception in Pustejovsky (1995), which limited copredication to coordinate structures. While the most standard copredication pattern is [V[Det Adj N]], such as *burned the offensive books* (Jezek & Vieu 2014), copredication can also involve (i) splitting the copredication between a main clause and a subordinate clause ('The building, which started yesterday, will be very nice'; Jacquey 2001: 15), (ii) a modificational structure ('The most provocative newspaper of the year has been sued by the government'), (iii) anaphora ('He paid the bill and threw it away'; Asher 2011: 63, Cruse 1986), or (iv) temporal disjunction between predicates ('The translation was completed last week and is on the table') (to take only the most commonly discussed cases; Jezek & Melloni 2011, Ortega-Andrés and Vicente 2019, Pietroski 2017).

More generally, alongside this core definition of pairing polysemous senses of semantically distinct types, we will assume with Schumacher (2013: 3) that, from a processing perspective, copredication involves "a type shift or meaning adjustment without altering the respective discourse referent in fundamental ways". For instance, 'Lunch was delicious but took forever' involves a clear sense shift but a clear focus on the same entity.

Raising briefly here an important point of context, Cruse (1986) also used copredication purely as a test or diagnostic for complex polysemy. But, during the 1990s, interest shifted from using copredication merely as a diagnostic to viewing it as an independent phenomenon worthy of theoretical investigation. By the 2000s, a small number of semantic theories had tried to accommodate it, and within the past few years copredication has also infiltrated certain strands of psycholinguistic research into polysemy, as we will see in the next chapter.

Considering other cases, in (6a) informational and physical predicates apply to *book*, while in (6b) the *bill* is simultaneously an abstract monetary amount and a slip of paper. This at least points towards type compatibility between predicates even though the types are semantically distinct (physical object vs. information), following standard assumptions about coordination (Partee 1992, Partee & Rooth 1983):

- 6) a. The book was brilliant^{INFO} but weighed a ton^{PHYS}.
b. He paid^{INFO} the bill and threw it^{PHYS} away.

There are also certain linguistic phenomena which are closely related to, but distinct from, copredication. For example, Asher (2015) makes a distinction between two kinds of meaning shifts:

Coercion: Aspectual verbs like *start*, *begin*, and *finish* or verbs like *enjoy* merging with entity nouns.

Copredication: Meaning modification resulting from an adjective and a common noun being merged.

While copredication involves accessing a particular sense seemingly inherent to a nominal, coercion involves attributing to a nominal an eventive reading, as in ‘began the book’, whereby *book* is not inherently an event but is rather shifted to such a reading due to the presence of the verb. Coercion will be discussed in greater detail in Chapter 3, when we turn to experimental concerns.

Another related but distinct phenomenon is metonymy, whereby an entity is referred to by the name of something closely associated with the entity in question, as when ‘the White House’ is used to refer not to the physical structure but the elected government. Some polysemous words permitting copredication are thought to be ‘true’ polysemes (Copestake & Briscoe 1995), like *book*, and others are thought to have their meanings determined by a metonymic lexical rule, like *place-for-institution* (e.g. *school*), where the rule states that a certain (PHYSICAL) sense can refer to another sense. Moreover, while many rule-derived polysemes like *lamb* (meat vs. animal) do not typically permit acceptable copredication (‘#The lamb was fed and then carved’; Frisson 2009: 120), there appear to be some exceptions to this, as in ‘Corn-fed and inexpensive chicken is difficult

to find' (Copestake & Briscoe 1995: 49; see also 37-43). *Place-for-event* copredications seem the most semantically deviant: '#Vietnam was horrific to live through [WAR] and is now attracting thousands of tourists [LOCATION]'.¹⁵ Overall, we will be restricting our focus to polysemous nominals which permit copredication, and as such certain copredications will instantiate metonymy (*school*) while others will not (*book*).

With this preface, we can now turn to reviewing and critically evaluating existing proposals concerning the structure of copredication. Given that our focus is largely on the lexical (representational) and psycholinguistic properties of copredication, we will leave aside much of the technical machinery used in many of the following proposals and review those features which pertain most clearly to the topics addressed in this thesis.

2.2. Objective II: Accounts of Copredication

This section reviews some of the theoretical debates concerning copredication. Even though the terrain across accounts will differ, we will try and show that the underlying theme is that *particular discourse effects appear to have a major impact on the licensing of copredication*. This conclusion will then be used as a window into the psycholinguistic properties of copredication.

As will become clear, the majority of accounts in the literature are *semantic* in nature. However, a smaller number of *psychological* and *pragmatic* accounts will be presented. I will attempt to provide a brief review of each proposal, taking on board certain observations which will motivate the view of copredication to be presented later in this thesis. In addition, I should note that some of the theories discussed are primarily theories of polysemy but ones that try and account for copredication, while others are exclusively theories of copredication.

Aiding the transition to empirical concerns in Chapter 3, the accounts reviewed here will be partitioned into certain camps, which we will briefly outline here. The *Sense*

¹⁵ There is also the related issue of whether metonymic rules (such as *part-for-whole*, *product-for-producer*, *place-for-event*, *place-for-institution*; Copestake & Briscoe 1995, Li & Slevc 2017) are genuinely lexical in nature, or whether the 'rules' themselves are merely reflections of possible conceptual relations permitted by semantic types. The more parsimonious explanation for this is to assume that these metonymic 'rules' are mere reflections of possible conceptual relations permitted by semantic types, and hence *school*- and *city*-type copredications are ultimately the result of conceptual structure.

Enumeration Lexicon (SEL) model proposes that the senses of polysemous words are represented in the mental lexicon such that there exists a distinct representation for each sense. In contrast, the *One Representation Hypothesis* (ORH) maintains that polysemous senses depend on or belong to a single lexical representation. A core theoretical motivation for SEL accounts is to subsume polysemy and homonymy under the same framework, while a core motivation for ORH accounts is based on the observation that polysemous senses are related to one another and are often extremely similar. We will segregate the accounts reviewed below based on whether they explicitly adhere to, or more generally support, either the SEL or ORH account.

Lastly, it is important to stress an issue relating to methodology, and also expository tone: All of the acceptability contrasts we will review in this chapter (e.g. the kind of contrasts in (1) and (2)) are purely intuitive, generally based on claims in the literature. For instance, Pustejovsky and Batiukova (2019: 199) make explicit claims about acceptability contrasts in copredication but no psycholinguistic data is used to support such contrasts. Currently, sparse empirical data exists which could provide evidence for or against particular models of polysemy with respect to copredication. Indeed, while Sprouse and Almeida (2017) show that individual acceptability judgements are highly robust when experimentally tested, there is the more urgent task of exploring the acceptability of copredication configurations which no individual researcher has made acceptability claims about (e.g. contrasting copredications with and without pronominals in certain positions, or copredications with predicates of varying semantic complexity controlled for sense type). This will be the major contribution of Chapters 3-4. For now, further motivation is needed before we can propose any particular experimental design.

2.2.1. Accounts Supporting the One Representation Hypothesis

2.2.1.1. Semantics Accounts

While polysemy and pragmatics have been explored in only relatively minor detail in relation to copredication, the most comprehensive and widely discussed account of complex nominals like *book* and *committee* comes from formal semantics accounts. The most influential of these (and the most relevant for our concerns) is Pustejovsky's (1991, 1995) Generative Lexicon theory. This maintains an ORH view of copredication, and certain currents in the Generative Lexicon literature have also occasionally made claims pertaining to processing, as we will see.

The Generative Lexicon supposes four basic levels of representation (Pustejovsky 1991: 418-419): Argument structure (the number and type of logical arguments, how a word maps to syntactic expressions), Event structure (the event type and subeventual structure of an expression; e.g. state, process, transition), Qualia structure (predicative force of a word, and the “essential attributes of an object”; Pustejovsky 1991: 418), and Lexical Inheritance structure (how a word is “globally related to other concepts in the lexicon”; Ibid). A set of operations applies to these levels and relates them in context, for instance *type coercion*, which explains the differences in uses of verbs like *enjoy* and *open* by converting an argument to the type which is expected by a function (Pustejovsky & Boguraev 1993), as in ‘enjoy the book’ whereby the stereotypical reading is that the enjoyment relates to an event.¹⁶

Of these four levels, it is Qualia structure which in particular distinguishes copredication relations. Pustejovsky (1991, 1995) proposes that word meaning is structured by four qualia roles which capture human understanding of objects and relations:

FORMAL: The basic category that distinguishes an object within a larger domain.

CONSTITUTIVE: The relation between an object and its constituent parts.

TELIC: The object’s purpose and function.

AGENTIVE: Factors involved in the object’s origin or ‘coming into being’.

¹⁶ Interestingly, coercion seems to operate unidirectionally in certain cases: ‘That dog bone lasted two minutes’ is a case of coercing a physical referent into an eventive reading, but one cannot easily shift an eventive referent into a physical reading (Liebesman & Magidor 2017: 150-151):

(i) #The lunch meeting was delicious, but lasted hours.

Note that the opposite acceptability pattern obtains when an event is combined with informational content. While event-to-physical coercion seems anomalous and physical-to-event is acceptable, the examples below suggest that event-to-information is anomalous and information-to-event is acceptable (the example in (ii) is taken from Asher 2011: 132, but as discussed elsewhere in this thesis, sense reversal is rarely conducted and so (iii) is not considered by Asher):

(ii) Mary’s testimony occurred yesterday and is riddled with factual errors and inconsistencies.

(iii) #Mary’s testimony is/was riddled with factual errors and inconsistencies and occurred yesterday.

This concern of *sense order* in copredication will be a major theme of this thesis. Note also that the selectional requirements (or selectional preferences, to use Zarcone’s 2014 more accurate term) of verbs also restrict copredication: *read* selects for both physical and informational senses (‘John read a book/story’), but *tell* does not (‘John told a story/*book’).

Pustejovsky (1995) uses these ideas to argue that the different meanings of *book* arise from the foregrounding of its distinct aspects; a book is simultaneously a physical and informational entity, and these properties are made salient by grammatical content and context (see also Srinivasan & Snedeker 2011: 249). This proposal adheres to core ORH assumptions.

While traditional semantic theories have focused on selectional restrictions and domain-specific constraints encoding a ‘static’ (Pustejovsky & Boguraev 1993) representation, the Generative Lexicon attempts to explain why new senses can emerge compositionally through the above system of semantic types (Pustejovsky 1991: 426-427). Less emphasis is placed on extra-grammatical and extra-semantic processes such as pragmatics, and the explanatory burden is typically placed on semantic type structure, whereby complex polysemous nominals are represented as ‘dot-types’ or ‘dot-objects’ (e.g. *book* would be of the type PHYSICAL • INFORMATION; although see Asher 2006 for a discussion of pragmatic effects in copredication from the perspective of semantic theory).

¹⁷ These are at the core of all copredications; their meaning “combines two or more different semantic types, which are equally important in the word’s definition” (Pustejovsky & Batiukova 2019: 175).

In psycholinguistic terms, it is assumed in this tradition that a given complex nominal like *book* is a single lexical representation having associated with it two semantically distinct senses. Indeed, the common term in the literature used for complex types is *inherent polysemy* (Pustejovsky 2008); what Jezek and Melloni (2011: 5) call “an ambiguity available by virtue of the semantics inherent in the noun itself”. The distinct senses of these polysemous nominals are, for others in the Generative Lexicon tradition, “different aspects of the object” (Asher & Denis 2005: 10) – where “object” is taken to mean *lexical entry* – rather than aspects of two distinct objects/lexical entries.

¹⁷ Although the formal details will not be relevant to us, a brief, motivating background for these types would look like the following: When lexical items inherit two distinct ontological semantic types (e.g. an event and entity reading), these cannot be defined by a standard meet operator, \wedge , assuming that the ontological type hierarchy is a tree structure with no joined nodes (i.e. events and entities occupy distinct branches in the type hierarchy). Since no multiple parent nodes are permitted, the •-operator creates a complex type out of two types at a bottom branch of the type hierarchy (see Pustejovsky & Batiukova 2019: 300 for a visual representation).

For Pustejovsky (2005), this property of inherent polysemy amounts to “the ability to appear in selectional contexts that are contradictory in type specification”. For each pair of “self-contradictory” (Elbourne 2011: 26), or “contradictory in type specification” (Jezek & Melloni 2011: 4, echoing Pustejovsky) or “incompatible” (Jezek & Vieu 2014 and Xue & Luo 2012) senses involved in copredication, there is a relation connecting the senses. For instance, *book* exhibits a form of containment relation and is syntactically distributed in a similar way to other container concepts (e.g. ‘John read about it *in* that book/newspaper’). Containment relations are encoded onto the Formal Quale value.

Overall, language permits rich combinations of semantic senses (Pietroski 2012), as seen in copredication via dot-types: PHYSICAL • INFORMATION (*book, video*), EVENT • PHYSICAL (*construction, examination*), EVENT • INFORMATION (*exam*), EVENT • FOOD (*lunch, dinner*), EVENT • PERSON (*appointment*)¹⁸, LOCATION • INSTITUTION (*city*). Each of these type products is created through a unique relation. As such, in addition to standard Montague types (*e* and *t*), Generative Lexicon models assume dot-types and a rich subtyping over the entity domain (PHYSICAL, ABSTRACT, LOCATION, and so forth; see Asher 2011, Jezek 2016).

Due to its influence and substantial descriptive scope, the Generative Lexicon model has seen a number of revisions and extensions since Pustejovsky (1995).¹⁹ We will now review a selection of the most prominent, relevant and recent accounts here before progressing to entirely different accounts outside the Generative Lexicon tradition.

¹⁸ However, Cruse (1986) claims *appointment* copredications generate semantically deviant interpretations, e.g. ‘#My appointment was long and (he was really) obnoxious’. Chapter 4 will present acceptability judgement data pertaining to this issue.

¹⁹ The work of Gotham (2012, 2015a,b, 2016) constitutes one such account, but due its focus being on numeric quantification it is not directly relevant to our concerns, and so will only be briefly mentioned here. Gotham argues that accounts of copredication which do not take into account individuation criteria would struggle with cases like ‘Five books are heavy and easy to understand’ when we have three physical books and two copies of a single informational book and a trilogy in one physical volume. Gotham assumes that we need not simply have a physical or informational reading, but a joint dot-type reading simultaneously involving the counting of both senses. This is also because there seem to be certain peculiar preferences for counting entities licensing copredication: Consider three physical books of different colours (red, blue, yellow), all of which form a double volume collecting *Iliad* and *Odyssey*. It seems possible to count three books (PHYSICAL) or two books (INFORMATION), but it seems odd to say that there are six books, i.e. *books* do not seem to be counted as complex entities of ordered pairs, PHYSICAL + INFORMATION (see Asher 2011: 140-141, and also Liebesman & Magidor 2019 for critical commentary).

2.2.1.1.1. *Linear Dot-Types and Sense Commonality*

Chatzikyriakidis and Luo (2015) claim that a meaning shift from one sense to another (PHYSICAL to INFORMATION) is a flexible process exhibiting few constraints, relying on a single lexical representation. The authors use this observation to motivate the claim that with *newspaper* this meaning shift exhibits a degree of rigidity – because, the authors claim, we need the PHYSICAL and INFORMATION senses to not occur with the INSTITUTION sense. Chatzikyriakidis and Luo claim that structures such as the following exhibit degraded acceptability, and they suggest that the INSTITUTION sense of *newspaper* cannot co-occur with its other senses (e.g. its PHYSICAL sense below):

- 7) That newspaper is owned by a trust^{INST} and is covered in coffee^{PHYS}.

In order to account for this, they invoke resource sensitive dot-types, or *linear dot-types*, which are single lexical entries. Putting aside the specific details (see Girard 1987), this proposal leads to the conclusion that if the institutional sense is used it must appear in isolation.²⁰ With the exception of *newspaper*, the authors concur with the standard Generative Lexicon assumption that other complex polysemous nominals can be represented as a dot-type and a single lexical representation (adhering to ORH).

2.2.1.1.2. *Type Composition Logic*

Differing from Chatzikyriakidis and Luo’s innovations to the Generative Lexicon, Asher (2011) proposes that the entire theory of predication needs to be substantially enriched to explain the multiple senses attributed to copredicated nominals. Asher proposes that lexical items are assigned a fine-grained type, and that predicative items place type

²⁰ This Boolean checklist-style approach has fruitfully been applied elsewhere, for instance by Jackendoff (1985) to the meaning of *climb*, which necessarily requires a subject to be MOVING UPWARDS or to CLAMBER, or both:

- (i) a. The cyclist climbed up/#down the hill (by bicycle).
b. The monkey climbed up/down the ladder.

As Wechsler (2015: 14) points out, we can blend these distinct senses without any anomalous results, suggesting that there is a single lexical representation, *climb*, hosting both senses:

- (ii) a. In this event, you climb up the hill by bicycle, then down using the rope ladder.
b. Would you rather climb up the hill on a bike or down the ladder without one?

presuppositions on arguments. For instance, ‘red’ and ‘informative’ presuppose that their arguments are, respectively, physical and informational objects.

How does Asher account for copredications? Since in cases like ‘The book is red and informative’ the two predicates place conflicting type presuppositions on their arguments, Asher invokes dot-types, following Pustejovsky. Yet as Asher notes, sentences like ‘The book is red and informative’ satisfy neither the presupposition for ‘red’ nor ‘informative’, so should be infelicitous, regardless of type structure. In response, Asher proposes a complex semantic mechanism which applies predicates of distinct types (INFORMATION • PHYSICAL) not directly to their subjects, but to modulated versions of the subject. This occurs through a functor taking the dot-object to either its physical or informational ‘aspects’ based on the predicate. As such, Asher assumes a single lexical representation for *book*, which univocally picks out objects of the dot-type INFORMATION • PHYSICAL.

Asher assumes that in copredication the meaning of *book* is shifted (from one dot-type aspect to another) based on which adjectives are associated with the nominal. This is claimed to involve a type-shifting operation (see Asher 2015 for formal characterisations). Asher maintains that, in copredication, the predicate retains its original meaning, able to be recovered in the event of gapping or sluicing. The only thing that changes is what Asher informally terms the “glue” linking them (2015: 70).²¹ This view differs from the pragmatic views we will soon turn to, which assume instead that it is the meaning of the predicate that shifts during copredications.

In brief, type interactions lead to situations which involve repairing type mismatches (in coercion; Godard & Jayez 1993) or adjusting modifier or nominal meaning (in copredication). More broadly, the compositional operation proposed in the Generative Lexicon literature which disambiguates the senses of complex nominals (i.e. complex dot-objects) is termed *Dot-Exploitation* (Asher & Pustejovsky 2006). This is commonly seen as “a ‘light’ form of coercion” (Jezek & Melloni 2011: 5), and is indeed termed *type coercion* in Pustejovsky and Jezek (2008), whereby “the type a function requires is imposed on the argument type” through “taking a part of the argument’s type to satisfy the function” (2008: 185). As such, the meaning modification involved in copredication may share a common psycholinguistic basis with the forms of coercion explored in much of the literature, which has been shown to result in processing costs, as the next chapter will review. We will explore this issue in greater detail below, but it should be noted that

²¹ See Luo (2010, 2011, 2012a,b) for an alternative method.

Pustejovsky and Jezek (2008: 191) maintain that “[f]rom the point of view of its computational cost, Dot exploitation is an inexpensive operation (i.e. a light form of coercion)”.

2.2.1.1.3. *Univocity*

As noted, previous accounts reviewed here assume that nominals licensing copredication are fundamentally ambiguous between multiple readings. Liebesman and Magidor (2017) depart from this assumption, and argue that theorising about copredication requires no revisions to type systems or metaphysics (i.e. the abandoning of referential semantics, as in Chomsky 2000; see also Collins 2015, 2017a, 2018, and Segal 2012). Instead, they claim nominals like *book* are not ambiguous but encode a single sense (a form of univocity) simultaneously designating both physical and informational entities, and that it is via contextual restriction that multiple readings are permitted. Despite their differences, Liebesman and Magidor and the above Generative Lexicon frameworks are in agreement that *book*-type nominals do not encode two distinct lexical representations (*book*₁, *book*₂), but a single lexical entry with distinct senses.

For example, an argument they make against the ambiguity of *book* is that cases like ‘Three colours are on the canvas’ – involving three distinct shades of red – cannot automatically be seen as supporting the ambiguity of the nominal *colours*. Rather, it is other words in the sentence like *three* which constrain the meaning of *colour*, or it is *red* which is ambiguous; in addition, *colour* is clearly contextually restricted (2017: 136). What to make of this? It might simply be that contextual restrictions are active for *colour*-type scenarios while genuine ambiguity is at play for *book*-type nominals – in particular given that *book* putatively encodes senses of distinct types, while *colour* can only encode different gradations of the same physical type.

Another core aim of Liebesman and Magidor’s is to show that copredication-licensing nominals are not the only linguistic entities that can instantiate semantically distinct properties. By doing so, they claim that this proves that the use of copredication to reject referential semantics (e.g. by Chomsky 2000) is illegitimate. To illustrate their point, they discuss properties that can be instantiated by both events and non-events, such as being ‘tolerable’: A certain condescending explanation can be deemed intolerable (event reading) by virtue of the mental state of the individual listening to it, while an individual can also be judged as intolerable (non-event reading) because of their penchant for

delivering condescending explanations. As such, “properties can be instantiated by different objects in different ways” (Liebesman & Magidor 2017: 143), and they claim that copredications can be derived from this basic metaphysical fact. Yet, the crucial difference between event and non-event readings of ‘tolerable’ and event and non-event readings of ‘lunch’ is that the latter involves the *simultaneous* instantiation of these readings; one cannot combine both readings of ‘tolerable’ or attribute them to a single entity.

2.2.1.2. *Psychological Accounts*

Not all accounts of complex polysemy are from formal semantics. Another line of research is *psychological* in nature. These accounts stand somewhere ‘between’ formal semantic and pragmatic theories, importing psychological frameworks while adhering to certain representational assumptions from semantics and stressing the importance of pragmatic processes.²² Two major accounts will be reviewed here: *activation packages* and *LCCM theory*, both of which assume an ORH model of polysemy.

2.2.1.2.1. *Activation Packages*

Differing from Liebesman and Magidor’s (2017) claims of non-ambiguity for copredication-licensing nominals, by focusing their attention on the nominal *school* and its range of sense combinations Ortega-Andrés and Vicente (2019) claim that *school* constitutes a “multiply polysemous word”, i.e. a nominal with a large number of meanings. They generalise from this the broader conclusion that certain institutional copredications involve “robust activation packages” (2019: 1), which are lexical items used to trigger certain conceptual representations. They cite examples including *Brazil* and *school* to demonstrate that these institutional entities can be ‘near’ somewhere, a ‘republic’, ‘high in inequality’, ‘start at 9:00am’, and so forth. Their explanation for copredication acceptability dynamics is that polysemous nominals constitute activation packages of senses (rather than dot-types) but that “senses which are more closely related have higher rates of co-activation” (Ortega-Andrés & Vicente 2019: 3). As such, their central claim is that copredications like ‘The newspaper fired its editor and fell off the table’ are putatively anomalous because the senses involved are not sufficiently related,

²² Indeed, one such psychological account holds that “[t]here is no principled distinction between semantics and pragmatics” (Evans 2015: 120).

and that the institutional sense “fails to activate” the physical sense (2019: 13). In addition, the authors assume that any given occasion of *school* will automatically activate all senses in the activation package due to their stipulated claim that all *school* senses are closely related (a claim we will return to below).

The claim that the institutional sense of *newspaper* “fails to activate” the physical sense cannot account for cases of acceptable copredications like (8a) and (8b) below, since even though relative clauses seem to boost acceptability (a topic returned to in Chapter 6), this alone cannot account for why the physical sense seems to be activated:

- 8) a. The newspaper that was sued^{INST} can be found on the table^{PHYS}.
- b. The town’s most famous^{INST} newspaper is on the desk^{PHYS}.

It seems that the physical sense is not primed *to the same degree* in INSTITUTION-PHYSICAL shifts than in INFORMATION-PHYSICAL shifts. We will elaborate on this possibility below. For now, we can at least conclude that Ortega-Andrés and Vicente’s (2019) activation package framework is too ‘all-or-nothing’, assuming that polysemous senses in copredication are either all activated at once, or not at all.

2.2.1.2.2. LCCM Theory

Attempting to explain a range of polysemies, Evans (2006, 2010, 2013, 2015) develops a ‘Theory of Lexical Concepts and Cognitive Models’ (LCCM Theory). LCCM relies on *cognitive models*, which populate the conceptual system and are multi-modal, cross-modular and analogous to perceptual and interoceptive experience.

Evans (2015) suggests that polysemy arises through linguistic context differentially highlighting distinct aspects of non-linguistic encyclopaedic knowledge (following the original outline of cognitive linguistics in Langacker 1987). Evans (2015) terms *book*-type polysemy “conceptual polysemy”, claiming that it arises from non-linguistic knowledge to which words facilitate access, such that an utterance of ‘book’ in a given context provides instructions to the conceptual systems to build a specific representation matching contextual criteria. Evans assumes a single lexical entry for nominals like *book* but one which links to these forms of non-linguistic knowledge, and also assumes that highly context-specific polysemous readings should be treated as distinct polysemous senses.

For example, Evans claims that a partial cognitive model profile for *France* could involve the nominal immediately linking to three types of ‘primary cognitive models’: geographical landmass, nation state, and holiday destination. These are then connected to ‘secondary cognitive models’: Nation state is related to national sports, political system, and cuisine. Finally, political system is related to, for instance, constitutional system. These are constructed based on an individual’s experiences: for some, France may not be a holiday destination, and so forth. This psychological model of polysemy allows us to appreciate the ways in which copredications can be implemented in a range of contexts.²³

In summary, psychological theories of copredication allow us to appreciate that while copredications may indeed reduce to PHYSICAL, INFORMATION, EVENT and INSTITUTION combinations, they nevertheless tap into an unusually broad range of conceptual and encyclopaedic knowledge.

2.2.2. Accounts Supporting the Sense Enumeration Lexicon Hypothesis

2.2.2.1. Coordination Reduction

Haspelmath (2007: 38-39) approaches copredication via an SEL lens by claiming that copredication-licensing nominals host multiple lexical entries. His source of evidence for this is his claim that the argument in “Lunch was delicious but (it) took forever” is resolved differently in each coordinate, such that *lunch*₁ denotes food while *lunch*₂ denotes an event (both picking out a distinct lexical entry) and that the sentence has the following underlying structure:

- 9) Lunch₁ was delicious but lunch₂ took forever.

Yet, as we have seen, copredication is not limited to this type of syntactic structure (e.g. ‘Bob stopped by during the delicious lunch’; see also Gotham 2012), and so it is unlikely that coordination reduction (i.e. generating the full syntactic structure before eliding certain elements, like *lunch*₂) can serve as an explanation.

²³ For instance, Evans is not claiming that HOLIDAY DESTINATION should be seen as a central polysemous sense stored in the lexical representation of *France* – he makes no claims as to the content of the single-entry, but is rather concerned with how this node can be used to access a range of conceptual representations.

2.2.2.2. Neighbouring Senses

Copestake and Briscoe's (1992, 1995) account of copredication constitutes a notable extension of the Generative Lexicon model. However, unlike the other Generative Lexicon accounts which universally assume an ORH model, Copestake and Briscoe's account is somewhat more nuanced, since they assume an SEL model for *newspaper*-type nominals (i.e. they assume *newspaper* hosts distinct senses), but an ORH model for other complex polysemous nominals like *book*.

While adopting most properties of the Generative Lexicon framework (i.e. Qualia structure and compositional operations), these authors discuss forms of polysemy relating “two or more senses” (1995: 15) and forms of polysemy involving a single sense of a lexical entry being underspecified for its meaning and contextually specified (for a recent version of this account, see Kinoshita et al. 2018).²⁴

Considering *book*-type copredications, the authors treat these as involving the selection of an “appropriate aspect of the meaning of the complement” (Copestake & Briscoe 1995: 32), as opposed to shifting the meaning of the noun phrase itself. As such, rather than claiming that these types of nominals are *ambiguous* (exhibiting multiple conventional readings), the authors claim that they are *vague* between event and object interpretations. What this means is that context facilitates the ‘filling-in’ of semantic details associated with a given use of a word, with ‘vagueness’ relating to “the range of application of an expression to a domain of semantic space” (Lehrer 1990: 208).²⁵

The authors note that there are certain cases of copredication which are not clear-cut as to what type of polysemy they should be classified as. *Newspaper*-type copredications are a case in point. Copestake and Briscoe (1995: 54), like Arapinis, note that “[i]t seems plausible to suggest that newspapers are regarded as (named) institutions in themselves”. This provides a much broader range of sense combinations, and so they claim that certain *newspaper*-type copredications can readily be classified as single lexical entries having their meaning underspecified (and contextually derived), while others seem to involve relating two distinct senses much more readily without the need for contextual support. Hence, they assume two lexical entries for *newspaper*: a physical representation and an

²⁴ Although the formal details will not concern us, the authors refer to these two types of polysemy as, respectively, ‘sense extension’ and ‘constructional polysemy’.

²⁵ In one of the earliest formulations, Chao (1959) argued that a lexical item is vague if its range of application is not precisely determined.

institutional representation. They motivate this distinction based on a range of putatively degraded cases arising from coordinating both structures, and also based on the fact that both the INSTITUTION and PHYSICAL senses are counted separately (unlike the INFORMATION sense; although see Gotham 2015a); the number of organizations denoted below (three) can be distinct from the number of physical copies burned (unbounded):²⁶

10) Three newspapers have been attacked^{INST} by the opposition and publicly burned^{PHYS} by demonstrators.

Lastly, moving away from representational basis, Copestake and Briscoe's theory of copredication acceptability is also based on whether the two senses are "neighbours" in a continuum from abstract (institution lexical representation) to concrete (physical lexical representation). To take some examples from their list of 12 sense examples for *newspaper*, they give the following as interpretations which seem to shift from one sense to another (1995: 54): 'That newspaper is owned by a trust' > 'That newspaper carries long articles about the internal struggles of the Labour Party' > 'That newspaper is full of spelling mistakes' > 'That newspaper has lots of smudged type' > 'That newspaper is covered with coffee'. Using this method, the authors can give examples shifting from the institutional to the informational to the physical readings of *newspaper*, with the association of 'distant' senses often being unacceptable due to it associating for them two distinct lexical entries. However, the authors do not define how 'distant' (in terms of how many senses away from each other; 1, 2, 3...?) senses need to be before they yield semantically deviant readings.

2.2.2.3. Pragmatics Accounts

The nature of complex polysemous nominals is not completely agreed upon in the literature, and as we have seen alternative semantic and psychological accounts exist. Other researchers have pursued different avenues, placing greater emphasis on the role of

²⁶ Weak definites can also be used to expose the distinct polysemous senses of *book* versus *newspaper*. 'Joe read the book and Bill did too' implies that both men read the same book, but 'Joe read the newspaper and Bill did too' could mean that Joe read *The Globe* and Bill *The Post* due to the larger range of senses of *newspaper* (notably, the addition of an institutional sense).

pragmatic processes in deriving copredications, with many pragmatic accounts falling into the SEL camp, as reviewed here.

So far, we have seen that formal semantic approaches to copredication focus on the contribution of lexical representations during composition. In contrast, pragmatic approaches focus on speaker intentions and conversational principles (Nunberg 1978, 1979, 2004, Recanati 2010, Ward 2004). Semanticists have readily acknowledged (in particular, Asher, Pustejovsky, Copestake and Briscoe) the importance that pragmatics can play in improving copredication acceptability. It is not that these researchers are *against* the idea that pragmatics plays a role, it is more simply that it is not their formal area of interest. Gotham (2012: 14), for example, notes that “[i]t certainly seems that some kind of pragmatic story needs to be told about ... [anomalous] copredication”. Pustejovsky’s (1991: 410) original discussion of the Generative Lexicon notes that it may be that “discourse and pragmatic factors should be handled differently or separately from the semantic contributions of the lexical items in composition”.

That said, there are also some more specific postulations in the semantics literature which force researchers to differ in how they account for copredications when compared with the explanations we find in the pragmatics literature. Taking the most commonly studied framework, in the pragmatics literature on meaning shifts the following factors have been typically assumed to permit meaning shifts from a property to an individual: The salience of the property identifying the individual; some form of functional correspondence between the property and individual; contextual support (Jackendoff 1997, Nunberg 1995). In particular, salience and contextual support are notions which the Generative Lexicon tradition has not focused on specifically.

2.2.2.3.1. *Predicate Meaning Transfer*

It was noted above that theorists such as Asher hold that the relation between predicates and arguments shifts during copredications. In contrast, dominant views of copredication from pragmatics instead assume that predicates can shift the meaning of nominals during discourse, and that furthermore this process is heavily reliant on contextual cues as opposed to some form of compositional operation. This has given rise to the general name of ‘predicate meaning transfer’ accounts.

In Nunberg (1995), the original conception of *predicate meaning transfer* is stated: “‘Transfers of meaning’ are linguistic mechanisms that make it possible to use the same

expression to refer to disjoint sorts of things”. In later work, Brandtner (2008, 2011) maintains that it is always the first predicate that fixes the meaning of the nominal, and that later predicates shift the meaning. Brandtner assumes homonym-like ambiguity for *book*, such that different homophones of *book* denote distinct meanings. Hence, Brandtner assumes two lexical entries for *book*, in accord with the SEL account. Brandtner (2008: 30) claims that “this mechanism [of predicate meaning transfer] does not act on the assumption that the nominalization has two readings at the same time”. For instance, in ‘Roth is Jewish and widely read’, Brandtner (2008) argues that we are accessing two distinct properties of the notion *person*, but that since we do not have to shift the nominalization due to its singular meaning, only the first predicate’s meaning is attributed to the nominal representation itself. Then, upon encountering the second predicate, the meaning of the nominal is shifted (such that we access the second lexical representation), yielding: ‘Roth₁ is Jewish and [Roth₂] widely read’. Lastly, Nunberg (1995: 112, 2004) states that meaning transfer is only permitted if there is a salient relationship between predicates and arguments, as in ‘I am parked out back’, where a salient relationship of OWNERSHIP exists between the speaker and the car.²⁷

Other pragmatic theories which extend on or relate to the insights of the predicate meaning transfer framework (e.g. Carston 2002, Winograd 1983) assume, in contrast to Pustejovsky-inspired theories, that the semantic component of a lexical item is impoverished and merely provides an indicator towards a general conceptual space, from which a more specific representation can be built on a context-by-context basis. This idea is closely aligned with Relevance Theory-inspired views (Sperber & Wilson 1985, 1995), which hold that the meaning of a word is determined by a given context.²⁸

²⁷ Consider also cases of verbal ellipsis. In ‘Your shoes are too loosely tied; so is your bowtie’, the predicate is not shifted such that the property of having untied laces is attributed to the bowtie. Rather, the property of the shoe being untied is transferred. The predicate is not strictly speaking shifted, but rather it “exploits the inner-structure of the object it applies to in order to highlight a piece of it” (Arapinis 2015: 9).

²⁸ Although we will not discuss these pragmatic theories further, it should be noted that Relevance Theory-inspired views are compatible with the ORH model since they assume lexical entries to be nodes in memory linking to a range of distinct conceptual systems (including atomic concepts, encyclopaedic and world knowledge).

2.2.2.3.2. Discourse Coherence

Elaborating on the specifics of her SEL-based account discussed above (assuming homonym-like ambiguity for *book*-type nominals), Brandtner (2009, 2011) further proposes that the semantic salience and coherence between predicates and arguments in copredications heavily factor in their acceptability. She argues that the establishment of copredication cannot be reduced to semantic principles, claiming that EVENT and RESULT readings can only be coordinated when a salient relation obtains between them. For instance, Brandtner claims that the copredications yielded by German deverbal *-ung* nominalisation cannot be addressed by compositional operations alone, but additionally require pragmatic processes. In the case of *Übersetzung* ('translation'), the selectional restrictions of two conflicting interpretations (EVENT and RESULT) simultaneously apply to one token of the nominal:

11) Die [langwierige]_{ev} Übersetzung [verkaufte sich millionenfach]_{re}.

The tedious translation sold themselves million-fold

“The tedious translation sold million-fold.”

Certain cases in which the predicates are unexpected (in a context in which ‘easy’ translations are not expected to sell many copies, and ‘tedious’ translations are expected to sell well) are argued by Brandtner to make copredication licensing more difficult:

12) ?Die [einfache]_{ev} Übersetzung [verkaufte sich millionenfach]_{re}.

The easy translation sold themselves million-fold

“The easy translation sold million-fold.”

She also points to “general ontological constraints” on type combinations, such that we cannot conceive of a firm’s management as being simultaneously an event and an agent, even though *management* can independently be either:

13) ??Die **Leitung** der Anwaltskanzlei ist [schwierig]_{ev} und hat [angerufen]_{ag}.

The management of the law firm is difficult and has called

“The management of the law firm is difficult and has called.”

With derived nominals (e.g. *invention, examination, translation*; Grimshaw 1990), event and object readings can be licensed if a causal or salient reading obtains (see Chapter 2.3.3 for a discussion of causality), with the tedious/difficult translation paying off with higher sales. But in ‘The easy translation sold million-fold’, Brandtner claims that since expectations (of easy translations selling poorly) have not been met, the unexpected reading must be licensed by local discourse markers, like ‘still’:

14) Die einfache Übersetzung verkaufte sich **dennoch** millionenfach.

The easy translation sold themselves still million-fold

“The easy translation still sold million fold.”

Norrick (1981: 115) also claims that slight alterations to copredications involving temporal markers impact their acceptability:

15) a. #Judy’s dissertation is thought provoking and yellowed with age.

b. Judy’s dissertation is still thought provoking though yellowed with age.

As such, Brandtner’s account helps us understand the ways in which copredication licensing interacts with context, and we will expand on Brandtner’s insights into causal and salient predicate relations in Chapter 2.3.3. While Brandtner specifically assumes an SEL-based framing (as discussed in the previous section), her particular assumptions about the importance of discourse coherence can be generalized quite readily to other framings, and so even though discourse coherence models have emerged out of SEL-inspired accounts they are not strictly wedded to them.

2.3. Evaluation: Predicate Ordering and Coherence as Factors in Copredication Acceptability

Thus far, we have delimited our definition of copredication and presented a selective overview of semantic, psychological and pragmatic accounts. This has allowed us to discuss a number of intriguing and unexplained features of copredication which we will investigate empirically in Chapters 3-5 (e.g. patterns in anomalous interpretations, impact of anaphoric relations in copredication, acceptability differences across nominal types).

In this final section, before moving to empirical terrain, I will discuss the two main themes that gradually emerged in the above review of theoretical accounts: *predicate ordering* and *coherence relations*. The motivation behind this is that these will be the two main factors postulated as candidates responsible for copredication acceptability dynamics – and, crucially, neither have been studied empirically in relation to copredication. I will also address a concern relating to the number of senses capable of being involved in a given copredication; an important issue if we are to be sure of our options when considering the number of possible predicate orderings.

As will soon become clear, existing theories of copredication have made brief reference to the possibility that predicate ordering potentially plays a major role in modulating copredication acceptability. After discussing this issue, we will present an overview of the literature on ‘coherence relations’ and argue that this notion should be integrated further into theories of copredication (in the spirit of the pragmatic accounts reviewed immediately above). After this evaluation, a *Copredication Hierarchy* will be proposed in order to capture the apparent range of copredications.

2.3.1. Number of Senses in Copredications

A topic which needs to be addressed before we can progress to experimental territory concerns the number of senses involved in possible copredications. We noted in the previous section when pursuing Objective (II) that only the INSTITUTION, EVENT and PHYSICAL senses are needed to derive interpretations of institutional copredications. How do these ideas relate to the rest of the literature?

Vicente (2018: 955) has noted that, “[i]n principle, there is no limitation as to the number of aspects that constitute a dot object” (see also Falkum & Vicente 2015 for related discussion), while Kinoshita et al. (2018: 156) note that copredications involve “two or more” predicates. Recall that Copestake and Briscoe’s (1995) model is compatible with n -senses being assumed for nominals involved in copredication. Ortega-Andrés and Vicente (2019: 3) have also observed how copredication “can involve a larger number of senses” than two, citing the following, which invokes institutional, physical, and nation-related cultural meanings:

16) Brazil is a large^{PHYS} Portuguese-speaking^{CULT-LANG} republic^{INST} that is very high in inequality rankings^{NATION} but always first in the FIFA ranking^{CULT-SPORT}.

The evidence presented so far in this thesis seems to necessitate this *n*-sense framework, while acknowledging that certain complex polysemous nominals licensing copredications will only host two senses (e.g. *lunch*), depending on the nominal in question.²⁹ More generally, while copredications involving *book* and *lunch* are by far the most commonly investigated cases, we may not be able to generalise observations made about these nominals to *all* copredication-licensing nominals.

Nevertheless, while we can agree with Vicente that “there is no limitation as to the number of aspects that constitute a dot object”, the semantics literature contains some claims which make this principled conclusion less likely to be arrived at by the outside observer. For instance, in Pustejovsky and Jezek (2008: 186) it is claimed that dot-types “have a symmetric internal structure consisting of two types clustered together by the type construction • (“dot”), which reifies the two elements into a new type”. On the other hand, more recently Pustejovsky and Batiukova (2019: 176) have claimed that LOCATION • HUMAN GROUP • ORGANIZATION dot types (e.g. *university*, *city*) exist. Further, although Asher’s (2011) work strictly adopts the idea of “dual aspect nouns” for complex polysemy, he does in fact discuss “nouns that involve a location, a physical object, and an institutional aspect like banks or cities” (2011: 319). Asher’s system does not limit the number and sorts of functors available, so even at this level it is not strictly a “dual aspect” model.

As such, it is important to make it clear that *n*-sense copredications seem possible in certain cases (defined more specifically in Chapter 2.3.4), and that while only a small number of semantic theories have made claims about limiting the scope of dot-objects to two senses, there is nevertheless a degree of ambiguity in the literature.

How can we relate these observations to the current literature? The semantic equivalent of Ortega-Andrés and Vicente’s (2019) ‘activation packages’ which could also accommodate *n*-sense copredication might take the form of a cluster of *n* aspects/senses which can be related by dot-object conjunction. In terms of their structure, these types

²⁹ It also seems to speak very directly against other recent claims from Chatzikyriakidis and Luo (2018: 137), where they maintain that “only two of the three senses can appear together” in *newspaper* copredications, and claim that “there are no cases where all three senses are coordinated nor [do] we know of any other common noun that allows this kind of situation” (Ibid.). Nevertheless, the authors also note that “in principle” a binary dot-object theory “could easily be generalized for *n* senses if there is a need to do so” (2018: 156).

would be similar to what Arapinis and Vieu (2015) refer to as “complex categories”, adding additional senses to a standard dot-object.³⁰ As such, we can assume that they might be implemented via a form of meaning modification over a single lexical entry as in Asher (2015), such that *newspaper*(INFORMATION) shifts to *newspaper*(INFORMATION • INSTITUTION), rather than *newspaper*₁ shifting to *newspaper*₂.

Furthermore, these assumptions pertaining to *n*-sense copredications allow us to accommodate structures of the following kind (‘for free’, derived from the semantic types themselves) without the need to radically modify type-theoretic accounts, invoke linear dot-types, or propose multiple lexical entries:³¹

17) The well-written^{INFO} newspaper that I held^{PHYS} this morning has been sued^{INST} by the government.

2.3.2. Predicate Ordering

This section will explore in greater detail the apparent effects of predicate ordering on copredication acceptability, evaluating certain claims presented in Chapter 2.2.

To begin, consider how Gotham (2015a: 140) notes that (18a) is infelicitous, but notice also that reversing the predicate order of Gotham’s example seems to alter acceptability in (18b):³²

- 18) a. #The bank is FTSE-100 listed^{INST} and used to be a police station^{PHYS}.
 b. The bank used to be a police station^{PHYS} and is FTSE-100 listed^{INST}.

³⁰ Indeed, Murphy (2002) originally noted that the three distinct senses of *newspaper* suggests that the word’s representation is complex and part of a unified structure.

³¹ We should note that location and physical object might be distinct senses (as Asher 2011 assumes), and that therefore constructions such as ‘The city near the river had three skyscrapers’ could constitute copredications, but we will assume for simplicity that they are instantiations of the same general physical type given that this matter carries no implications for the topics in this thesis.

³² *Bank* is also a standard example of a homonymy (*bank* [financial bank], *bank* [river bank]), but we are focusing on the fact that the *bank* [financial bank] meaning can also be divided into polysemously related senses of distinct types: PHYSICAL and INSTITUTION. Unlike English, in German the ambiguity of bank can be resolved through plural morphology: compare *bäncke* (benches) and *bancken* (financial institutions).

As this section will discuss, effects of predicate ordering on copredication acceptability have indeed been noted in the literature, but not discussed in detail. Furthermore, the particular factors relevant to predicate ordering effects have not been explored; that is to say, little is known about what we are re-ordering. Sense reversal may therefore yield licit/improved results. As such, a major topic for our empirical exploration of copredication will be predicate order.

Consider how *translation* can refer to a process or a physical text (Bisetto & Melloni 2007), yet while (19a) is well-formed, (19b), which reverses the predicate order, may potentially differ in acceptability, as claimed by Brandtner (2009):³³

- 19) a. The translation lies on the table^{PHYS} and was difficult^{PROC}.
b. #The translation was difficult^{PROC} and lies on the table^{PHYS}.

Brandtner (2009) notes that this example suggests that “structural aspects” impact copredication acceptability.

Like *translation*, other derived nominals can permit copredication (Asher & Denis 2005: 15):

- 20) a. The reproduction (of the painting) took place in that workshop and is eight feet tall.
b. #The reproduction (of the painting) is eight feet tall and took place in that workshop.

These effects of predicate/sense order may also be apparent across a range of syntactic structures; (21a) seems less acceptable than (21b):

- 21) a. That high-achieving^{INST} school is ugly^{PHYS}.
b. That ugly^{PHYS} school is high-achieving^{INST}.

³³ Pluralizing the nominal does not improve matters, for reasons discussed in Bisetto and Melloni (2007); e.g. ‘Rushed translations can consistently alter the original meaning of the text’ seems to disallow a complex event interpretation.

This phenomenon is not currently well understood. For instance, Kallmeyer and Osswald (2017) note that “there seem to be cases where a predication over one aspect blocks the other meaning aspects for further access” (a claim similar to Chatzikyriakidis and Luo’s linear dot-type explanation), but no specific explanation is presented.

Lastly, consider briefly how cities are composed of TOWN (i.e. GOVERNMENT/POLITY or PEOPLE) and PHYSICAL (specifically, BUILDING/PHYSICAL ARTEFACT, being intentionally constructed) senses.³⁴ Asher (2011: 63) notes that the order in which these senses are combined impacts acceptability:³⁵

- 22) a. The city has 500,000 inhabitants and outlawed smoking in bars last year.
- b. #The city outlawed smoking in bars last year and has 500,000 inhabitants.

Asher (2011: 64) notes that this indicates that copredications are subject to “discourse effects”. However, the precise factors influencing these discourse effects are not well understood.

Furthermore, this factor of sense order may be inadequate to explain the full range of copredication acceptability dynamics: Of crucial importance is the observation that Asher’s example seems to be improved by adding some form of clear, motivated relationship between the predicates, as in ‘The city outlawed smoking in bars last year and has 500,000 smokers’ or ‘The city outlawed smoking in bars last year but this will affect few of its 500,000 inhabitants’.³⁶ This idea is in line with the notion of *coherence relations* in discourse interpretation (Hobbs 1979, Kehler 2002, Sanders et al. 1992), through which explicit semantic features are held in common between each predicate (i.e. the concept *smoking* is referenced in both). This is the issue we will turn to next.

³⁴ The centrality of the PHYSICAL ARTEFACT sense becomes clear when we think of fantastical cities which were not intentionally constructed by a given population (e.g. a population of elves or dwarves) but rather the population settled in a given location which is naturally designed in a complex way, quite independent of the actions of the population. In this case, it would be peculiar to call this form of settlement *an elven/dwarven city*. It would only become an elven/dwarven city if its inhabitants make some intentional modifications (swirling wooden staircases around looming tree trunks, decorated by glass lanterns, and so forth).

³⁵ Dölling (Forthcoming) notes that this case illustrates how copredication depends “on the discourse context and the rhetorical connections between the two predications”.

³⁶ Thanks to Robyn Carston for this observation.

2.3.3. Coherence Relations

2.3.3.1. *Introducing Coherence*

Though initially applied to text comprehension across a series of utterances, coherence relations have more recently been shown to be relevant for intra-sentential relations. Coherence relations are “the cornerstone of comprehension” (Graesser et al. 2003: 82). De Beaugrande and Dressler (1981: vi) claim that part of coherence is found in a “continuity of senses”. Vakuleko et al. (2018) adopt a more specific definition, where coherence is the ability to “perceive meaningful relations” between concepts.

As Kehler (2002) emphasises, the importance of coherence in language has very often been sidelined by research focusing on syntactic and semantic factors. Yet the seemingly unavoidable importance comprehenders place on coherence can be seen in the following contrast (Kehler 2002). Even though (23b) is perfectly well-formed and the two sentences are readily relatable, comprehenders seek some form of connection between them (see Carston 2002, and also Bott et al. 2009 for empirical evidence that the use of a period, such as in the examples below, leads to a greater likelihood of a reassessment of the order of two events than the use of ‘and’):

- 23) a. John took a train from Paris to Istanbul. He has family there.
b. ?John took a train from Paris to Istanbul. He likes spinach.

Kehler (2002) goes on to argue that coherence relations can be used to explore a range of linguistic phenomena, including VP-ellipsis, gapping, and pronominal and tense interpretation. In this section, I will argue that coherence relations also impact the acceptability of copredications. As such, this section will be somewhat different from the brief, selective literature review of semantic, psychological and pragmatic accounts presented in Chapter 2.2, since I will actively be interrogating the notion of coherence and directly constructing a suitable coherence model for copredication.³⁷

Recall how Brandtner (2009) noted that creating a more salient relation (i.e. a salient temporal relation) between the predicates appears to improve the felicity of copredication:

³⁷ This is why the current sub-section is placed in the ‘Evaluation’ section, rather than the ‘Accounts of Copredication’ section, since there are currently no coherence models for copredication.

- 24) a. #The newspaper was founded in 1878 and is typed in Frankfurt.
b. The newspaper was founded in 1878 and is still typed in Frankfurt.

Relatedly, Schumacher (2013: 2) notes that the most standard copredication test, involving coordinate structures, is potentially problematic since other linguistic factors can interact with it: “[O]ther criteria that are independent of the meaning shift may be responsible for the failed copredication or coordination such as *coherence*, morphosyntax or the combination of incompatible predicates” (emphasis added). Copestake and Briscoe (1995: 59) mention that any theory of polysemy will need to explain how lexical factors “interact with pragmatic principles establishing discourse coherence”. However, no robust definitions of coherence are given by these authors, and part of the contribution of this particular discussion will be to draw up a clearer conception of coherence in order to establish more concretely how pragmatic factors interact with lexical and syntactic factors in the establishment of copredication.³⁸ Examining the literature on coherence relations will allow us to provide specific criteria for testing the effects of coherence on the acceptability of copredication.

2.3.3.2. A Coherence Model for Copredication

Coherence relations are “fundamentally conceptual” (Kamalski et al. 2008: 324) in nature, but can be made explicit via certain linguistic devices and markers (Knott & Sanders 1998). Although the number of coherence relations differs in the literature from two (Grosz & Sidner 1986) to over 100 (Martin 1992; although this is a very fine-grained list which includes substantial overlap), there are two main types of coherence relations that I will argue are applicable to copredication.³⁹

³⁸ A crucial point in this connection is that the existence of semantic anomaly with particular copredications does not immediately imply a lack of inherent polysemy. As the above examples show, a previously anomalous copredication can be improved through sense switching.

³⁹ There is indeed a third type of coherence relation impacting certain copredications but which we will not explore in detail given that it does not seem capable of shedding much light on the forms of copredication and anomalous interpretations discussed in the literature reviewed in this chapter. This is known as the EVIDENCE relation (Knott & Sanders 1998), as in cases like ‘Tim must love that beer. The crate is already half empty’, involving an acceptable shift from content to container, with the second sentence providing evidence for the claim in the first. We could also consider ‘Tim really wants to sue that

The first type is *causal connection* (e.g. PROBLEM-SOLUTION, CAUSE-CONSEQUENCE). In the literature, this has been referred to as *relational coherence* (Spooren & Sanders 2008). These relations are readily applicable to the predicates involved in copredication, and have in fact been used widely in the literature, often without the factor of coherence being discussed explicitly (e.g. compare ‘The newspaper was sued [and was]/[for being] offensive’, with the latter seeming more acceptable and easier to infer a causal relation from). Indeed, the most common surface cues of coherence relations are cue phrases (e.g. ‘by comparison’) and causal connectives (Degand 1998, Mann & Thompson 1992, Oversteegen 1997, Sanders 1997), realised often via conjunctions like ‘because’ and ‘so’ or adverbs like ‘therefore’. However, of crucial importance for our purposes is the observation that causal relations can readily be inferred *without* these cue connectives, and can be inferred from simple conjunction, as in ‘John was fired and was unhappy’ (where John’s state of mind can be inferred as a consequence of him being fired). Indeed, cue phrases and connectives, although the most common, are not the only ways coherence relations are realised (e.g. we infer that non-educational books should not be placed near children with *if-then* cases such as: ‘If [your books are not educational,] [it’s best not to put them near the children]’; see Hoek 2018). Causal connections can readily be apparent in copredications: CAUSE-CONSEQUENCE in ‘The school had unruly students and lots of graffiti’; PROBLEM-SOLUTION in ‘The city was polluted and was investing in green energy’.⁴⁰ Indeed, as Bott et al. (2009) explore, the conjunction ‘and’ does not provide a strict temporal order to events, but rather unifies the events into a single unit (Bar-Lev & Palacas 1980, Carston 2002; although see the discussion in Bott et al. 2009 for a more nuanced account of ‘and’ than the citations provided here). More specifically, these authors found no evidence that conjunctions facilitate iconic interpretations of event structure (e.g. Conjunct X occurring before Conjunct Y), and so we can assume that the

newspaper. He’s burned four copies today already’. However, EVIDENCE may effectively be a form of *causal connection*, albeit a more specific classification.

⁴⁰ Although he does not appeal to coherence relations, Collins (2017b: 690, n. 5) notes that (i) is degraded relative to (ii) because of “the absence of any connection”, which can be interpreted as gesturing towards a concept not unrelated to coherence relations (the corrections in (ii) are purely due to typographic errors in Collins 2017b, and do not alter his intended meaning):

- (i) #London voted Labour, and is roughly a hexagon.
- (ii) London voted Labour, but given new boundary changes, which [render] it roughly a hexagon, the Tories will stand a better [chance] next time.

use of ‘and’ in copredications does not bias any particular predicate ordering.⁴¹ Relatedly, the use of ‘and’ does not increase the number of iconic interpretations of schematically unordered or potentially simultaneous events (Bott et al. 2009). We can further define causal connections along pre-existing axes defined in the literature: forms of *semantic*, *external* or *subject matter* coherence (defined as part of the *relational* domain; Degand 1998, Degand & Sanders 1999, Kamalski et al. 2008).

The second type of coherence relation relevant to our concerns does not have a general name. We will call it *extensional overlap*. With respect to copredication, extensional overlap involves two predicates denoting a shared feature/concept. For instance, consider a case we have already discussed: ‘#The city outlawed smoking in bars and has 500,000 inhabitants’. This exhibits no extensional overlap, since the organisation and the population are not the same entities (as assumed in Lefevre-Halftermeyer et al. 2019, Vicente 2015, 2017, 2018 and much other work exploring copredication sense types). In comparison, consider ‘The city outlawed smoking in bars and has 500,000 smokers’. Here, the organization and the sub-population who smoke are also not the same entities – yet the acceptability is improved. Under the account I am pursuing here, the construction exhibits clear extensional overlap in the shared salient feature/concept of SMOKING. This account may also be able to be framed in terms of situation semantics (Elbourne 2005), whereby it is by virtue of an *event* hosting a particular shared feature/concept that permits acceptability increases. Extensional overlaps can be realised via simple conjunctions like ‘and’ or ‘but’, however since ‘and’ is the most commonly discussed type in the literature I will be focusing on this much more than other conjunctions.⁴² We can define extensional overlaps as a form of what is termed in the literature *pragmatic* (Sanders et al. 1992, van Dijk 1977), *internal* (Martin 1992) or *presentational* (Mann & Thompson 1988)

⁴¹ The authors note the possibility that participants may have “thought that if the speaker intended the order to be important for these items, he or she would have used an explicit temporal marker like *after* or *before*” (Bott et al. 2009: 695). The absence of such markers in the copredications we have discussed so far suggests, then, that no particular ordering based on event timings is biased; indeed, the authors conclude that ‘and’ does not generate a hard-and-fast interpretive rule, but rather interpretive constraints. In addition, notice that this issue of temporal ordering is related to causal connectedness, but is also distinct from it. As such, the temporal ordering that Bott et al. (2009) test may be an additional factor impacting copredications, which we will leave open to future research.

⁴² Although see Kripke (2017) for evidence that ‘and’, as well as ‘but’, can convey conflicting implicatures, and so their applicability ranges considerably beyond conjunction.

coherence (defined as part of the *discourse* domain).⁴³ Although I will not interrogate the notion much further here (partly because it is ultimately an empirical notion), the question of what exactly constitutes the type of features/concepts used in extensional overlaps is an entirely open one. Does it rely on specific lexicalised concepts like SMOKING more so than general abstract concepts relating to colour, shape, size and so forth? Does it rely more on eventive concepts than descriptive features? I will return below to analysing the presence of extensional overlaps in copredications, but I stress here that this is very much a preliminary study of the issue, in particular given that the coherence relations literature has not made contact with models of polysemy.

Examining this notion further, consider the distinction in Degand (1998) between connectives exhibiting completely overlapping, partially overlapping or non-overlapping meanings.⁴⁴ Applying this distinction to connectives in copredication, this generates the following three possibilities for extensional overlaps:

- 25) The government outlawed smoking in bars and has...
 - a. ...500,000 smokers [**Complete Overlap**]
 - b. ...500,000 inhabitants [**Partial Overlap**]
 - c. ...five skyscrapers [**Non-Overlap**]

There is a complete overlap in the concept SMOKING for (25a). With respect to the partial overlap in (25b), this exists insofar as some inhabitants are assumed to be smokers. Lastly, there is no extensional overlap between the government outlawing smoking and the existence of five skyscrapers in (25c), and in terms of the event semantics able to be assumed there is no event mentioned in which smoking occurs and five skyscrapers are involved (i.e. making smoking illegal is an event separate from the state of having five skyscrapers).⁴⁵ The reason why these distinctions are important for our purposes is that

⁴³ This list of terms seems admittedly vague, and the terminology is very specific to the coherence relations literature; i.e. all coherence relations impact ‘discourse’ in some sense, but the literature has reserved *discourse domain* for a certain set of relations.

⁴⁴ Degand (1998) refers to these as “totally overlapping”, “partially overlapping” and “exclusive” interpretations; I have adapted his terminology to fit our purposes.

⁴⁵ One might respond that the putative overlap here is possibly due to the two predicates sharing the same (morphologically and semantically related) lexical root. However, replacing ‘has 500,000 smokers’ with the colloquial ‘has many citizens who regularly light up’ seems to trigger the same coherence relation.

copredication seems to increase in acceptability as we move from non-overlapping through to completely overlapping.

What is most relevant about this literature is that it predicts that the presence of *any* coherence relation in a given copredication would very likely improve its acceptability, relative to one lacking any such relation. In other words, when comprehenders perceive a causal relation in a copredication, or a degree of extensional overlap, this should increase acceptability. More specific empirical predictions relating to coherence will be presented in the next chapter.

The coherence relations literature has come to a general consensus with respect to classification of relations (Ars & Demburg 2012, Das & Taboada 2018, Degand & Sanders 1999, Hoek 2018, Hoek et al. 2018, Scholman et al. 2016, Somasundaran et al. 2014). However, there is no established measure of these individual types of coherence (e.g. the degree of coherence relation x in a given discourse). Further, there is also no such thing as a general measure of coherence; there are only measures of distinct types of coherence relations.

The model of coherence relations we will claim to be relevant for copredication can be found below.

	<i>RELATIONAL COHERENCE</i>	<i>DISCOURSE COHERENCE</i>
<i>RELATION TYPE</i>	CAUSAL CONNECTION	EXTENSIONAL OVERLAP
<i>COPREDICATION EXAMPLE</i>	“The newspaper was sued because it was offensive.”	“The newspaper purchased more ink and had five colourful pages.”

Table 1: Model of coherence relations taken to be relevant for copredication licensing.

As a way of concluding this section, we can ask a final question: Given the apparent explanatory scope of coherence relations, why have they not been discussed more explicitly before by copredication theorists? Das and Taboada (2018) provide some insight: Coherence relations “are signalled more frequently and by more means than is generally believed”. As such, the variability in coherence marking may explain why the literature on copredication has only occasionally included non-specific discussions of coherence without much elaboration or explanatory weight being placed on it.

2.3.4. A Copredication Hierarchy

In this chapter, we have reviewed a relevant selection of copredication theories, as well as some literature from neighbouring domains in linguistics, and have gleaned from this the following:

(i) **Predicate ordering** and **coherence relations** may play a role in modulating copredication acceptability.

However, there is another task that remains before we can progress. As mentioned, there is currently little in the way of a systematic method for classifying types of copredication. As such, in this section we will attempt to provide such a classification.

To briefly foreground this, consider how the INSTITUTION sense seems to host an obligatory PEOPLE sense and an optional PHYSICAL ARTEFACT sense, since an organisation can exist independently of an accompanying physical structure. It can optionally be modified and conjoin with POLITY to form TOWN, or conjoin with standard dot-types like PHYSICAL • INFORMATION (to form *newspaper*). Finally, INSTITUTION can also conjoin with EVENT, as in nominals like *school* and *church* (e.g. ‘The school that starts at 9am hired a new teacher’).

From these considerations, copredication appears to have a high range of diversity and semantic complexity (see Hoffman et al. 2013 for related discussion). To formalise this, we will stipulate five types of copredication, of increasing complexity, based purely on the common senses used for complex polysemous nominals in the literature reviewed in this chapter. To spell out our terminology, certain simpler senses seem to be *monadic*, i.e. cannot be decomposed, like LOCATION/PHYSICAL.⁴⁶ This contrasts with INSTITUTION, which has *conjoined* PEOPLE and POLITY senses:

Copredication Hierarchy

Type I: MONADIC • MONADIC

Type II: MONADIC • CONJOINED

Type III: CONJOINED • CONJOINED

Type IV: MONADIC • MONADIC • CONJOINED

⁴⁶ Assumptions about atomic versus decomposable senses is found in other aspects of semantics, like with telic and atelic events (Stockall et al. 2010).

Type V: MONADIC • CONJOINED • CONJOINED

These five types of copredication can be yielded by the complex polysemous nominals reviewed in this chapter, capable of *n*-sense copredications (see Chapter 2.3.1). This yields a simple, and purely conjunctivist account of the varieties of copredication: Type I copredications involve *book*-type nominals containing two simple physical and informational senses. PHYSICAL OBJECT • APERTURE copredications like ‘John painted the door green and walked through it’ are also of Type I, which refer to the object but also the space associated with it (e.g. *window, fireplace, room*; Pustejovsky & Boguraev 1993).⁴⁷ Type II copredications include *lecture* and *film*, which combine the simple INFORMATION and complex EVENT senses (‘The boring lecture lasted nearly an hour’).⁴⁸ Type II copredications also involve *lunch* and *construction* cases, with the EVENT sense being able to be decomposed into sequentially structured subevents (such as states, processes and transitions; Pustejovsky 1991: 420; see also Chapter 4.3).⁴⁹ EVENT • INSTITUTION copredications, such as ‘The church starts at 10:30am and has a professional choir’, are of Type III, as are *city*-type copredications. Type IV copredications involve a dot-type being conjoined to an additional monadic sense and are of the *newspaper* variety (INFORMATION, PHYSICAL, INSTITUTION) and also *translation* (INFORMATION, PHYSICAL, EVENT). This type system is inherently dynamic. For instance, *school* and *church* can instantiate a higher type copredication (Type V), as in ‘The *beautiful* church starts at 10:30am and has a professional choir’, selecting for a monadic physical sense, while *lecture*-type nominals can instantiate Type IV copredications and be ‘loud’ or ‘quiet’, hence hosting a physical quality as well as the INFORMATION • EVENT composite.

This Copredication Hierarchy relies on the notion of semantic complexity. Since there is currently no widely agreed upon definition or framework of the notion of semantic complexity⁵⁰, it will here be defined in terms of the number of cognitive modules, or ‘core

⁴⁷ APERTURE is somewhat different from LOCATION, since it involves a specific Euclidean frame and does not seem reducible to the physical object associated with it.

⁴⁸ This proposal contrasts with Dölling’s (Forthcoming) claim that for *lunch, lecture* and *bank*, “neither [of the senses] ... can be viewed as more basic”.

⁴⁹ Further, it is a well-studied property of processes that they can shift their event type to become a transition (Hinrichs 1985, Krikfa 1987).

⁵⁰ The notion of semantic complexity has been explored before, but largely in domains not relevant to polysemy and copredication. For instance, Ezcurdia (2017) explores what is termed the *Noun Phrase*

knowledge systems' (e.g. number sense, agents and their actions, and basic geometric reasoning; Carey 2009), a given sense draws upon (see also Chapter 4.3). For instance, the physical sense of *newspaper* only draws on the basic physical object system (e.g. flat, smooth surface), while the institution sense of *newspaper* draws on social reasoning (Fiske & Taylor 2003), network dynamics and intentionality (e.g. agents working to a common end). Adopting standard assumptions in the literature (Asher 2011, Buitelaar 2000, McCaughren 2009), we can assume a hierarchy of complexity for the four most common sense types to be investigated, which also adheres to this cognitive perspective ('<' = 'less semantically complex than'):⁵¹

Complexity Hierarchy

PHYSICAL < INFORMATION < EVENT < INSTITUTION

To illustrate further, while both senses in *book* are monadic, they differ in semantic complexity, with information potentially ranging across a number of domains. The abstract content of a book is a more complex semantic construct than its concrete features, for reasons explored in much psycholinguistic work. For instance, it is known that abstract concepts such as *idea* are more difficult to process than concrete concepts such as *table*; a well-known phenomenon termed the concreteness effect which applies across a variety of tasks such as memory retrieval, comprehension, lexical decision and semantic deficits (Barber et al. 2013, Fliessbach et al. 2006, Jessen et al. 2000). Wiemer-Hastings and Xu (2005) also tested a hypothesis from Barsalou (1999) that abstract concepts are more complex than concrete concepts because they contain a larger variety of features/concepts (similar to our assumption that complexity scales with cognitive module variety). They discovered that abstract concepts had a greater number of properties relating to subjective

Thesis, which states that NPs are either semantically structured restricted quantifiers or semantically unstructured rigidly referring expressions. Ezcurdia claims that a phrase is semantically structured if its extension is determined in a *complex* way; for instance, the sets of sets that are the extensions of restricted quantifiers are “prima facie a function of the extensions of their parts and of the way they are arranged” (2017: 74). As such, this notion of complexity has little relevance for us.

⁵¹ Comparing this Complexity Hierarchy with the above Copredication Hierarchy, the extent to which these nominals differ in their semantic complexity will purely be a function of their abstract senses, given that they all host the concrete PHYSICAL sense. We will return to this issue of differing complexity levels in abstract senses in Chapter 4.3.

experiences than concrete concepts, and also had more relational properties than concrete concepts. Given that polysemous senses are typically assumed to be conceptual representations of some form, this seems an appropriate measure of complexity.

Looking ahead, the themes discussed in this chapter – polysemy types, predicate ordering, coherence – also have a certain psycholinguistic basis in the literature. We will now turn our attention to examining this literature in an effort to further motivate empirical investigations of constructions involving copredication.

3. Acceptability Properties of Copredication

The previous Chapter explored a number of complex cases of polysemy involving copredication, and a range of accounts were presented. This Chapter will focus on empirical considerations by reviewing research which could contribute to our understanding of the acceptability and processing properties of copredication. The frameworks concerning polysemy and lexical productivity assumed in the following studies have typically not made reference to copredication, in which multiple senses of *lunch* or *city* are of distinct semantic types. Most work on polysemy has focused on the processing costs of individual senses, and so the acceptability and processing dynamics of coordinating multiple senses remains obscure.

Presently, we can outline what the major processing hypotheses of polysemy are:

Psycholinguistics Hypotheses

- Sense Enumeration Lexicon Hypothesis
- One Representation Hypothesis

These hypotheses will now be reviewed by sketching out their basic properties before evaluating them against existing evidence. This will allow us to progress to experimental terrain with a number of psycholinguistic predictions. It will be argued here that experimental work into copredication can be used to inform certain psycholinguistic debates about the nature of lexical representation and sense activation. More generally, however, the present chapter will be largely exploratory, with Chapter 4 moving to more specific hypotheses about copredication acceptability dynamics.

3.1. Psycholinguistic Models of Polysemy

While their interests and claims can differ substantially, the theoretical accounts reviewed in Chapter 2 and psycholinguistic accounts do share something in common: They are typically placed either in the One Representation Hypothesis camp, or the Sense Enumeration Lexicon Hypothesis camp. As with the structure of Chapter 2, this section will first review psycholinguistic accounts of polysemy, before moving to evaluate them against existing evidence. Afterwards, we will review a selection of recent studies which targeted certain features of copredication (either explicitly or as an indirect consequence of experimental design).

3.1.1. Sense Enumeration Lexicon Hypothesis

As mentioned in Chapter 2, one of the most prominent models of polysemy discussed in the recent literature is the *Sense Enumeration Lexicon* (SEL) hypothesis, which maintains that the senses of polysemous words are represented in the mental lexicon such that there exists a distinct representation for each sense (Foraker & Murphy 2012, Katz 1972, Katz & Fodor 1963, Kempson 1980, Lehrer 1990), in this way being analogous to the meanings of homonyms (*bank* (river) vs. *bank* (institution)). This therefore amounts to a *storage* model; a model of the lexicon rather than the processing mechanisms used to access and process its representations (see also Li & Slevc 2017, Fig. 1 for a graphical representation of the model). SEL has its roots in Katz (1972), and has been discussed (e.g. in Frisson 2015) as a way of establishing an analogous framework to major theories of homonymy which assume distinct lexical representations for these meanings.

There are a small number of core theoretical motivations for SEL. One is to subsume polysemy and homonymy under the same framework. Another, as articulated by Lehrer (1990), is to account for the many cases of unpredictable polysemies; what Norrick (1981: 1) referred to as “spurious or poetic cases” of meaning extension. These include animal-based polysemies, as when a *chicken* can be a living creature or a type of food, as well as polysemies involving ambiguous prepositions like *in* or *on* (e.g. spatial, temporal). Lehrer argues that the existence of such unpredictable, non-regular polysemies supports the notion that polysemous senses are encoded as separate lexical entries. In addition, frequency is held to be a core feature of SEL accounts, as will be discussed below.

Among those theorists reviewed in Chapter 2 who assume an SEL account is Brandtner (2009, 2011); hence her focus on the importance of pragmatic processes. Indeed, she

notes that, “[w]ith respect to the processing of copredication structures, the question arises whether ... [they are] costly” (2011: 192). As discussed, Copestake and Briscoe (1995) also defend an SEL view specifically for *newspaper*-type nominals, but not for other nominals. Haspelmath (2007) also defends an SEL view from a formal semantics perspective.

One main challenge for SEL is that many words have a large number of senses. SEL also cannot account for how different senses are related to each other, since it treats homonyms and polysemes in the same manner. Indeed, one of Pustejovsky’s (1991: 437) motivations for introducing the Generative Lexicon was to argue against the view that “lexical ambiguity must be treated by multiple word entries in the lexicon”. In addition, a consequence of the SEL view is that the senses of polysemous words should be accessed and disambiguated in a similar way as homonyms, regardless of the degree of sense similarity (see discussion of Brocher et al. 2018 below for evidence against this assumption). In their recent assessment of the mental lexicon, Pustejovsky and Batiukova (2019: 4) note that the SEL view gives a “false impression” of the real complexities of lexical items, in particular polysemous words, since it assumes that word meanings amount to dispassionate “checklists” of dictionary-type entries.

3.1.2. One Representation Hypothesis

With respect to *storage* models, the major alternative to SEL is the *One Representation Hypothesis* (ORH), under which polysemous senses depend on or belong to a single lexical representation. Adherents include Allerton (1979), Chomsky (2000), Falkum and Vicente (2015), Pustejovsky (1995) and Ruhl (1989); see also Pylkkänen et al. (2006). A core theoretical motivation for ORH accounts is the observation that polysemous senses are related to one another, and are often historically derived from one another.

Most of the major theoretical accounts reviewed in Chapter 2 are versions of the ORH. Ever since Pustejovsky and Boguraev (1993) and Pustejovsky’s (1995) extensive critique of SEL accounts of polysemy, the literature has focused almost exclusively on ORH models. For example, Pustejovsky (1995) notes that SEL accounts cannot easily explain the creative use of new, extended senses. For instance, Pustejovsky and Boguraev (1993: 198) note that for adjectives like *fast* (which can involve moving quickly, performing an act quickly, doing something which requires a short space of time, or involving rapid motion) a finite enumeration of word senses would not be able to explain such creative

applications. More generally, all interpretations of *fast* are closely related and can all be derived from a single word use, and so “there is no need for enumerating the different senses”. Meanwhile, different lexical entries may still be needed for cases of ambiguity where there is a change in syntactic category and valence (e.g. *book* as a verb or noun), and also in the case of homonymys (Asher & Denis 2005: 17).

Establishing a closer connection between copredication and processing theories, we can adapt the terminology in Frisson and Pickering (1999) and refer to *Fully Specified ORH* and *Underspecified ORH*. The Fully Specified model assumes that all representations of the nominal are immediately activated, whereas the Underspecified model assumes that only an underspecified node is initially activated and context is used to home-in on the appropriate interpretation. We will discuss these more specific ORH models below.

3.1.2.1. Underspecification

Within the ORH framework a number of researchers have explored possible *processing* models for polysemy. ‘Underspecification’ processing accounts typically dominate discussions of polysemy processing. According to these views, only the underspecified meaning of a polysemous word (compatible with all senses) is initially activated, with subsequent material and context being used to ‘home-in’ on a more specific representation.⁵²

What is the relationship between underspecification processing accounts and storage accounts? Most prominently, underspecification directly implicates a single-entry (ORH) model of polysemy, not least because the underspecification account involves a period of homing-in to *refine* the single underspecified sense (rather than *select* a new sense/entry; see Frisson & Pickering 2001: 166-167).

The notion of underspecification refers more broadly to certain features not being expressed in a given representation. The implication is that the parser does not always need to construct a specific representation in order to proceed, and can delay representational commitment. Poesio (1996) notes that semantic ambiguity – a core feature of nominals licensing copredication – “is not necessarily *perceived* as ambiguous”

⁵² This view is similar to the ‘thin’ semantics in Pietroski (2017) and Cartson (2002, 2012, 2013), according to whom a nominal like *book* would trigger an index or instruction to construct a particular concept, although underspecification accounts are more closely related to psycholinguistic concerns.

(emphasis in original) by a parser capable of constructing underspecified representations, and proposes the following general hypothesis:

Underspecification Hypothesis

Human beings represent semantic ambiguity implicitly by means of UNDERSPECIFIED REPRESENTATIONS that leave some aspects of interpretation unresolved.

Upon encountering *book* or *city* an underspecified meaning which does not correspond to any specific sense (e.g. PHYSICAL, INFORMATION or INSTITUTION) is activated, and after this the processor can home-in on a specific interpretation. As such, the underspecification model assumes that when a polysemous word is encountered, no immediate activation of a fully specified sense takes place; the underspecified meaning is “an abstraction over the features of specific senses” (Frisson & Pickering 2001: 159).

What precisely constitutes an underspecified meaning? Presumably for complex nominals permitting copredication, this abstraction constitutes elements of INFORMATION-related and PHYSICAL-related memory traces (for *newspaper*-type nominals, for instance) along with a schema of its Qualia structure (Pustejovsky 1995) without fully specifying or committing to either sense. For instance, Frisson (2009: 116) gives the example of the homonymy *bank*, which can have a river bank meaning or a financial institution meaning, with the latter being polysemous. Frisson notes that, for this polysemous form of *bank*, the underspecified representation would include distinct senses “such as a financial institution, a building, a treasury, a company”. For words which are purely polysemous and not homonymous, like *newspaper*, “only one underspecified meaning will be activated” (Ibid) which is compatible with both senses, with the parser not being required to commit between distinct senses. As Frisson and Pickering (2001: 166) conclude, the underspecification account is the most compatible account with respect to the possibility of hosting multiple senses at the same time for a single word.

3.1.3. Empirical Review

This section will begin by reviewing the psycholinguistic evidence relevant to ORH and SEL, and will show that while the latter has a number of shortcomings, a precise

formulation of the former remains a controversial issue. Existing support for and against the underspecification account, with regards to copredication, will also be discussed.

Evaluating first the two main frameworks for sense/meaning representation, there appears to be some indication that a version of SEL is defensible. Klein and Murphy (2001) document a sensicality paradigm in which subjects responded to whether a noun phrase (e.g. *liberal paper*) was semantically coherent. These NPs (which I will refer to as the ‘target’) were always preceded by another two-word NP with the same head noun which either shared the same sense as the target (e.g. *daily paper*) or had a distinct sense (e.g. *wrapping paper*). Under ORH accounts, all polysemous senses would be activated simultaneously and the different senses should prime each other, and we would not expect any switch cost. Under SEL accounts, different polysemous senses are represented separately and they should not prime one another, and therefore a switch cost should incur. Klein and Murphy found that participants were slower to respond when they switched from one sense to another (e.g. *liberal paper* following *wrapping paper*) than when the senses were consistent, and have taken these findings to support SEL. These authors also found the same effect for homonyms, whereby conserving the meaning of homonyms like *bank* (*commercial bank* followed by *savings bank*) led to reduced costs in sensicality judgements compared to when the meaning shifted (*commercial bank* followed by *creek bank*).

However, a range of other findings suggest that polysemes behave differently from homonyms, and which favour ORH over SEL accounts: (i) Brisard et al. (2001) discovered significant priming effects for different senses of polysemous and vague adjectives, but not for different meanings of vague homonyms; (ii) Beretta et al. (2005) measured changes in magnetoencephalographic (MEG) recordings and demonstrated that homonymous meanings are accessed less quickly than polysemous senses (constituting evidence from early-stage processing); (iii) Rodd et al. (2002) revealed that unrelated homonymous meanings slow down recognition times while polysemous senses speed these times up (constituting evidence from late-stage processing); (iv) Frazier and Rayner’s (1990) eye-tracking data suggested that readers were immediately committed to the dominant meaning of a homonym when preceded by a neutral prior context but no such dedication was found for polysemous words, suggesting a degree of underspecification; (v) MacGregor et al.’s (2015) EEG study compared homonymy and polysemy and found a clear processing difference between the two (although see Meade

& Coch 2017 for different findings, but only for homonymy processing); (vii) Brocher et al.'s (2016) eyetracking study showed that participant reading times slowed down when homonyms were disambiguated towards the subordinate meaning, but not when polysemes were followed by a context that supports the less frequent senses⁵³; (viii) Pylkkänen et al. (2006) used MEG and showed that sense-relatedness in polysemy yielded an earlier M350 in the left-hemisphere compared to unrelated target words, concluding from this that “related senses connect to [the] same abstract lexical representation” (2006: 97); (ix) various studies have shown that homonymy meaning frequency and preceding context exert considerable influence on processing (Dopkins et al. 1988, Duffy et al. 1988, Sereno et al. 2006), but these effects do not obtain for polysemous sense frequency (Frisson 2009).

Focusing for a moment on one of the most recent studies into this issue, consider Li and Slevc (2017). These authors conducted a language production task in which participants had to name pictures after reading sentence fragments which primed polysemes and homonyms. Senses/meanings were primed either in direct competition to pictures or in indirect competition: Direct competition involved sense/meaning *x* being primed in the sentence, but sense/meaning *y* being depicted in the picture; e.g. *printer paper* would be presented in the sentence, and a picture of the directly related nominal *cardboard* was shown. Indirect competition involved sense/meaning *x* being primed in the sentence, but then the picture would depict a nominal related only to one of the polysemes/homonymys and not the alternative sense/meaning; e.g. *term paper* would be primed, but a picture of *cardboard* would be shown. Illustrating the task, the fragment ‘For the printer I bought a stack of bright white...’ would be followed by a picture of cardboard, and the authors measured how often the speakers accidentally produced the prime word (*paper*) rather than the target (*cardboard*). These accidental productions were termed ‘intrusions’.

The authors found that polysemes such as *paper* elicited equal numbers of intrusions for picture names (e.g. *cardboard*) compared to control conditions regardless of whether this involved priming as direct (*printer paper*) or indirect (*term paper*) competitors. In contrast, homophones such as *pen* elicited more intrusions to picture names (e.g. *crayon*) compared to control conditions when primed as direct competitors (*ballpoint pen*) relative

⁵³ Note that Brocher et al. (2016) explored irregular polysemes, which have related senses based on similar or shared features rather than a relational rule (see also discussion of Brocher et al. 2018 below).

to indirect competitors (*pig pen*). The authors used these findings to support a single-entry, ORH account of polysemy, while homonymous meanings appear, as in previous studies, to compete with each other (Li & Slevc 2017: 1546).

All in all, in terms of *storage* models the evidence currently leans in favour of the notion that polysemous senses of nominals are stored within the same lexical representation. Whether this applies more generally to all polysemous types, including complex polysemy, and whether polysemous senses behave the same way when undergoing copredication, are open questions.

3.1.4. From Polysemy to Copredication

While the studies reviewed in the previous section reveal something about polysemy, the subset of polysemous words which permit copredication have been investigated only recently. Frisson (2015) tested accounts of polysemy in two experiments with *book*-type polysemes. He contrasted the SEL and ORH accounts, in addition to Relevance Theory-inspired (RT) models of polysemy. Following the suggestions in Sperber and Wilson (2005) and much other work, Frisson defines the RT model as assuming that context will immediately guide interpretation towards a specific sense. RT is also noncommittal with regards to the representational base (i.e. whether senses are stored on single or multiple representations), making claims only about processing costs.⁵⁴

In the first experiment, participants were presented with adjective-noun constructions (e.g. *well-plotted book*) and were asked to indicate whether they were semantically well-formed. Crucially, the stimuli were presented in pairs and either repeated the same sense of the polysymous noun (e.g. INFORMATION-INFORMATION: *well-plotted book – scary book*), or switched from one sense to another (e.g. INFORMATION-PHYSICAL: *well-plotted book – bound book*). The items either switched from the subordinate sense to the dominant sense, or vice versa. Participants' reaction times were longer when the prime and target expressed different senses, but they did not differ between items in which the target expressed the dominant vs. subordinate sense of the polysymous noun. This suggests that the parser is sensitive to semantic *type* but not sense frequency, which is not predicted by standard SEL accounts (e.g. Katz 1972, see also Falkum 2011).

⁵⁴ Since the present thesis is largely concerned with adjectival conjunctions generating copredications, the importance of context guiding interpretation (and hence the importance of RT) is lessened in comparison to other concerns, and so I will not pursue this topic in any considerable detail.

In the second experiment, participants' eye movements were recorded when they read sentences in which a *book*-type polysemous word (such as *article* and *transcript*) was disambiguated to either its dominant (*scary*) or subordinate (*bound*) sense following (i) a neutral context (*Mary told me that the book was **scary/bound** ...*), (ii) a context in which the same sense was repeated (*Mary told me that the **science-fiction** book was **scary** ...*), or (iii) a context in which the sense was switched (*Mary told me that the **bound** book was **scary** ...*). For the Neutral condition, SEL and RT theories predict that the dominant sense is easier to process. In contrast, the ORH/underspecification view predicts that there is no difference in accessing either sense. For the Switch condition, both the SEL and RT theories predict a cost in switching in either direction (relative to the repeated and neutral conditions) since SEL assumes distinct lexical representations for these senses while RT assumes context guides and fixes the reader to dedicate to the initial, most contextually relevant sense. The ORH/underspecification view is agnostic with respect to sense switching.

The results showed no effect of sense dominance in the neutral condition at the target word (***scary/bound***), no advantage when a sense was repeated relative to neutral, and a cost when switched – in particular when switching from subordinate (in this case, concrete) to dominant (abstract) senses. While these results were not inconsistent with an underspecification model, they were not predicted by either an SEL or RT-inspired account (in particular, since an RT account would predict an advantage when a sense was repeated). Even though the SEL and RT-inspired accounts predict a cost when senses are switched and Frisson (2015) did indeed find this to be the case, he also discovered that switching from a subordinate to a dominant sense was costlier than the reverse – something which none of the psycholinguistic models predict.

To summarise: Frisson (2015) found increased processing times in inconsistently sensed adjective-noun pairs (e.g. *bound book* followed by *scary book*). The absence of a processing advantage for the dominant senses is not predicted by the SEL account. Meanwhile, the eye-tracking results were not predicted by either the SEL or RT-inspired view, since in the 'neutral' condition ('Mary told me that the book was bound/scary') subjects did not experience difficulty disambiguating towards the subordinate (*bound*) sense relative to the dominant (*scary*) sense.

Even with Frisson’s results, many questions remain unanswered. Nevertheless, the experimental research reviewed thus far seems to favour the ORH/underspecification model.

3.1.5. Initial Findings About Copredication

Bueno’s (2017) dissertation provides the only current example in the literature of an investigation into the acceptability properties of copredication. Through a series of acceptability judgement experiments, Bueno shows that *book*-type nominals and group nominals of the *committee* variety, which permit reference either to an abstract social object (‘The committee was founded in April’) or a collection of individuals (‘The committee met last night’), permit copredications that are judged to be acceptable. She exclusively explores embedded predications through relative clauses, such as ‘Ana broke the bottle of wine that Lea drank’ and ‘The committee that was founded last year met this morning’. Bueno (2017) discovered that for *book*-type and *committee*-type nominals, copredication yielded acceptability scores significantly lower than sentences involving sense matches (i.e. when the senses are repeated, as in PHYSICAL-PHYSICAL). These insights are highly relevant to the present dissertation, but there remains considerable scope for expansion and refinement. In addition, when exploring the acceptability properties of polysemous nominals, Bueno notes that her materials only included *book*-type and *committee*-type nominals, and her stimuli were limited in the range of syntactic structure. As such, we will be examining nominals from different polysemy classes, involving different sentence structures from those used by Bueno to examine the effects of copredication.

3.1.6. Copredication and Coercion

“An object is a rock. An event is a rock, but faster”.

Paul Bloom

Lastly, a related strand of current research which bears on the processing properties of copredication concerns the nature of coercion. The reason for its relevance lies in the fact that the representation association involved in copredicated nominals has also been claimed by the Generative Lexicon tradition to necessitate a form of meaning modification of the kind found in coercion. While with coercion a more complex shift in

meaning is involved (whereby a meaning otherwise not in the lexical entry of a given item is attributed to it), copredication involves a simpler triggering of polysemous nominal senses. As this section discussed, copredication has been argued to involve “a ‘light’ form of coercion” (Jezek & Melloni 2011: 5), and so findings about coercion may in some way pertain to our concerns.

As noted in Chapter 2, Pustejovsky (1995) suggested that additional semantic operations are required to interpret *began the book* compared to when *book* is understood to mean a physical object. The psycholinguistic prediction which emerges from this position is that *began the book* (in which an event is not explicitly mentioned) should be harder to interpret than *read the book*, when the verb does not require an argument that denotes an event. In line with this prediction, Traxler et al.’s (2002) eye-tracking study showed that entity NPs take longer to process following verbs that require event arguments (e.g. *began the book*) compared to when they follow verbs that do not (e.g. *read the book*). Their follow-up self-paced reading study corroborated this finding by showing that difficulties did not appear when verbs like *began* and *started* had arguments that referred to events (e.g. *started the puzzle*). Therefore, these findings have been taken to suggest that semantic coercion temporarily disrupts processing.

Exploring this topic in further detail, Frisson and McElree (2008) tested whether these coercion costs emerge either from, (i) the processes involved in selecting a single interpretation amongst multiple possible interpretations, or (ii) the competition arising from alternative interpretations. Their eye movement data indicated that constructions with multiple alternative interpretations and no dominant interpretation (e.g. *the director started the script*) were no more costly to process than constructions exhibiting few interpretations and a clear dominant interpretation (e.g. *the student finished the essay*). As such, this supports the claim that coercion costs reflect the construction of an event sense for the (concrete) complement, regardless of the range of possible interpretations to select from, and that frequency plays no central role in modulating parsing effort.

Although copredication involves an inherently ambiguous nominal having distinct senses associated with it, and hence no enrichment occurs, phrases like *difficult mountain* nevertheless seem to permit ‘dual’ readings of the nominal, involving the original physical meaning and the enriched eventive reading (i.e. a difficult mountain is still a physical object, despite its salient eventive reading, and indeed *the tall and difficult*

mountain approximates copredication). Consequently, it may be that copredications at some level involve similar processing mechanisms to these adjective-noun phrases.

Frisson et al. (2011) carried out an eye-tracking study examining enriched composition in adjective-noun phrases such as *the difficult mountain*. These involve enriching the meaning of the phrase such that an eventive reading becomes possible (i.e. the mountain was difficult to climb), but no type mismatch occurs since the verb selects for an entity, and the phrase satisfies this (Jackendoff 1997). Nevertheless, adjectives such as *difficult* modify events, and so it is possible that the phrase meaning is enriched. Compared with control phrases involving no enrichment (e.g. *the difficult exercise*), the coerced phrases were costlier to process. The authors concluded that coercion effects can be found not just with standard cases involving multiple phrases and within verb phrases (*began the book*), but also with single adjective-noun phrases lacking a type mismatch.

In brief, previous findings by Traxler et al. (2002) and others (e.g. Lapata et al. 2003, McElree et al. 2001, Pickering et al. 2005, Pykkänen & McElree 2006) suggested that meaning modification operations lead to additional processing costs in cases of complement coercion. Copredication has been argued to involve “a ‘light’ form of coercion” (Jezek & Melloni 2011: 5) this may also result in additional processing costs, as Traxler et al. observed for coercion. At the same time, as noted above, Pustejovsky and Jezek (2008: 191) maintain that although it is indeed “a light form of coercion”, the “computational cost” of the meaning modification involved in copredication is thought to be “inexpensive”; providing reason to expect no processing costs for copredication.

3.2. Acceptability Properties: Empirical Predictions

Acceptability judgements have formed a major part of the language sciences since Chomsky’s general Cartesian turn in the 1960s. Their continued popularity can partly be explained by what Langsford et al. (2018: 1), in a major study of the reliability, bias and variability of acceptability judgements, describe as “the way they allow theories to be tested against artificial constructions that passive observation would rarely or never provide”. According to Chierchia and McConnell-Ginet (2000: 5), speaker judgements are “the core of the empirical data against which semantic theories must be judged” (see also de Ruiter & de Ruiter 2017). Because the judgements of individual researchers do not match the level of quantitative standards seen in the rest of the cognitive sciences

(Gibson & Fedorenko 2010), despite their general reliability, a series of online acceptability judgement experiments was performed and analysed using standard multivariate methods. Moreover, and more pertinent for our purposes, it may also be the case that copredication acceptability judgements are particularly prone to performance factors such as predicate ordering, and indeed the level of acceptability difference between certain copredication contrasts may be quite subtle.

I will be primarily interested in two specific independent variables that I predict will modulate acceptability judgements: the presence of copredication, and predicate ordering. These variables will be manipulated in order to explore the effects of predicate order (*order x* vs *order y*) and copredication (*non-copredication* vs *copredication*) on acceptability. Later in the Chapter, a series of norming studies will be presented which will introduce a further hypothesis; namely, that different types of nominals used (*city-type*, *book-type* and *lunch-type*) will exhibit different levels of acceptability in copredication due to the inherent levels of semantic complexity found in their distinct polysemous senses. These norming studies will allow us to determine whether these effects are due purely to the copredications involved in each stimulus set and are not a result of the co-occurrence frequency of the adjectives. A separate set of norming studies, aimed at gauging a measure of coherence for the experimental stimuli, will also allow us to test the ideas developed in Chapter 2.3.3 concerning the impact that coherence may have on acceptability.

Due to the focus of behavioural and psycholinguistic research into polysemy being overwhelmingly on cases of simple polysemy, in order to address the properties of the complex forms of polysemy seen in copredication it is necessary to initially explore its most basic features. This will permit a general understanding of, for instance, the acceptability of sense integration seen in copredication relative to non-copredicated nominals. A series of acceptability judgement experiments was carried out to determine if copredication will have similar effects to coercion. Before turning to these experiments, we will outline the empirical predictions which emerge from the theories reviewed above.

In the present Chapter I will utilise acceptability judgements as an initial stand-in to explore these effects, but it should be acknowledged that claims about processing may require quite distinct experimental tools – that is, once certain elementary patterns in copredication acceptability are understood.

3.2.1. Effects of Copredication

Most of the accounts reviewed above, including the SEL model, Asher (2011, 2015) and Gotham (2012, 2015a), commonly predict copredication may incur some costs. Under the SEL model, copredication is expected to be more costly than ‘non-copredication’ (either two predicates of the same type being associated with one nominal, or two senses of different types being respectively associated with two different nominals) because it involves activating two distinct lexical representations for the different senses of polysemous words. Further, under the view that copredication involves meaning modification (e.g. Asher, 2011, 2015, Gotham 2015a), copredication *may* behave like complement coercion which has been shown to incur additional processing costs (e.g. Traxler et al. 2002).⁵⁵ Initial evidence for these accounts can be found in Bueno’s (2017) discovery that sentences involving distinct senses for *book*-type and *committee*-type nominals (i.e. copredication) were less acceptable than sentences involving matched senses (i.e. non-copredication). These accounts predict that copredication will incur acceptability costs. At the same time, the Generative Lexicon model is less committed to these processing predictions; as mentioned, Pustejovsky and Jezek (2008: 191) note that “[f]rom the point of view of its computational cost, Dot exploitation [meaning modification in copredication] is an inexpensive operation”. As such, one might expect no processing costs for copredication.

Meanwhile, underspecification accounts maintain that no single sense of a polysemous word is activated to a greater extent than others. Therefore, copredication is not expected to incur additional costs compared to non-copredication. It should be noted that, as Frisson (2015: 24, fn. 8) writes, “some of the crucial differences between the SEL model and the underspecification account are related to the exact time-course and location of processing” (for instance, at the point of the second predicate in copredications). We will therefore only be able to provide a modest contribution to the broader debate between psycholinguistic theories, with our narrower concern being the sense order dynamics in copredication.

3.2.2. Effects of Sense Ordering

Together with the effect of copredication, there is another set of hypotheses we will entertain. They directly pertain to predicate ordering, and I will call these accounts *sense*

⁵⁵ See Chersoni et al. (2017) for a distributional model of logical metonymy.

frequency-based accounts and *complexity-based* accounts. These can be summarised as followed:

- ***Sense Frequency-Based Hypotheses***: The dominance of the senses involved in copredication modulates the acceptability of their ordering.
- ***Complexity-Based Hypotheses***: The semantic complexity of the senses involved in copredication modulates the acceptability of their ordering.

Here I will first discuss sense frequency-based accounts before moving to discuss complexity-based accounts. The former pertain more closely to SEL accounts, and the latter pertain more closely to ORH accounts. Afterwards, I will introduce a more fine-grained perspective on the underspecification account discussed above in order to integrate this account with current literature.

3.2.2.1. Sense Frequency-Based Accounts

The SEL account assumes distinct lexical representations for polysemous senses and predicts that polysemy adheres to the frequency dynamics documented for homonymys such that dominant-subordinate sense orders are preferred (Frazier & Rayner 1990, Brocher et al. 2018; see Chapter 3.1.4), with Frisson (2015) replicating this dynamic for *book-type* polysemies. Indeed, as we will see below, certain ORH accounts are also open to the idea that sense frequency can impact acceptability.

Relatedly, Duffy et al. (1988) examined the processing of homonyms in sentences and found that placing a low-frequency meaning early in a sentence resulted in longer reading times for the remainder of the sentence compared to when a high-frequency meaning was placed early in the sentence, concluding from this that sense dedication (i.e. the extent to which participants committed themselves to a given interpretation) was stronger in the latter case due to the high frequency of the item (see also Sereno et al. 2006 for the ‘subordinate-bias’ effect in homonymy processing; or when preceding context primes the subordinate meaning but competition still occurs between both meanings at the target word). If the resolution of polysemous sense ambiguity proceeds as meaning ambiguity resolution does, this finding would predict dominant-subordinate ordering preferences, with the second sense being primed by the first. In other words, these findings from homonymy eye-tracking data may be tapping into general effects of frequency, such that

polysemous senses are accessed in order of their frequency (see Frisson & Pickering 2001 for similar discussion). This can be used to support the prediction of general dominant-subordinate sense order preferences. In addition, although Frisson's (2015) sensicality judgment data for *book*-type nominals revealed a cost for sense switching in both directions relative to sense repetition, the eye-tracking data suggested that subordinate-dominant sense switches were more difficult to process than the reverse order. It may be that this generalisation for *book*-type nominals also applies to other nominal types licensing copredication (e.g. *newspaper*-, *city*-, *lunch*- and *school*-type).

We might not discover homonymy-like frequency effects for copredication – other possibilities exist. In contrast to the above, Klepousniotou et al. (2008) examined the effect of sense frequency on the processing of pairs of polysemous phrases and found faster sensicality judgements for subordinate-dominant sense switches than dominant-subordinate sense switches. A preference for subordinate-dominant sense ordering has also been reported in an eye-tracking study by Foraker and Murphy (2012), who found that during the processing of sentences involving multiple senses of a polysemous word, commitment to dominant senses is stronger than commitment to subordinate senses: Given a dominant context, it was harder for participants to shift to a subordinate sense than shifting from a subordinate context to the dominant sense. Nevertheless, it should be noted that the effect Foraker and Murphy (2012) observed for polysemes occurred later and was more broadly distributed in its temporal dimension and sentence region than what has been observed for homonyms. It may be that the effects were therefore confounded by sentence-final wrap-up effects, and did not result from disambiguation processes.⁵⁶

Effects of sense frequency on acceptability are not exclusively predicted by the SEL model. As Frisson and Pickering (1999: 1379) note, we can distinguish between *ranked* and *unranked* ORH models. *Ranked* assumes that senses are activated based on which sense is most frequent; *unranked* assumes that all senses are activated equally (Frisson & Pickering 2001). Sense frequency effects arising at distinct points of copredication processing may be compatible with ranked ORH accounts.

There is also the possibility that no preferences will be found for sense frequency. Consider also findings in Frisson and Frazier (2004). These authors specifically examined

⁵⁶ Relatedly, it should be noted that in post-hoc testing Foraker and Murphy (2012) discovered that the strength of dominance effects was predicted by sense similarity ratings. This is unexpected under the SEL account that Foraker and Murphy's (2012) findings is typically used to support.

the ‘homing-in’ phase of ambiguity resolution in *book*-type nominals. Using eye-tracking, they found that when a post-nominal disambiguating predicate was preceded by a neutral context, there was no effect of frequency on processing, such that ‘Mary thought that the book looked tattered/enjoyable...’ (where ‘looked’ constitutes the disambiguating material, priming a physical predicate) exhibited no processing differences for ‘tattered’ and ‘enjoyable’. This leads to the predictions that for copredications spanning single sentences, no effects of frequency will be found.⁵⁷ Recall also Frisson and McElree’s (2008) findings that constructions with no dominant interpretation and multiple alternative interpretations were no more costly to process than constructions exhibiting a dominant interpretation and few alternatives. Relatedly, Frisson and Pickering (1999) found no evidence that the frequency of different PLACE-FOR-EVENT metonymies (*protested during Vietnam*) or ‘literal’ uses of the same polysemous nominals (*hitchhiked around Vietnam*) impacted processing. They also found similar results for PLACE-FOR-INSTITUTION metonymies (*answer to the convent*), noting that their results “provide no support for the hypothesis that the frequency of the senses influences reading times” (1999: 1376). The original study comparing polysemy and homonymy, Frazier and Rayner (1990), found that for polysemes like *paper* (INSTITUTION) vs. *paper* (PHYSICAL) no effects of frequency were found, and no extra processing effort was exerted when the subordinate sense was intended.

3.2.2.2. Complexity-Based Accounts

As an alternative to sense frequency being a major (or the major) determining factor in copredication acceptability, the effect of sense order may be modulated by the semantic complexity of polysemous senses. It has long been understood that the parser is sensitive to syntactic complexity (e.g. Lyn 1985), but effects of semantic complexity, in particular with reference to polysemy, remain an open possibility.

In Chapter 2, data concerning the range of possible copredication implementations and their sense order preferences was used to argue that this factor likely impacts

⁵⁷ While our experimental materials will be single-sentence items, it is noteworthy that Frisson and Frazier (2004) found that if the sentence with the polysemous nominal was left unspecified and neutral, and a subsequent sentence contained disambiguating information, then the dominant (INFORMATION) sense was processed faster than the subordinate (PHYSICAL) sense. This suggests that sense dedication/homing-in was completed by the sentence-final position.

acceptability. It may be that some form of ordering preference based on concreteness/abstractness (e.g. a Concrete-Abstract preference) can explain some of the contrasts discussed in Chapter 2, since as mentioned concrete senses are semantically less complex than abstract senses (with semantic complexity defined here as the number of cognitive modules a given polysemous sense draws upon).⁵⁸

Scorolli et al. (2011) provide further support for the idea that sense complexity may play a role in copredication acceptability and processing. Examining a range of abstract concepts, these authors presented participants with word pairs composed of a transitive verb and a concept noun. They placed a concrete verb before either a concrete or abstract noun, and also an abstract verb with a concrete or abstract noun (yielding CC/AA or CA/AC, in terms of category order). For example, ‘grasp’ was used either to refer to a physical action or to a process of achieving understanding. The authors used German and Italian materials in order to disambiguate between the meaning and grammatical class of the items. Participants were tasked with deciding whether the word combinations made sense, and Scorolli et al. monitored their reaction times and accuracy. There are two main findings which relate to our concerns: Firstly, compatible combinations (CC, AA) were processed faster than conflicting combinations (CA, AC). Secondly, they found that within the conflicting combinations, CA orderings were easier to process than AC orderings, regardless of grammatical class or whether the materials were German or Italian. The authors claim that this second finding might be due to the mode of acquisition differing between concrete and abstract concepts (Wauters et al. 2003), whereby concrete concept learning engages more motor and sensory experience (Borghetti et al. 2011). For our purposes, these results can be used to motivate the prediction that Concrete-Abstract sense orderings will be more acceptable than Abstract-Concrete orderings, regardless of whether or not copredication is involved.

Although it does not take a direct stance on the issue, ORH (as a general lexical framework) is not necessarily incompatible with the idea that sense order manipulations yield distinct acceptability and processing effects; it rather yields predictions about the initial stage of relating distinct senses. However, while ORH is a very general storage

⁵⁸ In contrast to the Concrete-Abstract preference prediction, Abstract-Concrete preferences could be found; or, since Bueno (2017) documented no significant differences in sense orderings for Concrete-Abstract and Abstract-Concrete predicates for sentences involving *book*-type and *committee*-type nominals, it may transpire that there is no complexity-based effect on sense order.

model, more specific versions of ORH are compatible with the claim that copredication acceptability is modulated by sense complexity.

We have proposed above that we will test the possibility that *semantic complexity* is a major feature resulting in parsing effects. In terms of matching the various ORH models to the above predictions for sense order acceptability, any significant differences between sense order switches for both copredication and non-copredication, along with no differences between copredication and non-copredication (or a preference for copredication) would support the Underspecified ORH account, in particular with sentences presenting the nominal before the predicates (as will be the case in Chapter 4). This would be due to context homing-in on one sense, at the point of the first predicate, before the parser is forced to switch senses (in either direction). If no differences in sense ordering are found, then the Fully Specified model would be supported, since both senses would be activated by accessing the nominal. This will apply more directly to the experiments to be reported in Chapter 4, which place the nominal before the predicates.

As such, on one extreme we have the *unranked Fully Specified ORH* model (predicting all senses being activated equally, with no preferences for discourse interpretation), and on the other extreme we have the *complexity-based Underspecified ORH* models, through which underspecified node is initially activated upon encountering the nominal (or is activated at the nominal after encountering the predicates), and subsequent predicate parsing (or predicate integration with the nominal, as in *Predicate-Predicate-Nominal* structures) is biased via a Concrete-Abstract or Simple-Complex ordering on the one hand, or an Abstract-Concrete or Complex-Simple preference on the other hand.⁵⁹ This factor of semantic complexity has not been systematically investigated, and will be discussed in greater detail in Chapter 4.

3.2.3. Effects of Nominal Type

It has been proposed that the effects of establishing copredications might differ between nominal types (e.g. Pustejovsky & Jezek 2008: 208). Arapinis's (2013, 2015) position, by claiming that the "hybrid" nature of institutional entities produces the most complex form of human semantic structures, predicts that copredications involving institutions (*city*-type or *school*-type nominals, based on the classification we will adopt here) would

⁵⁹ Currently, we have made no attempt to distinguish properly the Concrete/Abstract and Simple/Complex division, but we will return to this division throughout Chapters 3-4.

be the hardest to process and generally the least acceptable out of all copredicated types. Similarly, Chatzikyriakidis and Luo's (2015) linear dot-type theory also predicts that any construction in which the institutional sense of a complex nominal co-occurs with other senses would result in degraded acceptability ratings and severely increased processing costs. Barker (1992) predicts *committee*-type nominals like *school* and *church* to be completely unacceptable (these and other related *committee*-type nominals will be experimentally investigated in Chapter 4). These are a sub-type of institutional nominals; a meaning/type-shift operation is claimed to occur when a SOCIAL OBJECT sense is composed with a predicate selecting for a HUMAN or ANIMATE sense. Since this issue of nominal type differences in copredication has not been systematically investigated, we will test these predictions by analysing the effects of copredication acceptability for different nominal types.

3.2.4. Effects of Coherence

In addition to manipulating copredication and sense order, we will also attempt to provide insight into the effects of coherence relations on copredication, along the lines outlined in the previous chapter (see Chapter 2.3.3 for the coherence model of copredication tested here). To illustrate the potential problem that failing to provide a measure of coherence would present us, consider the following two constructions: 'The school hired a new teacher and starts at 9am'; 'The catalogue was sued for being inaccurate and contains old items'. These both involve copredication, yet the latter may be more acceptable since it contains a clear cause-consequence relation (i.e. the inaccuracy of the catalogue likely resides in the fact that it contained old items) this difference may boil down to coherence (notice that even though the second predicate explains the first, the coherence relation can still be derived; in this connection see Bott et al. 2009). It is therefore necessary to provide a fixed criterion for coherence in order to explore the complex forms of predicates typically used to establish coherence relations. We will outline below how this was achieved, but for now we can note that, following the discussion in Chapter 2, it is possible that as copredications increase in *the salience of their coherence relations*, their acceptability increases too. Alternatively, if there is in fact no relation between copredication acceptability and coherence relations, we would expect to find no such correlation between acceptability ratings and salience of coherence. If this is the case, then

any significant acceptability dynamics will be isolated as a consequence of other factors beyond coherence (i.e. those factors mentioned above).

There are other indications from the literature that coherence can impact the processing of structures with complex polysemous nominals. For instance, Frisson and Pickering (1999) examined eye movements and found that *place-for-institution* metonymic (abstract) readings and literal (concrete) readings were not significantly different in their processing costs, and it was only sentences without a *relevant metonymic interpretation* that bore processing costs (e.g. with ‘That blasphemous woman had to answer to the [convent/stadium] at the end of last March, but did not get a lot of support’, ‘convent’ is deemed familiar/coherent and ‘stadium’ unfamiliar/incoherent). These findings can possibly be captured in terms of coherence.

Turning to other relevant studies, Haberlandt (1982) revealed that reading times for sentences are decreased if they are preceded by a linguistic marker establishing some form of relation with the preceding text. Relatedly, Sanders and Noordman (2000) manipulated two types of coherence relations and examined the impact of them on processing. They examined Problem-Solution relations (e.g. ‘It is dangerous to X, and so the government has Y’, where X and Y respectively denote a particular problem and a solution), which are essentially causal connections, and List relations (e.g. ‘The council has built a subway, and also new traffic lights’; ‘Robins are singing birds. They live in woods. They usually have 3 eggs...’).⁶⁰ They discovered that segments connected via Problem-Solution relations are processed faster and recalled more accurately than those involving Lists.

Reviewing the currently understood range of linguistically-encoded coherence relations, Fetzer (2013: 694, emphasis mine) notes that “coherence ties are manifest in *coreference*, *conjunctive relation*, substitution, ellipsis, reiteration and lexical cohesion”. Substitution and ellipsis are not wholly relevant for testing copredication, since ‘The book was hilarious and the newspaper was too’ forces interpretation onto a single sense type (INFORMATION), rather than permitting sense switching. Reiteration would also involve sense repetition rather than switching. As such, *coreference* and *conjunctive relations* will be our focus, with Chapter 3 focusing on conjunctive relations and Chapter 4 focusing on both conjunctive and coreferential relations.

⁶⁰ In fact, two causal relations are apparent in Problem-Solution cases: between the initial situation and the action, and between the action and the resulting situation.

Drawing again on the coherence relations literature, it is known that positive relations (as in ‘We liked Bob because he was different’) are processed faster than negative relations (as in ‘They never failed to invite us although they knew we would never come’) (Hoek 2018: 43; see also Clark 1974, Murray 1997). As such, in all of the experiments reported below, negations will not be used.

In Chapters 3-4, the results of two norming studies (each exploring a different type of coherence relation; *extensional overlap* and *causal connection*) will be used to determine if there is a significant correlation between copredication acceptability and coherence. For each main experiment which includes this coherence analysis (namely, Experiments 1, 3, 6 and 9), the particular details about the relevant stimuli will be provided.

In previous experimental work on coherence involving textual annotation (Hoek 2018), clear, pre-existing measures of coherence were used to determine how coherent a text is, before the text was presented to participants to read. For example, Hoek (2018) determined whether a given text exhibited a POLARITY coherence relation (positive or negative relations, with the former previously being shown to exhibit faster processing times). Hoek then presented this text to participants and measured eye movements, determining whether POLARITY impacted reading times. But for our purposes, we currently have no pre-existing measure of *extensional overlap* or *causal connection* to independently gauge the coherence of our experimental materials. Unlike POLARITY, *extensional overlap* and *causal connection* are not binary constructs.⁶¹ Therefore, we will conduct norming studies intended to gauge an item-by-item measure of coherence, which we can then use to analyse alongside acceptability ratings.

3.2.5. Outline of Experiments

In order to explore the acceptability dynamics of copredication, and to hopefully contribute to the above debates about models of polysemy, a series of acceptability judgement experiments was carried out. A Likert scale was chosen for participants to rate their acceptability judgements. Motivating this choice, Langsford et al. (2018) compare Likert scales, versions of force-choice judgements, magnitude estimations, and a novel

⁶¹ While it is arguably a binary matter whether a sentence involves a causal connection (Yes/No), we will crucially explore sentences which have not intentionally been constructed to involve causation (and even if they were intended to include causal relations, it is not a guarantee that participants would detect and/or focus on this during comprehension).

Thurstonian approach derived from psychophysics. They conclude that Likert scales and Thurstonian approaches produce “the most stable and reliable acceptability measures and do so with smaller sample sizes than the other measures”. Interestingly, they additionally found that “the limitation of a discrete Likert scale does not impose a significant degree of structure on the resulting acceptability judgments” (meaning, there is nothing specific to Likert scales which skews the data relative to other measures). These findings, summarised below, motivate the use of Likert scales in the following experiments (Langsford et al. 2018: 27):

[T]heoretically motivated concerns about the restrictions a fixed LIKERT response scale imposes on participants turn out not to matter in practice [...] Although the LIKERT and THURSTONE acceptability scores agree, LIKERT scores are marginally more reliable and have the advantage of more easily accepting additional sentences into an existing set of comparisons.

Experiment 1 examined the effect of copredication by comparing sentences in which a polysemous noun is copredicated by two adjectives of different sense types against cases in which the noun is modified by two adjectives of the same senses, and also cases in which the adjectives were used to modify two different nouns. Normed data for the measure of coherence in the experimental items was also collected. Experiment 2 carried forward this topic by examining the effect of copredication in sentences in which the adjectives were ordered differently. In a series of norming studies, we explored the sense frequency of a range of polysemous nouns and also the acceptability of the adjective coordinate structures used in Experiment 2. In Experiment 3 we tried to replicate Experiment 2 with a better-controlled set of experimental stimuli, and also tested the sense frequency-based and complexity-based accounts, and also the effects of coherence. Experiment 4 used materials replicating the syntax used in Frisson (2015), namely *Adjective-Nominal-Adjective* copredications. Lastly, Experiment 5 translated stimuli from Experiment 3 into Italian to examine the cross-linguistic properties of copredication acceptability dynamics.

3.3. Experiment 1: Foundations of Copredication

In this first experiment we examined the effects of copredication by comparing sentences in which two adjectives modified one vs. two nominals. Crucially, the adjectives were either of the same (*red and blue*) or different (*red and educational*) semantic types. As such, the present experiment fully crossed two factors: Number of Nominals (1 or 2) and Sense Type (Different or Same), yielding four conditions. Table 2 depicts the design of these materials.

	<i>Same Sense</i>	<i>Different Sense</i>
<i>1 Nominal</i>	John said that the large and heavy book was on the table.	John said that the interesting and heavy book was on the table.
<i>2 Nominals</i>	John said that the large pamphlet and heavy book were on the table.	John said that the interesting pamphlet and heavy book were on the table.

Table 2: Sample experimental materials in Experiment 1. Copredication is present only in the 1 Nominal + Difference Sense condition (in bold).

As a result of this design only one condition (1 Nominal + Different Adjective Type) involved copredication. This design allows us to directly contrast the acceptability of copredication against minimally different sentences in which the nominal is modified by two adjectives of the same sense, or where two adjectives of different sense types modify two different nominals. If interpreting a sentence with copredication incurs additional acceptability costs beyond processing a sentence with two adjectives of different types, then we would expect an interaction between Nominal Number and Sense Type. The experiment was designed to explore the acceptability properties of copredicated structures relative to non-copredicated structures, with the latter departing as minimally as possible from the syntactic and semantic content of the former.

3.3.1. Methods

3.3.1.1. Participants

Data from 48 participants was analysed (mean age = 34; range = 18-54; 24 male). Participants were paid £6 per hour, with the average finishing time being 16 minutes. Because acceptability judgement data is known to be influenced by the selection of participants (Dąbrowska 2010) and sample size (Mahowald et al. 2016), participants were

filtered from Prolific Academic based on their age (above 18), native language (English), and their rate of approval from previous experiments (at least 90%). They provided informed consent and were asked to provide three sentences describing a recent activity they had participated in to ensure that they were proficient English speakers.

3.3.1.2. Materials

36 experimental sets of four sentences were constructed, along with a series of 108 fillers (72 ungrammatical and 36 grammatical filler sentences). Three nominal types (*book*-type, *city*-type, *lunch*-type; 12 each) were used, and two adjectives were used as predicates in each experimental item. Following standard English adjectival modification, and following also previous studies of polysemy which explore *The Adj-Noun* configurations (reviewed above in Chapter 3.1-3.2), an *Adjective-Adjective-Noun* syntax was adopted (relatedly, the most standard copredication pattern is [V[Det Adj N]], such as *burned the offensive books*; Jezek & Vieu 2014).

As illustrated in Table 1, two adjectives were coordinated and attributed either to a single nominal or each adjective was attributed to distinct nominals. The adjectives were either of the same semantic type (*large* and *heavy*) or of distinct types (*interesting* and *heavy*). Adjectives were selected to minimise ambiguity between distinct senses (e.g. *brief* cannot select for the PHYSICAL OBJECT sense of *breakfast*). Since recent research has suggested that word frequencies culled from film and television subtitles are more reliable predictors of word processing times than frequencies culled from written sources (Brysbaert et al. 2011, van Heuven et al. 2014), all stimuli predicates and nominals were selected based on their SUBTLEX-UK Zipf frequency (nominal averages: *book*-type: 4.3, *city*-type: 4.5, *lunch*-type: 4.1; no significant differences in frequency across nominals for one-way ANOVA: $F = 1.29$, $p = .28$; adjective averages: *book*-type: 4.1, *city*-type: 3.9, *lunch*-type: 3.7; no significant differences in frequency across adjectives: $F = 2.94$, $p = .057$; see meshugga.ugent.be/open-lexicons/interfaces/subtlex-uk), and all predicates and nominals were controlled for character length (nominal averages: *book*-type: 6.6, *city*-type: 7, *lunch*-type: 6.5; no significant differences in character length across nominals for one-way ANOVA: $F = 1.29$, $p = .83$; adjective averages: *book*-type: 6.7, *city*-type: 7.3, *lunch*-type: 7.1; no significant differences in character length across adjectives for one-way ANOVA: $F = 0.88$, $p = .41$). Predicates and nominals were also chosen based on their ability to yield a clear copredication, such that predicate X clearly referred to sense A and

predicate Y clearly referred to sense B (and not both A and B). Ungrammatical fillers included a range of grammatical violations such as verb number agreement violations (*Sam say that those videos are going to be watched next week*) or verb tense agreement violations (*The red house were going to be put on sale that day*). A complete set of the materials can be found in the Appendix.⁶²

A measure of coherence for the copredication items (i.e. the condition ‘1 Nominal, Different Sense’ in the present main experiment) was also gauged by conducting a separate norming study. Based on the coherence model for copredication outlined in Chapter 2, two separate norming studies were carried out on a distinct participant group to measure the coherence of the present set of stimuli.

The first study gauged the commonality of the predicates (*extensional overlap*) and the second gauged the causal relation between the predicates (*causal connection*). Both studies involved a different set of participants: 52 participants in each (*extensional overlap* mean age 33, 31 female; *causal connection* mean age 30; 40 female). The procedure and exclusion criteria were identical to the main experiment. Averaging finishing times were as follows: 18 minutes for *extensional overlap*, 21 minutes for *causal connection*.

For the *extensional overlap* norming study, this notion relies on the overlap of features referred to in both predicates, and so participants were asked to rate the commonality of two predicates. Participants were told that they would be presented with two statements which describe a range of objects, qualities and events. They were told to rate the statements on a scale from 1-7, with 1 being ‘Not related at all’, 4 being ‘Unsure’, and 7 being ‘Highly related’. For example, gauging the measure of extensional overlap for the item ‘Jack believed that the witty and laminated advert was going to be successful’, the following item was presented:

X is witty.

X is laminated.

For example, participants might rate this as 1 or 2, since the descriptions refer to two seemingly distinct things.

⁶² It should be noted that for example experimental item sets, the numbering will reset for each experiment, while for regular example sentences the numbering will continue from previous Chapters throughout the rest of the thesis.

Since a causal connection can be inferred via simple conjunction (as in the design of the main experimental materials) it was also important to include a measure of causal connectedness. While we are not the first to develop a measure of causal connectedness for the purpose of psycholinguistic dataset analyses (for instance, Bott et al. 2009 develop such a measure of causal connectedness for the purposes of exploring the semantics of conjunctions), applying such a measure to copredicated stimuli has not been done in the literature, and so a task design suited to copredicated stimuli was developed. Participants were asked to judge to what extent one phrase was a possible consequence of another. For example, the introductory instructions included the following example:

X is blue

X is heavy

Participants were told that, in this example, it is unlikely that something being ‘blue’ will necessarily cause it to be ‘heavy’, so this would be rated near the lower end of the spectrum. Because a causal relation can be inferred often in one ‘direction’ but not in another (Bott et al. 2009), and since participants were highly likely to read the items from top to bottom (i.e. they would read ‘X is blue’ and then ‘X is heavy’), the order of items was counterbalanced based on whether the concrete or abstract phrase was presented on the top or bottom, ensuring an equal number of both orders.

The same materials were used in both norming studies, such that participants judged whether ‘witty’ and ‘laminated’ bore any possible causal relation. After making their judgement in both experiments, a random selection of items (=50 items) required participants to type a reason for their choice in a text box. Lastly, a list of causal and non-causal fillers were included, and also a list of predicate pair fillers exhibiting clear commonality vs. no commonality (see Appendix).

3.3.1.3. Procedure

An online acceptability judgement experiment was carried out using Qualtrics (qualtrics.com/uk) and sourcing participants from Prolific Academic (prolific.ac). Each participant saw one of four lists of 72 sentences (36 experimental, 36 fillers). 17 Yes-No comprehension questions were randomly interspersed amongst the experimental and filler items. For instance, after making an acceptability judgement on the sentence ‘Pablo

thought that the wholesome pudding and evening feast were the best part of the weekend’, participants were prompted to respond to the question ‘Did Pablo think highly of the feast?’ before proceeding.

The following instructions were given to the participants:

In this experiment, a sentence will appear on your screen which you must read carefully. After this, you will need to rate the sentence based on how natural it sounds in terms of its grammaticality or acceptability. We are NOT interested in what you think about the overall meaning of the sentence, but what you think of the way it’s constructed.

It is important to bear in mind that acceptability does NOT refer to how likely these events are to occur in real life. What is important is how natural, well-formed or acceptable you find the sentence itself, i.e. whether you personally think someone could ever say something like that in English.

A standard Likert scale (1-7; ranging from very unacceptable to very acceptable) was used for participants to judge acceptability:

- 1 = Very unacceptable
- 2 = Quite unacceptable
- 3 = Fairly unacceptable
- 4 = Unsure whether acceptable or unacceptable
- 5 = Fairly acceptable
- 6 = Quite acceptable
- 7 = Very acceptable

Participants completed four practice trials before the experiment began.

3.3.1.4. Analysis

As the main analysis, we conducted 2 (Nominal Number) \times 2 (Sense Type) \times 3 (Nominal Type) repeated measures by-subjects and by-items ANOVAs on participants’ acceptability rating data using IBM SPSS Statistics 21 ($\alpha = 0.05$). This allowed us to examine whether the effect of either Nominal Number or Sense Type differed between

the three nominal types. Interaction effects were resolved by analysing data from different nominal types separately.

With respect to the coherence norming, after having gauged a measure of item coherence for both measures, a total coherence measure was calculated by summing both scores. For example, if one item scored an average of 5 for *extensional overlap* and an average of 1.5 for *causal connection*, then the item's total coherence score was 6.5. Because the main experimental items naturally varied to the extent that they exhibited either a possible causal relation and/or a clear commonality resulting in a highly-rated extensional overlap (or indeed neither), a single analysis unifying both coherence measures was conducted.

A bivariate (Pearson) correlational analysis was performed to see if acceptability correlated with coherence (IBM SPSS Statistics 25), using the factors Copredication Acceptability (from the main experiment; '1 Nominal, Different Sense' condition) and Coherence (summing both scores from the coherence studies).

3.3.2. Results

3.3.2.1. Comprehension Question Analysis

All participants scored above 80% on the comprehension questions.

3.3.2.2. Acceptability Judgement Data

Below is a figure and table reporting the average acceptability scores across each condition and nominal type.

For the ungrammatical and grammatical filler items, these scored an average of 1.3 and 5.7, respectively, indicating good participant performance.

Main Analysis: From the $2 \times 2 \times 3$ ANOVAs, the Nominal Number \times Sense Type analysis revealed a significant effect of sense type such that coordinating adjectives of distinct types significantly reduced acceptability relative to coordinating adjectives of identical types (F1: $F(1,47) = 13.131, p = .<001, \eta_p^2 = .218$; F2: $F(1,11) = 5.655, p = .037, \eta_p^2 = .340$), but there was found to be no effect of nominal number (F1: $F(1,47) = 2.547, p = .117, \eta_p^2 = .051$; F2: $F(1,11) = 1.123, p = .312, \eta_p^2 = .093$) and no interactions.

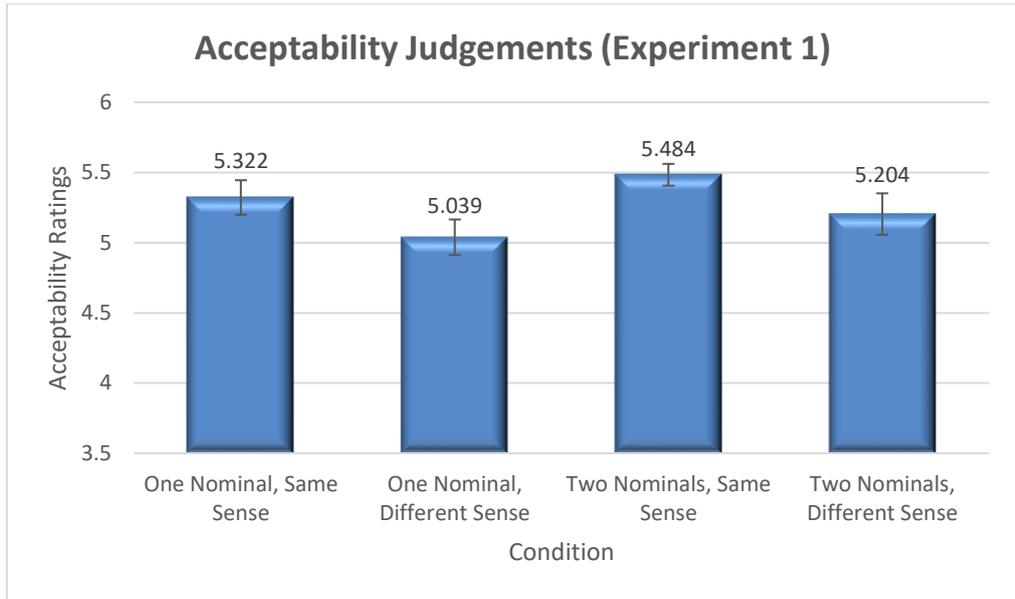


Figure 1: Average acceptability scores for the four experimental conditions with standard error bars.

Nominal Type: The $2 \times 2 \times 3$ (Nominal Type) ANOVAs revealed that nominal type did not interact with either of the other factors (F1: Nominal Type \times Sense Type: $p = .139$; Nominal Type \times Nominal Number: $p = .946$; Nominal Type \times Sense Type \times Nominal Number: $p = .610$; F2: Nominal Type \times Sense Type: $p = .574$; Nominal Type \times Nominal Number: $p = .994$; Nominal Type \times Sense Type \times Nominal Number: $p = .849$).

Condition	BOOK-TYPE	CITY-TYPE	LUNCH-TYPE
1 Nominal, SS	5.35 (.18)	5.22 (.13)	5.38 (.14)
1 Nominal, DS	5.22 (.15)	5 (.13)	4.88 (.18)
2 Nominals, SS	5.52 (.14)	5.46 (.15)	5.45 (.15)
2 Nominals, DS	5.38 (.15)	5.13 (.19)	5.09 (.17)

Table 3: Average acceptability scores (and standard errors) for all conditions across the three nominal types, following on from the $2 \times 2 \times 3$ ANOVA reported above. 'SS', 'DS' = Same/Different Sense.

Coherence: Summing the coherence score from the *extensional overlap* (M: 3.9; SD: 1.1) and *causal connection* (M: 2.9; SD: 1.1) norming studies, the 2-tailed correlation between coherence and copredication acceptability (i.e. acceptability of the '1 Nominal, Different Sense' condition) approached significance ($r = .275$, $n = 36$, $p = .052$), indicating the

possibility of a weak uphill (positive) relationship between coherence increase and copredication acceptability (see Figure 2).

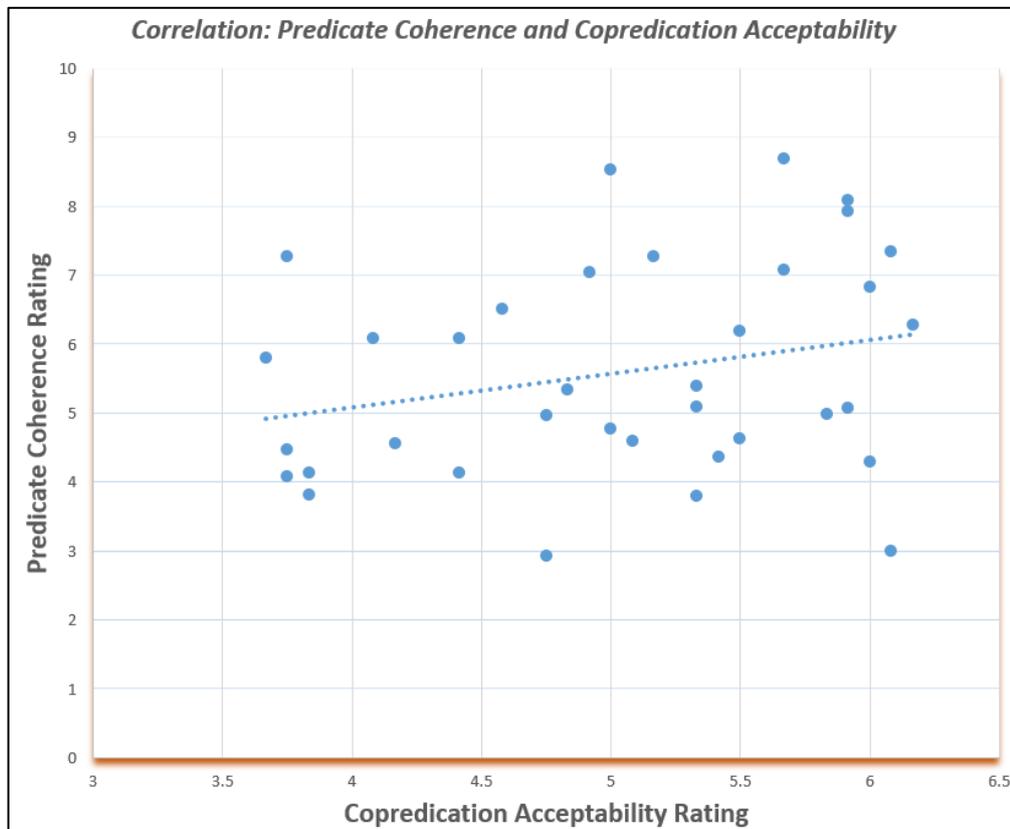


Figure 2: Scatter plot mapping copredication acceptability rating (X axis) against predicate coherence rating (Y axis) with linear trend line ($R^2 = 0.065$).

3.3.3. Discussion

The present results indicate that sentences containing adjectives of different senses are significantly less acceptable than sentences containing adjectives of semantically related senses. Importantly, this acceptability difference was not modulated by the number of nominals in the construction, meaning that sentences with copredication were not judged any worse than sentences in which different senses were attributed to different nominals.

The correlation between coherence and acceptability for the copredication items (i.e. the condition ‘1 Nominal, Different Sense’) was also found to approach significance. However, given the indeterminate nature of this particular analysis, we will wait until subsequent coherence analyses have been performed (i.e. for Experiments 3, 6 and 9) before proceeding with any further discussion about this issue.

The results are also mixed with respect to whether they support the ORH or SEL storage accounts. On the one hand, we found a cost of polysemous sense switching, as did Klein & Murphy (2001) (although these authors also invoked frequency effects to account for these effects, a topic we will return to in Experiment 3). On the other hand, we found no effect of nominal number, and as such these findings provide initial evidence that generating copredication does not have a unique effect on a sentence's acceptability beyond switching between different senses. One possibility is that copredication is costly only when the shift occurs in one direction (e.g. PHYSICAL OBJECT to INFORMATION) but not when it happens in a different direction. More specifically, as certain hypotheses presented earlier in this chapter would indicate, it may be that meaning modification is only costly based on the direction of complexity (e.g. concrete to abstract or simple to complex) or frequency (e.g. dominant to subordinate), such that any potential effects of copredication are only found in one specific sense order. Both of these observations may have conspired to mask any effect of copredication acceptability. However, we are not able to address this possibility in the present experiment as the adjectives of different senses were presented in different orders across items in the present stimulus set, and this factor was not controlled. We will explore this in the next experiment by directly manipulating sense order.

3.4. Experiment 2: Sense Order Effects

Since the results of Experiment 1 may have been a consequence of sense ordering effects, we investigated the effect of sense order on the acceptability of copredication in the present experiment. Here we used adjectives of different semantic types in all cases (with all conditions hosting both Abstract and Concrete adjectives) and manipulated the sense order of the adjectives (Abstract-Concrete or Concrete-Abstract) in sentences with or without coprediction. In the copredication conditions ('Single Nominal'), the two adjectives modify a single nominal; in the non-copredication conditions ('Dual Nominal'), the two adjectives modify two different nominals.⁶³

Table 4 depicts the design of these materials (compare with Table 2, which contained only one copredicated condition).

⁶³ Note that while we manipulated the number of nominals in the present experiment, this manipulation mapped directly onto coprediction vs. non-coprediction here but not in Experiment 1.

	<i>Concrete-Abstract</i>	<i>Abstract-Concrete</i>
<i>Single Nominal</i>	John said that the heavy and interesting book was on the table.	John said that the interesting and heavy book was on the table.
<i>Dual Nominal</i>	John said that the heavy pamphlet and interesting book were on the table.	John said that the interesting pamphlet and heavy book were on the table.

Table 4: Sample experimental materials in Experiment 2.

As in Experiment 1, we were interested principally in the effect of copredication. Further, crossing copredication with sense order will also allow us to ask if copredication has differential effects depending on sense ordering. If copredication has different effects on a sentence’s acceptability depending on the sense ordering of the adjectives, then we would expect to see an interaction between Copredication and Sense Order. If the complexity-based hypothesis is correct, then Concrete-Abstract sense orders will be more acceptable than the reverse. The present experiment was designed to test the above predictions concerning meaning modification, examining whether a shift from *book*(INFORMATION) to *book*(INFORMATION • PHYSICAL) involves acceptability costs.

3.4.1. Methods

3.4.1.1. Participants

Data from 52 participants was analysed (mean age = 32; range = 18-54; 33 male). As in Experiment 1, participants were paid £6 per hour, with the average finishing time being 17 minutes. The inclusion criterion was identical to Experiment 1.

3.4.1.2. Materials

A total of 36 experimental sets were constructed. As shown in Table 3, all items included two adjectives of semantically distinct senses and the ordering of the senses was manipulated (Concrete-Abstract vs. Abstract-Concrete). The adjectives modified one nominal in the copredication conditions and two different nominals in the non-copredication control conditions. The same nominals and adjectives as in Experiment 1 were used, selecting this time only for one concrete and abstract adjective per item set. The same fillers and comprehension questions from Experiment 1 were used.

3.4.1.3. Procedure

The experimental procedure was identical to Experiment 1.

3.4.1.4. Analysis

As the main analysis, we conducted 2 (Copredication) \times 2 (Sense Type) repeated measures by-subjects and by-items ANOVAs on participants' acceptability rating data. Due to unexpected and permanent loss of data, it was impossible to conduct further tests examining the effects of nominal type in this experiment.

3.4.2. Results

3.4.2.1. Comprehension Question Analysis

All participants scored above 80% on the comprehension questions.

3.4.2.2. Acceptability Judgement Data

Figure 3 depicts the average scores for each condition.

For the ungrammatical and grammatical filler items, these scored an average of 1.5 and 5.9 out of 7, respectively, indicating good participant performance.

2×2 repeated measures by-subjects and by-items ANOVAs (Copredication \times Sense Order) revealed a significant effect of sense order for the by-subjects analysis only, such that Abstract-Concrete orderings were less acceptable than the reverse (F1: $F(1,51) = 5.429$, $p = .024$, $\eta_p^2 = .096$; F2: $F(1,35) = 2.425$, $p = .128$, $\eta_p^2 = .065$), and a significant effect of Copredication for the by-subjects analysis only, such that copredication (Single Nominal) was less acceptable than non-copredication (Dual Nominal) (F1: $F(1,51) = 4.044$, $p = .050$, $\eta_p^2 = .073$; F2: $F(1,35) = 2.177$, $p = .149$, $\eta_p^2 = .059$). No interaction between these factors was discovered (F1: $F(1,51) = .685$, $p = .412$, $\eta_p^2 = .013$; F2: $F(1,35) = .538$, $p = .468$, $\eta_p^2 = .015$).

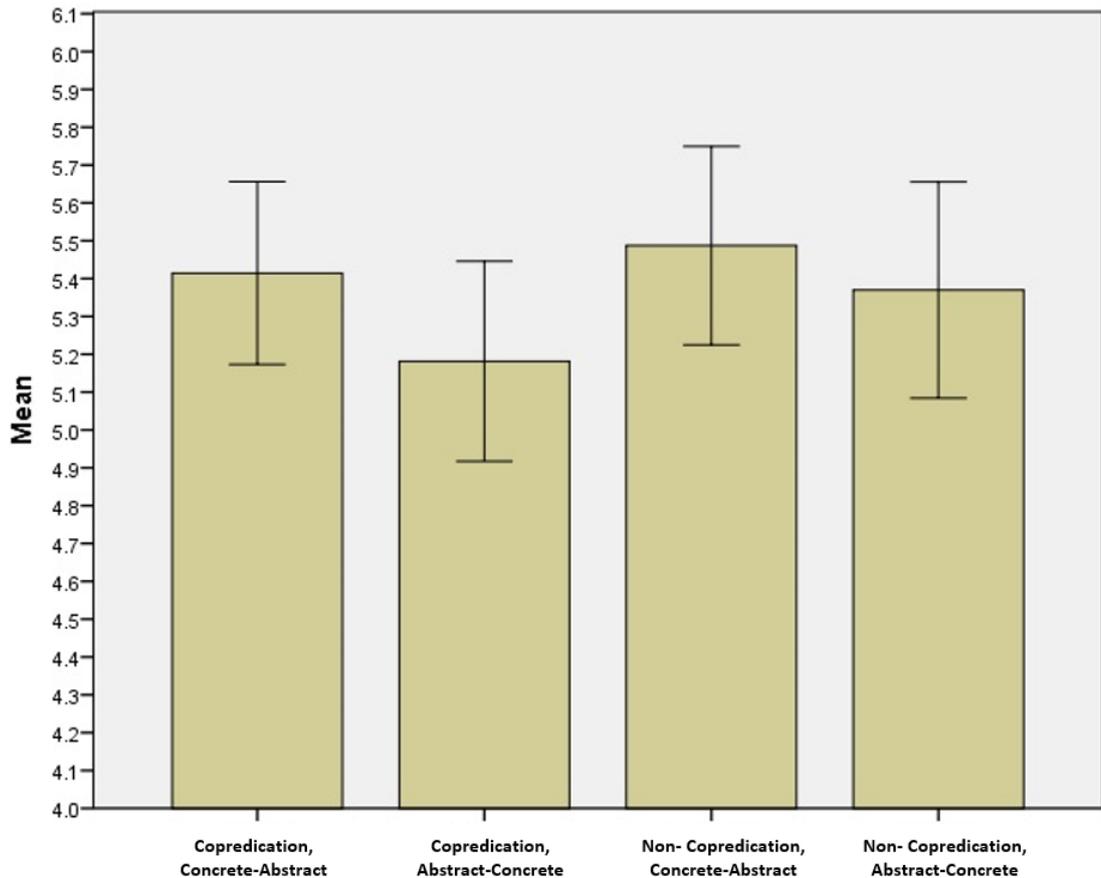


Figure 3: Average scores for the four experimental conditions. The two copredicated conditions were deemed less acceptable than the two non-copredicated conditions. Error bars set at 95% confidence intervals.

3.4.3. Discussion

In the present experiment, the by-subjects analysis showed an effect of sense order and copredication on acceptability, with copredication being rated less acceptable than non-copredication and Concrete-Abstract sentences being rated more acceptable than Abstract-Concrete sentences. However, since neither of these effects approached significance in the by-item analysis, we believe it would be prudent to replicate these effects first and as such we refrain from interpreting them or discussing their theoretical significance at the moment.

Meanwhile, the effect of sense order did not modulate the effect of copredication in either analysis, suggesting that the effect of copredication did not differ depending on the order of the senses. This fails to support the hypothesis that the absence of an effect of copredication in Experiment 1 was due to the ordering of the adjectives. We will attempt

to replicate these findings in Experiment 3, and we will explore other possible explanations in later experiments.

Lastly, the acceptability results of Experiment 2 could be due to factors ranging considerably far beyond the interpretation of the individual copredications, such as the co-occurrence of the adjectives, and the frequency of the different nominal senses. As a result, a series of norming studies was carried out. After reporting these in the next section, we will return to the issue of replicating the results of the present experiment and re-evaluating the results in light of the findings of the norming studies.

3.5. Norming Studies

3.5.1. Study 1: Sense Frequency and Adjective Coordination

The main concerns of the following norming studies were nominal sense frequency and the acceptability of adjectival coordinations.⁶⁴ Adjectives were elicited from speakers for each nominal using sentence frames such as “The book was _____” in order to gauge their *sense frequency* (i.e. was the physical or informational sense cited more often?). In addition, participants were asked to rate the acceptability of coordinated structures such as *folded and educational* and *educational and folded*. The results of this norming study will permit a more thorough and controlled interpretation of Experiment 2, and later acceptability experiments using these nominals and adjectives. More specifically, it will allow us to determine whether the acceptability dynamics in Experiment 2 were a result of the coordinations of adjectives alone. In addition, the results will allow us to test sense frequency-based accounts.

3.5.1.1. Methods

⁶⁴ Cruse (1986: 69) proposes a test to gauge the “established” sense of a nominal, seemingly correlating with frequency. This involves negating the non-established sense before asserting the established sense, with the converse process being less acceptable. This seems to reveal that the established sense of *book* is information. Nevertheless, for our purposes a more empirical measure will be required to make claims about sense frequency.

- (i) a. I’m not interested in the binding, cover, typeface etc. – I’m interested in the novel.
- b. #I’m not interested in the plot, characterization, etc. – I’m interested in the novel.

62 participants (29 male) were recruited for the experiment and were paid £6 per hour, with the average finishing time being 17 minutes. The study was composed of two parts and was carried out via Qualtrics. The first part was a fill-in-the-blank task attempting to gauge the frequency of polysemous senses. The instructions are presented below:

In this first task, you will first be asked to fill-in-the-blank after phrases like 'The book was ____'. Please type whichever word comes to mind and makes sense to you. It is completely fine to repeat a word you have already used.

After completing this task, the instructions for the second task – an acceptability study – were presented:

In this final task, you will need to rate a phrase based on how natural it sounds. The rating scale will be from 1-7, with 1 being the lowest and 7 being the highest rating, where 1 = very unacceptable, 7 = very acceptable.

1 = very unacceptable

2 = quite unacceptable

3 = fairly unacceptable

4 = unsure whether acceptable or unacceptable

5 = fairly acceptable

6 = quite acceptable

7 = very acceptable

What is important is how natural, well-formed or acceptable you find the phrase itself, i.e. whether you personally think someone could ever say something like that in English.

The fill-in-the-blank stimuli was presented first, since this avoided the risk that participants would simply be primed to insert certain adjectives based on what they would have recently encountered through the coordinated adjectives.

For the fill-in-the-blank task, 66 sentence fragments were used (e.g. “The book was ____”), including 36 nominals from Experiment 2 and 30 other nominals of similar types

or taken from the literature reviewed in Chapter 2 (for reasons of comprehensiveness). In total, 22 nominals from each of the three main lexical categories (*book*-type, *city*-type, *lunch/school*-type) were used, totalling 66 items. They were presented in two lists such that each participant saw 33 items (11 nominals from each category).

For the acceptability judgement task, all 72 coordinated adjectives taken from Experiment 2 were used. Four adjective pairs were changed from Experiment 2 to make the senses as clear as possible ('tasteful' was changed to 'pungent', 'interesting' to 'amusing', 'brown' to 'creased', and 'interrupted' to 'stalled'). The design of these materials allowed us to sidestep a potential criticism of the core experimental findings regarding predicate ordering: One might object, invoking Horn's principle, that an unconventional expression typically implies an unconventional meaning, such that *butter and bread* is thought to potentially license a meaning other than that implied by *bread and butter*. As such, none of the adjective pairs used could be considered conventionalised binomials, and so the acceptability scores could not be biased by familiarity per se. The materials were presented in two lists such that each participant saw one order from each coordinated adjective pair. Half the stimuli in each list were Concrete-Abstract, the other half were Abstract-Concrete.

3.5.1.2. Analysis

For the fill-in-the-blank task, the adjectival responses were coded for their sense (e.g. *tall* for 'The building was ___' was coded as PHYSICAL) in order to be plotted in the below table, and then were categorised as either concrete or abstract for the purposes of analysis. This procedure is in line with previous studies that used the first response provided by participants as a dominance measure (Klepousniotou & Baum 2007, Rayner & Duffy 1986). A small number of responses for 26 out of the 66 nominals were ambiguous (e.g. the most common were *amazing*, *great*, *interesting*, *nice*, *good*, *OK*), and these were omitted during dominance calculation (range of ambiguous responses per nominal: 1-8; average number of ambiguous responses: 2.6; see Appendix for the list of nominals with no ambiguous responses). For example, *letter* had 3 ambiguous responses, and so its dominance percentage was calculated from 28 rather than 31.

For the statistical analysis, the dominant sense for a given nominal (abstract or concrete) was the dependent variable, and the nominal type (*book*-, *city*- or *lunch*-type) was the independent variable, satisfying the assumption that binomial logistic regressions

require at least one continuous or categorical independent variable. A binomial logistic regression was performed using SPSS 27 (IBM) to ascertain the effects of nominal type on the likelihood that the dominant sense would be either abstract or concrete, with nominal type being the predictor and the type of the dominant sense (abstract or concrete) the predictee.

For the acceptability rating data, average acceptability scores were computed and a by-subjects ANOVA (3×2 ; Nominal Type \times Sense Order) was performed.

3.5.1.3. Results and Discussion: Sense Frequency

The sense frequency results will be presented here first, followed below by the acceptability rating results in the next sub-section.

The results are presented in Table 5. The results suggested that each nominal type has a clear dominant sense with some within-type variability.

Of the three main nominal types explored, *book*-type INFO-PHYS nominals are overwhelmingly INFO-dominant⁶⁵, *shop*-type PHYS-INST nominals are overwhelmingly PHYS-dominant, and *lunch*-type PHYS(FOOD)-EVENT nominals are overwhelmingly PHYS-dominant (where FOOD is naturally a sub-type of PHYS).

A binomial logistic regression was performed to ascertain the effects of nominal type on the likelihood that the dominant sense would be either abstract or concrete. As mentioned above, in order to conduct this analysis it was necessary to collapse certain of the senses in Table 5 into a single, coherent category; for instance, the LOCATION and PHYSICAL senses of *city* were collapsed into a single concrete sense (indeed, this follows the assumptions in Chapter 2 about LOCATION and PHYSICAL being instantiations of the same sense, and we have noted them separately in the tables here purely because, as mentioned, some researchers might consider them to be separate senses), while the POPULACE sense was left as the sole abstract sense. This created a dichotomous dependent variable. The logistic regression model was statistically significant ($\chi^2(65) = 2308.347$, $p < .001$) such that the type of nominal could predict the category of the dominant sense. All three nominal types added significantly to the model ($p = < .001$; *book*-type SE: .06, *city*-type SE: .08, *lunch*-type SE: .09). The model explained 57.8% (Nagelkerke R^2) of

⁶⁵ See also Frisson (2015) for support from the British National Corpus that *book*-type nominals are abstract-dominant, with Frisson finding 80.4% dominance in the nominals he surveyed; a figure very close to our score of 76.8% dominance for *book*-type items.

the variance in sense dominance (-2 Log likelihood: 3304.100) and correctly classified 80.8% of cases (i.e. given the type of a certain nominal x , the model could predict the category of the dominant sense of x , namely either abstract or concrete).

NOMINAL	DOM	SUBORD	% DOM	NOMINAL	DOM	SUBORD	% DOM	NOMINAL	DOM	SUBORD	% DOM
<i>Translation</i>	INFO		100	<i>Building</i>	PHYS		100	<i>Lunch</i>	FOOD	EVENT	96.6
<i>Exam</i>	INFO		100	<i>Library</i>	PHYS		100	<i>Dessert</i>	FOOD	EVENT	96.5
<i>Novel</i>	INFO	PHYS	96.7	<i>Village</i>	PHYS		100	<i>Appetiser</i>	FOOD	EVENT	92.5
<i>Commentary</i>	INFO	PHYS	96.7	<i>Farm</i>	PHYS	INST	96.7	<i>Dinner</i>	FOOD	EVENT	90
<i>Adaptation</i>	INFO	PHYS	93.5	<i>Bank</i>	PHYS	INST	93.5	<i>Meal</i>	FOOD	EVENT	88
<i>Bill</i>	INFO	PHYS	90.3	<i>Shop</i>	PHYS	INST	93.5	<i>Breakfast</i>	FOOD	EVENT	87.1
<i>Advert</i>	INFO	PHYS	88.4	<i>Gym</i>	PHYS	INST	90.3	<i>Supper</i>	FOOD	EVENT	86.2
<i>Video</i>	INFO	PHYS	87.1	<i>Church</i>	PHYS	INST	89.2	<i>Feast</i>	FOOD	EVENT	83.3
<i>Message</i>	INFO	PHYS	87.1	<i>Nursery</i>	PHYS	INST	87.1	<i>Brunch</i>	FOOD	EVENT	82.1
<i>Publication</i>	INFO	PHYS	80	<i>Factory</i>	PHYS	INST	87.1	<i>Banquet</i>	FOOD	EVENT	77.4
<i>Letter</i>	INFO	PHYS	78.5	<i>Workshop</i>	PHYS	INST	83.3	<i>Barbeque</i>	FOOD	EVENT	75.8
<i>Dissertation</i>	INFO	PHYS	77.4	<i>Borough</i>	PHYS	INST	83.3	<i>Picnic</i>	FOOD	EVENT	59.2
<i>Newspaper</i>	INFO	PHYS, INST	70.9	<i>Province</i>	PHYS	INST	74.1	<i>Appointment</i>	EVENT		100
<i>Magazine</i>	INFO	PHYS, INST	68.9	<i>Hotel</i>	PHYS	INST	70.9	<i>Renovation</i>	EVENT	PHYS	66.6
<i>Essay</i>	INFO	PHYS	67.7	<i>Settlement</i>	PHYS	INST	70	<i>Construction</i>	EVENT	PHYS	66.6
<i>Newsletter</i>	INFO	PHYS	67.7	<i>City</i>	PHYS	POP, LOC	67.7	<i>Entrance</i>	PHYS		100
<i>Book</i>	INFO	PHYS	64.5	<i>Town</i>	PHYS	POP, LOC	63.3	<i>Door</i>	PHYS		100
<i>Journal</i>	INFO	PHYS	61.2	<i>Restaurant</i>	PHYS	INST	58.0	<i>Archway</i>	PHYS	APERTURE	96.7
<i>Pamphlet</i>	INFO	PHYS	60.6	<i>Arthouse</i>	PHYS	INST	58.0	<i>Passageway</i>	PHYS	APERTURE	77.4
<i>Printout</i>	INFO	PHYS	51.6	<i>College</i>	PHYS	INST	56.6				
<i>Atlas</i>	PHYS	INFO	61.2	<i>Company</i>	INST	PHYS	83.8				
<i>Brochure</i>	PHYS	INFO	58.6	<i>Council</i>	INST	POP	76.6				
<i>Dictionary</i>	PHYS	INFO	58.0	<i>University</i>	INST	PHYS	58.0				
				<i>School</i>	INST	PHYS, EVENT	45.1				

Table 5: Average scores for the fill-in-the-blank norming study. ‘Dom’ denotes the dominant sense, ‘Subord’ denotes the subordinate sense, ‘% Dom’ denotes the percentage of dominance exhibited by the dominant sense. The nominal types were grouped by the following colours: Black: PHYS-INFO (book-type), Blue: PHYS-INST (city-type), Red: FOOD(PHYS)-EVENT (lunch-type), Purple: PHYS-APERTURE (door-type). Exceptions to the general frequency trend are highlighted in yellow.

3.5.1.4. Results and Discussion: Adjective Coordination

Nominal Type	Concrete-Abstract	Abstract-Concrete
<i>Book</i>	4.64 (.26)	4.49 (.26)
<i>City</i>	4.12 (.25)	3.95 (.26)
<i>Lunch</i>	3.78 (.26)	3.80 (.20)

Table 6: Average scores (and standard errors) for the phrase acceptability norming study.

The results of the adjective coordination study are in Table 6 (see Appendix for the full list of scores). A by-subjects ANOVA (3×2 ; Nominal Type \times Sense Order) revealed a significant effect of Nominal Type, but the by-items analysis did not ($F_1: F(2,60) = 55.98$,

$p = <.001$, $\eta_p^2 = .65$; F2: $F(2,10) = 2.68$, $p = .117$, $\eta_p^2 = .34$). No significant effects of Sense Order were found (F1: $F(1,61) = .84$, $p = .362$, $\eta_p^2 = .01$; F2: $F(1,11) = 2.03$, $p = .182$, $\eta_p^2 = .15$), and no interaction effects were found ($p > .05$). These results are distinct from those of Experiment 2, since Experiment 2 revealed a significant effect of sense order in the by-subjects analysis. This indicates that the effects of Sense Order found in Experiment 2 were not due to the adjectives themselves.

These results suggest that the acceptability results from Experiments 1 and 2 are not due to the co-occurrence of the adjectives, and provide evidence that the acceptability dynamics may result instead from the nominal-adjective associations involved in copredication and non-copredication. This allows a more controlled, robust interpretation of the data, and suggests that any Concrete-Abstract acceptability bias is not involved in the processing of bare coordinate phrases, and is rather active at some more complex discourse level (likely, the clausal level, following the coherence relations literature; this issue will be returned to below).

3.5.2. Study 2: Adjective Co-Occurrence and Sense Relatedness

Moving forward, it is necessary to assess the possibility that the relatedness of the senses influences both the results in the main experiments and the previous norming study. It is also necessary to control for the relatedness of the senses used in the main experiments, and to determine if any modifications to the materials might be needed to achieve this. The goal of the present study was therefore to determine the relatedness of the adjectives used with the different nominal types in the copredication stimuli. Of course, by definition the categories of distinct adjectives involved in copredication are different and unrelated, however it may be that certain nominal types host senses that are deemed to be considerably less related than those hosted by other nominal types. As such, it may be that this factor (sense relatedness) contributes to the acceptability dynamics documented in this chapter, in particular given Haber and Poesio's (2020: 114) discovery that "sense similarity appears to be a major contributor in determining co-predication acceptability". For example, as already noted, Klein and Murphy (2001) found a cost for switching polysemous senses (*wrapping paper* → *daily paper*). Yet at times the different senses were only weakly related (e.g. *nail gun* → *nail polish*). As a result, it is very likely that this factor contributed to producing results through which polysemous sense switches bore similar processing costs to homonymous meaning switches. The present study can

therefore help us avoid this confound. As Frisson (2009: 120) notes, “the content and object senses of words like *book*”, as well as “the place and institution senses of *school*”, could be “quite closely related”. This degree of relatedness might have “an impact on how the polysemes will be processed” (Ibid; see also Eddington & Tokowicz 2015 for a review of studies revealing effects of semantic relatedness on retrieval ease).

3.5.2.1. Methods

The adjectives were presented without any coordination and with a space between them (e.g. ‘heavy amusing’), with two lists being created such that each participant only saw one configuration (Abstract on the left and Concrete on the right, or vice versa). As such, the ‘Sense Order’ factor in the below analysis merely refers to the position of the adjectives on the computer screen. In addition, a list of 36 unrelated (e.g. ‘plane undermine’) and 36 related (e.g. ‘horse cat’) fillers were used, composed of a mix of lexical categories.

The task for participants was to answer the question ‘How related are these words?’ for each pair, with the following instructions being presented.

In this task, you will need to determine how related two words are. The rating scale will be from 1-7, with 1 being the lowest and 7 being the highest rating, where 1 = very unrelated, 7 = very related.

1 = very unrelated

2 = quite unrelated

3 = fairly unrelated

4 = unsure whether related or unrelated

5 = fairly related

6 = quite related

7 = very related

A practice round was provided, with participants being informed that ‘computer microchip’ was a related pair and ‘book olympic’ was an unrelated pair. Throughout the experiment, the same adjectives were used as in the previous norming study.

3.5.2.2. Results and Discussion

<i>Nominal Type</i>	<i>Concrete-Abstract</i>	<i>Abstract-Concrete</i>
<i>Book</i>	4.48 (.11)	4.64 (.10)
<i>City</i>	3.66 (.11)	3.89 (.10)
<i>Lunch</i>	3.95 (.10)	3.99 (.11)

Table 7: Average scores (and standard errors) for the phrase acceptability norming study.

ANOVAs (3×2 ; Nominal Type \times Sense Order) were performed over the three distinct nominal categories (*book-type*, *lunch-type*, *city-type*) used to categorise the adjective pairs (e.g. ‘heavy – amusing’ was categorised as *book-type*). These revealed no significant effects of Sense Order (F1: $F(1,61) = 1.118$, $p = .294$; F2: $F(1,11) = .564$, $p = .468$), Nominal Type (F1: $F(2,60) = 1.758$, $p = .181$; F2: $F(2,10) = 1.271$, $p = .322$), and no interaction effects (F1: $p = .511$, F2: $p = .683$).

The results revealed no significant difference between the sense relatedness for the predicates involved in the different nominal types, and that sense relatedness was also not modulated by the Abstract-Concrete vs. Concrete-Abstract configurations. This leads to the suggestion that the sense order effects documented in Experiment 2 were not due to differences in sense relatedness across the nominal types; in other words, it does not seem to be the case that the sense relatedness for the predicates involved in *book-type* items differed from *lunch-type* items, and so the sense order dynamics in Experiment 2 cannot be derived from this. In the first norming study, for the adjectival phrases the task explicitly had participants focus on the acceptability of the phrases as linguistic units (i.e. how natural the phrase sounds in English), whereas the present experiment tasked participants with focusing on the more conceptual level of semantic relatedness. Since the results of the two norming studies were similar and there was found to be no difference between nominal types and adjective orderings, the results of the first norming study likely resulted from the co-occurrence of the adjectives and their concomitant acceptability. This in turn suggests that the results of the main experiments were likely due to the noun-adjective associations involved in the stimuli (i.e. the effect of associating two adjectives with either one or two nominals) and were not the result of any particular feature of the adjectives.

3.6. Experiment 3: Revisiting Sense Order Effects

In the present experiment we attempted to replicate the results of Experiment 2. The same 2×2 design was used, fully crossing copredication (Single Nominal vs. Dual Nominal) and sense order (Concrete-Abstract vs. Abstract-Concrete). Crucially, in order to counterbalance the pairing of nominals and predicates in the materials, we expanded the stimulus set to ensure that both predicates are used to modify both nominals in each item.

In addition, with the results from the above norming studies, we are now in a position to differentiate between complexity-based and sense frequency-based accounts. Are sense order dynamics (either in copredication, or both in copredication and non-copredication) influenced by complexity (Abstract-Concrete vs. Concrete-Abstract) or frequency (subordinate-dominant vs. dominant subordinate)? The sense order manipulation used in this experiment is exclusively based on complexity. Recall also that this thesis is adopting the following hierarchy of semantic complexity: PHYSICAL < INFORMATION < EVENT < INSTITUTION.

Under the complexity-based account, we would expect that Concrete-Abstract orderings are significantly more acceptable than the reverse order. Meanwhile, since *book*-type nominals are abstract-dominant (in contrast to *lunch*- and *city*-type nominals which are concrete-dominant), sense frequency-based accounts predict an interaction between Nominal Type and Sense Order, such that Abstract-Concrete orderings should be more acceptable than Concrete-Abstract orderings for *book*-type items and the opposite pattern (Concrete-Abstract orderings being more acceptable) for *city*-type and *lunch*-type items.

3.6.1. Methods

3.6.1.1. Participants

A total of 168 participants were recruited (age range 18-59; 92 female) such that each list was used 21 times. Participants were paid £6 per hour, with the average finishing time being 20 minutes. The exclusion criteria for participants were identical to the first two experiments.

3.6.1.2. Materials

The present experiment had the same design as Experiment 2, manipulating Sense Order (Concrete-Abstract or Abstract-Concrete) and Copredication (Single Nominal or Dual Nominal). The most crucial departure from the previous experiment was the decision to counterbalance which predicates were associated with the nominals, such that four additional sentences were added for each experimental set:

- (1) a. John said that the *small* and *interesting* **book** was on the table.
- b. John said that the *interesting* and *small* **book** was on the table.
- c. John said that the *small* and *interesting* **pamphlet** was on the table.
- d. John said that the *interesting* and *small* **pamphlet** was on the table.
- e. John said that the *small* **pamphlet** and *interesting* **book** were on the table.
- f. John said that the *interesting* **pamphlet** and *small* **book** were on the table.
- g. John said that the *small* **book** and *interesting* **pamphlet** were on the table.
- h. John said that the *interesting* **book** and *small* **pamphlet** were on the table.

We changed 4 adjectives from Experiment 2 to make the senses minimally ambiguous (e.g. ‘tasteful’ became ‘tasty’). We also changed the second nominal in 3 items to ensure they were felicitous in the copredication condition (e.g. for *city*, the second nominal ‘man’ was changed to ‘district’ since ‘polluted man’ is anomalous). Aside from these very minor changes, the stimuli were identical to those of Experiment 2.

Among the *book*-type nominals, 11 out of 12 were INFORMATION-dominant, with only *dictionary* being PHYSICAL-dominant. Meanwhile, all *lunch*-type nominals were PHYSICAL-dominant. Lastly, 10 out of 12 *city*-type nominals were PHYSICAL-dominant, with only *school* and *company* being INSTITUTION-dominant (and hence Abstract-dominant). As such, both the *lunch*- and *city*-types were Concrete-dominant and the *book*-type nominals were Abstract-dominant.

We also included a new set of 36 filler sentences (18 grammatical + 18 ungrammatical) that had the same syntactic structure as the experimental sentences. The nominals used in these sentences did not permit complex polysemy. A total of 8 stimuli lists were created such that each participant saw one item from each stimulus set.

3.6.1.3. Analysis

As the main analysis, we conducted 2 (Copredication) \times 2 (Sense Order) \times 3 (Nominal Type) repeated measures by-subjects and by-items ANOVAs on participants' acceptability rating data. Interaction effects were resolved by analysing data from different nominal types separately.

Lastly, in order to more directly test the sense frequency-based hypotheses, we realigned the nominals based on their dominance profiles (with only *book*-type items being Abstract-dominant) and conducted 2 (Frequency; Dominant-Subordinate vs. Subordinate-Dominant) \times 2 (Copredication) ANOVAs to examine whether the ordered frequency of the polysemous senses influenced the acceptability of the sentences. For consistency, the same ANOVA contrast was chosen (i.e. Copredication vs Frequency/Sense Order) rather than adding Frequency as a covariate. For instance, a Dominant-Subordinate ordering for *book*-type trials would include 'interesting and small book' (whereby INFORMATION is dominant), while for *lunch*-type trials this would include 'tasty and delayed lunch' (whereby PHYSICAL is dominant). As such, the dominant sense of these nominals would be placed first (Table 5 provides dominance information determining the structuring of this particular analysis).

3.6.1.3.1. *Coherence Norming*

As with Experiment 1, measures of coherence (*extensional overlap* and *causal connection*) were also gauged, using the same design and participants as in the Experiment 1 norming. A bivariate correlational analysis was conducted to determine if acceptability correlated with coherence. Average scores for the copredication items in the main experiment were calculated (i.e. averaging the two Concrete-Abstract and Abstract-Concrete conditions) in order to achieve this.

3.6.2. Results

3.6.2.1. *Comprehension Question Analysis*

All participants scored above 80% on the comprehension questions.

3.6.2.2. *Acceptability Judgement Data*

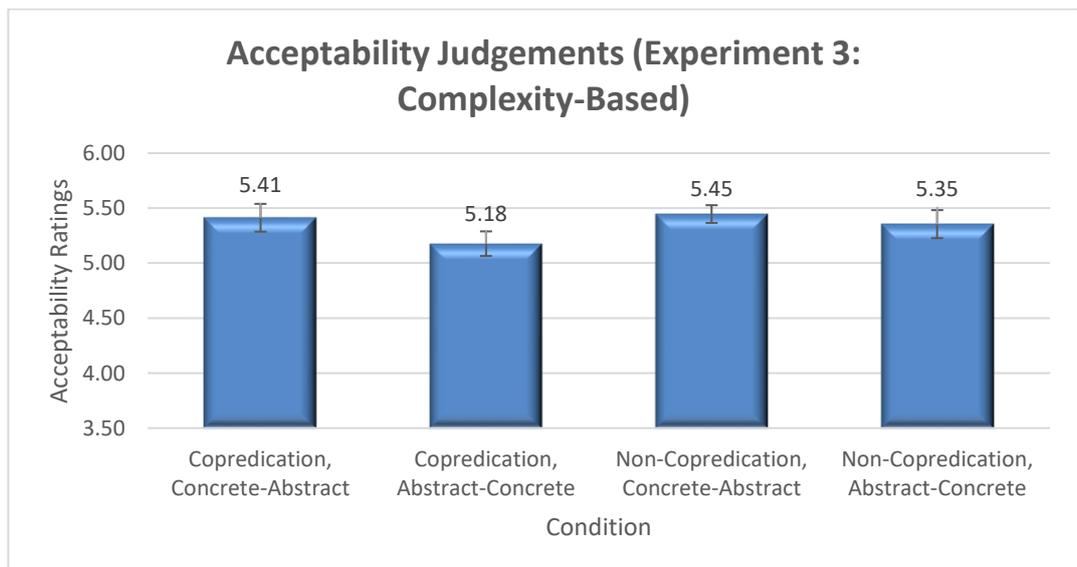
Figure 4 plots the average scores for the four conditions, and Table 8 plots the scores across all nominal types.

For the ungrammatical and grammatical filler items, these scored an average of 1.5 and 5.8, respectively, indicating good participant performance.

Complexity: The by-subjects analysis revealed a significant effect of Sense Order (F1: $F(1,167) = 70.871, p < .001$; F2: $F(1,11) = 4.094, p = .068$) and Copredication (F1: $F(1,167) = 15.968, p < .001$; F2: $F(1,11) = 3.805, p = .077$) such that Concrete-Abstract orderings were more acceptable than the reverse and Single Nominal trials were less acceptable than Dual Nominal trials, while the interaction effect between Copredication and Sense Order was not statistically significant (F1: $F(1,167) = 3.224, p = .074$; F2: $F(1,11) = 1.435, p = .256$).

Nominal Type: No analyses involving Nominal Type were significant (F1 Nominal Type: $F(1,167) = .769, p = .382$; F2 Nominal Type: $F(2,10) = .541, p = .598$; all $F_s < 1$ for all interactions).

Sense Frequency: The Frequency \times Copredication by-subjects ANOVA revealed no main effects or interaction: Frequency (F1: $F(1,51) = 3.602, p = .063$; $F(1,35) = .023, p = .880$); Copredication (F1: $F(1,51) = 3.411, p = .071$; F2: $F(1,35) = .131, p = .719$); Frequency \times Copredication (F1: $F(1,51) = 1.146, p = .289$; F2: $F(1,35) = .007, p = .934$).



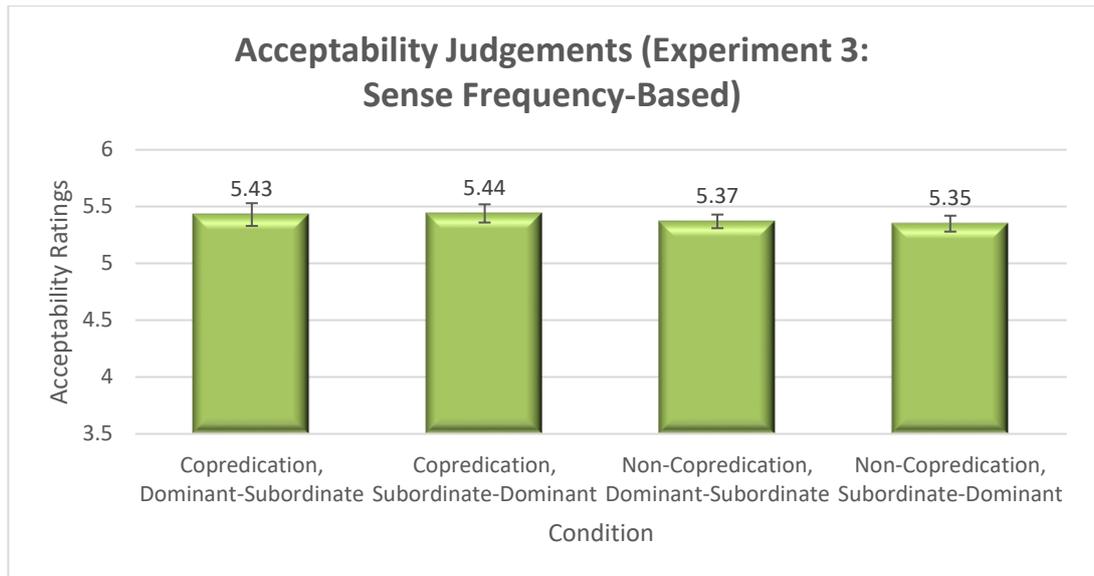


Figure 4: Average scores for the four experimental conditions framed around sense category/complexity (Top) and sense frequency (Bottom) with standard error bars.

Condition	BOOK-TYPE	CITY-TYPE	LUNCH-TYPE
<i>Copredication, C-A</i>	5.56 (.06)	5.32 (.05)	5.36 (.05)
<i>Copredication, A-C</i>	5.04 (.04)	5.16 (.04)	5.33 (.05)
<i>Non-Copredication, C-A</i>	5.54 (.04)	5.52 (.04)	5.28 (.03)
<i>Non-Copredication, A-C</i>	5.52 (.05)	5.33 (.05)	5.21 (.04)

Table 8: Average acceptability scores (and standard errors) for all conditions across the three nominal types. C-A = Concrete-Abstract, A-C = Abstract-Concrete.

Coherence: Adding the coherence score from the *extensional overlap* and *causal connection* norming studies for the items used in this experiment (M: 5.6; SD: 1.5) the 2-tailed correlation between coherence and copredication acceptability (i.e. acceptability of the two Copredication conditions) was found not to be significant ($r = .206$, $n = 36$, $p = .227$) (see Figure 5).

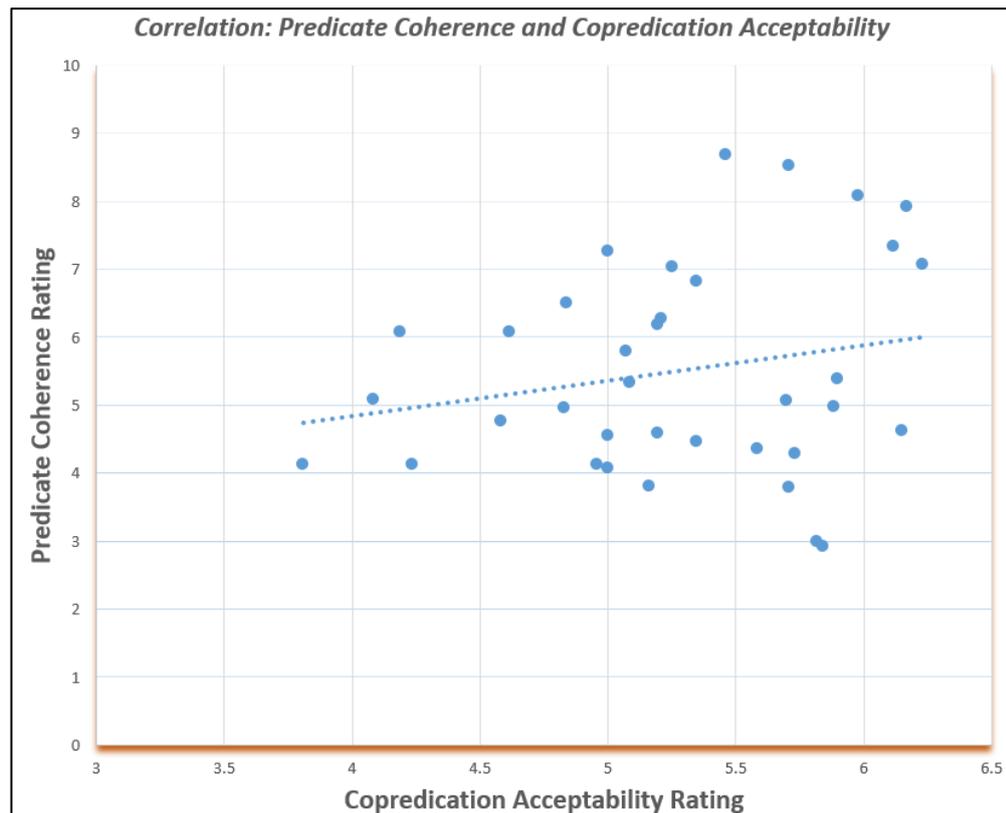


Figure 5: Scatter plot mapping copredication acceptability rating (X axis) against predicate coherence rating (Y axis) with linear trend line ($R^2 = 0.045$).

3.6.3. Discussion

The main results of the present experiment are largely similar to those in Experiment 2, such that an effect of Copredication (copredication being less acceptable than non-copredication) and Sense Order (Abstract-Concrete being less acceptable than Concrete-Abstract) was observed in the by-subjects analysis but not in the by-item analysis. The fact that neither effect reached statistical significance in the by-item analysis is likely due to the large variability between different items.

Although many storage accounts (including the Sense Enumeration Lexicon Hypothesis) predicted that copredicated sentences would be degraded relative to non-copredicated sentences, the present findings are more in line with the One Representation Hypothesis account due to the finding that associating two semantically distinct predicates did not result in acceptability costs.

Further, we did not observe a significant interaction effect between Nominal Type and either of the other factors. There were also no main effects of Frequency. We believe these findings cannot be accounted for by invoking sense frequency, since the norming study showed that the three nominal types exhibited different sense dominance profiles (with

sense dominance on the order of at least 70-80% being found for most of the nominals). Consulting Table 5, *book*-type nominals are abstract-dominant, with the most complex sense also being the dominant one. Yet we observed a preference for Concrete-Abstract ordering across all nominal types, and as such *book*-type items exhibited subordinate-dominant preferences, while *city*-type and *lunch*-type exhibited a dominant-subordinate preference. As such, the sense order preferences documented in the present experiment cannot be explained by the frequency profiles of these nominals. Overall, the evidence leans more in favour of the complexity-based account. However, there may be other factors contributing to the present results, such as choice of syntax; we will turn to this issue in the next experiment.

Lastly, we also found there to be no correlation between coherence and copredication acceptability. Given that the present materials were constructed to isolate effects of copredication and predicate ordering, and given that coherence was not an experimental factor (largely due to the very notion of coherence in relation to copredication being, at the moment, an exploratory one), we cannot rule out the effects that coherence may have on copredications – in particular given that the analysis in Experiment 1 approached significance. We will return to this issue in the next chapter.

3.7. Experiment 4: Syntactic Factors in Sense Order Acceptability

Returning to some earlier concerns, it was noted that Frisson's (2015) eye-tracking experiment using *book*-type nominals found that subordinate-dominant sense switches were more difficult to process (as shown by longer first fixation and gaze duration) than the reverse order, whereas we have found no effects of sense frequency; indeed, we found that Concrete-Abstract sense orders were more acceptable than Abstract-Concrete sense orders in the by-subject analysis of our data in Experiment 3. Rather than finding any effect of polysemous sense frequency on the acceptability of sentences, the results points towards an effect of sense complexity.

What to make of this? The different sentence structures used may be responsible, with Frisson placing one of the two adjectives before the nominal, whereas we placed both adjectives before the nominal. As such, we will here conduct an acceptability experiment using the same sentence structures used in Frisson (2015) (e.g. 'Laura said that the brief breakfast was tasty ...'), to determine if this factor can explain the differences in results.

In addition, we will be analysing the effect of sense complexity (as well as sense frequency) in a new syntactic structure for copredication. In particular, effects of sense frequency may be found here, since at the point of the second adjective the nominal sense has been made explicit.

Meanwhile, Frisson (2015) also found a processing cost for switching senses relative to sense repetition. Frisson's conditions were replicated here under the labels Copredication and Non-copredication, in keeping with the other experiments in this thesis. However, it should be noted that the form of 'Non-copredication' used in the present experiment is distinct from the forms used in other experiments, where two distinct nominals were used with the predicates to block copredication. In Experiment 3, we also found an effect of sense switching for the F1 analysis; here we will examine if the effect of sense switching is clearer with a different syntax.

Indeed, Lowder and Gordon (2013) have proposed that "sentence structure is a key factor to consider in developing psycholinguistic models" of figurative language; this may also be the case for models of copredication. They found that institutional senses of *college*-type metonymies were more difficult to process than physical senses, but that this cost was lessened if the institutional reading was embedded in an adjunct structure (see also Bott et al. 2016 for evidence that these institutional senses can still be directly accessed from the nominal, as opposed to being indirectly accessed via the 'literal'/physical sense; a finding which is in line with assumptions in this thesis about the senses of complex polysemous lexical entries being independently represented within the nominal representation).

3.7.1. Methods

3.7.1.1. Participants

A total of 84 participants were recruited (age range 18-54; 36 female). Participants were paid £6 per hour, with the average finishing time being 20 minutes. The exclusion criteria for participants and experimental platform were identical to the previous experiments.

3.7.1.2. Materials

The materials were constructed with direct reference to the 'Switch' and 'Repeat' conditions from Frisson (2015), which involved either switching or repeating the polysemous sense type, and accommodating these within the materials in the previous

experiment. The materials exhibited an *Adjective-Nominal-Adjective* syntax, in contrast to the above experiments. As such, the materials crossed the factors Copredication (Copredication vs. Non-Copredication) and First Adjective (Concrete vs. Abstract, or Dominant vs Subordinate, for both the complexity-based and frequency-based analyses, respectively). The condition First Adjective refers to the type of adjective appearing before the nominal. This condition allowed us to directly compare the Copredication conditions. As with previous experiments, all stimuli predicates and nominals were selected based on their SUBTLEX-UK Zipf frequency; the same nominals were used here as in the previous experiment, and a slightly expanded adjective list was required to accommodate the design (adjective averages: *book*-type: 4.1, *city*-type: 3.8, *lunch*-type: 3.8; no significant differences in frequency across adjectives: $F = 2.37, p > .05$; concrete adjectives: 3.92, abstract adjectives: 3.83, no significant differences in frequency: $t = .65, p = .25$; see meshugga.ugent.be/open-lexicons/interfaces/subtlex-uk). Table 9 depicts these conditions matched to their associated materials (see Appendix for full list):

	<i>Abstract First Adjective</i>	<i>Concrete First Adjective</i>
<i>Copredication</i> <i>(sense switching)</i>	Laura said that the brief breakfast was tasty and was worth the effort.	Laura said that the tasty breakfast was brief and was worth the effort.
<i>Non-Copredication</i> <i>(sense repetition)</i>	Laura said that the brief breakfast was interrupted and was worth the effort.	Laura said that the tasty breakfast was warm and was worth the effort.

Table 9: Sample experimental materials in Experiment 4, structured around the complexity-based framing.

The same fillers and comprehension questions from Experiment 2 were used, with some questions being modified to fit the modified experimental items.

3.7.1.3. Procedure

The procedure was identical to the previous acceptability judgement experiments.

3.7.1.4. Analysis

Focusing first on this chapter's major theme, we conducted 2 (Copredication: Non-Copredication vs Copredication) \times 2 (First Adjective: Concrete vs Abstract) \times 3 (Nominal Type: *book-*, *city-*, *lunch-*type) repeated measures by-subjects and by-items ANOVAs on participants' acceptability rating data. Examining the effect of sense order within the Copredication conditions alone, we then conducted paired t-tests within these two conditions, organising the data along *complexity* and *sense frequency* dimensions. Then, in order to test the sense frequency-based hypotheses, we re-aligned the data based on the sense frequency profile of the individual nominals and conducted 2 (Copredication) \times 2 (First Adjective: Dominant vs. Subordinate) ANOVAs.

3.7.2. Results

3.7.2.1. Comprehension Question Analysis

All participants scored above 80% on the comprehension questions.

3.7.2.2. Acceptability Judgement Data

Figure 6 plots the average scores for the four conditions, and Table 10 plots the scores across all nominal types.

For the ungrammatical and grammatical filler items, these scored an average of 1.6 and 5.6, respectively, indicating good participant performance.

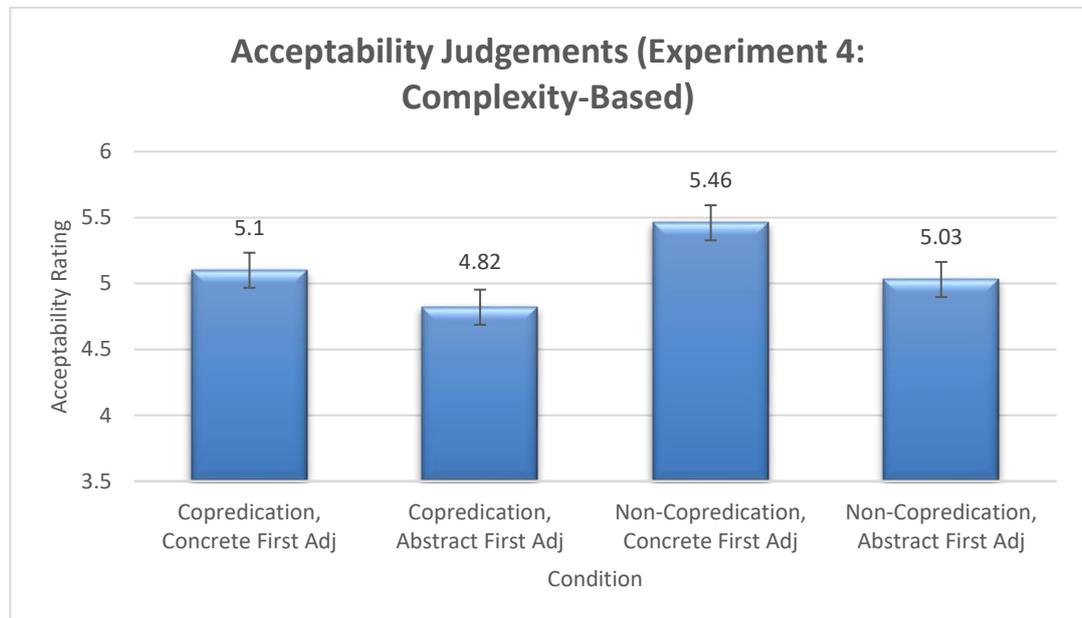
Complexity: Both the F1 and F2 analyses revealed significant effects of Copredication ($F(1,83) = 26.063, p = <.001$; F2: $F(1,11) = 16.198, p = .002$) and First Adjective ($F(1,83) = 34.596, p = <.001$; $F(1,11) = 25.996, p = <.001, \eta_p^2 = .725$) but no interaction (all p -values $>.05$). The copredication conditions were deemed less acceptable than the non-copredication conditions, and the Abstract First Adjective conditions were less acceptable than the Concrete First Adjective conditions.

Nominal Type: Turning to the Nominal Type analyses, a main effect of Nominal Type was found only for the F1 analysis (F1: $F(2,82) = 35.820, p = <.001$; F2: $F(2,10) = 3.935, p = .055$), but no interactions were found (all p -values $>.05$).

Examining the effect of sense complexity within the Copredication conditions, paired t-tests for these two conditions (framed around complexity: Concrete First Adjective, Abstract First Adjective) revealed a significant difference in acceptability ($t(35) = -2.92$,

$p = .005$, Shapiro-Wilk normality $p = .167$) such that placing the less complex adjective first resulted in increased acceptability. However, organising the data along the sense frequency axes (Dominant-Subordinate, Subordinate-Dominant) revealed no significant differences in acceptability ($t(35) = -0.05$, $p = .95$, Shapiro-Wilk normality $p = .066$).

Sense Frequency: The First Adjective (Dominant vs Subordinate) \times Copredication (Non-Copredication or Copredication) ANOVAs revealed only an effect of Copredication and no significant effects involving sense frequency, such that the ratings were higher for non-copredication than copredication (Copredication F1: $F(1,83) = 24.564$, $p = <.001$; Copredication F2: $F(1,35) = 16.136$, $p = <.001$; Frequency F1: $p = .39$; Frequency F2: $p = .60$; F1 Frequency \times Copredication: $p = .55$; F2 Frequency \times Copredication: $p = .57$).



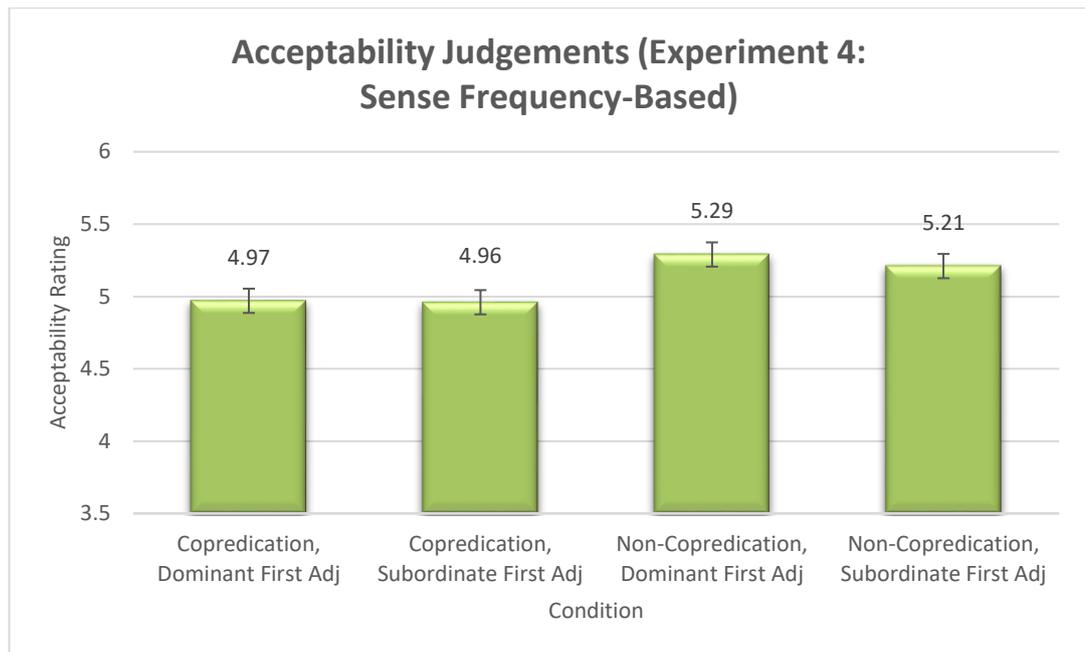


Figure 6: (Top) Average scores for the four experimental conditions (framed around complexity, where we found significant effects) with standard error bars. (Bottom) Average scores framed around sense-frequency with standard error bars.

Condition	Book-Type	City-Type	Lunch-Type
<i>Copredication, C</i>	4.96 (.13)	5.07 (.12)	5.27 (.17)
<i>Copredication, A</i>	4.56 (.13)	4.74 (.15)	5.18 (.11)
<i>Non-Copredication, C</i>	5.38 (.13)	5.26 (.18)	5.76 (.14)
<i>Non-Copredication, A</i>	4.86 (.14)	4.78 (.07)	5.46 (.18)

Table 10: Average acceptability scores (and standard errors) for all conditions (framed around complexity) across the three nominal types. C = Concrete First Adjective, A = Abstract First Adjective.

3.7.3. Discussion

The present results indicated an acceptability increase for sense repetition in *Adjective-Nominal-Adjective* constructions relative to sense switching. The cost that Frisson (2015) found for switching senses (copredication) relative to sense repetition (non-copredication) was replicated, and a preference for Concrete-Abstract switches relative to Abstract-Concrete switches was found. No effects of sense frequency were found on acceptability, suggesting the documented acceptability dynamics have a source beyond the domain of frequency.

Finding an effect of Copredication in both F1 and F2 analyses, unlike in the previous experiment, suggests that the nominal representation is more fixed by the point of the second adjective when it has previously been modified by an adjective that refers to a different sense of this nominal. Instead of having two consecutive predicates which are being associated with a nominal (as in *Nominal-Predicate-Predicate* structures), in this structure the nominal is already given a specific description being associated with another adjective. Indeed, Ortega-Andrés and Vicente (2019: 12) make a similar point when discussing Frisson's (2015) results, noting that the first adjective likely acts as a reference restrictor highlighting a particular property (either concrete or abstract) of the nominal, giving rise to certain expectations for subsequent material in the sentence. As such, the occurrence of the nominal still likely primes the alternative sense, as in the syntax used in previous experiments, but the effect seen in *Adjective-Nominal-Adjective* structures is due to reference restriction and expectations, supporting Frisson's (2015) original conclusion that the effects are likely pragmatic in nature.

While acceptability ratings may not directly map onto processing costs, and these studies may be exposing one of the many issues of comparing results from distinct methodologies, the present results for sense ordering/frequency are different to those reported in Frisson (2015). Yet the cost that Frisson (2015) found for switching senses relative to sense repetition was replicated here. It will be of interest to see if other syntactic structures replicate these dynamics; a topic addressed in the next chapter.

Lastly, the present results from the complexity-based analyses are also in line with the findings of Scorolli et al. (2011); namely, that Concrete-Abstract orderings will be more acceptable than the reverse orderings. We will return to this particular prediction in Chapter 4 (Experiment 9), and will aim to explore to what extent Scorolli et al.'s (2011) Concrete-Abstract preference can be used as a hypothesis for sense orderings (given that we have so far focused purely on contrasting concrete and abstract senses), or whether a more general framework invoking semantically simple or complex senses is preferable.

Moving forward, the next experiment will attempt to test the complexity-based and sense-frequency based accounts in a different language, exploring whether similar acceptability dynamics arise for a language other than English.

3.8. Experiment 5: Cross-Linguistic Properties of Copredication

In order to more thoroughly examine the sense frequency-based vs. complexity-based accounts of sense order effects, in this study we tested the acceptability of copredications in a language other than English. Indeed, since complexity-based acceptability accounts have not been tested before, broadening the range of languages tested seems essential before making any claims about its explanatory scope (e.g. are Concrete-Abstract preferences peculiar to English sentences involving coordinate structures?). Much is known about the various psycholinguistic properties of abstract and concrete words in Italian, such as their imageability and familiarity (see Della Rossa et al. 2010 for a comprehensive overview), and there is also an emerging understanding of the full range and scope of polysemy in Italian (Frontini et al. 2014), but no research has explored the *relation* between these polysemous concepts, most clearly exhibited in copredication. Since there is already some discussion in the literature concerning the frequency of complex polysemous nominals in Italian (Jezek & Vieu 2014, Jezek & Melloni 2011), an acceptability judgement experiment was carried out to explore, firstly, sense frequency in Italian complex polysemous nominals, and secondly, the effects of copredication and sense order in Italian. The former was investigated through a fill-in-the-blank paradigm, asking participants to describe a given nominal, as in ‘The book was ___’, in order to determine what the most frequently cited sense was. The latter was investigated through a (by now familiar) acceptability judgement task. Under sense frequency-based accounts, we expect to see a relation between the sense frequency of a given nominal (and nominal type) and the acceptability ratings of sentences involving these nominals which manipulate sense order. Under complexity-based accounts, we expect the sole determining factor of sense order acceptability to be the complexity of the senses.

Further, Russo and Caselli (2015) used corpus-based distributional information to propose a measure of eventivity in Italian nouns (i.e. to gauge when a given nominal is being used to refer to a particular event), however they also note that *translation*-type nominals allowing copredication between events and objects pose problems, due to the range of acceptability in complex polysemous nominals being unsettled in the literature. The present experiment, by also exploring event-object copredications, can potentially shed light on this issue.

3.8.1. Methods

3.8.1.1. Participants

92 participants (average age 30; age range 18-56; 45 female) were pooled from Prolific Academic based on them being native Italian speakers and having an approval rating on the site of at least 90%. Participants were paid £6 per hour, with the average finishing time being 21 minutes.

3.8.1.2. Materials

The experiment had two parts. The first was a fill-in-the-blank test and the second was an acceptability judgement test. In the first part, all participants were tasked with filling in a blank space to describe the 36 nominals to be used in the second part of the experiment. The nominals were translations of the ones used in Experiments 2 and 3. For example:

- (1) Il periodico era ____ ‘*The magazine was*’
La pubblicazione era ____ ‘*The publication was*’
L’antipasto era ____ ‘*The appetizer was*’
Il picnic era ____ ‘*The picnic was*’

The second part was an acceptability judgement task, using a 1-7 Likert scale. Since the primarily theoretical focus centred on whether the sense order effects found in English occur in Italian, the materials from Experiment 3 (leaving out the counterbalancing items) were translated such that a simple *book*-type, *city*-type and *lunch*-type set would be realised as:

- (1) John disse che il *pesante e divertente* **libro** era sul tavolo.
John disse che il *divertente e pesante* **libro** era sul tavolo.
John disse che il *pesante* **opuscolo** e il *divertente* **libro** erano sul tavolo.
John disse che il *divertente* **opuscolo** e il *pesante* **libro** erano sul tavolo.
- (2) Sarah pensò che *l’inquinata e reazionaria* **città** fosse uno spettacolo per gli occhi.
Sarah pensò che la *reazionaria e inquinata* **città** fosse uno spettacolo per gli occhi.
Sarah pensò che *l’inquinato* **quartiere** e la *reazionaria* **città** fossero uno spettacolo per gli occhi.
Sarah pensò che il *reazionario* **quartiere** e *l’inquinata* **città** fossero uno spettacolo per gli occhi.

- (3) Mary disse che il *saporito* e *rinviato* **pranzo** era degno dell'attesa.
 Mary disse che il *rinviato* e *saporito* **pranzo** era degno dell'attesa.
 Mary disse che la *saporita* **pietanza** e il *rinviato* **pranzo** era degno dell'attesa.
 Mary disse che la *rinviata* **pietanza** e il *saporito* **pranzo** era degno dell'attesa.

Hence, the factors Copredication (Copredication vs Non-Copredication) and Sense Order (Concrete-Abstract vs Abstract-Concrete) were used. 36 stimuli sets (composed of 12 sets of *book*-, *city*- and *lunch*-type sentences) were used and presented to participants via Qualtrics, along with a series of 52 filler sentences (36 ungrammatical and 16 grammatical) translated directly from the fillers in Experiment 2. The 36 experimental stimuli sets were divided into 4 lists, and each participant saw 36 experimental sentences, 52 fillers and 11 comprehension questions randomly inserted amongst experimental and filler items. Both parts of the experiment were forced-choice/entry, such that participants needed to select an option (in the second part), or type an answer (in the first part), in order to proceed.

3.8.1.3. Analysis

For the fill-in-the-blank task, the adjectival responses were coded for their sense in order to be plotted in the below table, and then were categorised as either concrete or abstract for the purposes of analysis. A number of ambiguous responses were found for 18 of the 36 nominals (range: 6-17; average: 10.7) and so these were excluded when calculating dominance profiles (see Appendix for the list of nominals with ambiguous responses). A binomial logistic regression was performed using SPSS 27 to ascertain the effects of nominal and nominal type on the likelihood that the dominant sense would be either abstract or concrete, with nominal type being the predictor and the type of the dominant sense (abstract or concrete) the predictee.

For the acceptability judgement data, we conducted 2 (Copredication) \times 2 (Sense Order) \times 3 (Nominal Type) repeated measures by-subjects and by-items ANOVAs on participants' acceptability rating data. We also ran 2 (Frequency) \times 2 (Copredication) ANOVAs following the procedure noted in Experiment 3 (i.e. aligning the item sets based on their frequency profile whilst accommodating any exceptions to the frequency trend, in this case *pubblicazione*, *società* and *periodico*).

3.8.2. Results

3.8.2.1. Comprehension Question Analysis

All participants scored above 80% on the comprehension questions.

3.8.2.2. Sense Frequency Data

The results are plotted in Table 11. What follows is a review of some notable responses.

NOMINAL	DOMIN.	SUBORD.	% DOM.	NOMINAL	DOMIN.	SUBORD.	% DOM.
<i>Video/Video</i>	INFO	PHYS	98.9	<i>Ristorante/Restaurant</i>	PHYS	INST	72.0
<i>Bolletta/Bill</i>	INFO	PHYS	98.9	<i>Scuola/School</i>	PHYS	INST	70.6
<i>Traduzione/Translation</i>	INFO	PHYS	98.8	<i>Cinema d'essai/Arthouse</i>	PHYS	INST	66.3
<i>Romanzo/Novel</i>	INFO	PHYS	90.2	<i>Pubblicazione/Publication</i>	INFO	PHYS	82.6
<i>Pubblicità/Advert</i>	INFO	PHYS	80.2	<i>Società/Company</i>	INST	PHYS	95.2
<i>Esame/Exam</i>	INFO	PHYS	70.6	<i>Periodico/Journal</i>	INFO	PHYS, INST	56.4
<i>Opuscolo/Pamphlet</i>	INFO	PHYS	68.4	<i>Banchetto/Banquet</i>	PHYS	EVENT	95.6
<i>Messaggio/Message</i>	INFO	PHYS	66.6	<i>Colazione/Breakfast</i>	PHYS	EVENT	93.4
<i>Libro/Book</i>	INFO	PHYS	63.1	<i>Dolce/Dessert</i>	PHYS	EVENT	92.3
<i>Lettera/Letter</i>	INFO	PHYS	58.7	<i>Grigliata/Barbecue</i>	PHYS	EVENT	91.3
<i>Giornale/Newspaper</i>	INFO	PHYS, INST	57.1	<i>Brunch/Brunch</i>	PHYS	EVENT	90.2
<i>Dizionario/Dictionary</i>	INFO	PHYS	51.0	<i>Convito/Feast</i>	PHYS	EVENT	89.3
<i>Biblioteca/Library</i>	PHYS	INST	94.5	<i>Cena/Dinner</i>	PHYS	EVENT	88.0
<i>Struttura/Construction</i>	PHYS	EVENT	93.8	<i>Antipasto/Appetiser</i>	PHYS	EVENT	86.9
<i>Edificio/Building</i>	PHYS	INST	92.3	<i>Pranzo/Lunch</i>	PHYS	EVENT	85.0
<i>Banca/Bank</i>	PHYS	INST	84.7	<i>Picnic/Picnic</i>	PHYS	EVENT	84.7
<i>Città/City</i>	PHYS	POP, INST	74.7	<i>Pasto/Meal</i>	PHYS	EVENT	83.5
<i>Paese/Town</i>	PHYS	POP	73.4	<i>Cenome/Supper</i>	PHYS	EVENT	82.8

Table 11: Average scores for the fill-in-the-blank norming study. ‘Domin.’ denotes the dominant sense, ‘Subord.’ denotes the subordinate sense, ‘% Dom.’ denotes the percentage of dominance exhibited by the dominant sense. The nominal types were grouped by the following colours: Yellow: Book-type, Green: City-type, Purple: Lunch-type. Deviations from the trend are highlighted in yellow.⁶⁶

A binomial logistic regression was performed to ascertain the effects of nominal type on the likelihood that the dominant sense would be either abstract or concrete, with nominal type being the predictor and sense dominance the predictee. The logistic regression model was statistically significant ($\chi^2(35) = 1225.052, p < .001$) such that the type of nominal could predict the category of the dominant sense. The model explained 52.3% (Nagelkerke R^2) of the variance in sense dominance (-2 Log likelihood: 2138.359) and

⁶⁶ Note that *pubblicazione* is technically an exception to the dominance trend too (and was therefore taken into account when conducting the Frequency \times Copredication analyses), but it is likely more accurately characterised as a *newspaper*-type nominal, and was only categorised as a *city*-type nominal here due to its role in the present acceptability judgement experiment which involved an institutional predicate rather than an informational predicate. Due to this, it remains unhighlighted in the table.

correctly classified 80.9% of cases. This allows us to predict, with a certain degree of confidence, that a randomly selected Italian nominal of, for instance, *city*-type, would be PHYSICAL-dominant.

Every *book*-type nominal in Italian was INFORMATION-dominant. For *city*-type nominals, most were found to be PHYSICAL-dominant, with the exception of *società* and *periodico*. Finally, all *lunch*-type nominals were found to be heavily PHYSICAL-dominant. Overall, the sense frequency profiles for these Italian nominals is very similar to those of English nominals.

3.8.2.3. Acceptability Judgement Data

Figure 7 presents the average ratings for each condition. Repeated measures ANOVAs were carried out using SPSS Statistics 27 ($\alpha = 0.05$).

Complexity: F1 and F2 ANOVAs both revealed a significant effect of Sense Order, such that Concrete-Abstract items were more acceptable than Abstract-Concrete items, but no effect of Copredication and no interaction effects (Sense Order F1: $F(1,91) = 13.373, p = <.001$; Sense Order F2: $F(1,11) = 14.356, p = .003$; Copredication F1: $F(1,91) = 1.844, p = .178$; Copredication F2: $F(1,11) = .948, p = .351$; Copredication \times Sense Order F1: $F(1,91) = 1.468, p = .229$; Copredication \times Sense Order F2: $F(1,11) = 1.047, p = .328$).

Nominal Type: Neither the F1 nor F2 analyses revealed any significant effects of Nominal Type nor an interaction (Nominal Type F1: $F(1,91) = 1.33, p = .251$; Nominal Type F2: $F(2,10) = 1.31, p = .312$; F1 and F2 interactions: all $F_s < 1$). Table 12 plots the condition scores across nominal types.

Sense Frequency: The Frequency \times Copredication ANOVAs revealed no main effects nor interactions (Frequency F1: $F(1,91) = .407, p = .525$; Frequency F2: $F(1,35) = .098, p = .756$; Copredication F1: $F(1,91) = .878, p = .351$; Copredication F2: $F(1,35) = .076, p = .784$; Frequency \times Copredication F1: $F(1,91) = .126, p = .723$; Frequency \times Copredication F2: $F(1,35) = .007, p = .027$).

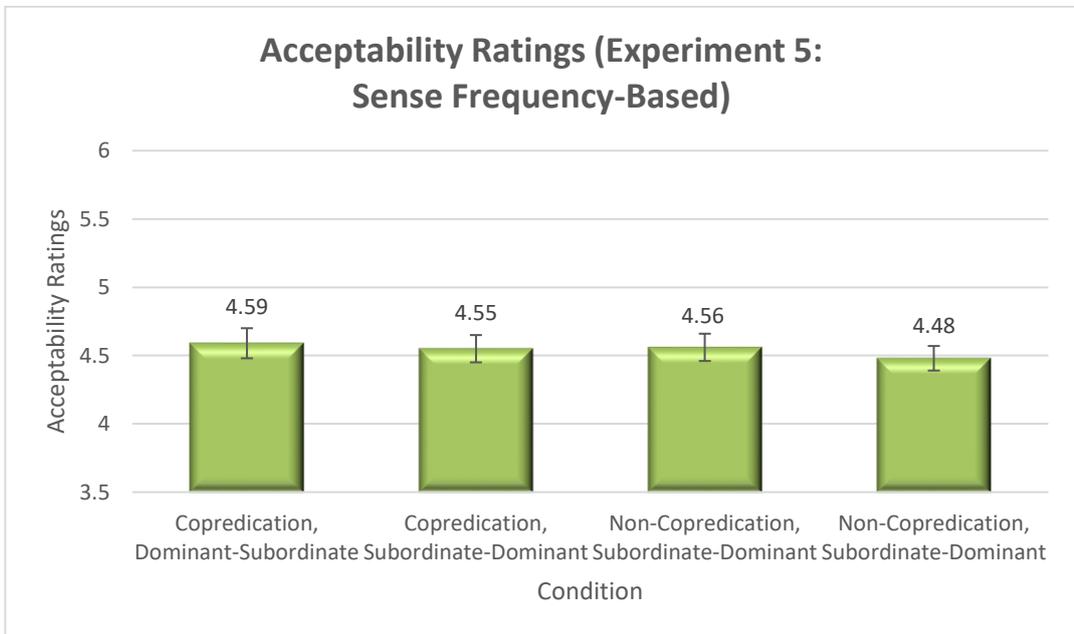
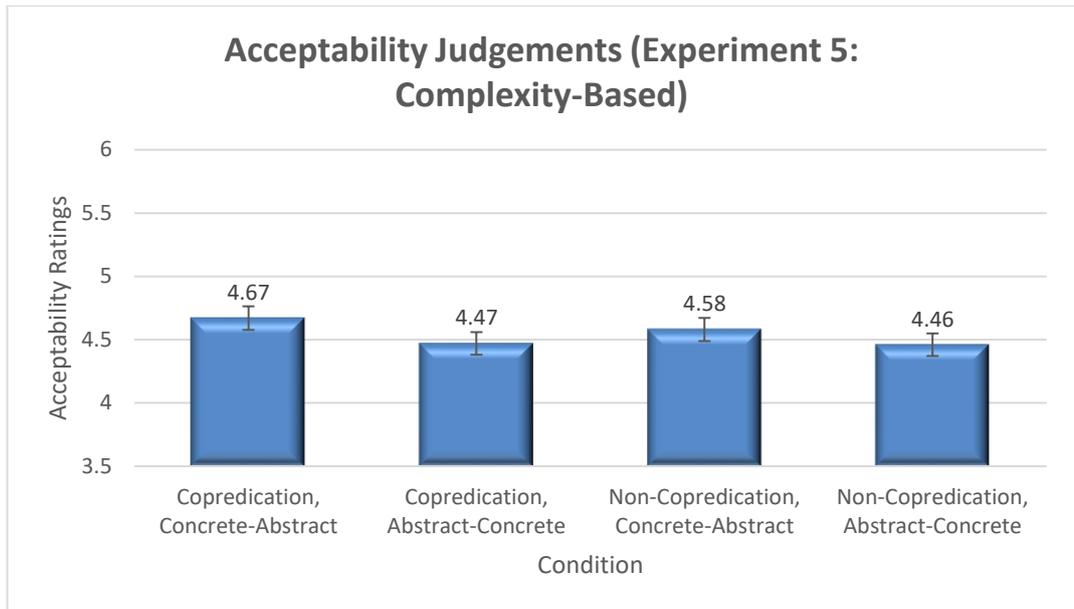


Figure 7: Average scores for the four experimental conditions framed by complexity (Top) and sense frequency (Bottom) with standar error bars.

Condition	BOOK-TYPE	CITY-TYPE	LUNCH-TYPE
<i>Copredication, C-A</i>	4.71 (.11)	4.64 (.10)	4.66 (.10)
<i>Copredication, A-C</i>	4.31 (.08)	4.49 (.09)	4.61 (.10)
<i>Non-Copredication, C-A</i>	4.62 (.10)	4.59 (.10)	4.54 (.09)
<i>Non-Copredication, A-C</i>	4.54 (.09)	4.40 (.08)	4.45 (.08)

Table 12: Average acceptability scores (and standard errors) for all conditions across the three nominal types. C-A = Concrete-Abstract, A-C = Abstract-Concrete.

3.8.3. Discussion

In the same way that Jezek and Vieu (2014) conjecture in their corpus-based distributional analysis of Italian copredication that “a *variety* of copredication contexts appearing with enough regularity might constitute evidence” for the existence of a genuine complex type, the present experiment aimed to show that the existence of a variety of coordinate structures which adhere to Concrete-Abstract sense order preferences constitutes evidence for the complexity-based account. The acceptability judgement data adheres strongly to the predictions of a complexity-based account, although as with the previous experiments the effect of Sense Order was not unique to copredication. Just as Scorolli et al. (2011) discovered Concrete-Abstract preferences for both German and Italian, our results replicate the findings from previous experiments and discovered a Concrete-Abstract preference for both English and Italian. It appears that the parser may exhibit a complexity-based bias, general to English and Italian and likely other languages (we will interrogate this notion further towards the end of this chapter). In addition, the sense frequency-based accounts are not supported by the results, with the three Italian nominal types differing in their sense dominance profiles yet all adhering to Concrete-Abstract sense order preferences, and the Frequency \times Copredication F1 and F2 ANOVAs revealing no significant effects. Differences between distinct nominal types were also not consistent across the experiments.

These findings expand on work by Srinivasan and Rabagliati (2015), who explored whether 27 distinct cases of polysemy in are present in 14 other languages. These authors found that they indeed were, indicating that polysemy likely arises from conceptual constraints rather than arbitrary, language-specific conventions. There was found to be no interaction effect between nominal type and the other factors, and so while the nominals exhibited distinct sense frequency profiles they nevertheless exhibited a Concrete-Abstract preference. *Book*-type nominals were found to be abstract-dominant, as in English, and also exhibited a Concrete-Abstract preference; the other nominal types were concrete-dominant, as in English, and adhered to the same ordering preference.

Lastly, all experimental conditions in the experiments presented thus far have used the most basic copredicated nominals (see the Copredication Hierarchy; see Chapter 2.3.4). It is possible that we will observe a clearer effect of copredication as we move up the

Copredication Hierarchy. We will turn to this in the next chapter, where we will investigate a wider range of copredications and sentence types.

3.9. Summary and Implications: *Incremental Semantic Complexity*

Overall, these experiments suggest that there is an effect of sense order on acceptability, but one which is not unique to copredication. With respect to the effect of copredication, the results from Experiments 1 and 4 suggested that the putative processes involved in generating copredication (reviewed in Chapter 2) do not lead to acceptability impairments, and as such they provided support for the One Representation Hypothesis. Pustejovsky and Jezek's (2008) claim about the inexpensive nature of copredication processing seems to be supported. By maintaining that no single sense of a polysemous word is activated to a greater extent than others, the underspecification account was also supported by the Copredication/Non-Copredication analysis, since attributing two distinct senses to a single nominal was deemed no less acceptable than attributing them to two nominals. Therefore, copredication is not expected to incur additional costs compared to non-copredication. Even though we did observe lower acceptability ratings for copredicated sentences relative to non-copredicated controls in Experiments 2 and 3, this was only the case for the by-subjects analysis. In addition, the effect of copredication found in Experiments 2 and 3 might be captured by the possibility that people prefer two nominals compared to one nominal, as the Experiment 1 average scores indicated (though not reaching significance). As such, it may not be an effect of 'Copredication' (as we classified it in the analysis) but rather nominal number. Lastly, sense switching was found to be costly not purely in relation to copredication, but also non-copredication, suggesting that sense order dynamics cannot be used to adjudicate between ORH and SEL accounts; instead, it seems that the most powerful tool in this respect is the copredication/non-copredication contrasts.

Experiments 3 and 4 failed to find evidence supporting sense frequency-based models of copredication acceptability and also Fully Specified ORH models, and they instead support models focused on the semantic complexity of the senses involved, such as the complexity-based Underspecification ORH model discussed earlier in this chapter. In particular, the more specific hypothesis of Concrete-Abstract sense order preferences was supported, compatible with the more specific complexity-based Underspecification ORH model. Since sense frequency played no role in acceptability dynamics, this speaks against

the Sense Enumeration Lexicon hypothesis, in particular the claim in Klein and Murphy (2001) that related senses are stored separately in the lexicon and consequently exhibit frequency effects, with the more frequent sense being more easily available, thus impacting acceptability when the order of both senses is manipulated. Instead, our results accord well with those reported in Frisson and Pickering (1999) and Frisson and McElree (2008). In particular, our results add to their findings (i.e. that frequency does not modulate metonymy or complement coercion processing) the further indication that frequency also does not impact polysemous sense order processing; a conclusion already proposed in Frazier and Rayner's (1990) eye-tracking study, which found an effect of frequency on homonymy but not polysemy comprehension. Table 13 below summarises the main findings of Experiments 1-5:

Experiment	Design	Sample Stimuli	Nominal Number Effect	Sense Type Effect	Nominal Number × Sense Order Interaction	Nominal Type Effect
1	Nominal Number (1 or 2) Sense Type (Same or Different)	Mel read that the [<i>huge/respected</i>] and <i>acclaimed school</i> was praised by her best friend. Mel read that the [<i>huge/respected</i>] <i>college</i> and <i>acclaimed school</i> were praised by her best friend.	No	<u>Yes</u> (F1 + F2): effect of Sense Type); Different < Same	No	No
	Design	Sample Stimuli	Copredication Effect	Sense Order Effect	Copredication × Sense Order Interaction	Nominal Type Effect
2	Copredication (Yes or No) Sense Order (Concrete-Abstract or Abstract-Concrete)	John said that the <i>interesting</i> [Ø/ <i>pamphlet</i>] and <i>heavy book</i> [was/were] on the table. John said that the <i>heavy</i> [Ø/ <i>pamphlet</i>] and <i>interesting book</i> [was/were] on the table.	<u>Yes</u> (F1): Copredication < Non-Copredication	<u>Yes</u> (F1): Abstract-Concrete < Concrete-Abstract	No	N/A
3	Copredication (Yes or No) Sense Order (Concrete-Abstract or Abstract-Concrete)	Molly read that the <i>lengthy</i> [Ø/ <i>meal</i>] and <i>organic brunch</i> [was/were] in the cafeteria. Molly read that the <i>organic</i> [Ø/ <i>meal</i>] and <i>lengthy brunch</i> [was/were] in the cafeteria.	<u>Yes</u> (F1): Copredication < Non-Copredication	<u>Yes</u> (F1): Abstract-Concrete < Concrete-Abstract	No	No
4	Copredication (Yes or No) First Adjective (Concrete or Abstract)	Laura said that the <i>brief</i> / <i>breakfast</i> was [<i>tasty/interrupted</i>] and was worth the effort. Laura said that the <i>tasty</i> / <i>breakfast</i> was [<i>brief/warm</i>] and was worth the effort.	<u>Yes</u> (F1 + F2): Copredication < Non-Copredication	<u>Yes</u> (F1 + F2): Abstract First < Concrete First	No	<u>Yes</u> (F1)
5	Copredication (Yes or No) Sense Order (Concrete-Abstract or Abstract-Concrete)	Mary disse che [il/la] <i>rinvitato</i> [Ø/ <i>pietanza</i>] e [Ø/il] <i>saporito pranzo</i> era degno dell'attesa. Mary disse che [il/la] <i>saporito</i> [Ø/ <i>pietanza</i>] e [Ø/il] <i>rinvitata pranzo</i> era degno dell'attesa.	No	<u>Yes</u> (F1 + F2): Abstract-Concrete < Concrete-Abstract	No	No

Table 13: Summary of experimental design and results. ‘>’ and ‘<’ denote, respectively, more acceptable than and less acceptable than.

We will now outline the core characteristics of what will be presented as the approach to copredication adopted here, supported by the current empirical evidence. It appears that a general, stepwise parsing preference may be needed to account for sense order effects in acceptability dynamics. While Ortega-Andrés and Vicente (2019), Liebesman and Magidor (2017), Copestake and Briscoe (1995), Asher (2011, 2015), Gotham (2015a,b), Arapinis (2013, 2015), Nunberg (1995), Chatzikyriakidis and Luo (2015, 2018), Xue and Luo (2012) and others have provided a range of insights into the nature of copredication, no current research has tested predicate ordering and/or coherence relations as being the determinant(s) of copredication acceptability. In order to formalise the part of this observation relating to predicate ordering, we will propose that the parser generally exhibits the following preference:

Incremental Semantic Complexity

Seek to process linguistic representations in incremental stages of semantic complexity.

In the present chapter, initial support has been provided for this generalisation, such that the parser appears to prefer semantically more complex objects to be accessed after less complex objects. Nevertheless, offline acceptability ratings are an indirect measure of any component of parsing/processing effort, and so the present results should be seen as an initial attempt at constructing a psycholinguistic framing for copredication rather than any robust measure of online comprehension. *Incremental Semantic Complexity* could potentially be implemented in a number of ways, which we will discuss further in subsequent chapters. For instance, it could be implemented via priming effects on polysemous senses, such that the simpler senses prime more complex senses to a greater degree than complex senses prime simpler senses. If the effects of predicate ordering were either non-existent or slight with respect to copredication licensing, then it could be argued that this is a peripheral phenomenon which could likely be derived from a more fundamental component of language (perhaps syntax or pragmatics). However, the current evidence suggests that predicate ordering can have substantial effects on copredication; yet, its full scope remains unclear.

4. *Anaphora and Complexity in Copredication*

The present chapter continues the focus of Chapter 3 by reporting four acceptability judgement experiments which examine the effects of copredication and sense order. We will focus on cases of copredication which involve the most semantically complex senses, assuming the complexity hierarchy discussed in Chapter 2 (see Chapter 2.3.4). These senses, co-occurring with other complex senses (e.g. INSTITUTION being copredicated with EVENT), produce forms of copredication which occupy the higher types in the Copredication Hierarchy.⁶⁷ In addition, we will test explicit cases taken directly from the literature, bringing our investigation into closer contact with existing accounts.

In Experiment 6, we move to the most complex nominals and senses licensing copredication (in particular, institutional copredications) and use sentences with a different syntax to previous experiments. This choice of syntax change becomes more relevant in the context of the findings documented in Chapter 3, where we found different dynamics for Predicate-Predicate-Nominal syntax and Predicate-Nominal-Predicate syntax. The materials and structure of Experiment 6 are then used to form Experiments 7 and 8, which explore anaphora, comparing anaphoric copredication both with non-copredication and the standard forms of copredication explored in Experiment 6. This constitutes an exploratory study into a form of copredication that has not been extensively studied. Further, some authors have discussed copredication examples without making an explicit distinction between copredications with and without pronominal anaphora (e.g. Haspelmath 2007, Liebesman & Magidor 2019, Pustejovsky & Batiukova 2019). For instance, Pustejovsky and Batiukova (2019: 176, 299) treat *lunch-* and *book-*type

⁶⁷ In English, the use of such complex predicates necessitates a Nominal-Predicate-Predicate syntax, regardless.

copredications with and without pronominal anaphora as equivalent, but it is not clear that these have the same acceptability profiles. Finally, in order to address some earlier concerns raised in Chapter 3, Experiment 9 attempts to test whether *Incremental Semantic Complexity* may in fact constitute a Concrete-Abstract preference, or whether a more general Simple-Complex ordering dynamic based on semantic complexity is more empirically adequate.

For both Experiments 6 and 9, a measure of coherence is provided and used to determine if copredication acceptability correlates with coherence (Experiments 7-8 were excluded given that these used the same or very similar variations on Experiment 6 materials). In Chapter 3, the predicates were placed before the nominal, and we did not find coherence significantly covarying with copredication acceptability. In the present chapter, we will be using complex (multi-word) predicates which will be placed after the nominals, and it may be that the more complex predicates help generate stronger coherence relations. Even though causal connections and extensional overlaps can certainly be inferred from pairs of single adjectives, it is likely the case that more complex predicates will make any coherence relation more explicit and clearer (indeed, the coherence relations literature reviewed in Chapter 2.3.3 exclusively uses multi-word predicates as examples).

While the experiments in the previous chapter allowed us to test storage accounts of polysemy (ORH and SEL) and the acceptability of associating two distinct predicates with a subsequent nominal, the present chapter will present the nominal *before* the predicates. As such, this will allow us to more easily relate our findings (albeit indirectly, as mentioned) to processing accounts, such as the various underspecification accounts, since these accounts require the appearance of the nominal in order for certain senses to be underspecified to begin with. That is to say, it is likely that any results emerging from testing sentences with the predicates *after* the nominal will reflect processes less involved in lexical storage/access than in processing nominal-predicate relations.

4.1. Experiment 6: Higher Copredicated Types

The central goal of this experiment was to determine whether more complex forms of copredication produce a clearer effect on a sentence's acceptability. In this experiment, the most complex forms of copredication were tested, such as *newspaper*, *town*, *school*,

church and *city*. As such, there was only a small degree of overlap between the nominals used in this experiment and the previous experiments. In particular, care was taken to replicate as many direct examples from the theoretical literature as possible – all of which placed the nominal before the predicates, shifting the syntax of the experimental items from the *Predicate_X–Predicate_Y–Nominal* syntax of the previous experiments. The predicates themselves were entirely different from the ones used in the previous experiments, not being restricted to single adjectives. They included adjectives (*difficult*), verb phrases (*founded in 1850*), quantifier phrases (*500,000 inhabitants*) and prepositional phrases (*next to the river*). As in Experiments 2 and 3, we manipulated the Sense Order of the predicates (Abstract-Concrete vs. Concrete-Abstract) and their Sentence Type (Copredication vs. Non-Copredication).⁶⁸ Table 14 depicts the design of these materials.

	<i>Concrete-Abstract</i>	<i>Abstract-Concrete</i>
<i>Copredication</i>	The newspaper is on the top shelf and was founded in 1850.	The newspaper was founded in 1850 and is on the top shelf.
<i>Non-Copredication</i>	The newspaper is on the top shelf and the magazine was founded in 1850.	The newspaper was founded in 1850 and the magazine is on the top shelf.

Table 14: Sample experimental materials in Experiment 6.

As discussed above, it is possible that the levels of acceptability of copredication relative to non-copredicated controls will diverge further as we move up the Copredication Hierarchy. Therefore, a prediction for this experiment was that there would be a clearer effect of copredication than that found in the experiments we have reported so far. Further, the *Incremental Semantic Complexity* hypothesis also predicts that sense order modulates acceptability such that delaying the more semantically complex, abstract polysemous sense would result in increased acceptability.

As indicated, particular emphasis was placed on INSTITUTION-denoting nominals. These nominals have been approached in the literature most notably by Arapinis (2013)

⁶⁸ ‘Sentence Type’ was used instead of ‘Copredication’ (the factor name in Chapter 3) because not all experiments in this chapter contained structures widely agreed to involve copredication, i.e. those involving anaphora.

and Jezek (2016). Arapinis discusses institutions in terms of their ontologically constant existential dependence and constitution, i.e. that they can exist independently of any physical manifestation. Arapinis claims that the multiple senses of institutional entities are “clustered in a symmetric structure” (2013: 35) via a single lexical representation.⁶⁹ He adds that “[t]he abstract institutional status, the population affiliated to institutions, and the buildings housing institutional activities, are inherent aspects of the concept of institution” (Ibid). Jezek (2016) notes that these institution-denoting nominals are capable of hosting ‘functional locations’, which are (originally) designed for the performance of certain activities. For instance, under standard Generative Lexicon assumptions, in ‘John attends church’ the nominal references the activity specified in its Telic quale, being interpreted as ‘church service’. But while the formal properties of these nominals are beginning to be understood, little is known about their acceptability profiles.

Lastly, a final goal of the present experiment (and also Experiments 7 and 8) was to test the sense frequency-based and complexity-based accounts, in the manner done in the previous chapter. The sense frequency profiles of the nominals, and their concomitant predictions for each account, will be discussed below. In Chapter 3, the documented differences in Nominal Type acceptability might be able to be derived from Norming Study 1, which exhibited the following acceptability profile: *book* > *city* > *lunch*. As such, we might be able to explain the differences in acceptability across nominal types from this basic finding. Yet this explanation only obtains for those experiments using the adjectival coordinations from the Norming Studies, and the present chapter will use an entirely new set of predicates. Hence, there is considerable motivation for conducting Nominal Type ANOVAs and Frequency ANOVAs in this chapter, since these allow us to further test the sense frequency-based hypotheses in greater depth.

4.1.1. Methods

4.1.1.1. Participants

⁶⁹ This hypothesis ties in with Lang and Maienborn’s (2011: 719) interesting proposal that institutional nominals appear to have a common purpose semantic feature, with the senses enveloping *schools* and *banks* and *shops* ultimately being centred on a core lexical meaning: “[A] legal entity that organizes purposeful events to be performed and/or received by authorized groups of persons in specific locations”. See also McCready (2006).

Data from 88 participants was analysed (mean age = 30; range = 18-58; 55 male). As in the first three experiments, participants were paid £6 per hour, with the average finishing time being 16 minutes. The exclusion criteria for participants were identical to the previous experiments.

4.1.1.2. Materials

36 experimental sets (12 *newspaper*-type, 12 *city*-type, 12 *school*-type) of four sentences were constructed, manipulating Sentence Type (Copredication vs. Non-Copredication) and Sense Order (Concrete-Abstract vs. Abstract-Concrete). In this experiment, we included a number of sentences taken directly from the literature on copredication (most of which were already discussed in Chapter 2), and the remaining sentences were closely modelled on these (see Appendix). As with previous experiments, all nominals were selected based on their SUBTLEX-UK Zipf frequency (nominal averages: *newspaper*-type: 4.2, *city*-type: 4.5, *school*-type: 4.4; no significant differences in frequency across nominals for one-way ANOVA: $F = 0.31, p = .73$); predicates were complex, multi-word structures so no frequency data was available. Nominals were also controlled for character length (nominal averages: *newspaper*-type: 8, *city*-type: 6.5, *school*-type: 7; no significant differences across nominals for one-way ANOVA: $F = 1.11, p = .34$). A small number of items (6 in total: 2 *newspaper*-type, 2 *city*-type, 2 *school*-type) did not contain a concrete sense but rather two abstract senses of distinct levels of semantic complexity (e.g. 4 and 5 below). Since pre-nominal adjectival coordination rarely permits the licensing of copredications high in the type hierarchy (compare ‘John read the funny and red book’ to ‘#John read the funny and sued newspaper’), the present stimuli were unlike those used in the previous experiments and were of the ‘*The X was A and B*’ kind in the Copredication conditions and ‘*The X was A and the Y was B*’ in the Non-Copredication conditions. The same 36 fillers used for Experiment 3 were used, and 26 comprehension questions were inserted randomly to both fillers and experimental items.

The following 6 sets of stimuli were derived from specific examples used in the copredication literature (see Chapter 2). The (b) examples involve placing the abstract sense before the less complex sense.

- (1) a. The bank used to be a police station and is FTSE-100 listed.
b. The bank is FTSE-100 listed and used to be a police station.

- c. The bank used to be a police station and the supermarket is FTSE-100 listed.
 - d. The bank is FTSE-100 listed and the supermarket used to be a police station.
- (Gotham 2015a)

- (2) a. The translation lies on the table and was difficult.
- b. The translation was difficult and lies on the table.
 - c. The translation lies on the table and the book was difficult.
 - d. The translation was difficult and the book lies on the table.
- (Brandtner 2009)

- (3) a. The city has 500,000 inhabitants and outlawed smoking in bars last year.
- b. The city outlawed smoking in bars last year and has 500,000 inhabitants.
 - c. The city has 500,000 inhabitants and the town outlawed smoking in bars last year.
 - d. The city outlawed smoking in bars last year and the town has 500,000 inhabitants.
- (Asher 2011)

- (4) a. The school starts at 9am and hired a new teacher.
- b. The school hired a new teacher and starts at 9am.
 - c. The school starts at 9am and the gym hired a new teacher.
 - d. The school hired a new teacher and the gym starts at 9am.
- (Dölling, Forthcoming)

- (5) a. The dissertation yellowed with age and is thought-provoking.
- b. The dissertation is thought-provoking and yellowed with age.
 - c. The dissertation yellowed with age and the book is thought-provoking.
 - d. The dissertation is thought-provoking and the book yellowed with age.
- (Norrick 1981)

- (6) a. The door was painted red and walked through by John.
- b. The door was walked through by John and painted red.
 - c. The door was painted red and the arch was walked through by John.

d. The door was walked through by John and the arch was painted red.
(Cruse 1986)

In addition to these sets derived from the literature, the remaining experimental stimuli were constructed using nominals of similar types on the Copredication Hierarchy. The nominals used in the present experiment were not only an almost entirely different set from those used previously, but even when the same nominal was used for the present study the more complex senses were accessed.

A major change in nominal types from the previous chapter was the replacement of *lunch*-type nominals with the more complex *school*-type nominals like *church* and *gym* (which, like *lunch*-type nominals, permit event and physical readings, but also social/institutional readings). These, like *lunch*-type nominals, are also concrete-dominant, and so the only nominal type that was abstract-dominant was the new *newspaper*-type (see below).⁷⁰ The list of *school*-type items was constructed based on their ability to host a combination of physical, event and institutional senses, and so to broaden our empirical coverage we included a subset of *door*-type items (permitting event and physical readings through their APERTURE sense) to address claims made in the literature about these items permitting acceptable, non-anomalous copredications (i.e. these were grouped with *school*-type items, since they crucially involved the same predicate types of eventive and concrete readings). Relatedly, the *book*-type category from the previous chapter was replaced with *newspaper*-type nominals, permitting combinations of physical, informational and institutional readings.

4.1.1.3. Procedure

The experimental procedure was identical to the first two experiments.

4.1.1.4. Analysis

The analysis procedure was identical to Experiment 5. As with Experiment 1 and 3, in addition to the main analysis a measure of coherence for the copredication items was also gauged by conducting a separate norming study. The same studies were conducted as in the previous chapter, gauging the commonality of the predicates (*extensional overlap*) and

⁷⁰ Note that *school* is abstract-dominant (see Norming Studies in the previous chapter), but the vast majority of other physical-event-institutional nominals are concrete-dominant.

the sense of causal relation between the predicates (*causal connection*). The items from the present experiment were used in the same coherence norming experiments as the ones reported in Chapter 3, and the procedure and exclusion criteria were identical to the main experiment.

For the extensional overlap study, participants were told that they would be presented with two statements which describe a range of objects, qualities and events. They were told to rate them on a scale from 1-7, with 1 being ‘Not related at all’, 4 being ‘Unsure’, and 7 being ‘Highly related’. Participants were instructed that since the following descriptions of X involve science, and also involve teaching, they might rate this as 6 or 7:

X is a Chemistry department.

X has 300 science students.

They were also given the following example item:

X employed two new managers.

X opened all evening.

They were told that since these descriptions of X both seem to relate to some form of organisation or management but it is not made clear how, we might rate this as a 4 or 5.

For the causal connection study, participants were tasked with judging to what extent one part of a sentence is a consequence of another part, using a scale from 1-7, with 1 being ‘Highly unlikely’, 4 being ‘Unsure’, and 7 being ‘Highly likely’. As an example, they were told that in ‘The man was fired from his job and was unhappy’, it is likely that the man could be unhappy *because* he has been fired, and that they could therefore rate the item as 7. In the case of ‘Mary said the lunch was tasty and in an expensive restaurant’, they were told that it may be that the lunch was tasty *because* of the quality of the restaurant, or it may be that it was tasty for some other reason. In this case, it is not completely clear that the parts of the sentence are related in this way, and so they were told that it might be rated as 4 or 5.

Lastly, for the causal connection study, because the order of segments in coherence relations can impact the sense of causality (see discussion in Chapter 2), we presented

both sense orders for the copredicated items and generated an average coherence score from both orders. A bivariate (Pearson) correlational analysis was conducted (IBM SPSS Statistics 25) using the factors Acceptability (from the main experiment) and Coherence (summing both scores from the coherence studies).

4.1.2. Results

4.1.2.1. Comprehension Question Analysis

All participants scored above 80% on the comprehension questions.

4.1.2.2. Acceptability Judgement Data

Figure 8 presents the average acceptability ratings across all conditions, and Table 15 presents the average ratings across all nominal types.

For the ungrammatical and grammatical filler items, these scored an average of 1.7 and 5.7, respectively, indicating good participant performance.

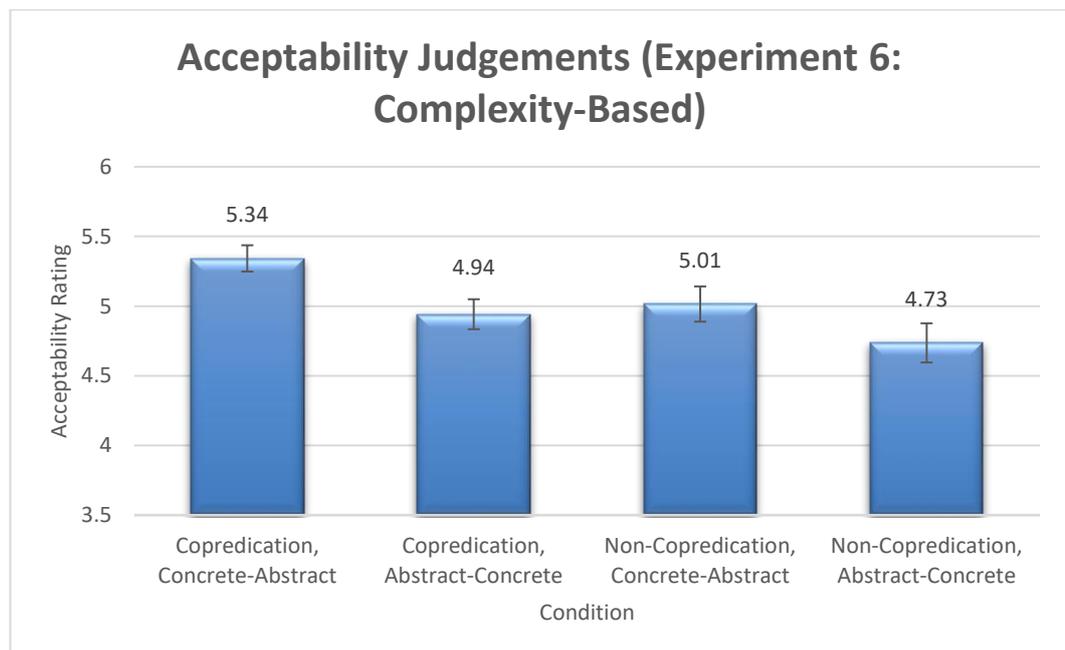
Complexity: The Sentence Type \times Sense Order contrast within the $2 \times 2 \times 3$ ANOVAs revealed main effects of Sense Order and Sentence Type for both F1 and F2 analyses, such that Abstract-Concrete sentences were deemed less acceptable than Concrete-Abstract sentences, and that non-copredications were less acceptable than copredications (Sense Order F1: $F(1,87) = 38.345, p = <.001$; Sense Order F2: $F(1,11) = 35.060, p = <.001, \eta_p^2 = .513$; Sentence Type F1: $F(1,87) = 16.120, p = <.001$; Sentence Type F2: $F(1,11) = 16.198, p = .002$). No interactions between Sense Order and Sentence Type were found (F1: $p = .210$; F2: $p = .446$). Ratings can be found in the Appendix.

Nominal Type: Examining the effect of Nominal Type (*newspaper-*, *city-* and *school-* type), for the by-subjects analysis we found an effect of Nominal Type ($F(2,86) = 31.537, p = <.001, \eta_p^2 = .423$) such that *school-* type items were more acceptable than *newspaper-* and *city-* type items, and an interaction was found between Nominal Type and Sentence Type ($F(2,86) = 3.330, p = .040, \eta_p^2 = .072$) but no three-way interaction ($F(2,86) = 1.115, p = .33, \eta_p^2 = .025$) (see Table 11). Resolving the interaction between Nominal Type and Sentence Type, t-tests contrasting the Copredication and Non-Copredication conditions for each nominal type, collapsing the Sense Order conditions, revealed significant effects for *newspaper-* type and *school-* type items such that copredication was deemed

significantly more acceptable than non-copredication (*newspaper*-type contrast: $t(87) = 2.90, p = .005$; *school*-type contrast: $t(87) = 4.34, p = <.001$) but the effect did not reach significance for the *city*-type items ($t(87) = 1.37, p = .173$).

For the by-items ANOVA, no effect of Nominal Type was found ($F(2,10) = 3.254, p = .082, \eta_p^2 = .394$) nor any interaction effects (all p -values $> .09$). As such, the critical effects noted for the by-subjects analysis may not be psycholinguistically significant.

Sense Frequency: The Frequency \times Sentence Type ANOVAs revealed only an effect of Sentence Type, such that Copredication items were more acceptable than Non-Copredication items (F1: Frequency ($F(1,35) = 1.138, p = .293, \eta_p^2 = .031$; Sentence Type ($F(1,35) = 11.723, p = .002, \eta_p^2 = .251$); Frequency \times Sentence Type ($F(1,35) = .236, p = .630, \eta_p^2 = .007$; F2: Frequency ($F(1,87) = 2.689, p = .105, \eta_p^2 = .030$); Sentence Type ($F(1,87) = 11.110, p = .001, \eta_p^2 = .113$); Frequency \times Sentence Type ($F(1,87) = 1.052, p = .308, \eta_p^2 = .012$)).



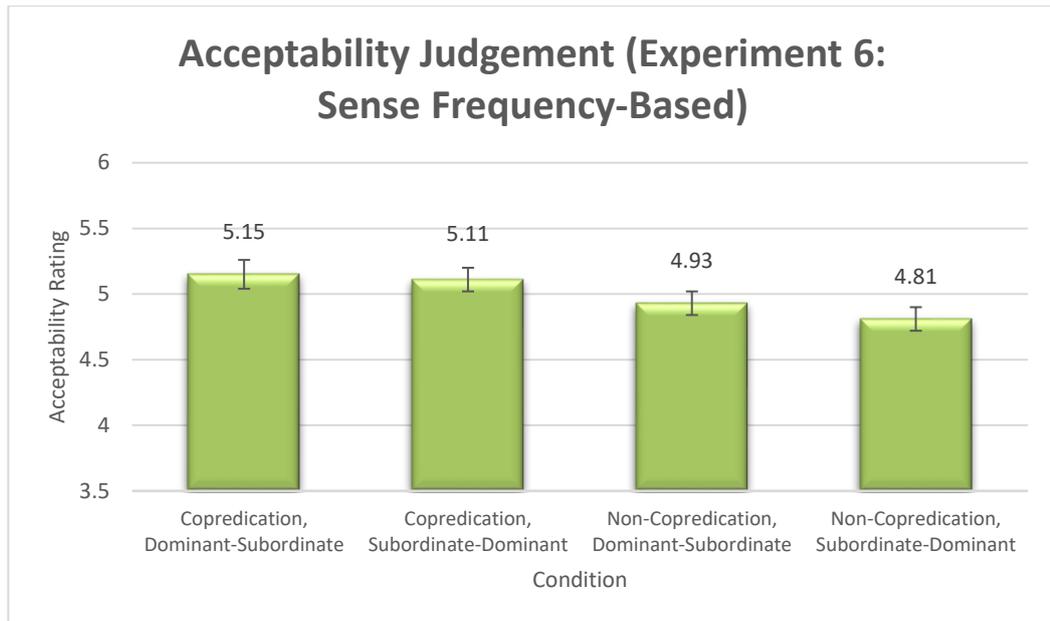


Figure 8: Average scores for the four experimental conditions framed around complexity (Top) and sense frequency (Bottom) with standard error bars.

Condition	NEWSPAPER-TYPE	CITY-TYPE	SCHOOL-TYPE
<i>Copredication, C-A</i>	5.28 (.11)	5.13 (.12)	5.61 (.11)
<i>Copredication, A-C</i>	4.73 (.14)	4.71 (.13)	5.37 (.12)
<i>Non-Copred, C-A</i>	4.81 (.14)	5.03 (.14)	5.20 (.14)
<i>Non-Copred, A-C</i>	4.59 (.17)	4.58 (.15)	5.01 (.14)

Table 15: Average acceptability scores (and standard errors) for all conditions across the three nominal types. C-A = Concrete-Abstract, A-C = Abstract-Concrete. Non-Copred = Non-Copredication.

Coherence: Considering the coherence (*extensional overlap + causal connection*) measure (M: 6.3; SD: 1.6), it was shown that the 2-tailed correlation between coherence and copredication acceptability (averaging both copredication conditions to put aside sense order concerns) was highly significant ($r = .561, n = 36, p = <.001$), indicating a strong uphill (positive) linear relationship between coherence strength and copredication acceptability (see Figure 9).

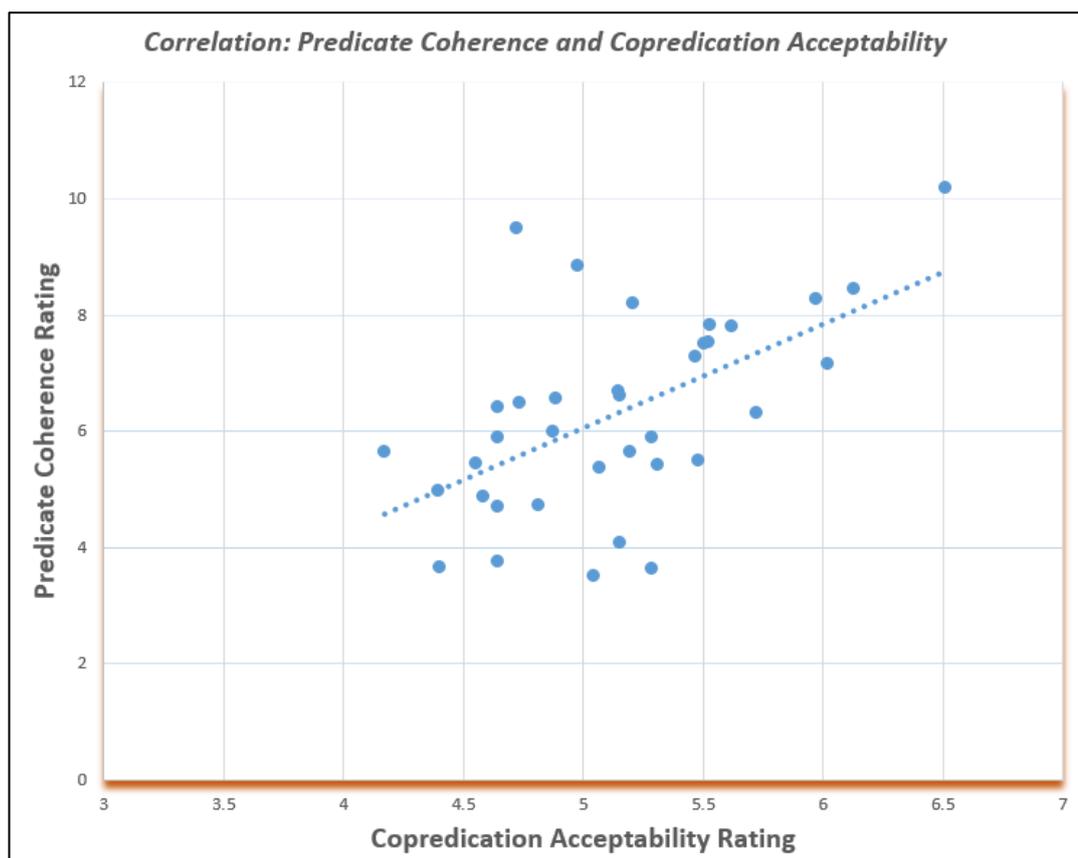


Figure 9: Scatter plot mapping copredication acceptability rating (X axis) against predicate coherence rating (Y axis) with linear trend line ($R^2 = 0.315$).

4.1.3. Discussion

In the present study we found a significant effect of both sense order and sentence type on acceptability ratings. Concrete-Abstract stimuli were rated more acceptable than Abstract-Concrete items, which is in line with the findings of Experiments 2-5. Since the present stimuli used both a different syntax and predicate length, this provides additional evidence that *Incremental Semantic Complexity* is a general linguistic parsing bias influencing polysemous and non-polysemous sentences alike. In addition, the Frequency \times Sentence Type F1 and F2 ANOVAs revealed no main effects of Frequency, in contrast to the predictions of the sense frequency-based hypotheses.

An unexpected finding of the present experiment is that the copredicated stimuli were found to be *more* acceptable than the non-copredicated stimuli (especially for *newspaper*-type and *school*-type items). This is different from the findings of Experiments 2 and 3, in which the copredicated stimuli were found to be less acceptable than the non-copredicated stimuli for the by-subjects analysis. As such, this suggests that copredication is not degraded in acceptability relative to non-copredication.

A potential explanation for the increased acceptability of sentences in the Copredication conditions is that the materials in the present experiment very often contained strong coherence relations (such that the relation between the predicates was motivated through semantic relatedness or narrative justification). Given that the narrative-based coherence relations were likely interpreted as being for the purposes of associating predicates with *single nominals*, this may have simultaneously licensed the copredications while also leading the sense mismatches in the non-copredication conditions to be relatively degraded (this is especially the case for the sentences directly taken from the literature, which only involved a single polysemous nominal). For example, ‘The bank is FTSE-100 listed and the supermarket used to be a police station’ involves a shift in both topic and sense type leading almost to a non-sequitur, whereas ‘The bank is FTSE-100 listed and used to be a police station’ at least bears a degree of narrative cohesion despite the shift in sense type. Sense mismatches were already documented in Experiment 1 to generate degraded acceptability scores, and it may be that the strong coherence relations in the copredication conditions allowed these materials to be interpreted as more acceptable while the introduction of a second nominal/topic in the non-copredication conditions interfered with these coherence relations.

This explanation can also be motivated by accounts in the coherence relations and pragmatics literature. For instance, consider Murray’s (1997) *continuity hypothesis* (see also Hoek 2018: 72 for discussion). This states that comprehenders have “a bias toward interpreting sentences in a narrative in a continuous manner” (1997: 228). Standard causal relations are classified as continuous, while a prime example of discontinuity is “an abrupt topic change” (Ibid). Quite independent from *Incremental Semantic Complexity*, this much broader processing bias may account for why Non-Copredication items were deemed less acceptable. Moreover, the highly significant correlation between coherence and copredication acceptability might contribute to the explanation for why copredications were more acceptable than non-copredications.

Meanwhile, the reduced acceptability of the sentences in the Non-Copredication conditions may be due to the fact that these conditions not only involve the shifting of sense type (as seen in Copredication), but they additionally involve the integration of this shifted sense type onto a distinct nominal, which in turn has to be integrated into the discourse. Of course, this was also the case for the Non-Copredication items in previous experiments, but this effect may only show up for cases of non-copredication involving

unusually complex sense shifts. Recall that these types of nominals can host more than two polysemous senses, and in previous experiments we have mostly focused on nominals with two senses. Due to their increased number of senses, encountering these complex polysemous types increases the level of ambiguity in sense selection, and placing two of these nominals close together in the discourse – each with their own distinct sense being triggered (i.e. Concrete *newspaper* followed by Abstract *magazine*) – might have decreased their acceptability. This may be because using a single nominal in the discourse may serve to make the sense mismatch less obvious, since both senses are being associated with a single entity, while associating distinct senses with two distinct entities (which, in addition, involves the introduction of a new topic into the discourse via the second nominal) might make the sense mismatch clearer. On the other hand, the results may be due not to the nominals, but the predicates: the present experiment used long predicates composed of multiple words, and it is also possible that pairing longer predicates with distinct nominals is costlier than associating these predicates to a single nominal. In addition, the predicates used in the present experiment contained more complex senses than those used in Chapter 3. A way to explore this in future studies would be to re-run Experiment 3 (involving *Adjective-Adjective-Nominal* syntax) but with longer predicates replacing the adjectives.

4.1.3.1. *Parallel Activation*

The increased Copredication acceptability can also be related to what has been termed in the literature a ‘Parallel Activation’ model. Although all four conditions involved associating different senses, only the Copredication conditions involved associating these senses to a single nominal representation. To illustrate, under the Parallel Activation framework, associating $Nominal_1$ with $Sense_\alpha$ and $Sense_\beta$ would be less costly than associating $Nominal_1$ with $Sense_\alpha$ and then accessing a distinct nominal representation and a distinct sense type ($Nominal_2 + Sense_\beta$), since it is assumed that the ‘parallel’ aspect of processing operates over senses of a given word, and not distinct senses of distinct words. Parallel Activation assumes the dual activation of multiple readings during processing (and is hence related to the Fully Specified ORH model), and since Copredication was no costlier than Non-Copredication this provides support for this idea.

Elsewhere in the literature, although they ultimately defend an underspecification account, Frisson and Pickering (1999) motivate a Parallel Activation model by showing

that metonymic and literal readings of *place-for-institution* and *place-for-event* do not significantly differ in their processing costs, which in combination with the design of their materials suggests that participants were simultaneously activating metonymic and literal interpretations. Parallel Activation models have also been proposed for metaphor meaning resolution (Cacciari & Glucksberg 1994, Glucksberg 1991). For instance, Parallel Activation models propose that the literal reading of a metaphor is accessed even in constructions and contexts highly favourable to metaphorical interpretations, since doing so allows the parser to guide and constrain processes of inferential comprehension.

It may seem to be the case that a Parallel Activation model is also favoured by complex polysemy, since there was no cost involved in associating distinct senses with a single nominal in *Adjective-Adjective-Nominal* and *Nominal-Predicate-Predicate* constructions. Only in *Adjective-Nominal-Adjective* constructions (Experiment 4) was there found to be a unique cost to copredication, and independent reasons for this relating to sense dedication have already been discussed.

The strongest evidence for Parallel Activation can perhaps be found in comparing *Nominal₁-Predicate₁-Nominal₂-Predicate₂* structures with *Nominal₁-Predicate₁-Predicate₂* structures, where the improved acceptability of the latter constructions suggests that the parser does in fact access the alternative polysemous reading in order to guide and constrain processes of inferential comprehension. More generally, although certain versions of the Parallel Activation model could be constructed such that a model might be more sensitive/dedicated to the dominant/subordinate meaning, the lack of documented frequency effects reported in this thesis also supports a simpler form of parallel activation, lacking any need to accommodate dominant-subordinate or subordinate-dominant preferences.

However, this Parallel Activation framework cannot explain the effects of sense order documented in this and previous experiments. While the Parallel Activation account can explain why copredication was more acceptable than non-copredication, the Underspecification ORH account provides a more satisfactory account of the documented sense order differences (with the ‘homing-in’ phase being resolved at the first predicate, before the second predicate forces the parser to shift sense types). In brief, it does not seem to be the case that all polysemous senses are initially activated, and as such neither the Fully Specified ORH model nor the Parallel Activation model appear to be adequate.

4.1.3.2. Review of Predictions

How do the present results relate to claims made in the literature? The main finding which bears on the debates discussed in Chapter 2 is the discovery that Concrete-Abstract sense order preferences are highly robust across syntactic structures and across nominal types. To illustrate the importance of this finding, consider that a small number of researchers have pointed to the possibility of *newspaper* copredications involving a combination of the institutional and either the physical or informational senses:

- 26) a. The newspaper has been attacked by the opposition and publicly burned by demonstrators. (Copestake & Briscoe 1995)
- b. The newspaper is selling very well in the stands and rising in stock market value. (Antunes & Chaves 2003)
- c. The newspaper contains some really useful information about restaurants and concerts but publishes a lot of useless junk as well. (Asher & Pustejovsky 2006)

Only (26a) involves placing the institutional sense first, and even here Copestake and Briscoe (1995) claim that the reason for the licensed copredication is purely due to the strong narrative-based explanation (i.e. the newspaper was burned as a direct result of the attacks from the opposition). *Incremental Semantic Complexity*, in conjunction with the present experimental results concerning sense ordering, provide new perspectives from which to theoretically frame this uniquely complex form of copredication.

The design and results of this experiment also allow us to align our findings with those elements in the literature (e.g. Frisson & Pickering 2007) that have shown that institutional metonymies are no costlier to process than expressions involving the concrete senses of institutional nominals (e.g. *school* as a building-for-institution metonymy; for us a case of inherent polysemy, as it is also for Ortega-Andrés & Vicente 2019). These findings lead to the prediction that institutional copredications may be no costlier to process than institutional non-copredications, and so the present results allow us to conclude that this generalisation about single-sense metonymic expressions referring either to the abstract (institution) or concrete (place) sense is borne out for constructions involving both senses (i.e. copredications).

Below is a brief list of similar implications for the literature:

- (1) The general acceptability of Concrete-Abstract items supports the claim in Dölling (Forthcoming) that these types of copredications are in fact possible.
- (2) The results do not support Chatzikyriakidis and Luo's (2015, 2018) claim that institution-based *newspaper* copredications are not permissible.
- (3) Brandtner's (2009) claim about the degraded nature of the Abstract-Concrete ordering for the *translation* sentence was supported; although her claim that the second predicate in copredications would bear costs (i.e. relative to non-copredication) was not supported.
- (4) The Concrete-Abstract *city* item was substantially more acceptable than the reverse sense order (6.26 vs. 4.78), supporting Asher's (2011: 64) specific claim concerning copredication acceptability being "subject to discourse effects", with Asher explicitly referring to predicate order.
- (5) Cruse's (1986) claim about *door*-type nominals permitting acceptable copredications through their PHYSICAL and APERTURE senses (with the latter resulting in event readings) was supported.

Overall, these results provide further evidence for *Incremental Semantic Complexity*. Only two *newspaper*-type items exhibited Abstract-Concrete preferences (*dissertation* and *text*). All of the *city*-type stimuli conform to the predicted pattern, with the exception of two items (*village* and *borough*). For *school*-type, there was only a single exception to the general trend of Concrete-Abstract preference (*entrance*), and so these results support *Incremental Semantic Complexity*. All remaining ratings can be found in the Appendix.

4.2. Experiments 7 and 8: Pronominal Reference in Copredication

We will now investigate the effects of pronominal anaphora on copredication acceptability. As mentioned in the introduction to this chapter, pronominal anaphora has been used in the literature often without explicit reference to its presence, as if copredications with pronominal anaphora are to be assumed to be identical in acceptability dynamics as copredications without it. The present experiments will both explore this issue, comparing the acceptability of copredicated structures with and without such anaphora.

To provide some context for this discussion beyond what has already been said about copredication acceptability dynamics, consider how it has been proposed that anaphora

can be used as a core diagnostic for genuine copredication (Collins 2019), as opposed to less complex forms of polysemy and metonymy:

- 27) a. I didn't find this **novel** very interesting [INFORMATION] so I returned **it** [PHYSICAL OBJECT] to my friend.
- b. John thought the **newspaper** was [deeply offensive] [INFORMATION]/ [printed with poisonous ink] [PHYSICAL OBJECT] so decided to sue **it** [INSTITUTION].
- c. *My **car** broke down [ENGINE] so I removed **it** [ENGINE].
- d. *John solved the **key** to the mystery [INFORMATION] but **it** wouldn't fit the lock [PHYSICAL OBJECT].

Further, in the examples below *salmon* also only permits rigid reference to one of its senses but seems to be “reset” (to use the term of Mery & Retoré 2013) by anaphoric reference, with the reference being eased by the inclusion of a modifier. It is as if (28b) bolsters a pragmatic effect such that the *salmon* representation can be re-accessed without the hindrance of immediately conjoining two semantically distinct senses. Indeed, the acceptability of (28c) suggests that the effect of the pronominal alone is sufficient, putting aside any effect of breaking up the discourse into separate statements:

- 28) a. #The salmon was fast and delicious.
- b. The salmon was lightning fast. It was delicious.
- c. The salmon was lightning fast and it was delicious.

Pietroski (2017: 214) also notes how ‘#France is a hexagonal republic’ can be improved with ‘France is hexagonal, and it is a republic’, commenting that it is “as if we can use ‘it’ to access a concept of France that is not accessed via the occurrence of ‘France’ in [the degraded construction]”. Yet these supposed cases of copredication involving anaphoric pronouns may aid sense integration (relative to copredications without such elements), perhaps pragmatically or otherwise, such that the sense integration is not computed onto a single, polysemous nominal representation but rather across the nominal and a pronominal such as *it*. This may result in distinct acceptability dynamics. In order to address these issues, two further acceptability judgement experiments were carried out.

Experiment 7 compared the Copredication conditions in Experiment 6 ('standard' copredications such as 'The publication is covered in coffee and is owned by a trust') with anaphoric copredications in new 'Pronominal' conditions ('The publication is covered in coffee and **it** is owned by a trust'). As such, the Copredication conditions from Experiment 6 were modified to include *it*. This was the sole change made to the materials, such that the factor of sense order was also included in order to potentially replicate, and further explore, the predicate ordering dynamics from Experiment 6.

Experiment 8 compared the acceptability dynamics of anaphoric copredication with non-copredication (e.g. 'The publication is covered in coffee and [it/the newspaper] is owned by a trust'), exploring whether the acceptability of these two structures differ in ways that were found in the previous experiment, while also examining potential predicate ordering effects. The Copredication conditions demand direct reference to a previous nominal in the discourse, while Non-Copredication conditions demand reference to a new nominal. If the introduction of a pronominal element into the discourse involves processes equal in cost to introducing a distinct nominal, then the acceptability dynamics between anaphoric copredication and non-copredication should not significantly differ. Processing studies have shown that the ontological type assigned to an entity impacts referential interpretation (e.g. Burkhardt 2006, Schumacher et al. 2010), and given that anaphoric copredication also involves a shift in ontological type (e.g. from INFORMATION to PHYSICAL OBJECT) it may be that reference resolution of this kind results in processing and acceptability costs relative to maintaining the ontological type of the antecedent (see also Brocher & von Heusinger 2018).

Lastly, as with the previous experiments, Nominal Type analyses and Frequency \times Sentence Type ANOVAs were conducted for both experiments, allowing us to explore sense frequency-based and complexity-based accounts.

4.2.1. Methods: Experiment 7

4.2.1.1. Participants

Data from 56 participants was analysed (mean age = 29; range = 20-48; 25 male). The same filtering, payment and experimental procedures were used as those in the previous experiments, and the average finishing time was 18 minutes.

4.2.1.2. Materials

Materials from Experiment 6 were used to construct four conditions, crossing Sentence Type (Copredication vs. Pronominal) and Sense Order (Concrete-Abstract vs. Abstract-Concrete). The experimental materials in Experiment 6 were adapted such that sentences in the Copredication conditions in that experiment were modified to include *it* immediately prior to the second predicate, e.g. ‘The nursery has a blue fence and **it** begins in early September’:

- (1)
 - a. The publication is covered in coffee and is owned by a trust.
 - b. The publication is owned by a trust and is covered in coffee.
 - c. The publication is covered in coffee and it is owned by a trust.
 - d. The publication is owned by a trust and it is covered in coffee.

The same fillers and comprehension questions were used as in Experiments 6, and the number of items was identical (36 experimental items for each participant with 4 item lists crossing each condition, and 36 fillers).

4.2.1.3. Procedure

The experimental procedure was identical to the previous experiment.

4.2.1.4. Analysis

The analysis procedure was identical to the previous experiment.

4.2.2. Results: Experiment 7

4.2.2.1. Comprehension Question Analysis

All participants scored above 80% on comprehension questions.

4.2.2.2. Acceptability Judgement Data

Figure 10 and Table 16 depict the average scores for the four conditions and three nominal types.

For the ungrammatical and grammatical filler items, these scored an average of 1.7 and 6.1 out of 7, respectively, indicating good participant performance.

Complexity: The Sentence Type \times Sense Order contrast revealed a significant effect of Sense Order in both the F1 and F2 analyses, such that Abstract-Concrete orderings were less acceptable than the reverse (F1: $F(1,55) = 6.810, p = .012$; F2: $F(1,11) = 9.725, p = .010$). An effect of Sentence Type was found for the F1 analysis, such that Copredication was more acceptable than Pronominal structures ($F(1,55) = 13.891, p = <.001$), but was not found for the F2 analysis ($F(1,11) = 3.832, p = .076$). Lastly, no interaction effects were found for either F1 or F2 analyses ($ps > 0.3$).

Nominal Type: Main effects were found for Nominal Type for the F2 analysis only (F2 Nominal Type: $F(2,10) = 10.127, p = .004$). There was also found to be a significant three-way interaction for the F1 analysis only (Nominal Type \times Sentence Type \times Sense Order: $F(2,54) = 4.385, p = .012$).

Resolving the by-subjects interaction, a 2×2 ANOVA was conducted for each nominal type. For *school*-type items, no effects were discovered (Sentence Type: $p = .166$; Sense Order: $p = .184$; Sentence Type \times Sense Order: $p = .102$). For *newspaper*-type items, significant effects of Sentence Type ($p = .031$) and Sense Order ($p = .019$) were discovered, such that Copredication was more acceptable than Pronominal structures, and Concrete-Abstract sense orderings were more acceptable than the reverse. No interaction effect was found ($p = .338$). For *city*-type items, significant effects of Sentence Type ($p = .021$) and Sense Order ($p = .003$) were found, revealing the same dynamics as *newspaper*-type items such that Copredication structures and Concrete-Abstract orderings were more acceptable than Pronominal structures and Abstract-Concrete orderings. An interaction effect was also discovered ($p = .018$). Subsequent t-tests revealed a significant effect of Sense Order for Copredication items, such that Concrete-Abstract orders were more acceptable than the reverse ($t(55) = 4.242, p = <.001$), but no such difference was observed in Pronominal items ($t(55) = .310, p = .758$).

Sense Frequency: The Frequency \times Sentence Type ANOVAs revealed only a main effect of Sentence Type for the F1 analysis, replicating the acceptability dynamic in the main ANOVAs above, finding no effect of Frequency on acceptability ratings: (F1 Sentence Type: $F(1,55) = 8.686, p = .005$; F1 Frequency: $F(1,55) = .231, p = .633$; F1 Frequency \times Sentence Type: $F(1,55) = .010, p = .922$; F2 Sentence Type: $F(1,35) = 3.236, p = .081$; F2

Frequency: $F(1,35) = .064, p = .801$; F2 Frequency \times Sentence Type: $F(1,35) = .020, p = .887$).

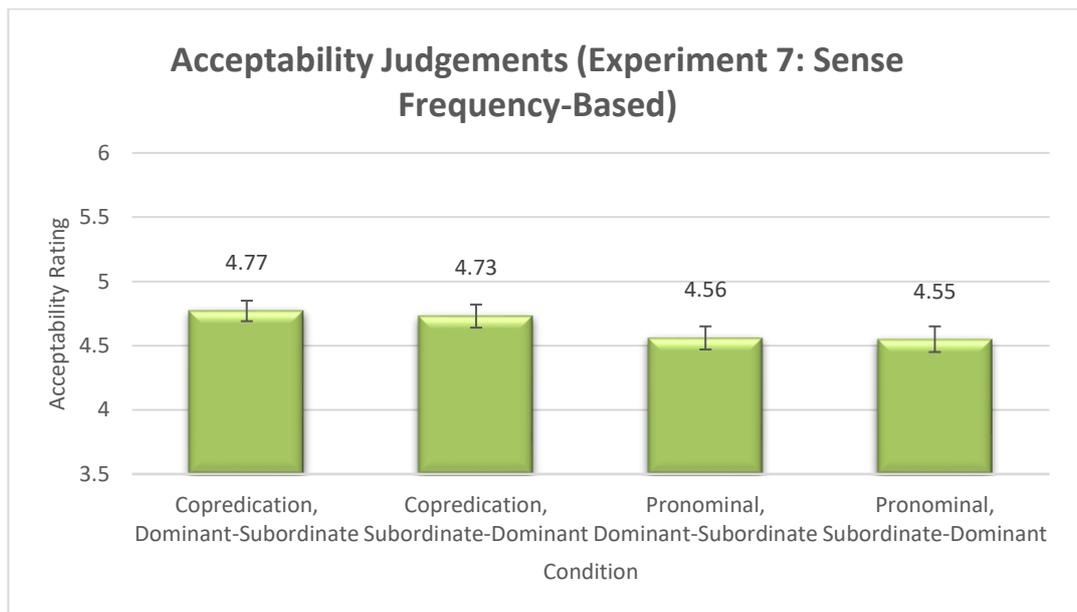
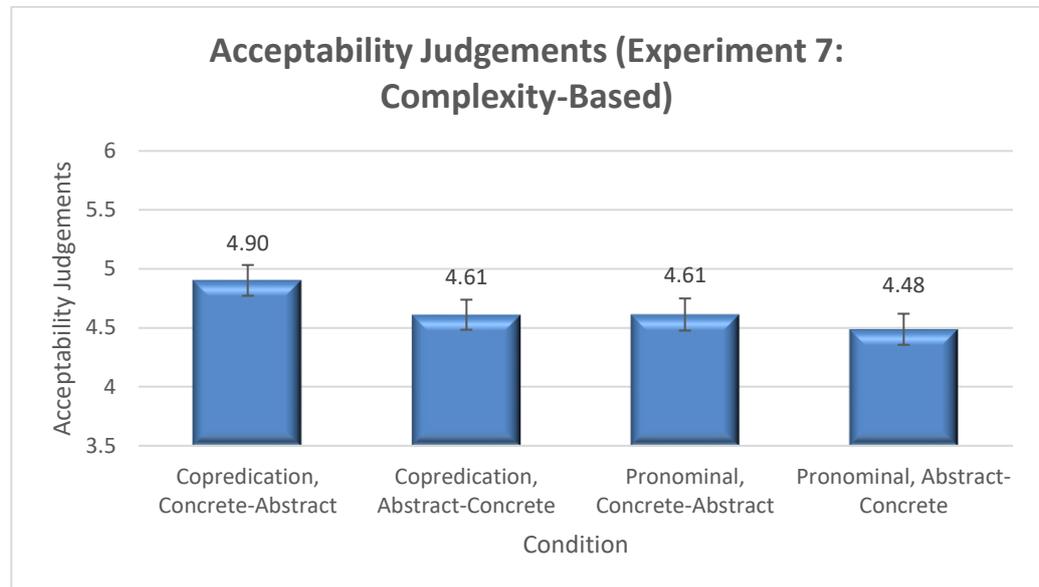


Figure 10: Average scores for the four experimental conditions framed by complexity (Top) and sense frequency (Bottom) with standard error bars.

Condition	NEWSPAPER-TYPE	CITY-TYPE	SCHOOL-TYPE
<i>Copredication, C-A</i>	4.84 (.17)	4.92 (.15)	4.94 (.15)
<i>Copredication, A-C</i>	4.41 (.17)	4.19 (.19)	5.33 (.15)
<i>Pronominal, C-A</i>	4.41 (.16)	4.28 (.20)	5.02 (.16)
<i>Pronominal, A-C</i>	4.24 (.13)	4.22 (.17)	4.96 (.17)

Table 16: Average acceptability scores (and standard errors) for all conditions across the three nominal types. C-A = Concrete-Abstract, A-C = Abstract-Concrete.

4.2.3. Methods: Experiment 8

4.2.3.1. Participants

Data from 84 participants was analysed (mean age = 29; range = 19-49; 54 male). The same filtering, payment and experimental procedures were used as those in the previous experiments, and the average finishing time was 20 minutes.

4.2.3.2. Materials

The Pronominal conditions from Experiment 7 were used in conjunction with the Non-Copredication items from Experiment 6, and were crossed with the familiar factor of Sense Order. As such, the ‘Pronominal’ and ‘Non-Copredication’ conditions formed the ‘Sentence Type’ factor:

- (1) a. The publication is covered in coffee and it is owned by a trust.
b. The publication is owned by a trust and it is covered in coffee.
c. The publication is covered in coffee and the newspaper is owned by a trust.
d. The publication is owned by a trust and the newspaper is covered in coffee.

The same fillers and comprehension questions were used as in Experiment 6, and the number of items was identical (36 experimental items for each participant with 4 item lists crossing each condition, and 36 fillers).

4.2.3.3. Procedure

The experimental procedure was identical to the previous experiment.

4.2.3.4. Analysis

The analysis procedure was identical to the previous experiment.

4.2.4. Results: Experiment 8

4.2.4.1. Comprehension Question Analysis

All participants scored above 80% on comprehension questions.

4.2.4.2. Acceptability Judgement Data

Figure 11 and Table 17 depict the average scores for the four conditions and three nominal types.

For the ungrammatical and grammatical filler items, these scored an average of 1.5 and 6.0 out of 7, respectively, indicating good participant performance.

Complexity: Within the $2 \times 2 \times 3$ ANOVAs, the Sentence Type \times Sense Order analysis revealed a significant effect of Sense Order such that Abstract-Concrete orderings were less acceptable than the reverse (F1: $F(1,83) = 21.238, p = <.001$; F2: $F(1,11) = 19.686, p = .001$), but there were no main effects of Sentence Type (F1: $F(1,83) = 2.515, p = .117$; F2: $F(1,11) = 1.578, p = .235$), and no interaction effects ($ps > 0.2$).

Nominal Type: Adding the factor Nominal Type (*newspaper-* vs *city-* vs *school-*type) into the repeated measures ANOVAs, there was found to be a three-way interaction between Nominal Type, Sense Order and Sentence Type for both the F1 and F2 analyses (F1: $F(2,82) = 4.790, p = .011$; F2: $F(2,10) = 7.009, p = .013$). For the F2 analysis, there was also an interaction between Sense Order and Nominal Type ($F(2,10) = 22.186, p = <.001$). Resolving the interactions, a 2×2 ANOVA was conducted for each nominal type.

For *school*-type nominals no significant effects were found (all p -values $> .10$ for F1 and F2). For *city*-type nominals, there was only a significant main effect of Sense Order (F1: $F(1,83) = 50.975, p = <.001$; F2: $F(1,11) = 65.509, p = <.001$), such that Abstract-Concrete sense orders were significantly less acceptable than the reverse order. Lastly, for the F1 analysis alone *newspaper*-type nominals showed an interaction between Sentence Type and Sense Order ($F(1,83) = 7.44, p = .008$), with no main effects (Sentence Type: $p = .114$; Sense Order: $p = .335$). Subsequent t-tests revealed that, for the Pronominal sentences, the Abstract-Concrete sense order ($M = 4.70, SD = 1.35$) was rated significantly less acceptable than the Concrete-Abstract sense order ($M = 5.11, SD = 1.31$) ($t(83) = 2.54, p = .013$), but no such difference was found in the Non-Copredication sentences ($p = .228$).

Sense Frequency: The Frequency \times Sentence Type ANOVAs revealed a main effect of Frequency (a Dominant-Subordinate preference) for the F1 analysis only, and an interaction for both the F1 and F2 analyses (F1 Frequency: $F(1,83) = 8.226, p = .005$; F1

Sentence Type: $F(1,83) = 1.931, p = .168$; F1 Frequency \times Sentence Type: $F(1,83) = 11.226, p = .001$; F2 Frequency: $F(1,35) = 3.778, p = .060$; F2 Sentence Type: $F(1,35) = 1.462, p = .235$; F2 Frequency \times Sentence Type: $F(1,35) = 6.059, p = .019$.

Resolving the interaction effects, for both the F1 and F2 analyses there was found to be a significant difference between the Non-Copredication conditions (F1: $t(83) = -4.32, p = <.001$; F2: $t(35) = -.2.84, p = .007$) indicating a Dominant-Subordinate preference. There were found to be no significant differences between sense orders for the Pronominal conditions (F1: $t(83) = .21, p = .83$; F2: $t(35) = .34, p = .72$).

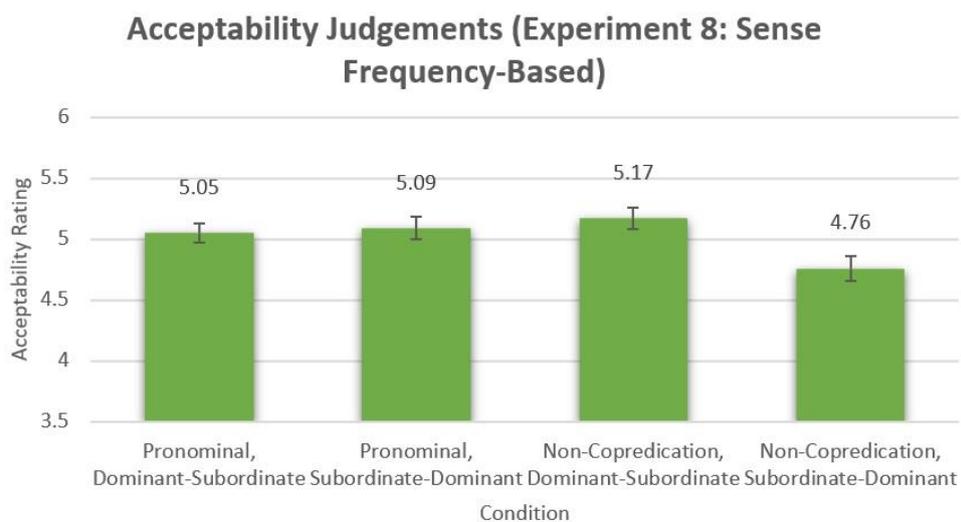
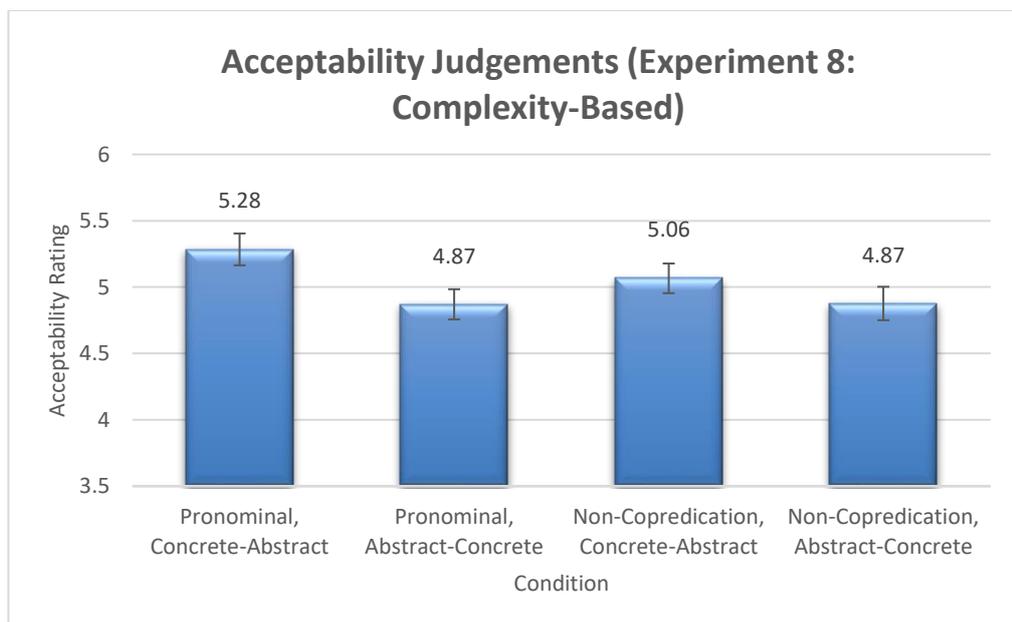


Figure 11: Average scores for the four experimental conditions framed around complexity (Top) and sense frequency (Bottom) with standard error bars.

<i>Condition</i>	<i>NEWSPAPER-TYPE</i>	<i>CITY-TYPE</i>	<i>SCHOOL-TYPE</i>
<i>Pronominal, C-A</i>	5.11 (.14)	5.26 (.13)	5.47 (.13)
<i>Pronominal, A-C</i>	4.70 (.14)	4.61 (.15)	5.24 (.13)
<i>Non-Copred, C-A</i>	4.66 (.14)	5.45 (.13)	5.10 (.14)
<i>Non-Copred, A-C</i>	4.85 (.14)	4.63 (.15)	5.16 (.14)

Table 17: Average acceptability scores (and standard errors) for all conditions across the three nominal types. C-A = Concrete-Abstract, A-C = Abstract-Concrete.

4.2.5. Discussion

Recall that Experiment 6 revealed an acceptability decrease for non-copredication relative to copredication. Here, Experiment 7 revealed a significant acceptability difference between pronominal and standard cases of copredication such that the former was less acceptable than the latter. In conjunction with the findings of Experiment 6, this suggests that pronominal reference in copredication incurs similar processing costs as introducing a distinct polysemous nominal (‘non-copredication’). Experiment 8 compared pronominal and non-copredication items and found no significant acceptability differences between them. It also replicated previous findings from the Chapter 3 experiments concerning the degraded acceptability status of Abstract-Concrete sense orderings relative to Concrete-Abstract orderings. The results suggest that the anaphoric pronoun introduced into the copredication items has a similar effect on sentence acceptability as the introduction of a second nominal, pointing to the possibility that they share some similar underlying processes. For instance, it is possible that two independent explanations can capture these dynamics: *Topic shift* for the Copredication > Non-Copredication dynamic, and *sense emphasis* for the Copredication > Pronominal dynamic.

We observed this Concrete-Abstract preference for *newspaper-type* and *city-type* items but not *school-type* items. Only in the F1 analysis for Experiment 8 was a main effect of Frequency found. As such, the documented Dominant-Subordinate preference found is not as replicable or reliable as the complexity-based Concrete-Abstract preference. For instance, the by-subjects ANOVA and paired t-tests for *city-type* items in Experiment 8 revealed a Dominant-Subordinate preference, but since this was an isolated occurrence it would be premature to interpret this effect as relating to sense frequency. Rather, in conjunction with the complexity-based ANOVAs, with their more general, reliable and replicable effects, it seems more reasonable to conclude that this ‘Dominant-Subordinate

preference' was rather a manifestation of *Incremental Semantic Complexity*. As such, the effect of frequency can also be characterised as an effect of complexity.

With respect to the implications for the literature, we can still maintain with Pietroski (2017) that pronominal elements can be used to access distinct senses of polysemous words in particular situations, but the broader, more general acceptability dynamic at play appears to be that accessing these distinct senses via a pronominal element is costlier than simply associating distinct senses via bare conjunctions. The present results suggest that rather than boosting the acceptability of copredications, the pronominal helps to *emphasise the sense mismatch*, which is otherwise less noticeable in standard copredications: Including the pronominal forces the parser to establish a referent for *it*, including the featural specification subsequently determined by the second predicate, which is naturally at odds with the semantic type of the first predicate. Lacking the pronominal, the Copredication conditions simply force the parser to associate two distinct senses.

In addition, the results of Experiment 8 do not seem to directly support the prediction emerging from Brocher and von Heusinger's (2018) study, which would predict that by introducing a new referent – as opposed to using a pronominal to refer to a pre-activated concept – Non-Copredication items will be less acceptable than *both* Copredication and Pronominal items. Instead, we found that Non-Copredication items are only less acceptable than Copredication items. This may be due to the fact that the referents with pre-activated concepts used by Brocher and von Heusinger (2018) – which they found to be easier to process than referents introducing new concepts – did not involve shifts in semantic type, but rather simply a new nominal referent. Hence, the present materials likely drew on additional integration mechanisms than those involved in purely integrating a new referent into the discourse. As such, the advantage documented by Brocher and von Heusinger (2018) for processing pre-activated concepts does not seem to override the costs to acceptability (and, likely, processing) that arise with sense type switching.

None of this is to say that using a pronominal element in certain copredicated environments can *never* improve acceptability, nor are we claiming that pronominal elements cannot serve important pragmatic functions. Rather, the present results lead us to conclude that the particular, specific sentence structures used for copredication in this experiment (i.e. a determiner phrase followed by complex predicates) are rated as more acceptable than the same structures including anaphora. This provides insight into the

psycholinguistic properties of complex polysemy and anaphora; in particular, that establishing pronominal anaphora in complex polysemies may involve costlier parsing processes than standard copredication. Nevertheless, as mentioned earlier, acceptability judgements are an indirect measure of parsing, and so these findings can conservatively be used to: (i) motivate further psycholinguistic inquiry into this topic through online experiments, and (ii) inform debates in the theoretical literature about the acceptability dynamics of anaphoric copredication and its implications for compositional models.

4.3. Experiment 9: Isolating Complexity in Copredication

Moving beyond the specific topics of the acceptability dynamics of Copredication vs. Non-Copredication and Concrete-Abstract vs. Abstract-Concrete contrasts, the present section will report an experiment addressing the following question: Is it purely Concrete/Abstract categorisations which impact copredication licensing (and also non-copredication licensing), or is there a more fundamental semantic dynamic at play? Although *Incremental Semantic Complexity* would predict that sense order preferences are based on semantic complexity, the previous experiments have not included an appropriate experimental control which could rule out the possibility that the documented sense order dynamics arise from a specific Concrete-Abstract preference, rather than a more general Simple-Complex processing bias. For example, as mentioned above, Scorolli et al. (2011) expose a Concrete-Abstract preference, but it may be that this preference is a complexity-based preference rather than a categorial preference. Alternatively, it may be that the results documented in our previous experiments were a direct consequence of this Concrete-Abstract ordering. If this was the case, then the conclusions in Scorolli et al. (2011) – namely, that Concrete-Abstract preferences emerge from the different modes of acquisition that concrete and abstract concepts are subject to – might be applicable to the present findings, and no further theoretical exploration may be required.

4.3.1. Approaching Complexity

In most approaches to abstract concepts in the semantics literature, there appears to be an agreement that increasing ‘abstractness’ is defined in terms of boundedness to features of the denoted situation, such as physical features or the degree of boundedness to space,

time and agents (Asher 2000, Consten & Knees 2008, Maienborn 2003, Schumacher et al. 2010). *Propositions*, for instance, are typically considered to be the most abstract structures since they are not strictly tied to one particular world or state of affairs (unlike *facts*).

The three semantic types of abstract senses we will be investigating are the ones already discussed: INFORMATION, EVENT and INSTITUTION. For instance, ‘The speech was long but interesting’ (Pustejovsky & Jezek 2008: 185) involves EVENT and INFORMATION senses. There seems to be a linear relation of increasing abstractness exhibited by these senses. The INFORMATION sense of polysemous nominals can be bound by physical features, though certainly not entirely (books may be educational and thrilling, but they have to have some physical source, ranging from paper to audiobooks). The EVENT sense seems less tied to physical features, though it is usually characterised in some way by these physical features or situational boundaries (e.g. a lunch may be boring and delayed, but it can only remain a lunch so long as food is involved or it occurs at a particular time, either during a time of day or based on the order of meals consumed that day). Lastly, the INSTITUTION sense is very typically not bounded by physical features (banks can relocate and act independently of their headquarters, schools can go on summer trips, and so forth), and so this seems to be the most abstract of the senses permitting copredication (intuitions already defended in Arapinis 2013).

In order to explore this topic with greater clarity, I will assume a particular abstractness scale from the literature, where ‘<’ denotes ‘less abstract than’ (cf. Asher 1993, Gennari & Poeppel 2003, Maisenborn 2003, Schumacher et al. 2010):

EVENT < PROCESS < STATE < FACT < PROPOSITION

Schumacher et al. (2010: 842) note that “[s]ince events are defined as spatio-temporal entities with specified beginnings and endings as well as certain agents, they have a high degree of boundedness and are the ‘least abstract’ complex entities” (note that the authors do not discuss the INFORMATION sense inherent to *book*-type polysemies).⁷¹ For Gennari

⁷¹ One might object here that there is naturally a sense in which INFORMATION is the most abstract type, in some ways encompassing events, processes, states, facts and propositions, which all convey some form of information. However, copredications always invoke nominal-associated forms of information, rather than any entirely abstract notion of information not tethered to a nominal entity.

and Poeppel (2003), since stative verbs denoting facts only contain INFORMATION, they should be seen as less semantically complex than eventive verbs denoting causally structured events, and that the latter type of lexical items lead to increased processing times for comprehenders (see also Brennan & Pytkänen 2010 for evidence that lexico-semantic complexity inherent to a given word is processed independently from, and in distinct neuroanatomical loci, distinct forms of semantic complexity such as coercion). As such, one might use processing effort as an indication of semantic complexity, with informational sources being thereby less complex than eventive concepts.

In further work which relates very directly to *Incremental Semantic Complexity* and its core predictions in this thesis, Consten et al. (2007) conducted corpus analyses of ontological shifts across discourses and their apparent constraints. For example, they looked at sentences when states are spoken of and are subsequently referred to using anaphoric phrases (namely, complex anaphors) denoting events. They provide evidence that ontological changes in discourse are restricted by what they call the *Abstractness Constraint*. This states that the complex anaphor cannot shift the type of the referent to a discourse entity that is less abstract than the type assigned by the antecedent:

Abstractness Constraint

If x is higher on the abstractness scale than y, where x represents the ontological type assigned by the antecedent and y that of the anaphor, then x cannot precede y.

For example, a process anaphor cannot pick up a proposition antecedent, since processes are lower down on the abstractness hierarchy. As such, an event anaphor ('this event') cannot be used to refer to a more abstract referent. For example (where [E] = event, [P] = process, [S] = state, [F] = fact, [PP] = proposition):

Bethesda is developing the next Elder Scrolls title [P]. This [P]/This process [P]/This state [S] will presumably last for five years. This fact [F] is well-known to fans. Until recently journalists were not allowed to verify this possibility [PP]/*this event [E].

This constraint appears to arise because ontological features that are not specified by the antecedent are unable to be reconstructed by the anaphor. Along with the *Abstractness Constraint* seeming to match a range of acceptability judgements, Consten et al. (2007) examined a list of 60 complex anaphors taken from the *TIGerKorpus* (a German newspaper corpus) and found no violations of the constraint (see also Consten et al. 2009). Supporting these intuitions of acceptability, Schumacher et al. (2010) presented participants with violations of the *Abstractness Constraint*, e.g. ‘The Nile perch in Lake Victoria gradually destroys most of the cichlid species. Conservationists observe this [development/phenomenon/*event] nowadays with great apprehension’. Such violations were found to elicit a more pronounced N400 (a negative-going waveform peaking approximately 400ms post-stimulus associated with long-term semantic memory processing; Kutas & Hillyard 1980, Kutas & Federmeier 2009, 2011; see Chapter 5 below) relative to maintaining the ontological type of the antecedent, or shifting to a higher type.

This idea of abstractness utilised by Consten et al.’s (2007) *Abstractness Constraint* may be related to the notion of semantic complexity inherent in *Incremental Semantic Complexity*.⁷² The general ban on shifting from a certain abstract type to a less abstract type (i.e. using an event complex anaphor to refer back to a state) seems to mirror the general degradation in acceptability found with shifting from an abstract, or complex polysemous sense to a concrete, or less complex polysemous sense. While the abstractness scale does not match one-to-one onto the Complexity Hierarchy proposed in Chapter 2 (see 2.3.4) – with institutions being more semantically complex, but less abstract, than events – both constraints, being applicable at the discourse level, might be caused by the same underlying processing bias. An ontological explanation for the Abstractness Constraint invoking features not specified by the antecedent failing to be reconstructed by the anaphor may be implemented via a unidirectional priming effect (e.g. processes prime ‘upwards’ in abstractness, not ‘downwards’ towards events) of the kind which may also implement *Incremental Semantic Complexity* (less complex polysemous senses priming more complex senses, with the latter indeed often being more abstract as well as more complex) (see Branigan et al. 1995, Pickering & Branigan 1999 for the distinction between unidirectional and bidirectional priming).

⁷² Facts and propositions cannot be mapped to polysemous senses involved in copredication, and it would be peculiar to say that propositions are more complex than institutions, for instance. But the general dynamic of predicate order preferences seems similar.

Consulting the Complexity Hierarchy, one might argue that EVENT is more complex than PROCESS since it includes a beginning and an end (and is therefore [+telic]; Maienborn 2003), whereas PROCESS lacks any specified boundary (and is [-telic]). As such, event representations are somewhat richer than processes, although whether or not this has any implications for semantic complexity remains unclear in the literature. For instance, the physical sense of *newspaper* can also often contain a richer representational range than the institutional sense, but it relies purely on simpler cognitive modules like perceptual features (shape, colour) whereas any given institutional sense relies on more complex Telic notions and group dynamics along with a broader possible range of relations with other senses (Arapinis 2013, 2015). Nevertheless, although it is not at all clear whether the PROCESS sub-type of *lunch* is semantically more complex than the EVENT sub-type (where both PROCESS and EVENT are considered different aspects of the same general eventive sense, as in *construction*; Asher 2011), it is unclear whether PROCESS-EVENT orderings (e.g. ‘Lunch was taking a long time although it finished at 2pm’) differ in acceptability from the reverse orderings (‘Lunch finished at 2pm although it was taking a long time’).⁷³ Consequently, the present experiment will keep to INFORMATION, EVENT and INSTITUTION senses. Moreover, constructions such as ‘John went to school’ and ‘School starts at 9:00’ are typically subsumed under a single eventive sense by semanticists (Pustejovsky & Batiukova 2019: 160-162, 292-300, Pustejovsky & Boguraev 1993), suggesting that these senses reflect the multiple realisability (Bickle 2016) of the EVENT type.

4.3.2. Experimental Design

Given the results reported in the previous experiments, what precisely appears to be the nature and scope of *Incremental Semantic Complexity*? Implementing a parsing preference based on scaling semantic complexity, it seems to specifically involve a priming effect from simple senses to complex senses, such that the activation of ‘Simple Sense₁’ primes

⁷³ Indeed, it may be that because events, processes and states are part of the same general type (they are also part of the same Event Structure relation in Pustejovsky 1995), *Incremental Semantic Complexity* may only be sensitive across semantic types. But, as mentioned, it still remains unclear what the complexity profile of these sub-types are, and indeed it may be considerably dynamic and change based on context, such that a particular state, sufficiently enriched by modifications in the discourse, may be more semantically complex than a simple event. It is possible that research into event simulation construction can provide insights into sense complexity (Pustejovsky 2013), a topic beyond the scope of this thesis.

‘Complex Sense₂’. The activation of a complex sense does not seem to prime (as strongly) the simpler sense(s). This appears to be the case since otherwise, if the parser more generally had difficulty with abstract senses, then both Concrete-Abstract and Abstract-Concrete structures would be difficult to process, with the only requirement being for the abstract sense to appear somewhere for acceptability costs to arise. But given that previous experiments found a Concrete-Abstract preference, and given that this generalises across polysemous and non-polysemous structures (i.e. both copredication and non-copredication in various syntactic structures exhibited a Concrete-Abstract preference), *Incremental Semantic Complexity* derives its name principally from this sense ordering effects. As discussed, while Frisson’s (2015) sensicality judgment data for *book*-type nominals revealed a cost for sense switching in both directions relative to sense repetition, the eye-tracking data suggested that subordinate-dominant sense switches were more difficult to process than the reverse order. This is compatible with the Concrete-Abstract preference documented here, since dominant-subordinate maps onto Concrete-Abstract for *book*-type nominals.

However, as mentioned above, a crucial factor currently remains unexplored. The ‘increments’ in *Incremental Semantic Complexity* might be based on a sensitivity purely to Concrete and Abstract senses, such that *Incremental Semantic Complexity* should more accurately be called *Incremental Abstractness*. The previous experiments included a small number of items involving the manipulation of two abstract senses of distinct levels of semantic complexity (e.g. Experiment 6 included 5 cases such as ‘The school hired a new teacher and starts at 9am’), however the majority of items included concrete and abstract senses. There were also a small number of examples presented in Chapter 2 which manipulated two abstract senses. Yet these claims are based on a small number of cases taken from the literature or constructed based on individual intuition, and so the present experiment was designed to contribute a more systematic evaluation of these claims by specifically isolating complexity orderings in copredication.

Based on the contrasts introduced in Chapter 2 and also the findings reported earlier in this chapter, it seems that for *newspaper*-type items the directionality of sense priming which *Incremental Semantic Complexity* is sensitive to is as follows: PHYSICAL > INFORMATION > INSTITUTION. Hence PHYSICAL-INSTITUTION orderings seem less felicitous than INFORMATION-INSTITUTION orderings, with both of these structures in turn being

more acceptable than INSTITUTION-INFORMATION/PHYSICAL orderings (such as ‘The newspaper was founded in 1850 and is on the table’; see Chapter 2 for examples).

Since the issues surrounding Copredication vs. Non-Copredication contrasts appear to be resolved to a greater degree than the current complexity-modulation issue (i.e. copredication is no less acceptable than non-copredication except in *Adjective-Nominal-Adjective* syntax), the current experimental design omitted any such Copredication/Non-Copredication contrast, not least because the *Nominal-Predicate₁-Predicate₂* syntax has been explored a number of times above. Instead, we examined the effect of Sense Order in items in which either (1) one of the senses is concrete while the other one is abstract, or (2) both of the senses are abstract, resulting in a 2 (Sense Order; Simple-Complex vs. Complex-Simple) × 2 (Sense Combination; Concrete+Abstract vs. Abstract+Abstract) design. For example, a Concrete+Abstract item would involve PHYSICAL-INSTITUTION, while an Abstract+Abstract items would involve INFORMATION-INSTITUTION. The PHYSICAL-INSTITUTION items exhibited a pairing of senses of a greater difference in semantic complexity than the INFORMATION-INSTITUTION items (assuming the Complexity Hierarchy from Chapter 2: PHYSICAL < INFORMATION < EVENT < INSTITUTION).⁷⁴ More generally, the difference in complexity between predicates was always bigger for the Concrete+Abstract items, as a direct consequence of keeping one of the more complex senses constant across item sets. The design of materials can be found in Table 18:

	<i>Simple → Complex</i>	<i>Complex → Simple</i>
<i>Concrete + Abstract</i>	The magazine is printed weekly and took part in the conference.	The magazine took part in the conference and is printed weekly.
<i>Abstract + Abstract</i>	The magazine focuses on politics and took part in the conference.	The magazine took part in the conference and focuses on politics.

⁷⁴ Indeed, it is fairly standard in the literature to treat copredications derived from metonymy as involving a ‘basic’ sense being extended to a more complex sense. For example, returning to some concerns from Chapter 2, Copestake and Briscoe (1995: 26) assume that *village*-type polysemies are derived from a *Place-for-Group* ‘rule’, permitting constructions such as ‘The south side of Cambridge voted Conservative’. As such, the Group/Institution sense is assumed to be derived from a more basic sense, supporting our present assumptions about sense complexity.

Table 18: Sample experimental materials in Experiment 9. It should be stressed that ‘Simple’ should be understood relative to the Complex sense, and not in an absolute sense, e.g. EVENT is less complex than INSTITUTION, but EVENT is still a complex sense relative to PHYSICAL.

Lastly, in order to again test the validity of sense frequency-based hypotheses, nominals for which a frequency profile had not already been established (via Chapter 3) were subjected to a fill-in-the-blank task. This resulted in 25 out of the 36 nominals being subject to this task. In order to avoid any potential sense priming, a separate group of participants took part in this brief experiment.

If the results of the previous experiments were due to a Concrete-Abstract preference (*à la* Scorolli et al. 2011), then for the Concrete+Abstract items we would expect to find a Simple-Complex preference, but for the Abstract+Abstract items we would expect to find no preferences. On the other hand, if the previous results were due to a more general Simple-Complex preference (*à la* *Incremental Semantic Complexity*), then we would expect to find a Simple-Complex preference for both Concrete+Abstract and Abstract+Abstract items, and in addition we would expect there to be a preference for Abstract+Abstract structures given that these exhibit a smaller divergence in complexity levels between the senses compared to Concrete+Abstract items.

4.3.3. Methods: Frequency Experiment

4.3.3.1. Participants

For the fill-in-the-blank experiment, 24 participants (average age: 30; range: 20-57; 9 male) took part. Participants were recruited through Prolific Academic and paid £6 per hour. The average completion time was 7 minutes.

4.3.3.2. Materials

25 nominals used in the below acceptability experiment, for which frequency profiles were unknown, were used to construct 25 fill-in-the-blank schemas, as in “The clinic was ____”.

4.3.3.3. Procedure

The experiment took part on Qualtrics, and participants were asked to type whichever single word came to mind for the fill-in-the-blank task. Participants were given simple instructions and all 25 nominals were presented in a single list.

4.3.3.4. Analysis

The responses were coded for their sense as either PHYSICAL, INFORMATION, EVENT or INSTITUTION in order to be plotted in the table below. A small number of responses for 8 out of the 25 nominals were ambiguous, and these were omitted during dominance calculation (range of ambiguous responses: 1-7; average number of ambiguous responses: 2.7; see Appendix for the list of nominals with ambiguous responses). No further analyses were conducted given that the frequency profiles of the nominals were calculated purely for the purposes of permitting Frequency ANOVAs to be carried out for the acceptability data.

4.3.4. Methods: Acceptability Experiment

4.3.4.1. Participants

60 participants (average age: 31; range: 18-57) took part. Participants were paid £6 per hour and the average completion time was 16 minutes.

4.3.4.2. Materials

36 experimental sets (12 *newspaper*-type, 12 *lecture*-type, 12 *school*-type) of four sentences were constructed, manipulating Sense Combination (Concrete-Abstract vs. Abstract-Abstract) and Sense Order (Simple-Complex vs. Complex-Simple). Nominals were controlled for their SUBTLEX-UK Zipf frequency (nominal averages: *newspaper*-type: 4.0, *lecture*-type: 4.3, *school*-type: 4.6; no significant differences in frequency across nominals for one-way ANOVA: $F = 2.73, p = .07$); predicates were complex, multi-word structures so no frequency data was available. Nominals were also controlled for character length (nominal averages: *newspaper*-type: 7.7, *lecture*-type: 6.8, *school*-type: 7; no significant differences across nominals for one-way ANOVA: $F = 0.77, p = .46$). The same 36 fillers used for the previous experiments in this chapter were used, and 26 comprehension questions were inserted randomly to both fillers and experimental items, with four item lists also being constructed so that each participant saw one item from each of the 36 experimental sets.

The materials were categorised into three nominal types exploring the three possible combinations of abstract senses in copredication (based on the following complexity hierarchy: INFORMATION < EVENT < INSTITUTION): *newspaper*-type (INFORMATION •

INSTITUTION), *lecture*-type (INFORMATION • EVENT) and *school*-type (EVENT • INSTITUTION).

This design is sufficient to explore the conflict between Concrete-Abstract and Simple-Complex preferences, and it is also constrained by the type structure of non-abstract polysemous senses: Since there is only one sense shared by all nominal types explored in this thesis (PHYSICAL), it would be impossible to test Concrete₁-Concrete₂ vs Concrete₂-Concrete₁ materials since there is little in the way of a hierarchy of semantic complexity with respect to the discrete PHYSICAL senses. The only exception, to my knowledge, involves Type/Token (i.e. Kind/Individual) implementations of the concrete sense of *newspaper*:⁷⁵

- 29) a. The newspaper was held by protestors in the street and can be found on the table.
b. The newspaper can be found on the table and was held by protestors in the street.

However, the confounding factor in experimentally testing these cases is that even at this level there is a clear Abstract/Concrete division (by definition) in the Type/Token contrast, with tokens (an individual copy of Friday's *Telegraph* on the table) being specific instantiations of a type (multiple copies of Friday's *Telegraph* being held by protestors). There is also the question of the complexity profiles of these Type/Token senses: Boye (2007) argues, from the perspective of cognitive linguistics, that "specific meanings ... [are] conceptually more complex than non-specific meanings", since, following Haspelmath (1997), holding a specific meaning requires maintaining two "mental space referents"; i.e. maintaining the specific instantiation along with the more general category, as opposed to simply maintaining a representation of the general category. 'John bought a horse' could refer to a specific horse or some horse or another, for example. This issue

⁷⁵ As a brief note, I also think this distinction can explain the "cline" that Copestake and Briscoe (1995: 53) and Cruse (1986: 71) note exists from properties that can be true of a book's content (the general informational type) through to properties that can be true of a particular copy (physical token). Copestake and Briscoe believe that this cline shows that the distinction between a book's senses "is really not straightforward", but once we add to the basic physical/information distinction the additional within-sense distinction between type and token, this explains why sense combinations do not always fit a clear physical/informational reading (e.g. in cases in which the informational sense denoting the type is coordinated with a strong token physical reading, as in '?That book is full of metaphorical language and is covered with coffee').

will not concern us, however, in particular given that the above examples both refer to a specific object (Friday's *Telegraph*) of varying degrees of abstractness, and so the literature on specific/non-specific semantic complexity does not seem to apply directly to copredication. To demonstrate, even though 'held by protestors in the street' does not denote a specific copy of the newspaper, it nevertheless refers to a particular extension in virtue of the predicate being associated with the Token reading, whereas 'bought a horse' purely refers to the category *horse*; on their own, without any copredication, 'bought a horse' and 'held by protestors in the street' exhibit the same level of non-specificity in meaning, but this degree of non-specificity is impacted by the introduction of copredication.

4.3.4.3. Procedure

The same procedure as the above acceptability judgement experiments was used. The experiment was carried out using Qualtrics (qualtrics.com/uk) and sourcing participants from Prolific Academic (prolific.ac). Each participant saw one of four lists of 72 sentences (36 experimental, 36 fillers). 17 Yes-No comprehension questions were randomly interspersed amongst the experimental and filler items, and a 1-7 Likert scale was used.

4.3.4.4. Analysis

2 (Sense Combination) \times 2 (Sense Order) \times 3 (Nominal Type) repeated measures by-subjects and by-items ANOVAs on participants' acceptability rating data were conducted. In addition, 2 (Sense Combination) \times 2 (Frequency: Dominant-Subordinate vs. Subordinate-Dominant sense order) ANOVAs were also conducted using the results from the fill-in-the-blank studies. The data was aligned based on which sense was most frequent.

As with Experiments 1, 3 and 6, since the present experiment involved the construction of a new set of copredication items, a measure of coherence was gauged from two norming studies. The same studies were conducted as were carried out for Experiment 6, gauging the commonality of the predicates (*extensional overlap*) and the sense of causal relation between the predicates (*causal connection*). The items from the present experiment were used in the same coherence norming experiments as the ones reported in Chapter 3, and the procedure and exclusion criteria were identical to those in the main experiment.

Lastly, as in the previous coherence norming analyses, a bivariate (Pearson) correlational analysis was conducted (IBM SPSS Statistics 25) using the factors Acceptability (from the main experiment) and Coherence (adding together both scores from the coherence studies).

4.3.5. Results: Frequency Data

The results are presented in Table 19. Data from the present experiment has been combined with the previously-existing frequency profiles from Chapter 3. The results suggested that each nominal type has a clear dominant sense with some within-type variability: *newspaper*- and *lecture*-type nominals were heavily INFORMATION-dominant while *school*-type nominals were heavily PHYSICAL-dominant.

NOMINAL	DOM	SUBORD	% DOM	NOMINAL	DOM	SUBORD	% DOM	NOMINAL	DOM	SUBORD	% DOM
<i>Tabloid</i>	INFO	PHYS	95.8	<i>Concert</i>	INFO		100	<i>Studio</i>	PHYS	INST	95.8
<i>Broadcast</i>	INFO	PHYS	95.6	<i>Debate</i>	INFO	EVENT	100	<i>Clinic</i>	PHYS	EVENT	91.6
<i>Periodical</i>	INFO	PHYS	95.4	<i>Talk</i>	INFO	EVENT	95.8	<i>Church</i>	PHYS	INST	89.2
<i>Gazette</i>	INFO	PHYS	82.4	<i>Announcement</i>	INFO	EVENT	95.8	<i>Nursery</i>	PHYS	INST	87.1
<i>Publication</i>	INFO	PHYS	80	<i>Interview</i>	INFO	EVENT	95.8	<i>Office</i>	PHYS	INST, EVENT	83.3
<i>Newspaper</i>	INFO	PHYS, INST	70.9	<i>Movie</i>	INFO	EVENT	95.4	<i>Cinema</i>	PHYS	EVENT	68.1
<i>Magazine</i>	INFO	PHYS, INST	68.9	<i>Adaptation</i>	INFO	PHYS	93.5	<i>Theatre</i>	PHYS	EVENT	63.6
<i>Report</i>	INFO	PHYS	67.7	<i>Poem</i>	INFO	EVENT	87.5	<i>College</i>	PHYS	INST	56.6
<i>Journal</i>	INFO	PHYS	61.2	<i>Lecture</i>	INFO	EVENT	83.3	<i>Institution</i>	PHYS	INST, EVENT	50
<i>Album</i>	INFO	PHYS	54.1	<i>Speech</i>	INFO	EVENT	79.2	<i>Circus</i>	EVENT	PHYS	95.8
<i>Paper</i>	PHYS	INFO	73.6	<i>Sermon</i>	INFO	EVENT	79.1	<i>University</i>	INST	PHYS	58.0
<i>Catalogue</i>	PHYS	INFO	53.8	<i>Pitch</i>	PHYS	INFO	91.6	<i>School</i>	INST	PHYS, EVENT	45.1

Table 19: Average scores for the fill-in-the-blank norming study. ‘Dom’ denotes the dominant sense, ‘Subord’ denotes the subordinate sense, ‘% Dom’ denotes the percentage of dominance exhibited by the dominant sense. The nominal types were grouped by the following colours: Black: newspaper-type, Green: lecture-type, Blue: school-type. Exceptions to the general frequency trend are highlighted in yellow.

Pitch and *paper* were outliers in the sense that they were interpreted by participants as *sports pitch*, but in the context of the acceptability experiment below it is clearly the *brief speech* and *newspaper* meanings being accessed, so these items were omitted from the Frequency ANOVAs conducted below.

4.3.6. Results: Acceptability Data

4.3.6.1. Comprehension Question Analysis

All participants scored above 80% on comprehension questions.

4.3.6.2. Acceptability Judgement Data

Figure 12 and Table 20 depict the average scores for the four conditions and three nominal types.

For the ungrammatical and grammatical filler items, these scored an average of 1.5 and 6.2 out of 7, respectively, indicating good participant performance.

Complexity: ANOVAs revealed highly significant main effects of Sense Combination (F1: $F(1,59) = 25.761$, $p = <.001$; F2: $F(1,11) = 16.198$, $p = .002$), such that Abstract+Abstract conditions were preferred to Concrete+Abstract conditions. A main effect of Sense Order was found only for the F1 analysis, although the F2 analysis approached significance (F1: $F(1,59) = 8.887$, $p = .004$; F2: $F(1,11) = 4.562$, $p = .056$), such that there was an indication that Simple-Complex orders were generally preferred. No interaction effects were found ($ps > 0.2$).

Nominal Type: ANOVAs revealed highly significant main effects of Nominal Type and Sense Combination (Nominal Type F1: $F(2,58) = 16.772$, $p = <.001$; Nominal Type F2: $F(2,10) = 13.563$, $p = .001$; Sense Combination F1: $F(1,59) = 26.655$, $p = <.001$; F2: $F(1,11) = 9.845$, $p = .009$). An effect of Sense Order was found only for the F1 analysis ($F(1,59) = 8.984$, $p = .004$). In addition, a Nominal Type \times Sense Order interaction was found for the F1 analysis ($F(2,58) = 5.696$, $p = .006$) (all other interactions $p > .241$).

Resolving the F1 interaction, t-tests contrasting the Simple-Complex and Complex-Simple conditions for each nominal type were conducted. Effects were found only for *lecture*-type items, for the two Concrete+Abstract conditions ($t(59) = 2.513$, $p = .015$) and the two Abstract+Abstract conditions ($t(59) = 4.756$, $p = <.001$) (for all other contrasts $p > .196$). As such, *lecture*-type items exhibited a strong Simple-Complex preference.

Frequency: The 2 (Frequency; Dominant-Subordinate vs. Subordinate-Dominant) \times 2 (Sense Combination) ANOVAs revealed a main effect of Sense Combination for both the F1 and F2 analyses (F1: $F(1,59) = 27.137$, $p = <.001$; F2: $F(1,33) = 7.273$, $p = .011$), replicating the above effect. No effect of Frequency was found (F1: $F(1,59) = .042$, $p = .837$; F2: $F(1,33) = .049$, $p = .825$). An interaction effect was found for the F1 but not F2 analysis (F1: $F(1,59) = 17.298$, $p = <.001$; F2: $F(1,33) = 3.109$, $p = .087$). Following up the F1 interaction, t-tests contrasting the Sense Combination conditions revealed a

<i>C+A, Simple-Complex</i>	4.40 (.30)	5.17 (.25)	4.44 (.25)
<i>C+A, Complex-Simple</i>	4.53 (.25)	4.65 (.13)	4.20 (.29)
<i>A+A, Simple-Complex</i>	5.01 (.15)	5.69 (.24)	4.74 (.17)
<i>A+A, Complex-Simple</i>	4.88 (.24)	4.98 (.24)	4.58 (.16)

Table 20: Average acceptability scores (and standard errors) for all conditions across the three nominal types (newspaper-type, lecture-type, school-type). C+A = Concrete+Abstract, A+A = Abstract+Abstract.

Coherence: Considering the coherence (*extensional overlap + causal connection*) measure (M: 7.6; SD: 2.0), it was shown that acceptability did not significantly correlate with coherence ($r = .090$, $n = 36$, $p = .453$) (see Figure 13).

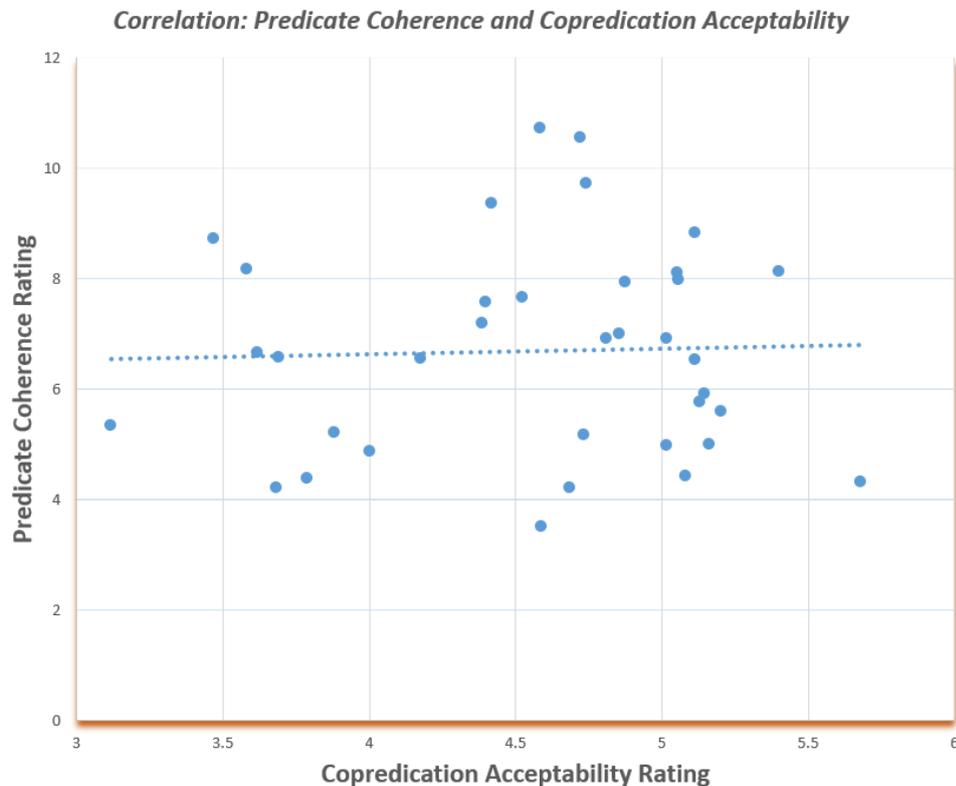


Figure 13: Scatter plot mapping copredication acceptability rating (X axis) against predicate coherence rating (Y axis) with linear trend line ($R^2 = 0.001$).

4.3.7. Discussion

The results indicated a significant effect of sense category combination, such that copredications involving two abstract senses are more acceptable than copredications involving a mix of concrete and abstract senses. In addition, there was an indication (from the F1 analysis) that a general Simple-Complex sense order preference was significant.

Of particular interest is the finding that this Simple-Complex order preference obtained even for copredications with two abstract predicates, suggesting that this ordering effect is not reducible to semantic category. These results support the present conception of *Incremental Semantic Complexity* according to which the acceptability of different sense orderings is driven by semantic complexity (and not semantic category along the concrete/abstract division). Furthermore, given that the Abstract+Abstract items were all structured along dimensions of complexity and not abstractness (the Simple-Complex items were structured as INFORMATION-INSTITUTION (*newspaper*-type), INFORMATION-EVENT (*lecture*-type), EVENT-INSTITUTION (*school*-type)), and given that all nominal types exhibited a Simple-Complex preference.

This particular framing of *Incremental Semantic Complexity* may also derive the reported Concrete-Abstract preferences in Scorolli et al. (2011), such that the simpler concrete sense primes the complex abstract sense. Indeed, as Scorolli et al. (2011: 8) note, participant sensicality judgement responses were faster when the first word shown in a sentence was concrete, “regardless of its grammatical class (verb vs. noun) and of the spoken language (German vs. Italian)”. The Simple-Complex preferences exhibited for Abstract+Abstract items in the present experiment may therefore emerge from a separate bias; possibly a related sense priming bias (e.g. EVENT priming INSTITUTION). Yet this would require a number of specific priming effects (INFORMATION → EVENT; EVENT → INSTITUTION; INFORMATION → INSTITUTION). *Incremental Semantic Complexity* would therefore provide a simpler explanation.

The Nominal Type analyses revealed that *lecture*-type items exhibited the most robust preference for Simple-Complex orderings. Examining the acceptability ratings, the only exceptions to the predictions of *Incremental Semantic Complexity* were the *newspaper*-type Concrete+Abstract conditions, although analysis did not reveal this average difference to be significant. Note that the standard error ratings for *newspaper*-type Concrete+Abstract conditions are higher than all other ratings (the average SE for all other conditions excluding *newspaper*-type Concrete+Abstract items is .21; compare this with .30 for the *newspaper*-type Concrete+Abstract Simple-Complex condition). This larger SE is an indication that the sample mean is likely to be a less accurate reflection of the actual population mean, and so variability in ratings for these conditions may have contributed to the unpredicted result.

Lastly, there was found to be no significant correlation between copredication and coherence. This supports the claim that the present experimental results, and the dynamics of sense complexity, were not primarily due to coherence, and were instead likely due to the effects of establishing distinct types of copredications and of doing so in different orderings. However, the lack of an effect for coherence contrasts with the significant effect found for Experiment 6. It appears that any effect of coherence on copredication acceptability may be localised to complex predicates (Experiment 6) but not simple predicates (Chapter 3), but not robustly so (no replication for Experiment 9). The reasons for variability here may be a function of the specific nominals chosen, which differed between Experiments 6 and 9, or indeed it may be due to the specific predicates.

4.4. Summary and Implications: *Copredication Licensing Effect*

Overall, the present experiments replicated the findings in Chapter 3 of a Concrete-Abstract sense order preference and grounded this in a more general Simple-Complex preference. Along with the findings reported in Chapter 3, the present experiments support the One Representation Hypothesis whereby complex polysemous nominals have a single lexical entry hosting distinct senses. This support comes in the form of syntactically ‘standard’ copredication involving conjunction (*The newspaper was Adj₁ and Adj₂*) not appearing to license polysemous sense integration in a manner that is more costly than sense integration over distinct nominal representations (either a different polysemous nominal or a pronominal element). Indeed, while Chapter 3 found a cost of polysemous sense switching, as did Klein and Murphy (2001), we also found evidence that in the majority of syntactic structures explored copredication is not costlier than non-copredication, and in some structures is less costly (i.e. Experiments 6 and 8). The exception to this trend was Experiment 4, which used *Adjective-Nominal-Adjective* syntax and also sense repetition for the non-copredication items, but all other constructions showed no robust cost for copredication. In conjunction with the previous chapter, these findings support the One Representation Hypothesis of complex polysemy storage. In particular, they support a core prediction of the related underspecification processing model, that words with a greater number of senses will not be harder to process than words with fewer senses (Frisson & Pickering 2001: 166).

A summary of all experiments in this chapter can be found in Table 21:

Experiment	Design	Sample Stimuli	Sentence Type Effect	Sense Order Effect	Coherence Effect	Sense Frequency Effect
6	Copredication (Yes or No) Sense Order (Concrete-Abstract or Abstract-Concrete)	The newspaper is on the top shelf and [Ø/the magazine] was founded in 1850. The newspaper was founded in 1850 and [Ø/the magazine] is on the top shelf.	<u>Yes</u> (F1 + F2) Copredication > Non-Copredication	<u>Yes</u> (F1 + F2) Concrete-Abstract > Abstract-Concrete	<u>Yes</u> (Positive correlation between Copredication acceptability and coherence) N/A	No
7	Sentence Type (Copredication or Pronominal) Sense Order (Concrete-Abstract or Abstract-Concrete)	The publication is covered in coffee and [Ø/it] is owned by a trust. The publication is owned by a trust and [Ø/it] is covered in coffee.	No	<u>Yes</u> (F1 + F2) Concrete-Abstract > Abstract-Concrete	N/A	No
8	Sentence Type (Pronominal or Non-Copredication) Sense Order (Concrete-Abstract or Abstract-Concrete)	Sentences from both Experiments 6 and 7 for, respectively, the Pronominal and Non-Copredication items.	<u>Yes</u> (F1) Copredication < Non-Copredication	<u>Yes</u> (F1) Abstract-Concrete < Concrete-Abstract	N/A	<u>Yes</u> (F1) Dominant-Subordinate preference
9	Sense Combination (Concrete + Abstract or Abstract + Abstract) Sense Order (Simple-Complex or Complex-Simple)	The magazine [is printed weekly/focuses on politics] and took part in the conference. The magazine took part in the conference and [is printed weekly/focuses on politics].	<u>Yes</u> (F1 + F2) Abstract-Abstract > Concrete-Abstract	<u>Yes</u> (F1) Simple-Complex > Complex-Simple	No	No

Table 21: Summary of experimental design and results. ‘>’ and ‘<’ denote, respectively, more acceptable than and less acceptable than.

There appears to be no relation between sense frequency and the results of the present experiments, which involved a different sentence structure from the experiments in Chapter 3 (*Nominal-Predicate₁-Predicate₂*). This is a crucial point, given that certain

sense frequency-based accounts are motivated by experiments exploring cases in which at least one of the predicates appears after the nominal. Only *newspaper*-type nominals are abstract-dominant out of the three nominal types used in the present chapter, and yet it was the *school*-type nominals which did not adhere to the Concrete-Abstract preference. As such, the results more strongly favour the complexity-based account. In addition, by showing that frequency has no direct effect on the results, we have provided further evidence in favour of a single-entry One Representation Hypothesis model of polysemy storage in the lexicon, while we have also provided further evidence for an underspecification model of processing. The results, in contrast, did not support a Parallel Activation model or the related unranked or ranked Fully Specified ORH model.

Moving to the latter part of the chapter, the results from Experiment 9 suggested that sense order acceptability is driven by semantic complexity across copredication types (Concrete+Abstract and Abstract+Abstract), not the concrete/abstract division, and that copredications involving two abstract senses are more acceptable than copredications involving a combination of concrete and abstract senses. This not only points towards a cost of switching between polysemous senses (*à la* Frisson 2015), but towards a further switching cost between different senses classified by the broader abstract/concrete categorial distinction.

In connection with the previous chapter's findings, the Simple-Complex preference departs from Bueno's (2017) discovery of highly similar acceptability scores for both Abstract-Concrete and Concrete-Abstract sense orderings in *book*-type (Chapter 3) and *committee*-type (*school*-type in the present experiment) copredications. The highly robust finding that Concrete-Abstract orderings were preferable to Abstract-Concrete orderings (and, more specifically, that Simple-Complex orderings were preferable to Complex-Simple orderings) supports the hypothesis that the parser adheres to the *Incremental Semantic Complexity* preference. Among other things, this may explain the contrast below discussed in previous literature (see Chapter 2), with the PROCESS sense in (30a) preceding the PHYSICAL sense:

- 30) a. #The translation that was difficult lies on the table.
- b. The translation that lies on the table was difficult.

As discussed in Chapter 2, when the INSTITUTION sense follows the other senses of *newspaper*, the results are subtly improved:

- 31) a. #John sued the newspaper that he had spilled coffee on.
- b. John spilled coffee on the newspaper that he had sued.

If this effect of sense order is indeed a general one, then many theories of copredication might in fact be discussing processing effects, and not semantic structure and conceptual constraints. In brief, there may not be much (if anything) unique about copredication from the perspective of acceptability judgements, but its unusual nature exposes certain properties of the parser which can inform psycholinguistic debates, and more generally reveal the properties of a unique linguistic phenomenon. The current results suggest that polysemous nominals licensing copredication are stored as single, complex representations. As Sprouse (2011) discovered, online acceptability tests yield almost indistinguishable results from laboratory settings, and so these conclusions can be drawn with a serious degree of confidence (see also Sprouse & Almeida 2017 for evidence that acceptability ratings are very often replicated).

Finally, as noted, it may be that offline *acceptability* judgements do not differ significantly between copredication and non-copredication, but more specific forms of online *processing* may expose certain differences, for instance with reading times or event-related potential responses implicated in semantic reanalysis and prediction. While acceptability scores do not significantly differ between copredications and non-copredication, the online processing of these structures may reveal a particular time course exhibiting significant processing differences. The next chapter will explore this.

Overall, the proposals in Chapter 2 and the empirical evidence reviewed here can be summarised via the following generalisation about copredication:

Copredication Licensing Effect (CLE)

Predicate ordering is a major factor in copredication acceptability, and there is partial support for *predicate coherence* positively correlating with copredication acceptability for complex (but not simple) predicates.

The results from Experiment 6 (which used complex, multi-word predicates, unlike Chapter 3's single-word predicates) support the inference that coherence increases can in some manner be related to acceptability increases. Meanwhile, the lack of an effect for coherence documented for Experiment 9 suggests that this effect may be sensitive to very particular combinations of predicates, and in addition that further research is required to explore this relation more systematically. The particular direction of causality inferred here can be justified by reference to the observation that the coherence norming studies did not focus on acceptability, and involved participants rating certain relations between bare adjectival and verb phrases. As such, while the analyses performed were merely correlational, and our conclusions must remain at this level, we would also like to suggest that further work could explore the possibility that the coherence-acceptability relationship can also be causal.

Wrapping up our discussion, recall that the theories of copredication which Chapter 2 outlined made a number of claims about the predicted acceptability and processing costs for various manipulations in copredication. Asher (2015) makes a refined contrast between coercion and copredication, but crucially claims that both phenomena are generated via meaning transfer. Arapinis (2013, 2015) produces a more specific claim about institutional concepts being the most semantically complex polysemous constructions. While the CLE is not inherently incompatible with certain theories reviewed in Chapter 2, it does crucially depart from some others, for instance, Brandtner's claims about meaning shifts at the second predicate make no recourse to ordering factors, even though she acknowledges the role of coherence. In addition, the CLE is effectively a summary of effects at the semantics-pragmatics interface (the connections between semantic structure and pragmatic processes are well-documented and extensive; Borg 2012, Carston 2009, Frisson 2009, Grindrod & Borg 2019, Recanati 2010), but it remains agnostic about the psychological accounts reviewed in Chapter 2 and their underlying processes.

In brief, the most robust finding from the present and previous chapters is that predicate ordering acceptability is modulated by sense complexity but not by sense frequency. The underlying themes here are: (i) a defence of a version of the One Representation Hypothesis, and (ii) the effects of sense complexity on predicate ordering acceptability.

5. *Processing Properties of Copredication*

It has so far been established, through the behavioural studies reported above, that copredication does not have a unique effect on sentence acceptability. It was also established that the parser may be sensitive to the predicate orderings involved in both copredication and non-copredication, such that Simple-Complex predicate orderings were generally more acceptable than the reverse. It was concluded that the major acceptability dynamic at play centred on predicate order, structured around semantic complexity (and not sense frequency or concreteness). These findings motivated an elementary, stepwise parsing preference, *Incremental Semantic Complexity*.

It was concluded in Chapters 3 and 4 that the data can best be captured by a particular complexity-based psycholinguistic hypothesis concerning the acceptability properties of copredication invoking *Incremental Semantic Complexity*. We will now use this psycholinguistic background to investigate the electrophysiological basis and processing properties of copredication.

It was noted in Chapter 4 that while the previous experiments revealed that the effect of copredication on acceptability ratings was not clear, more sensitive measures of online *processing* may present a clearer picture. Indeed, this lack of consistency might lead one to suggest that behavioural measures are not sufficiently sensitive to the parsing processes underlying copredication interpretation.

This chapter will report an electroencephalographic (EEG) experiment which aims to examine the effect of copredication on electrophysiology and whether it is modulated by target (i.e. second predicate) sense. Our investigation will look at evoked brain responses (event-related potentials, ERPs) as well as neural oscillations, which we will review below.

5.1. Measures of Processing in EEG

EEG is used in the present chapter to investigate the psycholinguistic processes involved in parsing copredication and non-copredication (Luck 2014). This will involve the examination of two core measures of processing: event-related potentials and neural oscillations.

5.1.1. Event-Related Potentials

Event-related potential responses (ERPs) are derived through time-locking EEG data to stimuli or events of interest and then averaging these epochs to generate a stable waveform. Since the early years of cognitive neuroscience, it has been observed by many that the electrophysiological processes involved in a variety of linguistic operations can be reflected in ERP components (see Swaab et al. 2012 for a review).

The present study will explore the processing properties of copredication through the lens of three ERP components known to be involved in language processing: the P200, N400 and P600. The P200 is a positive-going spike approximately 125-275ms post-stimulus. It is typically found in parieto-occipital or centro-frontal sites, although by definition it can appear anywhere. For our purposes, it has been argued to reflect early lexical access (Landi et al. 2007, Lee et al. 2012).

The N400 is a negative-going waveform peaking approximately 400ms post-stimulus (Kutas & Hillyard 1980). This is typically assumed to reflect lexical access (Lau et al. 2008) or the interpretation of meaningful stimuli in general (i.e. not specifically linguistic stimuli), and has also been associated with semantic memory, integration and expectation (Kutas & Federmeier 2009, 2011). Though it is elicited by almost every content lexical item, the amplitude of this component is thought to be modulated by semantic processing costs (Wlotko & Federmeier 2012). The N400 has also been proposed to index post-lexical integration processes (Brown & Hagoort 2000), although the most recent evidence suggests that it is primarily indexing lexical retrieval (Delogu et al. 2019).

The P600 is a positive-going waveform, typically peaking 600ms at posterior electrode sites (Neville et al. 1991, Friederici et al. 1993, Gouvea et al. 2010). The P600 is implicated in procedures of domain-general error detection (van de Meerendonk et al. 2010) and, alternatively, syntactic reanalysis (Osterhout & Holcomb 1992) and syntactic integration (Kaan et al. 2000). The P600 could also reflect language-external context-

updating processes (Coulson et al 1998, Brouwer et al. 2012) reacting to ‘surprise’ (Donchin 1981).

Examining studies more closely connected to our present concerns, Schumacher (2013) examined adjective-noun combinations like ‘the wooden turtle’ which transformed an animate entity into a physical object. As such, this involved the combination of semantically distinct meanings being attributed to a single object, albeit in this case – in contrast to copredication – it yielded a modification in the prototypical meaning of the nominal. A Late Positivity at the critical noun was seen by Schumacher (2013) as reflecting processing demands resulting from reference shift from the prototypical denotation (animate turtle) to the contextually derived interpretation (inanimate turtle).

Although this seems like a possibility in copredication, there are reasons to doubt the applicability of Schumacher’s findings to the present study. Firstly, the processes arising from this Late Positivity will not be applied to copredications, given that the two senses of *book* are part of its inherent polysemy. Thus, while a ‘reference shift’ may occur, this will not be from one denotation/extension to another, but rather from one aspect of an object to another. Secondly, as Schumacher already notes, the idea that stimuli like ‘the wooden turtle’ require a clear reference shift from prototype to contextually derived meaning is “supported by the linguistic unavailability of the original meaning, exemplified by copredication tests” (2013: 1). Although she did not directly test copredications, Schumacher did test content-for-container meaning shifts (e.g. ‘Chris put the beer on the table’) and found that these did not yield a Late Positivity (in contrast to container-for-content shifts, which did yield a Late Positivity). These content-for-container meaning shifts permit copredication, since they involve what Schumacher (2013: 3) calls “a type shift or meaning adjustment without altering the respective discourse referent in fundamental ways”.

As such, it remains an open question if there are any event-related potential differences between copredication and non-copredication. Metonymic shifts of the kind found in cases such as ‘The ham sandwich at table 2 wants to pay’ have been shown to result in enhanced processing costs relative to sentences involving no meaning shift (Schumacher 2011, 2014, 2019). However, these crucially bar copredication (*‘The ham sandwich at table 2 paid and was delicious’), and so this places further doubt on the idea that copredication should incur processing costs – or, at least processing costs comparable in scale and temporal localisation.

In related ERP work, Taler et al. (2013) found that words with a number of related senses (e.g. *eye*) yield low N400 responses compared to words with few related senses (e.g. *gym*). However, these findings may not be replicated for copredication/non-copredication contrasts since the polysemous nominals only have two (or in some cases three) senses, and Taler et al. tested words across lexical classes (e.g. *table* as a verb vs. noun).

Baggio et al. (2008) conducted an ERP study examining the effects of recomputing discourse models, or the processing involved in semantic reanalysis (in contrast to the much more heavily studied topic of syntactic reanalysis). These authors used narratives like ‘The girl was writing a letter when her friend spilled coffee on the paper’, and argued that these sentences involve firstly interpreting the progressive clause as yielding a prediction of a goal state (i.e. a completed letter), and secondly interpreting the subordinate clause to the effect that the goal state is not achieved; hence the discourse is recomputed/reanalysed. In contrast to controls, these sentences evoked larger sustained anterior negativities at around 400ms at the onset of the sentence-final word, lasting for around 400ms. This negativity correlated with the frequency with which participants judged that the goal state was not achieved (in a separate offline task). They concluded that the brain implements a form of non-monotonic recomputation to integrate information invalidating discourse assumptions. As such, it may be that copredications, involving direct meaning shifts, also trigger this sustained anterior negativity implementing this reanalysis procedure.

In more recent work, Yurchenko et al. (2018) found a priming effect for shifts from literal senses to metonymic senses of polysemous words (e.g. *shabby journal* – *science journal*), via a reduced N400 and P600 amplitude relative to literal-metaphorical shifts (e.g. *shabby journal* – *television journal*). This effect was taken to support “the idea that these [literal and metonymic] senses share a single representation in the mental lexicon” (2018: 2). As such, this would predict no significant ERP effects for copredication vs. non-copredication contrasts, given that these metonymic interpretations are closely related to copredications (e.g. *school*-type building-institution shifts are arguably metonymic in nature).

At the most general level, we can predict that an effect of copredication will modulate at least one of the above ERP components. More specifically, the core hypothesis we can construct for the P200 component is that copredication will involve a more demanding

series of computations related to memory access, searching the lexicon for senses of distinct categories. An N400 effect for copredication could also reflect an unsatisfied prediction (being linked as it is to semantic processing and ‘surprisal’), such that the parser might predict a concrete sense to come after another concrete sense (or an abstract after an abstract) (see Chow 2013, Dikker et al. 2009 and Kamide 2008 for discussions of prediction in language processing). P600 effects could be found for similar reasons relating to integrating categorially identical or distinct senses into the discourse. A P600 effect for copredication relative to non-copredication may also be due to the parser attempting to accommodate the second adjective with the first, semantically distinct one. More generally, a lack of any effect of copredication (i.e. copredication vs. non-copredication contrast) at these time windows would support the One Representation Hypothesis storage model and also the underspecification processing model of polysemy, while greater processing effort on the part of copredicated items relative to non-copredicated items would support a Sense Enumeration Lexicon storage model.

It should be stressed that there is no previous ERP work investigating copredication, and the present experiment is the first to report on its dynamics.

5.1.2. Neural Oscillations

Along with exploring ERP components, the oscillatory basis of copredication will also be briefly explored. Contemporary debates concerning the origins of ERP component generation have led some (Makeig et al. 2002, Tass 2000) to suggest that components do not emerge from latency-fixed polarity responses which are additive to continuing EEG responses, but rather emerge via a superposition of oscillations which reset their phases in reaction to sensory input. More generally, responses that are out of phase cannot be detected in ERPs.

Neural oscillations reflect synchronised fluctuations in neuronal excitability and are grouped by frequency, with the most commonly studied frequency ranges being delta (δ : ~0.5-4Hz), theta (θ : ~4-8Hz), alpha (α : ~8-12Hz), beta (β : ~12-30Hz) and gamma (γ : ~30-150Hz). These are generated by various cortical and subcortical structures and form hierarchical relations since slow rhythms phase-modulate the power of faster rhythms (Figure 8). It has been known since at least Wilson and Bower (1991: 498) that “the phase and frequency of cortical oscillations may reflect the coordination of general computational processes within and between cortical areas”. Fast γ oscillations can be

found at sites ranging from single neurons to neural clusters to EEG recordings, while slow rhythms below 10Hz have been found to dominate the cortex in both wakefulness and sleep, and have been found to be coupled to the amplitude of faster rhythms across all cortical layers (Halgren et al. 2017). There is accumulating evidence that neural oscillations are related to a number of basic and higher cognitive functions, for example speech perception (Giraud & Poeppel 2012, Kayser et al. 2015). I will be building on recent developments in the field to explore a feature of electrophysiology known as *cross-frequency coupling*, through which the behaviour of two frequencies are co-dependent. This arises through multiple means (see Figure 14). It has been shown that via ‘phase-amplitude’ cross-frequency coupling (example (e) in Figure 14) the phase of the lower frequency (e.g. δ) modulates the amplitude of the higher frequency component (e.g. γ), a process claimed to be involved in information transfer for faculties such as memory (Malekmohammadi et al. 2015, Tort et al. 2009). Bergmann and Born (2017) review evidence that phase-amplitude coupling constitutes a general mechanism for memory processing/consolidation and synaptic plasticity. In short, with phase-amplitude coupling the phase of the slower rhythm modulates the amplitude of the faster rhythm (Murphy 2015, 2016, 2018, 2020, Murphy & Benítez-Burraco 2019).

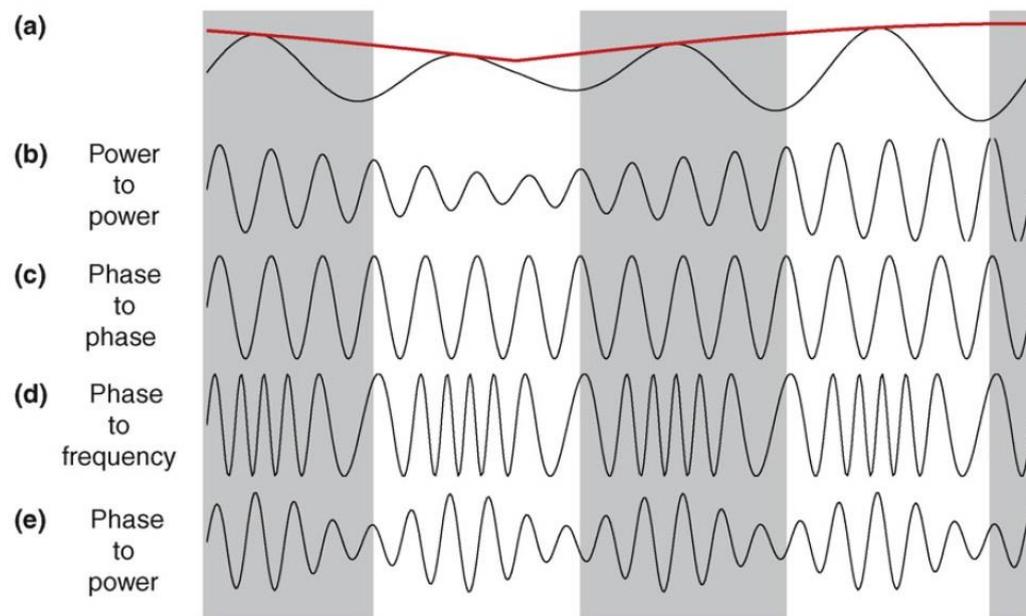


Figure 14: A representation of the different types of interplay slower and faster rhythms exhibit. (A) A theta oscillation and its power denoted by the red line. (B) Power-power: The amplitude of the slower and faster rhythms correlates. (C) Phase-phase: A set number of faster cycles within a given slower phase. (D) Phase-frequency: The faster rhythms correlate with the specific phase of the slower rhythm. (E) Phase-power (also known as phase-amplitude): The power of the faster rhythm correlates with the phase of the slower rhythm.

It should be stressed from the outset that since there has been no previous oscillation-based experimental work into copredication, the present experiment is therefore primarily exploratory. As such, the motivation for the oscillatory analysis presented below will be to cover new ground for investigations into the psycholinguistic basis of complex polysemy.

5.2. Experiment 10: Event-Related Potential and Phase-Coupling Properties of Copredication

The present experiment used EEG to explore the neural basis of copredication. In order to examine the effect of copredication and its potential interaction with target sense, we manipulated Sentence Type (Copredication vs. Non-Copredication) and Target Adjective (Abstract vs. Concrete). The target word was the second adjective, as in ‘The newspaper was witty and **educational**’ and was either Abstract or Concrete. The senses of the two adjectives were either the same or different. In particular, the present experiment tested simple adjectival conjunctions, and these constructions are much less problematic than copredications involving larger predicates. In the Concrete-target condition, the second predicate (i.e. the target word) was concrete (e.g. ‘The newspaper was {ripped/witty} and **folded** and was on the shelf’); in the Abstract-target condition, the second predicate was abstract (e.g. ‘The newspaper was {witty/ripped} and educational and was on the shelf’). The syntax of the sentences was chosen to ensure that the nominal representation was truly established by the point of the target word, and that what was analysed was precisely the moment of establishing the copredication. For instance, in ‘The ripped and educational newspaper...’, comprehenders may well predict a copredication at the point of ‘educational’, and so processing the target word (‘newspaper’) may involve integration and prediction-resolving processes not specific to copredications.

Recall from Chapters 3 and 4 that the currently most empirically supported storage model of polysemy is the One Representation Hypothesis, while the most well-supported processing model is the complexity-based underspecification account according to which initial processing does not differentiate between distinct senses. Even though ORH models

restrict their focus to early processing (lexical access), since the present experiment examined the effects of the target adjective and not subsequent material, the results reported here bear direct impact on them. Under ORH, polysemous senses either depend on or belong to a single representation. The core ORH prediction for the present set of materials is that we will find no significant effects of copredication on participants' brain responses (ERPs or oscillations) since both concrete and abstract senses – though categorially distinct – are assumed to be part of the nominal representation, priming each other (in particular, after presentation of the first predicate). Alternatively, under the Sense Enumeration Lexicon Hypothesis, one might expect to find a significant effect of Sentence Type in either electrophysiological measures. As such, our main focus here will be on the effects of copredication on these theoretical frameworks.

Support for the ORH can be found already in the neuroimaging literature. For instance, even though they did not explore copredication and focused purely on either the abstract or concrete senses of complex polysemous nominals (and never both at the same time, as we have done in this thesis), Tao (2015) used fMRI to explore the neural basis of abstract and concrete senses in the three main nominal types explored in this thesis (*book-*, *city-* and *lunch-*type). Participants encountered these senses in a minimal context (e.g. *cook the lunch*; *organise the lunch*), with both abstract and concrete senses revealing significant activation in the anterior temporal lobe (often seen as a semantic hub). As such, both senses of complex polysemous nominals appear to share a common representational basis, as opposed to a distinct one.

The design of the present study is not suited to examining the effect of sense order specifically, since comparing two distinct target words adds a number of confounds. Overall, the present study could discover an effect of target adjective but *no effect* of sentence type (Copredication vs. Non-Copredication) in the ERPs. Alternatively, if EEG is more sensitive to the underlying acceptability dynamics of copredication, then we may find an effect of copredication in this experiment. In addition, the effect of copredication might be modulated by sense order for reasons discussed in Chapter 3; namely, it may be that shifting from type *X* to type *Y* is costly from a processing perspective, but not the reverse. Given that Chapter 3 reported at least some acceptability differences in copredication relative to non-copredication, and between adjectival sense orderings, copredication may impact one or more of the language-related ERP components (in particular the N400, given its association with semantic processing). Alternatively,

perhaps even online measures like ERPs cannot detect any processing cost associated with copredication, and it would be left to measures such as eye-tracking and self-paced reading to further explore this complex issue.

In order to address these questions, it is necessary to have an understanding of the acceptability dynamics of the experimental materials. One could arguably infer this from the range of experiments reported in previous chapters, but since there was some variability in the Copredication/Non-Copredication comparisons, acceptability ratings for the items were gathered.

5.2.1. Methods: Acceptability Judgements

5.2.1.1. Participants

Data from 52 participants who did not take part in the EEG study was analysed (mean age = 28; range = 18-55; 29 male). Participants were paid £6 per hour, with the average finishing time being 34 minutes. Participants were filtered from Prolific Academic based on their age (above 18), native language (English), and their rate of approval from previous experiments (at least 90%). They provided informed consent and were asked to provide three sentences describing a recent activity they had participated in to ensure that they were proficient English speakers.

5.2.1.2. Materials

Experimental and filler items (and items lists) were identical to the EEG experiment; since item design was motivated by concerns relating to the ERP and oscillation analysis, these have been reported below.

5.2.1.3. Procedure

The procedure was identical to all previous acceptability judgement experiments (see Chapter 3), involving an online acceptability judgement experiment using Qualtrics (qualtrics.com/uk) and sourcing participants from Prolific Academic (prolific.ac), and employing a 1-7 Likert scale. The only difference between this experiment and the EEG procedure is that instead of binary plausibility questions (as in the EEG procedure), the present experiment used the familiar type of comprehension questions as used in the previous chapters.

5.2.1.4. Analysis

We replicated the full analysis from most of the previous acceptability judgement experiments, conducting 2 (Sentence Type) \times 2 (Adjective) \times 3 (Nominal Type) repeated measures by-subjects and by-items ANOVAs. 2 (Frequency; Dominant Target vs. Subordinate Target) \times 2 (Sentence Type) ANOVAs were also conducted.

5.2.2. Methods: EEG

5.2.2.1. Participants

Twenty-four participants (7 male, 17 female, mean age = 26) from University College London’s Psychology Subject Pool took part in the study and were either paid £7.50 per hour or were assigned course credit. This number is in line with the standard recommendation of 20-40 participants for the N400 and P600 (Luck 2014). All participants were right-handed native English speakers who had normal or corrected-to-normal vision and no history of neurological disorder. They provided informed consent in accordance with the Data Protection Act 1998 and completed a handedness questionnaire adhering to the Edinburgh inventory (Oldfield 1971).

5.2.2.2. Materials

120 experimental sets of four sentences were constructed, 40 for each nominal type (*book-type*, *city-type*, *lunch-type*) were presented. The four conditions are shown below, with the target word being in bold and other examples can be found in the Appendix. Table 22 depicts the design of these materials.

	<i>Abstract Target</i>	<i>Concrete Target</i>
<i>Copredication</i>	The newspaper was ripped and educational and was on the shelf.	The newspaper was witty and folded and was on the shelf.
<i>Non-Copredication</i>	The newspaper was witty and educational and was on the shelf.	The newspaper was ripped and folded and was on the shelf.

Table 22: Sample experimental materials in Experiment 10. Target words are in bold.

Ideally, we would like to compare participants' ERP response to an identical target word across all four conditions, as in sentences in which the nominal is the target (e.g. 'The stale and rushed **dessert**...'). However, this would bring with it a baseline problem since the target word would be preceded by different adjectives across conditions. Therefore, placing the adjectives in a post-nominal configuration (as in the examples above) was the most appropriate route forward. It follows from this design that any main effect of target Adjective will be uninterpretable in and of itself, since this would involve comparing two distinct words. Since the main research questions of this thesis centre on the effects of copredication and how they may be modulated by sense combinations, we will examine the effects of Sentence Type (Copredication vs. Non-Copredication) and its interaction with Target Adjective.

In order to avoid sentence-final wrap-up effects – namely, a substantial positive-going, and in some case negative-going ERP wave at the end of a sentence (Field 2004) – a phrase that was identical across the four sentences within each set was added after the target word (e.g. 'and was on the table', 'and was being discussed', 'but was far away', 'according to Sally').⁷⁶ Lastly, all stimuli predicates and nominals were controlled for their SUBTLEX-UK Zipf frequency (nominal averages: *book*-type: 3.9, *city*-type: 4.2, *lunch*-type: 4.0; no significant differences in frequency across nominals for one-way ANOVA: $F = 2.14$, $p = .12$; adjective averages: *book*-type: 4.0, *city*-type: 3.9, *lunch*-type: 3.9; no significant differences in frequency across adjectives for one-way ANOVA: $F = 2.16$, $p = .11$), and were also controlled for character length (*book*-type, *city*-type and *lunch*-type nominals all averaged 6.9 characters; average adjective character length: *book*-type: 7.1, *city*-type: 7.0, *lunch*-type: 6.6; no significant differences in character length across adjectives for one-way ANOVA: $F = 1.64$, $p = .19$).

120 filler items (72 ungrammatical + 48 grammatical items) were also presented, with these being identical to the ones used for the acceptability judgements in Chapter 3 (Experiment 3 onwards) and the grammatical filler list was slightly expanded to ensure 120 fillers.

⁷⁶ Although see Stowe et al. (2018), who show that sentence-final negativities reported in much of the literature are not in fact unique to sentence-final positions, nor do they obscure or distort ERP effects associated with linguistic manipulations. Nevertheless, the present addition of post-target material was not a hindrance to the experimental design or presentation.

Four lists of experimental items were constructed so each participant saw only one sentence from each set. This resulted in each participant being exposed to 240 sentences in total.

5.2.2.3. Procedure and Recording

Participants were seated in a soundproof EEG chamber and sat approximately 100cm from a computer screen. The temperature of the chamber was maintained at 16-18°C, and participants were sat comfortably. The BioSemi ActiveTwo system was employed for the continuous 64-channel recordings (see Figure 15). Silver chloride electrodes fixed to the 10-10 international system were used. Mastoid and eye electrodes were used as reference. Electrode offsets were kept between -25 and +25 μ V and the sampling rate was 2048Hz, later to be downsampled to 512Hz during analysis. Eye movements and blinks were monitored via left temple and right eye channels.

A fixation cross was presented on the screen at the start of each trial. Sentences were presented one word at a time in white font on a black background. Each word was presented on the screen for 300ms and was followed by a blank screen for 230ms. Sentence-final words ended with a period, and the question 'Is this sentence plausible?' appeared 1000ms later. Subjects were required to press a key for either 'Yes' or 'No' responses before pressing a key to continue to the next trial. This task was used purely to keep participants attended to and focused on the stimuli. Participants undertook six practice trials from which they received feedback, and were asked to not blink or move during each trial.

for analysis. We analysed averaged ERP amplitudes within three windows: 100-300ms for P200 (following the most temporal accommodation of this component in Blaszczyk et al. 2018), 300-500ms for the N400 (following the standard window discussed in the review in Kutas & Federmeier 2011) and 500-700ms for the P600 (following the recommendations of the review in Gouvea et al. 2010). Repeated measures ANOVAs were carried out on average ERPs at the above time windows at the following electrode sites and 9 topographic regions of interest (motivated by an aim for maximal scalp coverage): left-anterior: F3, FC3; left-central: C3, CP3; left-posterior: P3, O1; midline-anterior: Fz, FCz; midline-central: Cz, CPz; midline-posterior: Pz, Oz; right-anterior: F4, FC4; right-central: C4, CP4; right-posterior: P4, O2. The ANOVAs crossed Sentence Type (Copredication vs. Non-Copredication), Adjective (Concrete vs. Abstract target word), Anteriority (Anterior vs. Central vs. Lateral channels) and Laterality (Left vs. Midline vs. Right channels). Data from the filler sentences were not analysed.

Repeated measures ANOVAs were carried out using SPSS 27 for the three time windows. 2 (Copredication vs. Non-Copredication) \times 2 (Concrete vs. Abstract target word) \times 3 (Anterior vs. Central vs. Lateral channels) \times 3 (Left vs. Midline vs. Right channels) ANOVAs ($\alpha = 0.05$) were performed.

5.2.2.5. Cross-Frequency Coupling Data Analysis

In order to analyse possible cross-frequency couplings across the dataset, standard preprocessing was carried out in SPM12 (Statistical Parametric Mapping, Wellcome Trust Centre for Neuroimaging; fil.ion.ucl.ac.uk/spm/software/spm12) in MATLAB (version R2016b) following the above criteria from the ERPLAB analysis, with the exception of filtering which was low-passed filtered at 80Hz rather than 50Hz (with 80Hz being the limit of accurate scalp EEG γ activity, with anything above being typically seen as noise; Höller et al. 2018, Muthukumaraswamy 2013). Rather than looking at regional, sensor-level analysis, only the frequency bands and their cross-frequency coupling interactions were analysed. After epoching, filtering, montaging and artefact rejection, time-frequency datasets were constructed for each participant for the amplitude in the 30-80Hz range (regarded as the standard γ range) and phase in the 2-12Hz range (the standard range for δ - α) to be analysed for cross-frequency coupling.⁷⁷ The pre-specified sources of cross-

⁷⁷ Although the δ range is 0-4Hz, it is typically not recommended to include 0Hz in the phase frequencies in SPM as data will be band-passed filtered around it. A frequency of 0Hz also supplies a constant value

frequency coupling interactions were the full list of sensor sites across the scalp. Cross-frequency coupling was computed for all four conditions between the set phase limit (2-12Hz) and the set amplitude band (30-80Hz). A 2×2 ANOVA was conducted using SPM12 (2nd level statistics using the Full Factorial function; no masking applied). After this, contrasts for the β weights were computed using t-contrasts (paired sample t-tests). We will focus on those main effects which reached family-wise (cluster-level) corrected or family discovery rate (FDR) significance.⁷⁸

5.2.3. Results: Acceptability Judgements

5.2.3.1. Comprehension Question Analysis

All participants scored above 80% on the comprehension questions.

5.2.3.2. Acceptability Judgement Data

Figure 16 plots the average scores for the four conditions, and Table 23 plots the scores across all nominal types.

For the ungrammatical and grammatical filler items, these scored an average of 1.6 and 5.5 out of 7, respectively, indicating good participant performance.

Complexity: ANOVAs revealed a main effect for Sentence Type for the F2 analysis, and a main effect of Adjective for both the F1 and F2 analyses, such that Copredication was less acceptable than Non-Copredication and Concrete targets were less acceptable than Abstract targets (F1 Sentence Type: $F(1,51) = .173, p = .679$; F2 Sentence Type: $F(1,39) = 4.523, p = .040$; F1 Adjective: $F(1,51) = 4.500, p = .039$; F2 Adjective: $F(1,39) = 4.168, p = .048$).

Nominal Type: No effects of Nominal Type were found for either the F1 or F2 analyses (F2: $F(2,38) = .989, p = .381$).

(which does not move) and so it makes little sense to include it as part of a cross-frequency coupling analysis; hence the decision to start at 2Hz.

⁷⁸ Cross-frequency coupling is computed here across discrete frequencies, and so specific phase-amplitude values will be reported (rather than more general values such as ‘ δ - γ ’ coupling).

Sense Frequency: The 2 (Frequency) \times 2 (Sentence Type) ANOVAs revealed only an effect of Sentence Type for the F2 analysis (F1 Frequency: $p = .716$; F2 Frequency: $p = .708$; F1 Sentence Type: $p = .080$; F2 Sentence Type: $p = .023$; F1 Frequency \times Sentence Type: $p = .394$; F2 Frequency \times Sentence Type: $p = .590$).

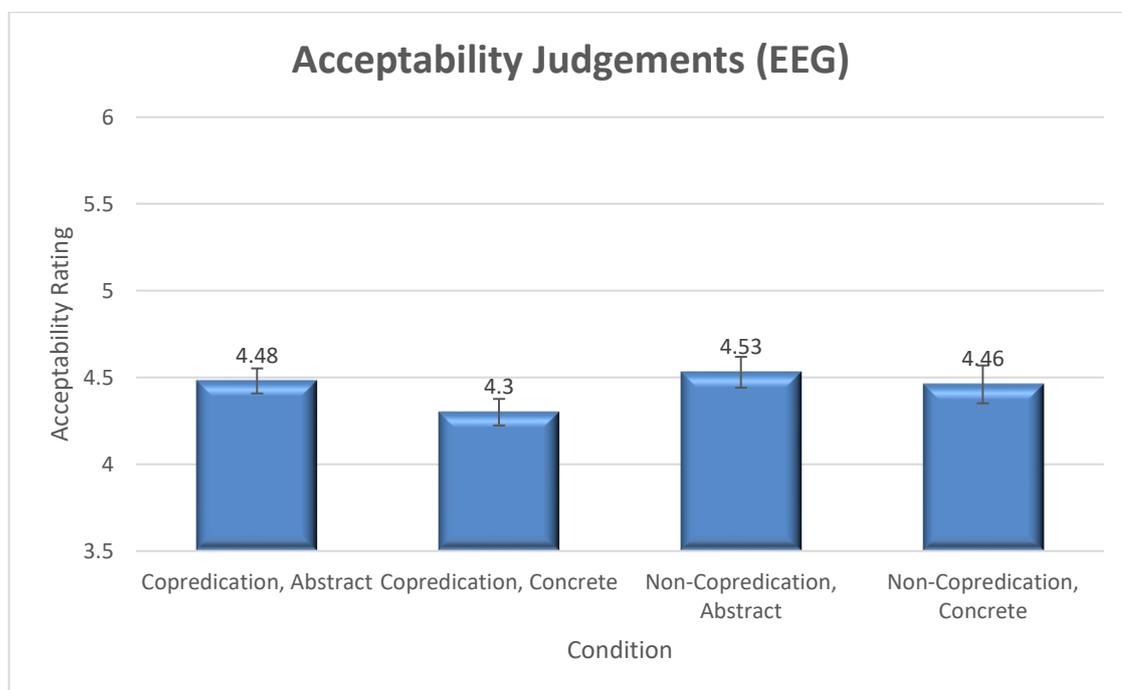


Figure 16: Average scores for the four experimental conditions with standard error bars.

Condition	Book-Type	City-Type	Lunch-Type
<i>Copredication, A</i>	4.63 (.09)	4.40 (.10)	4.34 (.10)
<i>Copredication, C</i>	4.58 (.07)	4.47 (.09)	4.29 (.13)
<i>Non-Copredication, C</i>	4.35 (.09)	4.43 (.09)	4.27 (.12)
<i>Non-Copredication, A</i>	4.60 (.09)	4.46 (.09)	4.48 (.11)

Table 23: Average acceptability scores (and standard errors) for all conditions across the three nominal types. A = Abstract Target, C = Concrete Target.

5.2.4. Results: EEG

5.2.4.1. Behavioural Data

All subjects correctly judged the vast majority of ungrammatical and meaningless controls as not plausible (91%), and also the vast majority of experimental items as plausible (97%).

5.2.4.2. Event-Related Potentials

Figures 17 and 18 show the grand average waveforms plotted topographically (based on scalp distribution) for, respectively, Non-Copredication vs. Copredication Abstract target, and Non-Copredication vs. Copredication Concrete target. Topographic scalp maps of the differences between conditions across the three time windows are plotted in Figure 19. The waveform for Cz is plotted in Figure 20 (see Appendix for all waveform traces).

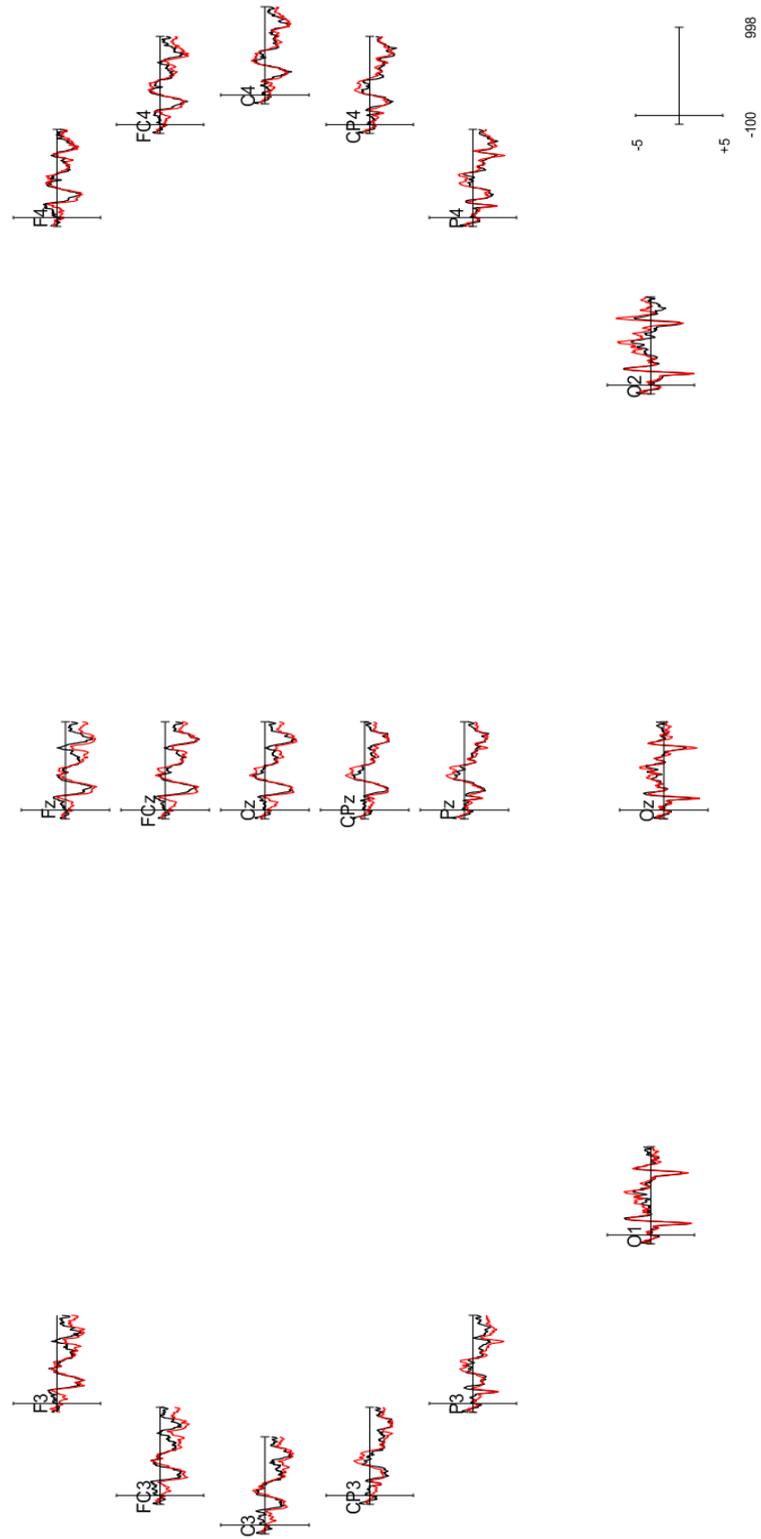


Figure 17: Grand average waveforms for the abstract target conditions. Black = non-copredication. Red = copredication.

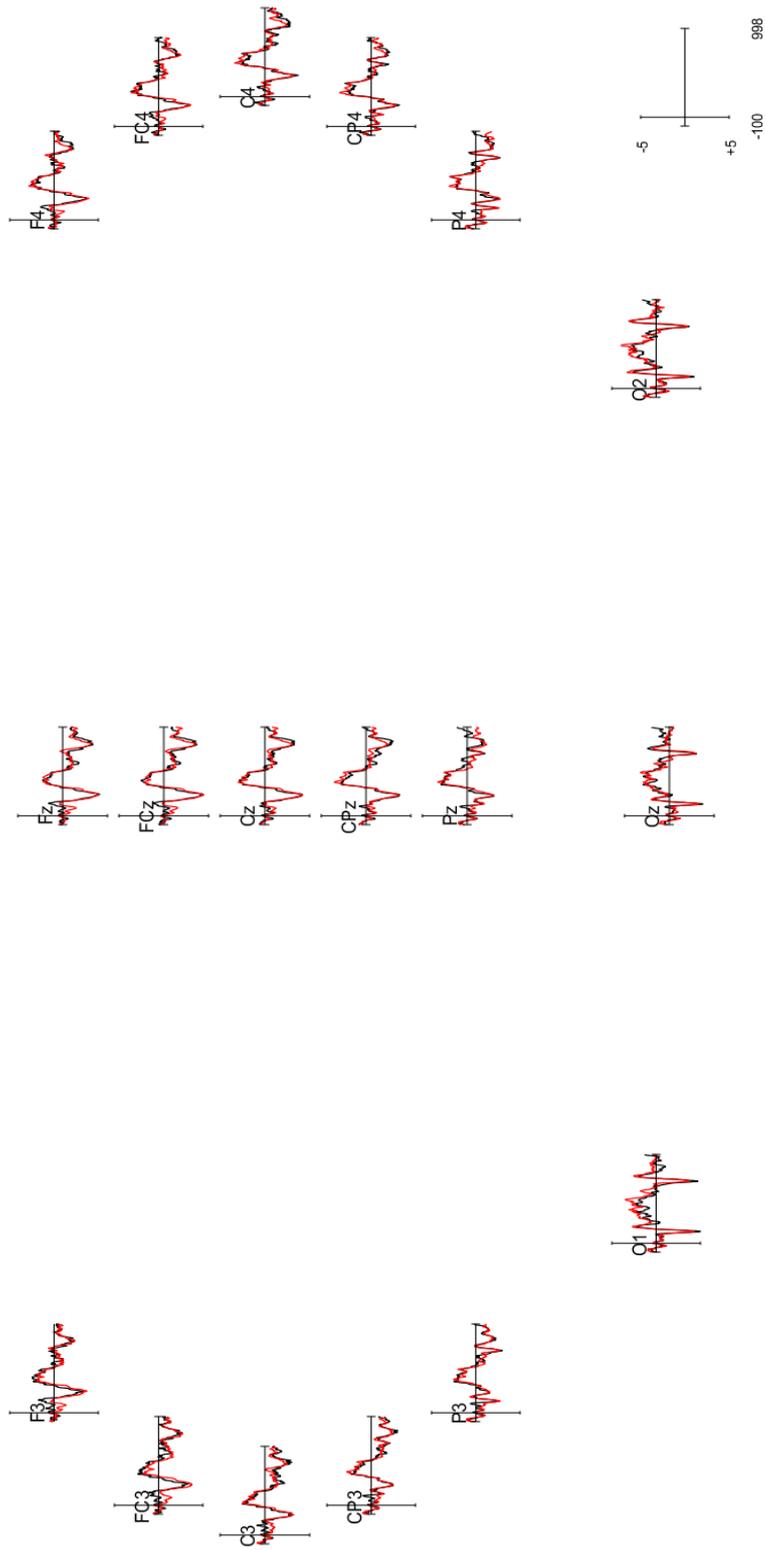


Figure 18: Grand average waveforms for the concrete target conditions. Black = non-copredication. Red = copredication.

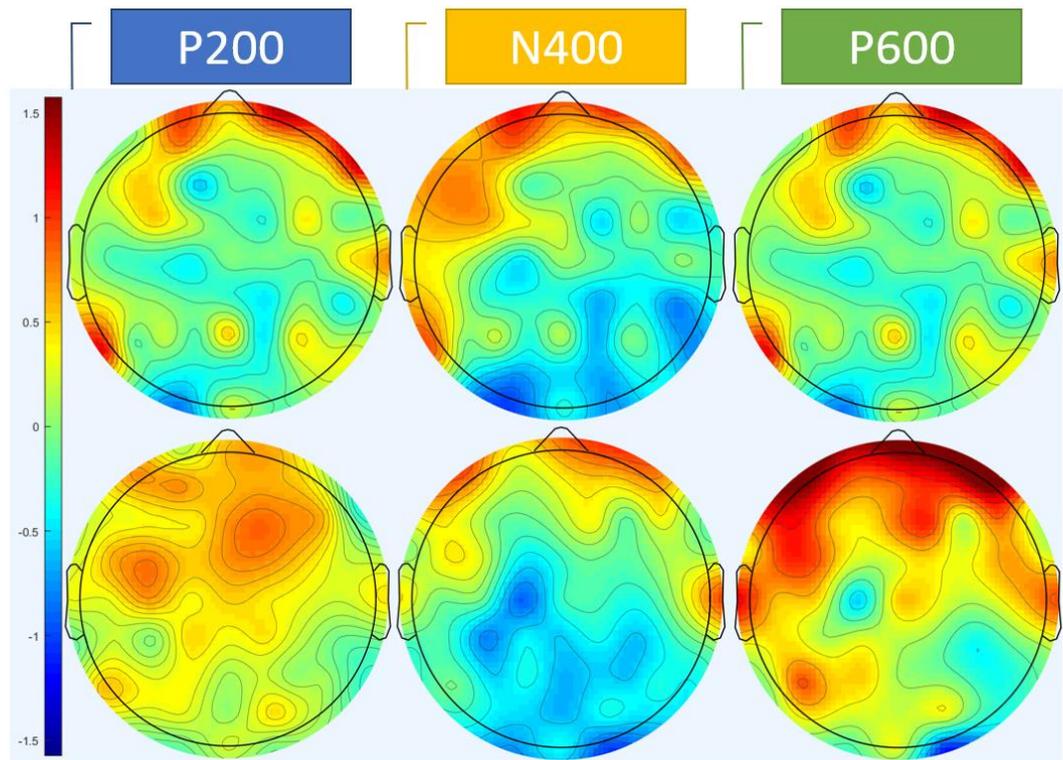


Figure 19: Effects of copredication in the Concrete target conditions (top row) and the Abstract target conditions (bottom row) Top row: Copredication + Concrete Target > Non-Copredication + Concrete Target; Bottom row: Copredication + Abstract Target > Non-Copredication + Abstract Target (y axis = potential).

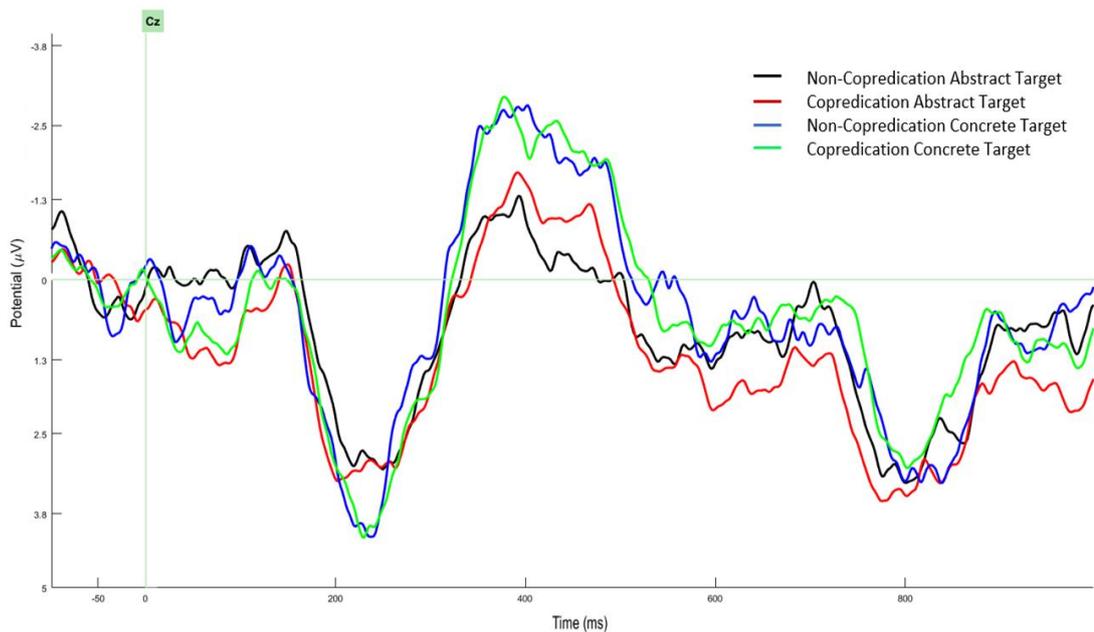


Figure 20: Grand average waveform for all four conditions at Cz.

Statistical analysis of the data revealed that at the 100-300ms window, the repeated measures ANOVA revealed no significant effects involving Sentence Type. At the 300-191

500ms window, repeated measures ANOVA revealed only a main effect of Adjective such that Concrete target words elicited a larger N400 component than Abstract target words, and no effects involving Sentence Type. At the 500-700ms window, there was also no effect involving Sentence Type. Further ANOVA F-values are presented in Table 24.

	df	100-300ms	300-500ms	500-700ms
<i>Omnibus ANOVA</i>				
<i>Sentence Type</i>	1,23	.645	.298	.061
<i>Adjective</i>	1,23	.008	15.131**	2.373
<i>Sentence Type × Adjective</i>	1,23	.019	.162	.052
<i>Sentence Type × Laterality</i>	2,22	.318	.658	.826
<i>Sentence Type × Anteriority</i>	2,22	1.432	1.055	.818
<i>Sentence Type × Adjective × Laterality</i>	2,22	.191	.022	.923
<i>Sentence Type × Adjective × Anteriority</i>	2,22	.344	.047	.431
<i>Sentence Type × Anteriority × Laterality</i>	4,20	.590	.711	1.090
<i>Sentence Type × Adjective × Anteriority × Laterality</i>	4,20	.608	.319	.895

Table 24: ANOVA F-values at the target word (second adjective) in Experiment 10. ** = $p < .001$; * = $p < .05$.

5.2.4.3. Cross-Frequency Coupling Analysis

Prior to applying family-wise corrections on the p -values, a main effect of Sentence Type was found, with phase-amplitude coupling (PAC) being significant between 11Hz phase and 44Hz amplitude (seeking uncorrected p -values at $< .05$), a case of α - γ coupling ($F = 5.94$, $p = .017$, $Z = 2.13$), being greater for Non-Copredication (see also below); this γ range is typically deemed low, or 30-60Hz, with 60+Hz typically considered high γ (Crone et al. 2009). However, family-wise (cluster-level) corrected p -values and family discovery rate q -values were not significant for this α - γ PAC (FWE-corrected $p = .650$, FDR-corrected $q = .359$, $kE = 12$), and so it is likely that this effect was due to chance.

Although the effect of Adjective is subject to the same limitations in its interpretability as above for the ERP analysis (namely, that comparing two distinct words renders any main effects of Adjective largely uninterpretable), it should be noted that a main effect of Adjective was found, with δ - γ phase-amplitude coupling being significant, reaching FWE- and FDR-corrected significance levels (3Hz phase coupled to 78Hz; $F = 8.05$, $p = .006$, $Z = 2.54$, FWE-corrected $p = .043$, FDR-corrected $q = .021$, $kE = 334$).

There was found to be no interaction effect between Sentence Type and Adjective.

Contrasts for the β weights were computed using t-contrasts (paired sample t-tests). Exploring purely the difference between concrete and abstract target words, and not making any particular claims about copredication, the contrasts for the two Copredication conditions revealed the following: The Concrete-Abstract > Abstract-Concrete contrast revealed that the (typically more acceptable, according to the results from Chapter 3) Abstract target word condition yielded significantly greater δ - γ coupling than the (less acceptable) Concrete target word order (3Hz phase coupled to 78Hz amplitude; $T = 3.68$, $p = <.001$, $Z = 3.55$). This δ - γ coupling also reached FWE-corrected significance ($p = .030$; FDR-corrected $q = .121$).⁷⁹ The contrasts for the two Non-Copredication conditions revealed that no forms of coupling reached FWE- or FDR-corrected significance.

Collapsing the four conditions into two, the contrast Non-Copredication > Copredication revealed that Non-Copredication yielded significantly greater α - γ PAC than Copredication (11Hz phase coupled to 44Hz amplitude; $T = 2.44$, $p = .008$, $Z = 2.39$), but this did not reach FWE-corrected significance. The reverse contrast, Copredication > Non-Copredication, revealed no significant clusters of PAC, nor any approaching significance.

Lastly, although the above disclaimers about interpretability apply, follow-up t-contrasts for the main effect of Adjective were conducted for comprehensiveness. These revealed that Abstract target words yielded significantly greater δ - γ coupling than Concrete target words (3Hz phase coupled to 78Hz amplitude; $T = 2.84$, $p = .003$, $Z = 2.77$), with the cluster-level values also approaching significance (FWE-correct $p = .059$, FDR-corrected $q = .075$, $kE = 96$).

5.2.5. Discussion

Part of the motivation for the present experiment was to determine if electrophysiology replicated Likert-scale acceptability judgements via event-related components. Another part of the motivation came more simply from documenting the processing properties of copredication, previously unexplored in the neurolinguistics literature.

⁷⁹ Despite not necessarily telling us anything specific about copredication, this analysis was conducted for comprehensiveness, and also to reveal the oscillatory distinctions between concrete and abstract sense processing.

5.2.5.1. ERPs Replicate Acceptability Dynamics

The present results revealed no effects involving Sentence Type across any of the time windows. This is consistent with the One Representation Hypothesis and the general underspecification framework, since copredication did not elicit any different ERP response than non-copredication; if there were found to be such effects, an argument could have been made supporting the claim that the categorially distinct polysemous senses are lexically stored in different representations and that accessing the nominal strongly biased/activated a specific sense, rather than generating an underspecified node. These findings also replicate Yurchenko et al.'s (2018) findings, and support MacGregor et al.'s (2015) findings of reduced N400 responses for polysemous sense switches relative to homonymous switches.

We only observed a main effect of Adjective in the N400 time window, such that Concrete words elicited a larger N400 response than Abstract words. However, due to the well-known ERP differences between concrete and abstract word processing (Kounios & Holcomb 1994, West & Holcomb 2000), the main effect of Adjective for the 300-500ms window is likely simply a reflection of this standard concreteness effect. However, this effect does not bear on the central research question in this thesis concerning copredication.

More generally, these findings appear to match the acceptability ratings of the items to a certain extent: a main effect of Adjective for the ratings matches the ERP effect, and while the acceptability judgement experiment additionally found main effects of Sentence Type across the analyses, these were never found for both F1 and F2 analyses in a given ANOVA. The lack of a robust effect of Sentence Type for the acceptability ratings also matches the lack of degraded acceptability (or, in the case of Chapter 4, increased acceptability) for copredication items relative to non-copredication items, and as such lends additional support to an ORH storage account.

There are certain parallels between the present results and those reported for the behavioural experiments reported in previous chapters. It is possible that the experimental items used in the present study exhibit the same acceptability dynamics as the items used in the experiments in Chapter 3, but that this acceptability dynamic does not emerge at – i.e. is not time-locked to – the second adjective. Unlike in the present experiment, the participants in Chapter 3 made judgements about entire sentences. In addition, due to the *Nominal-Adjective-Adjective* syntax of the present experimental materials, participants

might not have predicted copredication given that the nominal comes before the adjectives. Comparing *Nominal-Adjective-Adjective* and *Adjective-Adjective-Nominal* constructions in eye-tracking would constitute a promising follow-up experiment. Indeed, although it was initially concluded in Chapter 3 that ERPs might form a more reliable and accurate measure of acceptability dynamics, it may be that eye-tracking can shed more light, allowing us to look at the immediate response to the second adjective in addition to re-reading effects and reactions to post-copredication material.

5.2.5.2. *Oscillatory Basis of Copredication: An Exploratory Assessment*

The phase-amplitude coupling results revealed that the Copredication > Non-copredication contrast yielded no significant PAC results, and nor did the reverse contrast. The within-copredication contrasts yielded interesting results. The main finding was that Concrete-Abstract sentences yielded greater δ - γ coupling than Abstract-Concrete sentences; this result reached FWE-corrected significance, making it a candidate for an electrophysiological marker of Concrete-Abstract predicate order parsing. How can we account for this finding? Billeke et al. (2017) provide evidence from EEG that the coupling of the amplitude of fast γ (90-110Hz) to the phase of cortical δ differs as a function of cognitive task, ranging from memory recall to directed attention. There may be a common underlying mechanism for the δ - γ phase-amplitude coupling found in the present experiment and in these cognitive tasks, possibly relating to representational combinatorics.⁸⁰ For instance, Brennan and Martin (2019) analysed a naturalistic story-listening EEG dataset and showed that δ - γ phase-amplitude coupling increases with the number of predicates bound on a given word. As such, the ordering of predicates based on their semantic category may be a factor in this processing dynamic.

Meanwhile, greater θ - γ coupling levels for Abstract-Concrete structures relative to Concrete-Abstract structures approached significance. Looking again to the oscillation literature, θ - γ phase-amplitude coupling is known to be involved in constructing working memory stacks across a range of domains, including visual (Roux & Uhlhaas 2014),

⁸⁰ It is possible that this effect of cross-frequency coupling is related to the documented N400 effect in the ERP results – indeed, regardless of the explanation one attributes to the N400 and δ - γ coupling (concreteness effect, sense order parsing, etc.) some principled electrophysiological relation may obtain between them. What the nature of this relation is will be left to future neurolinguistics research, deviating as it does from our central inquiry into copredication.

auditory (Kaiser et al. 2009) and somatosensory working memory (Haegens et al. 2010), suggesting that this general mechanism can be implemented via distinct neural codes triggering domain-specific representations (Lisman & Jensen 2013). The potential relevance of this type of coupling to the construction of stacks of lexical items should be considered (see also Pinotsis et al. 2018 for the role of cross-frequency coupling in working memory load). As such, there is scope for follow-up studies to test the hypothesis that the θ - γ code for working memory is more intensively involved in less acceptable, and more difficult to process cases of copredication.⁸¹

It should be stressed that with the exception of δ - γ coupling for the Concrete-Abstract > Abstract-Concrete t-contrast, the lack of FWE- and FDR-corrected significance casts doubt on the idea that oscillatory interactions play a major role in copredication; more carefully controlled follow-up studies (avoiding the problem of comparing different target words across conditions) may be able to shed further light on the question.⁸²

In summary, future studies will be needed to further examine cross-frequency coupling in copredication using different materials in order to gauge its potential role. Contrary to the speculations proposed here, it may be that the basic neurocomputational architecture for lexical combinatorics lies not with cross-frequency coupling but rather with power increases, phase resets or forms of frequency interactions ranging beyond phase-amplitude coupling; variables not analysed in the present study.

5.2.6. Future Directions

Carrying the current research project forward, it would be of interest to investigate the electrophysiological dynamics of Italian copredications, determining whether the present results can be replicated. In addition, a closer examination of sense order effects is required, avoiding confounds relating to comparing two distinct target words.

With regards to the prospects for oscillatory studies, the GLM-CFC (General Linear Model) method provided by SPM12 is non-directional, and so it cannot infer from a given PAC analysis whether the phase is driving the amplitude or the amplitude is driving the

⁸¹ This suggestion is in line with a general trend in the cognitive neuroscience literature to re-interpret a number of mechanisms previously believed to be highly domain-specific as domain-general (see Murphy 2018 for a review).

⁸² It also currently remains unknown to what extent other forms of cross-frequency coupling may be involved in copredication.

phase – or indeed if the phase and amplitude are derived from different electrodes. The GLM only details whether there is any cross-frequency coupling present, performing a correlation measure. There are currently no DCMs (Dynamic Causal Modelling) available for testing precisely this. In order to investigate the topic of causality further, it would be necessary to apply the standard DCM for phase coupling but then compute the instantaneous phase of the amplitude time series instead of two phase time series from the original data. Alternatively, Jiang et al. (2015) propose a method to infer directionality of phase-amplitude coupling (what they term *cross-frequency directionality*) based on the phase-slope index (PSI) between the phase of slower oscillations and the power envelope of faster oscillations, which may be a fruitful direction to pursue. For instance, Jiang et al. (2015) showed that in the human resting state the power envelope of γ oscillations is able to drive slower α oscillations. Future EEG investigations into copredication could also average over a particular frequency range (say, the α and γ ranges, given the present results) before conducting repeated measures ANOVAs, analysing the volumetric data, as opposed to the present frequency-frequency maps, in order to determine the sensor sites of cross-frequency coupling.

Lastly, Tao (2015) used MEG to explore the oscillatory basis of concrete and abstract polysemous senses and revealed that γ power was a significant distinguishing marker for concrete and abstract senses, such that both interpretations yielded different amplitude fluctuations. The abstract sense yielded greater power at 400ms post-stimulus onset, perhaps aligning with the N400 effect discovered in the present experiment for the Adjective conditions. Tao (2015: 108) speculates that the increased γ power for abstract senses points to greater “composition demand and/or richer semantic knowledge in the abstract-coercion cases”; lending neurobiological support for the general framing of *Incremental Semantic Complexity* and also the Complexity Hierarchy proposed in Chapter 2, whereby abstract senses are more semantically complex.⁸³ As such, future work could explore the power dynamics of the oscillatory responses to copredication.

⁸³ This discovery also supports the claim we made in Chapter 2 that abstract concepts are more complex than concrete concepts, with γ rhythms being a well-documented marker of feature activation (Honkanen et al. 2015).

6. Conclusion

This thesis has investigated the theoretical and psycholinguistic properties of copredication. In particular, it has explored its semantic, pragmatic, acceptability, frequency, cross-linguistic, and electrophysiological properties.

In an attempt to progressively evaluate these domains, we can firstly conclude that the results of the acceptability experiments in Chapters 3 and 4 not only support the existence of a possible parsing preference, *Incremental Semantic Complexity*, but they also lend support to the One Representation Hypothesis that the senses of polysemous nominals share a common representational basis. This was due to the general finding that copredication is either more acceptable or no less acceptable than non-copredication. In addition, the broader *Copredication Licensing Effect* proposed in Chapter 4 summarises the main experimental results. These proposals are reproduced below:

Incremental Semantic Complexity

Seek to process linguistic representations in incremental stages of semantic complexity.

Copredication Licensing Effect (CLE)

Predicate ordering is a major factor in copredication acceptability, and there is partial support for *predicate coherence* positively correlating with copredication acceptability for complex (but not simple) predicates.

The overall finding from the experimental results was that a particular complexity-based account of sense order dynamics in copredication (predicting Simple-Complex ordering preferences, *à la Incremental Semantic Complexity*) was supported, while no sense

frequency-based account was supported. As mentioned, alongside this conclusion there was found to be evidence of a broader, architectural framework these dynamics can be situated within: In terms of processing, the underspecification account was most consistent with the findings of this thesis, while the One Representation Hypothesis was the most well-supported storage account (in particular, given the lack of documented frequency effects). Meanwhile, the pragmatics-based predicate meaning transfer view (reviewed in Chapter 2) predicted costs at the point of the second predicate in copredication (i.e. relative to the second predicate in non-copredication), and this was found not to be supported by our results.

More specifically, we found reasons to reject sense frequency-based models of copredication licensing and also Fully Specified ORH models, and instead found support for models invoking the semantic complexity of the senses involved, such as the Underspecification ORH model. In particular, the *Incremental Semantic Complexity*-based hypothesis of Simple-Complex sense order preferences was supported, compatible with the more specific *complexity-based Underspecification ORH* model.⁸⁴ Any significant differences between sense order switches for both copredication and non-copredication, alongside differences between copredication and non-copredication (or a preference for copredication), would have supported the Underspecified ORH account, in particular with sentences presenting the nominal before the predicates, as in Chapter 4. This would be due to context homing-in on one sense, at the point of the first predicate, before the parser is forced to switch senses (in either direction). All of these effects were found; more specifically, rather than finding a Complex-Simple preference we found a Simple-Complex preference, allowing us to provide support for one particular complexity-based Underspecification ORH model (i.e. rooted in *Incremental Semantic Complexity*) over the other possible Underspecification ORH model (i.e. rooted in a Complex-Simple preference).

We also found various nominal type differences, which we will discuss below, confirming the intuition in Pustejovsky and Jezek (2008: 208) that, “[f]rom a cognitive

⁸⁴ Recall from Chapter 3’s discussion of Frisson and Frazier (2004) that there are reasons to believe that for copredications spanning single sentences, no effects of frequency will be found, but for copredications spanning multiple sentences, subordinate-dominant cross-sentential switches would be degraded relative to the reverse order. The present experiments confirmed the former prediction, and future work should investigate the latter prediction by presenting subjects with copredications spanning multiple sentences.

point of view, we may speculate that some [dot-type] shifts are easier than others”. But what of the related theme, also discussed in Pustejovsky and Jezek (2008: 191), that “[f]rom the point of view of its computational cost, Dot exploitation is an inexpensive operation (i.e. a light form of coercion)”? The evidence presented here suggests that only in Adjective-Nominal-Adjective syntax (Experiment 4) is this form of meaning modification costly, but for most of the structures explored here copredication is either no more costly than non-copredication, or is less costly. Note that the materials for the EEG experiment, structured as *The N was A₁ and A₂*, exhibited degraded acceptability relative to non-copredication (repeating the sense type of *A₁*) but not uniformly across analyses, and so only Adjective-Nominal-Adjective structures seem to be robustly degraded. As such, the “light” forms of coercion and meaning modification discussed in the Generative Lexicon tradition may not have any acceptability costs associated with them except in Adjective-Nominal-Adjective environments.

This covers the full span of copredication interpretation, but what of the narrower instance of sense shifting? The *Incremental Semantic Complexity* bias was used to explain the Simple-Complex sense order preferences. This particular finding, given the nature of the experimental results, cannot easily be explained by any particular psycholinguistic model. I will discuss here potential ways to ground the results, with the caveat that the account presented faces a number of challenges and should be refined with further experimentation.

One potential way to implement *Incremental Semantic Complexity* is via a unidirectional priming effect for complex senses, such that the activation of ‘Simple Sense₁’ primes ‘Complex Sense₂’, and the activation of a complex sense does not seem to prime (as strongly) the simpler sense(s). We have claimed that this parsing bias can account for copredication acceptability dynamics and anomalous interpretations noted in the literature, and should be favoured as an account for these phenomena over those reviewed in Chapter 2. As noted in Chapter 3, it is already known that polysemous senses prime one another (Klepousniotou et al. 2008), and so this thesis effectively adds to this general finding the more specific proposal of (i) *how* this priming is realised between semantically distinct senses, and (ii) *what* scale it is based on. Namely, it is (i) realised in ways which apply to copredications and also non-copredications, suggesting that the effects of polysemous sense priming are sustained – at least within single sentences – across the presentation of different nominals, and (ii) this process is based on a scale of

semantic complexity in which simpler senses prime complex senses to a great degree than the reverse.

As reviewed in Chapter 3, previous research has revealed that polysemous senses prime each other while homonymous meanings compete, but it was unclear what the scope of this priming effect was and whether it obtained for polysemous senses with more than two semantically distinct meanings. The results from across the experiments presented here, which tested a range of nominal types and sense orderings, suggest that simpler senses prime more complex senses to a greater degree than complex senses prime simpler senses. This may be due to a separate but interacting factor: Sense commitment may be stronger for more semantically complex senses than for less complex senses. As such, two basic mechanisms – priming and commitment – may be responsible for the results. These explanations are far from mutually exclusive, and each may shed some light on some feature of acceptability costs.⁸⁵ Further, we can also use this framework to explain the occurrence of Simple-Complex sense order preferences in non-copredication: The priming effect appears to sustain into the broader nominal type throughout the discourse, and is not restricted purely to priming the specific distinct senses of the particular nominal under discussion. Hence, a PHYSICAL predicate referring to one nominal can serve to prime the INFORMATION sense associated with a different nominal of the same class (as in the *Nominal₁-Predicate_X-Nominal₂-Predicate_Y* structures used in Chapter 4). This proposal is in line with assumptions in the literature about priming effects not being isolated to specific lexical items but influencing neighbouring semantic, syntactic and even orthographic domains (Bowers et al. 2005, Brisard et al. 2001, Li & Slevc 2017).

With respect to the implications for polysemy representation, if priming indeed were to occur this would support the (broad) ORH model, while the more specific findings pertaining to ordering effects support a complexity-based Underspecification ORH model. The present empirical support for a particular type of underspecification account also departs somewhat with Ortega-Andrés and Vicente's (2019) claim that all senses are activated as an "activation package" upon encountering the nominal, since the present sense order results demand a more refined perspective on sense activation.

Nevertheless, it should be stressed that a particular acceptability judgement does not directly necessitate processing differences between the structures being judged.

⁸⁵ Again, the prospects for the use of multi-sentence stimuli in future work seem promising, given that we have highlighted priming and sense commitment.

Alternatively, multiple sources of processing difficulty (with distinct processing effects/weightings) can conspire to output any given differences in acceptability (Hofmeister et al. 2014). As such, exploring this issue moving forward will demand greater care when attempting to use the present results as a base from which to further explore real-time processing, since any given condition difference documented here may not readily map onto any clear online comprehension effect.

It should also be noted that we are comparing copredications and non-copredications across many different structures, given the range of syntax and the specific implementation of the non-copredication conditions across all experiments (e.g. two nominals can be used to block a copredication, or the senses can be repeated rather than switched). This arguably makes it more difficult to make general claims about ‘non-copredication’ versus copredication. However, this is an unavoidable consequence of the range of the design of the experimental materials.⁸⁶ Since we did not go down the problematic route of choosing one unified non-copredication structure (e.g. sense repetition) against which to compare all copredication structures, the baseline differs across all experiments.

One might also object here that an alternative formulation of *Incremental Semantic Complexity* is to assume that priming only occurs from Simple > Complex, and zero priming occurs in the other direction. However, this formulation would violate common assumptions in the polysemy literature (i.e. polysemous senses prime each other), and it seems more accurate to maintain that the priming effect is simply weighted based on the internal complexity of the polysemous senses.

Taking stock, there are arguably three distinct processes underlying *Incremental Semantic Complexity* if the priming account can be sustained (which, as argued, it may not be) (Collins & Loftus 1975, Heyman et al. 2015, Neely 1991, Rohaut et al. 2016, Tabossi & Zardon 1993):

- (1) Semantic activation of the prime.
- (2) Spreading activation from prime to target.

⁸⁶ Although the norming data reported in this thesis allowed us to control for certain features (sense relatedness, adjectival coordination acceptability) of the materials used in certain Chapter 3 experiments, it should be noted that a possible limitation of the present experiments is that, aside from SUBTLEX-UK Zipf frequency and character length, we did not control for features such as predictability and age of acquisition.

(3) Activation of the target.

The core differences between Simple-Complex and Complex-Simple predicate orderings may reside in (2), with Complex-Simple orderings involving a reduced activation spread from the Complex to the Simple sense. Indeed, there are also two possible options here: Either simpler senses trigger larger spreading activation, or complex senses are more receptive to such spreading activation. Both explanations would produce a Simple-Complex preference.

Even though we found no robust effects of frequency on acceptability, the literature on typical/atypical priming effects may be relevant here. For instance, Brunellière and Bonnotte (2018) ran lexical decision and semantic judgement tasks and found that with simple two-word prime-target pairs, priming can be disrupted when the target shares features within particular semantic categories with the target. When no such features are shared, decisions and semantic judgements are more clear-cut. Since semantic judgements formed a core component in participant behaviour for our experiments, it may be that inferences about semantic similarity were modulated by directionality, such that comparing a physical sense of *newspaper* with an already-presented institutional sense (in Complex-Simple orderings) resulted in a sense of low semantic similarity, compared to when an institutional sense was associated with an already-presented physical sense (in Simple-Complex orderings). While the standard spreading activation model of priming (Collins & Loftus 1975, O'Connor et al. 2009) relies on typicality (and hence frequency), a similar mechanism could be implemented with reference solely to semantic similarity judgements, i.e. participants may be judging the institution producing the newspaper to be more similar to its physical product than they would deem its physical product semantically similar to the institution (see also Chapter 6.1.2 below, and the discussion of Tversky and Gati's (1978) 'toy train' example). Moreover, judgements of semantic similarity are known to affect the *strength* of semantic priming effects (Hutchison 2003, Lucas 2000), and so this process may constitute a driver of any priming underlying *Incremental Semantic Complexity*.

As such, this account invoking semantic similarity judgements stands independently from any priming account (though it could also complement, and be framed within a priming account, as mentioned). Nevertheless, this semantic similarity account would also predict (though perhaps not as strongly) a different N400 signature for distinct sense

orderings. It may be that the locus of any processing costs for Complex-Simple orderings is not found during the presentation of the second predicate (the locus of analysis in Chapter 5), but rather at the point of sentence completion, as part of a more general wrap-up/monitoring effect. This would explain the lack of an N400 or P600 effect. Given the nature of the task and stimuli length in the EEG experiment, participants would not have expected sentence completion to occur after the second predicate. In brief, the locus of acceptability costs might translate not to direct lexical access (N400) or phrasal integration (P600), but to later wrap-up stages.

Priming research in psychology increasingly involves an ever-expanding list of ‘primeable’ representations, with priming occurring at multiple levels (syntactic, semantic, lexical, conceptual; see Bargh 2006 and Branigan & Pickering 2017 for reviews), and so it does not seem unmotivated to suggest that the polysemous senses of certain nominals prime one another based on their semantic complexity. For instance, Ziegler et al. (2018) report that priming for datives depends on the degree of overlap in event structures; a highly complex, semantic structure. The apparent discovery of a priming effect implementing *Incremental Semantic Complexity* is also not incompatible with an SEL storage model of copredication, but it seems less likely given the lack of sense frequency effects documented here and the seemingly systematic nature of the directionality of priming, in addition to the fact that no similar effects of complexity priming have been found for homonymy. Further, the discovery of sense switching effects – forming the core evidence for *Incremental Semantic Complexity* – mitigates against Parallel Activation and Fully Specified ORH models, with the switching costs (regardless of which ‘direction’ was preferable within the switch contrasts) acting as evidence against the claims that (i) all polysemous senses were fully activated at the point of the nominal in structures in which the nominal preceded the predicates, and (ii) the senses were equally able to be integrated at the point of the nominal in *Predicate₁-Predicate₂-Nominal* structures relative to *Predicate₁-Predicate₁-Nominal* structures (where the subscript denotes sense type).

An interesting question for future research concerns the full duration of any priming effect, which clearly outlasts initial polysemous co-activation of ~750ms (MacGregor et al. 2015) and may impact cross-sentence acceptability, but also likely cannot last for more than a small number of coherent discourse units.

Taking stock, it should also be stressed that the present priming account faces a number of obstacles. Firstly, a priming account of sense order effects would lead to a degree of

processing facilitation. Yet, the present experiments discovered acceptability differences which do not necessarily mark such facilitation. Rather, the core effect discovered was fundamentally pertaining to the notion of processing *cost*, such that Simple-Complex orderings do not necessarily boost acceptability but rather Complex-Simple orderings degrade acceptability. This thesis did not present at any point an independent baseline to determine this facilitation/cost dynamic and the underlying directionality. This issue is ripe for future experimentation.

In addition, a priming effect for sense ordering would likely have been indexed by a significantly different N400 signature, facilitating processing, which is something Chapter 5 did not discover. As such, the above priming account faces an empirical challenge from the EEG results. While ERPs have been shown to be more sensitive to subtle cognitive effects than fMRI (Geukes et al. 2013), it may be that the degree of priming was not substantial enough for it to be marked by scalp EEG (priming effects linked to the N400 have typically used stimuli with less subtle semantic distinctions than the Simple-Complex polysemous senses presented here; Kutas & Federmeier 2011), and that a more sensitive online measure (such as MEG) is needed to expose the different processing dynamics of polysemous sense ordering. Moreover, since acceptability ratings have a non-trivial relationship with processing effort, it may be that any acceptability difference incurred by Complex-Simple orderings carries very specific forms of processing costs. Frequency decomposition across the EEG signal may provide more fruitful results than ERP analyses, given the fine level of processing granularity that frequency-level analyses have exhibited in comparison to analyses derived from phase-level information (Schoffelen et al. 2017).

Moving away from the Simple-Complex/Complex-Simple distinction, does the issue of priming bear any broader relevance? Consider the relationship between semantic priming and working memory. Many priming processes are conceived as *automatic* because they occur without conscious awareness (Posner & Snyder 1975). It does not seem likely, given the nature of the present acceptability judgement tasks (shifting from predicate to predicate), that a form of priming known as *expectancy generation* (Becker 1980, Neely 1991) was at work in the copredication items, whereby *cat* would prime an expected word like *dog*. Instead, it is possible that a priming strategy recruiting ‘backward associate’ processing (*retrospective semantic matching*, RSM) was involved in the copredication items, whereby the parser checks if a target is related to a previously

displayed prime. In the context of a sentence, and not a single-element prime-target design, it is possible that (some) comprehenders were recruiting RSM for the copredication items but not the non-copredication items, since even though the latter could involve this form of processing, the interpretation of non-copredications is not as contingent on the relationship between the two nominals as the interpretation of copredications is on the relationship between the predicates. RSM has also been shown to be relatively effortless compared with other working memory processes (Hutchison et al. 2014), and is hence compatible with a lack of distinct ERP effects. If the non-copredication items instead recruited some other form of process, such as the more memory-intensive ‘forward associate’ (Heyman et al. 2015) processing (where there is no backward relation going from the target to the prime, and in the case of non-copredication involving a distinct nominal and two semantically distinct predicates being associated with distinct nominals, this is a clear possibility) then this might contribute to the acceptability differences between copredication and non-copredication found in the previous chapters, with greater working memory demands resulting in lower acceptability. Unlike automatic priming, these forms of strategic priming (backward/forward associate processing) are considered to be task-dependent and unstable across participants. Indeed, Heyman et al. (2015) were the first to show that these forms of priming carry different working memory loads, with forward associate processing demanding greater working memory resources. While the present task design did not explicitly involve any particular emphasis on working memory, participants would certainly have had to carefully (albeit very briefly) maintain the items in working memory in order for them to gauge an acceptability rating, and so it is possible that different processes were involved at the point of the second nominal/predicate. Future work could continue to explore this relation between semantic priming and working memory in connection to the form of polysemy involved in copredication.

6.1. Factors in Copredication Design

6.1.1. Syntactic Factors

The present account might shed some light on something we were previously unable to explain in Chapter 2; namely, the peculiar facts about relative clauses (‘The newspaper John is reading is being sued by Mary’) and modificational structures (‘The most

provocative newspaper of the year has been sued by the government’) such that they often increase the acceptability of copredication relative to coordinated structures. Chatzikyriakidis and Luo (2015) note that modificational structures increase acceptability but that they cannot provide a reason why. It is possible that these structures boost the coherence of the predicates, in particular in modificational structures since these provide additional semantic information and context. Relatedly, the same explanation can be extended to the observations in Chapter 2 that the inclusion of temporal adverbials like *still* and *already* can transform an unacceptable copredication into an acceptable one, and that the inclusion of some narrative-based explanation for the copredication can drastically improve acceptability. The inclusion of temporal adverbials likely serves to increase the coherence of the predicates in cases in which the adverbial occurs in one predicate and the other predicate refers to an event or process (e.g. ‘yellowed with age’, ‘building a house’; see Chapter 2.2), thus serving to increase discourse coherence. A topic for future research concerns whether these adverbial elements only serve to improve the acceptability of copredications insofar as they serve to improve semantic coherence, or whether they can play some other, independent role. Since Chapter 4 provided initial (though conflicting) evidence that coherence can improve copredication acceptability in particular contexts, it would seem justified to further test the impact of coherence relations on different copredication contexts.

In brief, all of the acceptability-improving methods available to the semanticists discussed in Chapter 2 seem to have the following, previously unacknowledged overlapping features: They either produce a Simple-Complex sense order, or they establish a coherent relation between the senses.⁸⁷

Nevertheless, the acceptability improvements yielded by relative clauses and modificational structures remain somewhat puzzling. While an explanation referring to

⁸⁷ Alternatively, perhaps explanations from theoretical syntax can be of some use, as opposed to these pragmatics-based accounts. Attempting to accommodate copredication and Pustejovsky’s (1995) theory of dot-objects into a syntactic framework, assuming (as is commonly done) that the meaning of complex words is derived in the syntax, Pross (2018) notes that “there is no principled reason why the system of dot-objects and type presuppositions cannot be translated into an – albeit very complicated – system of feature checking”. How exactly one might accommodate copredication into any given syntactic or morphological framework (Minimalism, Derivational Morphology, etc.) is a topic for future research and will not be pursued here; it is possible that such an endeavour can shed more principled light on the present observations about relative clauses and modificational structures.

the CLE seems reasonable, this account is admittedly stronger for modificational structures than for relative clauses (for instance, why should relative clauses aid to strengthen coherence relations?). The only place in the literature this issue has been addressed is in Ortega-Andrés and Vicente (2019: 12), where it is suggested that acceptability differences yielded by relative clauses in copredication might come about because the relative clause “may have the effect of changing the expectations/predictions” about upcoming senses. This seems like a reasonable direction of inquiry to follow in future experimental work (indeed, as noted above predictability is one factor we did not control for here).

There may be other explanations for these effects concerning relative clauses and copredication; explanations possibly related to expectations, as Ortega-Andrés and Vicente (2019) speculate, but also grounded in assumptions from the coherence relations literature. Chapter 2 introduced the two main types of coherence relations claimed in this thesis to impact copredications: causal connectives and extensional overlaps. In addition to the type of coherence relation, Patterson and Kehler (2013) maintain that other factors can influence the overt linguistic marking of these relations. In accord with the theme of the present discussion, these authors consider the syntactic position of coherence relations. They compose a model which marks whether the coherence relation is embedded inside another relation (*Rel2*), contains another relation (*Rel1*) or shares a segment (or for copredications, a predicate) with another relation (*S* = segment):

Containing (Rel1) + Embedded (Rel2) Relation

$$[S_1] \leftarrow Rel1 \rightarrow [S_2 [S_1 \leftarrow Rel2 \rightarrow S_2]]$$

Shared Segment

$$[S_1] \leftarrow Rel1 \rightarrow [S_2 S_1] \leftarrow Rel2 \rightarrow [S_2]$$

This allows us to take into account the syntactic dependency in a given coherence relation. As such, copredications involving relative clauses exhibit embedded coherence relations. These ideas echo Taboada’s (2009) syntactic division between paratactic (coordinate) and hypotactic (subordinate) coherence relations.

One question which even the most recent research on coherence relations (Hoek 2018, Patterson & Kehler 2013) has not addressed is whether syntactically embedded coherence

relations are easier to process, or are more acceptable, than other types of coherence relations. This research direction would bear directly on the present speculations about copredications involving relative clauses. For related work on this matter, consider Reali and Christiansen (2007). These authors used a corpus analysis in conjunction with self-paced reading tasks to show that the processing of different types of relative clauses is modulated by their frequency, such that more frequent relative clause types are easier to process. These authors only explored pronominal object relative clauses and pronominal subject relative clauses when the pronoun is personal (with the former being more frequent and easier to process than the latter). It may be, then, that the types of relative clauses copredications typically occur in (such as restrictive relative clauses) are – quite generally and independent of the polysemies themselves – more frequent than other types, boosting acceptability for reasons unrelated to any particular copredication. In addition, it may be the case that copredications occur in relative clause structures more frequently than in the other types of structures discussed in this thesis. Frequency effects would therefore play a broader role in the acceptability of general sentence types used for copredications.

6.1.2. Lexical Factors

Reviewing some potential lexical factors in copredication acceptability dynamics, it is possible that the theme of coherence can help explain why *school*-type sense orderings were not judged as significantly different in Experiments 7 and 8 (i.e. no effects were found for *school*-type items for the Nominal Type ANOVAs, in contrast to the other nominal types), since the EVENT and PHYSICAL senses may exhibit a strong degree of coherence; in particular, a strong Telic sense: schools (and related place-for-institution metonymies) are built for a single, easily-identifiable purpose. Unlike with the other nominal types permitting copredication, the abstract (EVENT) sense of *school*-type nominals seems to necessarily imply the PHYSICAL sense (the same applies for *lunch*-type nominals, which also host EVENT and PHYSICAL senses).⁸⁸ In contrast, *book* can refer very often simply to the physical object without implying any informational content, and vice versa (see also Frisson 2015 for related speculations concerning the increasingly remote nature of the information sense of *book*-type nominals in relation to the concrete sense,

⁸⁸ There cannot be *lunch* without food; even a *lunch meeting* lacking any food present is more properly characterised as a *lunchtime meeting*, emphasising the time of day, since *lunch meeting* very strongly implies the presence of food.

whose referents can now be read on tablets, sent via email, and so forth), while *city* has a range of associated senses which do not seem as strongly inter-related: a government seems less tied to the physical sense of *city* than an institution does to a school's physical building, most likely because a school (and other *school*-type nominals investigated, like *church* and *gym*) is typically a single building, or a small collection of inter-connected buildings, unlike a city.

Another possible factor to consider, which may bear on these present observations about *school*- and *lunch*-type copredications not strongly exhibiting adherence to *Incremental Semantic Complexity* as clearly as the other nominal types, is the observation in Pustejovsky and Batiukova (2019) that dot objects (responsible for copredications) are semantically closest in nature to events, relative to all other linguistic semantic constructs. Dot objects exhibit some form of relation between types, e.g. a *containment* relation for *book*-type nominals (the physical form 'contains' the information), a *participant* relation for *lunch*-type nominals (the event contains participating agents and objects), and so forth. Likewise, events represent a dynamic relationship between participants with certain roles (e.g. Agent-Patient relations). Conceiving of dot objects as "complex lexicalized relational states between two or more participants" (Pustejovsky & Batiukova 2019: 200), the apparent similarity in representational and structural (even metaphysical) constitution between dot objects and events may have some relevance with respect to *event*-based copredications exhibiting unique behaviour. However, we also need to consider the fact that *lecture*-type nominals exhibited a significant acceptability difference in Experiment 9 (i.e. a Simple-Complex ordering preference in both the Concrete+Abstract and also Abstract+Abstract conditions), unlike *school*-type nominals. *Lecture*-type nominals do involve events, but events paired either with a physical sense (the Concrete+Abstract conditions) or an informational sense (the Abstract+Abstract conditions). The fact that *both* types of copredications exhibited clear Simple-Complex ordering preferences, while neither of the *school*-type copredications in Experiment 9 did (at least, not a significant difference, although the trend was at least numerically present), possibly indicates that there is something more idiosyncratic to *school*- and *lunch*-type nominals. On the other hand, it may be that the close semantic proximity between *book*- and *lecture*-type nominals somehow feeds into the clearer effect for *lecture*-type Simple-Complex sense order preferences, with *book*-type nominals exhibiting very robust differences in sense order preferences. In other words, *lectures* are more semantically related to *books* than

schools and *lunches*, and they are also INFORMATION-dominant, while *school-* and *lunch-* type nominals are PHYSICAL-dominant. Therefore, one might be tempted to conclude that PHYSICAL-dominance somehow shields copredications from significant *Incremental Semantic Complexity* effects. However, another aspect of this issue to consider is that *city-* type nominals are robustly PHYSICAL-dominant yet exhibit significant *Incremental Semantic Complexity* effects. More specifically, then, PHYSICAL-dominance in combination with an eventive reading seem to conspire to prevent significant differences in sense order acceptability. Further work will be needed to explore this issue in greater detail, given that the account I have outlined here is not deeply explanatory in nature. It may transpire that *Incremental Semantic Complexity* forms a certain tendency and bias – though a fairly replicable one – as opposed to a strict rule.

In addition, this topic is one domain where frequency might have a substantial contribution to make: Although there is currently no data relating to this issue, it may be that the distinct senses of *book* are associated with each other less regularly than the distinct senses of *city-* type and *lunch-* type nominals. As such, any relative lack of co-occurrence may produce a greater acceptability difference which manifests itself via a processing bias such as *Incremental Semantic Complexity*. Alternatively, consider Jezek and Melloni’s (2011: 18) finding from a corpus analysis of Italian that “event/result nouns are crucially different from standard complex types, since the RESULT sense is causally dependent on the EVENT sense, a situation we refer to as (structural and semantic) asymmetry”. The type structure of these *construction-* type nominals approximates that of *school-* and *lunch-* type nominals much more than it does for *city-*, *book-* and *newspaper-* type nominals. This is due to the fact that schools and lunches cannot only host event senses, but also result senses, which is in turn closely related to the physical object that results from the event. This relation, of EVENT > RESULT > OBJECT, has already been noted in the literature, but for our purposes it may provide some insight into the psycholinguistic differences between *newspaper-*, *book-* and *city-* type nominals on the one hand, and *construction-*, *school-* and *lunch-* type nominals on the other. With the former, we have three nominal types lacking this “causally dependent” relation, but with the latter this dependence is very much present. As such, associating the distinct senses of *construction-* or *school-* or *lunch-* type nominals is likely less problematic due to the presupposed representational knowledge that results and their physical manifestations are causally dependent on their preceding events, whereas associating the informational and

organisational senses of *newspaper* involves an entirely different relation. That said, the norming studies in Chapter 3 suggested no differences in sense relatedness between *book-*, *city-* and *lunch-*type nominals (though *school-*type items were not included), and so these speculations may well be premature.⁸⁹

Note also that it appears from all of the frequency profiles presented in this thesis that the majority of polysemous nominals that host any salient INFORMATION senses will also be INFORMATION-dominant. This effect seems much more profound for INFORMATION than for other senses (e.g. PHYSICAL is also widely dominant, but is also a prominent subordinate sense). In other words, whenever INFORMATION is detected it appears to broadly dominate. This observation is admittedly somewhat orthogonal to the concerns of the present thesis, but it may be that this quirk of complex polysemy frequency profiles will have some bearing on future investigations into acceptability and processing dynamics.

Interestingly, recent work in distributional semantics (Chersoni et al. 2016) has attempted to establish an alignment between the semantic coherence and the semantic complexity of a sentence, such that a lower degree of complexity is also predicted to correlate with a lower degree of coherence. Coherence is here defined by Chersoni et al. based simply on the mutual typicality of a sentence's sub-components (i.e. 'the mechanic checked the spelling' is less typical than 'the journalist checked the spelling'), and the authors develop a model which argues that non-typicality leads to increased processing, which can reflect greater semantic complexity. More generally, the authors propose that "congruent sentences are less semantically complex than incongruent sentences" (Chersoni et al. 2016: 18). Although the relation in Chersoni et al. between complexity and coherence is naturally different from the one explored in this thesis, it is nevertheless noteworthy that the two general notions are beginning to be explored together.

An intriguing case for future work in this respect is *pathology*-type copredications, which like *lunch*-type nominals manipulate PHYSICAL and EVENT/PROCESS senses and were mentioned briefly in Chapter 2. These permit copredications such as 'The inflammation is acute and visible to the naked eye' and 'Walt's tumour is large but in remission'. Future work could explore whether the level of similarity these copredications

⁸⁹ In addition, the lack of differences found between *newspaper*-type materials and *book*-type materials not only points towards an ORH account of these nominals, but also speaks against Copestake and Briscoe's (1995) SEL account of *newspaper*-type nominals.

have with *lunch*-type copredications in terms of their senses also obtains for the similarity of frequency and acceptability profiles. For instance, if their acceptability dynamics are found to be the same as those of *lunch*-type copredications but their frequency profiles are found to be distinct (that is, if *pathology*-type nominals are heavily EVENT-dominant or have senses which are generally equal in dominance) then this will allow sense frequency-based and complexity-based hypotheses to again be tested.

It may also be worth following the lead of Tversky and Gati's (1978) seminal work on similarity relations. These authors pointed out that to say that a toy train is like a real train is much more acceptable than to say that a real train is like a toy train, because most features of the toy train are contained within the real train, but the real train only has a small number of features exhibited by the toy train. This effect may influence the acceptability of some of the copredications tested. For instance, to think about the POPULACE sense of *city* invites related intuitions about its institutional structure, yet when prompted about the INSTITUTION sense of *city* it seems less likely that any intuitions about its populace would be triggered. The same observations apply to *book*-type nominals, whereby speaking of the INFORMATION sense of a particular book does not trigger its PHYSICAL sense as easily as when the order is reversed. This may yield an acceptability disadvantage to Abstract-Concrete sense orders, which is something the present results can support. This notion of similarity judgements may be one possible driver of the priming underlying *Incremental Semantic Complexity*. Notice, however, that the notions of similarity which Tversky and Gati rely on crucially correlate with semantic complexity, and so there may be no principled way to differentiate the two accounts.

Certain other considerations of lexical content may be relevant to the major topics in this thesis, such as the storage models we have discussed. In recent years, the simple ORH/SEL division has increasingly been refined. Specifically, different types of ORH accounts seem possible with respect to different types of ambiguity – yet, crucially, so far none of these novel ORH accounts seem to easily accommodate copredication. For instance, Brocher et al. (2018) conducted an eye-tracking study and a lexical decision task, focusing on ‘irregular’ polysemes. This form of polysemy refers to words whose senses bear some similarity, but cannot be derived from one another via any particular rule (e.g. *wire*: electricity vs. police spying). As such, the senses of irregular polysemes like *wire* must be learnt separately, although they may be stored as a single lexical representation. Brocher et al. (2018) looked at how the degree of semantic similarity

between an ambiguous word's meanings/senses (homonyms vs. irregular polysemes) and meaning/sense frequency (biased vs. balanced meanings) impacted lexical access and disambiguation. For their eye-tracking study, they used sentences like the following, which represents the balanced polyseme condition (an unambiguous control word is in brackets): 'Marlene looked out for a cone (barrel) on her way home, since a big *pothole had been* marked there yesterday'. They found that all ambiguous words elicited longer reading times without a biasing context, but biased and balanced homonyms led to longer reading times in subsequent subordinate-biased contexts relative to polysemes and unambiguous controls. Balanced polysemes displayed a greater reanalysis cost than biased polysemes, and balanced polysemes also displayed a smaller reanalysis cost than balanced homonyms.

For Brocher et al.'s (2018) lexical decision task, when the intertrial interval (ITI) between prime and target was set at 50ms (e.g. for biased polysemy, this would either be *wire ... cable* or *wire ... police*) – testing retrieval processes – immediate sense/meaning access was seen for all ambiguous words. When the ITI was set at 200ms – testing disambiguation processes – a dominance effect was found for biased homonyms, but no effects were found for irregular polysemes.⁹⁰ At 200ms, a stronger response facilitation was found for targets of balanced polysemes than for those of biased polysemes. The authors claim that the semantic similarity between the senses of irregular polysemes allows the parser to switch to the competing sense with less difficulty than if it were to do so from one homonymous meaning to another.

These results were used to support what the authors call an *overlapping representation* account, a variant of ORH. One particular overlapping account is supported by their results, such that the senses of a balanced irregular polyseme (i.e. neither sense is considered more dominant than the other) such as *cone* (roadway marker vs. ice cream cone) share features; for example, to the extent that they are physical objects with approximately the same shape. The authors propose that these shared features explain the processing advantages they document for irregular polysemes in contrast to homonymy. As such, Brocher et al. (2018) distinguish between two types of overlapping accounts: the 'shared features' account (supported by their results) and the underspecification account. The latter account does not explicitly assume that polysemous senses share

⁹⁰ Note that their design for ITI manipulation was between-subjects.

features, and as such there is not necessarily any representational overlap. Rather, there is a single underspecified node associated with both senses.⁹¹

The underspecification account assumes that disambiguation occurs after encountering the ambiguous word (during the presentation of a disambiguating context) and that the underspecified node contains no information about relative sense frequencies (Frisson 2009). But, as indicated above, Brocher et al. (2018) used balanced vs. biased irregular polysemes (words with no dominant sense vs. words with a dominant sense), and found clear retrieval time differences between them, such that there was stronger competition between the unshared features of balanced polysemes relative to biased polysemes. This suggests that the senses of balanced irregular polysemes compete for activation much more so than the senses of biased irregular polysemes. Hence, the shared features account was supported rather than the underspecification account.

These findings suggest that the representational overlap seen in irregular polysemes allows the parser to adopt a degree of non-commitment to immediate sense selection. Yet, the authors also note that the assumption that senses are overlapping does not necessarily apply to regular polysemes: “It is still a matter of discussion whether the senses of regular polysemes ... share a significant number of salient features. For example, it is not clear to what extent NEWSPAPER, as a concrete object with sheets of newsprint, and NEWSPAPER, as the abstract content communicated in the publication, do in fact share many features”. As such, it is likely that the distinction between *separate features* and *shared features* cannot be applied to regular/complex polysemy involved in copredication. Indeed, it is the hallmark of copredication that the senses are of semantically distinct types. In addition, the bulk of the literature reviewed in this thesis suggests that an SEL model is inadequate for polysemy more generally. Therefore, it may be that the process of disambiguating an underspecified node of overlapping (though not necessarily shared) features applies to regular polysemies of the kind licensing copredication. Indeed, Brocher et al. (2018: 463) stress that the underspecification model was designed to accommodate the processing of regular polysemy.

⁹¹ Nevertheless, the more general process of underspecification can still be at play under a shared features account.

Thus, taking all of the above into consideration, the following representational structure may apply to ambiguous words:⁹²

Homonymy: SEL

Irregular Polysemy: ORH → *Shared Features*

Regular/Complex Polysemy: ORH → *Underspecified Node*

Looking ahead, this model could potentially help explain a range of lexical factors influencing the acceptability of copredications.

6.1.3. Ordering Factors

Moving to related terrain, the present set of experiments supported the complexity-based account under which Simple-Complex sense orders were preferred to Complex-Simple preferences. In addition, these ordering preferences were shown not to be modulated by sense frequency.

To take a specific case, and to return to some issues raised in Chapter 2, the results support the claim that *newspaper* copredications are not simply metaphors extending over institutional readings – as argued by Bahramian et al. (2017) – since semantically distinct senses can be attributed to *newspaper* within a simple coordinate structure without relative loss of acceptability compared to supposedly non-metaphorical cases of genuine polysemy (following the logic in Bahramian et al. 2017). In cases of metaphor, it would naturally be deemed unacceptable to say (32), in which two metaphorical uses of *lion* are conjoined, referring perhaps to the politically fierce nature of the publication and its editorial board – *reactionary* – and the colourful artistry on its cover – *next to the laptop*.

32) #The reactionary newspaper is a lion and is next to the laptop.

Conjoining two distinct metaphorical senses leads to category errors, but under Bahrahmian et al.'s (2017) metaphor account we would not expect that two distinct senses of *newspaper* involving institutional readings could be conjoined. Yet the experimental evidence suggests that the INSTITUTION sense can indeed be conjoined with PHYSICAL and

⁹² This proposal aligns with Klepousniotou and Baum's (2007) suggestion that lexical ambiguity should be understood as a continuum.

INFORMATION senses and yield acceptable sentences – and, further, that the acceptability of these conjunctions is modulated by sense order.

As mentioned earlier in this chapter, if we examine the cases of copredication which seem to easily permit institutional and physical/informational senses being combined, they initially appear to be of a particular form, being modificational structures involving, for instance, relative clauses or adjectival modifications. But there seem to be a number of other environments in which the organizational/institutional sense can be licensed alongside the physical and/or informational sense. As mentioned in Chapter 2, one diagnostic for complex polysemy is the crossing of distinct senses in anaphora seen in (33a) below, which seems to permit the co-occurrence of the institutional and informational senses of *newspaper* in (33b). Less complex forms of metonymy, as in (33c), do not license these anaphoric relations:

- 33) a. I didn't find this novel very interesting so I returned it to my friend.
- b. John thought the newspaper was [deeply offensive]/ [printed with poisonous ink] so decided to sue it.
- c. #My car broke down [ENGINE] even though I changed it [ENGINE] last week.

Therefore, a factor which is more general than syntactic structure seems to influence acceptability. The experiments presented in this thesis indicate that this factor is likely to be predicate ordering – a finding which potentially renders certain mechanisms introduced in the theoretical literature redundant (e.g. linear dot-types).

Other contemporary accounts of copredication are inadequate for reasons to do with sense order considerations. Vicente (2017: 234) argues (emphasis added):

[P]erhaps the activation of one of the senses of a regular polyseme spreads to the other(s) in a specially fast and stable way, *such that we experience no problem in switching from one sense to the other*, whereas the process of forming an ad hoc concept involves more effortful pragmatic reasoning. Such an explanation could perhaps also explain the copredication data: if two senses are linked by a pattern of strong co-activation, then both can be available for predication and anaphoric reference, even when the speaker switches from one to the other.

Vicente’s argument may have some merit with respect to the elementary processes of conceptual association and comparison, but claiming that “we experience no problem in switching from one sense to the other” cannot account for the sense order dynamics documented both in the present set of experiments and also throughout the literature (see Chapter 2).

It may also be possible that the sense order effects documented here for copredication bear some principled relation to the observation that quantificational NPs do not usually conjoin with names to form complex phrases, as Liebesman and Magidor (2017: 141) observe:

- 34) a. #Somebody and Emma are barking.
- b. Oli and Emma are barking.

Coordinating outside categories, as in (34a), seems much less acceptable than coordinating within categories, as in (34b). Yet notice that sense reversal of (34a) seems to improve acceptability (pending further empirical investigation of these dynamics):

- 35) Emma and somebody (else) are barking.

It is as if, with copredication, that once the more concrete sense (*Emma*, a definite token) is introduced, the more abstract sense (*somebody*, an indeterminate token) can more readily be conjoined.

As the present discussion has I hope illustrated, the possible explanatory range of *Incremental Semantic Complexity* may be considerable, and future research should be aimed towards explaining seemingly puzzling phenomena like the cases discussed in this section within the framework presented in this dissertation. What follows are some possible directions for such research.

6.2. Future Directions

6.2.1. Representational Basis of Copredication

We have made particular assumptions throughout this thesis about the structure of mental representations. We have assumed, for instance, that institutions are categorially and semantically distinct from sets of information, and that information imposes sortal constraints distinct from events, and that events are to be interpreted separately from physical artefacts. Future work should more explicitly delimit these sortal relations, since for the purposes of psycholinguistic investigation it has been adequate here to simply assume an interpretive distinction between events, objects, information and so forth, and to also argue that the One Representation Hypothesis of polysemy appears to be supported by the present and many previous experiments.

Is there any indication in the literature that these concerns have been addressed before? Dölling (1995) proposes a set of ontological relations of the kind relevant to our discussion: *Entity* is divided into *Kind* and *Object*, with *Object* being divided into *Physical Object* and *Social Object*. The former is categorised into *Stuff* and *Aggregate*, while the latter is categorised into *Group* and *Institution*. *Person* is defined as a sub-type of *Aggregate*, and is “associated with” *Institution*. This is the outline of a comprehensive ontology (e.g. *Stuff* is ill-defined), with the number of possible relations between nodes extending far beyond what Dölling sketches out. Relatedly, Lang and Maienborn (2011: 720) note that the conceptual specifications for institutional nominals like *school* “differ [from those of other nominal types] in ways that are poorly understood as yet”. It is my hope that the present theoretical discussion and experimental results go some way to expand our understanding of institutional representations.

Reaching further back into the literature, Keil (1979, 1981) discussed ontological knowledge as knowledge about classes of things. All such knowledge was claimed to be structured via an ontological tree, hierarchically organized, not dissimilar to Dölling’s (1995) formulation. Keil claimed that ontological classes occupying branches on the tree are organized via what can be predicated of them, and that there is a one-to-one mapping from predicability to distinct branches. Deviations from this one-to-one rule are termed *M-violations*, and are caused by polysemy. Keil proposes an *M-constraint* through which language users and learners understand that, with the strict exception of polysemy, words can be mapped to distinct ontological classes, and thereby filter out word meanings which exhibit *M-violations*. Gerard and Mandler (1983) conducted an acceptability judgement study and found that subjects failed to return answers that could be analyzed as arising from a preconceived hierarchy of predicates and terms, such that this one-to-one mapping

was not sustained, suggesting that the notion of ontological classes is non-trivial. The case of copredication seems to support this conclusion. The set of results reported in this thesis can be seen as supporting the idea that the ontological class of distinct predicates has an additional impact of acceptability when the order of presentation is modulated – yet, these fundamental questions of classification raised by Keil hover in the background, and demand further scrutiny in future work.

Other legitimate concerns arise in the fundamental framing of sense types; for instance, the very notion of ‘able to be perceived by the senses’ for concreteness (as outlined in Chapter 1) does not strictly permit a clear adjudication for things like *emotions*, which can generalise beyond any given instance of physical sensation (e.g. feeling anxious vs. anxiety as a general phenomenon). Further, it is possible that all senses involved in complex polysemy are ultimately categorised into more fundamental constituents, as in some areas of formal semantics which only postulate a division between *entities* and *truth-values* (see the collection in Partee 2004). Nevertheless, even if we are ultimately misguided about the categorisation of sense types (i.e. about which nominal goes in which camp), one cannot ignore the more direct linguistic issues about why certain sense types can readily co-occur, while others cannot. That is to say, the empirical findings in this thesis have to be accounted for somehow, and denying things like the concrete/abstract division – while potentially well-motivated from a number of standpoints, and while potentially also able to direct inquiry towards a more successful empirical account of the data – does not immediately achieve this.

Other ontological topics explored in this thesis demand further investigation. It is very often the case that nominal representations do not have anything remotely like a real-world referent. Collins (2017b: 236) notes for independent reasons that “extra-linguistic concepts have a rich structure independent of both perceptual capacity and grammatical categorisation”. This thesis has presented support for the following claim in Collins (2017a: 699):

The copredication argument ... does not, in particular, have as its goal the overthrow of ‘ordinary ontology’ in favour of linguistic idealism or a vanquishing of truth-conditional semantics. It simply commends a divorce, as it were, insofar nominals in particular support a range of construals, independently and copredicatively, which are not to be understood in terms of

the nominal picking out or semantically contributing an invariant external entity.

Relatedly, Pietroski (2017: 207) notes how Diet Coke has a higher percentage of H₂O than “the stuff from my well”. He adds that “Diet Sprite[®] and club soda are even more like H₂O” yet are not deemed *water* for reasons to do purely with “intended purposes”.⁹³ Pietroski (2018) also maintains that denotational acts, of the kind involving copredications, cannot be explained purely by semantic knowledge, and involve a range of intricate pragmatic rules; a framework closely aligned with the presently proposed interaction between complex polysemous single-storage representations and the detection of coherence relations.

Collins (2017b: 683) effectively concurs with Pietroski’s conclusions, noting that “many of the kinds of things we readily sanction as external have individuation conditions shot through with human-specific categories and are sensitive to our various conceptions and interests”. What exactly these “interests” and “intended purposes” are and how they impact language processing is a topic ripe for future experimental research. Numeric quantification, and its impact on individuation, would be a possible place to explore the most experimentally accessible elements of this terrain. For instance, it would be worthwhile to compare the counting effects in institutional, physical and informational entities via a lexical decision task, asking such research questions as ‘Is it easier to count the number of physical objects or institutions?’ There may be some correlation between sense complexity or frequency and the time taken to count the given number of entities. This is one domain where sense frequency-based accounts can potentially be of greater explanatory value than complexity-based accounts.⁹⁴

⁹³ Descartes’s ‘Comments on a Certain Broadsheet’ (1984) also made a distinction between the scientific definition of the *sun* and the commonsense concept *sun*.

⁹⁴ Moving further afield, in an attempt to draw additional connections between copredication and other areas of psycholinguistics future work could explore the possibility that orthographic factors in reading comprehension impacts the processing of copredication; e.g. *newspaper* includes ‘paper’ and might therefore prime the physical sense. For example, Bowers et al. (2005) show that words like *catch* prime conceptions of animals due to the orthographic presence of ‘cat’. Nominals like *bank* do not have the ability to exhibit this orthographic priming effect, and so might differ from *newspaper* in this respect. Li and Slevc (2017: 1545) speculate that “[t]he connection between a homophone’s lemmas may be diminished if there are orthographic differences between the homophones’ meanings (e.g., flour, flower)”. Research in this

6.2.2. Developmental Basis of Copredication

While the acquisition of single words has received much attention (Bloom 2000, McMurray et al. 2012), the development of more abstract *senses* (such as abstract and concrete) which can be represented through multiple words has received less attention (although see Barak et al. 2019 and Srinivasan et al. 2019 for, respectively, computational modelling and experimental explorations of this topic). This thesis has, broadly speaking, entertained sense frequency-based and complexity-based accounts of copredication acceptability and processing. A third possible account which future work might seek to examine (and which could fill this noted gap in the literature) can be termed *acquisition-based hypotheses*, which can be summarised under the following general description:

- ***Acquisition-Based Hypotheses***: The developmental stage at which the senses involved in copredication are acquired modulates the acceptability of their ordering.

As with the sense frequency-based and complexity-based hypotheses, acquisition-based hypotheses can be separated into at least two opposing camps: Either the sense acquired earlier should be placed first to maximise acceptability (Early-Late preference), or the sense acquired later should be (Late-Early preference). Thus far, we have presented evidence to suggest that sense frequency-based hypotheses are likely inapplicable to predicate ordering acceptability in copredication, and that a complexity-based hypothesis has empirical support, motivating the *Incremental Semantic Complexity* parsing preference. This section will briefly explore routes towards testing acquisition-based models of copredication.

To begin, there may be a simple reason why concrete word senses are extended over history to abstract word senses more often than the reverse: Concrete senses might be lexicalized earlier in childhood, and may be more easily retrieved as a result. There is in fact a range of evidence supporting the claim that concrete concepts are acquired earlier than abstract concepts, with the former also being deemed considerably more familiar to children (Caramelli et al. 2004, Schwanenflugel 1991, Schwanenflugel & Akin 1994,

connection would enhance theories concerning the broader architectural relations between different linguistic levels of representation.

Yore & Ollila 1985). Caramelli et al. (2004) also discovered via an association production task that concrete words elicited mainly attributive relations (characterised by perceptual properties), while abstract words elicited mainly thematic relations (e.g. spatial, temporal, and causal relations), potentially explaining their delayed development given that these types of thematic relations are independently known to develop later. Indeed, Caramelli et al. (2004) discovered that abstract words elicited virtually zero attributive relations. These differing stages of acquisition could impact sense order acceptability, or indeed other aspects of copredication acceptability.

Infants appear to develop innate perceptual and cognitive strategies for acquiring the meaning of words – an assumption already made in Bruner (1957) and which has been standardly used to support the ‘modularity thesis’ (Fodor 1983, Gunnar & Maratsos 1991). The division of sensory objects into ontological categories (e.g. SUBSTANCE and INDIVIDUAL, which help form a child’s intuitive materials-science) is one such well-documented capacity (Soja et al. 1991). Developmental psychologists have argued that concrete and abstract meanings emerge at distinct maturational stages (Bergelson & Swingley 2013), but the question of when copredicated structures gain their full semantic complexity has not yet been addressed. For instance, while it is known that proverbial and other forms of figurative knowledge become more robust in pubescent years (Nippold 2000), the developmental trajectory of paired abstract-concrete polysemous concepts has not been investigated. Moreover, the age of acquisition of concrete and abstract concepts has often been explored through rating procedures on adult subjects (e.g. in Della Rossa 2010 participants were asked to estimate at which age they thought they learnt words which were either abstract or concrete).

Moving to a closely related domain, only a small number of recent models of vocabulary learning provide scope for words with multiple senses. For example, Kachergis et al. (2017) implement a bias generating a single referent preference, but it also permits a second candidate meaning to be represented (albeit, an unrelated meaning, mirroring homonymy; see Stevens et al. 2017 for a similar model). In the literature on vocabulary learning more generally, it has typically not been a criterion of success for a given model that it successfully represent multiple meanings (see Barak et al. 2019 for discussion, and also Nematzadeh et al. 2014 for a model assigning internal structure to words, which can at least account for complex polysemous representations of the kind seen in copredications).

While they do not address copredication, Srinivasan and Snedeker's (2011) study of the representation of polysemous and homophonous meanings in 4-year-old children is perhaps the closest in the literature to the topic. These authors raise the possibility that the generative operations or lexical properties which yield polysemy might support children's representations of polysemy. They show that 4-year-olds can understand both the concrete and abstract meaning of *book*, and therefore argue that polysemous senses rely on a common representational base from early in development. They taught a group of 4-year-olds a novel label (such as *blicket*) that corresponded to a single known meaning of a polysemous word (such as the informational sense of *book*). Their results suggested that children can readily comprehend extended uses of these novel labels to another sense of the same polysemous word, suggesting that the senses share the same lexical entry, or representational base (see Srinivasan & Snedeker 2011 for further details), lending support to the ORH. They concluded that polysemous words seem to be acquired not by relating two distinct senses, but rather through "foundational properties of the mental lexicon or conceptual system" (2011: 250).

In more recent work, Srinivasan et al. (2019) explored children's use of polysemy to structure new word meanings, showing across a range of experiments that children employ a well-known heuristic (the shape bias; Landau et al. 1988) when learning polysemous words. They found that both children and adults extend a new object label (i.e. an invented label like 'gup') to other objects of the same shape, but also found that they typically override this shape bias and extend a label to the *material* the object is made of if they know that a word for an object can also be used to refer to the material composing it. Relating more to our present concerns, they also report experiments demonstrating that learning new polysemous word meanings forces accommodations and revisions to be made to old polysemous meanings. Further, Srinivasan et al. found that these processes of accommodation and revision of old polysemous meanings do not occur when learners perceive that the multiple meanings are arbitrarily paired, but occur only when they are associated in a way which yields a meaningful relation, allowing for more efficient meaning development. As such, these findings might be exposing how certain concrete meanings of *newspaper* or *lunch* are slightly modulated to permit them to be associated with abstract meanings.

In a recent study investigating these issues further, Murphy (2017) reports a questionnaire with 4-11-year-olds examining their comprehension of copredication. The

experimental questions put to the children either asked them to define a particular word, or to discuss its application in a given scenario and whether this application was appropriate. Although certain parts of the questionnaire may have been tapping into frequency effects rather than stages of acquisition (i.e. the simple definitional questions like ‘What is a book?’), the main relevance of this experiment for our purposes was its tracking of copredication comprehension. Half of the nominals investigated in this experiment (8 in total) permitted copredication of the kind already discussed in this thesis (*city, book, house, ship*) while the other half exhibited interesting dynamics between their Concrete sense and their Telic function (Pustejovsky 1995) which also permit forms of copredication. For instance, a *river* can be a physical substance but also an abstract route which can be reversed, re-directed, re-built and so on, while a *ship* can be a physical object but also maintain its abstract identity as a certain individual’s ship after having most or all of its physical components replaced. The results suggested that the children only began to discuss both abstract and concrete senses for all nominals at around age 10, although some forms of copredication were understood at age 4-5 (*person, city*). By plotting the relation between age of sense understanding and age of copredication understanding and finding a close correlation between the emergence of both senses and copredication, the results could effectively be showing that children perform better on copredication tasks when both senses are saliently understood by them. However, these results also provide insights into the approximate age at which this level of understanding likely reaches conscious awareness.

How do the topics in this thesis relate to some other concerns in the literature on development? Consider that during the first ‘iconic’ stage of lexical development when children learn that objects can have names, a period lasting from around ages 1-3 (Özçalışkan et al. 2014), they seem completely unable to learn abstract words. Given that concrete concepts seem to be acquired long before abstract concepts, this could be used to support an acquisition-based hypothesis under which Early-Late sense orders are preferred, thus matching the Concrete-Abstract preferences documented in this thesis. However, this general finding does not comprehensively account for certain other sense dynamics, such as those documented for Abstract₁-Abstract₂ copredications, which adhere to a more general Simple-Complex sense order preference. In order to account for this, acquisition-based hypotheses would additionally have to show that these distinct abstract polysemous senses were also acquired at different ages and in a generally

systematic order (i.e. the information sense acquired earlier than the event sense, as in nominals like *lecture* and *newspaper*, or the event sense acquired earlier than the institution sense, as in *church* and *school*). Given this, the *Incremental Semantic Complexity* account currently seems more comprehensively explanatory than the Early-Late acquisition-based account.

Returning to some broader concerns, consider the observations Ambridge et al. (2015: 240-241) in their comprehensive overview of frequency effects in language acquisition:

We do not argue that sensitivity to input frequency must be the defining feature ... of a successful account of acquisition (i.e., we do not argue for a frequency-DRIVEN or frequency-BASED mechanism). It is not difficult to think of factors that are more important than input frequency in at least some scenarios. ... We argue, instead, for a learning mechanism that is minimally frequency SENSITIVE.

Although they present five inter-related theses for frequency effects, only two appear applicable to the present thesis and its proposals. These are the *Levels and Kinds Thesis* (Ambridge et al. 2015: 242) and the *Interaction Thesis* (Ibid):

Levels and Kinds Thesis. Frequency effects exist at all levels and are of many different kinds. They are observed not only at the level of CONCRETE LEXICAL STRINGS (perhaps the prototypical frequency effect), but also at the level of ABSTRACT CATEGORIES (e.g. particular orderings of SUBJECT and OBJECT) and cues (e.g. animacy, givenness).

Interaction Thesis. Finally, we propose that frequency effects will interact with other effects. One example is utterance position: high-frequency verbs are generally learned before lower-frequency verbs ... and this effect is boosted for verbs that occur frequently in utterance-final position ... The downside of these interactions is that they can make frequency effects difficult to detect. The upside is that these interactions are generally informative with regard to the other factors that we need to build into the learning mechanism (e.g. sensitivity to utterance position or temporal ordering).

The results of the present thesis cannot be easily accommodated under the *Levels and Kinds Thesis* since the ‘particular orderings’ of abstract categories like Concrete and Abstract yielded no interaction effects with frequency. They also cannot be easily accommodated under the *Interaction Thesis* since we found no effect of sense frequency on acceptability dynamics.

In further work relating very directly to these developmental concerns, Jager and Cleland (2016) show that frequency-based and acquisition-based models cannot accurately characterise the behaviour of polysemous nominals. They conducted two reaction time studies in which participants had to determine whether a letter string was a word or a non-word. The first experiment used concrete polysemes (*bread, phone, cage, bottle*), the second abstract polysemes (*crown, hammer, pearl, balloon*); hence they did not explore copredication. They also presented participants with homonyms. Along with manipulating polysemy type (abstract vs. concrete), they manipulated sense diversity (low vs. high). This latter factor was derived from Hoffman et al.’s (2013) novel ambiguity measure, ‘sense diversity’, which estimates the semantic similarities of different linguistic contexts within a large text corpus, with larger differences between contexts being formalised as larger levels of diversity.⁹⁵ For concrete polysemes, there was no reaction time difference, but for abstract polysemes they found a “polysemy advantage” such that participants accurately responded significantly faster relative to homonyms. They also found no relation between sense frequency and reaction time, or age of acquisition and reaction time (relying on the comprehensive Kuperman et al. 2012 database for acquisition information), or even sense diversity and reaction time.

Although the authors do not draw any explicit theoretical conclusions from these findings, other than to claim that their findings “strengthen the case for the psychological reality of polysemy” (Jager & Cleland 2016: 153), these findings appear to support the ORH, reinforce the present downplaying of the centrality of developmental concerns, and, “[i]n addition, [they] rule out several alternative explanations for these polysemy effects, e.g., sense dominance, age-of-acquisition, familiarity, and semantic diversity” (2016:

⁹⁵ Note that Hoffman et al.’s (2013) sense diversity metric is distinct from sense complexity, since *book* can be discussed in a very large, ever-expanding range of semantically distinct contexts (electronic books, emailed books, ideas about potential books, etc.) yet its core senses are amongst the most semantically basic of all the senses that can be involved in copredications.

143). Interestingly, their findings would predict that semantic diversity, and hence copredication type, does not impact reaction times for this particular task. This suggests that, in terms of basic lexical access (the process required for word vs. non-word detection), complex polysemous nominals are likely detected at the same rates as more basic forms of polysemy. This is compatible with the lack of ERP effects for Sentence Type (Copredication or Non-Copredication) documented in the previous chapter. An interesting question for future research concerns the reaction time ratings for nominals permitting copredication, since they host both a concrete and abstract sense, and Jager and Cleland found a polysemy advantage for the latter but not the former.

Lastly, since children have to learn how to combine/relate two predicates in cases of copredication, future work should explore the possibility that *Incremental Semantic Complexity* may help narrow down the optimal sense order such that they are likely exposed to Concrete-Abstract orderings more often than the reverse. Learning predicates in a general order (Simple-Complex/Concrete-Abstract) would be easier than adapting a more flexible (but computationally more demanding) learning strategy. This topic would demand an engagement with the statistical learning literature and processing biases.

6.2.3. Incremental Semantic Complexity: A General Cognitive Principle?

Another potential route for future research involves embracing the possibility that *Incremental Semantic Complexity* is not strictly a parsing bias, but a general cognitive bias, ranging beyond language and impacting other domains (e.g. vision, spatial planning). It would be of interest to investigate how this might be manifested. However, note that the norming studies presented in Chapter 3 did not find effects of *Incremental Semantic Complexity* at the level of bare coordinate phrases (e.g. *sandstone and revered*), suggesting that for the parser it becomes sensitive to this top-down bias at some intermediate level between coordinate structures and the forms of copredicated sentences used throughout this thesis (most probably, as was concluded, at the level of direct nominal-adjective association, or possibly also at the level of a coherent discourse segment). *Incremental Semantic Complexity*, under the current set of results, is likely a *discourse-related* processing effect. Alternatively, it may be that a follow-up experiment to Norming Study 1, examining again the acceptability dynamics of bare adjectival

coordinations but expanding considerably the range and number of items and subjects⁹⁶, will reveal an effect of sense order.

Keeping for a moment to these results, it has briefly been noted that the adjective coordination pairs exhibited distinct acceptability levels across the different nominal types in the norming studies. Might we need to take this into consideration when evaluating here the results of the main experiments, and might this even motivate a reanalysis? It appears that the implications of this observation only apply to Experiment 3, which directly used the normed stimuli, but there is not a clear *book > city > lunch* (> = more acceptable than) pattern for the Experiment 3 results, as there was in the norming results. Hence, not only is there no clear relation between the two sets of results, but the acceptability of the bare adjectival coordinations also seems markedly degraded compared to when they are embedded in copredications. This is likely due to the bare adjectival pairings merging two semantically distinct representations (e.g. ‘blue’ and ‘educational’), which seem semantically unrelated without any copredication being established.

In addition, it may also be the case that by presenting subjects with the task of rating simple phrases, the Chapter 3 norming studies did not tap into ordinary parsing procedures active in normal discourse interpretation, and hence would mask any discourse/sense order effects. As Hoek (2018: 16) notes, the smallest unit able to function as a discourse segment is “often taken to be the grammatical clause”, or “a unit headed by a verb” (see Evers-Vermeul 2005, Wolf & Gibson 2005). As such, certain parsing biases like *Incremental Semantic Complexity* may not be active at the level of adjectival coordinations, and indeed in the norming studies themselves participants may have been treating the constructions (correctly) as more isolated, discrete units with no discourse relevance.

This would also explain why the structure of adjectival ordering acceptability is not always structured along a Simple-to-Complex dimension (Cinque 1994). For instance, while ‘vegetarian Russian lawyer’ seems more acceptable than ‘#Russian vegetarian lawyer’ (Teodorescu 2006), which seems to follow a Simple-Complex ordering bias (nationality assumed to be more semantically complex than dietary commitment), the literature suggests that general ordering preferences are based on a dimension separate from complexity (see Cinque 1994, 2005); here are two prominent cross-linguistic

⁹⁶ But see Smith and Little (2018) for a defence of small-*N* designs.

models, where it is difficult to see any Simple-Complex or Concrete-Abstract ordering (e.g. Quality/Value before Color):

- 36) a. Quality > Size > Shape > Color > Provenance (Sproat & Shih 1991)
- b. Value > Dimension > Physical Property > Speed > Human Propensity > Age > Color (Dixon 1982)

It seems that within adjective phrases, and also within adjectival coordinations, the demands of more general discourse biases may not be (strongly) applicable, perhaps only weakly applicable. While *Incremental Semantic Complexity* may to some extent underlie adjectival hierarchies where more semantically complex/abstract senses typically appear after simpler senses (*size, colour, nationality*; compare ‘The big, red Russian man’ with ‘*The Russian, red big man’), the variability in cross-linguistic adjectival hierarchies in terms of their Simple-to-Complex dimensionality is difficult to account for. Alternatively, an account invoking processes of grammaticalization may be more plausible for the peculiar phenomenon of adjectival hierarchies (Say 2004).

This addresses the issue of ‘where’ *Incremental Semantic Complexity* is likely rooted in the language system, but what of its relation to other features of language? As discussed, there is a range of evidence from language, outside of copredication, which may support *Incremental Semantic Complexity*. To take a recent example, Flaherty et al. (2018) present data from silent gesture and an emerging sign language which speaks to this idea. They found that objects of intensional verbs (objects relating to the abstract, subjective perspective of a given individual, e.g. ‘John saw the cup’) are more likely to follow those verbs than are objects of extensional verbs (objects relating to a real-world event, e.g. ‘John touched the cup’). In this sense, abstract objects appear to be delayed in the syntax relative to concrete objects. Even though this only involves an order-related component (pre-verb or post-verb), rather than a more direct binary manipulation of both objects, the fact that more abstract events are delayed in the syntax (SVO; where the abstract event is denoted by the Object) relative to constructions involving extensional verbs (SOV) indicates that conceptual category/complexity might modulate word order. For example, although we have supposed here that *Incremental Semantic Complexity* is implemented in polysemy via a priming effect, it seems unlikely that priming can explain its apparent manifestation in silent gesture in emerging sign languages. As such, a more domain-

general Simple-to-Complex processing bias may influence distinct linguistic sub-systems, manifesting itself via priming effects, broad syntactic preferences (silent gesture word ordering), narrow syntactic preferences (category coordination; see Chapter 6.1.3 above), and other means.

6.2.4. Capturing Coherence

Results reported in Chapter 4 suggested that *Incremental Semantic Complexity* should be defined in terms of sensitivity to semantic complexity, and that a Concrete-Abstract preference (*à la* Scorolli et al. 2011) may only be reflective of a more general parsing bias. Nevertheless, in none of the experiments reported here have we directly manipulated coherence; rather, we included a coherence measure in the analysis. It was discovered that for Experiment 6, there was a significant correlation between coherence and copredication acceptability, suggesting some form of possible relation between these two factors; most probably, that the acceptability of copredication scales with the salience of predicate coherence for complex predicates, and not single-word predicates. Importantly, coherence relations are claimed to be active between “segments that are minimally clauses” (Hoek 2018: 42), and so this likely explains why only complex predicates (and not individual adjectives, like in Chapter 3) trigger strong coherence relations impacting copredication acceptability.

<i>Experiment</i>	<i>Bivariate (Pearson) correlational analysis</i>	<i>Interpretation</i>
Exp. 1	Appr. sig. ($p = .052$)	A possible weak uphill relationship between coherence increase and copredication acceptability.
Exp. 3	Not sig. ($p = .227$)	Sense order results unrelated to coherence.
Exp. 6	Highly sig. ($p = <.001$)	Strong linear relationship between coherence strength and copredication acceptability.
Exp. 9	Not sig. ($p = .453$)	Sense order results unrelated to coherence.

Table 25: Summary of the bivariate correlational analyses investigating the relationship between predicate coherence and copredication acceptability.

While the correlation between copredication acceptability and coherence approached significance in Experiment 1, there was no significant correlation for Experiments 3 and 9 (see Table 25). As mentioned in the experimental discussions in Chapters 3-4, this does not in principle rule out a relation between acceptability and coherence, and it rather allows us to conclude that the acceptability dynamics were due to other factors. In addition, consider how participants in the coherence norming studies were explicitly asked to detect coherence, whereas the participants in the main experiments were asked to rate acceptability. As such, while for Chapter 3 in particular (involving very short sentences and single-word predicates) the norming study participants may have detected some coherence between predicates, the participants in the main experiments may not have consciously detected these due to the nature of the task. They were instructed to focus on “*how natural, well-formed or acceptable*” the sentences were, and so any aspects of the sentence which they thought made it acceptable or unacceptable would be relevant, and coherence would presumably only be one of many factors influencing this.

Given that Chapter 2 placed a considerable degree of explanatory emphasis on the coherence between predicates, it will be necessary in future work to further subject this factor to investigation. One way to pursue this direction would be to test the acceptability of copredicated constructions which manipulate coherence relations (Coherence vs. Non-Coherent; using the normed coherence scores) and coherence type (Extensional Overlap vs. Causal Connection).⁹⁷

Consider also how Vicente (2019) notes that “we are very far from having ... an account” for why the acceptability contrast below exists. Assuming that copredications require a coherent spatiotemporal frame between predicates, this contrast seems puzzling since one would expect (37b) to be just as unacceptable as (37a).

- 37) a. #The school caught fire when it was on excursion.
b. The school in NYC caught fire when it was celebrating 4th of July in Chicago.

⁹⁷ Given that the issue of sense order preferences has essentially been resolved in this thesis, this factor has been omitted from the proposed design – not least because it is difficult to construct causal connectives which can have their predicates switched without significantly impacting acceptability. Nevertheless, sense order should at some point be directly manipulated against coherence, since there may be a dynamic relationship between the presence/absence of coherence and differences in sense order acceptability, such that, for example, as coherence decreases differences in sense order acceptability increase.

Following the account presented in this thesis, the clear coherence relation between the predicates in (37b) (namely, *extensional overlap*, with the overlapping feature being location-related information) greatly improves the copredication.⁹⁸

Lastly, Vakulenko et al. (2018) note that semantic coherence is always relative to the background knowledge of participants. As such, it is possible that the present acceptability experiments constitute an unusual form of coherence relation processing, given that the experiment involved single sentences. It may be that an experimental design utilising a range of context sentences or brief narratives will more faithfully tap into the normal processes involved in computing coherence in copredication.

6.2.5. Prototype Structure of Complex Polysemous Nominals

One last feature of copredication which could be explored in future work is the prototypical structure of complex polysemous nominals. In a recent paper on the nature of consciousness, Chomsky (2018: 38) considers “one of the most ancient problems of philosophy: How can we cross the same river twice?”⁹⁹ These are problems of “identity” and “individuation” for Chomsky; by now familiar themes in this thesis. Future experimental work could explore this topic through a forced choice or acceptability judgement task. This issue has already been discussed in the philosophical literature, e.g. Collins (2017b: 686): “Thus, a group of people and a geographical area wildly dissociate in every conceivable sense save for them being referred to by *London*, say. We can kill the population of London, but not the area in south-east England. Equally, we can burn the city down while sparing the people, but rebuild the same city elsewhere, with a new population”. What we might term the *persistence conditions* of copredication could be

⁹⁸ Consider also Hoek’s (2018: 44) category of the BASIC OPERATION in coherence relations. This operation takes two values: *causal* and *additive* (a distinction from Renkema 2004). These directly map on to causal connections and extensional overlaps. The BASIC OPERATION is *causal* if there is an implication relation between arguments ($P \rightarrow Q$), as in ‘The newspaper was sued because it was offensive’. The BASIC OPERATION is *additive* if there is no causal relation between segments and the only relation that obtains is $P \& Q$, as in ‘The newspaper purchased more ink and had five colourful pages’. As such, *additive* relations cover standard copredications but also extensional overlaps.

⁹⁹ Collins (2017b: 680) presents an example demonstrating how *river* can license copredication through it being a geographical feature, an abstract relation or a body of water:

- (i) The Nile runs the length of Egypt and it serves as the most important trade route in the region as well as the source of irrigation for nigh-on all of Egypt’s crop production.

subject to experimental investigation, specifically INSTITUTION-related copredication, making close contact with the nature of prototypical copredications. The main research question could be ‘What are the conditions under which the identity of a given entity can survive?’¹⁰⁰

Cognitive models of polysemy have suggested that vagueness, polysemy and homonymy represent “a cline of diminishing schematicity and increasing instances of salience” (Lewandowska-Tomaszczyk 2007: 139), such that polysemous senses bear a lower degree of salience than homonymous meanings do, and vague words have an even lower degree of salience for a particular meaning. For instance, *student* is not polysemic with respect to the distinction between *young student* and *old student* (‘I gave the book to a student but not to a student’ cannot refer to an old and young student respectively); it is vague and unmarked. In a similar way that one would typically say ‘Milton Keynes is close to London’ and not ‘London is close to Milton Keynes’, due to proximation to a larger city being seen as a prototypical frame of geographical reference, it may be that there is an empirically detectable range of sense prototypicality in copredication such that a given sense may invariantly be seen as more essential to the polysemous nominal than others (this topic relates very directly to literature on psychological essentialism: Frisson & Wakefield 2012, Gelman 2003, Hampton et al. 2009, Malt & Sloman 2007).

The main set of prototype effects are plotted in Table 26 (adapted from Lewandowska-Tomaszczyk 2007: 151, and modified to focus on complex polysemy in copredication). This shows how degrees of salience, clustering of senses, a lack of clear necessary and sufficient features, and variability in category membership are hallmarks of prototype effects – notice that *all* of these are clearly present in copredication licensing. The table plots effects relating to extensions and intensions, which are, respectively, entities

¹⁰⁰ The complex polysemy seen in copredication also seems to explain why Chomsky’s (2000) *London* can be demolished and rebuilt elsewhere and why Pietroski’s (2005) *France* can simultaneously be both hexagonal and a republic. Indeed, as Vicente (2017: 235) notes, “if ... all Londoners and the London institutions go on exile and decide not to move to the new location, we can also say that London is wherever the Londoners and the institutions are”, suggesting that a way to choose between Londons in order to determine the “most London-like” one might be to examine which one hosts the greatest number of senses: The *London* with just the bulk of the populace might not be deemed *London* when compared to the *London* with the physical buildings and political institutions. Additionally, I think much of the “lexical underdeterminacy” discussed in Ludlow (2014) can be accounted for when explored through accounts of polysemy.

referred to by the concepts and senses which the concepts are composed of. These effects can in turn be categorised based on whether they effect the salience of the sense (how clear and prominent it is in a given interpretation) or its discreteness (related to issues of demarcation).

	Extentionally	Intensionally
<i>SALIENCE</i>	Differences of salience among senses	Clustering of senses into nominal representations
<i>DISCRETENESS</i>	Senses can demarcate different entities	Absence of definitions in terms of necessary and sufficient features

Table 26: Main prototype effects and their mutual relationships.

As the framework depicted in the above table would predict, it has been found that people tend not to categorise objects using necessary and sufficient features, but rather do so by comparing their similarity to a prototype of the candidate category (Rosch 1975, 1978). As such, when judging whether a cluster of senses in a given context constitutes a *school* or not, comprehenders will presumably compare this structure to their stored prototypical representation. Interestingly, there are recent signs that the semantics literature is able to accommodate these concerns: For instance, Del Pinal (2015, 2018) proposes a new Qualia structure for the Generative Lexicon framework. This ‘Perceptual’ structure represents the stereotypical appearance of an entity; how the entities “tend to look” (2018: 176).

Yet, the main theoretical difficulty in discussing this topic surrounds the issue of what precisely constitutes the prototype. As Gries (2015: 473-474) notes, the prototypical sense of a word could be the most frequent, most salient, most concrete, or the earliest acquired sense (that is, it could call upon all of the possible factors in copredication design discussed so far in this chapter), and it is furthermore likely that the criteria of prototypicality differ across nominal classes. As such, there seems little fundamental connection between prototype structure and the models of copredication reviewed in Chapter 2; rather, the prototype is a representation likely independent of semantic or pragmatic processes and, as mentioned, the criteria for being a prototype likely differ across word classes and conceptual domains. The exceptions here are the psychological theories of polysemy reviewed in Chapter 2, which seem much more related to prototype theories than semantic and pragmatic models of copredication. For instance, Ortega-Andrés and Vicente’s (2019) model of activation packages is very likely able to

accommodate this broad range of prototype criteria, given that the authors claim that activation packages are structured via relations differing from nominal to nominal.

As Geeraerts (1989) also proposed, there are certain concepts (for our purposes, INSTITUTION-related polysemous nominals) which may not be able to be defined through a set of necessary and sufficient features, and which exhibit a semantic structure which assumes the form of a set of clustered and overlapping interpretations. For example, (38) contains a number of clustered senses being attributed to a single nominal, along the lines briefly discussed in Chapter 2 (see 2.3.1).

38) The school with large windows starts at 9am and has a strict headmaster and unruly students.

However, it may be the case that one of these senses is more salient and prototypical than the others, but intuition alone does not seem a powerful enough measure to expose this (none of the *school* senses seems to be the most prototypical). As such, a behavioural test aimed to explore the issue of prototype senses could be conducted in future work.

6.3. Evaluation

Ott (2017: 5) claims that any theory of language will require “the incorporation of various forms of evidence, from introspective to neurological, that can be hoped to tap the human ‘notion of structure,’ in Jespersen’s famous formulation”. It is my hope that this thesis has moved in the direction of achieving this goal for complex polysemy, exploring its introspective acceptability dynamics and electrophysiological properties.

Summarizing current inquiry, Haber and Poesio (2020: 115) claim that “the prevailing understanding of co-predication is that it is rendered felicitous if the different sense interpretations are activated simultaneously and can be shifted between without additional processing costs”. The experimental results in the current thesis provide evidence motivating a modification to this consensus. It has been shown that certain acceptability contrasts noted in the literature can be explained via psycholinguistic factors. A parsing bias termed *Incremental Semantic Complexity* was proposed to account not only for stipulated acceptability contrasts presented by other researchers in the theoretical literature, but also to account for the present experimental results concerning the

acceptability dynamics of copredication. As discussed in Chapter 3, since the acceptability dynamics for Italian and English copredications were very similar, this lends weight to the general picture in Srinivasan and Rabagliati's (2015) research that polysemy arises from conceptual, and not linguistic, constraints.

Adding to the empirical evidence reviewed in Chapter 3 supporting the idea that polysemes and homonyms are processed in different ways, this thesis has presented behavioural as well as electrophysiological evidence that the senses of polysemous nominals permitting copredication are *processed* as single complex representations, but that the order of accessing these senses impacts *acceptability* for reasons quite independent of the nature of lexical storage and relating rather to parsing biases. As such, this seems to confirm a broader intuition that "underspecified lexical representations may interact with context and conceptual structure to select a contextually relevant meaning" (Schumacher 2013: 1).

This should encourage researchers concerned with copredication to shift their attention towards the parser. Indeed, the presently reported acceptability experiments only provide data about offline participant judgements, and the EEG study also centred on the initial presentation of the second predicate as opposed to post-target processing stages (e.g. integration, re-evaluation, and so on). As such, information about the full time-span of processing cannot be gleaned from these findings, and future work should use other online processing measures, such as eye-tracking or self-paced reading, to explore copredication.

This perspective also allows us to maintain certain insights of SEL-supporting studies like Klein and Murphy (2001), who showed a cost of polysemous sense switching, but also the insights of ORH-supporting studies like Frisson (2015). Indeed, Frisson (2015: 29) concludes that his experiments support the underspecification/ORH model, and yet "the account itself is woefully underspecified and one area that needs to be explicated in much more depth is what happens *after the assignment of an underspecified meaning*" (emphasis added), noting that his results "suggest that sense dominance and pragmatic considerations might be a factor in how strongly one commits to a specific homed-in sense". We can now qualify these statements with the following observations: (i) After the assignment of an underspecified meaning the parser remains sensitive to the semantic type of subsequent meanings; (ii) While the sense frequency and acceptability results preliminarily suggest that sense dominance is not a significant factor in sense

commitment, we provided initial evidence that pragmatic (coherence) factors may be influence the acceptability of copredications involving complex predicates.¹⁰¹

More broadly, this thesis has argued that copredication is both a more *extensive* phenomenon than previously believed, involving a greater number of sense combinations than typically assumed, but is also more *constrained* given the sense order/discourse effects documented. Moreover, while copredication was our general thematic focus throughout, by exploring the acceptability and processing dynamics of this specific form of polysemy we have ultimately been able to make claims about a seemingly more general acceptability preference, taking scope beyond copredication: *Incremental Semantic Complexity*.

¹⁰¹ Although homonym has not been our main concern, I should note that these acceptability and sense frequency results also support the notion that polysemous and homonymous words are stored differently in the lexicon, since frequency does not seem to impact polysemy processing in the way it very clearly does for homonymous meanings (Simpson & Burgess 1985).

Appendix

Experiment 1 Items

Book-type

- John said that the large and heavy book was on the table.
- John said that the interesting and heavy book was on the table.
- John said that the large pamphlet and heavy book were on the table.
- John said that the interesting pamphlet and heavy book were on the table.
- Sam claimed that the short and small letter was in the post.
- Sam claimed that the funny and small letter was in the post.
- Sam claimed that the short movie and small letter were in the post.
- Sam claimed that the funny movie and small letter were in the post.
- David mentioned that the plastic and damaged video was near the chair.
- David mentioned that the scary and damaged video was near the chair.
- David mentioned that the plastic book and damaged video was near the chair.
- David mentioned that the scary book and damaged video was near the chair.
- Kath noticed that the orange and thick pamphlet was being talked about.
- Kath noticed that the left-wing and thick pamphlet was being talked about.
- Kath noticed that the orange poster and thick pamphlet was being talked about.
- Kath noticed that the left-wing poster and thick pamphlet was being talked about.
- Dan recalled that the hurtful and offensive message had been sent yesterday.
- Dan recalled that the printed and offensive message had been sent yesterday.
- Dan recalled that the hurtful card and offensive message had been sent yesterday.
- Dan recalled that the printed card and offensive message had been sent yesterday.
- Sam watched as the weighty and large dictionary was put on the shelf.
- Sam watched as the informative and large dictionary was put on the shelf.
- Sam watched as the weighty manual and large dictionary were put on the shelf.

Sam watched as the informative manual and large dictionary were put on the shelf.
Jack believed that the smooth and laminated advert was going to be successful.
Jack believed that the witty and laminated advert was going to be successful.
Jack believed that the smooth card and laminated advert were going to be successful.
Jack believed that the witty card and laminated advert were going to be successful.
Michael assumed that the white and unopened exam was beside the desk lamp.
Michael assumed that the tough and unopened exam was beside the desk lamp.
Michael assumed that the white paper and unopened exam were beside the desk lamp.
Michael assumed that the tough paper and unopened exam were beside the desk lamp.
Stewart thought that the creased and brown bill was being talked about at the table.
Stewart thought that the expensive and brown bill was being talked about at the table.
Stewart thought that the creased book and brown bill were being talked about at the table.
Stewart thought that the expensive book and brown bill were being talked about at the table.
Jemima said that the flat and folded newspaper was on the shelf.
Jemima said that the educational and folded newspaper was on the shelf.
Jemima said that the flat document and folded newspaper were on the shelf.
Jemima said that the educational document and folded newspaper were on the shelf.
Emily claimed that the bound and thin translation would be a bestseller.
Emily claimed that the difficult and thin translation would be a bestseller.
Emily claimed that the bound poem and thin translation would be bestsellers.
Emily claimed that the difficult poem and thin translation would be bestsellers.
Sally thought that the crumpled and slim novel was next to the locker.
Sally thought that the insightful and slim novel was next to the locker.
Sally thought that the crumpled map and thin novel were next to the locker.
Sally thought that the insightful map and thin novel were next to the locker.

City-type

Sarah thought that the busy and polluted city was a sight to behold.
Sarah thought that the reactionary and polluted city was a sight to behold.
Sarah thought that the busy man and polluted city were a sight to behold.
Sarah thought that the reactionary man and polluted city were a sight to behold.
John heard that the massive and tall construction was being discussed.

John heard that the difficult and tall construction was being discussed.
John heard that the massive staircase and tall construction were being discussed.
John heard that the difficult staircase and tall construction were being discussed.
Patrick said that the small and sunny town was facing some problems.
Patrick said that the organised and sunny town was facing some problems.
Patrick said that the small campaign and sunny town were facing some problems.
Patrick said that the organised campaign and sunny town were facing some problems.
Mel read that the respected and acclaimed school was praised by her best friend.
Mel read that the huge and acclaimed school was praised by her best friend.
Mel read that the respected teacher and acclaimed school were praised by her best friend.
Mel read that the huge teacher and acclaimed school were praised by her best friend.
Luke asked if the expansive and colourful building was next to the lake.
Luke asked if the prestigious and colourful building was next to the lake.
Luke asked if the expansive museum and colourful building were next to the lake.
Luke asked if the prestigious museum and colourful building were next to the lake.
Nathan said that the opulent and grand restaurant was not far from the house.
Nathan said that the admired and grand restaurant was not far from the house.
Nathan said that the opulent café and grand restaurant were not far from the house.
Nathan said that the admired café and grand restaurant were not far from the house.
Natasha worried that the tiny and sandstone library would not be open.
Natasha worried that the revered and sandstone library would not be open.
Natasha worried that the tiny shop and sandstone library would not be open.
Natasha worried that the revered shop and sandstone library would not be open.
Chloe saw that the multistory and towering bank was being discussed on TV.
Chloe saw that the wealthy and towering bank was being discussed on TV.
Chloe saw that the multistory organisation and towering bank were being discussed on TV.
Chloe saw that the wealthy organisation and towering bank were being discussed on TV.
Brad said that the absorbing and readable journal was part of the office block.
Brad said that the prosperous and readable journal was part of the office block.
Brad said that the absorbing magazine and readable journal were part of the office block.
Brad said that the prosperous magazine and readable journal were part of the office block.
Linda thought that the affluent and wealthy arthouse was right next to the park.

Linda thought that the purple and wealthy arthouse was right next to the park.

Linda thought that the affluent house and wealthy arthouse were right next to the park.

Linda thought that the purple house and wealthy arthouse were right next to the park.

Harry claimed that the famous and esteemed publication was close to the train station.

Harry claimed that the scrunched and esteemed publication was close to the train station.

Harry claimed that the famous magazine and esteemed publication were close to the train station.

Harry claimed that the scrunched magazine and esteemed publication were close to the train station.

Lenny said that the upland and hillside company was beyond the forest.

Lenny said that the rich and hillside company was beyond the forest.

Lenny said that the upland agency and hillside company were beyond the forest.

Lenny said that the rich agency and hillside company were beyond the forest.

Lunch-type

Mary said that the delicious and tasty lunch was worth the wait.

Mary said that the delayed and tasty lunch was worth the wait.

Mary said that the delicious food and tasty lunch was worth the wait.

Mary said that the delayed food and tasty lunch were worth the wait.

Molly read that the prolonged and lengthy brunch was in the cafeteria.

Molly read that the organic and lengthy brunch was in the cafeteria.

Molly read that the prolonged meal and lengthy brunch were in the cafeteria.

Molly read that the organic meal and lengthy brunch were in the cafeteria.

Jacob wrote that the juicy and savory supper was going to be expensive.

Jacob wrote that the postponed and savory supper was going to be expensive.

Jacob wrote that the juicy appetizer and savory supper were going to be expensive.

Jacob wrote that the postponed appetizer and savory supper were going to be expensive.

Laura said that the sweet and tasteful breakfast was worth the effort.

Laura said that the brief and tasteful breakfast was worth the effort.

Laura said that the sweet snack and tasteful breakfast were worth the effort.

Laura said that the brief snack and tasteful breakfast were worth the effort.

Julia felt that the hurried and rushed dinner was definitely worth complaining about.

Julia felt that the salty and rushed dinner was definitely worth complaining about.

Julia felt that the hurried meal and rushed dinner were definitely worth complaining about.

Julia felt that the salty meal and rushed dinner were definitely worth complaining about.

Dale said that the nutritious and vegetarian meal was in the company headquarters.

Dale said that the annual and vegetarian meal was in the company headquarters.

Dale said that the nutritious feast and vegetarian meal was in the company headquarters.

Dale said that the annual feast and vegetarian meal was in the company headquarters.

Sharon believed that the healthy and bountiful banquet was going to go down well.

Sharon believed that the overdue and bountiful banquet was going to go down well.

Sharon believed that the healthy dessert and bountiful banquet were going to go down well.

Sharon believed that the overdue dessert and bountiful banquet were going to go down well.

Pablo thought that the dark and evening feast was the best part of the weekend.

Pablo thought that the wholesome and evening feast was the best part of the weekend.

Pablo thought that the dark pudding and evening feast were the best part of the weekend.

Pablo thought that the wholesome pudding and evening feast were the best part of the weekend.

Linda speculated that the uncommon and yearly barbecue was in the large field.

Linda speculated that the spicy and yearly barbecue was in the large field.

Linda speculated that the uncommon pastry and yearly barbecue were in the large field.

Linda speculated that the spicy pastry and yearly barbecue were in the large field.

Mick guessed that the dull and bland dessert was going to impress nobody.

Mick guessed that the hurried and bland dessert was going to impress nobody.

Mick guessed that the dull cake and bland dessert were going to impress nobody.

Mick guessed that the hurried cake and bland dessert were going to impress nobody.

Oliver said that the flavourful and fruity appetiser was opposite the main course.

Oliver said that the prompt and fruity appetiser was opposite the main course.

Oliver said that the flavourful cookout and fruity appetiser were opposite the main course.

Oliver said that the prompt cookout and fruity appetiser were opposite the main course.

Sue said that the pungent and delectable picnic was going to be forgotten.

Sue said that the interrupted and delectable picnic was going to be forgotten.

Sue said that the pungent roast and delectable picnic were going to be forgotten.

Sue said that the interrupted roast and delectable picnic were going to be forgotten.

Experiments 1 Fillers

Filler types

72 ungrammatical fillers:

9: Sam say that those videos are going to be watched next week. (*V number agreement*)

9: The red house were going to be put on sale that day. (*V tense agreement*)

9: That black toy was put on the table yesterday at Sally. (*PP agreement*)

9: The box that have made John laugh is next to the door. (*V number agreement*)

9: John liked those tables what where next to the television. (*incorrect C*)

9: A dinner was booking by John that day for the whole family. (*V tense agreement*)

9: Having ordered those food Sam sat down at the table. (*ungrammatical DP*)

9: By the table is where John and put the food. (*superfluous conjunction*)

36 grammatical fillers:

9: Russia and China are on John's long list of vacation resorts.

9: Suddenly the child decided to run outside of the building.

9: It was the brown bag near the door that Sandra liked.

9: Round and heavy bags were on the back seat of the car.

Fillers (Full List)

John say that those videos are going to be watched next week.

Simon claim that the trucks are about to be loaded with boxes.

Jill writing that the circular tubes are on sale at the market.

Alex utter that those seats were going to be taken by his friends.

Max respond that the ideas were too unrealistic to work properly.

Malthus noticing that the food had not been cooked in the best way.

Fred say that those green boats are going to land in the harbour.

Kyle proclaiming that the small business would employ five new workers.

Olsen shout that the three men in the building were trespassers.

The red house were going to be put on sale that day.

The riveting story maybe be sold at the auction next month.

Those wealthy factories selling themselves to the Russian last week.
That flat pan fry the meat very well at last week's barbeque.
The angry manager fires the tall employee yesterday for being late.
The long river wind itself round the town by the hillside.
That blue shirt falling off the rack when Janet walked past.
The fast train shoot round the corner too quickly for Mary to stop it.
Those torn pages burn to a crisp last night at the festival.
That black toy was put on the table yesterday at Sally.
That yellow scarf was bought by Melissa on the supermarket.
The scary film was watched on the whole class yesterday.
The funniest man was told to come to the party at Dave.
That crippled gentleman was going to arrive late on the park.
The oldest woman was getting over the train as Jack was arriving.
The escaped phoenix was whispered about from Jason in the palace.
That bright light was shining of the statue when Helen left the building.
That interesting play was performed with great competence into the Royal Hall.
The box that have made John laugh is next to the door.
Those laptops that mays cost Sandra a fortune will be posted tomorrow.
The dog that don't make Paul happy was in the large park.
The mice that have annoyed Wallace is back in the kitchen.
Those builders that mays finish the job on time were waiting at the entrance.
Those cars that done make Susan impressed were parked in the driveway.
The lecturer that have bored Timothy was walking up and down the room.
The students that mays pass the exam with full marks were sat near the front.
That pensioner that dids make Frederick interested was sat by the fire.
Jon liked those tables what were next to the television.
Hanson enjoyed the games if were being played in the garden.
Eileen liked the film how was being watched in the cinema that day.
Indy hated those books whom were being sold at the carboot sale.
Gareth read those files what were placed on his desk in a large pile.
Wade stole the keys if were in the draw next to the safe.
Paolo bought the clothes how were on sale in January at the famous shop.
Nigel sold the candles whom were taking up too much space in the living room.

Karen ate the bagels what were on the kitchen table last Sunday.
A dinner was booking by Yumi that day for the whole family.
Five films were buying by Tom in the evening to watch that night.
Square paper was fold by Jensen to start the party decorations.
Laminated posters were make by Lana to promote the fundraising event.
Wooden benches were construct by Maureen to put in her garden.
Bumpy roads were driving over by Paul that night on his way home.
Polluted streets were clean by the workers all day and night.
Purple towels were using by the swimmers in the school team.
Friendly animals were showing to Zoe at her birthday party at the zoo.
Having just ordered the food, Sam sat down at several table.
With Jonathan buying the skateboards, he had no money left for whom party.
Since Kendra liked the music, it was played much louder at much party.
Having sung the song, Gina sat down to let that others take over.
Given the range of jobs, Jenna decided to apply for several hardest one.
Because of Mark, the table was polished very well with many cloth.
Founded in the last century, that museum was regarded as those best choice.
Built on sandstone, every school were bound to need good air conditioning.
Due to the delay, the passenger was getting annoyed with many pilot.
By that table is where John and put the food for a large meal.
On the sofa is where Shabinah but laid out the duvet cover.
Near the chimney is where Leo or placed the bag of presents.
Around the tree is where a rope so were put last night by Benjamin.
Next to the fireplace is where a lighter and were placed by Maria.
Close to that screen is where Gregory or found the missing coat.
By the brochure is where Nancy so noticed the map of the island.
Through the doorway is where Pinker but walked to leave the meeting.
On that mattress is where Wally and found the expensive wallet.
Russia and China are on John's long list of holiday locations.
Nottingham and Liverpool are both hosting large music festivals.
Sheffield and Leeds are famous for their respected universities.
Scunthorpe and Chelsea are centres of cultural excellence and diversity.
Holland and Turkey are signing a peace accord at the weekend.

London and New York are the giants of hedge fund management.
Berlin and Kyoto are visiting the Middle East to end a major conflict.
Newcastle and Dover are part of Lily's university research project.
Argentina and Greece are about to start the next round of voting.
Suddenly, the child decided to run outside of the building.
Lazily, John reached into the bag and pulled out his laptop.
Hastily, Vincent packed his suitcase and left the hotel without a word.
Anxiously, Hazel wrote the letter and posted it the next morning.
Merrily, Pete washed his hands and prepared dinner that evening.
Defiantly, Ashley left her meeting and walked over to the restaurant.
Elegantly, Susie carved the chicken and served each person one piece.
Angrily, Jimmy pushed the door open and demanded his money back.
Sadly, Lisa could not make it to the party so she watched a film instead.
It was the brown bag near the door that Sandra liked.
It may be that happy comic book that made Sam feel much better.
It was the top science prize that Tanya nearly won that weekend.
It can not have been Maxine who turned the light off that night.
It should have been Derek who got detention last Wednesday.
It never surprised Bernard to see the annoying cat hiss at him.
It always rained at the blue lodge where Karl spent his holidays.
It had to be the salmon that Ian ate to make him that ill.
It has never amounted to anything but Nelson often protests against war.
Round and heavy bags were on the back seat of the car.
Warm and pleasant coffee was poured for the hotel guests.
Smooth and expensive linen was sold to the customer from Venice.
Pink and cheap cars were made in the factory across from town.
Quiet and fast train journeys were worth paying extra money for.
Silent and brief films were made by the art students as summer projects.
Rude and eccentric guests were becoming more frequent at the diner.
Kind and helpful teachers were not very common at the university.
High and narrow cliffs were flown through by the missing pilot.

Coherence Norming Items

Extensional Overlap items (X + Y form a single item)

X is heavy

Y is interesting

X is short

Y is funny

X is brown

Y is scary

X is thick

Y is left-wing

X is offensive

Y is printed

X is informative

Y is large

X is witty

Y is laminated

X is tough

Y is unopened

X is creased

Y is expensive

X is folded

Y is educational

X is thin

Y is difficult

X is slim

Y is insightful

X is reactionary

Y is polluted

X is difficult

Y is tall

X is organised

Y is sunny

X is respected

Y is huge

X is colourful
Y is prestigious
X is opulent
Y is admired
X is sandstone
Y is revered
X is multistory
Y is wealthy
X is prosperous
Y is readable
X is affluent
Y is purple
X is famous
Y is crunched
X is rich
Y is hillside
X is tasty
Y is delayed
X is organic
Y is lengthy
X is savoury
Y is postponed
X is tasty
Y is brief
X is rushed
Y is salty
X is annual
Y is nutritious
X is overdue
Y is healthy
X is evening
Y is wholesome
X is spicy

Y is yearly
X is bland
Y is hurried
X is prompt
Y is flavourful
X is stalled
Y is delectable
X is on the top shelf
Y was founded in 1850
X lies on the table
Y was difficult
X is printed on yellow paper
Y has a young chief executive
X yellowed with age
Y is thought-provoking
X is covered in coffee
Y is owned by a trust
X focuses on politics
Y took part in the press conference
X is full of coffee stains
Y revolutionised the western world
X is filled with typos
Y was sued last week
X is considered to be a masterpiece
Y has coffee stains
X took longer than expected
Y is published on red paper
X caused family tensions
Y is on the top shelf
X shocked the audience with violence
Y lasted two hours
X outlawed smoking in bars last year
Y has 500,000 inhabitants

X is FTSE-100 listed
Y used to be a police station
X voted in the election last week
Y has two small libraries
X was sued last week
Y is next to the river
X is made of red brick
Y raised tuition fees last year
X is next to the river
Y was criticised last month
X is near the hill
Y is going to make a decision soon
X has two floors
Y is on strike for the rest of the week
X won the national football league
Y voted in the referendum
X saw an increase in share value
Y had wide windows
X was hiring a new chef
Y had expensive furniture
X demanded a new election
Y is close to the sea
X starts at 9am
Y hired a new teacher
X has been renovated
Y has a professional choir
X was painted red
Y was walked through by John
X was very obnoxious
Y took forever
X was finished in two months
Y stands next to the library
X was passed through very often

Y had a lot of engravings
X has been criticised frequently
Y has modern equipment
X took almost three months
Y was very expensive
X has five floors
Y starts at 8am
X has a blue fence
Y begins in early September
X was used to transport goods
Y had been vandalised
X was being used to deliver food
Y was in need of a repair
X is printed weekly
Y took part in the press conference
X focuses on politics
Y took part in the press conference
X is printed in black ink
Y is seeking a new editor
X is famous for inaccuracies
Y is seeking a new editor
X is printed on yellow paper
Y has a young chief executive
X is known for useful information
Y has a young chief executive
X is covered in coffee
Y is owned by a trust
X is up-to-date
Y is owned by a trust
X can be found on the table
Y decided to employ new staff
X reported on the wildfires
Y decided to employ new staff

X is printed weekly
Y is offering students a job
X is uniquely educational
Y is offering students a job
X was folded for recycling
Y sent a reporter to the city
X was deemed offensive by readers
Y sent a reporter to the city
X was printed on yellow paper
Y was praised for brave reporting
X was accurately describing events
Y was praised for brave reporting
X is full of colourful adverts
Y hired a new chief reporter
X is interesting to read
Y hired a new chief reporter
X employs a number of writers
Y is sold widely
X employs a number of writers
Y is fun to read
X was sued for being inaccurate
Y is heavy to pick up
X was sued for being inaccurate
Y contains old items
X was compiled by a university press
Y was smooth to touch
X was compiled by a university press
Y was fascinating to read
X took longer than expected
Y was written down
X took longer than expected
Y was very fascinating
X lasted two hours

Y was published on paperback
X shocked the audience with violence
Y lasted two hours
X took one hour to listen to
Y was copied down
X took one hour to listen to
Y was very entertaining
X lasted two hours
Y was sold on DVD
X lasted two hours
Y was listened to widely
X lasted three hours
Y was kept in the closet
X lasted three hours
Y was historically accurate
X occurred in the afternoon
Y was written onto paper
X occurred in the afternoon
Y was fascinating to listen to
X was transcribed by hand
Y lasted three minutes
X was really beautiful
Y lasted three minutes
X was printed for everyone
Y lasted for one hour
X inspired many visitors
Y lasted for one hour
X was reproduced on paper
Y took ten minutes
X was very offensive
Y took ten minutes
X was rewritten on paper
Y lasted one hour

X was very humorous
Y lasted one hour
X was ultimately published
Y lasted a few hours
X was very fiesty
Y lasted a few hours
X was documented in print
Y lasted a while
X was seen as intriguing
Y lasted a while
X was painted blue
Y hired a new teacher
X starts at 9am
Y hired a new teacher
X is well located
Y is looking for new converts
X begins at 10am
Y is looking for new converts
X was being rebuilt
Y was seeking new clients
X was open at the weekend
Y was seeking new clients
X raised tuition fees again
Y was composed of three buildings
X raised tuition fees again
Y started classes after summer
X employed hundreds of staff
Y was built next to a river
X employed hundreds of staff
Y taught classes all season
X fired some employees
Y was painted blue
X fired some employees

Y began activities in the morning
X won awards for innovation
Y is well lit
X won awards for innovation
Y begins lessons at 10am
X was reported for tax-dodging
Y is built underground
X was reported for tax-dodging
Y opens for ten hours
X is hiring a new receptionist
Y is unusually small
X is hiring a new receptionist
Y opens for eight hours
X bought some new animals
Y was beautifully decorated
X bought some new animals
Y began evening entertainment
X employed two new managers
Y had a refurbishment
X employed two new managers
Y opened all evening
X had a new general manager
Y had three floors
X had a new general manager
Y had opened all winter

Extensional Overlap fillers (non-italics = 'common', italics = 'uncommon')

X is red
Y is blue
X is heavy
Y is hard
X is loud
Y is noticeable

X is illegal
Y is sued
X is expensive
Y is cheap
X is triangular
Y is round
X is fast
Y is efficient
X is hidden
Y is underneath
X is painted
Y is protected
X is old
Y is orange
X is crazed
Y is chic
X is broken
Y is tasteful
X is unsatisfied
Y is tucked
X is wooden
Y is dazed
X is dated
Y is ceramic
X is concrete
Y is kneeling
X is vigorous
Y is plasma
X is fit
Y is yelling
X is selling well
Y is on sale
X is playing rough

Y is a good sport
X is very tasty
Y is really chewy
X is running fast
Y is crouching low
X bartered for a good deal
Y had spotted a cheap item
X cast the woman out
Y expelled the student
X was folded
Y was ironed well
X was working hard
Y was hitting the deadline
X heard it from a mile away
Y was strumming their guitar
X was south of London
Y was hungry
X debated in the room
Y drank hot soup
X shared their food
Y is painted green
X is sitting close to the back
Y was rebuilt again
X is crossing their legs
Y never found the shoe
X drank from the chalice
Y owns a black car
X travelled home that night
Y is bushy and green
X never found their socks
Y sued the newspaper
X staged the riot
Y was always late for work

Causal Connection items (for the immediately below X-X items the italics is used purely to help demarcate individual items; in addition, items in bold were removed from the experiment due to them being repeated, e.g. between Experiment 6 and 9)

X is heavy

X is interesting

X is short

X is funny

X is brown

X is scary

X is thick

X is left-wing

X is offensive

X is printed

X is informative

X is large

X is witty

X is laminated

X is tough

X is unopened

X is creased

X is expensive

X is folded

X is educational

X is thin

X is difficult

X is slim

X is insightful

X is reactionary

X is polluted

X is difficult

X is tall

X is organised

X is sunny
X is respected
X is huge
X is colourful
X is prestigious
X is opulent
X is admired
X is sandstone
X is revered
X is multistory
X is wealthy
X is prosperous
X is readable
X is affluent
X is purple
X is famous
X is scrunched
X is rich
X is hillside
X is tasty
X is delayed
X is organic
X is lengthy
X is savoury
X is postponed
X is tasty
X is brief
X is rushed
X is salty
X is annual
X is nutritious
X is overdue
X is healthy

X is evening

X is wholesome

X is spicy

X is yearly

X is bland

X is hurried

X is prompt

X is flavourful

X is stalled

X is delectable

The newspaper is on the top shelf and was founded in 1850.

The newspaper was founded in 1850 and is on the top shelf.

The translation lies on the table and was difficult.

The translation was difficult and lies on the table.

The journal is printed on yellow paper and has a young chief executive.

The journal has a young chief executive and is printed on yellow paper.

The dissertation yellowed with age and is thought-provoking.

The dissertation is thought-provoking and yellowed with age.

The publication is covered in coffee and is owned by a trust.

The publication is owned by a trust and is covered in coffee.

The magazine focuses on politics and took part in the press conference.

The magazine took part in the press conference and focuses on politics.

The book is full of coffee stains and revolutionised the western world.

The book revolutionised the western world and is full of coffee stains.

The gazette is filled with typos and was sued last week.

The gazette was sued last week and is filled with typos.

The document has coffee stains on it and is considered to be a masterpiece.

The document is considered to be a masterpiece and has coffee stains on it.

The commentary is published on red paper and took longer than expected.

The commentary took longer than expected and is published on red paper.

The diary is on the top shelf and caused family tensions.

The diary caused family tensions and is on the top shelf.

The play lasted two hours and shocked the audience with its violence.

The play shocked the audience with its violence and lasted two hours.
The city has 500,000 inhabitants and outlawed smoking in bars last year.
The city outlawed smoking in bars last year and has 500,000 inhabitants.
The bank used to be a police station and is FTSE-100 listed.
The bank is FTSE-100 listed and used to be a police station.
The town has two small libraries and voted in the election last week.
The town voted in the election last week and has two small libraries.
The settlement is next to the river and was sued last week.
The settlement was sued last week and is next to the river.
The university is made of red brick and raised tuition fees last year.
The university raised tuition fees last year and is made of red brick.
The village is next to the river and was criticised last month.
The village was criticised last month and is next to the river.
The council is near the hill and is going to make a decision soon.
The council is going to make a decision soon and is near the hill.
The shop has two floors and is on strike for the rest of the week.
The shop is on strike for the rest of the week and has two floors.
The province voted in the referendum and won the national football league.
The province won the national football league and voted in the referendum.
The company had wide windows and saw an increase in share value.
The company saw an increase in share value and had wide windows.
The ship had expensive furniture and was hiring a new chef.
The ship was hiring a new chef and had expensive furniture.
The borough is close to the sea and demanded a new election.
The borough demanded a new election and is close to the sea.
The school starts at 9am and hired a new teacher.
The school hired a new teacher and starts at 9am.
The church has been renovated and has a professional choir.
The church has a professional choir and has been renovated.
The door was painted red and walked through by John.
The door was walked through by John and painted red.
The appointment was very obnoxious and took forever.
The appointment took forever and was very obnoxious.

The construction stands next to the library and was finished in two months.
The construction was finished in two months and stands next to the library.
The archway had a lot of engravings and was passed through very often.
The archway was passed through very often and had a lot of engravings.
The gym has modern equipment and has been criticised frequently.
The gym has been criticised frequently and has modern equipment.
The renovation was very expensive and took almost three months.
The renovation took almost three months and was very expensive.
The college has five floors and starts at 8am.
The college starts at 8am and has five floors.
The nursery has a blue fence and begins in early September.
The nursery begins in early September and has a blue fence.
The passageway had been vandalised and was used to transport goods.
The passageway was used to transport goods and had been vandalised.
The entrance was in need of repair and was being used to deliver food.
The entrance was being used to deliver food and was in need of repair.
The magazine is printed weekly and took part in the press conference.
The magazine took part in the press conference and is printed weekly.
The magazine focuses on politics and took part in the press conference.
The magazine took part in the press conference and focuses on politics.
The newspaper is printed in black ink and is seeking a new editor.
The newspaper is seeking a new editor and is printed in black ink.
The newspaper is famous for inaccuracies and is seeking a new editor.
The newspaper is seeking a new editor and is famous for inaccuracies.
The journal is printed on yellow paper and has a young chief executive.
The journal has a young chief executive and is printed on yellow paper.
The journal is known for useful information and has a young chief executive.
The journal has a young chief executive and is known for useful information.
The publication is covered in coffee and is owned by a trust.
The publication is owned by a trust and is covered in coffee.
The publication is up-to-date and is owned by a trust.
The publication is owned by a trust and is up-to-date.
The paper can be found on the table and decided to employ new staff.

The paper decided to employ new staff and can be found on the table.
The paper reported on the wildfires and decided to employ new staff.
The paper decided to employ new staff and reported on the wildfires.
The periodical is printed weekly and is offering students a job.
The periodical is offering students a job and is printed weekly.
The periodical is uniquely educational and is offering students a job.
The periodical is offering students a job and is uniquely educational.
The tabloid was folded for recycling and sent a reporter to the city.
The tabloid sent a reporter to the city and was folded for recycling.
The tabloid was deemed offensive by readers and sent a reporter to the city.
The tabloid sent a reporter to the city and was deemed offensive by readers.
The broadcast was printed on yellow paper and was praised for brave reporting.
The broadcast was praised for brave reporting and was printed on yellow paper.
The broadcast was accurately describing events and was praised for brave reporting.
The broadcast was praised for brave reporting and was accurately describing events.
The gazette is full of colourful adverts and hired a new chief reporter.
The gazette hired a new chief reporter and is full of colourful adverts.
The gazette is interesting to read and hired a new chief reporter.
The gazette hired a new chief reporter and is interesting to read.
The paper is sold widely and employs a number of writers.
The paper employs a number of writers and is sold widely.
The paper is fun to read and employs a number of writers.
The paper employs a number of writers and is fun to read.
The catalogue is heavy to pick up and was sued for being inaccurate.
The catalogue was sued for being inaccurate and is heavy to pick up.
The catalogue contains old items and was sued for being inaccurate.
The catalogue was sued for being inaccurate and contains old items.
The album was smooth to touch and was compiled by a university press.
The album was compiled by a university press and was smooth to touch.
The album was fascinating to read and was compiled by a university press.
The album was compiled by a university press and was fascinating to read.
The play was published in paperback and lasted two hours.
The play lasted two hours and was published in paperback.

The play shocked the audience with violence and lasted two hours.
The play lasted two hours and shocked the audience with violence.
The lecture was written down and took longer than expected.
The lecture took longer than expected and was written down.
The lecture was very fascinating and took longer than expected.
The lecture took longer than expected and was very fascinating.
The speech was copied down and took one hour to listen to.
The speech took one hour to listen to and was copied down.
The speech was very entertaining and took one hour to listen to.
The speech took one hour to listen to and was very entertaining.
The concert was sold on DVD and lasted two hours.
The concert lasted two hours and was sold on DVD.
The concert was listened to widely and was sold on DVD.
The concert was sold on DVD and was listened to widely.
The movie was kept in the closet and lasted three hours.
The movie lasted three hours and was kept in the closet.
The movie was historically accurate and lasted three hours.
The movie lasted three hours and was historically accurate.
The talk was written onto paper and occurred in the afternoon.
The talk occurred in the afternoon and was written onto paper.
The talk was fascinating to listen to and occurred in the afternoon.
The talk occurred in the afternoon and was fascinating to listen to.
The poem was transcribed by hand and lasted three minutes.
The poem lasted three minutes and was transcribed by hand.
The poem was really beautiful and lasted three minutes.
The poem lasted three minutes and was really beautiful.
The sermon was printed for everyone and lasted for one hour.
The sermon lasted for one hour and was printed for everyone.
The sermon inspired many visitors and lasted for one hour.
The sermon lasted for one hour and inspired many visitors.
The announcement was reproduced on paper and took ten minutes.
The announcement took ten minutes and was reproduced on paper.
The announcement was very offensive and took ten minutes.

The announcement took ten minutes and was very offensive.

The pitch was rewritten on paper and lasted one hour.

The pitch lasted one hour and was rewritten on paper.

The pitch was very humorous and lasted one hour.

The pitch lasted one hour and was very humorous.

The debate was ultimately published and lasted a few hours.

The debate lasted a few hours and was ultimately published.

The debate was very fiesty and lasted a few hours.

The debate lasted a few hours and was very fiesty.

The interview was documented in print and lasted a while.

The interview lasted a while and was documented in print.

The interview was seen as intriguing and lasted a while.

The interview lasted a while and was seen as intriguing.

The school was painted blue and hired a new teacher.

The school hired a new teacher and was painted blue.

The school starts at 9am and hired a new teacher.

The school hired a new teacher and starts at 9am.

The church is well located and is looking for new converts.

The church is looking for new converts and is well located.

The church begins at 10am and is looking for new converts.

The church is looking for new converts and begins at 10am.

The clinic was being rebuilt and was seeking new clients.

The clinic was seeking new clients and was being rebuilt.

The clinic was open at the weekend and was seeking new clients.

The clinic was seeking new clients and was open at the weekend.

The college was composed of three buildings and raised tuition fees again.

The college raised tuition fees again and was composed of three buildings.

The college started classes after summer and raised tuition fees again.

The college raised tuition fees again and started classes after summer.

The university was built next to a river and employed hundreds of staff.

The university employed hundreds of staff and was built next to a river.

The university taught classes all season and employed hundreds of staff.

The university employed hundreds of staff and taught classes all season.

The nursery was painted blue and fired some employees.
The nursery fired some employees and was painted blue.
The nursery began activities in the morning and fired some employees.
The nursery fired some employees and began activities in the morning.
The studio is well lit and won awards for innovation.
The studio won awards for innovation and is well lit.
The studio begins lessons at 10am and won awards for innovation.
The studio won awards for innovation and begins lessons at 10am.
The institution is built underground and was reported for tax-dodging.
The institution was reported for tax-dodging and is built underground.
The institution opens for ten hours and was reported for tax-dodging.
The institution was reported for tax-dodging and opens for ten hours.
The office is unusually small and is hiring a new receptionist.
The office is hiring a new receptionist and is unusually small.
The office opens for eight hours and is hiring a new receptionist.
The office is hiring a new receptionist and opens for eight hours.
The circus was beautifully decorated and bought some new animals.
The circus bought some new animals and was beautifully decorated.
The circus began evening entertainment and bought some new animals.
The circus bought some new animals and began evening entertainment.
The cinema had a refurbishment and employed two new managers.
The cinema employed two new managers and had a refurbishment.
The cinema opened all evening and employed two new managers.
The cinema employed two new managers and opened all evening.
The theatre had three floors and had a new general manager.
The theatre had a new general manager and had three floors.
The theatre had opened all winter and had a new general manager.
The theatre had a new general manager and had opened all winter.

Causal Connection fillers (non-italics = 'causal', italics = 'non-causal')

X is unhappy

X is alone

X is rich

X is happy
X is scared
X is threatened
X is delicious
X is well-cooked
X was hungry
X ate something
X found treasure
X was wealthy
X hated nobody
X was liked
X is clean
X is showered
X is hot
X was cooked
X is burned
X was in sunlight
X is tasty
X is baked
X is hard
X is rock
X is cold
X is icy
X is round
X is circular
X is intelligent
X is top-scoring
X is red
X is cardboard
X is smelly
X is orange
X is friendly
X is Australian

X is solid

X is outcast

X is fast

X is Scottish

X is golden

X is underneath

X is disgusted

X is saved

X is loud

X is savoury

X is healthy

X is rough

X is cultured

X is fast

X is light

X is wet

X is childlike

X is safe

X is welcome

X is famished

X is framed

X is together

X is infinite

X is landscaped

X is grown

X is terrific

X is unhealthy

X is entering

X is downstairs

X is lengthy

The car was fast and had a powerful engine.

The food was hot and cooked in the oven.

The knife was dangerous and had been sharpened.

The television was expensive and high-tech.
The table was antique and very rare.
The gentleman was polite and extremely well-educated.
The phone was brand new and really cool.
The child was irritable and had to be restrained.
The waiter was rude and got fired.
The sauce was really spicy and made with chili.
The speaker was influential and hard to book.
The politician was voted leader and really popular.
The holiday was relaxing and mostly on the beach.
The sign was very misleading and inaccurate.
The sofa was comfortable and made with soft material.
The coffee was very tasty and the bus was orange.
The jacket was unusually thick and on the floor.
The senator was despised and wore black shoes.
The man was exceedingly happy and hungry.
The grass was long and next to the shop.
The girl was hopeless and fashionable.
The bench is being repaired and is close to the river.
The car was expensive and Japanese.
The can was open and was green.
The barber was French and middle-aged.
The supermarket was closed and John was tired.
The bag was Italian and purple.
The envelope was open and was brown.
The bus was uncomfortable and loud.
The boy was foppish and American.

Experiment 2 Items¹⁰²

John said that the heavy and interesting book was on the table.
John said that the interesting and heavy book was on the table.

¹⁰² See description in Methods sections to see how this list was slightly modified to generate the Experiment 3 stimuli list.

John said that the heavy pamphlet and interesting book were on the table.
John said that the interesting pamphlet and heavy book were on the table.
Sam claimed that the short and funny letter was in the post.
Sam claimed that the funny and short letter was in the post.
Sam claimed that the short movie and funny letter were in the post.
Sam claimed that the funny movie and small letter were in the post.
David mentioned that the brown and scary video was near the chair.
David mentioned that the scary and brown video was near the chair.
David mentioned that the brown book and scary video were near the chair.
David mentioned that the scary book and brown video were near the chair.
Kath noticed that the thick and left-wing pamphlet was being talked about.
Kath noticed that the left-wing and thick pamphlet was being talked about.
Kath noticed that the thick poster and left-wing pamphlet was being talked about.
Kath noticed that the left-wing poster and thick pamphlet was being talked about.
Dan recalled that the printed and offensive message had been sent yesterday.
Dan recalled that the offensive and printed message had been sent yesterday.
Dan recalled that the printed card and offensive message had been sent yesterday.
Dan recalled that the offensive card and printed message had been sent yesterday.
Sam watched as the large and informative dictionary was put on the shelf.
Sam watched as the informative and large dictionary was put on the shelf.
Sam watched as the large manual and informative dictionary were put on the shelf.
Sam watched as the informative manual and large dictionary were put on the shelf.
Jack believed that the laminated and witty advert was going to be successful.
Jack believed that the witty and laminated advert was going to be successful.
Jack believed that the laminated card and witty advert were going to be successful.
Jack believed that the witty card and laminated advert were going to be successful.
Michael assumed that the unopened and tough exam was beside the desk lamp.
Michael assumed that the tough and unopened exam was beside the desk lamp.
Michael assumed that the unopened paper and tough exam were beside the desk lamp.
Michael assumed that the tough paper and unopened exam were beside the desk lamp.
Stewart thought that the creased and expensive bill was being talked about at the table.
Stewart thought that the expensive and creased bill was being talked about at the table.

Stewart thought that the creased book and expensive bill were being talked about at the table.

Stewart thought that the expensive book and creased bill were being talked about at the table.

Jemima said that the folded and educational newspaper was on the shelf.

Jemima said that the educational and folded newspaper was on the shelf.

Jemima said that the folded document and educational newspaper were on the shelf.

Jemima said that the educational document and folded newspaper were on the shelf.

Emily claimed that the thin and difficult translation would be a bestseller.

Emily claimed that the difficult and thin translation would be a bestseller.

Emily claimed that the thin poem and difficult translation would be bestsellers.

Emily claimed that the difficult poem and thin translation would be bestsellers.

Sally thought that the slim and insightful novel was next to the locker.

Sally thought that the insightful and slim novel was next to the locker.

Sally thought that the slim map and insightful novel were next to the locker.

Sally thought that the insightful map and slim novel were next to the locker.

Sarah thought that the polluted and reactionary city was a sight to behold.

Sarah thought that the reactionary and polluted city was a sight to behold.

Sarah thought that the polluted district and reactionary city were a sight to behold.

Sarah thought that the reactionary district and polluted city were a sight to behold.

John heard that the tall and difficult construction was being discussed.

John heard that the difficult and tall construction was being discussed.

John heard that the tall staircase and difficult construction were being discussed.

John heard that the difficult staircase and tall construction were being discussed.

Patrick said that the sunny and organised town was facing some problems.

Patrick said that the organised and sunny town was facing some problems.

Patrick said that the sunny campaign and organised town were facing some problems.

Patrick said that the organised campaign and sunny town were facing some problems.

Mel read that the huge and respected school was praised by her best friend.

Mel read that the respected and huge school was praised by her best friend.

Mel read that the huge teacher and respected school were praised by her best friend.

Mel read that the respected teacher and huge school were praised by her best friend.

Luke asked if the colourful and prestigious building was next to the lake.

Luke asked if the prestigious and colourful building was next to the lake.

Luke asked if the colourful museum and prestigious building were next to the lake.

Luke asked if the prestigious museum and colourful building were next to the lake.

Nathan said that the opulent and admired restaurant was not far from the house.

Nathan said that the admired and opulent restaurant was not far from the house.

Nathan said that the opulent café and admired restaurant were not far from the house.

Nathan said that the admired café and opulent restaurant were not far from the house.

Natasha worried that the sandstone and revered library would not be open.

Natasha worried that the revered and sandstone library would not be open.

Natasha worried that the sandstone shop and revered library would not be open.

Natasha worried that the revered shop and sandstone library would not be open.

Chloe saw that the multistory and wealthy bank was being discussed on TV.

Chloe saw that the wealthy and multistory bank was being discussed on TV.

Chloe saw that the multistory organisation and wealthy bank were being discussed on TV.

Chloe saw that the wealthy organisation and multistory bank were being discussed on TV.

Brad said that the readable and prosperous journal was part of the office block.

Brad said that the prosperous and readable journal was part of the office block.

Brad said that the readable magazine and prosperous journal were part of the office block.

Brad said that the prosperous magazine and readable journal were part of the office block.

Linda thought that the purple and affluent arthouse was right next to the park.

Linda thought that the affluent and purple arthouse was right next to the park.

Linda thought that the purple house and affluent arthouse were right next to the park.

Linda thought that the affluent house and purple arthouse were right next to the park.

Harry claimed that the scrunched and famous publication was going to be discussed that night.

Harry claimed that the famous and scrunched publication was going to be discussed that night.

Harry claimed that the scrunched magazine and famous publication were going to be discussed that night.

Harry claimed that the famous magazine and scrunched publication were going to be discussed that night.

Lenny said that the hillside and rich company was beyond the forest.
Lenny said that the rich and hillside company was beyond the forest.
Lenny said that the hillside agency and rich company were beyond the forest.
Lenny said that the rich agency and hillside company were beyond the forest.
Mary said that the tasty and delayed lunch was worth the wait.
Mary said that the delayed and tasty lunch was worth the wait.
Mary said that the tasty food and delayed lunch was worth the wait.
Mary said that the delayed food and tasty lunch were worth the wait.
Molly read that the organic and lengthy brunch was in the cafeteria.
Molly read that the lengthy and organic brunch was in the cafeteria.
Molly read that the organic meal and lengthy brunch were in the cafeteria.
Molly read that the lengthy meal and organic brunch were in the cafeteria.
Jacob wrote that the savoury and postponed supper was going to be expensive.
Jacob wrote that the postponed and savoury supper was going to be expensive.
Jacob wrote that the savoury appetizer and postponed supper were going to be expensive.
Jacob wrote that the postponed appetizer and savoury supper were going to be expensive.
Laura said that the tasty and brief breakfast was worth the effort.
Laura said that the brief and tasty breakfast was worth the effort.
Laura said that the tasty snack and brief breakfast were worth the effort.
Laura said that the brief snack and tasty breakfast were worth the effort.
Julia felt that the salty and rushed dinner was definitely worth complaining about.
Julia felt that the rushed and salty dinner was definitely worth complaining about.
Julia felt that the salty meal and rushed dinner were definitely worth complaining about.
Julia felt that the rushed meal and salty dinner were definitely worth complaining about.
Dale said that the nutritious and annual meal was in the company headquarters.
Dale said that the annual and nutritious meal was in the company headquarters.
Dale said that the nutritious feast and annual meal was in the company headquarters.
Dale said that the annual feast and nutritious meal was in the company headquarters.
Sharon believed that the healthy and overdue banquet was going to go down well.
Sharon believed that the overdue and healthy banquet was going to go down well.
Sharon believed that the healthy dessert and overdue banquet were going to go down well.
Sharon believed that the overdue dessert and healthy banquet were going to go down well.
Pablo thought that the wholesome and evening feast was the best part of the weekend.

Pablo thought that the evening and wholesome feast was the best part of the weekend.
Pablo thought that the wholesome pudding and evening feast were the best part of the weekend.

Pablo thought that the evening pudding and wholesome feast were the best part of the weekend.

Linda speculated that the spicy and yearly barbecue was going to be exciting to witness.
Linda speculated that the yearly and spicy barbecue was going to be exciting to witness.
Linda speculated that the spicy meal and yearly barbecue were going to be exciting to witness.

Linda speculated that the yearly meal and spicy barbecue were going to be exciting to witness.

Mick guessed that the bland and hurried dessert was going to impress nobody.

Mick guessed that the hurried and bland dessert was going to impress nobody.

Mick guessed that the bland cake and hurried dessert were going to impress nobody.

Mick guessed that the hurried cake and bland dessert were going to impress nobody.

Oliver said that the flavourful and prompt appetiser was opposite the main course.

Oliver said that the prompt and flavourful appetiser was opposite the main course.

Oliver said that the flavourful cookout and prompt appetiser were opposite the main course.

Oliver said that the prompt cookout and flavourful appetiser were opposite the main course.

Sue said that the delectable and stalled picnic was going to be very memorable.

Sue said that the stalled and delectable picnic was going to be very memorable.

Sue said that the delectable roast and stalled picnic were going to be very memorable.

Sue said that the stalled roast and delectable picnic were going to be very memorable.

Norming Studies

Acceptability Judgement study average scores

CONCRETE FIRST	SCORE	ABSTRACT FIRST	SCORE	CONCRETE FIRST	SCORE	ABSTRACT FIRST	SCORE
tasty and delayed	2.79	delayed and tasty	3.67	sandstone and revered	3.20	revered and sandstone	3.04
multistory and wealthy	3.90	wealthy and multistory	3.22	short and funny	6.37	funny and short	5.92
sunny and organised	3.92	organised and sunny	3.61	purple and affluent	3.77	affluent and purple	3.69
laminated and witty	2.84	witty and laminated	2.98	large and informative	5.60	informative and large	5.77
heavy and amusing	3.69	amusing and heavy	3.47	bland and hurried	5.03	hurried and bland	5.22
tasty and brief	4.5	brief and tasty	4.22	spicy and yearly	2.58	yearly and spicy	3.15
folded and educational	4.30	educational and folded	3.57	thin and difficult	4.31	difficult and thin	4.24
slim and insightful	4.51	insightful and slim	4.12	unopened and tough	5.11	tough and unopened	4.96
huge and respected	5.5	respected and huge	4.84	printed and offensive	5.14	offensive and printed	5.04
hillside and rich	3.59	rich and hillside	2.84	creased and expensive	4.83	expensive and creased	5.01
thick and left-wing	4.19	left-wing and thick	4.22	nutritious and annual	3.47	annual and nutritious	3.48
healthy and overdue	4.39	overdue and healthy	4.29	salty and rushed	4.85	rushed and salty	4.38
flavourful and prompt	4.74	prompt and flavourful	4.39	lengthy and organic	3.96	organic and lengthy	3.63
delectable and stalled	2.55	stalled and delectable	3.06	scrunched and famous	2.79	famous and scrunched	3.25
wholesome and evening	3.38	evening and wholesome	3.20	colourful and prestigious	5.47	prestigious and colourful	5.53
brown and scary	4.80	scary and brown	4.65	tall and difficult	4.58	difficult and tall	4.66
savoury and postponed	3.20	postponed and savoury	2.95	readable and prosperous	3.85	prosperous and readable	3.79
polluted and reactionary	3.65	reactionary and polluted	3.61	opulent and admired	5.33	admired and opulent	5.35

Nominals with no ambiguous responses (Norming Study 1)

book, message, dictionary, bill, newspaper, novel, adaptation, commentary, essay, newsletter, dissertation, journal, printout, atlas, breakfast, banquet, exam, door, appointment, archway, gym, hotel, nursery, passageway, entrance, city, school, building, restaurant, library, bank, farm, arthouse, company, university, village, shop, province, factory

Experiment 4 Items

John said that the heavy book was amusing and was on the table.

John said that the amusing book was heavy and was on the table.

John said that the heavy book was blue and was on the table.

John said that the amusing book was present and was on the table.

Sam claimed that the short letter was funny and was in the post.

Sam claimed that the funny letter was short and was in the post.

Sam claimed that the short letter was yellow and was in the post.

Sam claimed that the funny letter was puzzling and was in the post.

David mentioned that the brown video was scary and was near the chair.

David mentioned that the scary video was brown and was near the chair.

David mentioned that the brown video was grimy and was near the chair.

David mentioned that the scary video was original and was near the chair.

Kath noticed that the thick pamphlet was left-wing and was being talked about.

Kath noticed that the left-wing pamphlet was thick and was being talked about.

Kath noticed that the thick pamphlet was torn and was being talked about.

Kath noticed that the left-wing pamphlet was radical and was being talked about.

Dan recalled that the printed message was offensive and had been sent yesterday.
Dan recalled that the offensive message was printed and had been sent yesterday.
Dan recalled that the printed message was orange and had been sent yesterday.
Dan recalled that the offensive message was rude and had been sent yesterday.
Sam claimed that the large dictionary was informative and was put on the shelf.
Sam claimed that the informative dictionary was large and was put on the shelf.
Sam claimed that the large dictionary was bound and was put on the shelf.
Sam claimed that the informative dictionary was updated and was put on the shelf.
Jack believed that the laminated advert was witty and was going to be successful.
Jack believed that the witty advert was laminated and was going to be successful.
Jack believed that the laminated advert was shiny and was going to be successful.
Jack believed that the witty advert was persuasive and was going to be successful.
Michael assumed that the unopened exam was tough and was beside the desk lamp.
Michael assumed that the tough exam was unopened and was beside the desk lamp.
Michael assumed that the unopened exam was flat and was beside the desk lamp.
Michael assumed that the tough exam was baffling and was beside the desk lamp.
Stewart thought that the creased bill was expensive and was being talked about at the table.
Stewart thought that the expensive bill was creased and was being talked about at the table.
Stewart thought that the creased bill was folded and was being talked about at the table.
Stewart thought that the expensive bill was reasonable and was being talked about at the table.
Jemima said that the folded newspaper was educational and was on the shelf.
Jemima said that the educational newspaper was folded and was on the shelf.
Jemima said that the folded newspaper was damaged and was on the shelf.
Jemima said that the educational newspaper was confusing and was on the shelf.
Emily claimed that the thin translation was accurate and would be a bestseller.
Emily claimed that the accurate translation was thin and would be a bestseller.
Emily claimed that the thin translation was pristine and would be a bestseller.
Emily claimed that the accurate translation was difficult and would be a bestseller.
Sally thought that the slim novel was insightful and was next to the locker.
Sally thought that the insightful novel was slim and was next to the locker.

Sally thought that the slim novel was black and was next to the locker.
Sally thought that the insightful novel was timely and was next to the locker.
Sarah thought that the polluted city was reactionary and was a sight to behold.
Sarah thought that the reactionary city was polluted and was a sight to behold.
Sarah thought that the polluted city was grimy and was a sight to behold.
Sarah thought that the reactionary city was right-wing and was a sight to behold.
John heard that the tall construction was difficult and was being discussed.
John heard that the difficult construction was tall and was being discussed.
John heard that the tall construction was solid and was being discussed.
John heard that the difficult construction was deferred and was being discussed.
Patrick said that the sunny town was organised and was facing some problems.
Patrick said that the organised town was sunny and was facing some problems.
Patrick said that the sunny town was hot and was facing some problems.
Patrick said that the organised town was earnest and was facing some problems.
Mel read that the huge school was respected and was praised by her best friend.
Mel read that the respected school was huge and was praised by her best friend.
Mel read that the huge school was expansive and was praised by her best friend.
Mel read that the respected school was admired and was praised by her best friend.
Luke asked if the colourful building was prestigious and was next to the lake.
Luke asked if the prestigious building was colourful and was next to the lake.
Luke asked if the colourful building was small and was next to the lake.
Luke asked if the prestigious building was famous and was next to the lake.
Nathan said that the opulent restaurant was admired and was not far from the house.
Nathan said that the admired restaurant was opulent and was not far from the house.
Nathan said that the opulent restaurant was dazzling and was not far from the house.
Nathan said that the admired restaurant was infamous and was not far from the house.
Natasha said that the sandstone library was revered and would not be open.
Natasha said that the revered library was sandstone and would not be open.
Natasha said that the sandstone library was red and would not be open.
Natasha said that the revered library was reputable and would not be open.
Chloe saw that the multistory bank was wealthy and was being discussed on TV.
Chloe saw that the wealthy bank was multistory and was being discussed on TV.
Chloe saw that the multistory bank was tall and was being discussed on TV.

Chloe saw that the wealthy bank was notorious and was being discussed on TV.
Brad said that the readable journal was prosperous and was known by many.
Brad said that the prosperous journal was readable and was known by many.
Brad said that the readable journal was smooth and was known by many.
Brad said that the prosperous journal was renowned and was known by many.
Linda thought that the purple arthouse was affluent and was right next to the park.
Linda thought that the affluent arthouse was purple and was right next to the park.
Linda thought that the purple arthouse was red and was right next to the park.
Linda thought that the affluent arthouse was snobbish and was right next to the park.
Harry claimed that the scrunched publication was famous was going to be discussed that night.
Harry claimed that the famous publication was scrunched and was going to be discussed that night.
Harry claimed that the scrunched publication was ripped and was going to be discussed that night.
Harry claimed that the famous publication was notorious and was going to be discussed that night.
Lenny said that the eastbound company was rich and was beyond the forest.
Lenny said that the rich company was eastbound and was beyond the forest.
Lenny said that the eastbound company was downstream and was beyond the forest.
Lenny said that the rich company was hated and was beyond the forest.
Mary said that the tasty lunch was delayed and was worth the wait.
Mary said that the delayed lunch was tasty and was worth the wait.
Mary said that the tasty lunch was delicious and was worth the wait.
Mary said that the delayed lunch was slow and was worth the wait.
Molly read that the organic brunch was lengthy and was in the cafeteria.
Molly read that the lengthy brunch was organic and was in the cafeteria.
Molly read that the organic brunch was spicy and was in the cafeteria.
Molly read that the lengthy brunch was postponed and was in the cafeteria.
Jacob wrote that the savoury supper was postponed and was going to be expensive.
Jacob wrote that the postponed supper was savoury and was going to be expensive.
Jacob wrote that the savoury supper was cooked and was going to be expensive.
Jacob wrote that the postponed supper was funded and was going to be expensive.

Laura said that the tasty breakfast was brief and was worth the effort.
Laura said that the brief breakfast was tasty and was worth the effort.
Laura said that the tasty breakfast was warm and was worth the effort.
Laura said that the brief breakfast was interrupted and was worth the effort.
Julia felt that the salty dinner was rushed and was definitely worth complaining about.
Julia felt that the rushed dinner was salty and was definitely worth complaining about.
Julia felt that the salty dinner was burned and was definitely worth complaining about.
Julia felt that the rushed dinner was hurried and was definitely worth complaining about.
Dale said that the nutritious meal was scheduled and was in the company headquarters.
Dale said that the scheduled meal was nutritious and was in the company headquarters.
Dale said that the nutritious meal was healthy and was in the company headquarters.
Dale said that the scheduled meal was annual and was in the company headquarters.
Sharon believed that the healthy banquet was overdue and was going to go down well.
Sharon believed that the overdue banquet was healthy and was going to go down well.
Sharon believed that the healthy banquet was succulent and was going to go down well.
Sharon believed that the overdue banquet was lauded and was going to go down well.
Pablo thought that the wholesome feast was early and was the best part of the weekend.
Pablo thought that the early feast was wholesome and was the best part of the weekend.
Pablo thought that the wholesome feast was yummy and was the best part of the weekend.
Pablo thought that the early feast was prompt and was the best part of the weekend.
Linda speculated that the spicy barbecue was yearly and was going to be exciting to witness.
Linda speculated that the yearly barbecue was spicy and was going to be exciting to witness.
Linda speculated that the spicy barbecue was appetizing and was going to be exciting to witness.
Linda speculated that the yearly barbecue was convenient and was going to be exciting to witness.
Mick guessed that the bland dessert was hurried and was going to impress nobody.
Mick guessed that the hurried dessert was bland and was going to impress nobody.
Mick guessed that the bland dessert was stale and was going to impress nobody.
Mick guessed that the hurried dessert was rushed and was going to impress nobody.
Oliver said that the flavourful appetiser was prompt and was opposite the main course.

Oliver said that the prompt appetiser was flavourful and was opposite the main course.
Oliver said that the flavourful appetiser was sour and was opposite the main course.
Oliver said that the prompt appetiser was fast and was opposite the main course.
Sue said that the delectable picnic was stalled and was going to be very memorable.
Sue said that the stalled picnic was delectable and was going to be very memorable.
Sue said that the delectable picnic was pretty and was going to be very memorable.
Sue said that the stalled picnic was overdue and was going to be very memorable.

Experiment 5 Items

John disse che il pesante e divertente libro era sul tavolo.
John disse che il divertente e pesante libro era sul tavolo.
John disse che il pesante opuscolo e il divertente libro erano sul tavolo.
John disse che il divertente opuscolo e il pesante libro erano sul tavolo.
Sam dichiarò che la breve e spiritosa lettera era nella cassetta della posta.
Sam dichiarò che la spiritosa e breve lettera era nella cassetta della posta.
Sam dichiarò che il breve film e la spiritosa lettera erano nella cassetta della posta.
Sam dichiarò che lo spiritoso film e la breve lettera erano nella cassetta della posta.
David accennò che lo spaventoso video marrone era vicino alla sedia.
David accennò che lo spaventoso video marrone era vicino alla sedia.
David accennò che il libro marrone e lo spaventoso video erano vicino alla sedia.
David accennò che lo spaventoso libro e il video marrone erano vicino alla sedia.
Kath si accorse che lo spesso e sinistreggiante opuscolo era argomento di discussione.
Kath si accorse che il sinistreggiante e spesso opuscolo era argomento di discussione.
Kath si accorse che lo spesso manifesto e il sinistreggiante opuscolo erano argomento di discussione.
Kath si accorse che il sinistreggiante manifesto e lo spesso opuscolo erano argomento di discussione.
Dan si ricordò che lo stampato e offensivo messaggio era stato mandato ieri.
Dan si ricordò che l'offensivo e stampato messaggio era stato mandato ieri.
Dan si ricordò che lo stampato biglietto e l'offensivo messaggio erano stati mandati ieri.
Dan si ricordò che l'offensivo biglietto e lo stampato messaggio erano stati mandati ieri.
Sam osservò mentre il grande e istruttivo dizionario veniva messo sullo scaffale.
Sam osservò mentre l'istruttivo e grande dizionario veniva messo sullo scaffale.

Sam osservò mentre il grande manuale e l'informativo dizionario venivano messi sullo scaffale.

Sam osservò mentre l'istruttivo manuale e il grande dizionario venivano messi sullo scaffale.

Jack credette che la plastificata e ingegnosa pubblicità avrebbe avuto successo.

Jack credette che l'ingegnosa e plastificata pubblicità avrebbe avuto successo.

Jack credette che il plastificato biglietto e l'ingegnosa pubblicità avrebbero avuto successo.

Jack credette che l'ingegnoso biglietto e la plastificata pubblicità avrebbero avuto successo.

Michael suppose che il sigillato e difficile esame fosse a fianco della lampada da tavolo.

Michael suppose che il difficile e sigillato esame fosse a fianco della lampada da tavolo.

Michael suppose che il sigillato compito e il difficile esame fossero a fianco della lampada da tavolo.

Michael suppose che il difficile compito e il sigillato esame fossero a fianco della lampada da tavolo.

Steward pensò che la spiegazzata e costosa bolletta fosse discussa a tavola.

Steward pensò che la costosa e spiegazzata bolletta fosse discussa a tavola.

Steward pensò che lo spiegazzato libro e la costosa bolletta fossero discussi a tavola.

Steward pensò che il costoso libro e la spiegazzata bolletta fossero discussi a tavola.

Jemima disse che il piegato e istruttivo giornale era sullo scaffale.

Jemima disse che l'istruttivo e piegato giornale era sullo scaffale.

Jemima disse che il piegato documento e l'istruttivo giornale erano sullo scaffale.

Jemima disse che l'istruttivo documento e il piegato giornale erano sullo scaffale.

Emily affermò che la sottile e difficile traduzione era un successo editoriale.

Emily affermò che la difficile e sottile traduzione era un successo editoriale.

Emily affermò che la sottile poesia e la difficile traduzione erano un successo editoriale.

Emily affermò che la difficile poesia e la sottile traduzione erano un successo editoriale.

Sally pensò che il sottile e illuminante romanzo fosse vicino all'armadietto.

Sally pensò che l'illuminante e sottile romanzo fosse vicino all'armadietto.

Sally pensò che la sottile mappa e l'illuminante romanzo fossero vicino all'armadietto.

Sally pensò che l'illuminante mappa e il sottile romanzo fossero vicino all'armadietto.

Sarah pensò che l'inquinata e reazionaria città fosse uno spettacolo per gli occhi.

Sarah pensò che la reazionaria e inquinata città fosse uno spettacolo per gli occhi.

Sarah pensò che l'inquinato quartiere e la reazionaria città fossero uno spettacolo per gli occhi.

Sarah pensò che il reazionario quartiere e l'inquinata città fossero uno spettacolo per gli occhi.

John sentì che l'alta e difficile struttura era argomento di discussione.

John sentì che la difficile e alta struttura era argomento di discussione.

John sentì che l'alta scala e la difficile struttura erano argomento di discussione.

John sentì che la difficile scala e l'alta struttura erano argomento di discussione.

Patrick disse che il soleggiato e organizzato paese stava affrontando dei problemi.

Patrick disse che l'organizzato e soleggiato paese stava affrontando dei problemi.

Patrick disse che la soleggiata campagna e l'organizzato paese stavano affrontando dei problemi.

Patrick disse che l'organizzata campagna e il soleggiato paese stavano affrontando dei problemi.

Mel lesse che l'enorme e rispettata scuola era elogiata dal suo migliore amico.

Mel lesse che la rispettata e enorme scuola era elogiata dal suo migliore amico.

Mel lesse che l'enorme insegnante e la rispettata scuola erano elogiati dal suo migliore amico.

Mel lesse che la rispettata insegnante e l'enorme scuola erano elogiati dal suo migliore amico.

Luke chiese se il colorato e prestigioso edificio fosse vicino al lago.

Luke chiese se il prestigioso e colorato edificio fosse vicino al lago.

Luke chiese se il colorato museo e il prestigio edificio fossero vicino al lago.

Luke chiese se il prestigioso museo e il colorato edificio fossero vicino al lago.

Nathan disse che il sontuoso e apprezzato ristorante non era lontano dalla casa.

Nathan disse che l'apprezzato e sontuoso ristorante non era lontano dalla casa.

Nathan disse che il sontuoso caffè e l'apprezzato ristorante non erano lontano dalla casa.

Nathan disse che l'apprezzato caffè e il sontuoso ristorante non erano lontano dalla casa.

Natasha si preoccupò che la prestigiosa biblioteca in arenaria non sarebbe stata aperta.

Natasha si preoccupò che la prestigiosa biblioteca in arenaria non sarebbe stata aperta.

Natasha si preoccupò che il negozio in arenaria e la prestigiosa biblioteca non sarebbero state aperte.

Natasha si preoccupò che il prestigioso negozio e la biblioteca in arenaria non sarebbero state aperte.

Chloe vide che la ricca banca a più piani/multipiano era argomento di discussione alla TV.

Chloe vide che ricca banca a più piani era argomento di discussione alla TV.

Chloe vide che l'organizzazione a più piani e la ricca banca erano argomento di discussione alla TV.

Chloe vide che la ricca organizzazione e la banca a più piani erano argomento di discussione alla TV.

Brad disse che il leggibile e redditizio periodico era parte dello stesso palazzo.

Brad disse che il redditizio e leggibile periodico era parte dello stesso palazzo.

Brad disse che la leggibile rivista e il redditizio periodico erano parte dello stesso palazzo.

Brad disse che la redditizia rivista e il leggibile periodico erano parte dello stesso palazzo.

Linda pensò che il fruttuoso cinema indipendente viola fosse vicino al parco.

Linda pensò che il fruttuoso cinema indipendente viola fosse vicino al parco.

Linda pensò che la casa viola e il fruttuoso cinema indipendente fossero vicino al parco.

Linda pensò che la fruttuoso casa e il cinema indipendente viola fossero vicino al parco.

Harry affermò che l'accartocciata e famosa pubblicazione sarebbe stata discussa quella sera.

Harry affermò che la famosa e accartocciata pubblicazione sarebbe stata discussa quella sera.

Harry affermò che l'accartocciata rivista e la famosa pubblicazione sarebbero state discusse quella sera.

Harry affermò che la famosa rivista e l'accartocciata pubblicazione sarebbero state discusse quella sera.

Lenny disse che la ricca società sul pendio della collina si trovava al di là del bosco.

Lenny disse che la ricca società sul pendio della collina si trovava al di là del bosco.

Lenny disse che l'agenzia sul pendio della collina e la ricca compagnia si trovavano al di là del bosco.

Lenny disse che la ricca agenzia e la società sul pendio della collina si trovava al di là del bosco.

Mary disse che il saporito e rinviato pranzo era degno dell'attesa.

Mary disse che il rinviato e saporito pranzo era degno dell'attesa.

Mary disse che la saporita pietanza e il rinviato pranzo era degno dell'attesa.

Mary disse che la rinviata pietanza e il saporito pranzo era degno dell'attesa.

Molly lesse che il biologico e lungo brunch era nella caffetteria.

Molly lesse che il lungo e biologico brunch era nella caffetteria.

Molly lesse che il biologico pasto e il lungo brunch erano nella caffetteria.

Molly lesse che il lungo pasto e il biologico brunch erano nella caffetteria.

Jacob scrisse che la saporita e rinviata cena sarebbe stata costosa.

Jacob scrisse che la rinviata e saporita cena sarebbe stata costosa.

Jacob scrisse che il saporito antipasto e la rinviata cena sarebbero state costose.

Jacob scrisse che il rinviato antipasto e la saporita cena sarebbero state costose.

Laura disse che la saporita e veloce colazione valeva la pena.

Laura disse che la veloce e saporita colazione valeva la pena.

Laura disse che il saporito spuntino e la veloce colazione valevano la pena.

Laura disse che il veloce spuntino e la saporita colazione valevano la pena.

Julia pensò che la salata e frettolosa cena fosse decisamente motivo di lamentela.

Julia pensò che la frettolosa e salata cena fosse decisamente motivo di lamentela.

Julia pensò che il salato pasto e la frettolosa cena fossero decisamente motivo di lamentela.

Julia pensò che il frettoloso pasto e la salata cena fossero decisamente motivo di lamentela.

Dale disse che il nutritivo e annuale pasto si teneva nella sede centrale della società.

Dale disse che l'annuale e nutritivo pasto si teneva nella sede centrale della società.

Dale disse che il nutritivo banchetto e l'annuale pasto si tenevano nella sede centrale della società.

Dale disse che l'annuale banchetto e il nutritivo pasto si tenevano nella sede centrale della società.

Sharon credette che il salutare e tardivo banchetto sarebbe stato apprezzato.

Sharon credette che il tardivo e salutare banchetto sarebbe stato apprezzato.

Sharon credette che il salutare dolce e il tardivo banchetto sarebbero stati apprezzati.

Sharon credette che il tardivo dolce e il salutare banchetto sarebbero stati apprezzati.

Pablo pensò che il sano e serale banchetto fosse la parte migliore del fine settimana.

Pablo pensò che il serale e sano banchetto fosse la parte migliore del fine settimana.

Pablo pensò che il sano dessert e il serale banchetto fossero la parte migliore del fine settimana.

Pablo pensò che il serale dessert e il sano banchetto fossero la parte migliore del fine settimana.

Linda immaginò che la piccante e annuale grigliata sarebbe stata entusiasmante come ospite.

Linda immaginò che l'annuale e piccante grigliata sarebbe stata entusiasmante come ospite.

Linda immaginò che il piccante pasto e l'annuale grigliata sarebbero stati entusiasmanti come ospite.

Linda immaginò che l'annuale pasto e la piccante grigliata sarebbero stati entusiasmanti come ospite.

Mick indovinò che l'insipido e sbrigativo dolce non avrebbe fatto una buona impressione su nessuno.

Mick indovinò che lo sbrigativo e insipido dolce non avrebbe fatto una buona impressione su nessuno.

Mick indovinò che l'insipida torta e lo sbrigativo dolce non avrebbero fatto una buona impressione su nessuno.

Mick indovinò che la sbrigativa torta e l'insipido dolce non avrebbero fatto una buona impressione su nessuno.

Oliver disse che il gustoso e veloce antipasto era di fronte al secondo.

Oliver disse che il veloce e gustoso antipasto era di fronte al secondo.

Oliver disse che il gustoso pranzo all'aperto e il veloce antipasto erano di fronte al secondo.

Oliver disse che il veloce pranzo all'aperto e il gustoso antipasto erano di fronte al secondo.

Sue disse che il delizioso picnic al coperto sarà veramente indimenticabile.

Sue disse che il delizioso picnic al coperto sarà veramente indimenticabile.

Sue disse che la deliziosa grigliata e il picnic al coperto saranno veramente indimenticabili.

Sue disse che la grigliata al coperto e il delizioso picnic saranno veramente indimenticabili.

Experiment 5 Filler examples

Grammatical (Italian):

1. I clienti di quel negozio escono sempre con un sorriso.
2. Roma e Milano sono due città molto visitate dai turisti in estate.
3. Peter ama cucinare in compagnia dei suoi amici alla sera.
4. Richard pensava di aver perso il treno che per fortuna era in ritardo.
5. I gatti del quartiere erano molto rumorosi quella sera e svegliarono tutti il vicinato.
6. La casa dei nonni di Jules era stata distrutta dal terremoto nel 1976.
7. I film più interessanti sono quelli in cui non c'è un lieto fine.
8. Le due squadre di calcio finirono entrambe a giocare in serie A.
9. Claire da bambina aveva paura dei fantasmi e dormiva con la luce accesa.
10. In quella sala c'erano dei giocatori di carte molto bravi e astuti.
11. Veronica chiese all'agente se c'erano ancora posti disponibili sul volo.
12. Gli amici di Sarah non amavano passare il tempo al mare ma preferivano la montagna.
13. Questa pizzeria ha una sala riservata ai fumatori sempre molto frequentata.
14. Jack sapeva di essere uno studente modello e cercava sempre di parlare per primo.
15. Il premio fu vinto da un atleta che partecipava alla gara per la prima volta.
16. La situazione finanziari di quell'azienda non era delle migliori per un nuovo investimento.

Grammatical (English):

1. The clients of that shop always leave with a smile.
2. Rome and Milan are two cities often visited by tourists in summer.
3. Peter loves cooking with his friends in the evening.
4. Richard thought he had missed his train which was fortunately delayed.
5. The neighbourhood cats were very noisy that night and they woke up the entire neighbourhood.
6. Jules' grandparents' house had been destroyed by the earthquake in 1976.
7. The most interesting films are the ones with no happy ending.
8. Both football teams ended playing in the big leagues.

9. When Claire was a child she was scared of ghosts and she used to sleep with the light on.
10. In that room there were many good and cunning card players.
11. Veronica asked the agent if there were still seats available on the flight.
12. Sarah's friends did not like spending their time at the seaside but preferred the mountains.
13. This pizzeria has a very busy smoking room.
14. Jack knew that he was a model student and always tried to speak first.
15. The prize was won by an athlete who was attending the race for the first time.
16. The financial situation of the business was not ideal for a new investment.

Ungrammatical (Italian):

1. Amy fu chiamato per un colloquio di lavoro nell'ufficio.
2. Molte persone chiama per avere un autografo dal famoso attore.
3. Lucy e Matthew ha mangiato molti piatti tipici spagnoli in vacanza.
4. Matto il cappellaio si addormentò di colpo dopo aver bevuto il tè.
5. Il conducente dell'autobus ebbe un incidente perciò stava guardando il cellulare.
6. Lo studente di medicina ha studiati i libri molto tempo a casa.
7. Il gruppo di amici giocano a tombola di mattina ogni giorno.
8. La decisione del gruppo furono molto discussa fino a tarda sera.
9. Gli asciugamani chiari erano usare i nuotatori nella squadra della scuola.
10. L'hotel di cui pranzano gli ospiti è il più conosciuto della Toscana.
11. Il tassista partiva mentre l'avvocato scende di fretta per non fare tardi all'appuntamento.
12. Nella fattoria gli animali si rincorrono i bambini ogni giorno.
13. Gli uccelli stavano volare a sud prima dell'arrivo dell'inverno.
14. L'albero chi stava crescendo nel giardino faceva molta ombra nelle giornate di sole.
15. Le macchine erano assemblate sulla fabbrica in periferia.
16. La scena teatrale più conosciuto è quella del balcone di Romeo e Giulietta.

Ungrammatical (English):

1. Amy was called for a job interview in the office. (gender agreement – Amy_{fem} fu chiamata_{fem})
2. Many people calls to have an autograph from the famous actor. (number agreement – Molte persone_{pl} chiamano_{pl})
3. Lucy and Matthew ate many Spanish typical dishes on holiday. (number agreement – Lucy e Matthew hanno_{pl} mangiato)
4. Mad the Hatter suddenly fell asleep after drinking his tea. (Il cappellaio matto)
5. The bus driver had an accident so he was looking at his phone. (wrong conjunction – Il conducente dell'autobus ebbe un incidente perché_{cause})
6. The med student studied the books for a long time at home. (Lo studente di medicina ha studiato_{sing} i libri_{pl})
7. The group of friends play bingo in the morning every day. (number agreement - Il gruppo_{sing} di amici gioca_{sing})
8. The group decision were discussed until late in the evening. (number agreement – La decisione_{sing} del gruppo fu_{sing})
9. The light towels were use by the swimmers in the school team. (Gli asciugamani chiari erano usati_{past.part})
10. The hotel of which the guests have lunch is the most famous in Tuscany. (wrong preposition – L'hotel in cui)
11. The taxi driver was leaving while the lawyer gets out quickly to not be late at the appointment.
12. In the farm the animals chase themselves the children every day. (Nella fattoria gli animali rincorrono)
13. The birds were fly South before winter arrives. (Gli uccelli stavano volando)
14. The tree who was growing in the garden provided shade on sunny days. (L'albero che stava crescendo)
15. The cars were built on the factory in the suburbs. (preposition – Le machine erano assemblate nella)
16. The most famous theatre scene is the one of the balcony from Romeo and Juliet. (gender agreement – La scena_{fem} teatrale più conosciuta_{fem})

Nominals with ambiguous responses for fill-in-the-blank task (# of ambiguous responses)

newspaper (9), book (9), letter (12), advert (11), message (5), translation (8), construction (11), city (6), town (13), restaurant (6), company (8), journal (14), breakfast (16), feast (17), lunch (12), meal (13), picnic (7), supper (16)

Experiment 6 Items

Newspaper-Type

The newspaper is on the top shelf and was founded in 1850.

The newspaper was founded in 1850 and is on the top shelf.

The newspaper is on the top shelf and the magazine was founded in 1850.

The newspaper was founded in 1850 and the magazine is on the top shelf.

The translation lies on the table and was difficult.

The translation was difficult and lies on the table.

The translation lies on the table and the book was difficult.

The translation was difficult and the book lies on the table.

The journal is printed on yellow paper and has a young chief executive.

The journal has a young chief executive and is printed on yellow paper.

The journal is printed on yellow paper and the magazine has a young chief executive.

The journal has a young chief executive and the magazine is printed on yellow paper.

The dissertation yellowed with age and is thought-provoking.

The dissertation is thought-provoking and yellowed with age.

The dissertation yellowed with age and the book is thought-provoking.

The dissertation is thought-provoking and the book yellowed with age.

The publication is covered in coffee and is owned by a trust.

The publication is owned by a trust and is covered in coffee.

The publication is covered in coffee and the newspaper is owned by a trust.

The publication is owned by a trust and the newspaper is covered in coffee.

The magazine focuses on politics and took part in the press conference.

The magazine took part in the press conference and focuses on politics.

The magazine focuses on politics and the newspaper took part in the press conference.

The magazine took part in the press conference and the newspaper focuses on politics.

The book is full of coffee stains and revolutionised the western world.

The book revolutionised the western world and is full of coffee stains.

The book is full of coffee stains and the pamphlet revolutionised the western world.

The book revolutionised the western world and the pamphlet is full of coffee stains.
The gazette is filled with typos and was sued last week.
The gazette was sued last week and is filled with typos.
The gazette is filled with typos and the magazine was sued last week.
The gazette was sued last week and the magazine is filled with typos.
The document has coffee stains and is considered to be a masterpiece.
The document is considered to be a masterpiece and has coffee stains.
The document has coffee stains and the thesis is considered to be a masterpiece.
The document is considered to be a masterpiece and the thesis has coffee stains.
The commentary is published on red paper and took longer than expected.
The commentary took longer than expected and is published on red paper.
The commentary is published on red paper and the review took longer than expected.
The commentary took longer than expected and the review is published on red paper.
The diary is on the top shelf and caused family tensions.
The diary caused family tensions and is on the top shelf.
The diary is on the top shelf and the leaflet caused family tensions.
The diary caused family tensions and the leaflet is on the top shelf.
The play shocked the audience with violence and lasted two hours.
The play lasted two hours and shocked the audience with violence.
The play shocked the audience with violence and the carnival lasted two hours.
The play lasted two hours and the carnival shocked the audience with violence.

City-Type

The city has 500,000 inhabitants and outlawed smoking in bars last year.
The city outlawed smoking in bars last year and has 500,000 inhabitants.
The city has 500,000 inhabitants and the town outlawed smoking in bars last year.
The city outlawed smoking in bars last year and the town has 500,000 inhabitants.
The bank used to be a police station and is FTSE-100 listed.
The bank is FTSE-100 listed and used to be a police station.
The bank used to be a police station and the supermarket is FTSE-100 listed.
The bank is FTSE-100 listed and the supermarket used to be a police station.
The town has two small libraries and voted in the election last week.
The town voted in the election last week and has two small libraries.

The town has two small libraries and the city voted in the election last week.
The town voted in the election last week and the city has two small libraries.
The settlement is next to the river and was sued last week.
The settlement was sued last week and is next to the river.
The settlement is next to the river and the city was sued last week.
The settlement was sued last week and the city is next to the river.
The university is made of red brick and raised tuition fees last year.
The university raised tuition fees last year and is made of red brick.
The university is made of red brick and the school raised tuition fees last year.
The university raised tuition fees last year and the school is made of red brick.
The village is next to the river and was criticised last month.
The village was criticised last month and is next to the river.
The village is next to the river and the town was criticised last month.
The village was criticised last month and the town is next to the river.
The council is near the hill and is going to make a decision soon.
The council is going to make a decision soon and is near the hill.
The council is near the hill and the organization is going to make a decision soon.
The council is going to make a decision soon and the organization is near the hill.
The shop has two floors and is on strike for the rest of the week.
The shop is on strike for the rest of the week and has two floors.
The shop has two floors and the school is on strike for the rest of the week.
The shop is on strike for the rest of the week and the school has two floors.
The province voted in the referendum and won the national football league.
The province won the national football league and voted in the referendum.
The province voted in the referendum and the town won the national football league.
The province won the national football league and the town voted in the referendum.
The company had wide windows and saw an increase in share value.
The company saw an increase in share value and had wide windows.
The company had wide windows and the business saw an increase in share value.
The company saw an increase in share value and the business had wide windows.
The ship had expensive furniture and was hiring a new chef.
The ship was hiring a new chef and had expensive furniture.
The ship had expensive furniture and the restaurant was hiring a new chef.

The ship was hiring a new chef and the restaurant had expensive furniture.

The borough is close to the sea and demanded a new election.

The borough demanded a new election and is close to the sea.

The borough is close to the sea and the town demanded a new election.

The borough demanded a new election and the town is close to the sea.

School-Type

The school starts at 9am and hired a new teacher.

The school hired a new teacher and starts at 9am.

The school starts at 9am and the gym hired a new teacher.

The school hired a new teacher and the gym starts at 9am.

The church has been renovated and has a professional choir.

The church has a professional choir and has been renovated.

The church has been renovated and the school has a professional choir.

The church has a professional choir and the school has been renovated.

The door was painted red and walked through by John.

The door was walked through by John and painted red.

The door was painted red and the arch was walked through by John.

The door was walked through by John and the arch was painted red.

The appointment was very obnoxious and took forever.

The appointment took forever and was very obnoxious.

The appointment was very obnoxious and the committee took forever.

The appointment took forever and the committee was very obnoxious.

The construction stands next to the library and was finished in two months.

The construction was finished in two months and stands next to the library.

The construction stands next to the library and the school was finished in two months.

The construction was finished in two months and the school stands next to the library.

The archway had a lot of engravings and was passed through very often.

The archway was passed through very often and had a lot of engravings.

The archway had a lot of engravings and the entrance was passed through very often.

The archway was passed through very often and the entrance had a lot of engravings.

The gym has modern equipment and has been criticised frequently.

The gym has been criticised frequently and has modern equipment.

The gym has modern equipment and the shop has been criticised frequently.
The gym has been criticised frequently and the shop has modern equipment.
The renovation was very expensive and took almost three months.
The renovation took almost three months and was very expensive.
The renovation was very expensive and the outhouse took almost three months.
The renovation took almost three months and the outhouse was very expensive.
The college has five floors and starts at 8am.
The college starts at 8am and has five floors.
The college has five floors and the schoolhouse starts at 8am.
The college starts at 8am and the schoolhouse has five floors.
The nursery has a blue fence and begins in early September.
The nursery begins in early September and has a blue fence.
The nursery has a blue fence and the exhibition begins in early September.
The nursery begins in early September and the exhibition has a blue fence.
The passageway had been vandalised and was used to transport goods.
The passageway was used to transport goods and had been vandalised.
The passageway had been vandalised and the tunnel was used to transport goods.
The passageway was used to transport goods and the tunnel had been vandalised.
The entrance was in need of repair and was being used to deliver food.
The entrance was being used to deliver food and was in need of repair.
The entrance was in need of repair and the exit was being used to deliver food.
The entrance was being used to deliver food and the exit was in need of repair.

Newspaper-Type Ratings

The newspaper is on the top shelf and was founded in 1850: **5.52**
The newspaper was founded in 1850 and is on the top shelf: **5.08**
The publication is covered in coffee and is owned by a trust: **5.82**
The publication is owned by a trust and is covered in coffee: **4.26**
The document has coffee stains and is considered to be a masterpiece: **6.04**
The document is considered to be a masterpiece and has coffee stains: **4.91**
The magazine focuses on politics and took part in the press conference: **4.91**
The magazine took part in the press conference and focuses on politics: **4.52**
The commentary is published on red paper and took longer than expected: **5.47**

The commentary took longer than expected and is published on red paper: **4.90**
The book is full of coffee stains and revolutionised the western world: **4.66**
The book revolutionised the western world and is full of coffee stains: **4.61**
The diary is on the top shelf and caused family tensions: **4.76**
The diary caused family tensions and is on the top shelf: **4.52**
The play shocked the audience with violence and lasted two hours: **6.23**
The play lasted two hours and shocked the audience with violence: **5.69**
The gazette is filled with typos and was sued last week: **5.23**
The gazette was sued last week and is filled with typos: **5.69**
The dissertation yellowed with age and is thought-provoking: **4.47**
The dissertation is thought-provoking and yellowed with age: **5.14**
The journal is printed on yellow paper and has a young chief executive: **5.26**
The journal has a young chief executive and is printed on yellow paper: **3.90**
The translation lies on the table and was difficult: **4.81**
The translation was difficult and lies on the table: **3.52**

City-Type Ratings

The city has 500,000 inhabitants and outlawed smoking in bars last year: **6.26**
The city outlawed smoking in bars last year and has 500,000 inhabitants: **4.78**
The settlement is next to the river and was sued last week: **4.71**
The settlement was sued last week and is next to the river: **4.56**
The town has two small libraries and voted in the election last week: **4.57**
The town voted in the election last week and has two small libraries: **4.52**
The council is near the hill and is going to make a decision soon: **5.04**
The council is going to make a decision soon and is near the hill: **4.71**
The university is made of red brick and raised tuition fees last year: **5.69**
The university raised tuition fees last year and is made of red brick: **4.60**
The province voted in the referendum and won the national football league: **5.26**
The province won the national football league and voted in the referendum: **4.86**
The company had wide windows and saw an increase in share value: **5.08**
The company saw an increase in share value and had wide windows: **4.38**
The ship had expensive furniture and was hiring a new chef: **5.80**
The ship was hiring a new chef and had expensive furniture: **5.23**

The shop has two floors and is on strike for the rest of the week: **5.57**

The shop is on strike for the rest of the week and has two floors: **5.00**

The village is next to the river and was criticised last month: **4.21**

The village was criticised last month and is next to the river: **4.57**

The borough is close to the sea and demanded a new election: **4.09**

The borough demanded a new election and is close to the sea: **4.69**

School-Type Ratings

The school starts at 9am and hired a new teacher: **5.04**

The school hired a new teacher and starts at 9am: **4.90**

The appointment was very obnoxious and took forever: **5.23**

The appointment took forever and was very obnoxious: **5.17**

The archway had a lot of engravings and was passed through very often: **6.08**

The archway was passed through very often and had a lot of engravings: **5.95**

The gym has modern equipment and has been criticised frequently: **5.23**

The gym has been criticised frequently and has modern equipment: **5.04**

The renovation was very expensive and took almost three months: **6.61**

The renovation took almost three months and was very expensive: **6.39**

The college has five floors and starts at 8am: **5.91**

The college starts at 8am and has five floors: **4.65**

The nursery has a blue fence and begins in early September: **5.30**

The nursery begins in early September and has a blue fence: **5.00**

The passageway had been vandalised and was used to transport goods: **5.66**

The passageway was used to transport goods and had been vandalised: **5.57**

The entrance was in need of repair and was being used to deliver food: **5.90**

The entrance was being used to deliver food and was in need of repair: **6.34**

The construction stands next to the library and was finished in two months: **5.65**

The construction was finished in two months and stands next to the library: **5.34**

The door was painted red and walked through by John: **4.76**

The door was walked through by John and painted red: **4.52**

The church has been renovated and has a professional choir: **5.95**

The church has a professional choir and has been renovated: **5.47**

Experiment 9 Items:

Newspaper-Type

The magazine is printed weekly and took part in the press conference.
The magazine took part in the press conference and is printed weekly.
The magazine focuses on politics and took part in the press conference.
The magazine took part in the press conference and focuses on politics.
The newspaper is printed in black ink and is seeking a new editor.
The newspaper is seeking a new editor and is printed in black ink.
The newspaper is famous for inaccuracies and is seeking a new editor.
The newspaper is seeking a new editor and is famous for inaccuracies.
The journal is printed on yellow paper and has a young chief executive.
The journal has a young chief executive and is printed on yellow paper.
The journal is known for useful information and has a young chief executive.
The journal has a young chief executive and is known for useful information.
The publication is covered in coffee and is owned by a trust.
The publication is owned by a trust and is covered in coffee.
The publication is up-to-date and is owned by a trust.
The publication is owned by a trust and is up-to-date.
The report can be found on the table and was sued for libel.
The report was sued for libel and can be found on the table.
The report reported on the wildfires and was sued for libel.
The report was sued for libel and reported on the wildfires.
The periodical is printed weekly and is offering students a job.
The periodical is offering students a job and is printed weekly.
The periodical is uniquely educational and is offering students a job.
The periodical is offering students a job and is uniquely educational.
The tabloid was folded for recycling and sent a reporter to the city.
The tabloid sent a reporter to the city and was folded for recycling.
The tabloid was deemed offensive by readers and sent a reporter to the city.
The tabloid sent a reporter to the city and was deemed offensive by readers.
The broadcast was printed on yellow paper and was praised for brave reporting.
The broadcast was praised for brave reporting and was printed on yellow paper.
The broadcast was accurately describing events and was praised for brave reporting.

The broadcast was praised for brave reporting and was accurately describing events.
The gazette is full of colourful adverts and hired a new chief reporter.
The gazette hired a new chief reporter and is full of colourful adverts.
The gazette is interesting to read and hired a new chief reporter.
The gazette hired a new chief reporter and is interesting to read.
The paper is sold widely and employs a number of writers.
The paper employs a number of writers and is sold widely.
The paper is fun to read and employs a number of writers.
The paper employs a number of writers and is fun to read.
The catalogue is heavy to pick up and was sued for being inaccurate.
The catalogue was sued for being inaccurate and is heavy to pick up.
The catalogue contains old items and was sued for being inaccurate.
The catalogue was sued for being inaccurate and contains old items.
The album was smooth to touch and was compiled by a university press.
The album was compiled by a university press and was smooth to touch.
The album was fascinating to read and was compiled by a university press.
The album was compiled by a university press and was fascinating to read.

Lecture-Type

The lecture was written down and took longer than expected.
The lecture took longer than expected and was written down.
The lecture was very fascinating and took longer than expected.
The lecture took longer than expected and was very fascinating.
The adaptation was published in paperback and lasted two hours.
The adaptation lasted two hours and was published in paperback.
The adaptation shocked the audience with violence and lasted two hours.
The adaptation lasted two hours and shocked the audience with violence.
The speech was copied down and took one hour to listen to.
The speech took one hour to listen to and was copied down.
The speech was very entertaining and took one hour to listen to.
The speech took one hour to listen to and was very entertaining.
The concert was sold on DVD and lasted two hours.
The concert lasted two hours and was sold on DVD.

The concert was listened to widely and lasted two hours.
The concert lasted two hours and was listened to widely.
The movie was kept in the closet and lasted three hours.
The movie lasted three hours and was kept in the closet.
The movie was historically accurate and lasted three hours.
The movie lasted three hours and was historically accurate.
The talk was written onto paper and occurred in the afternoon.
The talk occurred in the afternoon and was written onto paper.
The talk was fascinating to listen to and occurred in the afternoon.
The talk occurred in the afternoon and was fascinating to listen to.
The poem was transcribed by hand and lasted three minutes.
The poem lasted three minutes and was transcribed by hand.
The poem was really beautiful and lasted three minutes.
The poem lasted three minutes and was really beautiful.
The sermon was printed for everyone and lasted for one hour.
The sermon lasted for one hour and was printed for everyone.
The sermon inspired many visitors and lasted for one hour.
The sermon lasted for one hour and inspired many visitors.
The announcement was reproduced on paper and took ten minutes.
The announcement took ten minutes and was reproduced on paper.
The announcement was very offensive and took ten minutes.
The announcement took ten minutes and was very offensive.
The pitch was rewritten on paper and lasted one hour.
The pitch lasted one hour and was rewritten on paper.
The pitch was very humorous and lasted one hour.
The pitch lasted one hour and was very humorous.
The debate was ultimately published and lasted a few hours.
The debate lasted a few hours and was ultimately published.
The debate was very fiesty and lasted a few hours.
The debate lasted a few hours and was very fiesty.
The interview was documented in print and lasted a while.
The interview lasted a while and was documented in print.
The interview was seen as intriguing and lasted a while.

The interview lasted a while and was seen as intriguing.

School-Type

The school was painted blue and hired a new teacher.

The school hired a new teacher and was painted blue.

The school starts at 9am and hired a new teacher.

The school hired a new teacher and starts at 9am.

The church is well located and is looking for new converts.

The church is looking for new converts and is well located.

The church begins at 10am and is looking for new converts.

The church is looking for new converts and begins at 10am.

The clinic was being rebuilt and was seeking new clients.

The clinic was seeking new clients and was being rebuilt.

The clinic was open at the weekend and was seeking new clients.

The clinic was seeking new clients and was open at the weekend.

The college was composed of three buildings and raised tuition fees again.

The college raised tuition fees again and was composed of three buildings.

The college started classes after summer and raised tuition fees again.

The college raised tuition fees again and started classes after summer.

The university was built next to a river and employed hundreds of staff.

The university employed hundreds of staff and was built next to a river.

The university taught classes all season and employed hundreds of staff.

The university employed hundreds of staff and taught classes all season.

The nursery was painted blue and fired some employees.

The nursery fired some employees and was painted blue.

The nursery began activities in the morning and fired some employees.

The nursery fired some employees and began activities in the morning.

The studio is well lit and won awards for innovation.

The studio won awards for innovation and is well lit.

The studio begins lessons at 10am and won awards for innovation.

The studio won awards for innovation and begins lessons at 10am.

The institution is built underground and was reported for tax-dodging.

The institution was reported for tax-dodging and is built underground.

The institution opens for ten hours and was reported for tax-dodging.
 The institution was reported for tax-dodging and opens for ten hours.
 The office is unusually small and is hiring a new receptionist.
 The office is hiring a new receptionist and is unusually small.
 The office opens for eight hours and is hiring a new receptionist.
 The office is hiring a new receptionist and opens for eight hours.
 The circus was beautifully decorated and bought some new animals.
 The circus bought some new animals and was beautifully decorates.
 The circus began evening entertainment and bought some new animals.
 The circus bought some new animals and began evening entertainment.
 The cinema had a refurbishment and employed two new managers.
 The cinema employed two new managers and had a refurbishment.
 The cinema opened all evening and employed two new managers.
 The cinema employed two new managers and opened all evening.
 The theatre had three floors and had a new general manager.
 The theatre had a new general manager and had three floors.
 The theatre had opened all winter and had a new general manager.
 The theatre had a new general manager and had opened all winter.

Nominals with ambiguous responses for fill-in-the-blank task (# of ambiguous responses)

periodical (2), broadcast (1), gazette (7), movie (2), debate (1), cinema (2), theatre (2)

Experiment 10 Items:

The book was satirical and funny and was on the table.
 The book was heavy and funny and was on the table.
 The book was heavy and green and was on the table.
 The book was satirical and green and was on the table.
 The letter was witty and intelligent and was in the post.
 The letter was brown and intelligent and was in the post.
 The letter was brown and small and was in the post.
 The letter was witty and small and was in the post.
 The video was weird and scary and was near the chair.

The video was plastic and scary and was near the chair.
 The video was plastic and brown and was near the chair.
 The video was weird and brown and was near the chair.
 The pamphlet was progressive and inspiring and was being discussed.
 The pamphlet was thick and inspiring and was being discussed.
 The pamphlet was thick and yellow and was being discussed.
 The pamphlet was progressive and yellow and was being discussed.
 The message was rude and offensive and had not yet been sent.
 The message was blue and offensive and had not yet been sent.
 The message was blue and printed and had not yet been sent.
 The message was rude and printed and had not yet been sent.
 The dictionary was detailed and informative and was put on the shelf.
 The dictionary was black and informative and was put on the shelf.
 The dictionary was black and large and was put on the shelf.
 The dictionary was detailed and large and was put on the shelf.
 The advert was appealing and successful and was seen by everyone.
 The advert was red and successful and was seen by everyone.
 The advert was red and laminated and was seen by everyone.
 The advert was appealing and laminated and was seen by everyone.
 The exam was unusual and difficult and was near the desk lamp.
 The exam was folded and difficult and was near the desk lamp.
 The exam was folded and unopened and was near the desk lamp.
 The exam was unusual and unopened and was near the desk lamp.
 The bill was shocking and expensive and was being talked about.
 The bill was folded and expensive and was being talked about.
 The bill was folded and creased and was being talked about.
 The bill was shocking and creased and was being talked about.
 The newspaper was witty and educational and was on the shelf.
 The newspaper was ripped and educational and was on the shelf.
 The newspaper was ripped and folded and was on the shelf.
 The newspaper was witty and folded and was on the shelf.
 The translation was eloquent and difficult and was going to sell well.
 The translation was crinkled and difficult and was going to sell well.

The translation was crinkled and thin and was going to sell well.
 The translation was eloquent and thin and was going to sell well.
 The novel was sad and insightful and was next to the locker.
 The novel was orange and insightful and was next to the locker.
 The novel was orange and slim and was next to the locker.
 The novel was sad and slim and was next to the locker.
 The album was heartening and hilarious and was chosen by Bill.
 The album was laminated and hilarious and was chosen by Bill.
 The album was laminated and red and was chosen by Bill.
 The album was heartening and red and was chosen by Bill.
 The diary was interesting and intriguing and was on the table.
 The diary was smooth and intriguing and was on the table.
 The diary was smooth and red and was on the table.
 The diary was interesting and red and was on the table.
 The edition was complete and comprehensive and was sold in the library.
 The edition was heavy and comprehensive and was sold in the library.
 The edition was heavy and hardback and was sold in the library.
 The edition was complete and hardback and was sold in the library.
 The manual was instructive and easy but was hard to locate.
 The manual was thin and easy but was hard to locate.
 The manual was thin and white but was hard to locate.
 The manual was instructive and white but was hard to locate.
 The text was difficult and pretentious but was very cheap.
 The text was colourful and pretentious but was very cheap.
 The text was colourful and blurry but was very cheap.
 The text was difficult and blurry but was very cheap.
 The paperback was sad and poetic but was very unique.
 The paperback was torn and poetic but was very unique.
 The paperback was torn and thin but was very unique.
 The paperback was sad and thin but was very unique.
 The textbook was fascinating and helpful but was not sold anywhere.
 The textbook was green and helpful but was not sold anywhere.
 The textbook was green and heavy but was not sold anywhere.

The textbook was fascinating and heavy but was not sold anywhere.
 The volume was emotional and acclaimed but nowhere to be found.
 The volume was smooth and acclaimed but nowhere to be found.
 The volume was smooth and pink but nowhere to be found.
 The volume was emotional and pink but nowhere to be found.
 The hardcover was surprising and insightful but was not in the box.
 The hardcover was big and insightful but was not in the box.
 The hardcover was big and bulky but was not in the box.
 The hardcover was surprising and bulky but was not in the box.
 The monograph was silly and hilarious but was over by the lamp.
 The monograph was orange and hilarious but was over by the lamp.
 The monograph was orange and hefty but was over by the lamp.
 The monograph was silly and hefty but was over by the lamp.
 The poem was sad and mournful but was published very late.
 The poem was thin and mournful but was published very late.
 The poem was thin and torn but was published very late.
 The poem was sad and torn but was published very late.
 The treatise was admired and progressive but never actually signed.
 The treatise was flat and progressive but never actually signed.
 The treatise was flat and brown but never actually signed.
 The treatise was admired and brown but never actually signed.
 The dissertation was excellent and completed but was never found.
 The dissertation was bound and completed but was never found.
 The dissertation was bound and weighty but was never found.
 The dissertation was excellent and bound but was never found.
 The text was detailed and informative but was on the top shelf.
 The text was light and informative but was on the top shelf.
 The text was light and red but was on the top shelf.
 The text was detailed and red but was on the top shelf.
 The paper was finished and educational but was in the other room.
 The paper was thin and educational but was in the other room.
 The paper was thin and white but was in the other room.
 The paper was finished and white but was in the other room.

The periodical was reactionary and bitter but was never found.
 The periodical was slender and bitter but was never found.
 The periodical was slender and published but was never found.
 The periodical was reactionary and published but was never found.
 The tabloid was offensive and reactionary but was not talked about.
 The tabloid was purple and reactionary but was not talked about.
 The tabloid was purple and weighty but was not talked about.
 The tabloid was offensive and weighty but was not talked about.
 The notebook was astute and shrewd but did not help.
 The notebook was thick and shrewd but did not help.
 The notebook was thick and brown but did not help.
 The notebook was astute and brown but did not help.
 The diary was wise and private according to Sarah.
 The diary was bent and private according to Sarah.
 The diary was bent and yellow according to Sarah.
 The diary was wise and yellow according to Sarah.
 The register was comprehensive and informative according to John's son.
 The register was red and informative according to John's son.
 The register was red and white according to John's son.
 The register was comprehensive and white according to John's son.
 The article was savvy and discerning according to Sam.
 The article was orange and discerning according to Sam.
 The article was orange and thin according to Sam.
 The article was savvy and thin according to Sam.
 The document was confusing and difficult according to Mary.
 The document was green and difficult according to Mary.
 The document was green and black according to Mary.
 The document was confusing and black according to Mary.
 The comic was amusing and thoughtful according to Jason.
 The comic was colourful and thoughtful according to Jason.
 The comic was colourful and thick according to Jason.
 The comic was amusing and thick according to Jason.
 The report was intuitive and observant according to Mary.

The report was slight and observant according to Mary.

The report was slight and portable according to Mary.

The report was intuitive and portable according to Mary.

The portfolio was official and secret according to Mark.

The portfolio was shiny and secret according to Mark.

The portfolio was shiny and leather according to Mark.

The portfolio was official and leather according to Mark.

The report was unhelpful and boring according to Tom.

The report was laminated and boring according to Tom.

The report was laminated and glossy according to Tom.

The report was unhelpful and glossy according to Tom.

The album was illuminating and thorough according to Luke.

The album was massive and thorough according to Luke.

The album was massive and hefty according to Luke.

The album was illuminating and hefty according to Luke.

The play was stupid and foolish according to Jake.

The play was dark and foolish according to Jake.

The play was dark and burgandy according to Jake.

The play was stupid and burgandy according to Jake.

The city was hostile and reactionary and was a sight to behold.

The city was dirty and reactionary and was a sight to behold.

The city was dirty and polluted and was a sight to behold.

The city was hostile and polluted and was a sight to behold.

The zone was corrupt and wicked and being talked about.

The zone was unclean and wicked and being talked about.

The zone was unclean and murky and being talked about.

The zone was corrupt and wicked and being talked about.

The town was friendly and organised and was facing some problems.

The town was noisy and organised and was facing some problems.

The town was noisy and sunny and was facing some problems.

The town was friendly and sunny and was facing some problems.

The school was admired and respected and was praised by many.

The school was huge and respected and was praised by many.

The school was huge and expansive and was praised by many.
 The school was admired and expansive and was praised by many.
 The building was famous and prestigious and was next to the lake.
 The building was small and prestigious and was next to the lake.
 The building was small and radiant and was next to the lake.
 The building was famous and radiant and was next to the lake.
 The restaurant was infamous and admired and not far from the house.
 The restaurant was dazzling and admired and not far from the house.
 The restaurant was dazzling and opulent and not far from the house.
 The restaurant was infamous and dazzling and not far from the house.
 The library was reputable and revered and was not open.
 The library was red and revered and was not open.
 The library was red and sandstone and was not open.
 The library was reputable and sandstone and was not open.
 The bank was wealthy and notorious and was being discussed on TV.
 The bank was wide and notorious and was being discussed on TV.
 The bank was wide and tall and was being discussed on TV.
 The bank was wealthy and tall and was being discussed on TV.
 The journal was renowned and prosperous and was known to everyone.
 The journal was smooth and prosperous and was known to everyone.
 The journal was smooth and thick and was known to everyone.
 The journal was renowned and prosperous and was known to everyone.
 The arthouse was snobbish and affluent and was next to the park.
 The arthouse was red and affluent and was next to the park.
 The arthouse was red and purple and was next to the park.
 The arthouse was snobbish and purple and was next to the park.
 The publication was notorious and famous and was discussed yesterday.
 The publication was ripped and famous and was discussed yesterday.
 The publication was ripped and scrunched and was discussed yesterday.
 The publication was notorious and scrunched and was discussed yesterday.
 The company was hated and rich and was beyond the forest.
 The company was white and rich and was beyond the forest.
 The company was white and black and was beyond the forest.

The company was hated and black and was beyond the forest.
 The capital was famous and renowned and was next to the river.
 The capital was smelly and renowned and was next to the river.
 The capital was smelly and polluted and was next to the river.
 The capital was famous and polluted and was next to the river.
 The downtown was edgy and cool and was lit up well.
 The downtown was loud and cool and was lit up well.
 The downtown was loud and busy and was lit up well.
 The downtown was edgy and busy and was lit up well.
 The borough was friendly and happy and next to the sea.
 The borough was flowery and happy and next to the sea.
 The borough was flowery and green and next to the sea.
 The borough was friendly and green and next to the sea.
 The conurbation was kind and helpful but was far away.
 The conurbation was ornate and helpful but was far away.
 The conurbation was ornate and florid but was far away.
 The conurbation was kind and florid but was far away.
 The enclosure was approachable and welcoming but was a long way off.
 The enclosure was pretty and welcoming but way a long way off.
 The enclosure was pretty and ornate but was a long way off.
 The enclosure was approachable and ornate but was a long way off.
 The quarter was amiable and loving but was in a bad neighbourhood.
 The quarter was adorned and loving but was in a bad neighbourhood.
 The quarter was adorned and gaudy but was in a bad neighbourhood.
 The quarter was amiable and gaudy but was in a bad neighbourhood.
 The locality was hostile and hated but was far away.
 The locality was smoggy and hated but was far away.
 The locality was smoggy and ugly but was far away.
 The locality was hostile and ugly but was far away.
 The dominion was political and revolutionary but had historic value.
 The dominion was wrecked and revolutionary but had historic value.
 The dominion was wrecked and bloody but had historic value.
 The dominion was political and bloody but had historic value.

The state was argumentative and hostile but always won its battles.
 The state was smelly and hostile but always won its battles.
 The state was smelly and polluted but always won its battles.
 The state was argumentative and polluted but always won its battles.
 The ship was receptive and neighbourly but was not within walking distance.
 The ship was foggy and neighbourly but was not within walking distance.
 The ship was foggy and misty but was not within walking distance.
 The ship was receptive and misty but was not within walking distance.
 The university was praised and prestigious but also quite snobbish.
 The university was big and prestigious but also quite snobbish.
 The university was big and tall but also quite snobbish.
 The university was praised and tall but also quite snobbish.
 The college was famous and renowned but hard to find.
 The college was tall and renowned but hard to find.
 The college was tall and sturdy but hard to find.
 The college was famous and sturdy but hard to find.
 The estate was hated and despised but eventually found peace.
 The estate was wrecked and despised but eventually found peace.
 The estate was wrecked and crumbled but eventually found peace.
 The estate was hated and crumbled but eventually found peace.
 The manor was wealthy and notorious but too far away.
 The manor was peach and notorious but too far away.
 The manor was peach and white but too far away.
 The manor was wealthy and white but too far away.
 The club was fusty and snobbish but also quite affordable.
 The club was polished and snobbish but also quite affordable.
 The club was polished and clean but also quite affordable.
 The club was fusty and clean but also quite affordable.
 The deli was friendly and delightful but a long drive away.
 The deli was colourful and delightful but a long drive away.
 The deli was colourful and painted but a long drive away.
 The deli was friendly and painted but a long drive away.
 The shop was organic and vegetarian but attracted some strange people.

The shop was green and vegetarian but attracted some strange people.
 The shop was green and paintedbut attracted some strange people.
 The shop was organicand paintedbut attracted some strange people.
 The store was elitist and expensive but also very busy.
 The store was marbled and expensive but also very busy.
 The store was marbled and golden but also very busy.
 The store was elitist and golden but also very busy.
 The supermarket was cordial and helpful according to Jim.
 The supermarket was expansive and helpful according to Jim.
 The supermarket was expansive and large according to Jim.
 The supermarket was cordial and large according to Jim.
 The outlet was affable and welcoming according to Martha.
 The outlet was yellow and welcoming according to Martha.
 The outlet was yellow and humungous according to Martha.
 The outlet was affable and humungous according to Martha.
 The bureau was suspicious and alert according to Frank.
 The bureau was cold and alert according to Frank.
 The bureau was cold and underground according to Frank.
 The bureau was suspicious and underground according to Frank.
 The office was loving and welcoming according to Donald.
 The office was clean and welcoming according to Donald.
 The office was clean and tidy according to Donald.
 The office was loving and tidy according to Donald.
 The department was peaceful and amiable according to Tracy.
 The department was busy and amiable according to Tracy.
 The department was busy and crowded according to Tracy.
 The department was peaceful and crowded according to Tracy.
 The factory was organised and busy according to Sally.
 The factory was loud and busy according to Sally.
 The factory was loud and noisy according to Sally.
 The factory was organised and noisy according to Sally.
 The mall was digilant and competent according to Garath.
 The mall was elegant and competent according to Garath.

The mall was elegant and beautiful according to Garath.
 The mall was diligent and beautiful according to Garath.
 The county was powerful and businesslike according to Gary.
 The county was florid and businesslike according to Gary.
 The county was florid and verdant according to Gary.
 The county was powerful and verdant according to Gary.
 The territory was disciplined and skillful according to Paul.
 The territory was ugly and skillful according to Paul.
 The territory was ugly and unattractive according to Paul.
 The territory was disciplined and unattractive according to Paul.
 The station was energetic and profitable according to Peter.
 The station was gorgeous and profitable according to Peter.
 The station was gorgeous and stunning according to Peter.
 The station was energetic and stunning according to Peter.
 The lunch was slow and delayed and was worth the wait.
 The lunch was delicious and delayed and was worth the wait.
 The lunch was delicious and tasty and was worth the wait.
 The lunch was slow and tasty and was worth the wait.
 The brunch was postponed and lengthy and was in the cafeteria.
 The brunch was hot and lengthy and was in the cafeteria.
 The brunch was hot and spicy and was in the cafeteria.
 The brunch was postponed and spicy and was in the cafeteria.
 The supper was prolonged and suspended and was going to be expensive.
 The supper was mixed and suspended and was going to be expensive.
 The supper was mixed and cooked and was going to be expensive.
 The supper was postponed and cooked and was going to be expensive.
 The breakfast was short and brief and was worth the effort.
 The breakfast was cold and brief and was worth the effort.
 The breakfast was cold and mild and was worth the effort.
 The breakfast was short and mild and was worth the effort.
 The dinner was hurried and rushed and worth complaining about.
 The dinner was burned and rushed and worth complaining about.
 The dinner was burned and heated and worth complaining about.

The dinner was hurried and heated and worth complaining about.
 The meal was scheduled and annual and in the company headquarters.
 The meal was healthy and annual and in the company headquarters.
 The meal was healthy and nutritious and in the company headquarters.
 The meal was scheduled and nutritious and in the company headquarters.
 The banquet was famous and overdue and was going down well.
 The banquet was succulent and overdue and was going down well.
 The banquet was succulent and tasty and was going down well.
 The banquet was famous and tasty and was going down well.
 The feast was late and slow and was spoken about by everyone.
 The feast was wholesome and slow and was spoken about by everyone.
 The feast was wholesome and yummy and was spoken about by everyone.
 The feast was late and yummy and was spoken about by everyone.
 The barbecue was yearly and delayed and was going to be good.
 The barbecue was heavenly and delayed and was going to be good.
 The barbecue was heavenly and tempting and was going to be good.
 The barbecue was yearly and tempting and was going to be good.
 The dessert was hurried and rushed and was not impressive.
 The dessert was stale and rushed and was not impressive.
 The dessert was stale and bland and was not impressive.
 The dessert was hurried and bland and was not impressive.
 The appetiser was prompt and timely and opposite the main course.
 The appetiser was sour and timely and opposite the main course.
 The appetiser was sour and tangy and opposite the main course.
 The appetiser was prompt and tangy and opposite the main course.
 The picnic was stalled and deferred and going to be memorable.
 The picnic was savory and deferred and going to be memorable.
 The picnic was savory and delectable and going to be memorable.
 The picnic was stalled and delectable and going to be memorable.
 The snack was quick and fast and left everyone hungry.
 The snack was unsavory and fast and left everyone hungry.
 The snack was unsavory and sweet and left everyone hungry.
 The snack was quick and sweet and left everyone hungry.

The luncheon was suspended and withheld and was speculated about.
 The luncheon was steamy and withheld and was speculated about.
 The luncheon was steamy and hot and was speculated about.
 The luncheon was suspended and hot and was speculated about.
 The tea was extended and protracted and really quite good.
 The tea was hot and protracted and really quite good.
 The tea was hot and delicious and really quite good.
 The tea was extended and delicious and really quite good.
 The drink was entertaining and heartening but didn't last long.
 The drink was alcoholic and heartening but didn't last long.
 The drink was alcoholic and plentiful but didn't last long.
 The drink was entertaining and plentiful but didn't last long.
 The cuisine was brief and shortened but was not expensive.
 The cuisine was ugly and shortened but was not expensive.
 The cuisine was ugly and tasteless but was not expensive.
 The cuisine was brief and tasteless but was not expensive.
 The chowder was late and overdue but was hard to swallow.
 The chowder was fragrant and overdue but was hard to swallow.
 The chowder was fragrant and palatable but was hard to swallow.
 The chowder was late and palatable but was hard to swallow.
 The roast was delayed and slowed but was not expensive.
 The roast was banal and slowed but was not expensive.
 The roast was banal and insipid but was not expensive.
 The roast was delayed and insipid but was not expensive.
 The sustenance was brief and hasty but was quite pricy.
 The sustenance was organic and hasty but was quite pricy.
 The sustenance was organic and healthy but was quite pricy.
 The sustenance was brief and healthy but was quite pricy.
 The ration was brief and abrupt but was quite delicious.
 The ration was crispy and abrupt but was quite delicious.
 The ration was crispy and small but was quite delicious.
 The ration was brief and small but was quite delicious.
 The grub was lasting and overdue but was hard to find.

The grub was flavoursome and overdue but was hard to find.
 The grub was flavoursome and tasty but was hard to find.
 The grub was lasting and tasty but was hard to find.
 The provision was lasting and lengthybut hard to acquire.
 The provision was delish and lengthybut hard to acquire.
 The provision was delish and delectable but hard to acquire.
 The provision was lasting and delectable but hard to acquire.
 The refreshment was suspended and halted but made some people happy.
 The refreshment was spicy and halted but made some people happy.
 The refreshment was spicy and cookedbut made some people happy.
 The refreshment was suspended and cooked but made some people happy.
 The recipe was long and big but very unusual.
 The recipe was tangy and big but very unusual.
 The recipe was tangy and scrumptious but very unusual.
 The recipe was long and scrumptious but very unusual.
 The dish was extended and continued but only served a few.
 The dish was fruity and continued but only served a few.
 The dish was fruity and tasty but only served a few.
 The dish was extended and tasty but only served a few.
 The beef was overdue and delayed but was not very expensive.
 The beef was black and delayed but was not very expensive.
 The beef was black and overcooked but was not very expensive.
 The beef was overdue and overcooked but was not very expensive.
 The lamb was deferred and delayed but did not bother anyone.
 The lamb was soft and delayed but did not bother anyone.
 The lamb was soft and undercooked but did not bother anyone.
 The lamb was deferred and undercooked but did not bother anyone.
 The steak was early and slowed but did not make anyone ill.
 The steak was crisp and slowed but did not make anyone ill.
 The steak was crisp and hard but did not make anyone ill.
 The steak was early and hard but did not make anyone ill.
 The food was early and punctual but did not please everyone.
 The food was spicy and punctual but did not please everyone.

The food was spicy and colourful but did not please everyone.
 The food was early and colourful but did not please everyone.
 The construction was arduous and difficult according to Henry.
 The construction was bright and difficult according to Henry.
 The construction was bright and tall according to Henry.
 The construction was arduous and tall according to Henry.
 The development was hurried and rushed according to Melissa.
 The development was sandstone and rushed according to Melissa.
 The development was sandstone and small according to Melissa.
 The development was hurried and small according to Melissa.
 The roadwork was incomplete and urgent according to Kevin.
 The roadwork was loud and urgent according to Kevin.
 The roadwork was loud and noisy according to Kevin.
 The roadwork was incomplete and noisy according to Kevin.
 The formation was reckless and slapdash according to Chris.
 The formation was sleek and slapdash according to Chris.
 The formation was sleek and shiny according to Chris.
 The formation was reckless and shiny according to Chris.
 The assembly was postponed and delayed according to Charles.
 The assembly was turbulent and delayed according to Charles.
 The assembly was turbulent and rowdy according to Charles.
 The assembly was postponed and rowdy according to Charles.
 The creation was fast and early according to Polly.
 The creation was flat and early according to Polly.
 The creation was flat and colourless according to Polly.
 The creation was fast and colourless according to Polly.
 The invention was sluggish and leisurely according to Kyle.
 The invention was glossy and leisurely according to Kyle.
 The invention was glossy and silver according to Kyle.
 The invention was sluggish and silver according to Kyle.
 The painting was scheduled and overdue according to Graham.
 The painting was sleek and overdue according to Graham.
 The painting was sleek and slick according to Graham.

The painting was scheduled and slick according to Graham.

The housework was slow and strenuous according to Brenda.

The housework was hushed and strenuous according to Brenda.

The housework was hushed and silent according to Brenda.

The housework was slow and silent according to Brenda.

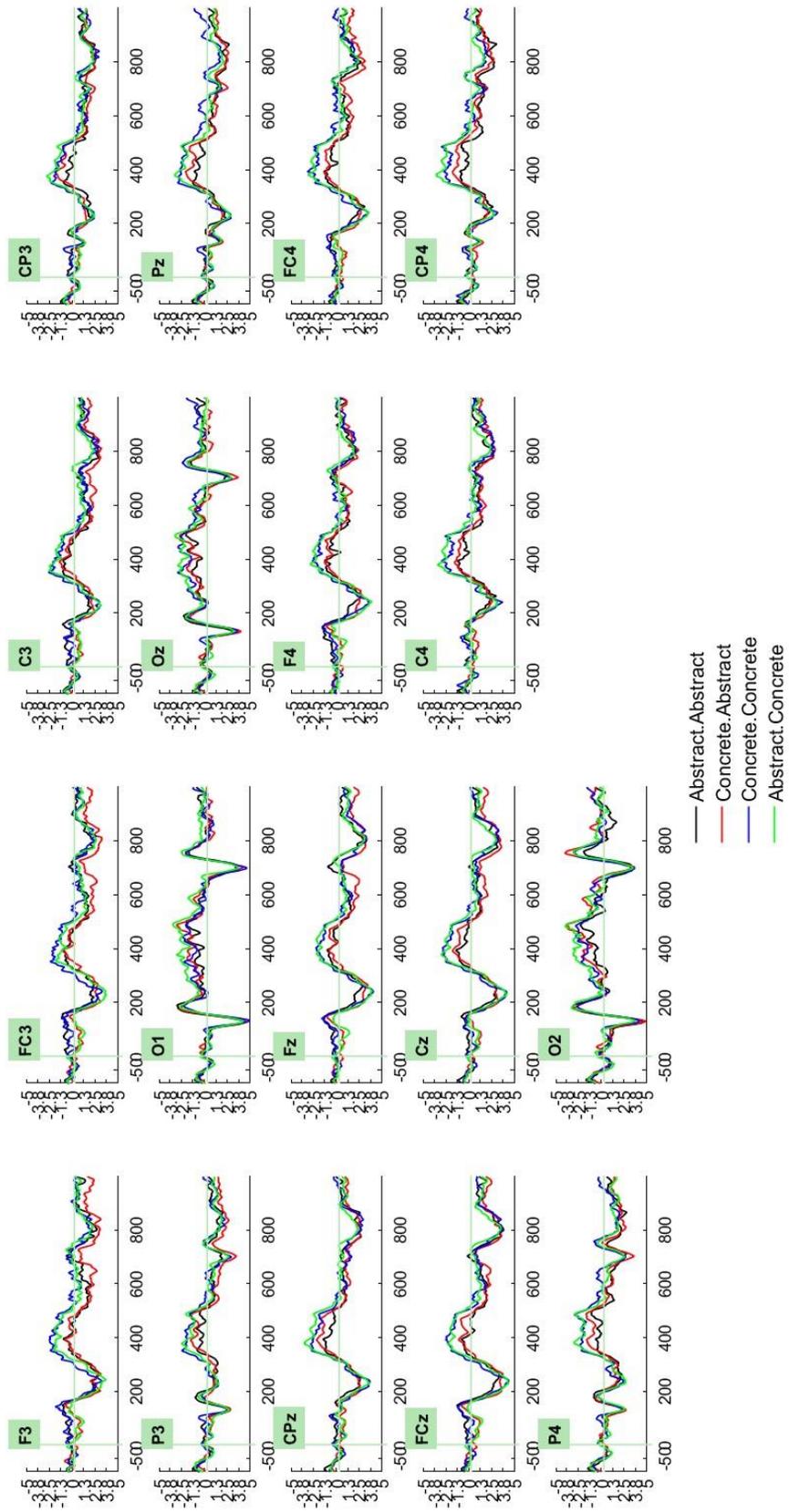
The drilling was untimely and premature according to Ian.

The drilling was turbulent and premature according to Ian.

The drilling was turbulent and loud according to Ian.

The drilling was untimely and loud according to Ian.

Experiment 10 EEG Waveforms:



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