Essays on Genericity

James Ravi Kirkpatrick
University College

A thesis submitted for the degree of DPhil in Philosophy
at the University of Oxford

Hilary Term, 2019

To my parents

Contents Overview

Essays on Genericity

by

James Ravi Kirkpatrick
University College, University of Oxford

A thesis submitted in fulfilment of the requirements for
the degree of Doctor of Philosophy in Philosophy
in Hilary Term, 2019

Abstract
This thesis collects five papers that are connected by the common theme of genericity in natural language, and gives an account of the meaning of generic sentences.

I begin in Chapter 2 by exploring extant versions of the modal theory, providing novel considerations in favour of two particular implementations which I build upon in later chapters.

In Chapter 3, I turn to the logical form of generic sentences, which I take to involve covert quantification. I develop a new argument that generics have covert quantificational structure by examining the ramifications of the invalidity of the under-explored logical principle Generic Excluded Middle. This argument has deleterious effects for kind-predication theories that eschew quantification.

Chapter 4 considers whether recent research on the primary acquisition of genericity in early child speech poses a problem for the modal theory. I argue that all the acquisition data that rival theories can accommodate can also be explained by appealing to Universal Grammar, but not *vice versa*, a fact that counts in favour of the modal theory.

Chapter 5 develops a new semantics for generics which I call *the structured theory*. The structured theory is comprised of a standard modal semantics (like those given in Chapter 2) together with an algebraic account of plurality in the framework of situation semantics. I argue that the structured theory makes sense of generic conjunctions, like 'Elephants live in Africa and Asia', by providing an adequate account of their meaning, and thus undermines the support for alternative semantics.

Chapter 6 investigates novel data concerning sequences of generics, and develops a compositional account of how the dynamics of conversation affects the interpretation of generics, which I call *the dynamic theory*. The key is to take the meaning of generics to be constrained by possibilities raised by previously entertained generics. This theory illustrates the need for a dynamic semantics for generics, one that the modal theory comfortably provides.

Word Count: 66,408

Thesis Supervisor: Paul Elbourne
Title: Professor of the Philosophy of Language

Thesis Supervisor: Timothy Williamson
Title: Wykeham Professor of Logic

Preface

This thesis concerns the phenomenon of genericity, and, in particular, the meaning of generic sentences, those sentences which express generalisations about what is characteristic for kinds of things or events.

In this thesis, I defend a modal theory of the meaning of generics, a view according to which generics express universal generalisations over a contextually restricted domain of normal individuals and/or worlds. I begin in Chapter 2 by exploring extant implementations of the modal theory, providing novel considerations in favour of two such approaches that I build upon in later chapters. Chapter 3 develops a new argument for the view that generics have a covert quantificational structure by examining the ramifications of the invalidity of an under-explored logical principle. Chapter 4 considers whether recent empirical research on the primary acquisition of genericity in early child speech poses a problem for the modal theory, and argues that Universal Grammar explains more acquisition data than rival theories. Chapter 5 develops a new semantics for generics which I call *the structured theory*. The structured theory is comprised of a standard modal semantics (like those given in Chapter 2) together with an algebraic account of plurality. I argue that the structured theory makes sense of phrasal conjunctions embedded in generic environments, thus providing an adequate account of their meaning. Chapter 6 investigates novel data concerning sequences of generics, and develops an account of their meanings which I call *the dynamic theory*. The dynamic theory is comprised of a compositional account of how the dynamics of conversation affects the standard modal semantics. The key is to take the interpretation of generics to be constrained by previously entertained generics. This thesis collects these five papers and bookends them with an introductory chapter and a concluding chapter. With the exception of these bookends, the chapters are written as independent papers and, as such, they can be read in any order. Nevertheless, the arrangement of this thesis is a natural one: individually, each chapter focuses on a separate problem for developing an empirically adequate account of generics; together, they build an integrated defence of the modal theory of generics.

In October 2012, a graduate class was held at the University of St Andrews on the philosophy of G.E.M. Anscombe. In his discussion of Anscombe's 'Modern Moral Philosophy', John Haldane described her attempt to reorient the direction of moral philosophy away from consequentialist and deontological approaches, and towards a virtue-theoretic path, as being intimately connected with genericity and the meaning

of generic sentences. For whatever is involved in explaining why certain generics are true must surely also be involved in underpinning certain ‘norms’ in human virtues, given the common lack of statistical correlatives:

> just as *man* has so many teeth, which is certainly not the average number of teeth men have, but is the number of teeth for the species, so perhaps the species *man*, regarded not just biologically, but from the point of view of the activity of thought and choice in regard to the various departments of life — powers and faculties and use of things needed — “has” such-and-such virtues: and this “man” with the complete set of virtues is the “norm,” as “man” with, e.g., a complete set of teeth is a norm. (Anscombe 1958: 14)

This was the first time that I came across the topic of genericity and I was struck by how deeply related issues in the philosophy of language and moral philosophy could be.

In March 2013, I was struck once again by the importance of generic sentences, this time in Herman Cappelen’s pro-seminar learning about Sarah-Jane Leslie’s work. Leslie’s research highlights the value of understanding the mechanisms that underlie the expression of genericity in language and thought, not least for its epistemological and social implications. While I have spent much time working on these issues since coming up to Oxford — first, in my BPhil thesis, and now here, in this thesis — I hope the reader will forgive me for having nothing of interest to say about these lofty topics, nor of the import that generics has outside the confines of philosophy of language and formal semantics. Nevertheless, I hope that this thesis goes some way to improving our understanding in these areas.

I gratefully acknowledge the Arts and Humanities Research Council for providing a doctoral studentship and the Royal Institute of Philosophy for providing a Jacobsen Scholarship. I should also like to thank the Master and Fellows of University College, Oxford for awarding me a G.A. Paul Scholarship in 2017, and to the Univ Old Members’ Trust for their generous support to attend numerous conferences and workshops. My thanks also go to University College and the Faculty of Philosophy for providing stimulating and welcoming environments in which to work.

I am incredibly grateful to my DPhil supervisors, Paul Elbourne and Timothy Williamson, for the countless meetings, discussions, and seminars, and whose writings and comments have inspired and improved this thesis from its inception. Over the last four years, Paul and Tim have taught me how to work on the philosophy of language and semantics, as well as philosophy more broadly, always with philosophical rigour and formal precision, and never without good humour and perspective. I am extraordinarily fortunate to have been taught by them, and I am deeply grateful for all the ways that they have supported me in writing this thesis, and my research in general.

In addition to my supervisors, I owe great debts to two informal advisors. This thesis began life as my BPhil thesis, which was written over the Hilary and Trinity terms of 2015. I warmly thank Ofra Magidor, my BPhil supervisor, for her guidance and direction during that project. It has been a privilege to study with Ofra, both in supervisions and in her seminars. Her refusal to succumb to formal sophistry has kept me intellectually grounded. I also owe a great deal to John Hawthorne, for the time he spent insightfully discussing much of this material with me. Conversations with John have been a source of philosophical delight, and have been the catalyst for much of the work in this thesis.

I was fortunate enough to have the opportunity to present material from this thesis on numerous occasions. For helpful comments and questions, I thank the audiences at the 2015 Joint Session of the Aristotelian Society and the Mind Association at Warwick; at the Generic Workshop at Harvard University in 2015; at the 2nd CCP conference at the University of Warsaw; at GAP.10 at the University of Cologne; at the *Just Words* workshop at UCL; at the 12th Annual Cambridge Graduate Conference on the Philosophy of Mathematics and Logic; and at numerous meetings of the Ockham Society in Oxford. I am also grateful to my respondents at two of these events: Preston Stovall (at Harvard) and Maarten Steenhagen (at Cambridge).

Oxford has been an incredible place to work on topics at the interface of philosophy and linguistics, and I have greatly benefited from being part of such an intellectually rich community. In addition to those already mentioned, thank you to the many individuals who have provided me with helpful comments on ideas or early drafts of material in this thesis. In particular, I should like to thank Annie Bosse, Ben Brast-McKie, Sam Carter, Sam Clarke, Christina Dietz, Rachel Fraser, Matthew Hewson, Justin Khoo, Rae Langton, Annina Loets, Matthew Mandelkern, Mike Martin, Bernhard Nickel, Alexander Roberts, Weng Kin San, Rachel Sterken, Matt Teichman, and Ravi Thakral. Many thanks also go to Iris Geens, Sarah Panko, and Sally Baume for their impeccable and always reliable practical support.

I am privileged to be able to count many of the individuals named above among my friends. In addition to these individuals, and in the summative spirit of Chapter 5, I wish to express my sincere gratitude to $\bigoplus[\![\text{friend of James}]\!]^{@}$, for their companionship, lightheartedness, and high spirits. In particular, I want to thank Luke Davies, John Lidwell-Durnin, Simon-Pierre Chevarie-Cossette, and Tanya Goodchild. I apologise to those whose names should be, but are not, on this list.

I give my most heartfelt thanks to Daisy Dixon, for her love, empathy, and kindness, and to Andrew and Sunita, for their encouragement, their laughter, and for helping me keep things in perspective.

Lastly, thank you to my parents, without the love of whom none of this would be possible. I hope this thesis stands as a testament to their unwavering love, support, and faith in me. I dedicate this thesis to them.

James Ravi Kirkpatrick
University College, Oxford
April, 2019

Detailed Contents

List of Figures

List of Tables

Chapter 1

Introduction

This thesis is concerned with the phenomenon of genericity, and, in particular, the semantics of generic sentences, or *generics* for short. Generics abstract away from facts or events concerning specific individuals and are used to express generalisations concerning what is characteristic for kinds of individuals or events. The generalisations that generics express typically tolerate exceptions, and generics are able to communicate them without the presence of an explicit quantifier. For example, when speakers want to communicate generalisations, they often use sentences like the following:

(1) a. Ravens are black.
b. Dogs bark.
c. A duck lays eggs.
d. The Sikh wears a turban.
e. Bishops move diagonally.
f. Sea-turtles live to be a hundred years old or more.

The phenomena related to genericity has a fairly wide range, and so it is necessary to delineate the scope of this thesis. I restrict my attention largely to the class of sentences in which genericity seems to arise at the level of the whole sentences, such as those in (1). Call these *characterising sentences*. This is in contrast with a class of sentences in which the source of genericity seems to stem from a determiner phrase (DP), such as those in (2), which we may call *reference-to-kind sentences*.[1]

(2) a. The potato was cultivated in South America.

b. Dodos are extinct.

Furthermore, following a convention widely adopted in much of the literature, I focus on *bare plural* characterising sentences, such as those in (1a–b) and (1e–f), rather than definite and indefinite DP, such as those in (1c–d).[2] And I will restrict my attention to English. The hope is that what I have to say will be useful in formulating a general account of generics that includes definite and indefinite generics, generics that involve reference to kinds, and generics in other languages; but there is more than enough to occupy myself with even being confined to the narrow domain of bare

[1] Here I follow the terminology from Krifka et al.'s (1995) seminal survey on the topic. Historically, characterising sentences and reference-to-kind sentences used to be labelled 'I-generics' and 'D-generics', respectively; see, for example, Gerstner and Krifka (1993). The idea was that characterising generalisations are manifested by indefinite singular or bare plural DPs, whereas reference to kinds are encoded in definite DPs. However, as Krifka et al. (1995: 4) point out, neither forms of genericity are universal properties of grammatical constructions, since we frequently use such DPs to make claims about specific or non-generic cases, nor are those forms of genericity isolated to merely those constructions. Thus, I will follow the more contemporary terminology outlined in the main text.

[2] While definite and indefinite characterising sentences may initially appear to function just like bare plural characterising sentences, there are subtle differences in meaning between bare plural, definite, and indefinite characterising sentences that put the consideration of the latter outside the scope of this thesis. To get a flavour of this complexity, consider the following minimal pairs (cf. Lawler 1972; Dahl 1975):

(i) a. A madrigal is polyphonic/*popular.

b. Madrigals are polyphonic/popular.

Notice the contrast between sentences expressing an 'essential' property of madrigals, like *is/are polyphonic*, with sentences expressing a merely accidental property of madrigals, like *is/are popular*. Bare plural characterising sentences sound fine regardless of the predicated property, whereas indefinite singular characterising sentences only sound good when paired with the 'essential' predicate. This shows that bare plural and indefinite DPs are not generally substitutable *salva veritate* in generic contexts. Rather than obscuring these delicate points, I instead restrict my attention to bare plural characterising sentences. For more discussion on the relation between bare plural and indefinite characterising sentences, see Greenberg (2004, 2007).

plural characterising sentences in English. Lastly, I want to note that I equivocate between different uses of the word 'generics'. While it is sometimes used to denote characterising sentences broadly construed, as well as reference-to-kind sentences, most of the time I use it to denote bare plural characterising sentences.

There has been a huge amount of research on the semantics of generic sentences over the last three decades, spanning across the disciplines of philosophy, linguistics, artificial intelligence, and cognitive science.[3] However, there is little consensus as to their semantic analysis. Many theories of generics find support from at least some contemporary scholars. Among them are the following families of theories:[4]

1. **Kind-predication theories**: that generic sentences should be analysed as a sub-species of genuinely kind-referring sentences and kind predication (e.g., Carlson 1977a,b; Liebesman 2011; Cohen 2013; Teichman 2015, 2016);

2. **Modal theories**: that generic sentences express universal quantification over a contextually restricted domain of normal individuals or worlds (e.g., Heim 1982; Delgrande 1987a,b; Boutilier 1994a,b; Asher and Morreau 1995; Krifka et al. 1995; Pelletier and Asher 1997; Drewery 1998; Eckardt 2000; Greenberg 2004, 2007; Asher and Pelletier 2013);

3. **Probabilistic theories**: that generic sentences have probability-based truth-conditions (Cohen 1995, 1996, 1999a,b);

[3] See, for example, the collection of papers in Carlson and Pelletier (1995), Pelletier and Asher (1997), and Mari et al. (2013a), as well as the myriad books and papers in philosophy and linguistics journals that have been published on the topic. While the phenomenon of genericity has been studied at length in the linguistics literature since the late 1970s, reference to the phenomenon can be found much earlier. For example, J.S. Mill discusses the semantics of so-called 'general terms' (or, in contemporary parlance, 'kind terms') in his 1843 *System of Logic*, and Jesperson (1927) discusses generic forms in English as well as other languages. Discussion goes as far back as at least Arnauld and Nicole's Port-Royal Logic Arnauld and Nicole (1996) and arguably even Aristotle.

[4] This is only a representative sample of the numerous analyses that have been proposed for generics, and as such it is not exhaustive nor are the families of theories listed mutually exclusive. One such omission is Sterken (2015b)'s theory that generics involve indexicals. Since this idea is compatible with a number of these families, I classify Sterken's theory as a way to implement the theories above, rather than as a separate theory itself. For a survey of other theories of generics, see Krifka et al. (1995); Pelletier and Asher (1997); Mari et al. (2013b).

4. **Generics-as-default-generalisations**: that generic sentences give voice to generalisations produced by a cognitively primitive, default mechanism for generalising (Leslie 2007, 2008);
5. **Existential modal theories**: that generic sentences involve existential quantification over a contextually restricted domain of normal individuals or worlds (Nickel 2008, 2010a,b, 2016);
6. **Non-truth-conditional theories**: that generics express rules of inference or have some other non-truth-conditional meaning (e.g., Geurts 1985; Veltman 1996).

The purpose of this thesis is to argue for a version of theory number 2, which I will call *the modal theory* and, occasionally, *the modal analysis* or *the modal conditional theory*.

Despite receiving support from a venerable list of theorists, the modal theory is often ruled out relatively quickly. For example, some theorists argue that the modal theory cannot explain central data involving the exception-permitting behaviour of generics, while others take issue with the claim that the semantics and syntax of generics involve universal quantification; some theorists claim that the modal theory is too semantically sophisticated to explain the centrality of genericity in human cognition, while others argue that it is not sophisticated enough to handle logically complex sentences. On the basis of these objections, theorists attempt to motivate their own alternative accounts of generics.

This thesis aims to address these concerns, bolstering the case for the modal analysis, while simultaneously undermining the evidential support that these problems are supposed to provide for rival theories. I do not pretend to provide a conclusive argument for the modal theory or to have fully explored the complexities of genericity more generally. But those problems that I tackle here seem most pressing for the modal theory, and I hope that the following chapters build an attractive abductive case for the modal analysis of generics.

The structure of this thesis is as follows. **Chapter 2** addresses a problem that arises from the modal theory's commitment to a *majority-based* semantic analysis of generics. According to majority-based analyses, the truth of a generic sentence requires that the majority of some contextually restricted domain of individuals or worlds have the relevant property in question. Since the modal theory claims that generics involve contextually restricted universal quantification over normal individuals or worlds, it is committed to this approach. However, it is commonly complained that majority-based semantic analyses cannot account for the truth of generic generalisations, when their exceptions outnumber their witnesses, sometimes in considerable quantities. For example, the modal theory seems to deliver the wrong truth-conditions for sentences like 'Ducks lay eggs' and 'Mosquitos carry the West Nile virus'.[5] These sentences seem true, even though only a minority of normal ducks lay eggs — namely, the fertile female ducks of reproductive age — and that an even smaller minority of mosquitos carry the West Nile virus — namely, those of a certain species who have been infected with the virus. Proponents of the modal theory must provide some explanation for these kinds of exception-permitting generics. In this chapter, I explore extant versions of the modal theory, providing novel considerations in favour of two such implementations, which I will develop in later chapters, and illustrating how they can handle these objections.

Chapter 3 concerns the logical form of generic sentences. The modal theory is committed to the widely-held view that generic sentences have a tripartite logical form and involve a phonologically null generic operator called 'Gen'.[6] This operator is theorised to be a source of genericity, operating as an adverb of quantification or

[5] For the *locus classicus* of the first criticism, see Carlson (1977a: 38–39), and for an early version of the second, see Iwabe (2002). This kind of objection has recently been brought to the attention of the philosophical mainstream by Leslie (2007, 2008).
[6] It appears that *Gen* was first introduced by Farkas and Sugioka (1983).

as a quantificational determiner. Call this the *quantificational approach* to generics, an approach to which the modal theory, among others, is committed. However, some theorists have recently questioned this standard view and revived a competing proposal according to which generics involve the predication of properties to kinds.[7] This proposal eschews covert quantificational structure in favour of a simpler subject–predicate logical form and a semantic treatment of bare plural DPs as referring to kinds. By adopting this *kind-predication approach* to generics, these theorists take aim at one of the foundational assumptions of the modal theory. In this chapter, I offer a novel argument in favour of the standard quantificational view on the basis of the invalidity of Generic Excluded Middle, the principle according to which any sentence of the form ⌜Either Fs are G or Fs are not G⌝ is true. I argue that the kind-predication approach either collapses into a form of the quantificational analysis — albeit with a commitment to reference to kinds — or else it garners some unpalatable metaphysical commitments. The upshot of this chapter is that whether the bare plural subject of generics refers to kinds is strictly independent of whether generics are quantificational, and so the modal theory should be seen as thoroughly compatible with the most empirically adequate version of the kind-predication approach.

Chapter 4 concerns the acquisition of generics. Sarah-Jane Leslie (2007; 2008) has recently argued that the primary acquisition of genericity poses a *prima facie* problem for quantificational theories of generic sentences like the modal theory. More specifically, empirical studies show that young children grasp and produce generics far quicker and more readily than they do more well-understood and mathematically well-behaved explicit quantificational determiners like *every* and *some*. This fact is surprising, not least because the generic operator *Gen* is standardly given a far more complex semantic analysis than these quantificational determiners. To account for the early appearance of generics in child speech, Leslie proposes a deflationary cognition-

[7] See, for example, Carlson (1977a,b); Liebesman (2011); Cohen (2013); Teichman (2015, 2016).

based account of their meaning, according to which they give voice to an innate, default mode of generalising that is postulated to exist in our cognitive system. This default mode of generalising informs the semantics of generics by encoding the truth-conditions of generics in the accuracy conditions of this cognitive system, and so we have a sense of their truth-conditions from an early age. Contrastingly, quantificational determiners require inhibitory processes to override the default mechanism, and so they are acquired only once we reach the appropriate level of cognitive sophistication. While I am sympathetic with the view that there is something psychologically primitive and deep about genericity, I disagree that the acquisition data favours Leslie's explanation or her specific account of their truth-conditions. In this chapter, I point to parallel phenomena in the primary acquisition of adverbial quantifiers, modals, and tense — namely, that these expressions are acquired around the same stage of development as generics — and argue that Leslie's cognition-based explanation of early acquisition does not generalise to these expressions without loss of explanatory power. This additional evidence undermines the support for Leslie's theory of generics. I conclude with a conjecture about why some quantifiers are acquired earlier than others. The upshot of this chapter is that the data about generic acquisition can be accommodated by quantificational accounts of generics like the modal theory, and so a central argument in favour of Leslie's semantic theory fails.

Chapter 5 concerns generic sentences involving phrasal conjunctions, such as 'Elephants live in Africa and Asia'. Recently, Bernhard Nickel (2008; 2016) has argued that such generics present a *prima facie* problem to majority-based theories of generics, the family of views of which the modal theory is a member. According to Nickel, the modal theory predicts that the sentence 'Elephants live in Africa and Asia' is true just in case every normal elephant lives in both Africa and Asia. But this prediction is clearly incorrect, since normal elephants are not transnational. In response to this problem, Nickel has proposed a radical departure from the orthodoxy arguing that generics express weak existential quantification over ways of being normal: theory 5 on our list. In this chapter, I argue that such departures are unwarranted: not only do they not fully accommodate the data involving generics, the phenomenon under question is much broader than Nickel would have us believe. I develop a new semantics for generics which I call *the structured theory.* The structured theory is comprised of a standard modal semantics (like those given in Chapter 2) together with an algebraic account of plurality. I argue that the structured theory makes sense of phrasal conjunctions embedded in generic and non-generic environments alike, and thus providing an adequate account of their meaning. The upshot of this chapter is that generic conjunctions are unproblematic for majority-based theories of generics like the modal theory, and so a central datum in favour of Nickel's theory fails.

Chapter 6 concerns two novel challenges that arise from the exception-permitting behaviour of generic sentences. First, analyses of generics must capture the felicity of sequences of generics like 'Ravens are black, but albino ravens are not'. Second, analyses of generics must capture the infelicity of sequences of generics like 'Albino ravens aren't black, but ravens are'. Call these *generic Sobel sequences* and *reverse generic Sobel sequences*, respectively. In this chapter, I argue that most prominent analyses of generics fail to meet the second challenge: they fail to capture the infelicity of reverse Sobel sequences. I develop another version of the modal theory that adequately explains the infelicity of reverse Sobel sequences, which I call *the dynamic theory.* The dynamic theory is comprised of a compositional account of how the dynamics of conversation affects the standard modal semantics. The key is to take the interpretation of generics to be constrained by previously entertained generics. While the theory I develop is dynamic in character, it is strictly speaking still a truth-conditional theory. The upshot of this chapter is that generics seem to require some dynamic component in their semantics, a requirement that is comfortably accommodated by a modal theory.

Chapter 7 concludes by summarising the overall position of the thesis and highlighting areas for future research.

Chapter 2

The Modal Theory

2.1 Introduction

The analysis of the meaning of generic sentences that I defend in this thesis is the modal theory, a prominent approach according to which generics express universal generalisations over a contextually restricted domain of normal individuals or worlds.

The modal theory finds some intuitive support in the natural thought that the sentence 'Ravens are black' communicates something similar to the generalisation that all of the normal ravens are black; after all, the only exceptions to the generalisation are albino ravens, and they are arguably abnormal in a salient way. Similarly, the sentence 'Dogs bark' communicates something like the generalisation that all the normal dogs bark; only dogs with a birth defect, those who have undergone devocalisation, or members of the Basenji breed cannot bark, and again they are arguably abnormal. The modal theory attempts to do justice to these thoughts.

Another reason to favour the modal theory is the similarities between generics, on the one hand, and conditional sentences, restrictive *when*-clauses, and dispositional sentences, on the other.[1] For example, a generic sentence like 'Birds fly' can be rephrased as a conditional like 'If something is a bird, then it normally flies', or sentences with overt adverbial quantifiers like 'Birds normally fly'. Furthermore, restrictive *when*-clauses are frequently used in generic sentences, such as 'When a dog sees a postman, it usually bites him', and they are similar to conditional clauses in some respects (see, e.g., Kratzer 1986). And the philosophical literature often treats sentences containing dispositional and ability predicates, such as *be soluble in water*, as reducible to lawlike conditionals, such as 'If x is put in water, then x will dissolve', which are in turn analysed as modalised sentences. Generic sentences and counterfactuals also share similar entailment properties. For example, two conditionals with contradictory consequents can be consistent even though one antecedent entails another: it seems fine to say 'If it were to rain, I would get wet, even though if it were to rain and I brought an umbrella, I wouldn't get wet' (cf. Lewis 1973). Correspondingly, generics exhibit similar behaviour: it is fine to say 'Birds fly, although birds with broken wings don't fly'. The modal account of generics takes this resemblance between generics and conditionals seriously.

However, a number of theorists have argued that the modal theory is unable to accommodate a range of data concerning the exception-permitting behaviour of generic sentences. Most recently, Sarah-Jane Leslie (2007; 2008) has argued that the modal account of generics is unable to accommodate sentences like the following:[2]

(1) a. Ducks lay eggs.

b. Cardinals are red.

(2) a. Mosquitos carry the West Nile virus.

b. Sharks attack bathers.

[1] See, for example, Lawler (1973); Delgrande (1987b); Boutilier (1994a); Krifka et al. (1995); Asher and Morreau (1995).

[2] This objection has roots in Carlson (1977a), and has been repeated by a number of theorists over the decades.

The sentences in (1) seem true, even though only the fertile female ducks of a certain age lay eggs, and only male cardinals are red. And the sentences in (2) strike many native English speakers as true, even though the vast majority of mosquito species do not carry the West Nile virus, and the frequency of shark attacks is very low. However, on an initial naive understanding of the modal theory, it predicts that the sentences in (1) are true iff all normal ducks lay eggs and all normal cardinals are red, and that the sentences in (2) are true iff all normal mosquitos carry the West Nile virus, and all normal sharks attack bathers. But these predictions are empirically inadequate: some male ducks are normal ducks which do not lay eggs, some female cardinals are normal cardinals which are not red; and the vast majority of mosquito species contain normal mosquitos which do not carry the virus, and many normal sharks do not attack bathers. So much worse, the argument goes, for the modal account of generics.

The aim of this chapter is to lay out what I take to be the best versions of the modal theory and to illustrate how they can accommodate these data points, as well as other important phenomena concerning generics. The modal theory of generics is a broad church with a long tradition of philosophers, linguists, and computer scientists providing different implementations of its core idea. Accordingly, I consider a variety of extant theories in a general framework, with the aim of adjudicating between them on the basis of general logical principles. Sections 2.2–2.10 carry out this project and develops some promising versions of the modal theory, discussing certain generics along the way. To aid exposition and comparison, I adopt a methodology traditionally favoured by the proponents of the modal theory, one that eschews compositional semantics in favour of formal representations of generics in augmented languages of first-order predicate logic.[3] Nevertheless, I will have much more to say about

[3] Here, for example, is what Asher and Morreau say about their methodology:

> we have very little to say about how genericity is actually expressed in language, or about translation procedures which associate formal representations with natural language expressions. In the formal language defined below, we assume generic sentences somehow to have been recognized and and represented as such. [. . .] we leave linguistic

compositional implementations of these ideas in later chapters. Sections 2.11–2.12 revisit the problematic sentences in (1) and (2), and demonstrates how the modal theories can be adapted to handle these observations. Section 2.13 concludes.

2.2 Strict Conditionals

Let us begin by considering a simple version of the modal theory that analyses generics in terms of strict conditionals. Any formal analysis that treats a generic as a strict conditional must posit a logical representation involving a non-variable modality, a first-order quantifier, and a material conditional. Suppose we have a language of quantified modal logic with all the usual sentential connectives and a necessity operator '$\Box$' that is intuitively understood as 'It is normal that'. Then we assign to generic sentences like the one in (3a) logical representations like in (3b):

(3) a. Ravens are black.

b. $\Box\forall x(\text{raven}(x) \to \text{black}(x))$

In English, (3b) is true iff in all the most normal worlds, if something is a raven, then it is black.[4] Call this the *strict conditional approach.*

To evaluate the plausibility of the strict conditional, it is proper to introduce a model to interpret our strings of symbols. However, there is an immediate problem with the strict conditional approach that can be made clear in informal terms, namely, that it seems to make incorrect predictions about sequences of generics. Observe that

issues as much as possible to one side, concentrating instead on providing a theory of what our formal representations of generic sentences mean [. . .] (Asher and Morreau 1995: 301)

[4] Given the Converse Barcan formula, (3b) is equivalent to $\forall x\Box(\text{raven}(x) \to \text{black}(x))$, which is true iff for all individuals x, in the most normal worlds in which x is a raven, then x is black. However, it is unlikely that any intuitive logic for normality is strong enough to validate the Converse Barcan formula.

two generics may make contradictory predications even though one of their subject terms entails the other:[5]

(4) a. Birds fly.

b. Birds that are penguins don't fly.

When analysed as a strict conditional, such sentences are jointly unsatisfiable, but we even though we intuitively take them to be true. For according to the first version of the strict conditional approach, if (4a) is true, then in all the normal worlds, every bird flies; and if (4b) is true, then in all the normal worlds, every bird that is also a penguin does not fly. But this seems like a contradiction: we have just said that in the normal worlds, every bird flies but the penguins among them do not. One might suppose then that the normal worlds do not contain penguins, or that the penguins in the normal worlds actually fly; but then one has no explanation for why the sentence 'Penguins fly' is false.

It is open to proponents of the strict conditional theory, of which there are none to my knowledge, to argue that the worlds over which the necessity operator quantifies can vary across a discourse. I return to this consideration in Chapter 6, but for now let us set aside the strict conditional theory and consider other theories.

2.3 Normal Worlds in Ordering Models

This section considers a version of the modal theory that takes generics to express universal quantification over a restricted set of 'normal' worlds. To fix ideas, let us introduce a formal language of first-order predicate logic $\mathcal{L}$ with the usual stock of predicate letters, constants, variables, non-logical symbols, propositional connectives $(\neg, \wedge, \vee, \rightarrow)$, and quantifiers $(\forall, \exists)$. We will use the Greek letters 'ϕ', 'ψ' as

[5] This example is taken from Pelletier and Asher (1997: 1144).

metalanguage variables for formula of $\mathcal{L}_>$, 'Π', 'ξ', 'ζ' for metalanguage variables for its predicate letters, and '$v_1, v_2, \ldots$' as metalanguage variables ranging over object language variables. Then let $\mathcal{L}_> = \mathcal{L} \cup \{>\}$ be the augmentation of $\mathcal{L}$ with a binary connective '$>$', which has the following formulation clause:

If ϕ and ψ are formulas, then $\ulcorner\phi > \psi\urcorner$ is a formula.

As an initial gloss, the intended interpretation of the conditional $\ulcorner\phi > \psi\urcorner$ is that it is true at a world w iff ψ is true at every member of some set of worlds in which ϕ is true. According to this theory, generics are universally quantified, normality conditionals of this kind, and so generics like 'Ravens are black' can be assigned by the following logical representation:

$$\forall x[\text{raven}(x) > \text{black}(x)]$$

Intuitively, we want to the truth-conditions for this sentence to be something like: the sentence 'Ravens are black' is true at a world w iff for every individual d, d is black in every member of some set of worlds in which d is a raven. The task of the following sections is to determine how this set is chosen.

The interpretation of the normality conditional will be subject to contextual variation, just as the interpretation of any context-sensitive expressions is contingent on features of the conversational background. To introduce these ideas, consider the familiar effects of context on the interpretation of modals:

(5) John must be happy.

The interpretation of *must* in (5) depends on different background information. For example, on an epistemic reading, (5) might be interpreted as expressing something like 'Given what we know, it is necessary that John is happy'; on a deontic reading, it might be interpreted as 'In order to fulfil some requirement, it is necessary that

John is happy'; and on an instrumental or prudential reading, it might be interpreted as 'In order to achieve some ends, it is necessary that John is happy'. Differences in background information result in different interpretations of the sentence.

Similarly, any formal analysis giving truth-conditions to generics must somehow take into account the impact of background information. For present purposes, we may think of background information as ordering the set of possible worlds. (For the moment, let us keep things simple and assume that there are only finitely many worlds.) Given the facts that obtain at w, and features of context that weight some facts more heavily than others, we can say that some worlds are more normal with respect to the facts of world w than others. Equivalently, some worlds are less abnormal relative to w, than others. For the moment we are assuming that the ordering over the possible worlds is *perspectival*; an ordering is relative to the background information at some particular world, its perspective. Some times it is not clear how two worlds compare with respect which is more normal relative to w; the ordering may be partial. But it should be crystal clear that w is not always one of the most normal worlds from its own perspective, since there is no guarantee that it adheres most closely to the background facts. Call this a *comparative normality ordering.*

Given some normality conditional $\ulcorner \phi > \psi \urcorner$, such an ordering divides the worlds where the antecedent holds into two classes. There are those that are least abnormal from the perspective of a given world, and there are those that are abnormal to some degree. Then we may say that a normality conditional is true just in case the consequent is true throughout the worlds in the former class, ignoring the latter worlds and the undesirable abnormalities that they harbour.

Admittedly, the notion of normality is inherently vague and context-sensitive, but nevertheless we have some intuitive grasp of it. From the perspective of our world, a bird that flies is more normal (insofar as birds go) than a bird that cannot fly; a world where a particular bird flies is more normal than another world that differs only with respect to whether that bird can fly. The background information that gives rise to this ordering is determined by facts about our world; and how it depends on them is potentially determined by our linguistic practices and context. Arguably, the relationship between background information and our practices is plausibly a complex loop; the background information will determine this ordering, and so influence our future practices, but those future practices may in turn change the background facts. The combination of our linguistic practices and context gives rise to a 'model' against which we can evaluate normality conditionals with the aid of a world.

Let us define an *ordering model* to encode the notion of perspectival normality ordering over worlds as follows:

Definition 2.3.1 (Ordering Models)**.** Let an *ordering model* $\mathcal{M} = \langle W, D, \leq, I \rangle$ for $\mathcal{L}_{>}$ be a tuple such that:

(i) W is a non-empty set of worlds.

(ii) D is a non-empty set of individuals.[6]

(iii) $\leq$ is a ternary relation over W such that:

- for any $w \in W$, $\leq_w$ is reflexive;
- for any $w \in W$, $\leq_w$ is transitive;

(iv) I is an *interpretation function* such that:

- if α is a constant, then $I(\alpha) \in D$
- if Π^n is an n-place predicate, then $I(\Pi^n)$ is a set of $n+1$ tuples of the form $\langle u_1, \ldots, u_n, w \rangle$, where $u_1, \ldots, u_n$ are members of D and $w \in W$.

[6] We assume a constant domain of individuals such that our metalanguage quantifiers range over every individual at every world and time. This significantly simplifies our semantics, since we do not need to associate each world with a domain of quantification containing just those objects that exist in that world. Of course, we can always introduce this complication later as required.

We write '$v \leq_w u$' to mean 'v is not more abnormal relative to w than u'. We say that '$v <_w u$' ('v is less abnormal/more normal relative to w than u') just in case: $v \leq_w u$ and $v \neq_w u$. The initial constraints on $\leq_w$ are natural and intuitive, and we have not assumed that w is at least as normal relative to itself than any other world. Let $\wp(W)$ be the set of *propositions.* We call v a *most normal p-world relative to w* (according to a frame) just in case (i) v is a p-world, and (ii) there is no world u such that $u <_w v$.[7]

Then we can provide the following informal truth-conditions for normality conditionals: the conditional $\ulcorner \phi > \psi \urcorner$ is true at a world w according to an ordering model $\mathcal{M}$ just in case:

(6) ψ is true at every most normal world in which ϕ is true relative to w.

So long as we stick to the finite case, this general truth-condition is common to all the theories that I will consider. But the basic intuition can be captured formally in numerous ways, with different theories imposing different constraints on the ordering models to determine different sets of worlds relevant for the evaluation of generics.

Some of these considerations are informal. For example: Is it correct to describe the orderings that governs the truth of generics as concerning the 'perspectival normality' of worlds? How is the appropriate ordering determined by the facts of the world or in practice relative to a context? These questions largely fall outside the scope of this chapter.

Other differences involve additional formal requirements that one might impose on our models. One version of this view was introduced first in the AI literature by Delgrande (1987b,a), and taken up by Boutilier (1994a). In the linguistics literature, the survey article by Krifka et al. (1995) in *The Generic Book* sketches another version of this treatment based on the accounts of modality developed in Kratzer (1977) and Heim (1982).Yet another version of the view has been developed by various

[7] The term 'p-world' denotes a world at which the proposition p obtains.

permutations of Nicolas Asher, Michael Morreau, and Francis Pelletier (see Asher and Morreau 1995; Pelletier and Asher 1997; Asher and Pelletier 2013).

The following sections examine these options more carefully. Section 2.4 introduces Asher, Morreau, and Pelletier's theory of generics; call this the Asher–Morreau–Pelletier (AMP) theory. I then defend it against other options that resulting from forcing additional constraints on the ordering models. Since the purpose of this chapter is to introduce the modal theory of generics, I cannot consider every possible theory to this question; instead, I focus on the general structure of the theory, highlighting some interesting choice points along the way. In particular, Section 2.5 defends the use of a comparative normality relation over the use of a binary absolute normality relation; Section 2.6 rejects the constraint that there is single most normal world; and Section 2.7 defends the assumption of there is at least one most normal world.

I conclude this section by completing the formal exposition of the semantics of $\mathcal{L}$ fragment of $\mathcal{L}_{>}$. First, we must define the notion of variable assignment:

Definition 2.3.2 (Variable Assignment)**.** α is a variable assignment for a model $\langle W, D, \leq, I\rangle$ iff α is a function that assigns to each variable some $d \in D$.

We adopt the standard notation for a *modified* variable assignment: for $d \in D$, let $\alpha[v_i/d]$ be the assignment such that $\alpha[v_i/d](v_i) = d$ and $\alpha[v_i/d](v_j) = \alpha(v_j)$, for all $v_j \neq v_i$.

We then interpret $\mathcal{L}$ with respect to an ordering model, world and variable assignment using the standard satisfaction definitions for the atomic formula and the usual complex formula involving $\neg, \wedge, \vee, \rightarrow, \exists, \forall$:

Definition 2.3.3 (Satisfaction)**.** Let $[\![.]\!]^{\mathcal{M},w,\alpha}$ be a function from expressions of $\mathcal{L}$ to its semantic value relative to an ordering model $\mathcal{M}$, a possible world w, and a variable assignment α, subject to the following constraints:

(i) For any constant c, $[\![c]\!]^{\mathcal{M},w,\alpha} = I(c)$.

(ii) For any variable v, $[\![v]\!]^{\mathcal{M},w,\alpha} = \alpha(v)$.

(iii) For any n-ary predicate Π^n and terms $t_1, \ldots, t_n$,

$$[\![\Pi^n t_1, \ldots, t_n]\!]^{\mathcal{M},w,\alpha} = 1 \text{ iff } \langle [\![t_1]\!]^{\mathcal{M},w,\alpha}, \ldots, [\![t_n]\!]^{\mathcal{M},w,\alpha}, w\rangle \in I(\Pi^n).$$

(iv) For any wffs ϕ, ψ:

a. $[\![\neg\phi]\!]^{\mathcal{M},w,\alpha} = 1$ iff $[\![\phi]\!]^{\mathcal{M},w,\alpha} = 0$.

b. $[\![\phi \wedge \psi]\!]^{\mathcal{M},w,\alpha} = 1$ iff $[\![\phi]\!]^{\mathcal{M},w,\alpha} = 1$ and $[\![\psi]\!]^{\mathcal{M},w,\alpha} = 1$.

c. $[\![\phi \vee \psi]\!]^{\mathcal{M},w,\alpha} = 1$ iff $[\![\phi]\!]^{\mathcal{M},w,\alpha} = 1$ or $[\![\psi]\!]^{\mathcal{M},w,\alpha} = 1$.

d. $[\![\phi \rightarrow \psi]\!]^{\mathcal{M},w,\alpha} = 1$ iff $[\![\phi]\!]^{\mathcal{M},w,\alpha} = 0$ or $[\![\psi]\!]^{\mathcal{M},w,\alpha} = 1$.

e. $[\![\exists v\phi]\!]^{\mathcal{M},w,\alpha} = 1$ iff for some $d \in D$, $[\![\phi]\!]^{\mathcal{M},w,\alpha[v/d]} = 1$.

f. $[\![\forall v\phi]\!]^{\mathcal{M},w,\alpha} = 1$ iff for every $d \in D$, $[\![\phi]\!]^{\mathcal{M},w,\alpha[v/d]} = 1$.

Truth in a model is defined in terms of satisfaction under every variable assignment. I drop the superscripts $\mathcal{M}$ and α when it is clear which model is meant.

2.4 The AMP Semantics

In this section, I outline Asher, Morreau, and Pelletier's semantics for generics. According to their theory, $\ulcorner\phi > \psi\urcorner$ is true at w iff the set of worlds where the proposition denoted by ϕ holds along with everything else which, at w, is normally the case where that proposition holds is a subset of the set of ψ-worlds. The ordering models defined above allow us to encode this interpretation using a selection function $*$, which assigns to each world w and proposition p (i.e., set of worlds) a set of worlds. Intuitively, $*(w, p)$ is the set of worlds where p holds along with everything which, at w, is normally the case where p holds:[8]

[8] Recall that we have not assumed that $\leq_w$ is connected. If $\leq_w$ is total, then we can define the selection function as follows: $*(w,p) = \{w' : p(w') \,\&\, \forall w'' \in W : p(w'') \rightarrow w' \leq_w w''\}$

$$*(w,p) = \{w' : p(w') \,\&\, \forall w'' \in W : p(w'') \rightarrow w'' \not<_w w'\}.$$

To see how * works, let us consider an example. Let p be the proposition that Kermit is a frog. Let w be the actual world, where it is true that frogs normally ribbit and that frogs normally jump around. Then $*(w,p)$ contains only worlds where Kermit ribbits and jumps around; the actual world falls outside $*(w,p)$, since the television character is a pretty atypical frog, since he is able to speak English and was married to a pig. Notice that the selection function allows that what is normal where p holds to be a contingent matter, since it takes worlds as one of its arguments. Consequently, the actual world may well be a normal p world relative to bizarro worlds where it is true that frogs normally speak English. And notice that the model does not suppose an absolute normality ordering on possible worlds, since $*(w,p)$ is not identified with the most normal of all possible worlds where p holds irrespective of perspective.

So far, I have not specified any constraints on the selection function. One appealing constraint that we will definitely impose is that the set of worlds $*(w,p)$ must be a subset of the p-worlds. That is, the worlds where p holds along with everything else normally associated with p, are themselves worlds where p holds. This is encoded in the following constraint:

Facticity. $*(w,p) \subseteq p$.

One constraint that we definitely do not want to impose is that the world in the argument of the selection function is in its image. That is, '*' should not obey the following constraint:

Centering If $w \in p$, then $w \in *(w,p)$.

It should be obvious that the fact that p holds in a particular world w is no guarantee that w is a world where everything holds which is normally associated, in w, with

p. Even if Kermit is a real frog in w, many things could be true of him that do not normally go with being a frog: he might still have married a pig. And if our Kripkean fixations prevent us from considering worlds where individuals are different species from the ones that they actually are, the selection function simply chooses the empty set. For example, if Yogi is actually a bear in w and p is the proposition that Yogi is a bird, then $*(w, p) = \varnothing$; there are no most normal worlds where Yogi is a bird relative to w.

We may now give the following satisfaction clause for $>$:

Definition 2.4.1 (AMP-conditional)**.** $[\![\phi > \psi]\!]^{\mathcal{M},w,\alpha} = 1$ iff $*(w, [\![\phi]\!]^{\mathcal{M},\alpha}) \subseteq [\![\psi]\!]^{\mathcal{M},\alpha}$

where $[\![\phi]\!]^{\mathcal{M},\alpha}$, *the proposition expressed by* ϕ *in* $\mathcal{M}$ *relative to* α, is defined as the following set of possible worlds: $\{w \in W_{\mathcal{M}} : [\![\phi]\!]^{M,w,\alpha}\}$. To get a feel for this definition, observe that the AMP semantics will predict that (7b), our translation of (7a), is true at a world w in $\mathcal{M}$ iff the conditions in (7c) obtain:

(7) a. Ravens are black.

b. $\forall x[\text{raven}(x) > \text{black}(x)]$

c. for every variable assignment α, for every individual $\delta \in D$ of $\mathcal{M}$,

$$*(w, [\![\text{raven}(x)]\!]^{\mathcal{M},\alpha[x/d]}) \subseteq [\![\text{black}(x)]\!]^{\mathcal{M},\alpha[x/d]}.$$

More generally, for any 1-place predicates ζ, ξ, $\ulcorner\forall v(\zeta v > \xi v)\urcorner$ is true at w iff for every individual δ in the domain of the model, $*(w, [\![\zeta\underline{\delta}]\!]^{\mathcal{M}}) \subseteq [\![\xi\underline{\delta}]\!]^{\mathcal{M}}$, where $\underline{\delta}$ is the name of δ in $\mathcal{L}_{>}$. That is, it is true just in case for every individual δ, the set of worlds where $\zeta\underline{\delta}$ holds along with everything else which, in w, would normally be the case where $\zeta\underline{\delta}$ holds — *the most normal* $\zeta\underline{\delta}$*-worlds relative to* w — are a subset of the $\xi\underline{\delta}$-worlds.

Observe that the AMP semantics immediately avoids the problems that plague the strict conditional account. First, observe that the truth of 'Birds fly' does not guarantee that all birds fly nor that there is a world where all birds are normal. More carefully, let p be the proposition that Tweety is a bird and q be the proposition that Nevermore is a bird. The truth of 'Birds fly' means that $*(w, p)$ is a subset of the worlds where Tweety flies and that $*(w, q)$ is a subset of the worlds where Nevermore flies, but this does not guarantee that $*(w, p) = *(w, q)$.

Furthermore, let p be the proposition that Tweety is a bird, q be the proposition that Tweety is a penguin, and r be the proposition that Tweety flies. Then $*(w, p)$ is the set of worlds where Tweety is a bird and everything else that is normally the case relative to w, if Tweety is a bird, holds. Since birds normally fly, $*(w, p)$ will be a subset of r. But there is no guarantee that $*(w, p \cap q)$ will fall inside $*(w, p)$, since worlds where Tweety is a bird *and* a penguin may be more abnormal with respect to w than worlds where he is a bird. Thus, there is no guarantee that $*(w, p \cap q)$ will be a subset of r.

More generally, it is important to note that the consequent of the normality conditional is evaluated relative to only a certain subset of the antecedent-satisfying worlds. For example, a sentence like 'Ravens are black' may be true even at worlds where all ravens happen to currently be white, so long as those worlds are embedded in the right modal structure. If the outbreak of corvusian albinism is temporary and not long-lasting, then it is highly plausible that the actual world is not a world in which everything that normally holds when Nevermore is a raven holds. But if the outbreak is more permanent, chances are the albino world is a normal raven-world and the sentence 'Ravens are black' would be false in it.

This semantics also allows us to adequately explain why some generics are false, even though there are few exceptions to the generalisation they express, as witnessed by the following sentences:

(8) a. Prime numbers are odd.

b. Books are paperbacked.

These sentences are all false despite the vast majority of the members of the kinds in question confirming to the generalisation. The falsity of (8a) is perhaps surprising, given the number of supporting instances is countably infinite; the only exception being the prime even number 2. And (8b) is also false, despite a preponderance of paperbacked books. The AMP semantics explains why (8a) is false because there is a certain prime number that is always even, even in the most normal of prime number worlds; a world without the number 2 would be extremely unusual. And it explains why (8b) is false because it is not abnormal for a book to be paperbacked, despite the present popularity of such bindings.

Having laid out a compelling theory of generics, I should like to postpone consideration of how the AMP semantics handles the problematic sentences from the Section 2.1 until Sections 2.11 and 2.12. Instead, we turn to the comparison between this account and some alternatives in the vicinity.

2.5 Absolute Normality

Normality has been taken to be a relative matter, subject to the perspective of a world. But normality could just as well be an absolute notion, with a single determinate ordering over the possible worlds. Delgrande (1987a) proposes exactly these kinds of models, which can be obtained from the ordering models above by replacing our ternary relation $\leq$ with a binary relation $\trianglelefteq$ that is not relativised to a world. We write '$v \trianglelefteq u$' to mean 'v is not more abnormal than u. Again assume that $\trianglelefteq$ is reflexive and transitive.[9] Then we can define a number of different functions, such as the *Delgrande selection function* $g : W \times \wp(W) \mapsto W$:

$$g(w, p) = \{w' : w' \trianglelefteq w \,\&\, p(w') \,\&\, \forall w''(w''' \trianglelefteq w' \,\&\, p(w'') \rightarrow w' \trianglelefteq w'')\}.$$

Then we can use this selection function to derive a satisfaction clause for $\ulcorner \phi > \psi \urcorner$ that does not depend on any perspectival normality ordering:

[9] Delgrande also assumes that the ordering is *forward connected*: If $w_1 \trianglelefteq w_2$ and $w_1 \trianglelefteq w_3$, then either $w_2 \trianglelefteq w_3$ or $w_3 \trianglelefteq w_2$.

(9) $[\![\phi > \psi]\!]^{\mathcal{M},w,\alpha} = 1$ iff $g(w, [\![\phi]\!]^{\mathcal{M},\alpha}) \subseteq [\![\psi]\!]^{\mathcal{M},w,\alpha}$

However, it is unclear what it would be to be a 'most normal world' in an unrestricted sense (cf. Pelletier and Asher 1997: 1144). For if we have not relativised normality on the basis of some background facts, then surely our world would be the most normal in virtue of being the only one. And in this case the normality conditional collapses into the material conditional (or a trivalent counterpart). Or, if we allow that our world may not be most normal, what determines exactly how the worlds are ranked? At least with perspectival normality orderings, we have the beginnings of a story to tell about these questions. Background information, known or unknown, determines normality orderings; alternative backgrounds allow for normality that departs from actuality. Given these considerations, we shall stick with comparative, perspectival normality orderings.

2.6 Uniqueness

It is interesting to consider whether any additional restrictions should be placed on our selection function. For example, for all that we have said, there could be many equally normal p-worlds relative to w. That is, the image of $*(w,p)$ may contain multiple worlds. But we might think that there is always a most normal way for p to obtain, and so we might want the selection function to select a singleton set that designates the most normal p-world relative to w. To capture this, we could impose the following condition:

Uniqueness. For any world w and proposition p, $\exists! w' : w' \in *(w,p)$.

That is, for any world–proposition pair $\langle w, p\rangle$, there is exactly one world where p holds along with everything else which, at w, is normally the case where p holds. Correspondingly, we can refine the selection function $f : W \times \wp(W) \mapsto \wp(W)$ as follows:

$$f(w,p) = \{w' : p(w') \;\&\; \forall w'' \in W : p(w'') \to w'' \not\leq_w w'\}.$$

Then, given this new selection function, we can define a new satisfaction clause for $\ulcorner \phi > \psi \urcorner$:

(10) $[\![\phi > \psi]\!]^{\mathcal{M},w,\alpha} = 1$ iff $f(w, [\![\phi]\!]^{\mathcal{M},\alpha}) \subseteq [\![\psi]\!]^{\mathcal{M},w,\alpha}$.

In English: a normality conditional $\ulcorner \phi > \psi \urcorner$ is true at a world w iff the most normal $[\![\phi]\!]$-world relative to w is a $[\![\psi]\!]$-world. Then, a generic of the form $\ulcorner \forall v[\xi v > \zeta v] \urcorner$ is true at a world w iff for every individual $\delta \in D$, the unique most normal $[\![\xi\underline{\delta}]\!]^{\mathcal{M}}$-world is a $[\![\zeta\underline{\delta}]\!]^{\mathcal{M}}$-world.

It is unclear whether anyone defends this semantics in the literature, although Delgrande (1987a: 343) seem to define a "world-selection function f" with which to analyse $>$ that fits the uniqueness assumption. But there is very good reason not to take this path. Uniqueness is an extremely undesirable principle for normality conditionals and generics, because the resulting models validate the following principle:[10]

NEM. For any ϕ, ψ, the sentence $\ulcorner (\phi > \psi) \vee (\phi > \neg\psi) \urcorner$ is true.

I submit that NEM should be invalid for conditional logics for normality. To see this, suppose we have a fair coin — call her 'Penny' — who, like a good fair coin, lands heads just as many times as she lands tails. Consider the following sentence formalised in $\mathcal{L}_>$:

(11) [flipped(penny) > heads(penny)] $\vee$ [flipped(penny) > tails(penny)]

In English: 'If Penny is flipped, then she normally lands heads, or if Penny is flipped, then she normally lands tails'. This sentence is clearly false: it is equally normal for

[10] NEM is structurally equivalent to conditional excluded middle, a popular, albeit not uncontroversial, principle in conditional logic; see Stalnaker (1968); Stalnaker and Thomason (1970); Lewis (1973); Williams (2010); Klinedinst (2011), for related discussion. Without recanting the arguments for or against CEM, I wish to note that analogous considerations apply to conditional logics for normality. I consider a related principle in connection with genericity in Chapter 3.

Penny to land heads as it is for her to land tails, and so the proposition that, when flipped, she normally lands heads (tails) does not obtain.

Now, on the uniqueness-based semantics, the sentence 'If Penny is flipped, then she normally lands heads' is true at w just in case Penny lands heads in the most normal world in which Penny is flipped. Given Uniqueness, there is exactly one most normal world relative to w and to Penny's being a fair coin, and so either this world is one in which Penny lands heads or it is not. If the former, then the first disjunct of (11) is predicted to be true; if the latter, then the second disjunct of (11) is predicted to be true. Either way, (11) is predicted to be true, contrary to our judgment. Consequently, the Uniqueness-based semantics is empirically inadequate.

Contrastingly, the AMP semantics coheres with our judgment. Unlike the uniqueness-based semantics, the AMP semantics does not predict that (11) is true. According to the AMP semantics, the first (second) disjunct is true in w iff the set of most normal Penny-flipped-worlds relative to w fall within the worlds where she lands heads (tails). But there is no guarantee that the most normal Penny-flipped-worlds are uniform with respect to how she lands. Indeed, upon reflection, one would expect that she lands heads in half of the selected worlds, and tails in the other half. Consequently, the AMP semantics does not predict that (11) is true.

Of course, it is open to proponents of Uniqueness to argue that, where others see genuine ties for the most normal worlds in the normality orderings, there is actually indeterminacy. That is, rather than having (at least) two worlds tied for the most normal Penny-flipped-worlds, any individual normality ordering is perfectly clear that there can be only one such world. Instead, there are multiple candidate orderings, and our linguistic practices and context simply do not determine a unique ordering to be in play.

Suppose that there are two candidate comparative normality orderings, $\leq_w^1$ and $\leq_w^2$, and the context cannot decide between them. Let $\leq_w^1$ rank a Penny-landingheads-world as the most normal, and let $\leq^2_w$ rank a Penny-landing-tails-world as most normal. Then there will be two selection functions in play that the context cannot decide between. Write '$f_{\leq^i_w}$', for the selection function determined on the basis of the i^{th} normality ordering for w. Then we say that $\ulcorner \phi > \psi \urcorner$ is *supertrue* at a world w iff it is true for every contextually salient normality ordering:

(12) $[\![\phi > \psi]\!]^{\mathcal{M},w,\alpha} = 1$ iff $f_{\leq^i_w}(w, [\![\phi]\!]^{\mathcal{M},\alpha}) \subseteq [\![\psi]\!]^{\mathcal{M},w,\alpha}$, for every contextually salient normality ordering $\leq^i_w$.

This resolves the problem above, since the first (second) disjunct in (11) will be false on $\leq^2_w$ ($\leq^1_w$), and so it will fail to be supertrue. By similar reasoning, it will also fail to be superfalse. Our intuitions are then vindicated, since the disjunction will inherit those truth-value gaps.[11]

Unfortunately, this line of argument is suspect when considering conditional logics for normality. For while one may concede that our grasp of normality is limited, it is surely part of the concept of a fair coin that it does not normally land one way over the other. For example, if a coin normally lands heads, one would be hard pressed to call it a fair coin. If this thought is correct, then it is plausible that there are genuine ties for the most normal worlds, something that the Uniqueness-based semantics does not permit. Furthermore, consider a particular uniqueness-based selection function and world that it demarcates as the most normal world where Penny is a fair coin. This world will either be a world where Penny lands heads or a world where Penny lands tails. But in either case, Penny has a hard time claiming that she is a fair coin, when she only lands one way. Consequently, even with the tools of indeterminacy, Uniqueness should be rejected.

[11] For a fuller discussion of this kind of strategy, albeit in the conditionals literature, see, for example, van Fraassen (1974), Lewis (1973: 91–95).

2.7 The Limit Assumption

So long as we restrict ourselves to the finite case, we can provide an equivalent semantics for the normality conditional that bypasses selection functions altogether and deals directly with the comparative normality ordering. This is the kind of account that is sketched in Krifka et al. (1995), which is in turn based on the accounts of modality developed in Kratzer (1977, 1981, 1991, 2012) and Heim (1982).[12] According to this account, the satisfaction clause for the normality conditional are then given with respect to this model as follows:

(13) $[\![\phi > \psi]\!]^{\mathcal{M},w,\alpha} = 1$ iff: (i) there is no world w' such that $[\![\phi]\!]^{\mathcal{M},w',\alpha} = 1$,

or

(ii) there is a w' such that $[\![\phi]\!]^{\mathcal{M},w',\alpha} = 1$ and, for every w'', if $w'' \leq_w w'$, then $[\![\phi \rightarrow \psi]\!]^{\mathcal{M},w''\alpha} = 1$.

In English: $\ulcorner \phi > \psi \urcorner$ is true at a world w iff either (i) ϕ is not true in any world, or (ii) there is a world w' where ϕ is true and, for every $[\![\phi]\!]^{\mathcal{M},\alpha}$-world no more abnormal than w', if ϕ is true at there, then ψ is true there as well. In the finite case, this semantics is as good as the AMP semantics. Then the truth-conditions for a generic of the form $\ulcorner \forall v[\xi v > \zeta v] \urcorner$ are as one would expect. For ease of reference, call this the *Krifka et al.* semantics.[13]

However, the adequacy of these truth-conditions becomes doubtful when we look into the infinite. For all we have said, there may be infinite sequences of ever more normal p-worlds relative to w without limit, no most normal p-world relative to w in sight. Then, on the AMP semantics, any normality conditional whose antecedent expresses p will be true in w regardless of what its consequent is. Contrastingly, Krifka

[12] This account is also similar to David Lewis's (1973) influential treatment of counterfactuals.
[13] Here I am simplifying away from some details in Krifka et al. (1995), who relativise their semantics to *two* conversational backgrounds: a modal base and an ordering; see Section 2.8, for more discussion.

et al.'s semantics predicts that the conditional is true in w, just so long as there comes a point where its consequent worlds all the way down, that is, for some p-world, every p-world more normal than it relative to w agrees that the proposition expressed by the consequent is true.

Proponents of the AMP semantics may resolve the problem by imposing an extra constraint on ordering models that prohibits infinitely descending chains of increasingly more normal worlds without end.

Limit Assumption. For any proposition p and world w, there is at least one p-world w' such that no other p-world is more normal (with respect to p and w) than w'.[14]

Do we have the right to make the Limit Assumption? Are there cases that conceivably involve infinitely descending chains of increasingly more normal worlds? Consider the following case: Suppose that the average height of some population is 175 cm and that closeness-to-the-average is the contextually-salient notion of normality. Consider a normality conditional with the antecedent 'John is taller than average', where 'John' refers to an arbitrary individual.[15] It follows that the closer John's height is to 175 cm at a world, the more normal that world is in that respect. Suppose that in some world—say w_1—John's height is 180 cm. Keeping other possible sources of variation on the parameters of normality constant, if there were no worlds where John's height is closer to 175 cm than in w_1, then w_1 is the most normal world (with respect to John's height) where John is taller than average. But there are infinitely many possible worlds where John's height gets ever closer to 175 cm without meeting it. For example, consider w_2 where John's height is $179\frac{1}{2}$ cm, or w_3 where John's height is $179\frac{1}{3}$ cm.

[14] The term 'Limit Assumption' is due to David Lewis (1973) and his related discussion for counterfactuals. For further discussion of the Limit Assumption as applied to generics, see Boutilier (1994b,a).

[15] Arbitrary objects are frequently used in mathematics and philosophy, and are philosophically defensible; see Fine (1985). For those wishing to make use of arbitrary objects without excessive ontological commitments, see Breckenridge and Magidor (2012).

More generally, for any world w where John's height is some real value m, such that $179 < m$, there is a more normal world w' where John's height is some real value n, such that $179 < n < m$. Consequently, we have no right to assume that there will always be a most normal world relative to some world–proposition pair $\langle w, p \rangle$.

Here's another example. Suppose that the average human height is 175 cm, as illustrated by the following normal distribution curve in Figure 2.1. Consider a normality conditional with the antecedent 'The average height is greater than it actually is'. Such a sentence requires us to consider worlds with a normal height distribution involving a greater mean than that of Figure 2.1 but with the same variance. Since height is continuous, for any such world w with such a distribution d, there is some other world w' whose normal height distribution d' has a greater mean than that of Figure 2.1, but less than d. Since a less exceptional normal height distribution is plausibly one that is closer to the normal height distribution at the actual world, for any world w where the normal height distribution d is greater than it actually is, there is some more normal world where the normal height distribution is less than d. And so on without end. Consequently, we are not entitled to assume that there is a most normal world where the average height is greater than it actually is. It follows that violations of the Limit Assumption are conceivable, and so these kinds of examples raise doubt about the viability of the Limit Assumption. In turn, this is enough to raise some doubts about the empirical adequacy of the AMP semantics.

However, things are not all that rosy for Krifka et al.'s semantics either. Consider the following principle:

Generalised Consequence Principle. If Γ is a set of sentences such that $\ulcorner \phi > \psi \urcorner$ is true for each $\psi \in \Gamma$ and if Γ entails χ, then $\ulcorner \phi > \chi \urcorner$ is true.[16]

The intuitive case for GCP may be stated as follows. First note that everyone should

[16] Pollock (1976) and Herzberger (1979) embrace and defend the counterfactual version of GCP, which is derived from substituting '$\Box\!\!\rightarrow$' for '$>$' in the above schema, and argue that it does not hold in Lewis's semantics for counterfactuals. My arguments here draw on their work.

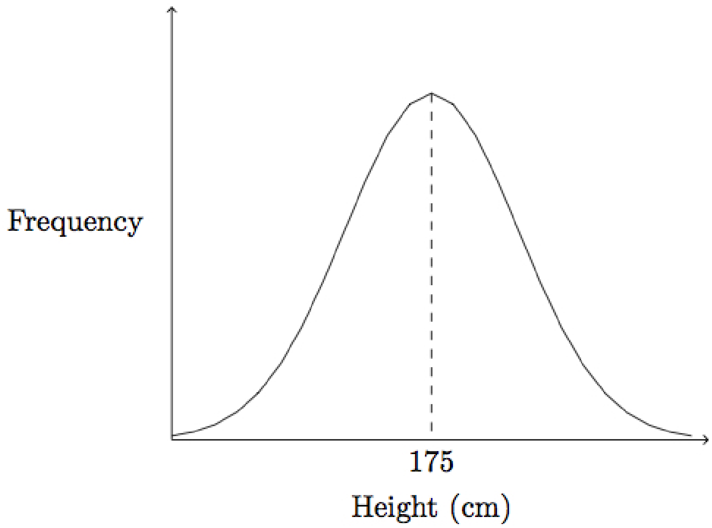


Figure 2.1: Theoretical Distribution of Average Human Height

agree with the following two claims:

$$\text{If } \ulcorner \phi > \psi \urcorner \text{ and } \psi \text{ entails } \chi, \text{ then } \ulcorner \phi > \chi \urcorner.$$

$$\text{If } \ulcorner \phi > \psi_1 \urcorner, \ldots, \ulcorner \phi > \psi_n \urcorner \text{ and } \psi_1, \ldots, \psi_n \vDash \chi, \text{ then } \ulcorner \phi > \chi \urcorner.$$

Generalising from these claims, we get the following principle:

Finite Consequence Principle. If Γ is a finite set of sentences such that $\ulcorner \phi > \psi \urcorner$ is true for each $\psi \in \Gamma$, and if Γ entails χ, then $\ulcorner \phi > \chi \urcorner$ is true.

The idea is that the Generalised Consequence Principle should enjoy the same intuitive appeal as the Finite Consequence Principle. For why should we think that premise closure holds in the finite case and not in the infinite case? More specifically, deductive closure for infinite premise sets should have the same intuitive basis as deductive closure for finite premise sets. For if you think that deductive closure holds for finite premises sets, why think it does not hold for infinite premise sets? Consequently, we should embrace GCP on the same basis as FCP, in the absence of a good reason to the contrary.

Unfortunately, the Krifka et al. semantics predicts that GCP can fail.[17] Recall the case from earlier involving a normality conditional with the antecedent 'John is taller than average', where 'John' refers to an arbitrary individual. Krifka et al.'s semantics requires us to consider the worlds in which John is taller than average height, where the average height is fixed by the actual world at 175 cm. Supposing that the only way these worlds differ is in John's height, then we may plausibly rank these worlds in accordance with how normal or exceptionless John's height is. That is, we will rank these worlds in accordance with how close to the average John's height is in each of these worlds. However, no matter how close to the average that John's height is, there is some less exceptional world where John is closer still to the average height. That means that for any height of real value m greater than 175 cm, there is a world in which John is taller than average height and is not m cm tall which is more normal than any world in which that individual is m cm. The Krifka et al.'s semantics predicts that the conditional 'John is taller than average $>$ John would not be m cm', is true for any height m greater than 175 cm. Now consider the set of sentence Γ of the form 'John is not m cm tall' where m ranges over every value greater than 175 cm. Γ entails the sentence 'John is not taller than the average'. Applying GCP, we get the conditional "John is taller than average $>$ John is not taller than the average". However, this conclusion is not intuitively reasonable, nor is it true at any world in any ordering model. Furthermore, since 'John' is stands for an arbitrary object, we may abstract away from the particulars of this case and conclude that the Krifka et al.'s semantics predicts the generic 'People taller than average are not taller than average' is true. This conclusion is also highly counterintuitive. Proponents of Krifka

[17] Note that the notion of *logical consequence*, $\vDash$ deployed in GCP is defined for ordering models $\mathcal{M}$ for $\mathcal{L}_>$ in the standard way (here adapted from Asher and Morreau (1995: 314)):

Definition 2.7.1 (Logical Consequence)**.** Let Γ be a set of formulas, and let ϕ be a single formula. $\Gamma \vDash \phi$ just in case for all $\mathcal{L}_>$-models in $\mathcal{M}$, for all possible worlds w, and for all variable assignments α: if $[\![\gamma]\!]^{\mathcal{M},w,\alpha} = 1$ for every $\gamma \in \Gamma$, then $[\![\phi]\!]^{\mathcal{M},w,\alpha} = 1$.

et al.'s semantics must reject GCP to avoid these conclusions, but GCP is extremely plausible and independently well-motivated. This is enough to raise doubts about the empirically adequacy of Krifka et al.'s semantics.

What should we do? I believe that the way is to accept the Limit Assumption and adopt a certain amount of coarse-graining. Whenever recalcitrant infinitary case arise, we imitate the finite case by forcing coarse-grainedness on to the set of worlds. In actual use, we are rarely, if ever, interested in the fine-grainedness of height down to the exact real number. Instead, there is usually a contextually salient measure that partitions and rounds height to nearest contextually relevant unit, be they inches or centimetres or what not. With a suitable formal mechanism for implementing this idea, the fine-grained distinctions needed to that threaten the Limit Assumption will not arise.

2.8 Background Information

We may wish to expand on the ways that background information can affect the interpretation of generics from a single dimension to two dimensions. Following Kratzer (1977, 1981), we can distinguish between the following two contextual parameters relevant for the interpretation of modals like those in 'John must be in his office': the *modal base* and the *ordering source*:[18]

(i) *Modal base.* The first parameter specifies a set of worlds quantified over by the modal operator. The modal base may vary from world to world and the same sentence may be evaluated in terms of several different modal bases, each yielding a different interpretation. For example, the sentence 'John must in his office' may be evaluated with respect to an *epistemic* modal base according to which John's location is necessitated by a contextually-salient set of knowledge,

[18] Here I am holding fixed the quantificational strength of *must*.

a *deontic* modal base according to which John's location is a matter of some deontic requirement, and so on. Often the modal base is left unspecified and is provide by the context of utterance. But we can treat the modal base is an accessibility relation over worlds in our model.

(ii) *Ordering source*. The second parameter provides an ordering among possible worlds. Notice that on epistemic interpretation, the sentence 'John must be in his office' asserts that John is not in Timbuktu, but it does not rule out the existence of such worlds. Instead, these worlds are deemed to be not 'similar' enough to be taken into account when interpreting the proposition embedded under the modal. An ordering source formalises this intuition by providing a relation over the modal base.

By appealing to these notions, we may further constrain the selection functions of our ordering models so that they can only choose from a contextually restricted set of worlds. Let us write '$B(w)$' for the modal base at w and let our normality ordering be our ordering source. Then let $*\lfloor_{B(w)}(w,p)$ be the *restriction* of $*(w,p)$ to $B(w)$.[19] Formally:

Definition 2.8.1. (Restriction) $*\lfloor_{B(w)}(w,p) = \{w' \in B(w) : p(w') \;\&\; \forall w'' \in B(w) : p(w'') \rightarrow w' \leq_w w''\}$

We can always recover our original models by imposing the following condition on the new ordering models:

Universality $\forall w \forall p : *\lfloor_{B(w)}(w,p) = *\lfloor_W(w,p)$.

Appealing to a mixture of these backgrounds, we can account for a wide range of different interpretations of generics. Consider the following sentences:

(14) a. Turtles live for over one hundred years or more.

[19] Note that the present usage of 'restriction' deviates from its standard usage in mathematics.

b. Gentleman do not peel bananas in front of ladies. (adapted from Krifka et al. 1995: 53)

There are different ways we could interpret the sentences in (14a). Consider Koopa the turtle and consider any normal Koopa-turtle world. Given certain background information in which we take an Aristotelian perspective of what is the natural 'telos' of a turtle, we would evoke a deontic modal base in which everything goes as it should do for Koopa as a turtle. In such worlds, he lives to be 100. Against this background, (14a) comes out true. Contrastingly, if we consider the grim facts about how life proceeds for a turtle based on the actual statistics, we would evoke a more factual modal base that contains many worlds in which Koopa meets an early, grisly end. Against this background, (14a) comes out false. Similarly, consider (14b); this sentence may well be true against the right (or wrong) kind of deontic modal base, but when considered against a factual modal base in which the nouveau riche have ascended the social hierarchy, the sentence may well turn out false. In these ways, the background information and other contextual features, such as preceding discourse, fixes the relevant notion of normality in play.

Importantly, the semantics is deliberately vague about what the suitable standards of normality are and what determines them.[20] Nevertheless, we should have fairly intuitive idea of what such standards might be. Kratzer gives the example that, in the world we live in, people normally die when exposed to certain quantities of arsenic. To represent this kind of normality in a stereotypical conversational background, B, we might have it that all $w \in B(w_@)$ are worlds where everyone dies when exposed to a critical amount of arsenic. Since some people have managed to build a tolerance to arsenic $w_@ \notin B(w_@)$, B is not realistic. It should be noted that a world that is normal

[20] While providing an account of what determines suitable standards of normality is outside the scope of this chapter, one should expect that an adequate story would incorporate different standards for different types of things. For example, what is normal for biological kinds may depend on either statistical matters or what we find psychologically striking about them, while what is normal for artefacts may depend on their function; see, for example, Leslie (2007; 2008).

in one respect may be very abnormal in another, that is, a world where everyone dies when exposed to a critical amount of arsenic may be normal with respect to how people normally react to arsenic, but abnormal with respect to the *quantity* of people that die when exposed to a critical amount of arsenic. This suggests that context plays an important role in determining what kind of normality — what modal base and ordering on this base — is relevant in evaluating a sentence.

2.9 Generics and Existence

Some generics are true even if there are no actual supporting instances. Consider the following sentences

(15) a. Orange Crusher 3000s crush oranges.

b. Mary handles the mail from Antarctica.

c. Members of this club help each other in emergencies.

These sentences may be true even if (i) every OC3000 has been destroyed in a factory fire, (ii) there has never been any mail from Antarctica, and (iii) there has never been any emergencies involving members of this club. Indeed, it seems to suffice for the truth of these sentences that the function of OC3000s is to crush oranges, that it is part of Mary's employment contract to handle Antarctic mail, and convention dictates that members of the club come to each others aid in emergencies.[21] Generic sentences like these do not carry an existence presupposition on their bare plural DPs.

The modal theory of generics allows us to handle the sentences in (15), but we must first say a little more about the background information that settles the model

[21] Some readers may struggle to access the true readings of these generics, especially if they have corrupted themselves through years of considering the existence presuppositions of, say, definite descriptions. To ease such readers in to these judgments, consider utterances of the (15) as responses to the questions 'What do OC3000s do exactly?', 'Hypothetical question: who handles the mail from Antarctica?', 'And what benefits will being a member of this club bring in, say, emergencies?'.

under consideration. Background information can inform generic generalisations in at least two ways: inductively or deductively. Inductively-derived generics are typically formed against a factual background of statistical facts. That is, they are the result of inferences from some specific occurrences of a certain type of event or behaviour by a certain number of individuals. Contrastingly, deductively-derived generics are typically formed against a non-realistic background information concerning certain rules, laws, or the essential natures of species or artefacts. That is, they are deduced from a number of rules of facts. Background information metamorphose subject to contextual features and linguistic practises, and so the interpretation of generics is affected accordingly.

To see how these ideas work in practice, let us consider (15a). When considering particular artefacts, it is natural to contemplate their purpose or function rather than probabilistic information about propensities. Such contemplations take us away from the confines of the actual world, and allow us to consider the state of affairs in those worlds where the OC3000s have not been destroyed by a factory fire. What are the worlds that our selection function chooses when it is fed the proposition that δ is an OC3000s and that it crushes something? Those worlds are ones in which oranges are the things that the OC3000 crushes. In (15a), the truth that OC3000s crush oranges is independent of actual orange crushing events only because of the facts concerning the internal structure of OC3000s and its function. We can derive the generalisation in (15a) by considering the *purpose* for which the machine was designed. Similar remarks apply to the other sentences in (15).

More formally, we can represent these differences within the formal semantic analysis by exploiting the effects that the contextual background information has in selecting the model — and, in turn, the selection function — against which the generic is evaluated. Against a factual background, the selection function may select worlds that agree with our own with respect to the causal and statistical dependencies and regularities, but may differ in isolated accidental facts. And, against other non-realistic backgrounds, the selection function may select other worlds that are more idealised in certain respects. A commonality between both backgrounds, and central to the approach taken here, is the rejection of Centering as general constraint on our selection function:

Centering. If $w \in p$, then $w \in *(w, p)$.

By rejecting Centering, we may turn a blind eye to the happenings of the actual world, where there are no OC3000s, mail from Antarctica, or emergencies concerning certain social clubs.

2.10 Normal Objects

One might wonder how speakers acquire the sophisticated knowledge of these counterfactual worlds, when all they have to go on is the world they are in. For example, for an arbitrary singular individual δ, how do we find out what would normally be the case when δ itself satisfies the property expressed by the monadic predicate ξ? We could try stressing the fact that δ must be a normal ξ, but it is unclear how normality orderings over worlds are supposed to translate to normality orderings over instances of properties. Instead of a world-orientated approach, one may be moved to base one's modal theory of generics around the notion of a normal object.

More carefully, the relevant notion that needs to be captured is that δ is a normal ξ when δ is a ξ and everything goes as it should ξ-wise. That is, a normal $\xi\underline{\delta}$-world is one where δ satisfies the property expressed by $\lambda x.\xi x$ and has the properties of a normal ξ. For example, a normal Tweety-bird-world would be a world where Tweety is a bird and has the properties of a normal bird, which presumably include flying, tweeting, and so on. It is difficult to characterise precisely how we know that a normal Tweety-bird-world is one where Tweety is a bird and has the properties of a normal bird rather than, say, that a normal Tweety-bird-world is one where Tweety is a bird and has the properties of a normal Tweety.[22]

Let us make the notion of the normal objects in a category formally precise by defining a family of functors (Eckardt 2000):

(16) $N_n : W \times (D_e)^n \mapsto W \times (D_e)^n$.

These functors map every n-ary property P on to their normal parts $N(P)$. That is, for any world w, $N_n(P)(w)$ is the set of all tuples $\langle a_1, \ldots, a_n \rangle$ that are normal P's in w.

One natural constraint on N would be that it maps a property to a subset of itself. That is, if $N_n(P)(w) = \langle a_1, \ldots, a_n, w \rangle$, then $\langle a_1, \ldots, a_n, w \rangle \in P$. The following constraint implements this idea:

Objectual Facticity For all w: $N(P)(w) \subseteq P(w)$

Now we can specify a semantics for the normality conditional that examines the most normal objects, rather than the most normal worlds. Then the satisfaction clause for $\ulcorner \phi > \psi \urcorner$ depends on ϕ:

(17) $[\![\phi > \psi]\!]^{\mathcal{M},w,\alpha} = 1$ iff :

$$\text{if } \langle [\![t_1]\!]^{\mathcal{M},\alpha}, \ldots, [\![t_n]\!]^{\mathcal{M},\alpha}, w \rangle \in N_n(w, [\![\Pi^n]\!]^M), \text{ then } [\![\psi]\!]^{\mathcal{M},w,\alpha} = 1.$$

where $\phi = \Pi^n t_1 \ldots t_n$. In English, (17) says: Take w and the meaning of the n-ary predicate Π^n as argument of the N functor, to get the normal Π^n's in w. Then the conditional is true if $[\![t_1]\!]^{\mathcal{M},\alpha}, \ldots, [\![t_n]\!]^{\mathcal{M},\alpha}$ are not normal Π^n's in w, or ψ is true.

[22] One proposal worth exploring further relies on the distinction between topic and comment in descriptive talk. Descriptive statements typically have an aboutness topic to them, that is, an entity that the sentence is about. For example, while the sentence 'Joanie loves Chachi' presumably has the same truth-conditions as the sentence 'Chachi is loved by Joanie', the former is about Joanie while the latter is about Chachi. Applying this idea to the problem in the main text, assuming a notion of topic-comment structure that leads to a structuring of propositions into a topic part and a comment part, we may say that the selection function from a world w and the proposition that Tweety is a bird takes us to the set of worlds where Tweety is a bird and has the properties of a normal bird, because the proposition has a topic–comment structure where 'Tweety' is the topic and 'is a bird' is the comment.

According to this approach, a generic sentence like (18a) will receive a logical representation as in (18b), and its truth-conditions relative to a model $\mathcal{M}$, world w, and variable assignment α are described in (18c):

(18) a. Ravens are black.

b. $\forall x[\text{raven}(x) > \text{black}(x)]$.

c. for all $d \in D$, if $\langle [\![x]\!]^{\mathcal{M},\alpha[x/d]}, w\rangle \in N_n(w, [\![\text{raven}]\!]^{M})$,

then $\langle [\![x]\!]^{\mathcal{M},\alpha[x/d]}, w\rangle \in [\![\text{black}]\!]^{\mathcal{M}} = 1$.

In English: (18a) is true at w iff for every individual x, if it is a normal raven in w, then it is black.

This adequately captures the notion of normal objects that we sketched at the start of this section. However, as stated so far, there is a problem with the theory: it is too extensional. Recall that generic sentences like the following may be true, even though there are no actual instances:

(19) (=(15b)) Mary handles the mail from Antarctica.

This sentence may well be true, even though there has never been any mail from Antarctica. The analysis proposed in (17) makes this prediction, but only vacuously, since the set of normal letters from Antartica is empty. Unfortunately, vacuous truth proliferates throughout the system: if (19) is vacuously true, then so is 'Mary eats the letters from Antarctica'. This is an undesirable result.

Instead, to capture the intensional component of generics, we must rule out universal statements that are true by accident, and rule sensibly about generics that express generalisations about things that are yet to occur. To account for these aspects of generics, let us introduce a binary equivalence relation $\approx$ over possible worlds that is intended to single out those worlds that are relevant in the evaluation of a generic sentences.[23] More formally, $\approx$ is an accessibility relation between possible worlds such that for some world w, the $\approx$-accessibility worlds are those that are like w "with respect to causal and statistical dependencies and regularities, but may differ from w in isolated accidental facts" (Eckardt 2000: 243). Eckardt writes:

> While * selects *better* worlds than ours, $\approx$ accesses those worlds which behave *like* our own. These need not be more normal in any way, but may differ with regard to facts that are relevant for our generic beliefs. (Eckardt 2000: 243)

To incorporate the notion of dispositional worlds into our theory, we must extend our language once more. Let $\mathcal{L}_{>}^{+} = \mathcal{L}_{>} \cup \{\circledast\}$ be the augmentation of $\mathcal{L}_{>}$ with a unary modal operator $\circledast$, which as the following formation clause:

$$\text{If } \phi \text{ is a formula, then } \ulcorner \circledast\phi \urcorner \text{ is a formula.}$$

We can directly provide a satisfaction clause for $\ulcorner \circledast\phi \urcorner$ as follows:

(20) $[\![\circledast\phi]\!]^{\mathcal{M},w,\alpha} = 1$ iff for every world u, if $u \approx w$, then $[\![\phi]\!]^{M,u\alpha} = 1$

In English: $\ulcorner \circledast\phi \urcorner$ is true in a world w iff ϕ is true in every world u $\approx$-related to w.

We can then reconfigure the logical representation for generics and give new truth-conditions as follows:

(21) a. Ravens are black.

b. $\circledast\forall x(\text{raven}(x) > \text{black}(x))$.

[23] Alice Drewery (1998) proposes an account that is similar to Eckardt's in many respects, although Drewery relativises her equivalence relation $\sim$ to a predicate and defines it as follows:

$$w_1 \sim_{\Pi^n} w_2 \Leftrightarrow_{\text{df}} N_n(w_1, [\![\Pi^n]\!]^{\mathcal{M}}) = N_n(w_2, [\![\Pi^n]\!]^{\mathcal{M}})$$

In English: w_1 is $\sim_{\Pi^n}$ w_2 just in case the normal Π's in w_1 are the same as the normal Π's in w_2. (Here I am abstracting away from some subtleties of Drewery's account, but they are not relevant for my point.) It should be clear from this definition that Drewery's account cannot account for sentences like (19).

c. for all $u \in W$, if $u \approx w$, then: for all $d \in D$, if $\langle [\![x]\!]^{\mathcal{M},\alpha[x/d]}, u\rangle \in N_n(u, [\![\text{raven}]\!]^{M})$,

$$\text{then } \langle [\![x]\!]^{\mathcal{M},\alpha[x/d]}, u\rangle \in [\![\text{black}]\!]^{\mathcal{M}} = 1.$$

In English: (21a) is true at w iff for every $\approx$-related world u to w, the normal ravens at u are black at v. This improved account overcomes the problem of intensionality raised above because, while our world may not be one with letters from Antarctica, there are worlds that behave just like ours with respect to causal and statistical dependencies and regularities except they *do* have mail from Antarctica, and in those worlds Mary handles it.

This concludes my exposition of the normal objects version of the modal theory.[24] At this point, I do not wish to adjudicate between the present semantics and the AMP selection function approach introduced above. Instead, I want to turn to the problematic generics from the introduction to see how these two theories handle themselves.

2.11 Accommodation

Recall the first pair of sentences from the introduction:

(1) a. Ducks lay eggs.

b. Cardinals are red

Historically, these sentences have been taken to be particularly problematic for the modal theory, since it is a majority-based theories of generics, it is a theory according to which the truth of a generic sentence requires that the majority of some contextually

[24] There are some subtleties that I have ignored. Eckardt's full theory introduces another range of functors, which she calls ideality operators, that are supposed to handle ideal generics like 'Turtles live for 100 years old or more'. Where Eckardt proposes lexical ambiguity, the AMP semantics permits the background information to select different models, and hence different selection functions.

restricted domain of individuals have the relevant property in question. (1a) and (1b) are true, even though less than half of ducks lay eggs — namely, the subset of those fertile female ducks of reproductive age — and only male cardinals are red — the females are a pale brown with reddish tinges on their wings, tails and crest.

The problem is that the versions of the modal theory sketched thus far make incorrect predictions about the truth-conditions of these sentences. For example, they predict that (1a) is true just in case all normal ducks lay eggs, and that (1b) is true just in case all normal cardinals are red. But on the assumption that our truth-value judgments are veridical, the modal account incorrectly predicts that the sentences in (1a) are false, since there are normal male ducks that do not lay eggs, and there are normal female cardinals that are not red. These predictions are empirically inadequate.

Numerous solutions to this proposal have been offered. The basic idea behind these solutions is that the antecedents of the normality conditionals in the logical representation of (1) are somehow contextually restricted and they exclude male ducks and female cardinals respectively. Different theorists offer different mechanisms behind this approach. Some suggest that Lewis's (1979) ideas on accommodation and von Fintel's (1994) ideas on quantificational domain restriction are relevant. Others propose that the partitioning of sentence material into an antecedent and a consequent is sensitive to focus, prosody, and topic–comment structure (cf. Partee 1991b; Krifka 1995; Rooth 1995; Chierchia 1998). Further theorists suggest that the antecedent contains a contextual variable which is filled by a disjunction of contextually-salient alternatives to the consequent (cf. Cohen 1997; Asher and Pelletier 2013). In this section, I propose one implementation of the last idea.

The basic idea is that the antecedent of the logical representation of a generic has a free context variable C, the value of which is determined by the focus, prosody, and topic–comment structure of the sentence. According to this approach, the logical representation of (1a) is something like the following:

(22) $\forall x[\text{duck}(x) \wedge C > \text{lays.eggs}(x)]$

How is the value of C determined? It is widely believed that, in addition to standard semantic content, utterances of sentences also carry information about their focused semantic value, which can be though of as a set of ordinary semantic values, except there is an existentially quantified variable in the position of the focused phrase. That is, we make think of the focus semantic value as a set of propositions which potentially contrast with the ordinary semantic value. Formally:

(23) a. $[\![[\text{John}]_f \text{ loves Mary}]\!]_f^{\mathcal{M},\alpha} = \{\lambda w.\text{loves}(x, m, w) : x \in D\}$.

b. $[\![\text{John loves } [\text{Mary}]_f]\!]_f^{\mathcal{M},\alpha} = \{\lambda w.\text{loves}(j, x, w) : x \in D\}$.

where '$[\![.]\!]_f^{\mathcal{M},\alpha}$' denotes is a function from sentences to their focus semantic value relative to a model $\mathcal{M}$ and variable assignment $\mathcal{M}$.[25]

A similar phenomenon occurs at the level of predicates, except the focused interpretation may be thought of a set of propositions representing the alternative properties that individual in question may satisfy other than one denoted by the predicate. These properties will achieve the same ends or are sufficiently similar in a contextually-determined way to the predicate-denotation. Consequently, the focused interpretation of (24) is as follows:

(24) $[\![\text{Daisy [lays eggs]}_f]\!]_f^{\mathcal{M},\alpha} = \{\lambda w.P(d, w) : P \text{ is a way of reproducing offspring}\}$

And we can make the mechanism work for open sentences as well:

(25) $[\![x \text{ [lays eggs]}_f]\!]_f^{\mathcal{M},\alpha} = \{\lambda w.P(\alpha(x), w) : P \text{ is a way of reproducing offspring}\}$

These kinds of meanings will help determine the value for C. But as things stand, they are the wrong kind of thing; we need propositions, not sets of propositions. To

[25] Unfortunately, providing a full compositional account of how the focus semantic value is determined is outside the scope of this chapter.

make these focus semantic values suitable for our purposes, we must transform them from sets of propositions into propositions using the familiar union operation from set theory:

(26) a. $\cup$ $[\![\text{Daisy [lays eggs]}_f]\!]_f^{\mathcal{M},\alpha}$

$= \cup\{\lambda w.P(d,w) : P \text{ is a way of reproducing offspring}\}$

$= \lambda w.\text{lays.eggs}(d,w) \vee \text{births.live.young}(d,w) \vee \ldots$

b. $\cup$ $[\![x \text{ [lays eggs]}_f]\!]_f^{\mathcal{M},\alpha}$

$= \cup\{\lambda w.P(\alpha(x),w) : P \text{ is a way of reproducing offspring}\}$

$= \lambda w.\text{lays.eggs}(\alpha(x),w) \vee \text{births.live.young}(\alpha(x),w) \vee \ldots$

With these kinds of meanings in place, we can informally state the proposal as follows: if S is a generic sentence, then the value for its context variable C will be the union of focus semantic value of S, abstracting out any material already contained in the antecedent. For example, the value for C in (22) will be (26b). Then, we can give the truth-conditions for (22) as follows:

(27) $[\![\forall x(\text{duck}(x) \wedge C > \text{lays.eggs}(x))]\!]^{\mathcal{M},w,\alpha} = 1$ iff:

for every $d \in D$

$$*(w, [\![x \text{ is a duck}]\!]^{\mathcal{M},\alpha[d/x]} \cap \cup[\![x \text{ [lays eggs]}_f]\!]_f^{\mathcal{M},\alpha[d/x]}) \subseteq [\![x \text{ lays eggs}]\!]^{\mathcal{M},\alpha[d/x]}.$$

In English: (1a) is true at a world w iff for every individual δ, for every world where δ is a duck that reproduces in some way, along everything else which, in w, would normally holds if δ were a duck that reproduces in some way, we find that δ lays eggs. These truth-conditions are intuitive adequate.

In sum, by allowing the antecedent of the generic's logical representation to be sensitive to further contextual features, the modal theory can comfortably handle the first set of supposed problematic sentences.

2.12 Mosquitos and Shark Attacks

To conclude, I want discuss a final piece of data that has received much attention in the philosophical literature. Recently, Sarah-Jane Leslie (2007; 2008) has revived an old class of generics such as those in (28), rebranding them 'striking property' generics and claiming that they are problematic for every extant view of generics except for her own:

(28) a. Mosquitos carry the West Nile virus.

b. Sharks attack bathers.

c. Pitbulls maul children.

d. Tigers eat people.

Leslie attests that each of these generics is intuitively true, despite the fact that very few members of the kind in question possess the predicated property: (12a) is taken to be true, even though less than 1% of mosquitos carry WNV.[26] Leslie writes:

> These generics are true even though the vast majority of Ks are exceptions to the generalization. [Striking property generics] have something in common; in all of them, the sentence attributes harmful, dangerous, or appalling properties to the kind. More generally, if the property in question is the sort of property of which one would be well served to be forewarned, even if there were only a small chance of encountering it, then generic attributions of the property are intuitively true. We see a similar phenomenon elsewhere in our judgements: compare the number and regularity of times one must worry to be a worrier versus the number of murders one must commit to be a murder. (Leslie 2008: 15)

[26] A variation on the theme: Many people judge the sentence 'Mosquitos carry malaria' to be true, but the fact is that out of approximately 3,500 species of mosquitoes grouped into 41 genera, human malaria is transmitted only by females of the genus *Anopheles*. Moreover, of the approximately 430 *Anopheles* species, only 30-40 transmit malaria in nature.

Leslie continues:

> It should be evident upon reflection that the criteria that govern troublesome generics reflect our psychology. It is especially evident [with striking property generics]: the more striking, appalling, or otherwise gripping we find the property predicated in the generic, the more tolerant the generic is to exceptions. For [such sentences], it appears that it is sufficient for the truth of the generic that just *some* of the members of the kind have the property in question. (Leslie 2008: 15)

Some proponents of the modal theory insist that it *can* handle such sentences, so long as the finessing of logical representations is permitted. For example, Asher and Pelletier (2013: 331) argue that a generic like (28a) expresses that, *in appropriate circumstances*, mosquitos *do* normally carry the WNV, and they propose to capture this with the following logical representations that generic predication over both individuals and eventualities:

(31) $\forall x(\text{mosquito}(x) > \forall e(C(e) > \text{carry the WNV}(x, e)))$.

However, there is another line that one could take that relies on the fluid nature of background information. Following Sterken (2015a), I believe that the most plausible account of striking property generics involves an error theory according to which our truth-value judgments are systematically skewed by our cognitive biases. Sterken writes:

> such cognitive biases interfere with how we form beliefs about the world, causing us to have incorrect beliefs—in this case, speakers exhibit a certain *blindness or ignorance about the world.* [...] this demonstrated bias can be treated as impacting the truth-conditions of generic sentences (Leslie's view) or as merely impacting our judgments about the truth of such sentences. (Sterken 2015a: 82)

One way to develop Sterken's suggestion is to suppose that striking property generics are analysed against an *doxastic* modal base, one that is populated by worlds compatible with our misinformed beliefs. Then given the widespread misinformation about the prevalence of WNV in mosquito populations and shark attacks, and the possibility that cognitive biases have misshaped our judgments about the world, we should expect that our doxastic modal bases are neither faithful to actual statistical facts nor the telos of the species involved. If generics are interpreted against such misinformed modal bases, then it is no surprise that we often judge the sentences in (28) as true.

Some evidence in favour of this approach is the lack of consistency that Leslie's data exhibits. For example, many striking property generics are not judged to be true, despite sharing similar distribution patterns. Consider the following sentences:

(32) a. Hippopotamuses attack people.

b. Coconuts kill people.

My informants report that (32a) and (32b) seem false on a generic reading, at least when uttered in isolation. But attacking and killing people are exactly the kinds of properties that would be striking, if anything is. Moreover, the counterinstances — those hippos and coconuts that do not attack or kill people — presumably are appropriately negative. That is, there is no other perceptually salient or striking property that non-murderous hippos or coconuts have. Consequently, Leslie's theory should predict that these sentences are true and is thus empirically inadequate. Contrastingly, on the suggestion under consideration, the modal bases against which the sentences in (32) are evaluated are not subject to misinformation about the prevalence of hippo- or coconut-related deaths, and so they correctly predict that these sentences are false.

In summary, it is possible that when we judge the sentences in (28) true, but the sentences in (32) false, we are simply bringing different doxastic backgrounds and biases to the table that colour our evaluation. It is exactly these kinds of contextual influences that the modal theory, as I have outlined it, embraces. While I do not take myself to have completely disarmed objections from striking property generics, I do believe that I have drawn sufficient doubt on their dialectical power to warrant further investigation of the modal theory.

2.13 Conclusion

To conclude, I have surveyed the modal theory of generics and defended two implementations: Asher, Morreau, and Pelletier's semantics and Eckardt's semantics. Along the way I have canvased a wide range of generic sentences, and illustrated how these views comfortably handle them, including those sentences held to be particularly problematic among philosophers. This sets the stage for the rest of the thesis. The remaining chapters defend certain aspects of the modal theory from recent objections, such as its commitment to a majority-based semantics or a quantificational logical form, and develop the theories outlined here.

Chapter 3

Generic Excluded Middle

3.1 Introduction

This chapter concerns the semantic analysis of characterising sentences, sometimes called generic sentences or *generics* for short, such as those in (1).[1,2]

(1) a. Ravens are black.

b. A duck lays eggs.

c. The tiger has stripes.

d. This kind of animal has a mane. [Uttered while pointing at a lion.]

Generics manage to express generic generalisations about groups of particular events, facts, or individuals without the presence of an overt or articulated quantifier or operator appearing to be responsible for expressing this content. For example, (1a)

[1] It need scarcely be added that the philosophical interest in generic sentences continues to grow. For recent examples, see Leslie (2007, 2008); Liebesman (2011); Haslanger (2011, 2014); Nickel (2008, 2010b, 2016); Sterken (2015a,b).

[2] This chapter focuses mainly on bare plural generics of the form ⌜Fs are G⌝, and sets aside generics involving definite and indefinite determiners like ⌜The F is G⌝ and ⌜An F is G⌝. The meanings of these sentences differ from bare plural generics in subtle ways that put them beyond the scope of this chapter.

expresses a generalisation about ravens that is similar, say, to that which is expressed by *Ravens are generally black*, even though it does not contain any explicit quantificational adverb, like *generally*. The lack of a dedicated, phonologically articulated generic operator is no quirk of English either: no known language has such a generic operator.

Nevertheless, the standard view of generic sentences is that their logical form is essentially quantificational. That is, despite the lack of any overt or pronounced elements that are responsible for their general content, generics have a tripartite logical form involving a quantifier, a restrictor clause, and a matrix clause (which is sometimes called its 'nuclear scope'), akin to explicitly quantificational sentences like *Ravens are generally black*. To bridge the theoretical gap between generics and sentences containing overt quantifiers, theorists posit a covert, unpronounced generic operator called 'Gen' that is responsible for the general content of generics.[3]

However, some theorists have recently questioned the standard quantificational approach and revived a competing proposal. According to this proposal, generics are akin to sentences which genuinely express kind-level predications, such as those in (2), and do not involve quantification or covert material in their logical form.[4]

(2) a. Dodos are extinct.

b. Potatoes were cultivated in South America.

This view has received a lot of recent attention and the arguments must be considered by the followers of the standard view.

The central aim of this chapter is to provide a novel argument in favour of the quantificational approach to generics, and against the kind-predication approach. More specifically, I argue that the kind-predication approach either collapses into a

[3] For a comprehensive survey of proponents of the quantificational view, see Krifka et al. (1995); Pelletier and Asher (1997); Mari et al. (2013b).

[4] For proponents of the kind-predication view, see Lawler (1972); Dahl (1975); Carlson (1977b,a); Liebesman (2011); Teichman (2015, 2016). For critical discussion of some other shortcomings of this view, see Krifka et al. (1995); Leslie (2015).

form of the quantificational approach, or else it garners unpalatable metaphysical commitments.

The chapter is structured as follows. Section 3.2 outlines the logical forms postulated by the quantificational and kind-predicational approaches. Section 3.3 argues that a novel principle concerning generics, *Generic Excluded Middle* (GEM), is invalid and draws out the consequences for the two approaches.[5] In particular, I argue that the kind-predication approach erroneously predicts that GEM is valid. Section 3.4 argues that, to avoid validating GEM, the kind-predication approach must either admit covert quantificational structure or else accept some unpalatable metaphysical commitments. Section 3.5 outlines some constraints that the invalidity of GEM places on the quantificational approach. Section 3.6 concludes.

3.2 Generics and Quantificational Structure

Let us begin by carefully distinguishing the logical forms that the quantificational and kind-predication approaches postulate for generics. According to the quantificational approach, the logical form of generic sentences is a tripartite quantificational structure consisting of a phonologically null sentential quantifier called 'Gen' which is analysed as an adverb of quantification in the style of Lewis (1975).[6] More specifically, the Gen operator relates two open sentences called the restrictor clause and the matrix clause. The matrix clause makes the main assertion of the generic sentence, specifying the property attributed to the relevant members of the domain. The restrictor clause states the restricting cases relevant to the matrix. The Gen operator unselectively binds over any free variables in its scope, whether they be individuals, situations,

[5] To the best of my knowledge, GEM has only been discussed in one other place, namely, von Fintel (1997), in which von Fintel advocates a version of the principle. See Section 3.5.2 for discussion of von Fintel's proposal.

[6] A minority of theorists treat Gen as a quantificational determiner (e.g., Pelletier and Asher 1997). Since, the differences between the adverbial treatment and the determiner treatment of Gen are irrelevant for present purposes, I focus on the adverbial treatment throughout.

worlds, or events. The variables it binds depends on the particular analysis in question. Consequently, the general logical form of generics will be given as in the following schema (cf. Krifka et al. 1995: 26ff.):

(3) Gen $x_1 \ldots x_i$[Restrictor$(x_1, \ldots, x_i)$][$\exists y_1 \ldots y_j$ Matrix$(\{x_1\}, \ldots, \{x_i\}, y_1, \ldots, y_j)$]

where $x_1, \ldots, x_i$ are the variables to be bound by Gen, $y_1, \ldots, y_i$ are the variables to be bound existentially with scope just in the Matrix, $\phi[\ldots x_m \ldots]$ is a formula where x_m occurs free, and $\phi[\ldots \{x_m\} \ldots]$ is a formula where x_m possibly occurs free.

While we have not yet provided a semantic interpretation to the above notation, nor tied it directly to the syntax, this schema provides us with a useful means to represent various readings of characterising sentences. Indeed, a compelling piece of linguistic evidence in support of the quantificational analysis comes from Carlson's observation that some sentences appear to have more than one generic interpretation (Carlson 1989). For example, there are two salient generic interpretations of the sentence in (4), which may be represented as follows:

(4) Typhoons arise in this part of the Pacific.

   a. Typhoons in general have a common origin in this part of the Pacific.
      Gen $x; y$[typhoons(x)][$y =$ this.part.of.the.Pacific $\wedge$ arise.in(x, y)]

   b. There arise typhoons in this part of the Pacific.
      Gen x[$x =$ this.part.of.the.Pacific][$\exists y$(typhoons$(y) \wedge$ arise.in(y, x))]

The ambiguity in (4) is evidence for the quantificational approach, because quantified sentences often exhibit the same type of ambiguity. Moreover, the quantificational approach can accommodate the two readings of (4) by partitioning the surface material into the restrictor and matrix clauses in different ways. In (4a), the bare plural *typhoons* contributes material to the restrictor clause and the predicate *arise in this part of the Pacific* contributes material to the matrix clause; whereas in (4b), the demonstrative *this part of the Pacific* contributes material to the restrictor and the predicate *arise in* and the bare plural *typhoons* contributes material to the matrix.

What does the quantificational approach say about the semantics of Gen? Many semantic analyses have been proposed for the Gen operator, with proposals involving conditional probabilities, modal conditionals, default psychological generalisations, or existential quantification over ways of being normal.[7] Nevertheless, for present purposes, it is irrelevant which of these proposals is the correct semantic analysis for Gen.[8] What matters is that the logical form of characterising sentences is treated as quantificational. The only relevant factors are that (i) characterising sentences are assigned tripartite logical forms and (ii) Gen is treated as a quantifier.

Contrastingly, according to the kind-predication approach, the logical form of generic sentences is a simple dyadic subject–predicate structure, roughly equivalent to the logical form of atomic sentences that predicate properties of individuals. On this view, bare plurals refer to kinds and the sentence predicates a property of that kind. Consequently, characterising sentences of the schema (5a) receive the logical form (5b) as in:

(5) a. Fs are G

b. G(F-kind)

Proponents of the kind-predication approach draw a strong analogy between sentences involving genuine reference to kinds like in (6a) and generic sentences like in (7a), arguing that they have essentially the same logical form:

(6) a. Dinosaurs are extinct.

b. extinct(dinosaur-kind)

[7] See, for example, Cohen (1999a); Asher and Morreau (1995); Pelletier and Asher (1997); Asher and Pelletier (2013); Leslie (2007, 2008); Nickel (2008, 2016).

[8] Although see Section 3.5, for some discussion.

(7) a. Tigers have stripes.

b. striped(tiger-kind)

The kind-predication view is motivated by a number of considerations. First, proponents of the kind-predication approach claim that the lack of any phonological or orthographical realisation of Gen in any know language and its semantical intractability counts significantly against its existence (Carlson 1977a; Liebesman 2011).[9] Second, proponents of the kind-predication approach seek to provide a uniform treatment of sentences involving genuine reference to kinds and characterising sentences by generalising the treatment of the former to the latter. For example, given that the subject term of (6a) refers to a kind, they claim that, by parity of reasoning, the subject term in (7a) must also refer to a kind. Third, and relatedly, they claim that only the kind-predication approach can explain the semantics of generics involving complex copredications, like 'Mosquitos are widespread and irritating', which involve the co-occurrence of direct kind-predication and genericity (cf. Carlson 1977a; Liebesman 2011).

What does the kind-predication approach say about the nature of kinds and how they can be predicated properties usually reserved for first-order individuals? What is the nature of tiger-kind and how can it have the property of being striped when such properties seem to be satisfied only by first-order individuals like specific tigers? Proponents of the kind-predication approach sometimes claim that kinds are whatever are the referents of bare plural nouns and that providing an account of kind-predication is in the remit of metaphysics, not semantics.[10] Indeed, for present purposes, it is irrelevant what the nature of kinds is and whether kind-level predications reduce to quantificational facts about individual members of the kind. What matters is that the logical form of characterising sentences is treated as non-quantificational.

[9] Also, see Leslie (2007, 2008), for similar thoughts.

[10] See, for example, Liebesman (2011: 418).

The only relevant factors are that (i) characterising sentences are assigned bipartite, subject–predicate logical forms, (ii) bare plurals denote kinds typed as (higher-order) individuals, and (iii) a characterising sentence is true iff the kind has the property in question.

Determining whether the kind-predication approach or the quantificational approach is correct is a delicate task. In what follows, I will attempt to adjudicate between the above theories by appealing to the invalidity of Generic Excluded Middle, a putative logical principle concerning generics. I will argue that the kind-predication approach erroneously predicts that GEM is valid, whereas the quantificational approach correctly predicts that it is invalid. Ultimately, I think that the kind-predication approach can only avoid validating GEM by either endorsing covert quantificational structure or committing itself to unpalatable metaphysical consequences.

3.3 Generic Excluded Middle

I now offer an argument against the kind-predication approach to generics, one that also supports the quantificational approach. Consider the following putative principle governing the logic of generics:

Generic Excluded Middle (GEM): For any bare plural characterising sentence of the schematic form ⌜Fs are G⌝, the sentence ⌜Either Fs are G or Fs are not G⌝ is true.

For discursive lucidity, let us distinguish between the *opposite* of a generic and its *negation*, where for any generic of the form ⌜Fs are G⌝, its opposite is ⌜Fs are not G⌝ and its negation is ⌜It is not the case that Fs are G⌝. Negated generics should be conceptually distinguished their unnegated opposites, at least in principle, since narrow-scope negation may not necessarily be reducible to wide-scope negation. Then, the idea behind GEM is that, for any bare plural generic, either it or its opposite is true. In a slogan: opposite generics are not both false.

However, despite any intuitive appeal that GEM might enjoy, the principle is subject to systematic counterexamples, such as those in (8):

(8) a. Books are paperbacked or books are not paperbacked.

b. Fair coins land heads or fair coins do not land heads.

c. Lions are male or lions are not male.

A counterexample to GEM is a false disjunction constituted by a characterising sentence and its opposite. For example, sentence (8a) is a counterexample to GEM: it is false that books are paperbacked and it is false that books are not paperbacked, even though it is true that books are either paperbacked or not paperbacked.[11] Similar remarks apply for the other examples. With sufficient ingenuity, such counterexamples multiply without limit. Therefore, GEM is invalid.

Investigating whether GEM is valid is a useful tool for evaluating theories of generics more generally, since it provides a simple, yet overlooked, test for whether a theory of generics is empirically adequate. For given the invalidity of GEM, it follows that any semantic analysis of generics that validates GEM is empirically inadequate. Moreover, the counterexamples to GEM are robust and systematic, unlike other sentences that apparently pose problems for theories of generics, such as 'Ducks lay eggs' or 'Mosquitos carry the West Nile Virus'. After all, the counterexamples to GEM form a unified class and judgments about their falsity are firm, whereas the generation of other problematic generics is unsystematic and the truth-value judgments of well-informed native speakers vary.[12] Consequently, we are on firmer ground by

[11] These judgments receive wide support in the literature: see, for example, Carlson (1977a), Pelletier and Asher (1997: 1132), Leslie (2008: 7). It is worth noting that Cohen (1999a: 228) considers such sentences as cases of mere unacceptability, similar to cases of presupposition failure, rather than cases of falsity. I offer reasons for rejecting this suggestion in Section 3.5.2.

[12] For compelling arguments that intuitions about these sentences should not significantly inform semantic theorising, see Asher and Pelletier (2013); Sterken (2015a).

evaluating theories of generics against the proposed datum.

With this test in hand, let us consider whether either the kind-predication approach or the quantificational approach validates GEM. First, I examine the consequences of the invalidity of GEM for the kind-predication approach. To answer this question, GEM should be reformulated to highlight the bipartite logical structure that the kind-predication approach assigns to generics:

Kind-Predication Generic Excluded Middle (K–GEM): For any generic sentence of the schematic form ⌜Fs are G⌝: ⌜G(F-kind) ∨ ¬G(F-kind)⌝ is true,

where '¬' and '∨' are the usual truth-functional connectives. Observe that, in K–GEM, the negation in the second disjunct (*Fs are not G*) is given wide-scope because the kind-predication approach does not postulate enough structure to distinguish between the logical forms of negated generics and their unnegated opposite counterparts. In other words, both (9a) and (9b) receive (9c) as their logical form:

(9) a. ⌜It is not the case that Fs are G⌝

b. ⌜Fs are not G⌝

c. ⌜¬G(F-kind)⌝

This is not be surprising, since the kind-predication approach treats bare plurals as individual-denoting terms, and sentences headed by individual-denoting terms generally treat sentential and predicate negation equivalently, as evidenced in (10):

(10) a. It is not the case that John is happy.

b. John is not happy.

c. ¬happy(j)

An immediate upshot of the observation that the kind-predication approach does not distinguish between negated generics and their unnegated opposites is that, for the kind-predication approach, K–GEM is a special instance of the Law of Excluded Middle:

Law of Excluded Middle (LEM): For any sentence ϕ, $\ulcorner\phi$ or $\neg\phi\urcorner$ is true.

In other words, the kind-predication approach and LEM jointly entail K–GEM. According to the kind-predication approach, bare plural DPs like *tigers* refer directly to kinds which are themselves modelled as special types of first-order individuals (Liebesman 2011). Given that LEM says that every first-order individual i either satisfies a given predicate or it does not, it follows from this first-order treatment of kinds that they either satisfy a given predicate or they do not. For example, just as the individual name *Shere Khan* either satisfies the predicate *has stripes* or it does not, so too does the bare plural *tigers* either satisfies the predicate *has stripes* or it does not. More generally, if a kind term F either satisfies a predicate G or it does not, then either $\ulcorner$G(F-kind)$\urcorner$ is true or $\ulcorner\neg$G(F-kind)$\urcorner$ is true. Consequently, the kind-predication view, in conjunction with LEM, entails K–GEM and thus GEM.[13]

On the other hand, the quantificational approach does not entail GEM, at least not as a matter of logical form. To see this, we must first again reformulated GEM to highlight the relevant tripartite structure that the quantificational approach assigns as the logical form of generics:[14]

Quantificational Generic Excluded Middle (Q–GEM): For any generic sentence of the schematic form $\ulcorner\text{Gen}[\phi][\psi]\urcorner$: $\ulcorner\text{Gen}[\phi][\psi] \vee \text{Gen}[\phi][\neg\psi]\urcorner$ is true.

An immediate consequence of this reformulation is that, unlike the kind-predication approach, the quantificational approach and LEM do not jointly entail GEM. After

[13] For discussion of other versions of the kind-predication approach that also entail GEM, see von Fintel (1997: 31–2).

[14] To remain neutral between competing versions of the quantificational approach, I simplify the LF representation by leaving tacit the variables bound by Gen and using ϕ, ψ as schematic metavariables ranging over the restrictor and matrix clauses respectively.

all, the quantificational approach postulates enough structure to distinguish between the logical forms of negated generics and their unnegated opposite counterparts:

(11) a. ⌜It is not the case that Fs are G⌝

b. ⌜$\neg$Gen[ϕ][ψ]⌝

(12) a. ⌜Fs are not G⌝

b. ⌜Gen[ϕ][$\neg\psi$]⌝

Given that the quantificational approach can logically distinguish between these sentences, it does not follow that sentences of the form (12a) entail sentences of the form (12a), at least not as a matter of logical form. That is, for everything that we have said so far, both ⌜Gen[ϕ][ψ]⌝ and ⌜Gen[ϕ][$\neg\psi$]⌝ may be false. So long as the semantics for Gen does not collapse the distinction between (12b) and (12b), there is no conflict with LEM. Consequently, the quantificational approach does not immediately entail GEM.

To summarise the discussion, the fact that the kind-predication approach entails GEM is significant evidence that the approach is incorrect. For given LEM, if the kind-predication approach is correct, then the disjunction 'Books are paperbacked or books are not paperbacked' is true. But neither disjunct is true; neither 'Books are paperbacked' nor 'Books are not paperbacked' is true. Consequently, the original disjunction is not true, and so the kind-predication approach is incorrect. Furthermore, the fact that the quantificational approach does not immediately entail GEM is a significant advantage to its predictive power, since it avoids the unpalatable prediction that sentences like those in (8) are true. Nevertheless, there may be additional semantic principles that, together with the quantificational approach, entail GEM. I will outline some of these principles in Section 3.5.

The question remains whether the kind-predication theorist has enough linguistic or metaphysical resources at her disposal to account for the invalidity of GEM. The following section will consider this question, arguing that either the kind-predication theorist must either embrace quantificational structure or else commit herself to some unpalatable metaphysical consequences.

3.4 Kind-Predication, Truth-Gaps, and Covert Material

In the previous section, I argued that the simple kind-predication approach cannot account for the invalidity of GEM. However, the kind-predication theorist may respond to this argument either by (i) rejecting the Law of Excluded Middle, the principle upon which my argument relied, or by (ii) adopting additional covert material in the logical form of generics that allows them to distinguish between negated generics and their unnegated opposites. In this section, I shall consider and reject these responses.

3.4.1 Kind-Predication and Metaphysics

It may be tempting to resist the above argument by rejecting LEM. After all, if LEM is false, then not every individual must either satisfy a property G or not. Then there would be no reason to think every kind must either satisfy a given property or not. Consequently, rejecting LEM can reconcile the kind-predication approach with the invalidity of GEM. However, rejecting LEM comes at a significant cost, namely, the rejection of standard classical logic. Given that classical logic and semantics are considered to be superior to its alternatives in terms of simplicity, power, and past success, it would be *ad hoc* to reject LEM to keep the kind-predication approach, at least without independent motivation.

There are at least two independently motivated strategies for rejecting LEM to which defenders of the kind-predication approach might appeal. First, one might argue that a generic is neither true nor false if the denotation of its subject term is undefined.[15] Then if the counterexamples to GEM contain undefined bare plural DPs, they would be neither true nor false. This would allow the kind-predication approach to reject LEM in cases of presupposition failure or failure of reference, while accepting a localised version of LEM that holds for every *defined* sentence of the language.

Is there any independent reason to think that bare plurals in characterising sentences are sometimes undefined? One potential might come from the observation that not just any nominal constituent can form a kind-referring definite DP (Dahl 1975; Carlson 1977b). For example, the contrast in the acceptability of the following pair of sentences has been traced back to the existence of a "well-established kind" for Coke bottles, but not for green bottles:[16]

(13) a. The Coke bottle has a narrow neck.

b. #The green bottle has a narrow neck.[17]

If this point extends to bare plural DPs, then bare plural DPs that fail to refer to well-established kinds are undefined and sentences in which they are contained are neither true nor false. On this response, our truth-value judgments about counterexamples to GEM are mistaken. While we mistakenly judge the sentence 'Fair coins land heads or fair coins do not land heads' to be false, it is actually truth-valueless, since *fair coins* fails to refer to a well-established kind. As a result, not every instance of GEM (and, by extension, LEM) is true: the principle holds only of those generics whose DPs refer to "well-established kinds". Consequently, the kind-predication view does not entail GEM.

However, this strategy is inadequate for at least three reasons. First, the strategy will not work for all of the counterexamples to GEM. Some bare plural DPs in

[15] For other semantic theories that predict truth-value gaps arise from undefinedness, see the Frege–Strawson theory of definite descriptions which holds that sentences containing definite descriptions are truth-valueless when their definite descriptions are undefined due to presupposition failure (Heim and Kratzer 1998; Elbourne 2013).

[16] An analysis of the notion "well-established kind" is not attempted here, since the distinction seems real enough given the strikingness of the example sentences.

[17] '#' indicates infelicity of some sort.

the counterexamples are not obvious candidates for reference failure, since it is highly plausible that they denote well-established kinds (if they denote kinds at all). For example, book-kind and lion-kind have as good a chance as any to satisfy "well-establishedness" in the intended sense. Consequently, generics like 'Books are paperback or books are not paperback' and 'Lions are male or lions are not male' are still counterexamples to GEM.

Second, the strategy incorrectly predicts truth-value judgments about the counterexamples to GEM. The counterexamples to GEM and their individual disjuncts are typically judged as False, not the 'squeamish' "I-don't-know" or 'Neither' commonly reported by LEM-deniers. Consequently, it is highly doubtful that the counterexamples to GEM involve the presupposition failure or failure of reference that usually motivates these strategies for rejecting LEM.

Third, and more generally, the strategy inaccurately predicts that bare plural DPs must refer to well-established kinds for the characterising sentences in which they are contained to be felicitous. But while characterising sentences containing definite DPs that supposedly refer to non-well-established kinds are infelicitous, their bare plural counterparts sound fine:[18]

(14) a. #The green bottle has a narrow neck.

b. Green bottles have narrow necks.

Since bare plural DPs do not pattern with their definite DPs counterparts, there is little reason to think they refer to well-established kinds. Moreover, many generics, whose DPs are gerrymandered and do not refer to anything well-established, are judged true. For example, the sentence 'Australian Tour de France winners are Australian' seems true, even though it is doubtful that Australian Tour de France winners is a well-established kind (cf. Dayal 1992). Requiring that *all* generics involve

[18] See Krifka et al. (1995: 11–12).

"well-established" kinds limits our ability to explain why such generics are true. Given these reasons, the first strategy is inadequate for rejecting LEM.

Let us now turn to the second strategy for rejecting LEM, which claims that the peculiarities of property inheritance allows for property gaps, which in turn give rise to truth-value gaps. According to the kind-predication approach, an F-kind has the individual-level property iff the kind inherits the property from its instances. For example, tiger-kind has the individual-level property *being striped* iff it inherits the property from individual tigers. But what it takes for a kind to inherit a property is an opaque matter. Indeed, Liebesman expresses doubt over any useful general principles concerning property inheritance:

> Generics ascribe properties to kinds and, given the multiplicity of properties and the multiplicity of ways kinds inherit properties from their members, no fully general account of inheritance will be forthcoming. (Liebesman 2011: 420)

For some cases, then, the inheritance relation may be sufficiently complex to lead to property gaps where some properties are neither instantiated nor anti-instantiated. If so, then violations of both GEM and LEM are predicted by the kind-predication approach. So, the approach does not entail GEM.

However, at least two considerations count against this strategy. First, if this strategy is to accommodate the counterexamples to GEM, then the kinds denoted in the counterexamples to GEM should fail to instantiate both their respective positive and negative properties. But these kinds do not fail to instantiate both their respective positive and negative properties. Consider the following sentences:

(15) a. Either book-kind is paperbacked or book-kind is not paperbacked.

b. Either fair-coin-kind lands heads or fair-coin-kind does not land heads.

c. Either lion-kind is male or lion-kind is not male.

Each sentence in (15) is true. To see this, suppose every individual is divided into one of two lists: things that are paperbacked and things that are not. Where should book-kind appear? If the property gap approach is correct, it should not appear on either list. But in the same way that Kermit the Frog appears on the second list because he isn't the kind of thing that can be paperbacked, so to book-kind is not paperbacked, and so it appears on the second list. Consequently, property inheritance does not admit property gaps and the kind-predication theorist is unable to explain the contrast between truth-value judgments for counterexamples to GEM and sentences in (15).

Second, failing to inherit the property of being G is plausibly equivalent to inheriting the property of being not-G.[19] This claim is supported by Liebesman's claim that the inheritance relation is modelled on the part–whole relation on which complex objects inherit properties from their parts. He argues that the myriad ways that kinds inherit properties from their instances mirrors the myriad ways that complex objects inherit properties from their parts:

> Attempting to give a systematic account of the way in which material objects inherit properties from their parts is something of a fool's errand. The quantity and salience of the parts that is required for inheritance varies greatly. (Liebesman 2011: 420)

But, despite its complexity, the part–whole relation seems not to give rise to property gaps. Consider a complex object composed of five red balls and five green balls. It does not inherit the property of being entirely red from its parts in virtue being having non-red parts, but it does inherit the negative property of being not entirely red from its parts. If property inheritance is properly understood as analogous with the

[19] More carefully, failing to inherit (and not instantiate!) the property $[\lambda x.\phi]$ is equivalent to inheriting (or otherwise instantiating!) the property $[\lambda x.\neg\phi]$. These caveats are included because some properties instantiated by complex objects, such as emergent properties, are not plausibly inherited from its parts.

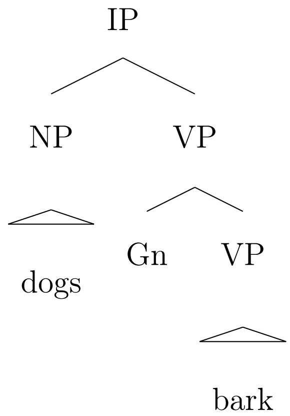
part–whole relation, it also should not lead to property gaps. Consequently, the only grounds for rejecting LEM comes from rejecting the equivalence between the failure to inherit the property of being G and inheriting the property of being not-G. But rejecting this equivalence leads both to property gaps and to truth-value gaps. For the reasons given above, this constitutes a high metaphysical cost for the kind-predication theorist to pay.

3.4.2 Kind-Predication and Linguistics

The other option is that the kind-predication theorist might appeal to additional covert structure in the logical form of generic sentences already encoded in the syntax of generics (Carlson 1977b; Chierchia 1998; Teichman 2016). There are a number of ways of implementing this idea. Some theorists admit the existence of a *monadic* generic operator Gn that is part of the verbal aspect of generic sentences (cf., Chierchia 1998); others argue that a covert predicate modifier shifts episodic or stage-level predicates like *smoke* to kind-level predicates suitable for predication to kinds (cf. Teichman 2016); and some argue that a generic quantifier is introduced by some pragmatic process of reinterpretation (cf. Cohen 2013). Despite these differences, each of these proposal are committed to the claim that generic sentences end up being assigned a tripartite, quantificational logical form.

Let us see how this works in practice. Following Chierchia, the generic 'Dogs bark' can be assigned the following (simplified) logical form:

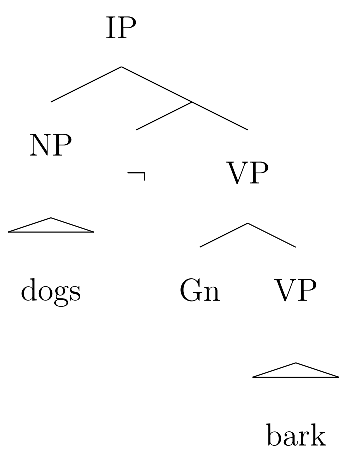
(16) a.



b. Gn $x, s[{}^{\cup\cap}\text{dog}(x) \wedge C(x, s)][\text{bark}(x, s)]$

where ${}^{\cup\cap}$dog $= \lambda x.\lambda s.dog(x, s)$, the result of typeshifting from dog-kind to denotation of the predicate *dog*, and C is a variable whose value is supplied by the context, restricting the domain of Gn to appropriate individuals and situations.[20] Once these quantificational, tripartite logical forms are admitted, it is clear how the kind-predication theorist now has the descriptive power to distinguish negated generics from their unnegated opposites:

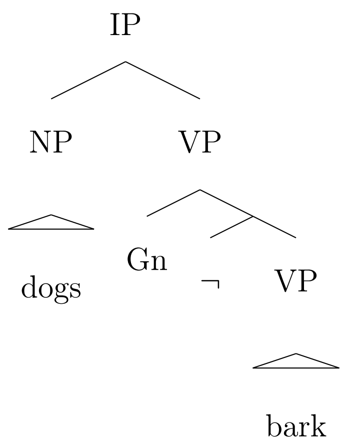
(17) a.



b. $\neg$Gn $x, s[{}^{\cup\cap}\text{dog}(x) \wedge C(x, s)][\text{bark}(x, s)]$

[20] Alternatively, one may retain full commitment to the view *dogs* denotes a kind, and instead postulate that Gn denotes a function from verb phrases to a function from kinds to truth-values (or the intensional equivalent); compare Teichman (2016).

(18) a.



b. Gn $x, s[^{\cup\cap}\text{dog}(x) \wedge C(x, s)][\neg\text{bark}(x, s)]$

Furthermore, with this additional descriptive power, the sophisticated kind-predication theorist can agree that LEM is valid without admitting that GEM is valid for exactly the same reasons why the quantificational theorist can.

While I have no general in-principle objections to these sophisticated versions of the kind-predication approach, I should like to observe that these strategies essentially concede that the logical form of generic sentences is quantificational.[21] One role that covert material plays in these theories is to distinguish between negated generics and their unnegated opposites. And these theorists have postulated that the additional covert material is quantificational; indeed, it's not clear how else one can distinguish the scope of negation. So, if one endorses covert structure on the basis of the argument from the invalidity of GEM, then one is committed to endorsing something like the generic quantifier Gen as well. More generally, in this section I have argued that the kind-predication theorist must admit the existence of something like Gen or commit herself to unpalatable metaphysical consequences, such as truth-value or property gaps.

[21] For arguments against Cohen (2013), see Sterken (2016).

3.5 Some Constraints on the Quantificational Approach

In Section 3.3, I argued that the quantificational approach does not entail GEM as a matter of logical form and that additional arguments are needed to show that the quantificational approach entails GEM. In this section, I consider three cases where additional semantic commitments may end up collapsing the distinction between negated generics and their unnegated opposite to deleterious effects.

3.5.1 Argument from Disjunction Distribution

First, proponents of the quantificational approach should be sure that the following principle of distribution is not validated by their semantics:

Disjunction Distribution: $\ulcorner \mathrm{Gen}[\phi][\psi \vee \chi] \urcorner \Rightarrow \ulcorner \mathrm{Gen}[\phi][\psi] \vee \mathrm{Gen}[\phi][\chi] \urcorner$

For if Disjunction Distribution is valid, then we can argue for GEM by substituting $\ulcorner \neg\psi \urcorner$ for χ:

(19) $\ulcorner \mathrm{Gen}[\phi][\psi \vee \neg\psi] \urcorner \Rightarrow \ulcorner \mathrm{Gen}[\phi][\psi] \vee \mathrm{Gen}[\phi][\neg\psi] \urcorner$

Here, any instance of the premise is necessarily true and any instances of the conclusion is an instance of Q–GEM. For example, the following substitution instance 'Fair coins either land heads or do not land heads' is necessarily true.[22] So, if Disjunction Distribution is valid, it follows that the sentence 'Fair coins land heads or fair coins do not land heads' is true. Consequently, if Disjunction Distribution is valid, then the quantificational view entails GEM.

[22] The sentence 'Fair coins either land heads or do not land heads' has two further readings, neither of which are necessarily true, namely, (i) 'Some fair coins are such that they either land heads or do not land heads', and (ii) 'Fair coins either land heads (in general) or don't land heads at all'. Thanks to Paul Elbourne for drawing my attention to these readings.

Of course, proponents of the quantificational view have independent reason to reject the validity of Disjunction Distribution. The sentence 'If fair coins lands heads or land tails, then either fair coins land heads or fair coins land tails' is a counterexample to disjunction distribution. The sentence 'Fair coins land heads or land tails' is a true instance of the premise, since it simply states the two ways that fair coins can land. But, as noted above, this is false, since neither of its conjuncts is true. Consequently, there is no reason to think that the principle of distribution is valid. Proponents of the quantificational approach should be well-warned to avoid validating this inference pattern.

3.5.2 Homogeneity

Second, one might think that the quantificational view entails GEM because the Gen operator triggers a "homogeneity presupposition".[23] It has been observed that definite plurals seem to carry an 'all-or-nothing' presupposition (Fodor 1970). For example, the sentence 'The children are asleep' seems to presuppose that either all or none of the children are asleep, and asserts that all of them are asleep. Similarly, it has been observed that generic bare plurals also seem to carry a homogeneity presupposition (von Fintel 1997). For example, the sentence 'Ravens are black' seems to presuppose that either all or no normal ravens are black, and asserted that all of the normal ones are black. This may be taken as evidence for the claim that the Gen operator is lexically specified to trigger a presupposition of homogeneity:[24]

Homogeneity: $\ulcorner \text{Gen}[\phi][\psi] \urcorner$ is defined only if:

$$\ulcorner(\forall x \in D : \phi(x) \rightarrow \psi(x)) \vee (\forall x \in D : \phi(x) \rightarrow \neg\psi(x))\urcorner$$

where D is some suitable domain of individuals.

[23] Kai von Fintel (1997) argues this point, appealing to Janet Fodor's dissertation (1970) as a precedent. Another version of a homogeneity presupposition is defended by Cohen (2004). Similar remarks made in this section apply to his proposal.

[24] This formulation generalises von Fintel's proposal.

Given Homogeneity, it directly follows that $\ulcorner$Gen$[\phi][\psi]\urcorner$ is false iff $\ulcorner$Gen$[\phi][\neg\psi]\urcorner$ is true, or shorter:

(20) $\ulcorner\neg$Gen$[\phi][\psi]\urcorner$ iff $\ulcorner$Gen$[\phi][\neg\psi]\urcorner$

Given (20), LEM and the substitution of material equivalences, GEM immediately follows. Given LEM, $\ulcorner$Gen$[\phi][\psi] \vee \neg$Gen$[\phi][\psi]\urcorner$. Then, given (20), $\ulcorner$Gen$[\phi][\neg\psi]\urcorner$ can be substituted for $\ulcorner\neg$Gen$[\phi][\psi]\urcorner$ to get Q–GEM: $\ulcorner$Gen$[\phi][\psi] \vee$ Gen$[\phi][\neg\psi]\urcorner$. Consequently, if the Gen operator triggers the homogeneity presupposition, then the quantificational approach validates GEM.

However, there is reason to doubt that the Gen operator triggers the homogeneity presupposition, since it fails standard tests for determining whether a sentence generates a presupposition. First, generic sentences fail the 'Hey, wait a minute' (HWM) test proposed by von Fintel (2004b). According to the HWM test, a complaint is legitimate when it is about a presupposition of an utterance that is not established fact prior to that utterance, but not when it is about an asserted, non-presuppositional component of the utterance. Consider (21):

(21) A: Has Elmo stopped smoking?

B: Hey, wait a minute! I had no idea Elmo used to smoke.

C: #Hey, wait a minute! I had no idea that Elmo stopped smoking.

B's complaint to the presuppositional component of A's utterance is felicitous, but C's complaint to the asserted, non-presuppositional component is infelicitous. Consequently, the claim that Elmo used to smoke is a presupposition, whereas the claim that Elmo stopped smoking is not.

If characterising sentences trigger presuppositions that either all or no individual in a certain domain satisfied the predicate, then we would expect that C's complaint to A's utterance would be felicitous. But this is clearly not the case.

(22) A: Are cats black?

B: Hey, wait a minute! I had no idea that cats could be black.

C: #Hey, wait a minute! I had no idea that either all or no normal cats had to be black.

While B's complaint to a clearly presuppositional component of A's utterance is felicitous, C's complaint is not. Consequently, characterising sentences fail the HWM test.

Second, generic sentences fail projection tests for presuppositions. It is well known that presuppositions project from questions, as evidenced by the fact that the question in (21) commits the speaker to the belief that Elmo used to smoke. If characterising sentences trigger homogeneity presuppositions, the question in ((22)) would commit A to the belief that either all or no normal cats are black. But this is not the case. The question of whether cats are black is compatible with normal cats being coloured in a variety of ways—indeed, normal cats may be brown, ginger, white, black, or a mixture of the four.

Furthermore, it is well known that presuppositions project from the antecedent of a conditional. For example, (23) presupposes that Elmo used to smoke:

(23) If Elmo stopped smoking, then he's probably feeling jittery.

If characterising sentences triggered homogeneity presuppositions, then (24) should entail that either all or no normal cats are black. But this is clearly not the case:

(24) If cats are black, then we better be careful crossing paths with cats.

Since passing the HWM and projection tests are plausible necessary conditions for the existence of presuppositions, this is strong evidence that the Gen operator is not lexically specified to trigger the Homogeneity Presupposition. Consequently, the homogeneity argument for GEM fails.

3.5.3 A Constraint on Modal Theories of Generics

The modal theory of characterising sentences is a version of the quantificational approach, since it makes use of the phonologically null quantifier Gen. The modal theory is motivated by the resemblance between characterising sentences and conditional sentences. For example, characterising sentences like *Ravens are black* seem to express similar claims to conditional sentences like *If something is a raven, it is normally black*. On this basis, theorists try to extend the possible-worlds semantics for conditional sentences, as developed by David Lewis, Robert Stalnaker, Richmond Thomason, and Angelika Kratzer, to characterising sentences.[25] In particular, they propose to analyse characterising sentences in terms of an accessibility relation on worlds based on a relativised notion of normality.

The simplest modal theory for characterising sentences is inspired by Stalnaker's 1968 semantics for conditionals. According to this semantics, a conditional sentence of the form $\ulcorner \phi > \psi \urcorner$ is true at w iff the 'closest' ϕ-world relative to w is a ψ-world. Correspondingly, a characterising sentence of the form *Fs are G* is true at w iff, for each individual x, x is G in the unique most 'normal' world with respect to x's being F and w. For example, this semantics would assign the sentence (25a) the logical form in (25b) and its truth-conditions relative to a possible world w are given in (25c):

(25) a. Ravens are black.

b. Gen $x; w[\text{raven}(x, w)][\text{black}(x, w)]$

c. $\forall x : f(w, [\![x \text{ is a raven in } w]\!]) \in \{w \in W : x \text{ is black in } w\}$

(Here $[\![\phi]\!]$ is the set of worlds in which ϕ is true, and $f(w, [\![\phi]\!])$ is a function from pairs of worlds and propositions (sets of worlds) to the unique most normal world with respect to w and ϕ.) This is equivalent to the following:

[25] See Stalnaker (1968); Stalnaker and Thomason (1970); Lewis (1973); Kratzer (1981); Heim (1982).

(26) For each individual δ, δ is black in the unique most normal world with respect to δ's being a raven and w

Unfortunately, the Stalnaker-style semantics entails GEM. According to the Stalnaker-style semantics, for every individual δ, there is exactly one most $\xi\underline{\delta}$-normal world. Consequently, either it is a $\zeta\underline{\delta}$-world or it is a not-$\zeta\underline{\delta}$-world. Plausibly, for all individuals δ, normal-$\xi\underline{\delta}$-worlds are uniform with respect to whether or not they are $\zeta\underline{\delta}$-worlds. So if we gather each unique most normal $\xi\underline{\delta}$-world relative to w, for all individuals δ, those worlds will either all be a $\zeta\underline{\delta}$-world or a not-$\zeta\underline{\delta}$-world. If they are $\zeta\underline{\delta}$-worlds, then $\ulcorner$Gen $x[\xi x][\zeta x]\urcorner$ is true; if they are not-$\zeta\underline{\delta}$-worlds, $\ulcorner$Gen $x[\xi x][\neg\zeta x]\urcorner$ is true. Consequently, this semantics entails Q–GEM and hence GEM. Therefore, since GEM is false, the Stalnaker-style semantics is false.

Fortunately, not all modal conditional analyses entail GEM. Consider, for example, the theory of Asher and Morreau (1995); Pelletier and Asher (1997); Asher and Pelletier (2013). According to the Asher–Morreau–Pelletier (AMP) semantics, a characterising sentence of the form *Fs are G* is true at w iff, for each individual δ, the most normal world*s* with respect to δ's being F and w are such that δ is a G in those worlds. For example, this semantics would assign (25a) the logical form in (25b), and its the truth-conditions relative to w are given in (27):

(27) $\forall x : {*}(w, [\![x \text{ is a raven in } w]\!]) \subseteq \{w \in W : x \text{ is black in } w\}$

Here ${*}(w, [\![\phi]\!])$ is a function from pairs of worlds and propositions (sets of worlds) to propositions, namely, the most normal worlds with respect to w and ϕ. This is equivalent to the following:

(28) For every individual δ, the most normal worlds with respect to w and to δ's being a raven in w are a subset of the set of worlds in which x is black

The AMP semantics for characterising sentences does not entail GEM, since it allows more than one most normal world for each individual. Consequently, Penny the fair coin may land heads in some of the most normal Penny-fair-coin-worlds, and she may land tails in the others. More generally, for some characterising sentences of the form *Fs are G*, some most normal F-worlds are G-worlds and some most normal F-worlds are not-G-worlds. In such cases, neither $\ulcorner$Gen[ϕ][ψ]$\urcorner$ nor $\ulcorner$Gen[ϕ][$\neg\psi$]$\urcorner$ is true. Consequently, the AMP analysis of Gen entails neither Q–GEM nor GEM.

The upshot of this discussion is that the quantificational approach does not, in general, entail GEM, although even proponents of the quantificational approach need to be careful that their semantics for Gen does not entail GEM.

3.6 Concluding Remarks

The main lesson of this chapter concerns the semantics of generics: any adequate theory of generics must predict that GEM is invalid. This observation is particularly relevant when deciding between kind-predicational and quantificational approaches to the semantics of characterising sentences. If the arguments in this chapter are correct, the kind-predication approach entails GEM and so it is false. On the other hand, the quantificational approach fares much better. No general argument that the quantificational approach entails GEM is forthcoming. Moreover, some prominent semantic analyses for Gen are shown not to entail GEM. Nevertheless, careful attention must be paid to whether particular semantic analyses of Gen entail GEM. As we have seen, some semantics for Gen do entail GEM, and so they too should be rejected. Investigating whether a particular semantics entails GEM is thus a useful test for whether that analysis is true.

Chapter 4

The Acquisition of Generics

4.1 Introduction

When speakers want to communicate generalisations, they often use sentences like the following:

(1) a. Ravens are black.

b. The tiger is striped.

c. Ducks lay eggs.

d. A bishop moves diagonally.

These sentences are examples of generic sentences, or *generics* for short.[1] Generics manage to express propositions about regularities which summarise groups of particular episodes or facts without the presence of an articulated quantifier or operator, such as *generally* or *typically*, that is responsible for generating the general content. For example, (1a) manages to express a generalisation about ravens, say, for example, the

[1] As witnessed by the sentences in (1), generic interpretations of sentences in English are compatible with bare plural, definite singular, and indefinite singular noun phrases. For present purposes, I shall focus primarily on *bare plural generics*, like in (1a).

proposition that ravens are generally black, even though it does not contain any explicit expression responsible for generating that general content, such as *generally*. Indeed, the lack of a dedicated, phonologically articulated generic operator is no quirk of English: no known language has any such phonologically articulated operator (Krifka et al. 1995; Dayal 1999). Nevertheless, the standard view of generic sentences is that their logical form is essentially quantificational. That is, despite the lack of any overt or pronounced elements that are responsible for their general content, generics have a tripartite structure consisting of a quantifier, a restrictor clause, and a nuclear scope (the matrix), akin to explicitly quantificational sentences like 'Ravens are generally black' or 'Most ravens are black'. To bridge the theoretical gap between generics and sentences containing overt quantifiers, theorists typically posit a covert, phonologically null generic operator called 'Gen' and provide it with a reductive semantic analysis in terms of quantification over suitably restricted domains of normal individuals, worlds, or histories.[2]

However, despite the widespread consensus that generics are essentially quantificational, Sarah-Jane Leslie (2007; 2008) has recently argued that the primary acquisition of genericity in early child speech raises apparent problems for this view. More specifically, Leslie claims that empirical studies show that young children grasp and produce generics far quicker and more readily than they do more well-understood and mathematically well-behaved explicit quantificational determiners like *every* and *some*. According to Leslie, if generics are correctly analysed in terms of quantification, it is puzzling why children acquire generics before explicit quantifiers, especially since children should have difficulty learning in the absence of a phonologically articulated constituent with which the phenomena can be associated. To account for the acquisition data, Leslie advocates an approach to generics that places more emphasis on cognitive concerns than traditional approaches in formal semantics. According to this

[2] For a good summary of the literature on generics, see Krifka et al. (1995); Mari et al. (2013b).

cognition-based approach to generics, the cognitive system has an innate, default mode of generalising and it is to these generalisations that generics give voice. Moreover, the default mode of generalising informs the semantics of generics by encoding their truth-conditions in the accuracy conditions of this cognitive system. Thus, according to Leslie, there is no mystery about how children learn truth-conditionally complex generics, since children have already been forming the corresponding generalisations from birth and these generalisations inform the truth-conditions of the generics. Quantificational determiners, on the other hand, require inhibitory processes to override this default mechanism. Given the difficulties of recalling and assessing statistical patterns denoted by quantificational determiners, this is a more cognitively demanding task and so they are acquired later in development after infants have developed sufficient cognitive sophistication.

I disagree with Leslie's explanation of the early acquisition of generics. I argue that the acquisition of generics is consistent with the standard view of their syntax and semantics: the early acquisition of generics is reflected in general constraints on how infants are guided in their analysis of linguistic stimuli, constraints that are placed by a system of rich linguistic knowledge and are broadly independent of the truth-conditions of the sentences in question.

My strategy is, first, to raise a novel problem for the cognition-based approach to generics. I present evidence that other expressions bearing the hallmarks of quantification — such as adverbial quantifiers, modals, tense, and aspect — also emerge at around the same time as generics in early child speech. In effect, I argue that the problem of generic acquisition reduces to a more general problem of explaining how children acquire quantificational expressions of this kind. But, as I shall argue, these facts undermine the empirical support for the cognition-based approach, since it is ill-equipped to account for the early acquisition of these expressions. We are left with the following puzzle: how do we best explain the acquisition data, while doing justice to both the empirical progress made by formal semantics more generally and the psychological insights of the cognition-based approach? I conjecture that these acquisition puzzles are resolved once we pay careful attention to more general constraints on infants' acquisition of language.

This chapter is structured as follows. Section 4.2 outlines the problem of generic acquisition and the issues that it raises for the standard quantificational approach to generics. Section 4.3 explains how the cognition-based approach aims to resolve this problem. Section 4.4 raises a number of concerns about the empirical support for the cognition-based approach. Section 4.5 argues that the cognition-based approach is unable to account for a parallel phenomenon involving other verbal quantifiers, like adverbial quantifiers, modals, and tense. Section 4.6 explores and rejects an extension of the default generalisation hypothesis to accommodate the acquisition of adverbs, modals and tense. Section 4.7 considers the possibility of explaining the acquisition puzzles by appealing to certain features of our innate ability to learn languages. Section 4.8 concludes.

4.2 The Problem of Generic Acquisition

Sarah-Jane Leslie (2007; 2008) has argued that recent empirical studies have uncovered a striking asymmetry between the acquisition of generics and explicit quantificational determiners in early child speech.[3] More specifically, generics are less challenging for young children to acquire and comprehend than quantificational determiners, even though the semantics of the latter has proved much more amenable than the former. This section summarises these findings and the problems they pose for the standard approach to generics.

Production studies show that generics are acquired readily by young children from

[3] For an overview of the literature, see Gelman (2010).

the age of two years, significantly before explicit quantifiers like *all*, *every*, and *some* (Gelman and Raman 2003; Roeper et al. 2006). For example, Gelman et al. (2008) report data from a study of the developmental acquisition of generics by examining longitudinal transcripts of parent–child conversations from data provided by the Child Language Data Exchange System (CHILDES) project (MacWhinney and Snow 1985, 1990). The study involved eight children aged 2;0 to 3;7 at first recording who were followed to ages 3;1 to 4;11.[4] The study found that all children for whom there were data at age two years produced generics, with children of age four years producing generics as frequently as adults. The study also found that children actively initiate generic conversations, rather than merely imitate their parents' generic talk.

Furthermore, comprehension studies indicate that young children comprehend the generics they produce as such, whereas it is only by the age of 4 that children distinguish generics from *all* and *some*. For example, Gelman and Raman (2003) report results of experiments in which children aged 2;0 to 4;0 were presented with atypical category instances (e.g., two birds that cannot fly) and asked questions that varied in linguistic form class (e.g., 'Do *birds* fly?' [generic] versus 'Do *the birds* fly?' [non-generic]). They found that children make use of these form-class cues to identity generics by age 2;6. This is evidence that young children also comprehend generics as such.[5] Hollander et al. (2002) conducted two studies examining whether children aged 3;0 and 4;0 distinguish between generics, 'all', and 'some'. They found that while four-year-olds treat generics as distinct from indefinites and universal quantifiers, three-years-olds do not distinguish between 'all', 'some', and the generic form.

Leslie argues that these findings pose a problem to a standard approach to generic sentences according to which they have quantificational tripartite logical forms. To see this, let us briefly outline the central tenets of the standard view. It is generally

[4] This chapter follows the established convention of represent children's ages as two numbers separated by a semi-colon, m;n, where m is the year and n is the month.
[5] See also Cimpian and Markman (2008).

agreed amongst linguists that *Gen* functions as an *adverb of quantification* in the sense of Lewis 1975.[6] That is, *Gen* relates two open formula: a Restrictor, which specifies the domain about which the sentence makes its generalisation, and a Matrix, which specifies the property attributed to the relevant members of the domain. The generic operator also binds any free variables in its Restrictor and Matrix. Consequently, the general logical form of a generic sentence is represented as follows:[7,8]

(2) $\text{Gen}\, x_1 \ldots x_n[\text{Restrictor}(x_1, \ldots, x_n)][\exists y_1 \ldots y_n \text{Matrix}(\{x_1\}, \ldots, \{x_n\}, y_1, \ldots, y_m)]$

where $x_1, \ldots, x_n$ are the variables to be bound by *Gen*, $y_1, \ldots, y_m$ are the variables to be bound existentially with scope just inside the Matrix, $\phi(\ldots, x_m, \ldots)$ is a formula with where x_m occurs free, and $\phi(\ldots, \{x_m\}, \ldots)$ is a formula in which x_m may occur free. Any variables occurring free only in the Matrix undergo existential closure and are bound by an existential quantifier (cf. Kratzer 1995). For example, assuming that *Gen* binds individual and situation variables, we can represent the logical form of (3a) as in (3b):

(3) a. Ravens are black

b. $\text{Gen}\, x, s[\text{raven}(x, s)][\text{black}(x, s)]$

Without settling exactly how the logical form in (3b) is derived from the sentence material in (3a), we can see that in this example the plural noun phrase *ravens* contributes the Restrictor and the predicate *are black* contributes the Matrix. The free individual and situation variables are then bound by the Gen operator.

[6] While most theorists adopt the view that Gen functions as an adverb of quantification, the hypothesis that generics have a tripartite logical form is also compatible with the view that Gen is a quantificational determiner; see Pelletier and Asher (1997).

[7] Alternatively, rather than taking the Restrictor and Matrix clauses to be open sentences, we could take them to be 1-place predicate letters, in which case Gen can be treated as denoting a function, say, of type $\langle\langle s, t\rangle, \langle\langle s, t\rangle, \langle s, t\rangle\rangle\rangle$ and generics may have an LF like $[_{\text{IP}}$ Gen $[_{\text{IP}}$ Restrictor$][_{\text{IP}}$ Matrix$]]$ instead; see Heim (1997) for some relevant discussion.

[8] While this LF may seem unnecessarily complex, it is required to handle the different interpretations of complex generics like ‘Typhoons arise in this part of the Pacific’.

Virtually all contemporary theorists hold that the schema in (2) underwrites the logical form of generics.[9] Nevertheless, substantial debate about how Gen should be semantically interpreted has led to the proliferation of increasingly sophisticated proposals. For example, modal-based approaches to generics typically deploy universal quantification over normal individuals or normal worlds (Asher and Morreau 1995; Krifka et al. 1995; Eckardt 2000). Contrastingly, probability-based accounts typically deploy universal or majority-based quantification over all suitable smoothed out admissible temporal segments of possible worlds that extrapolate from the current history so far (Cohen 1999a). Each of these proposals attempt to provide a reductive semantic analysis of Gen in terms of more theoretically tractable quantification over a suitably restricted domain, such as individuals, worlds, or world histories.

We are now in a position to state Leslie's puzzle. Given the sophisticated attempts to reduce the semantics of generics to quantification, it is unclear how and why children acquire generics before they acquire explicit quantifiers: children learn with ease what generations of talented linguists and philosophers have struggled to theorise.[10] Moreover, the fact that children acquire generics so easily is even more surprising considering the lack of any corresponding phonologically realised operator associated with generics.[11] Given that Gen is not articulated in any known language (Krifka et al.

[9] However, for some notable exceptions, see Carlson (1977b); Liebesman (2011). See Leslie (2015), for a convincing rebuttal of Liebesman (2011).

[10] An astute reader will notice that this problem is not specific to generics; indeed, the observation children seem to learn with ease what linguists struggle to theorise is the foundational basis of linguistics as a field of study. See Sections 4.5–4.7 for further discussion.

[11] I note in passing that phonologically null expressions are not necessarily more difficult to learn *in principle*. For example, children produce and comprehend wh-questions from a similarly early age, even though contemporary syntactic analyses of wh-questions posit phonologically null traces as a result of movement, as in the example below; for a good overview of the acquisition of wh-movement, see Guasti (2002: Chapter 6).

(i) What did John see?

a. $[_{CP}$ what$_j$ $[_{C'}$ did$_i$ $[_{TP}$ John t$_i$$[_{VP}$ buy t$_j$$]]]]$

No specialised default module needs to be postulated to explain the acquisition of wh-movement: the standard explanation for the acquisition of wh-movement is that it is mandated by Universal Grammar, and so children simply acquire it as part-and-parcel of acquiring the language.

1995; Dayal 1999), there is no direct or explicit object of study on which children can form hypotheses and from which they can learn. Leslie claims that it is puzzling that they master generics from a young age, since associations with absence are notoriously difficult for children to master. Contrastingly, one would expect that children would acquire explicit quantifiers more quickly, since they are phonologically realised, thereby giving children an object of study.

Call the task of accounting for the primary acquisition of generics **the problem of generic acquisition**. Any empirically adequate account of generics must explain these facts and, in particular, how children acquire generics before explicit quantifiers, even though the former are truth-conditionally more complex than the latter and do not offer an explicit object of study.[12]

4.3 Generics as Default Generalisations

In response to the problem of generic acquisition, Leslie (2007; 2008) argues that the appearance of genericity in early child speech is predicted by a certain view of the mind according to which the cognitive system is endowed with a primitive, default mechanism of generalisation and it is to these generalisations that generics give voice. Empirical studies indicate the ability to generalise in this manner pre-dates the acquisition of language. For example, infants of age 0;9 to 1;2 can form category-wide generalisations on the basis of experience with a few instances of the category (Baldwin et al. 1993; Graham et al. 2001). Leslie takes the capacity of pre-verbal infants to form generalisations as evidence for the existence of an innate cognitive mechanism for generalising from a few instances to the class of perceptually similar items that, though aided by language, does not depend on language per se. It is the generalisations of this primitive mechanism to which generics give voice. Call this the

[12] Although note that linguists have proposed some rather complex treatments of quantifiers in order to handle donkey anaphora; see Heim (1990); Elbourne (2005).

generics-as-default-generalisations hypothesis.

Leslie characterises the default mode of generalising as a basic information-gathering mechanism that provides information as quickly and efficiently as possible. Under certain conditions, the default mode of generalising is activated and the mind forms the corresponding generic belief. Such a mechanism increases the efficiency with which infants gather information about the world by taking advantages of certain regularities, drawing inferences from particular instances of a category to novel and unobserved ones. Contrastingly, the comprehension of explicit quantifiers involves a more complex process than the comprehension of generics. More specifically, if generics give voice to the only default mode of generalising, then this mechanism for forming generalisations must be inhibited or overridden to make the kinds of generalisations expressed by existential and universal quantification. Given that these kinds of inhibitory processes are more taxing for the conceptual system to implement than non-inhibitory process, the conceptual system will likely be overwhelmed when trying to implement the inhibitory process and consequently revert to the default. Given this hypothesis, it is unsurprising that we see a correlation between the appearance of quantificational determiners in early child speech and an increase in our ability to implement inhibitory processes between ages three and four.

Leslie hypothesises that the default mechanism that gives rise to generic generalisations is sensitive to a number of interesting features. First, the mechanism requires that any exceptions to the generalisations must be 'negative' counterinstances that merely fail to have the property in question, rather than individuals who have an equally psychologically salient positive property instead. For example, giving birth to live young is way of having a positive alternative to the property of laying eggs, whereas merely not laying eggs is negative alternative property. Second, the mechanism is sensitive to the relevant characteristic dimensions of the kind in question, such as, modes of reproduction, modes of locomotion, diets, and so on. Once the mechanism has identified a characteristic dimension for a kind, it fills in the value with ease. For example, despite the large numbers of male ducks and barren female ducks that do not lay eggs, we are eager to find a value for how ducks gestate and so we seize on the only positive instances available and conclude that ducks lay eggs. Third, the mechanism is sensitive to information that is particularly striking, horrific, or appalling. For example, when dealing with information that we would be well-served to be forewarned about, the mechanism generalises even when only a few instances of the kind possess the property in question. Consequently, we are eager to conclude that mosquitos carry the West Nile virus, even though very few mosquitos are actually carriers, because we would be well-advised to stay clear of insects that carry the West Nile virus. Fourth, regarding more neutral information that is neither characteristic nor striking, the mechanism requires that the majority of the kind instantiates the property for it to be generalisable. For example, we judge that ravens are black only because the majority of ravens are black; if only a small percentage of ravens were black, then we would not form this generalisation.

Leslie claims that the conditions under which generics are true reflect the quirks of the default mechanism of generalisation, and so we can understand that 'worldly truth specifications' of generics — descriptions of how the world must be for the sentence to be true — in terms of the nature of the default mechanism of generalisation:[13]

> the circumstances under which a generic of the form 'Ks are F' is true are as follows:
>
>> The counterinstances are negative, and:
>>
>> If F lies along a characteristic dimension for the Ks, then some Ks are F, unless K is an artefact or social kind, in which case F is the function or purposes of the kind K;
>>
>> If F is striking, then some Ks are F and the others are disposed to be F;

[13] Also see Leslie (2007: 386).

Otherwise, almost all Ks are F. (Leslie 2008: 43)

According to Leslie, these truth-conditions correctly predict our truth-value judgments for certain supposedly troublesome generics. On the basis of these truth-conditions, she claims that the sentence ‘Ravens are black’ is true (after all, there are no negative counterinstances and almost all ravens are black), as is ‘Ducks lay eggs’ (for laying eggs lies along a characteristic dimension for ducks, namely, reproduction, and some ducks lay eggs) and ‘Mosquitos carry the West Nile virus’ (only some mosquitos carrying the West Nile virus would be sufficient for the truth of the sentence, since carrying the West Nile virus is a striking property, and there are only negative counterinstances, and other mosquitos are disposed to carry the virus). It also predicts that the sentence ‘Books are paper-backed’ is false, since there are positive counterinstances like hard-backed books.

Leslie argues that if the generics-as-default-generalisations hypothesis is correct, then there is no puzzle about how children acquire generics. For on this view, generics are the manifestation of our default method of generalising and children will have already formed the generalisations to which generics give voice before acquiring any language at all. Consequently, the task of learning generics would merely consist of generating Logical Forms for generics by partitioning the sentence material into the restrictor and matrix clauses and binding any free variables therein, in addition to associating the generic interpretation with particular forms, such as the bare plural. It is natural to suppose that the language faculty’s innate endowment—say, innate knowledge of Universal Grammar—is responsible for children’s ability to partition sentence material into the restrictor and matrix clauses, and subsequently bind any free variables. Moreover, we can explain why children handle generics with greater ease than explicit quantifiers, and why they tend to interpret quantified sentences as though they were generics: processing explicit quantifiers is a sufficiently complex cognitive task and, as such, we would expect it to manifest at a later developmental stage and for children to default back to generics under pressure. If correct, the generics-as-default-generalisations hypothesis explains why children acquire generics before explicit quantifiers and the problem of generic acquisition dissolves.

4.4 Limitations of Data

The generics-as-default-generalisations hypothesis marks a dramatic shift in more than 40 years of research on generics, setting aside the conventional tools of formal semantics and developing an account of generics couched in the framework of cognitive science. It is undeniable that the generics-as-default-generalisations hypothesis provides a compelling explanation of the acquisition of genericity, whereas the standard approaches seem to have no explanation. However, a closer look at the empirical evidence make it far from clear that Leslie's theory is well-supported by the data.

The first set of problems I want to draw attention to is the extent to which the empirical evidence supports the generics-as-default-generalisations hypothesis. The primary problem is that neither Leslie nor the studies that she cites directly compares the age at which children acquire generics with the age at which they acquire adverbs of quantification, such as *always*, *usually*, and *sometimes*. Instead, Leslie only makes compares the acquisition of generics with the acquisition of quantificational determiners, like *every*, *some*, and *all*. This is surprising because the literature on generics typically analyse the generic operator to be an adverb of quantification, rather than a quantificational determiner, and so the acquisition of generics should really be compared to the acquisition of adverbial quantifiers, and not quantificational determiners.[14] Indeed, if adverbial quantifiers and quantificational determiners constitute separate grammatical categories, with different syntax and semantics, then the choice to contrast the acquisition of generics with the acquisition of quantificational

[14] Indeed, I know of only Pelletier and Asher (1997) who advocate that the generic operator is a quantificational determiner.

determiners is suspect. In the following section, I argue that children seem to acquire adverbs of quantification at around the same age as they acquire generics, which suggests a much less dramatic picture than Leslie's.

The second problem about the empirical data is that the studies that Leslie cites do not directly compare the acquisition of generics and the acquisition of quantificational determiners. As Lazaridou-Chatzigoga et al. (2015: 482) point out, neither the Gelman et al. (2008) study nor other studies reporting generic utterances in early child speech contrast the rates of generic production with the rates of quantified utterances in the children at the same ages. While the presence of generic utterances in early child speech is consistent with the generics-as-default-generalisations hypothesis, this direct comparison is needed to fully support the generics-as-default-generalisations hypothesis. Furthermore, Lazaridou-Chatzigoga et al. (2015) claim that at the time of their writing only two studies that investigate the production and comprehension of generics in early child speech report robust evidence that young children show an early advantage for generic versus quantified generalisation, namely Hollander et al. (2002) and Leslie and Gelman (2012); all other studies indicate that children as young as 2;0 perform well in their comprehension of both generic and quantified or specific statements. Furthermore, conflicting evidence is presented by Gelman et al. (2015), who find that children as young as 3 year olds can distinguish between generics and quantifiers. These observations draw doubt on the initial claim about the contrast between generics and quantificational determiners to which Leslie appeals in favour of the generic-as-default-generalisation hypothesis.

The third problem about the empirical data concerns the importance that so-called 'troublesome' generics, like 'Ducks lay eggs' and 'Mosquitos carry the West Nile virus', play in Leslie's theory. According to Leslie, our truth-value judgments reflect how the world must be for these sentences to be true, in particular that laying eggs lies on a characteristic dimension for ducks and carrying the West Nile virus is a striking property. However, while adults may ascent to these generalisations, the empirical evidence does not support the hypothesis that children grasp all the subtleties concerning generics, as Leslie herself admits:

> One might wonder whether young children grasp all the troublesome aspects of generics. Perhaps these features are acquired more slowly—perhaps more slowly than explicit quantifiers are acquired. This is an empirical question, and I do not know of data that bear directly on the question at this time. (Leslie 2008: 28, ft. 20)

But if Leslie is correct about the quirks of the default mode of generalising and how they are reflected in the worldly truth-conditions of generics, then it is unclear how a child could fail to grasp the truth-conditions of certain troublesome generics. Further research must be carried out to support the claim that the quirks of the default mode of generalising is reflected in the cognition of infants. Any failure to grasp these aspects would undermined her appeal to these generics in support of her theory.

The fourth problem concerns the adequacy of Leslie's metaphysical truth-conditions. According to Leslie's semantics, a generic is true only if all of its counterinstances are negative. In explaining the difference between positive and negative counterinstances, Leslie appeals to an intuitive difference between simply lacking a feature and "lacking it in virtue of having another, equally memorable, feature" Leslie (2008: 35). A counterinstance is negative simply when an instance fails to be F, rather than engendering a *positive* counterexample. For example, the sentence 'Birds are female' is false because those birds that fail to be female do so in virtue of possessing the positive alternative property of being male, whereas the sentence 'Birds lay eggs' is true in part because those birds that do not lay eggs merely fail to possess the property in question, rather than by possessing a positive alternative property like birthing live young.

However, there are examples of true generics which have positive counterinstances in the sense that they lack a property by having an equally memorable alternative property. Consider, for example, the sentence 'Mammals birth live young'. This sentence is true despite the existence of egg-laying platypuses. But Leslie's theory predicts that this sentence is false, since the property of laying eggs counts as a positive alternative to giving birth to live young, if anything does. Similarly, the sentence 'Ravens are black' is true, despite the presence of albino ravens. But if being white is a positive alternative to being black, then Leslie's theory predicts the sentence to be false. Lastly, speaker report that sentences like 'Hippopotamuses attack people' is false. But given attacking people is a striking property and the rate of bear attacks is not negligible, Leslie's theory incorrectly predicts that the sentence is true. With sufficient ingenuity, counterexamples multiply without limit.[15]

As we have seen, whether the generics-as-default-generalisations hypothesis is correct depends on subtle questions about the extent to which the empirical literature supports it and whether the truth-conditions accurately reflect the quirks of the default mode of generalising. The next section revisits the first concern by introducing a puzzle that arises from strong evidence that other grammatical categories bearing the hallmarks of quantification also appear before explicit quantifiers in early child speech: adverbs of quantification, modals, tense, and aspect. I shall argue that this undermines the empirical support for Leslie's cognition-based to generics.

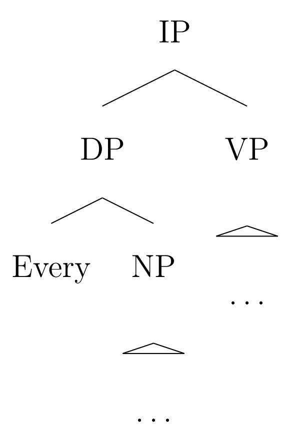
4.5 Linguistic Evidence for the Early Acquisition of A-Quantifiers

While the standard logico-philosophical approaches to quantification primarily concern quantificational determiners like *every* and *some*, the manifestation of quantification is by no means restricted to these expressions. More specifically, natural language also

[15] For similar arguments, see Sterken (2015c: 2497–2500); Nickel (2016: 89–91).

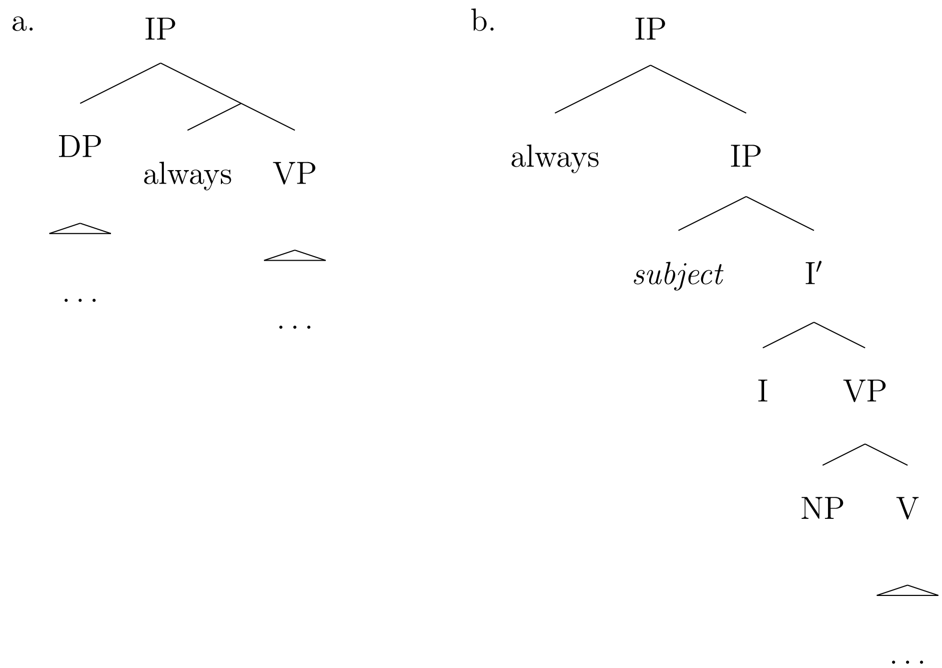
incorporates the expression of quantification in verbal morphology, either in the whole verb stem or in auxiliary verbs, preverbs and verbal affixes. Following the work of Lewis (1975) and Heim (1982) and the distinction introduced by Partee (1991a), we may then distinguish D-quantifiers and A-quantifiers, where 'D' is a mnemonic for Determiner and 'A' for the cluster of Adverbs, Auxiliaries, Affixes, and Argument-structure Adjusters, such as *usually*, *always*, *mostly*, *often*, *rarely*, *never*, *sometimes*, *must*, and *may*.[16] Syntactically speaking, D-quantifiers, like *every* and *some*, form a constituent with a projection of the lexical category of nouns, whereas A-quantifiers form a constituent with some projection of the category of verbs or sentences, such as in the simplified syntactic structures in (4)–(5):

(4)



[16] See Partee (1995), for examples from other languages.

(5)



Given the widespread treatment of the generic operator Gen as an adverbial quantifier, it is puzzling why Leslie directly compares the acquisition of generics with the acquisition of explicit quantificational determiners. Instead, it would be more natural to compare the acquisition of generics with the acquisition of other A-quantifiers, such as explicit adverbial quantifiers, modals, and tense morphology. This section presents evidence that such quantifiers also emerge at around the same time as generics. This observation undermines the motivation for a fully cognitive account of generic sentences. For if generics alone express a default mode of generalising, then we would expect these other A-quantifiers to emerge at a later point, since they would presumably require inhibitory processing. The fact that they appear at around the same time is problematic for the generics-as-default-generalisations hypothesis.

4.5.1 Adverbial quantifiers

Adverbial quantifiers, such as *always*, *sometimes*, and *usually*, are used to express generalisations over times, events, or situations. Since Gen is widely held to be something like an adverbial quantifier, such expressions play a central role in theorising about generics.[17] Theorists typically agree that sentences containing adverbial quantifiers have a tripartite logical form involving an operator that unselectively binds any free variables in its restrictor and matrix (Lewis 1975). For example, the sentence in (6a) may be given the simplified logical form as in (6b):[18]

(6) a. When Mary goes to the cinema, Mary usually takes John.

b. usually e [Mary goes to the cinema in e][Mary takes John to the cinema in e]

The semantic value of adverbial quantifiers are widely held to be functions from cardinalities of sets to truth-values, with different adverbial quantifiers varying in their quantificational strength. For example, (6a) is true, roughly speaking, if and only if the cardinality of the set of events in which Mary is going to the cinema and she takes John is greater than the cardinality of the set of events in which Mary is going to the cinema and she doesn't take John.

Given that adverbial quantifiers are quantificational and their truth-conditions involve set-cardinalities, the generics-as-default-generalisations hypothesis should predict that they are acquired later than generics for similar reasons why quantificational determiners are acquired later. However, it turns out that children acquire adverbs of quantification from a young age as well. For example, the groundbreaking Antinucci and Miller (1976) study finds cases of children as young as 1;8 producing and comprehending adverbs as witnessed in the following dialogue:

(7) (1; 8) (The child sees a cat moving along the eaves of a house)

Adult: *Che bel gattone; ti piace i gatti*? 'What a pretty cat; do you like cats?'

[17] Indeed, to the best of my knowledge, only Pelletier and Asher (1997) offer treatments of Gen as a quantificational determiner, although this hypothesis is entertained by Nickel (2016).

[18] When the restriction of the adverbial quantifier is not explicitly represented, such as in 'Usually, Mary takes John to the cinema', the correct restriction is derivable from some context-sensitive process, such as 'semantic partition' or pragmatic anaphora resolution; see, for example, Rooth (1985); Partee (1991b); von Fintel (2004a). The precise characteristics of this process is not relevant to this chapter.

Child: *Graffiano* 'They scratch'

Adult: *Graffiano solo se vengono disturbati* 'They scratch only if they are disturbed'

Child: *No, graffiano* ***sempre*** *... cattivi gatti* 'No, they **always** scratch ... bad cats' (Antinucci and Miller 1976: 174, emphasis added)

Similarly, (Cromer 1968) reports that, in Polish, adverbs such as *zawsze* 'always' and *nigdy* 'never' merge before the age of 3. Recall that, in Section 4.2, we surveyed evidence that children begin to acquire generics from between 2 and 3 years of age. This strongly suggests that children acquire generics and adverbial quantifiers at around the same time.

These findings substantially weaken the dialectical force of the problem of generic acquisition. Adverbial quantification is universal in all known languages, whereas determiner quantification is rare (Bach et al. 1995). Given that genericity is also universal in all known languages, it is more likely that Gen is one of the ubiquitous quantificational adverbs, rather the less-common quantificational determiner. Given that Gen is commonly taken to be an adverb of quantification, and given the early acquisition of adverbs of quantification and their universality, it is unclear why we should compare the acquisition of generics to the acquisition of explicit quantifiers. When generics are understood as involving adverbial quantification, the problem of generic acquisition falters.

4.5.2 Modals

The standard view of modals, such as *may*, *must*, and *have to*, is that they are essentially quantificational. That is, they are context-dependent quantifiers over a domain of possibilities (see, for example, Kratzer 1977, 1981). Different flavours of modality correspond to quantification over different domains of possibilities; deontic modals quantify over possibilities that are compatible with what ought to be, epistemic modals quantify over possibilities that are compatible with what is known. Different strengths of modality correspond to different strengths of quantification; possibility modals like *may* involve existential quantification, whereas strong necessity modals like *must* involve universal quantification. Moreover, some theorists have argued that not only does natural language have the expressive power of a language with explicit quantification over worlds, syntactic structures also contain items that function as variables over worlds and that are bound by modals (Cresswell 1990; Stone 1997; Percus 2000; Schlenker 2006).

Given that modals bear these hallmarks of quantification and their truth-conditions involve sophisticated intensional notions, the generics-as-default-generalisations hypothesis should predict that they too are acquired later than generics. Nevertheless, there is strong evidence that the use of English modals appears at an early age, between 1;10 and 2;6 (Brown 1973; Kuczaj and Maratsos 1983; Shatz and Wilcox 1991). According to the work of Wells (1979), involving a time-sampled (3-month intervals) study of 60 children along with their mothers from 1;3 to 3;6, by 2;6 more than 50% of children used *can* to convey ability and permission, and *will* to communicate intention. By 3;3 all categories of root modality are in place. Fletcher (1979) uses the diary data for a child named Hildegard and finds that her first auxiliaries were *won't* and *can't* at the age of 2;0–2;2 years. About a month later, she acquired *will* in yes-no questions and answers to them. Hildegard also started using *will* in sentences not dependent on a question at 2;4 and *I may* at around the same time. By 2;5 she was using the progressive form *be+ing*. The modal use of these auxiliaries suggest that children as young as 2 years have a rudimentary comprehension of modality. These finding further weaken the empirical support for the generics-as-default-generalisation hypothesis, since children seem to already have the ability of use complex intensional notions around the age that generics emerge.

4.5.3 Tense–Aspect

Lastly, let us consider tense and aspect. Roughly speaking, tense locates a situation in relation to some other time, such as speech time, whereas aspect characterises 'different ways of viewing the internal temporal constituency of a situation' (Comrie 1976: 3). For example, the difference between *John is sleeping* and *John was sleeping* is a matter of tense, since the *is/was* contrast signifies a difference in the temporal location of the described situations relative to speech time. The difference between *John drank coffee* in its non-generic use and *John was drinking coffee* is a matter of aspect, since the contrast is about how the action of drinking coffee is viewed by the speaker; the former describes the situation in its entirety, as a completed action, whereas the latter describes the situation as being of an event in progress or continuing.

Linguists and philosophers standardly treat tense as involving quantification over times, and aspect as involving quantification over events or times. For example, on a simple analysis of past tense, a sentence of the form $\ulcorner\text{PAST}(\phi)\urcorner$ is true at a time t iff there is some time t' prior to t at which ϕ is true (cf. Prior 1967; Montague 1973). Similar analyses are often proposed for aspect as well. For example, on a simple analyse of the progressive, a sentence of the form $\ulcorner\text{PROG}(\phi)\urcorner$ is true at an interval T just in case T is a subinterval of some interval T', and ϕ is true at T' (cf. Bennett and Partee 1972). While the problems with these proposal are well known, they serve to illustrate the point that quantificational treatments of tense and aspect are promising.

There is evidence that children begin to acquire tense and aspect from a young age (before 2;6), although evidence suggests that children's use of past tense morphology and perfective markers are initially restricted to telic predicates, verbs that describe events in their entirety or that result in a change of state, such as *broke* or *built*, while also restricting present tense or imperfective morphology to atelic predicates, verbs that describe events as in progress or continuing, such as *dancing*. For example, children will often frequently say *broke* (past + perfective + telic) and *riding* (imperfective + atelic) but rarely *breaking* (imperfective + telic) and *rode* (past + perfective + atelic). Different explanations for the systematic under-use of available tense–aspect options have been proposed. For example, according to the Defective Tense Hypothesis, the appearance of tense in child speech is defective, since it only marks aspectual relations, and not diectic ones (Weist et al. 1984); whereas, according to the Aspect-Before-Tense Hypothesis, aspect is acquired before tense and this influences the acquisition and the choice of the latter, without constraining it to the same degree as the stronger hypothesis (Bloom et al. 1980).

The early acquisition of tense and aspect enjoys cross-linguistic support. For example, in a seminal study on the acquisition of tense and aspect, Antinucci and Miller (1976) examine the speech of eight children, seven of which are Italian, one is American, ages 1;6 to 2;5. They also use supplementary data from longitudinal records of the speech of another Italian child and from records of spontaneous speech of a number of other Italian children (cross-sectional data from 48 children age 2;0 to 4;4). Furthermore, there is evidence that Polish children use imperfective activity verbs in the past, such as the following examples from Weist et al. (1984):

(8) Leciał samalot
fly:IPFV:PAST plane
'The plane was flying' Marta (1;7)

(9) Pływała się
swim:IPFV:PAST
'She was swimming' Bartosz (1;8)

(10) Jadłam
eat:IPFV:PAST
'I was eating' Paulina (1;11)

Children have some trouble distinguishing tense from grammatical aspect, but this is resolved by age three. Weist et al. (1984) analysed experimental data and data from naturalistic observation on the acquisition of Polish claimed that children marked both tense and aspect (both are grammaticalized in Polish) at early stages. Moreover, children acquiring both Polish and English succeed at interpreting both combinations of perfective + telic combination and imperfective + telic combination by the age three years Weist et al. (1991, 1997, 1999). Wagner and Lakusta (2009); Wagner et al. (2009) support the idea that children have the conceptual and grammatical resources to understand grammatical aspect independently of lexical aspect.

Similar results were also found in German with the word *werden* is used to form future tense and that passive. Both structures appear around age 3;0. For example, from the diary entries of the Scupins' children, we can see that the first examples of future and passive with *werden* are at the age of 2;3 and 2;4 (Scupin and Scupin 1907; 1910, quoted from Mills 1985: 223).

(11)

(Himbeeren)	wird	gleich	alle	sein
	AUX.FUT	soon	allgone	be

'The raspberries will soon be all gone' Scupin (2;3)

(12)

wern	uns	jetzt	samn	setzen
AUX.FUT	REFL.PRO:1PL	now	together	sit

'we'll sit down together now' Scupin (2;6)

(13)

Mann	wird	mit	die	großen	Schere	kommt	und	Beindel	ab-	deschneidet
man	AUX.FUT	with	DEF.ART	big	scissors	come	and	legs	off	cut

'man will come and cut off (my) legs' Scupin (2;6)

Bar-Shalom (2002) shows that Russian children can correctly use the Past tense of both perfective and imperfective verb forms before they are 2 years old. This is not surprising, considering that the psychological literature offers robust evidence that children show understanding of temporal relations before they acquire the ability to express them linguistically (e.g., Harner 1982). Bloom et al. (1980) and Gerhardt (1988) also observed that American children learn temporality at the same time as aspect. More generally, these finds are quite robust cross-linguistically; see, for example, the references in Slobin (1985).

4.5.4 Summary

I began this section by observing that, given that the generic operator is standardly analysed as an adverbial quantifier, the evidence that generics are acquired before quantificational determiners does not straightforwardly support the hypothesis that generics express a primitive form of generalisation, since different grammatical categories may plausibly be acquired at different stages. Instead, we should compare the acquisition pathway of generics with that of A-quantifiers, the grammatical category to which the generic operator belongs, and only if we find that generics are acquired before A-quantifiers, would this then support the generics-as-default-generalisations hypothesis.

However, when one looks outside the study of generics, one finds strong evidence that children acquire adverbs, modals, tense, and aspect from around the same time that they acquire generics. Given that the cognition-based approach to generics led us to believe that only generics gives voice to cognitively primitive generalisations, it is puzzling why children acquire these A-quantifiers at the same time as generics. Indeed, given Leslie's puzzle of the acquisition of generics, one would naturally expect explicit A-quantifiers to appear latter on in language development, presumably at the same time as explicit D-quantifiers. This is because the denotations of both categories presumably involve computationally complex statistical patterns and require inhibitory process to override any default mode of generalising. Therefore, the fact that A-quantifiers are in fact acquired at around the same time as generics poses a serious problem for the type of evidential support for the generics-as-default-generalisations hypothesis, and any framework that ties the formation of generic generalisations and the truth-conditions of generics to some default mode of generalising.

4.6 Default Reasoning in the Verbal Domain

A general explanation for why A-quantifiers appear before D-quantifiers in language acquisition must be forthcoming. It is natural to wonder whether the early acquisition of non-generic A-quantifiers can also be explained by extending the hypothesis that humans are endowed with default mechanisms of representation to modality and temporality, with such mechanisms being analogous to those posited for genericity. For while genericity, modality, and temporality are different phenomena and concern different subject matters, recent research suggests that our judgments in these domains are shaped by a default way of thinking about specific matters, such as categories, possibilities, and events. According to this research, modal and temporal language also give voice to default methods of representing, albeit with possibilities and temporality. While it is important to remember that these phenomena are distinct, it is tempting to see whether the connections between these different domains can shed light on the early acquisition of A-quantifiers. In particular, it is natural to suggest that these default modes of representing quantificational domains are evidence that children are endowed with primitive cognitive faculties which help to facilitate the early acquisition of A-quantifiers. This potential extension to Leslie's hypothesis would allow other expressions to give rise to primitive forms of generalising or representing, and so generics are only one of several different default mechanisms.

I shall call this hypothesis the **Generalised Defaults Hypothesis**. Whereas the generics-as-default-generalisations hypothesis says that generics give voice to the only default mode of generalising, the Generalised Defaults Hypothesis would say that there are a number of default cognitive mechanisms responsible for interpreting a wide variety of phenomena, with modals and tense giving voice to the default representations of possibility and temporality. Importantly, for the Generalised Defaults Hypothesis to be fully analogous with Leslie's theory, it must tie the full complexity of the relevant domains to the corresponding default mechanisms. This section provides a brief overview of existing research that might support this kind of hypothesis and raises doubts for this general strategy.

An immediate problem with the Generalised Defaults Hypothesis is how it accommodates the early acquisition of adverbial quantifiers. For if the hypothesis is correct, then the early acquisition of adverbial quantifiers should be explained by some cognitively primitive mechanism that generalises over whatever such quantifiers range, such as events, times, or situations. But it is the generic quantifier Gen that is supposed to play the role of such an default operator. Consequently, it is not possible to maintain both that Gen is *the* default adverbial quantifier and that the early acquisition of explicit adverbial quantifiers is explained by something like the Generalised Defaults Hypothesis. But if one rejects the claim that Gen is the unique default adverbial quantifier, and accepts that each adverbial quantifier must also play the role of a default operator, we can maintain neither the elegance of Leslie's solution to the problem of generic acquisition nor her explanation for why explicit quantifiers trigger inhibitory processing. The Generalised Defaults Hypothesis falters at the first hurdle.

A solution to this problem would be to reject the assumption that the generic operator is an adverbial quantifier, and instead assume that it is a quantificational determiner. Then, one could hold that generics are the manifestation of cognitively primitive generalisations over *individuals*, thus freeing up the possibility that some other default mechanism is responsible for the emergence of explicit adverbial quantifiers. However, to my knowledge, there is no existing literature that tries to establish a default mechanism for representing eventualities. Consequently, defenders of this proposal would have to find evidence that such a mechanism exists, as well as explain how the generic operator functions when the determiner position is already filled by a definite or indefinite article, as in sentences like 'The lion has a mane'.

Putting these issues aside, let us consider how the Generalised Defaults Hypothesis fares in extending Leslie's explanation for the early acquisition of generics to modals and tense. According to this approach, children possess default representations of possibilities and events, and it is to these representations that modalised and tensed sentences give voice. Given that children are already capable of forming these generalisations, they must learn nothing else except the meanings of words and how to partition the sentence material into the Restrictor and Matrix. If this explanation is correct, then the puzzle of A-quantifier acquisition dissolves.

There is some empirical support for the claim that humans poses default methods for representing modality and temporality. Recent research suggests that humans pose a primitive ability to construct default representation of modality in which both prescriptive and statistical considerations are relevant (Phillips and Cushman 2017; Phillips and Knobe 2018). That is, the default representation of a modal involves quantification over possibilities that are both prescriptively permissible and statistically plausible. There is strong evidence in favour of this hypothesis. One study shows that, when forced to answer under pressure, people default towards an interpretation that involves both prescriptive and statistical considerations (Phillips and Cushman 2017), while another study shows that young children find it difficult to interpret modals so that either the prescriptive or the statistical considerations are not relevant (Shtulman and Phillips 2018). While other interpretations are possible, these interpretations are only accessed by overriding the default interpretation.

Furthermore, while there is relatively little published work in the cognitive developmental literature on children's temporal concepts, several claims have been made about children's concepts of time based on their use of tensed verbs from within developmental linguistics that suggests a default mode of representing events. Recall that children do not initially use the full range of tense–aspect combinations available in their language. On this basis, some theorists have concluded that children use tensed forms before they are able to engage in temporal decentering, that is, before they are able to adopt alternative temporal perspectives on an event that are not necessarily contemporaneous with the time of the event itself nor with the present time (see, for example, McCormack and Hoerl 1999). In a slogan, children first use tense morphology to mark aspectual distinctions rather than to mark tense. If this observation is interpreted as a cognitive limitation on how children think of events, namely, in terms of aspectual notions such as 'ongoing' or 'completed', then children may possess a default representation of events as restricted to the present, whereby past events are only initially thought of from the perspective of their present effects, that is as completed, whereas present events are thought of as ongoing. Therefore, there are aspectual influences on tense comprehension: children's understanding of time is closely tied to their representations of events.

However, there are problems with extending Leslie's explanation of the emergence to generics to modals and tense. In particular, modalised and tensed sentences give voice to more complex representations than simply the defaults. For example, in addition to the default representation of modality as involving a mixture of descriptive and prescriptive considerations, modals also come in a wide array of 'flavours', such as the following (adapted from Kratzer 1977):

(14) a. The ancestors of the Maori *must* have arrived from Tahiti. (epistemic)

b. All Maori children *must* learn the names of their ancestors. (deontic)

c. If you *must* sneeze, at least use your handkerchief. (dispositional)

d. When Kahukura-nui died, the people of Kahungunu said: Rakaipaka *must* be our chief. (preferential)

Furthermore, tense–aspect systems in natural language are capable of expressing far more tenses than just those borne out of the 'aspect-before-tense' hypothesis. Recall that Leslie claims that the truth-conditions of generic sentences are reflected in the quirks of the default mode of generalising. By parity of reasoning, if the Generalised Defaults Hypothesis is correct, then we should expect the quirks of modals and tense to be encoded in the default representations of these domains. But we have found no evidence for this claim; the corresponding default mechanisms only accommodate a proper subset of the data. Consequently, the Generalised Defaults Hypothesis should predict that it is surprising that we develop the sophisticated modal and tense–aspect systems that we see in natural language. While their possession of default representations of possibilities and events may help to explain their initial acquisition of modality and tense, these explanations do not mirror Leslie's claims that the complexities of the phenomena in question are encoded in the cognitively primitive systems.

This section draws doubt on whether Leslie's explanation of the early acquisition of genericity — an explanation that makes essential appeal to a default mode of generalising to also explain all the semantic subtleties of genericity — can be extended to the domains of modality, temporality, and eventuality. More specifically, if Leslie's cognition-based account of generics is correct, then the early acquisition of modality and tense should be explainable in terms of our possession of default ways of representing possibilities and times. But despite evidence that humans possess default representations of these domains, these mechanisms alone cannot accommodate the wide variety of modal flavours nor the full range of tense–aspect combinations. This is unsurprising, since these mechanisms are presumably intended to only account for a certain subset of the phenomena, rather than a full explanation of every facet. It is important to stress that these limitations do not constitute evidence that such mechanisms do not exist. Rather, it provides evidence that default mechanisms cannot be expected to do the work of a complete explanation of quantification. Default mechanisms may help as a heuristic to fill in certain contextually specified values in the semantic interpretation of sentences, but they cannot be expected to be a substitute for a full semantic account. Consequently, in lieu of a reason to reject the symmetry between generics and these other expressions, this is a strong reason to reject fully cognition-based accounts of these expressions. The upshot of this discussion is that any hypothesised default mechanism of generalisation or representation should be decoupled from a full semantic analysis of the corresponding expressions.

4.7 The Acquisition of Generics and Universal Grammar

The question remains why children acquire genericity, modality, tense, and aspect with such apparent ease, while struggling with explicit D-quantifiers. In order to solve this puzzle in a way that is consistent with the standard view of generics, we need to explain why A-quantifiers emerge alongside generics and before the acquisition of quantificational determiners, even though they all involve a quantificational semantics. Furthermore, any solution should do justice to the idea that there is something innate and cognitively primitive about the role that generics play in human cognition. In this section, I shall tentatively propose an alternative solution to these problems of acquisition.

The proposal is couched in the framework of Universal Grammar (UG), the theory according to which humans are endowed with a system of rich linguistic knowledge that guides infants in their (implicit) analysis of linguistic stimuli (Chomsky 1975, 1981, 1986). I contend that quite general features of this innate and richly structured language capacity explain the acquisition pathways of quantifiers. The idea that features of UG encode the order of acquisition of quantifiers in a predictable manner has already received support from recent empirical research.[19] Katsos et al. (2016)

[19] I should note that what I have said is broadly sympathetic to Leslie's proposal insofar as I agree that generics are innately encoded to emerge at certain times, whereas other quantifiers are innately encoded to emerge at other times; cf. "Some contemporary theorists hold that quantifiers are innate,

successfully predict that the following four constraints systematically affect the order of acquisition of D-quantifiers: (i) that children are more successful at comprehending monotone increasing quantifiers compared with monotone decreasing quantifiers, (ii) that children are more successful at acquiring quantifiers that attribute a property to all or none of the members of a set than they are at acquiring quantifiers that attribute a property to only part of a set, (iii) that children are more successful at comprehending *some* than *most*, and (iv) children are stricter towards violations of truth than violations of pragmatic felicity. In a similar vein, I conjecture that general features of UG are responsible for the order of acquisition of A-quantifiers.

My central conjecture is that the computational demands of the acquisition of quantificational determiners exceed the cognitive capacities of young infants, whereas the acquisition of A-quantifiers do not carry the same demands.[20] It is well know that, in order to interpret quantified sentences, one must have acquired certain binding principles and be able to access a representational system through something like Quantifier Raising, an operation that allows us to define the scope of quantifiers. To see how these constraints could pose problems for the acquisition of quantifiers, let us consider the following sentence:

(15) Every farmer is riding a donkey.

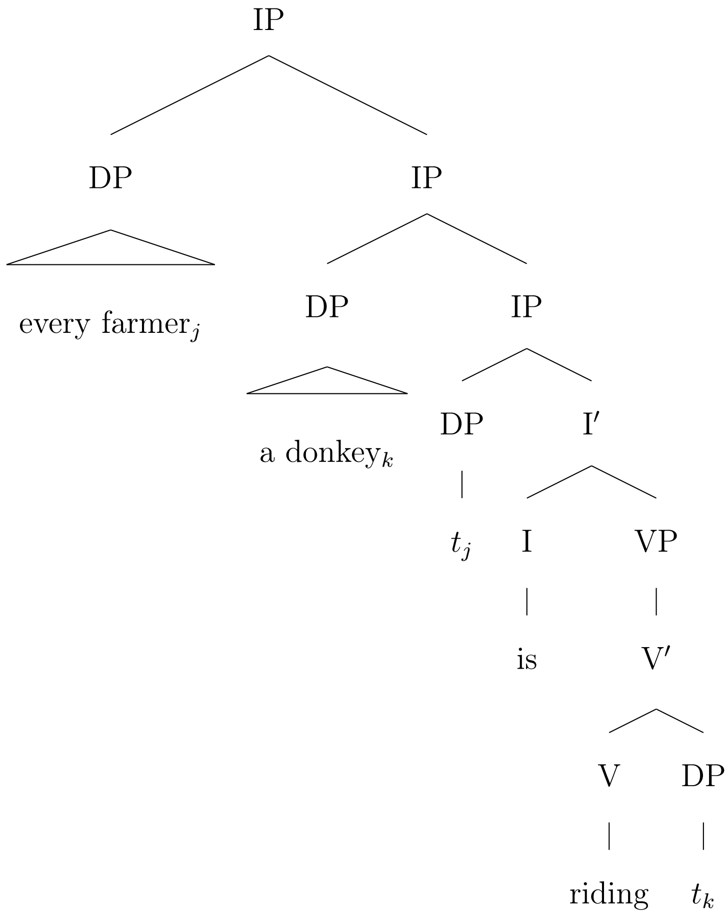
To be interpreted, the quantifiers *every farmer* and *a donkey* must move and adjoin a suitable site using a movement operation called Quantifier Raising (QR). That is, at the level of Logical Form, the quantified expressions are moved from their surface position to a suitable site, such as, for example, IP, as in (16). From there, they bind their traces, which are construed as variables bound by the coindexed raised quantified expressions.

---

even though they emerge later in development. I have no quarrel with this view, though I take it as self-evident that if quantifiers are innate, so are generics" (Leslie 2008: 23, ft 16).

[20] In this sense, I agree with Leslie that quantificational determiners are more cognitively taxing than generics, although I disagree this is because they involve inhibitory reasoning.

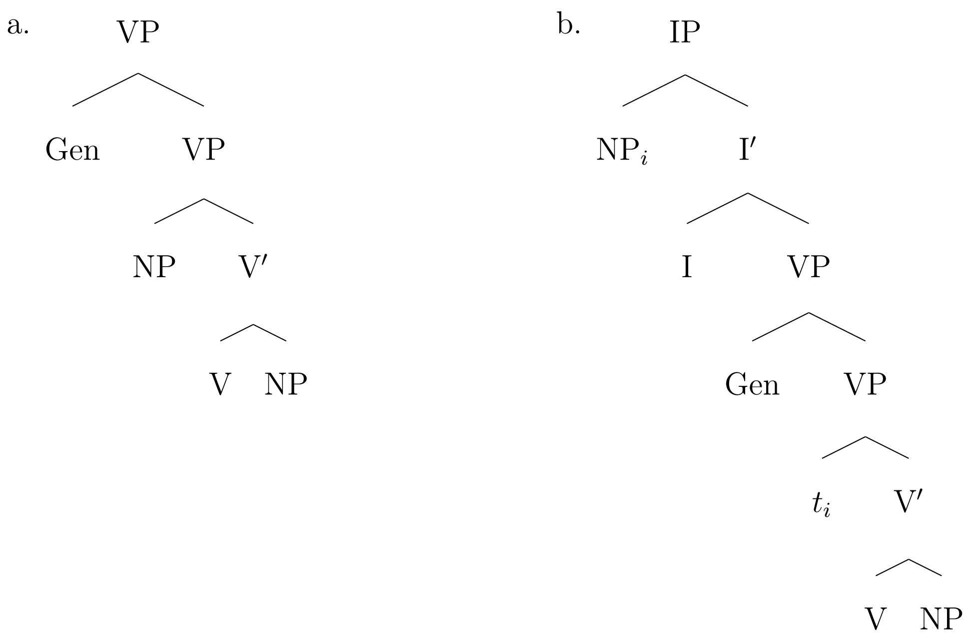
(16)



If anything like the syntactic representation in (16) is correct, then children must have mastered both of these mechanisms to acquire quantificational determiners. Given the cognitively sophisticated nature of binding principles and QR, it is unsurprising that children only master binding principles at around 3- to 4-years of age. Importantly, this correlates with the age that they acquire quantificational determiners. I conjecture that the emergence of quantification determiners at this age is a result of mastering these constraints.

Let us compare the situation with adverbial quantifiers. For concreteness, I shall adopt the proposal of Diesing (1992), according to which adverbial quantifiers are propositional operators whose scope is set rigidly as the VP. Furthermore, I adopt the 'Internal Subject Hypothesis' according to which subjects are base-generated in a VP-internal subject position and either raise to a suitable site or are interpreted in their initial subject position. Importantly, I conjecture that this mechanism is not always obligatory for adverbial quantifiers, modals, and tense. In particular, when children begin to acquire adverbial quantifiers, they are only able to generate simple representations in which the adverbial quantifier takes scope over the whole VP, with the subject in its base-generated VP-internal position, such as in (17a), rather than more complex syntactic structures that result from scoping mechanisms, as in (17b):

(17)



If I am right that adverbial quantifiers do not give rise to obligatory movement and binding operations, then this would explain why these quantifiers emerge earlier than quantificational determiners: analogous simple representations are not available for quantificational determiners, since QR is obligatory in such contexts. Moreover, this explanation naturally extends to the standard account of generics, since it analyses the generic operator *Gen* as an adverbial quantifier. It is for this reason that A-quantifiers are acquired before D-quantifiers; it is not unconceivable that these syntactic demands delay the acquisition of quantificational determiners without affecting the acquisition of A-quantifiers.

I will not pretend to be confident that my proposal completely explains the acquisition of A-quantifiers. For example, I am open to being convinced that UG offers other reasons why generics may be acquired early, such as the fact they are typically not marked for tense or aspect, or alternatively, they employ the least marked tense–aspect choice in the language (Dahl 1995). Given that children do not have to associate any additional tense or aspect morphology with the generic forms of verbs, it is perhaps unsurprising that genericity is acquired at around the same time as verbs more generally, whereas quantificational determiners require the association of additional quantificational morphemes with quantification: additional morphology may pose an initial barrier to their acquisition. Furthermore, I have not denied the existence of any primitive method for representing the domains in question. Rather I have only rejected Leslie's claim that the quirks of these mechanisms explain all aspects of the semantics of generics. Since the facts to be explained involve a variety of semantic and psychological sophistication, I am not embarrassed by a multi-layered explanation of their character. While a complete investigation of these hypotheses must be left to future work, I hope that my discussion has shown that there is no pressing need to depart from the standard quantificational approach to generic sentences.

4.8 Conclusion

My strategy in this chapter has been to raise doubt on the generics-as-default-generalisations hypothesis by drawing connections between the acquisition of generics and the acquisition of other A-quantifiers. We began with an analogue of Leslie's problem of generic acquisition involving the acquisition of other A-quantifiers, and saw that it calls into question the empirical support for the hypothesis. A natural solution to this analogous puzzle would be to extend Leslie's hypothesis to the modal, temporal, and eventual domains. However, while there is empirical evidence for default modes of representing in such domains, these modes are unable to fully account the wide semantic behaviour of the corresponding expressions. This spells trouble for Leslie's solution to the problem of acquisition, since we would expect similar mechanisms to be responsible for the acquisition of A-quantifiers more generally. More specifically, this raised a problem for Leslie's claim that the truth-conditions of generic sentences are essentially tied to the default cognitive mechanism. So we were forced to seek another solution to both problems of acquisition. I have suggested that a more economical and ecumenical explanation of the language acquisition data would involve appealing to general constraints in the framework of Universal Grammar, and I have outlined some suggestions about how to proceed. While this hypothesis is preliminary and speculative, and further research is required, if I am right, then we can solve the problem of generic acquisition along with the problem of A-quantifier acquisition without rejecting the standard quantificational and formal semantical approaches to generic sentences outright.

Chapter 5

Generic Conjunctivitis

5.1 Introduction

There is an orthodox approach to thinking about the semantics of characterising sentences, such as those in (1), according to which they express universal or near-universal generalisations about what is characteristic for a contextually determined subset of members of a particular kind.[1,2]

(1) a. Ravens are black.

b. Whales are mammals.

c. Elephants have trunks.

d. Bishops move diagonally.

According to the orthodoxy, characterising sentences have a tripartite quantificational structure involving a phonologically null generic operator called 'Gen'. The quantificational strength of *Gen* is quasi-universal and encodes some kind of intensional

[1] See, for example, the theories expressed in Krifka et al. (1995); Pelletier and Asher (1997); Mari et al. (2013a), as well as Cohen (1999a); Greenberg (2004).

[2] This chapter focuses primarily on characterising sentences involving bare plural noun phrases, rather than indefinite and definite singular noun phrases. The semantics of these sentences differ in subtle ways that puts them outside the scope of this thesis.

component, which accounts for the exception-permitting behaviour of generics. Devotees of the orthodoxy differ on how they treat the intensional component of *Gen*. Some claim that characterising sentences express relative frequency probability judgments smoothed out over suitable stretches of times and histories (Cohen 1999a). Others hold that they express claims about what properties are had by all/most normal individuals of a certain kind (Asher and Morreau 1991, 1995; Krifka et al. 1995; Pelletier and Asher 1997; Eckardt 2000; Asher and Pelletier 2013). Nevertheless, despite diverging on some semantic details, most extant theories of characterising sentences subscribes to some variant of the orthodoxy.

However, recent theorists have argued that characterising sentences involving phrasal conjunctions pose serious problems for the orthodoxy (Carlson 1977a; Schubert and Pelletier 1987; Nickel 2008, 2016; Liebesman 2011).[3] Call these sentences **generic conjunctions**:

(2) a. Elephants live in Africa and Asia. (Nickel 2008)

b. Cardinals are red and lay eggs. (Asher and Pelletier 2013)

c. Humans are male and female. (Nickel 2016)

[3] Coordination pose problems for the standard approach across the board. For a related argument that disjunctive coordination also poses a similar problem, see Nickel (2010b). Briefly, Nickel argues that the standard approach cannot accommodate so-called *free choice* effects in generics, in which characterising sentences involving disjunction coordination like 'Elephants live in Africa or Asia' seem to entail conjunctions of simpler characterising sentences like 'Elephants live in Africa and elephants live in Asia'.

Generics involving copredications such as 'Ducks lay eggs and are widespread throughout Europe' and 'Snow is white and is falling right now through Alberta' also pose problems for the orthodoxy (Carlson 1977a; Schubert and Pelletier 1987; Liebesman 2011). These sentences involve the application of a determiner phrase as the argument of multiple predicates, but which requires the determiner to denote entities of different types in each case. For example, if the individual-level predicate *lay eggs* is understood as denoting a property of individuals and the kind-level predicate *are widespread throughout Europe* is understood as denoting a property of kinds, then it is unclear what the bare plural NP *ducks* could denote so that it could successfully play both roles. However, this is problematic for the orthodox approaches to generics, which typically postulate a uniform lexical entry for bare plural determiners as either contributing kinds or properties (functions from individuals to truth-values, or an intensional variant). Unfortunately, developing an adequate account of generic copredications is outside the scope of this chapter. For further discussion, see Carlson (1977a); Schubert and Pelletier (1987); Nickel (2008, 2016); Liebesman (2011); Asher and Pelletier (2013); Leslie (2015); Cohen (2007). For recent discussions of copredication in general, see Gotham (2015); Liebesman and Magidor (2017).

d. Mary smokes [cigars and cigarettes]$_f$ after dinner.[4]

Generic conjunctions involve equally good, but mutually incompatible characteristic properties, none of which are satisfied by the majority of the kind. For example, (2a) is true even though it is not the case that all/most elephants (in a suitable domain) live in both Africa and Asia. (2b) is even more difficult to deal with, since we seem to be predicating two properties to cardinals even though no cardinal can have both: only male cardinals are red and only female cardinals lay eggs. Similarly, (2c) is true, even though no human is both male and female. And (2d) illustrates that a similar phenomenon arises with habitual sentences; the sentence may be true even though Mary never smokes both a cigar and a cigarette after her dinner. However, these observations pose a problem for orthodox approaches to generics, which predict that (2a) is true iff all or most (contextually determined) elephants live in both Africa and Asia; that (2b) is true iff all or most all or most (contextually determined) cardinals are both red and lay eggs; that (2c) is true iff all or most (contextually determined) humans are both male and female; and that (2d) is true iff after every or most (contextually determined) dinner(s), Mary smokes a cigar and a cigarette. But since no elephant lives in both Africa and Asia, no cardinal is both red and lays eggs, and Mary never smokes both a cigar and a cigarette after dinner, the orthodoxy is empirically inadequate.[5]

The study of generic conjunctions is important for at least two reasons. First, judgments about generic conjunctions are robust and systematic. Other sentences that apparently pose problems for theories of characterising sentences, such as ‘Ducks

[4] This example is due to Timothy Williamson. Focal stress is orthographically marked with the ‘$[.]_f$’ which is phonologically realised by focusing the bracketed constituent or with the appropriate prosody.

[5] The problem of generic conjunctions is further bolstered by the intuitive acceptability of inferences involving conjunction introduction under the scope of a generic operator (cf. Leslie 2007):

(i) Peacocks lay eggs
Peacocks have fabulous blue-green tails
―――――――――――――――――
Peacocks lay eggs and have fabulous blue-green tails

lay eggs' or 'Mosquitos carry the West Nile Virus', are limited and the truth-value judgments of well-informed native speakers vary.[6] Contrastingly, generic conjunctions seem to present a unified class and judgments about their truth are firm.

Second, when confronted with generic conjunctions, it is tempting to jettison the standard approach in favour of other more revisionary accounts which deny that characterising sentence express claims about the properties had by a majority (Nickel 2008, 2016). Such accounts represent a significant departure from the orthodoxy. However, we should be cautious about accepting such accounts without a thorough investigation into the nature of generic conjunctions. In particular, it is worth consider whether they can be accommodated within the familiar majority-based framework, explaining the facts concerning generic conjunctions as epiphenomena of more general, independently known phenomena. If so, then generic conjunctions do not support these views.

This chapter argues that a satisfactory explanation can be given for generic conjunctions without departing from the orthodox approach to characterising sentences. In particular, accommodating generic conjunctions does not require us to revise our assumptions about the logical form of characterising sentences nor to take radically different approaches to their semantics.

I develop a general account of the behaviour of generic conjunctions that both vindicates the standard approach to characterising sentences and undermines a central motivation for revisionist semantics. In what follows, I make use of a particular combination of syntactic and semantic assumptions which I feel is best suited to

[6] Sarah-Jane Leslie (2007; 2008) recently argues against the standard approach on the grounds that it cannot accommodate the truth of 'Ducks lay eggs' without incorrectly predicting that 'Ducks are female' is also true. Furthermore, she argues that the standard approach incorrectly predicts that 'Mosquitos carry the West Nile Virus' is false because less than 1% of mosquitos are WNV carries, even though native speakers of English judge it to be true. However, these considerations are more subtle than Leslie supposes. For compelling arguments that the standard approach can accommodate 'Ducks lay eggs' and 'Ducks are female' by utilising a predicate-induced restriction and accommodation, see Chapter 2, as well as Cohen (1997, 1999a); Asher and Pelletier (2013). For compelling arguments that intuitions about 'Mosquitos carry the West Nile Virus' should not significantly inform semantic theorising, see Sterken (2015c).

supplement my hypothesis. In particular, I adopt a situation-based framework (Kratzer 1989; Elbourne 2013) combined with an algebraic treatment of plurals in the style of Gottlob Link (1983; 2017). Moreover, I choose to implement my solution in a normality-based, modal variation of the standard approach (cf. Krifka et al. 1995; Asher and Morreau 1995; Asher and Pelletier 2013). While these assumptions are widely shared and independently motivated, they do not represent the only way in which the thesis I am exploring can be cast, and the success of my basic argument is compatible with many other alternative implementations.[7,8]

The plan for this chapter is as follows. Section 5.2 outlines four central commitments of the orthodox approach to characterising sentences. Section 5.3 carefully presents the problematic data involving generic conjunctions. Section 5.4 draws upon and generalises some technical resources concerning plurals and conjunctions (Link 1983, 1998; Champollion 2017) to accommodate cumulative readings in generic sentences. Section 5.5 illustrates how the resulting theory provides a satisfactory account of the problematic data that is in keeping with the central commitments of the orthodoxy. Section 5.6 compares my theory with how Bernhard Nickel's semantically revisionary theory of generics deals with these sentences. I argue that his revisionist semantics are actually ill-equipped to account for the data, not least because the phenomenon in question is not specific to generics. Section 5.7 concludes.

[7] For other approaches to pluralities, see the set-theoretic approach (Winter 2001) or the plural logic approach (Yi 2005, 2006; Moltmann 2013; Oliver and Smiley 2013). The ideas in this chapter can be adapted to such frameworks.

[8] I should emphasise that that basic view defended in this chapter is not mine alone. In particular, Asher and Pelletier (2013: 329–330) suggest that some generic conjunctions may be accommodated by treating natural language conjunction as a sum-forming operator, rather than a Boolean connective; and Miguel Hoeltje (2017) suggests something similar. Also, see Krifka et al. (1995: 27–30, 39–40) for some discussion of generics and sum-individuals, although those authors do not apply these ideas to generic conjunctions. However, to the best of my knowledge, no one has provided a compositional account of the variety of the data I cover in this chapter.

5.2 The Orthodoxy

The orthodox approach is a broad church of different concrete proposals to the semantics of characterising sentences. Nevertheless, there are several commonalities that are useful for characterising the common ground between the theories. Each version of the orthodoxy is committed to the views that (a) the semantic interpretation of characterising sentences have a tripartite quantificational structure with a generic quantifier, (b) that the quantificational force of characterising sentences is quasi-universal, (c) they involve an intensional element, and (d) their predicate induces a restriction on the domain of quantification. This section outlines each of these central elements that forms the common ground of the views.

5.2.1 Logical Form

According to the standard approach, characterising sentences have a tripartite quantificational structure involving a phonologically null variable-binding operator, usually called 'Gen'. The generic operator *Gen* is typically treated as an adverb of quantification in the style of (Lewis 1975).[9] More specifically, *Gen* is analysed as a quantifier that relates two open sentences called the restrictor clause and the matrix clause. The matrix clause makes the main assertion of the characterising sentence, specifying the property attributed to the relevant members of the domain. The restrictor clause states the restricting cases relevant to the matrix. *Gen*, then, unselectively binds

[9] See (Krifka et al. 1995; Pelletier and Asher 1997; Mari et al. 2013a). Note, the standard approach need not necessarily treat *Gen* as a quantificational adverb. Instead, *Gen* might act like a quantificational determiner like *all*, *some*, *the* or *a*. On this approach, the logical form (LF) of characterising sentences of the schematic form $\ulcorner$*Fs are G*$\urcorner$ would be something like $\ulcorner G(Gen(F))\urcorner$ or $\ulcorner [Gen(F)](G)\urcorner$ depending on the precise nature of *Gen*. For exegetical reasons, we shall ignore this complication, since the identical problems arises for this approach.

A minority of theorists hold a kind-predication approach to characterising sentences according to which characterising sentences involve predications of properties to kinds; see, for example, (Carlson 1977a,b; Chierchia 1998; Liebesman 2011; Teichman 2016). Since our focus concerns majority-based theories, consideration of kind-predication accounts are outside the scope of this chapter.

any free variables in its scope, whether the variables range over individuals, worlds, (spatial-temporal) locations, events, or situations. Consequently, characterising sentences receive the schematic logical form (3), where the content of the sentence is somehow divided between the restrictor and the matrix, and *Gen* binds any free variable in its scope:

(3) Gen $x_1 \ldots x_i$[Restrictor($x_1, \ldots, x_i$)][$\exists y_1 \ldots y_j$ Matrix($\{x_1\}, \ldots, \{x_i\}, y_1, \ldots, y_j$)]

where $x_1, \ldots, x_i$ are the variables to be bound by Gen, $y_1, \ldots, y_i$ are the variables to be bound existentially with scope just in the Matrix, $\phi[\ldots x_m \ldots]$ is a formula where x_m occurs free, and $\phi[\ldots \{x_m\} \ldots]$ is a formula where x_m possibly occurs free. For example, the characterising sentence in (4a) will receive the (significantly simplified) logical form as in (4b):[10]

(4) a. Ravens are black.

b. Gen x[ravens(x)][black(x)]

In (4a), the bare plural *ravens* contributes the restrictor clause and the predicate *are black* contributes the matrix clause. The generic operator *Gen* is then introduced to bind the unbound variables. Defenders of the orthodoxy may remain neutral on how the tripartite structure is generated and what is the precise procedure for mapping the material in the sentence to the restrictor and matrix. Nevertheless, this procedure is likely to be a focus-related phenomenon and to involve an independently-motivated movement operation.[11] Importantly, defenders of the orthodoxy may remain neutral about whether the subject bare plurals of characterising sentences denote kinds or

[10] Strictly speaking, the proposition expressed will involve some indexing to other contextually salient parameters such as times, locations, worlds, events, or situations. As mentioned before, the generic operator *Gen* will bind any such free variable in its scope. Consequently, this framework is extremely flexible and can be implemented in event semantics and situation semantics. I shall omit this sensitivity to times, locations, events, situations, and so on for ease of exposition.

[11] For more details, see Section 5.4 and (Chierchia 1995; Rooth 1995; Asher and Pelletier 2013).

contribute predicates to the semantic value of the sentence, so long as the resulting implementation produces a tripartite structure.[12]

5.2.2 Quasi-Universal Quantificational Force

The second feature of the orthodoxy is that the semantics of characterising sentences involves a quasi-universal quantifier. It is well known that generics are not universal generalisations, since they allow exceptions. Nevertheless, despite their exception-permitting behaviour, most theorists agree that generics have a quasi-universal flavour, giving voice to generalisations about an actual or hypothetical majority of a kind. Consider, for example, the following sentences:

(5) a. Mammals bear live young.

b. Mary [smokes]$_f$ after dinner.

These sentences allow exceptions: (5a) is true even though some mammals lay eggs and (5b) is true even if Mary sometimes does things other than smoke after dinner. But despite allowing for exceptions, they have a quasi-universal flavour, typically requiring a majority of instances to satisfy some property. Most mammals have to bear live young for (5a) to be true, and it Mary usually does other things after dinner (5b) would be false.

Different versions of the orthodoxy encode the quasi-universal character of generics in different ways. Normality-based accounts typically deploy universal quantification over normal individuals or normal worlds. For example, Krifka et al. (1995: 52) write that:

> in order to capture the quasi-universal force of characterising sentences, we will want to employ a necessity operator in our representation. [For example, the

[12] For theories that combine kind-referring bare plurals with tripartite quantificational structure, see (Chierchia 1998; Moltmann 2013; Nickel 2016; Teichman 2016).

> sentence 'A lion has a bushy table' states that] everything which is a lion in the worlds of the modal base is such that, in every world which is most normal according to the ordering source, it will have a bushy tail.. . . [This representation] does not require that every lion has a bushy tail, not even of those lions in [the modal base worlds]. It merely states that a world which contains a lion without a busy tail is less normal than a world in which that lion has a bushy tail. (Krifka et al. 1995: 53).

Similarly, Asher and Pelletier (Asher and Morreau 1995) write:

> [$\ulcorner\phi$'s are normally ψ's$\urcorner$] is true just in case for every individual δ, if we look at the worlds where $\phi\underline{\delta}$ holds along with everything else which, in w, is normally the case where $\phi\underline{\delta}$ holds, we find that $\psi\underline{\delta}$ holds. (Asher and Morreau 1995: 313)

Probability-based versions of the orthodoxy typically deploy universal or majority-based quantification over all suitable smoothed out admissible temporal segments of possible worlds that extrapolate from the current history so far. For example, Cohen (1999a: 37) provides the following truth-conditions:

> Let $Gen[\psi][\phi]$ be a sentence, where ψ and ϕ are properties.
> Let $A = \textsc{alt}(\phi)$, the set of alternatives to ϕ. Then
> $Gen[\psi][\phi]$ is true iff $P(\phi|\psi \wedge \bigvee A) > 0.5$

where P is a frequentist probability function. Given frequentism, this amounts to the claim that the frequency of ϕs in a suitable reference class of ψ's that also satisfy one of the alternatives associated with ϕ is greater than 0.5. That is, 'most' such ψs are ϕs.

5.2.3 Intensionality

The third feature of the orthodoxy is that the semantics of characterising sentences involves an intensional element. This element captures the inherently intensional feature of characterising sentences which pose problems for purely extensional analyses. Consider the following well-known examples:

(6) a. Mary handles the mail from Antarctica

b. Members of this club help each other in emergencies

Sentence (6a) may be true even if there has never been any mail from Antarctic, just so long as handling such mail is part of Mary's employment contract. For example, we can imagine someone who doesn't know whether any mail has arrived from Antartica referring us to Mary by saying (6a). Similarly, (6b) may be true even if no emergencies have ever occurred, so long as, say, such an obligation is part of the club's code of conduct.

Every version of the orthodox approach can accommodate the intensional aspect of these generics because, in one way or another, they do not presuppose actual or current instances of mail from Antartica or emergencies. Instead, they ask us to look at what happens normally or in certain future continuations of the current history. On these approaches, (6a) suffice to be true just so long as if there were mail from Antartica, Mary would be the one who normally or is most likely to handle it. Similarly, (6b) is true iff if there were emergencies, the members of this club would normally or be more likely to help each other.

5.2.4 Predicate-Induced Restriction

The fourth feature of the orthodox approach is that it postulates an additional restriction, induced by the predicate, to accommodate troublesome sentences like (7):[13]

(7) Ducks [lay eggs]$_f$.

[13] See, for example, Carlson (1977a: 38ff.).

While native speakers of English judge that the sentences in (7) are true, naive versions of the orthodox approach incorrectly predict that they are false. For example, not all normal ducks lay eggs, since normal male ducks certainly don't; and given that only female ducks lay eggs, the conditional probability that an arbitrary individual will lay eggs, given that it is a duck is not greater than 0.5.

Typically, defenders of the orthodoxy account for sentences like those in (7) by arguing that additional material may enter the restrictor, such as, through the focus-sensitive nature of generics. It has long been observed that prosody affects the division of content to the restrictor and the matrix clauses of generic sentences. Research on prosody and generics suggests that focused material is selected for the matrix clause of focus-sensitive constructions, while the backgrounded material contributes to the restrictor. This follows fairly standard assumptions about how to divide content between the restrictor and matrix clauses in generic sentences (Chierchia 1995; Krifka 1995; Rooth 1995; Cohen 1999a). Since generics are like other focus-sensitive constructions, the restrictor in (7) should also include the disjunction of alternatives to the prosodically prominent element, namely, the focus interpretation of the sentence (7). For example, in (7), the focused material is the predicate *lay eggs* and so the restrictor of the sentence includes a disjunction over alternatives to egg laying, namely, alternative modes of reproduction, like birthing live young, reproducing via mitosis, and so on. Again, different mechanisms have been proposed for handling this process, but the resulting truth-conditions for (7) can be stated informally as:

(8) a. (7) is true iff all normal ducks that produce offspring in some way or other lay eggs.

b. (7) is true iff the conditional probability that an arbitrary individual lays eggs, given that it is a duck that produce offspring in some way or other, is greater than 0.5.

These truth-conditions are empirically adequate.

5.2.5 Summary

In summary, these four features of the orthodoxy contribute to an empirically powerful theory and accommodate a wide range of generic sentences. Almost every extant semantic theory of generic sentences subscribes to (some variant of) the standard approach (with the exception of those I discuss in Section 5.6) . However, as we will see in the next section, it has difficulty accommodating characterising sentences that involve phrasal conjunctions.

5.3 Generic Conjunctions

Let us return to the generic conjunctions in (2), repeated here:

(2) a. Elephants live in Africa and Asia.

b. Cardinals are red and lay eggs.

c. Humans are male and female.

d. Mary smokes cigars and cigarettes after dinner.

Each of the sentences in (2) involve different kinds of phrasal conjunctive coordination: (2a) involves the coordination of two determiner phrases in object position of a transitive verb; (2b) involves the coordination of two verb phrases which involve different topics; (2c) involves adjectival coordination; and (2d) involves noun phrase coordination in a habitual sentence. As we can see then, the phenomenon covers a broad range of syntactic positions, none of which the standard approach seems able to accommodate. This section explores three natural strategies for accommodating the data, and argues that they are incompatible with the standard approach.

The first strategy provides a phrasal analysis of the coordination in (2). According to this approach, the highest VP nodes that the subject terms in (2) c-command will denote a complex predicate, such as the following (or their intensional counterparts):[14]

(9) a. $\lambda x.[\text{live.in}(x, \text{Africa} \oplus \text{Asia})]$

b. $\lambda x.[\text{red}(x) \wedge \exists y[\text{eggs}(y) \wedge \text{lay}(x, y)]]$

c. $\lambda x.[\text{male}(x) \wedge \text{female}(x)]$

d. $\lambda x.\exists y \exists z \exists z'[\text{cigars}(z) \wedge \text{cigarettes}(z') \wedge y = z \oplus z' \wedge \text{smokes}(x, y)]$

The crucial observation is that these denotations cannot figure in the interpretation of the sentences in (2) without predicting that it is characteristic for elephants to have residencies on two continents, for peacocks to both lay eggs and have colourful tails, for a human to be both male and female, and for Mary to simultaneously smoke cigars and cigarettes. But the sentences in (2) say no such thing, nor does any normal or statistically probable elephant, peacock, or human have these properties. Consequently, the first strategy is incompatible with the standard approach.

The second strategy attempts to treat each sentence in (2) as elliptical for its counterpart sentential coordination, as in (10).[15]

(10) a. Elephants live in Africa and elephants live in Asia.

b. Cardinals are red and cardinals lay eggs.

c. Humans are male and humans are female.

d. Mary smokes cigars and cigarettes after dinner.

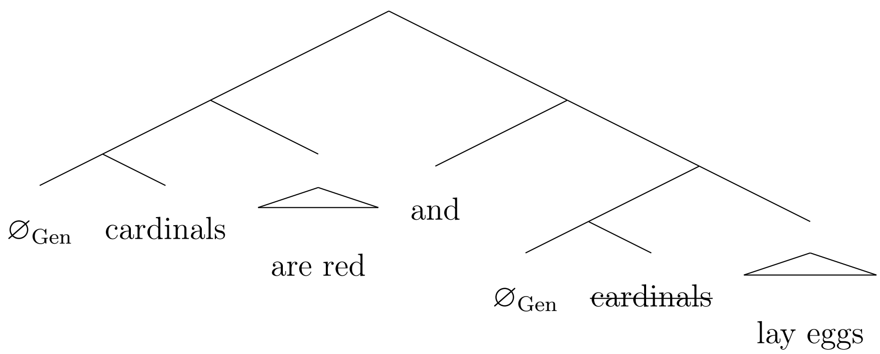
According to this strategy, which we may call the *sentential coordination strategy*, the generic conjunctions in (2) are glossed as the sentential conjunctions in (10), which are assumed to be truth-conditionally equivalent. While contemporary syntactic theory has

[14] Informally, '$a \oplus b$' roughly means 'the sum of a and b'. For a more precise formulation, see Section 5.4.

[15] Note that Nickel's (2008; 2016) revisionist proposals follows this strategy, citing Ariel Cohen's suggestion that 'Peafowl lay eggs and have colourful tail-feathers' as a precedent (Cohen 1999b: 113). Consequently, as I will argue more fully in Section 5.6, his theory falls foul to the problems outlined in this section.

disavowed theories of syntax (like Transformational Grammar) that straightforwardly allow the LFs of the sentences in (2) are essentially those of the sentences in (10), defenders of the sentential coordination strategy can argue that generic conjunctions are elliptical constructions for the corresponding sentential conjunctions. This approach is most plausible for cases of ellipsis that result in VP coordinations, such as in (2b), since NPs can undergo PF deletion when there is an explicit linguistic antecedent. Thus, I propose that the most plausible version of this approach will hold that (2b) has the simplified LF in (11), where ~~struckthrough~~ text represents NP-deletion at the level of PF:[16]

(11)



Then given that the conjuncts have different predicate-induced restrictions, the standard approach will predict that (2b) is true iff all/most cardinals whose colour reflects pressure from sexual selection are red and all/most cardinals which produce offspring in some way or another lay eggs. So far, so good.

However, when paired with this strategy, the standard approach only makes correct predictions about the truth-conditions of (10b); it makes incorrect predications about the other sentences. For example, the modal version of the standard approach predicts that (10a) is true iff all normal elephants live in Africa and all normal elephants live in Asia. (Alternatively, in a probabilist key, (10a) is true iff the probability of living

[16] One might object to this proposal on the grounds that NP-deletion must be preceded by a genitive phrase or some determiner other than *no*, *every*, *a*, and *the* (cf. Lobeck 1995: 42–45), and no such determiner is present in our data. However, I propose that the deleted *cardinals* is preceded by the generic operator, here represented as '$\varnothing_{\text{Gen}}$', which is present at LF, even though it is unpronounced at PF.

in Africa, conditional on being an elephant is greater than 0.5, and the probability of living in Asia, conditional on being an elephant is greater than 0.5.) But, in the absence of international elephants, these truth-conditions are clearly inadequate. Similar remarks apply to the other sentences. Consequently, the second strategy is also incompatible with the standard approach.

Furthermore, there is strong reason to reject the sentential coordination strategy more generally, since the deletion strategy does not generalise to the other generic conjunctions, and it is unclear whether there is any other principled syntactic mechanism that generates the required interpretations. The deletion strategy does not generalise to the other sentences because the phrasal coordinations of those sentences are *constituents*, groups of words that function as a single unit within the syntactic structure. The constituent structure of the phrasal coordinations are identified by the following consistency tests:

(12) **Fragment Answers**: only a constituent can answer a question while also retaining the meaning of the original sentence.

a. Elephants live in Africa and Asia.
→ Q: Where do elephants live? A: In Africa and Asia.[17]

c. Humans are male and female.
→ Q: What sexes are humans? A: Male and female.

d. Mary smokes cigars and cigarettes after dinner.
→ Q: What does Mary smoke after dinner? A: Cigars and cigarettes.

(13) **Topicalisation**: only a constituent can be relocated at the beginning of the sentence.

[17] Constituency tests for DPs embedded under a presupposition typically result in the preposition being moved as well.

a. Elephants live in Africa and Asia.

→ In Africa and Asia, elephants live.

c. Humans are male and female.

→ Male and female, humans are.

d. Mary smokes cigars and cigarettes after dinner.

→ Cigars and cigarettes, Mary smokes after dinner.

(14) **Clefting**: only a constituent can appear in the frame "____ is/are/who/where/what/when/why/how…".

a. Elephants live in Africa and Asia.

→ In Africa and Asia is where elephants live.

c. Humans are male and female.

→ Male and female are what humans are.

d. Mary smokes cigars and cigarettes after dinner.

→ Cigars and cigarettes are what Mary smokes after dinner.

Since passing a constituency test is a sufficient (though not a necessary) condition for being a constituent, the coordinations are constituents. Constituents do not admit of phonologically deleted material and cannot be split in the manner predicted by the sentential coordination strategy.[18] Consequently, sentential coordination is not a plausible account of generic conjunctions more generally, orthodoxy or not.

Lastly, it is worth ruling out any strategy that assumes that the conjunctions in (2)

[18] Compare (12a)–(14a) to the following minimal pairs:

(i) Where do elephants live? A: #In Africa and elephants live in Asia.

(ii) #In Africa and elephants live in Asia, elephants live.

(iii) #In Africa and elephants live in Asia is where elephants live.

Given that the phrasal coordinations are constituents, if the deletion strategy is correct, then (i)–(iii) should be felicitous. But they are not. So the deletion strategy is incorrect.

should be interpreted as disjunctions. Call this the *and-as-or hypothesis*.[19] According this view, the truth-conditions of (2a) can be roughly stated as follows:

(15) 'Elephants live in Africa and Asia' is true iff in a suitable domain, suitably many elephants live in Africa *or* Asia.

While the *and*-as-*or* hypothesis maintains the simple syntactic analysis of the verb phrase, it makes a number of wrong predications. It is well-known that disjunction-introduction is semantically valid for any disjoinable type. For example, if 'John is at home' is true, then, trivially, 'John is at home or in his office' is true. Consequently, the *and*-as-*or* hypothesis validates the following inference:

(16) a. Elephants live in Africa and Asia.

b. Elephants live in Africa, Asia, and Antarctica.

However, this prediction is not born out in practice, since native speakers of English treat (16b) as false. Furthermore, ruling (16b) out as pragmatically infelicitous on broadly Gricean considerations is unlikely to be successful, since generic conjunctions do not pattern as though they carry the standard implicatures associated with disjunction. For example, while sentences that cancel ignorance implicatures, like in (17a), are acceptable, the minimal variation involving generic conjunctions involving novel natural kinds, like in (17b), are not:[20]

(17) a. John is at home or in his office. Actually, John is at home.

b. Zarpies live in Africa and Asia. #Actually, they only live in Asia.

Consequently, the *and*-as-*or* hypothesis is incorrect, and so it should be rejected.

[19] Upon reflection, any suggestion that *and* should be interpreted as *or* should be reason enough for one to pause. But this strategy has been suggested to me with surprising enough frequency to warrant some brief remarks here.

[20] Here I appeal to the novel natural kind term *Zarpie* to control for any influence that the reader's background knowledge may have.

I want to finish this section by highlighting that the problem of generic conjunctions is more general than the opponents of the orthodoxy have supposed. While the orthodoxy makes empirically inadequate predictions about the truth-conditions of generic conjunctions, the phenomena in question is more pervasive and arises in non-generic constructions as well. Going at least as far back as Scha (1981), theorists have noticed when transitive verbs with definite or indefinite plural arguments are distributive in both argument positions, such as in (18a), they permit *cumulative* readings like the one paraphrased in (18b).[21]

(18) a. 600 Dutch firms use 5,000 American computers. (Scha 1981)

b. 600 Dutch firms each use at least one American computer and 5,000 American computers are each used by at least one Dutch firm.

More generally, observe that non-generic contexts also give rise to similar readings as the sentences in (2) do. For example, the sentences in (19a)–(21a) clearly have the readings paraphrased in (19b)–(21a), although these readings are not always the most prominent:[22]

(19) a. The men love Berlin and New York.

b. The men each love Berlin or New York, and Berlin and New York are each loved by at least one of the men.

(20) a. The birds are swimming and flying. (Winter 2001)

b. The birds are each either swimming or flying and at least one bird is swimming and at least one bird is flying.

[21] For discussion of the complexities of singular predicate conjunction, see Lasersohn (1995) and Krifka (1990).

[22] Interestingly, the sentences in (19a)–(21a) are not equivalent to their sentential conjunction counterparts. For example, 'The birds are swimming and the birds are flying' is false in any situations in which (19a) is true. Consequently, since these sentences cannot be analysed in terms of the sentential coordination strategy, this is another reason to reject that strategy.

(21) a. The women sanded and polished the table.

b. The women each either sanded or polished the table and at least one woman sanded the table and at least one woman polished the table.

These quasi-cumulative readings closely track the readings of generic conjunctions with which I have been concerned. Given this strikingly similarity, we should be suspicious of accounts of generic conjunctions that have nothing to say about non-generic quasi-cumulative readings, and, conversely, accounts of the non-generic conjunctions should be suitably extendable to generic conjunctions. Uniform explanations of related phenomena are preferable to variable explanations that provide different accounts for each case.

To summarise, we have seen that there are three minimal conditions that any adequate account of generic conjunctions should meet: (i) it should analyse generic conjunctions in terms of phrasal coordinations rather than sentential coordinations; (ii) it should not validate inferences like in (16); and (iii) it should have some principled explanation of quasi-cumulative readings of non-generic phrasal conjunctions. With this in mind, the rest of the chapter proposes an account of generic conjunctions that is compatible with the standard approach, one that is closely modelled on the non-generic case.

5.4 Structured Genericity

How can we account for generic conjunctions in light of these conditions? One simple explanation would be to base the truth-conditions for generic conjunctions on the quasi-cumulative readings for sentences (19)–(21). According to this proposal, generic conjunctions are true just in case every relevant member of the kind in question satisfies some 'part' of the predicate and each 'part' of the predicate is satisfied by some member of the kind. This would immediately explain why 'Elephants live in

Africa and Asia' is true, since some of the normal elephants live in Africa and the others live in Asia. Moreover, this would also explain why 'Elephants live in Africa, Asia, and Antarctica' is false, since there are no normal elephants that live in Antarctica. Similar remarks would apply to the other generic conjunctions.

This reaction might seem to be incompatible with the standard approach, given that it is committed to a majority-based semantic analysis of generics. But I will argue that this reaction is the correct one and that it is compatible with the standard approach. The reason why extant versions of the standard approach fail to make the right predictions is that their treatment of genericity does not reflect the structural properties to which natural language seems to be committed. Once we accept that plural morphology tracks the structural properties of the domains of discourse, the problems of generic conjunctions disappear.

In this section, I sketch such a semantics. While the basic idea could be implemented in different ways, my theory, which I call the **structured theory** of generics, combines two ideas. The first idea concerns the structural properties of the ontological types that undergird our semantic framework. I adopt an algebraic treatment of plurality that models the structure of individuals and situations in mereological terms. The second part of theory concerns the meaning of generics. I propose generic sentences involve a normality-based, modal semantics ranging over contextually restricted possibilities, and which carry information about the mereological structure of the denotations of their constituents.[23]

In the rest of this section, I sketch provide a unified perspective on these domains. I will begin by giving a brief intuitive characterisation of the treatment of plurality in algebraic semantics, then I will explain how my theory of generic sentences exploits these resources, and then I will spell out a more precise framework for theorising in

[23] While these ideas best highlight the general approach that I have in mind, analogous frameworks that incorporate set-theoretic or plural logic approaches to plurality, or which adopt alternative semantics for generics will make similar predictions.

this manner.

5.4.1 Algebraic Semantics

It is standard in theorising about natural language to posit that the interpretation of plural expressions like *John and Mary* or *the Beatles* denote *pluralities* or *collections*. There are different ways to spell out precisely how to understand these notions. For our purposes, the most useful framework treats a plurality as the mereological sum of atomic individuals.[24]

In standard Montague semantics, the domain of discourse is simply a collection of disjoint non-empty sets, which constitute things from which the denotations of words and larger constituents are built. Theorists who are interested in extensional semantics, such as Heim and Kratzer (1998), tend to follow this tradition, adopting austere model-theoretic frameworks that assume no more than a domain of individuals and a domain of truth-values. Other theorists extend these frameworks by adding sets representing a variety of other ontological entities, such as worlds, situations, events, and times, to model intensional phenomena. Since the 1980s, the Montaguvian framework has been further augmented by *algebraic semantics*, a semantics in which the domain of individuals also includes plurals and mass entities (Link 1983, 1998).[25] According to this framework, atomic and plural entities are taken to stand in a *parthood* relation,

[24] Alternatively, one could model the denotations of plural expressions using set theory or plural logic. I prefer a mereology approach over set theory because it permits a uniform semantic typing across the singular–plural divide. For example, its treats the denotations of singular and plural terms as being of the same semantic type, namely, type e. The set-theoretic approach, on the other hand, requires that plural expressions are typed at a higher level than their singular counterparts. For example, if singular terms have e-type denotations, then plural terms have $\langle e, t\rangle$-type denotations. This complication percolates across grammatical categories, and thus requires type-shifting operators to ensure that composition runs smoothly.

It is more difficult to make a case for the mereological approach over plural logic, given the existence of Russell-style paradoxes for mereological fusions (Oliver and Smiley 2013). While this is an issue that deserves serious philosophical thought, I will nevertheless appeal to mereology under the assumption that all of the relevant mereology talk can be translated in a language of plural logic with no loss in explanatory power.

[25] Also see Scha (1981); Landman (1989a,b); Krifka (1998); Champollion (2017).

which is added directly to the model and the logic, with its intended interpretation being characterised by axioms.[26] The motivation for this was the phenomenon like distributive and collective predication, as well as cumulative predication.[27] Distributive predicates, like those in (22), lead to near-equivalent sentences when they take these expressions as argument, where as collective predicates like in (23) do not:[28]

(22) **Distributive predicates**

a. The Beatles play guitar. $\Leftrightarrow$ Each member of the Beatles plays guitar.

b. John and Paul composed. $\Leftrightarrow$ John composed and Paul composed.

(23) **Collective predicates**

a. Ringo and George met. $\not\Leftrightarrow$ *Ringo met and George met.

b. The Beatles gathered. $\not\Leftrightarrow$ *Each member of the Beatles gathered.

The algebraic line of thinking about distributive and collective predication proposes to make sense of these roughly as follows. Plural noun phrases denote a plurality composed of individuals (or atoms). When a predicate is distributive, like *play guitar*, this means that they can apply to the members of a plurality. When a predicate is collective, like *met* and *gathered*, this means that they are not distributive. In (22), the predicates are distributive, and so the inferences are licensed because the predicates can apply to the members of the subjects' meanings. But things are otherwise in (23),

[26] The notion of 'parthood' is highly ambiguous and vague. There are at least three notions of parthood that should be distinguished, namely, a rich, a material, and an austere (or thin-blooded) notion. According to the rich notion, parts may compose some complex whole, which is organised by a number of complex extra-logical relations; see, perhaps, Friederike Moltmann's notion of an integrated whole (Moltmann 1995). According to the material notion, wholes are composed of those parts that constitute the very matter from which they are composed. Such notions figure in classic philosophical discussions about constitution and identity; see (Moltmann 1995), for a survey of this literature. According to the austere notion, the meaning of 'parthood' does not go beyond what can be expressed in strictly logical terms.

[27] See Link (1998), for other motivations for algebraic semantics.

[28] Although, see Winter (2001, 2002) for criticisms of this traditional distinction. See Champollion (2017: 72–75) for a recent survey.

where the predicates are collective, and so the predicates cannot apply to the members of subjects' meanings. Algebraic semantics has been further extended to include other ontological domains, such as intervals and events (e.g., Krifka 1998; Landman 2000). And, importantly for our purposes, these kinds of algebraic structures are not confined to just the domain of primitive types: functional types, like properties and relations, can also be thought of as forming these kinds of algebras.

This suffices to give a sense of the original motivation for admitting pluralities as mereological sums in to our ontology. In a moment, I will return to the question of how to formally spell out these ideas. But what is important for now is simply that a plurality is mereological sum of atomic individuals, and that this general kind of algebraic structure pervades the ontology of natural language.

5.4.2 A Modal Account of Generics

My theory of generics builds on the central ideas of the modal version of the orthodoxy. But it is couched in a situation-theoretic framework and augments the modal truth-conditions with a pragmatic story about how the restrictor of the generic operator is contextually determined by a discourse topic or question under discussion. I will now outline these aspects of the theory in turn.

This chapter uses a version of situation semantics based mostly on Kratzer's 1989 system in which situations are taken to be parts of possible worlds.[29,30] More precisely, we can think of what situations consist in terms of one or more individuals having one or more properties or standing in one or more relations at some spatiotemporal location (Barwise and Perry 1983: 7). In keeping with the algebraic framework of the previous section, the set of situations is mereologically structured by a parthood

[29] See also Barwise and Perry (1983); Heim (1990); Elbourne (2005, 2013).

[30] Situation semantics has arguably led to substantial progress in numerous domains, such as the treatment of naked infinitives (Barwise and Perry 1983), pronouns and anaphora (Heim 1990; Elbourne 2005), and conditionals (Kratzer 1989; Fine 2012), among other topics. Nevertheless, a comprehensive survey of situation semantics is outside the scope of this chapter.

relation $\preceq$. Formally, this is a partial ordering on the set of situations. I will also make use of the notion of a *minimal situation*. Intuitively speaking, a minimal situation that support a proposition are those situations that contain the smallest number of individuals, properties, or relations to support that proposition. For example, the minimal situations that support the proposition that John and Paul sing, are those situations that contain just John and Paul plus the property of singing, which they each instantiate; no other individuals, relations, or properties are present. Formally, for any set of situations S, the set of minimal situations in S, $\min(S) = \{s \in S : \forall s' \in S(s' \preceq s \rightarrow s' = s)\}$, or, equivalently, $\{s \in p : \neg\exists s'[P(s') \wedge s' \prec s]\}$ (Heim 1990). The semantic value a declarative sentence is a set of situations (or the characteristic function of that set), and declarative sentences are evaluated for truth relative to a situation in the usual way.

Let us now turn to the central assumptions that I will make about the generic operator *Gen*.[31] Following von Fintel's (2004a) account of adverbs of quantification, I assume that (i) Gen is a universal quantifier over situations whose nuclear scope corresponds to the denotation of the sentence minus Gen, and (ii) the restrictor is given as a free variable ranging over situation predicates.[32] The value of this variable is resolved on the basis of contextual information and/or world knowledge in combination with information structure, such as the Topic/Focus Articulation or prosody of the scope, syntactic movements that mark topics, or explicit or implicit questions.

I will outline the formal lexical entry for *Gen* and then discuss its features. Formally, the lexical entry for *Gen* is as follows:

(24) $[\![\text{Gen}]\!] = \lambda C_{\langle s,\langle s,t\rangle\rangle}.\lambda p_{\langle s,t\rangle}.\lambda s.\forall s'[s' \in B(s) \wedge s' \in \cup\min(C(s)) \rightarrow$

[31] This part of the theory draws on Asher and Morreau (1995); Eckardt (2000); von Fintel (2004a), but some details, including the precise formulation of the lexical entry of the generic operator, are novel.

[32] I want to stress again that the basic idea of this chapter does not depend on this particular account of adverbs of quantification. It can be implemented by theories of adverbs according to which the restrictor of an adverb is made explicit in the logical form and is computed by grammatical processes. See Chierchia (1995); Kratzer (1995); Rooth (1995), for examples of such theories.

$$\exists s''[s' \preceq s'' \wedge s'' \in \min(p)]]$$

In 'English': for every minimal situation s' such that $s' \in B(s)$ and that $\cup\min(C)(s') = 1$, there is a situation s'' that is a minimal situation such that $s' \preceq s''$ and $p(s'') = 1$.

Following Elbourne's 2013 treatment of quantificational adverbs, it will be useful to strip out the existential quantifier over situations in the consequent of the conditional of (24) from the lexical entry for *Gen* to give (25) and instead represent the existential quantification by introducing a new morpheme (26):

(25) $[\![\text{Gen}]\!] = \lambda C_{\langle s,\langle s,t\rangle\rangle}.\lambda p_{\langle s,\langle s,t\rangle\rangle}.\lambda s.\forall s'[s' \in B(s) \wedge s' \in \cup\min(C(s)) \rightarrow s' \in \min(p)]$

(26) $[\![\text{QA}]\!] = \lambda p_{\langle s,t\rangle}.\lambda s.\lambda s'.\exists s''[s' \preceq s'' \wedge p(s'')]$

As it turns out, splitting up quantification in this way has useful empirical consequences in the analysis of anaphora, and consequently the interpretation of bare plurals later on. In particular, it allows certain situation pronouns in the nuclear scope to, in effect, be bound by the restrictor. On this approach, then, we posit the following as a general schema for generic sentence, where δ is the sentence with the generic operator removed:

(27) [[Gen C][QA δ]]

There are two components to this semantics that I want to elaborate one here: the operator B and the restriction $\cup\min(C)$. First, notice that this semantics makes use of an operator B, which is a function from situations to sets of worlds. There are different ways to think about B depending on the specific modal commitments of the theory. For the purposes of this chapter, we will think of B as selecting the *dispositional orbit*, those situations whose worlds are like w_s with respect to causal, statistical, or dispositional dependencies and regularities, but may differ from w_s with respect to specific isolated facts (cf. Eckardt 2000). Let $\approx$ be an accessibility relation between worlds such that, for some world w, any $\approx$-accessible world that are like w with respect to causal and statistical dependencies and regularities. Then:

$$B(s) = \{s' \in S : w_{s'} \approx w_s\}$$

In English: the dispositional orbit of s are those situations whose worlds are like w_s with respect to causal, statistical, and dispositional dependencies and regularities.

The second component of the semantics that I wish to elaborate on is the restriction $\bigcup\text{min}(C)$. To fix ideas, I take the value of the restrictor's free variable C to be the semantic value of a contextually salient question under discussion. Following Hamblin (1973), I take the semantic value of a question to be a set of propositions, namely, the set of possible true or false answers to it. Ultimately, the generic operator relates two sets of situations, and so we must take the union of this set of propositions to constrain the domain of the generic operator. The kinds of questions that will generally fix the value for C will be questions like 'What colour are normal ravens?' or 'Where do normal elephants live?'.

To see how these ideas work in practice, let us consider a simple case. Consider the sentence (28a), which I assume has the (much simplified) syntactic structure in (28b), and is interpreted as in (28c).[33]

(28) a. Ravens are black.

b. $[[\varnothing_{\text{Gen}} C][[\varnothing_{\text{the}} \text{ ravens}][\text{are black}]]]$

c. $\lambda s.\forall s'[s' \in B(s) \wedge s' \in \min(\lambda s^*.\text{coloured}(\iota x[N(\text{ravens})](x)(s^*))(s^*)) \rightarrow$
$\exists s''[s' \preceq s'' \wedge s'' \in \min(\lambda s'.\text{black}(\iota x[\text{ravens}(x)(s')])(s''))]]$

In English: (28a) is true at a situation s iff for every situation s' such that $s' \in B(s)$ and the normal ravens at s' are coloured at s', then there is a minimal situation s''

[33] For a precise articulation of the syntactic mechanisms behind this approach to adverbs of quantification, see Elbourne (2016).

such that $s' \preceq s''$ and ιx x are ravens in s' are black in s''. These truth-conditions are intuitively adequate.

Before turning to the formal system that compositionally derives these truth-conditions, I wish to reflect once more on the restrictor of the generic. Intuitively, the contextual parameter is determined relative to a question under discussion, in this case, 'What colour are normal ravens?'. To encode the notion of 'normal ϕ', let us define a family of functors:

$$N_n : S \times D^n \mapsto S \times D^n$$

that map all n-arty properties P to their normal parts $N(P)$ (cf. Eckardt 2000). For all situations s, $N_n(P)(s)$ is the set of all those tuples $\langle a_1, \ldots, a_n \rangle$ that are normal P's in s. Since the normal P's are required to be P's, I assume that $\forall s : N(P)(s) \subseteq P(s)$. Then, assuming that $\iota x.N(\text{ravens})(x)(s^*)$ refers to the normal ravens in s^* (if there are any), the semantic value of the question 'What colour are normal ravens?' will be the following set of propositions:

(29) $\{\lambda s.R(\iota x.N(\text{ravens})(x)(s))(s) : \forall R : R \in \textsc{alt}(\lambda x.\lambda s.\text{black}(x)(s))\}$

where $\textsc{alt}(\lambda x.\lambda s.\text{black}(x)(s))$ is the set of alternatives to being black (e.g., being red, being green, being blue, and so on). Of course, a set of propositions is the wrong semantic type to restrict a quantifier, which is why the lexical entry for *Gen* takes the union of the set corresponds to the $\min(\lambda s^*.\text{coloured}(\iota x[N(\text{ravens})](x)(s^*))(s^*))$, the set of minimal situations s such that the ravens in s are coloured.

Call the semantics for the generic operator in (24) the *situation semantics* for generics. I will use the term *structured theory* to refer to the theory which results from combining this semantics with the specific approach to plurality which I outline now.

5.4.3 The Framework

In this section, I elaborate on the key formal details of the proposal with the aim of highlighting exactly what explains generic conjunctions in the structured theory of generics.

Ontological Ingredients

To spell out the formal details of our semantics, we need to state what our models are:[34,35]

Definition 5.4.1 (Frame)**.** Let a *frame* $\mathcal{F} = \langle D, S, \preceq, W, \leq_w \rangle$ be a tuple consisting of:

(i) a non-empty set, D, the *set of individuals*,

(ii) a non-empty set, S, the *set of situations*,

(iii) a partial order, $\preceq$, over $D \cup S$, the *parthood relation*, such that at least the following conditions are satisfied:[36]

  a. For no $s \in S$ is there an $x \in D$ such that $s \preceq x$.

  b. For all $s \in S \cup A$, there is a unique $s' \in S$ such that $s \preceq s'$ and for all $s'' \in S$: if $s' \preceq s''$, then $s'' = s'$.

(iv) W is a subset of S, *the set of possible worlds.*

(v) $\leq_w$ is an ordering over W (an accessibility relation);[37] ◁

[34] **Notation.** I shall follow the following notational conventions: t for truth-values, e for individuals and substances, and s for situations. Functional types will denoted as usual: if σ, τ are types, then $\langle \sigma, \tau \rangle$ is a type. f for predicates of various functional types. θ and Θ for functions of type $\langle s, e \rangle$.

[35] The following theory draws heavily from Link's (1983; 1998) treatment of plurality and Champollion's presentation in his 2017; it diverges substantial from it by embedding the general algebraic approach in an intensional system; see also Scha (1981); Landman (1989a,b); Krifka (1998).

[36] A relation R over a set S is a partial order over S iff R is reflexive ($\forall x \in S, Rxx$), anti-symmetric ($\forall xy \in S[Rxy \wedge Ryx \rightarrow x = y]$), and transitive ($\forall xyz \in S[Rxy \wedge Ryz \rightarrow Rxz]$).

[37] For simplicity, we assume that the relevant accessibility relation is reflexive, symmetric, transitive, and so is a normal S5 modal logic.

Let $\wp(S)$ be the powerset of S, *the set of propositions*; a proposition p is true at a situation s iff $s \in p$. We say that $x \preceq_{atom} y$ iff x is an atomic part of y, that is, iff x is a part of y and x has no parts itself. We say that two things *overlap* iff they have a part in common, and that a *sum* of (the things in) a set P is a thing that contains everything in P and each of whose parts each overlap with something in P:[38,39]

Definition 5.4.2 (Overlap). $x \circ y =_{def} \exists z(z \preceq x \wedge z \preceq y)$ ◁

Definition 5.4.3 (Sum). $\text{sum}(x, P) =_{def} \forall y(P(y) \rightarrow y \preceq x) \wedge \forall z(z \preceq x \rightarrow \exists z'(P(z) \wedge z \circ z'))$ ◁

We say that a structure $\langle S, \preceq \rangle$ is closed under sums iff every subset P of S has a sum. It immediately follows that the union set of individuals and situations and the parthood relation over that set, $\langle D \cup S, \preceq \rangle$, forms a model of *classical extensional mereology* (CEM).[40] That is, $\preceq$ is *partial order* and *unique*. While readers may be familiar with the notion of a partial order, the notion of uniqueness, that every non-empty subset has a unique sum, may be novel:

(30) **Uniqueness.** $\forall P[P \neq \varnothing \rightarrow \exists! z \text{sum}(z, P)]$

For convenience, we define a number of auxiliary notions. First, we define a binary sum operator and a generalised sum operator which allow us to explicit refer to the sum of two things and the sum of an arbitrary set.[41]

[38] Note that there are several different ways that sum can be defined in mereology, and while they are equivalent given CEM, they are not logically equivalent (Hovda 2009). I have defined sum using the auxiliary notion of overlap.

[39] One may think that our theory formulated in first-order predicate logic is less powerful than a suitable second-order logic that quantifies over the predicate letter P, since there are countably many formula equivalent but uncountably many sets. But so long as 'P' is the name of an arbitrary object whose value range is the set of possible predicate denotations, such cardinality worries disappear; see Fine (1985), for a defence of arbitrary objects, or Breckenridge and Magidor (2012), for the ontologically squeamish.

[40] See Simons (1987) and Varzi (2016) for two excellent surveys of CEM and other mereological systems.

[41] The iota operator ι forms expressions of type e, following Peano (1906) and contrary to the practice of Whitehead and Russell (1925).

Definition 5.4.4 (Binary sum)**.** $x \oplus y =_{df} \iota z \mathrm{sum}(z, \{x, y\})$ $\triangleleft$

Definition 5.4.5 (Generalised sum)**.** For any nonempty P, let its sum be defined as follows:

$$\bigoplus P =_{df} \iota z \mathrm{sum}(z, P). \quad \triangleleft$$

Informally, these definitions say that the *binary sum* of two things is the thing which contains both of them and whose parts each overlap with one of them, and that the *sum of an arbitrary set* P is the thing that contains every element of P and whose parts each overlap with an element of P. Note the expression $\iota x P(x)$ is defined iff there is exactly one object x such that $P(x)$ is true. When defined, the expression denotes that object.

The definition of a generalised pointwise sum allows us to construct the sum of a relation, the pointwise sum of its positions:

Definition 5.4.6 (Generalised pointwise sum)**.** For any non-empty n-place relation R_n, its sum $\bigoplus R_n$ is defined as the tuple $\langle z_1, \ldots, z_n \rangle$ such that each z_i is equal to:

$$\bigoplus \{x_i : \exists x_1, \ldots, x_{i-1}, x_{i+1}, \ldots, x_n [R(x_1, \ldots, x_n)]\} \quad \triangleleft$$

Central to the present explanation of plural nouns and verbs will be the notion of *algebraic closure* of a set P, the set that contains the sum of things taken from P, indicated by the star operator * (Link 1983):

Definition 5.4.7 (Algebraic closure)**.** The algebraic closure $^*P$ of a set P is defined as follows:

$$P^* = \{x : \exists P' \subseteq P [x = \bigoplus P']\}. \quad \triangleleft$$

We extend the notion of *algebraic closure to a relation R of arbitrary arity*, the relation that contains any sum of types each contained in R (Vaillette 2001), where $\overrightarrow{x}$ ranges over sequences:

Definition 5.4.8 (Algebraic relation)**.** The algebraic closure $^*R$ of a non-functional relation R is defined as:

$$R^* = \{\overrightarrow{x} : \exists R' \subseteq R[x = \bigoplus R']\}. \qquad \triangleleft$$

Lastly, we introduce a group formation or "upsum" operator $\uparrow$ as a primitive function, which distinguishes between the sum $a \oplus b$, whose proper parts are the individuals a and b, and the group $\uparrow(a \oplus b)$, which has no proper parts.

Let us pause to make some observations. The first observation is that, in models of CEM, two things composed of the same parts are identical. While there are some reasons to think that Uniqueness is an undesirable feature in general — for example, we may want to allow for different committees composed of the same members, a situation that is forbidden by Uniqueness — for present purposes, I treat Uniqueness as a harmless idealisation, since we can always adopt a richer mereology at some later point with suitable amendments to our definitions.

The second observation is about the structure of our domains. The set of atomic (or singular) individuals the set of atomic (or singular) situations are proper subsets of the set of individuals and the set of situations, respectively. D, S, and $D \cup S$ each form an algebra with the structure of a join sub-semi-lattice.[42]

Third, given summation and uniqueness, we cannot follow Kratzer (1989) in defining worlds as the set of maximal elements with respect to $\preceq$, since it entails that there exists only one world, namely, $\bigoplus S$.[43] There are two ways of avoiding this result. The first option is that we could take worlds as primitive. The second option is that we define the set of worlds in spatiotemporal terms.[44] Note also that since every

[42] It is natural to think of the sum operation '$\oplus$' as the join operation of a join subsemilattice; then '$\oplus$' is idempotent ($a \oplus a = a$), symmetric ($a \oplus b = b \oplus a$), and associative ($a \oplus (b \oplus c) = (a \oplus b) \oplus x$).
[43] *Proof.* For all $s \in S$, let w_s be the maximal element s is related to by $\preceq$. Then, for any situations $s, s' \in S$, $w_s = w'_s$, since $s, s' \in S$, and so $s, s' \preceq \bigoplus S$, which is by definition the top of the join sub-semi-lattice. As far as I know, Dekker (2004) is the first to explicitly state this.
[44] Let $\sim$ be a partial equivalence relation over S; that is, it is symmetric and transitive relation on S such that $x \sim y$ iff there is a spatiotemporal relation R like *being 4 meters from* or *being 2 years away from* and xRy. Then $\sim$ is an equivalence relation on a proper subset $S' \subset S$ such that

singular individual is related to a unique world, our representation in other worlds must be mediated by our counterparts.[45]

What words mean

In this section, I outline how I will treat various types of linguistic constituents. In what follows, I will switch freely between set notation and predicate notation. That is I treat $x \in P$ as interchangable with $P(x)$. I also follow the well-established notation from Heim and Kratzer (1998) according to which a λ-expression of the form $[\lambda v : \phi.\alpha]$ denotes a function from v-type denotations to α-type denotations. Those authors capture presuppositions through the use of partial functions; a colon indicates that we are dealing with a partial function, where the material ϕ after the colon but before the period marks the domain condition of the function, the conditions that must obtain for the function to apply.

Nouns. I analyse singular count nouns, such as *cat* and *table*, as sets of singular individual–situation pairs (or, in functional talk, functions from singular individuals to functions from situations to truth-values). I also adopt the 'inclusive' approach to plural count nouns, such as *cats* and *tables*, according to which they denote the algebraic closure of its singular counterpart:[46]

(31) $[\![\mathrm{N}_{pl}]\!] = {}^{*}[\![\mathrm{N}_{sing}]\!]$

$S' = \{s \in S : s \sim s\}$. Since $\sim$ is an equivalence relation on S', we can define the equivalence class of an element $s \in S', [s]$, as $\{s' \in S' : s' \sim s\}$ of elements of S' related to s by $\sim$. It can be proven that the set of equivalence classes of $\sim$ form a partition over S' into spatiotemporally isolated systems. Then let $W = \{\bigoplus[s] : \forall s \in S'\}$.

[45] See Lewis (1968, 1986), for a defence of this notion and details on the counterpart relation.

[46] The central motivation for the inclusive approach is that an 'exclusive' approach, which takes the denotation of plural count nouns to be algebraic closure of its singular counterpart with all the singular individuals removed, struggles to accommodate sentences like 'There are no doctors in the room' and 'Are there any doctors in the room?'. Proponents of the inclusive approach can always capture the exclusive reading of plural count nouns through grammaticalised scalar implicatures; see Spector (2007); Chierchia (2006).

The denotations of singular and plural nouns is illustrated in Figure 5.1.[47] Importantly, since individuals are world-bound, the arguments of nouns will carry an implicit counterpart function $\mathcal{C}_s$ mapping any suitable individual x to its counterpart in the world of s, w_s.[48] I leave open what kind of counterpart relation is relevant, although note that if $x \prec w_s$ then $\mathcal{C}_s(x) = x$. Note that these counterparts do not figure directly in our compositional semantics and so I often omit them for readability.

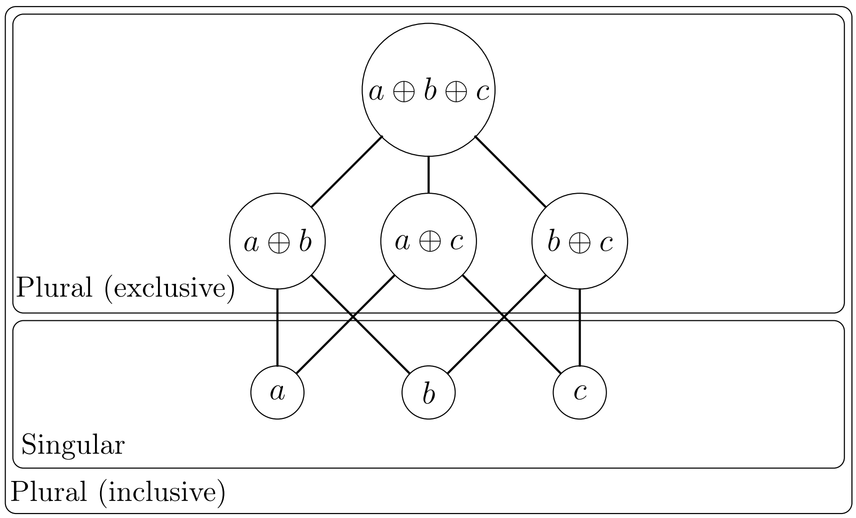


Figure 5.1: Different Views on the Plural

Definite Descriptions, Bare Plurals. I analyse definite descriptions as referential expressions that refer to the maximal sum satisfies their nominal descriptive content relative to a situation.[49]

(32) $[\![\text{the}]\!] = \lambda P_{\langle e,st\rangle}\lambda s : s \in S \wedge \exists x P(x)(s) \wedge \forall y(P(y)(s) \rightarrow y \preceq x)). \bigoplus\{x : P(x)(s)\}.$

For example, an utterance of a definite description *the cats* in a situation s denotes the sum of all of the cats in s, if there are any. Following Elbourne (2013), I assume

[47] Note for completeness that there is also a mixed view according to which the meaning of a plural count noun is ambiguous between the inclusive and exclusive view; see Farkas and de Swart (2010).
[48] For a similar proposal, see Heim (2001), as reported by Sauerland (2014), and Sauerland (2014).
[49] This is essentially the Fregean account of definite descriptions, generalised to the case of plurals; see Elbourne (2013) for the singular case.

that the definite article takes two arguments, a noun phrase and a situation pronoun. Thus it has the following configuration:

(33) [[the NP]s]

Two cases are possible. First, the definite description could appear with referential situation pronouns denoting a particular restrictor situation. I assume that referential situation pronouns are present in the syntax but phonologically unarticulated. Second, the situation pronoun in the definite description is bound. Again, following Elbourne (2013), I will assume that this binding occurs with syntactically realised situation binders like Σ_i. Such assumptions are need to deal with syntactically complex sentences involving anaphora in the present framework.

Following Chierchia (1995), I assume that bare plurals in languages like English occur with a phonologically null but syntactically articulated determiner. However, unlike Chierchia, I assume that the semantics of this determiner functions essentially like the definite determiner does in English, although this does not mean that bare plural inherit the distribution properties of definite determiners. There is no reason to suppose that phonologically unarticulated constituents have all the properties of their articulated semantic counterparts.

Verbs. I analyse verbs as (the characteristic functions of) sets of situations, and assume that the denotations of all verbs are closed under sum formation. This is an intensional version of a broadly neo-Davidsonian position that assumes that the verb denotations do not encode the argument positions, as in more traditional treatments of verb denotations.[50] This treatment has the theoretical advantage of exposing thematic

[50] It may seem awkward to treat verb denotations as functions from situations to truth-values, since it types verb denotations and declarative sentences in the same way. The intension neo-Davidsonian view results from substituting situations for events in the Neo-Davidsonian characterisation of the verb denotations as functions from *events* to truth-values. The motivation for this anti-relational treatment of verb denotations is the greater expressive power. Typing verbs as functions from events to truth-values is unproblematic because the resulting theory is extensional and so sentence meanings are taken to be truth-values, not propositions. However, in situation semantics, this results

Position	Verbal denotation	Example
Traditional	$\lambda x.\lambda y.[\text{stab}(y, x)]$	stab(b,c)
Classical Davidsonian	$\lambda x.\lambda y.\lambda e.[\text{stab}(e, y, x)]$	$\exists e[stab(e, b, c)]$
Neo-Davidsonian	$\lambda e.[\text{stab}(e)]$	$\exists e[\text{stab}(e) \wedge \text{agent}(e, b) \wedge \text{theme}(e, c)]$
Kratzer	$\lambda y.\lambda e.[\text{stab(e,y)}]$	$\exists e[\text{agent}(e, b) \wedge \text{stab}(e, c)]$
Neo- Davidsonian (Situation)	$\lambda s.[\text{stab}(s)]$	$\lambda s.[\text{stab}(s) \wedge \text{agent}(s, b) \wedge \text{theme}(s, c)]$

Table 5.1: Approaches to Verbal Semantics

roles to the compositional semantics, rather than keeping them implicit in the lexical entry of the verb. Table 5.1 illustrates the difference between my position and some others in the literature.

I assume lexical cumulativity, that whenever two situations are in the denotation of a verb, then their sum is as well; see Scha (1981); Schein (1986, 1993); Lasersohn (1989); Landman (2000). For present purposes lexical cumulativity, corresponds to the assumption that thematic roles are closed under fusion and that the denotations of verbs are closed under pointwise sum formation, when they are relations. Following Landman I capture the difference between cumulative and collective predication by deploying a group forming operation from the denotations of plural noun phrases to an group individual that represents the denotation of the noun phrase, taken as a group. Bare plurals will be taken to denote sets of entities.

Thematic Roles. I analyse verb arguments using the notion of *thematic roles*, function from situations to individuals. Thematic roles represent the different ways that agents can participate in situations. I shall adopt a traditional and widespread view that thematic roles capture generalisations over shared entailments of argument positions of different predications, and are *agent*, which characterises the initiator of

in verb denotations being assigned the same semantic value as sentences, which are taken to denote propositions (functions from situations to truth-values). Perhaps this awkwardness can be resolved by integrating events into situation semantics, but for the purpose of this chapter, I consider this typing as no more embarrassing than other more standard forms of coincidentally identical typing.

the situation's event, and *theme*, which characterises what undergoes the situation's event. Furthermore, for the purposes of compositionality, I shall assume that thematic roles have syntactic counterparts which relate verbs to their arguments.[51] The term *thematic role* shall be reserved for the semantic relation, while the term *theta role* shall be reserved for their syntactic counterparts. I assume thematic uniqueness, that each situation has at most one agent, one theme, and so on. Formally, thematic roles are functions of type $\langle v, e \rangle$.

Following Landman (2000), I assume that thematic roles are their own algebraic closures, a property which is known as *cumulativity* or *summativity of thematic roles*:

(34) **Cumulativity assumption for thematic roles**

For any thematic role θ and any subset S in its domain:

$$\theta(\bigoplus S) = \bigoplus(\lambda x.\exists s \in S.\theta(s) = x)$$

Consequently, thematic roles are sum homomorphisms: $\theta(s_1 \oplus s_2) = \theta(s_1) \oplus \theta(s_2)$, for any thematic role θ. In our models, the sum of any two singular situations is itself a situation. For example, if s_1 is a minimal situation of John singing and s_2 is a minimal situation of Paul singing, then $s_1 \oplus s_2$ is itself a situation, namely the minimal situation of John and Paul singing. Given that thematic roles are sum homomorphisms, the agent of the sum situation is the sum of the agents of its parts, namely, $j \oplus p$.

Conjunction. English, and many other languages, allow conjunction to coordinate a wide variety of syntactic categories, such as sentences, predicative adjectives quantificational nouns, verbs, and so on. To accommodate this phenomenon, it is natural to suggest that conjunction is defined as an operation that takes as argument a wide variety of logical types. And given that we want to give an explanation of conjunctions of proper names in terms of plural individuals, we shall give an account in terms of

[51] One may think of the "little v" head as relating verbs to their external arguments, or agents; see Chomsky (1995).

non-boolean conjunction. Following Krifka (1990), we shall start with the recursive definition of a general inclusion relation '$\sqsubseteq$':

Definition 5.4.9 (Recursive definition of a generalised inclusion relation '$\sqsubseteq$')**.**

- if $\alpha, \alpha' \in D_e$, then $\alpha \sqsubseteq \alpha'$ iff $\alpha = \alpha'$,
- if $\alpha, \alpha' \in D_t$, then $\alpha \sqsubseteq \alpha'$ iff $\alpha \rightarrow \alpha'$ (that is, the truth value of α is less than or equal to the truth value of α'),
- if $\alpha, \alpha' \in D_{\langle\sigma,\tau\rangle}$, then $\alpha \sqsubseteq \alpha'$ iff for all $\beta \in D_\sigma$, $\alpha(\beta) \sqsubseteq \alpha'(\beta)$. $\triangleleft$

For example, when $\alpha, \alpha \in D_{\langle e,t\rangle}$, $\alpha \sqsubseteq \alpha'$ effectively amounts to set inclusion, $\alpha \subseteq \alpha'$. Then we give the following definition for a generalised conjunction operator '$\sqcup$':

Definition 5.4.10 (Recursive (partial) definition of a generalised conjunction $\sqcup$)**.**

- if $\alpha, \alpha' \in D_e$, then $\alpha \sqcup \alpha' = \alpha \oplus \alpha'$,
- if $\alpha, \alpha' \in D_t$, then $\alpha \sqcup \alpha' = \alpha \wedge \alpha'$,
- if $\alpha, \alpha' \in D_{\langle\sigma,\tau\rangle}$ and $\beta, \beta' \in D_\sigma$, then $\alpha(\beta) \sqcup \alpha'(\beta') \sqsubseteq \alpha \sqcup \alpha'(\beta \sqcup \beta')$. $\triangleleft$

This generalised conjunction will be used as the semantic value of *and.*

Sample Lexical Entries

(35) a. $[\![\text{John}]\!] = j$

b. $[\![\text{elephant}]\!] = \lambda x_e.\lambda s.[\text{elephant}(\mathcal{C}_s(x))(s)]$

c. $[\![\text{elephants}]\!] = {}^*[\![\text{elephants}]\!] = \lambda x_e.\lambda s.[{}^*\text{elephant}(\mathcal{C}_s(x))(s)]$

d. $[\![\text{-s}]\!] = \lambda f_{\langle e,\langle s,t\rangle\rangle}.\lambda x_e.[{}^*f(\mathcal{C}_s(x))(s) = 1]$

e. $[\![\text{an elephant}]\!] = [\![\text{elephant}]\!]$

f. $[\![\text{a(n)}]\!] = \lambda f_{\langle e,\langle s,t\rangle\rangle}.f$

g. $[\![\text{the}]\!] = \lambda P_{\langle e,st\rangle}\lambda s : \exists x P(x)(s) \wedge \forall y(P(y)(s) \rightarrow y \preceq x)).\bigoplus\{x : P(x)(s)\}.$

h. $[\![[[\text{the}_{sum} \text{ elephants}]s^*]]\!] = \bigoplus\{x : [\![\text{elephant}]\!](x)(s^*)\},$ if defined

i. $[\![[[\text{the}_{group} \text{ elephants}]s^*]]\!] = \uparrow(\bigoplus\{x : [\![\text{elephant}]\!](x)(s^*)\}),$ if defined

j. $[\![\text{in}]\!] = \lambda x_\tau.x_\tau$

k. $$[\![\text{and}_{\langle\tau,\langle\tau,\tau\rangle\rangle}]\!] = \begin{cases} \lambda x_e.\lambda y_e.[x \oplus y] & \text{if } \tau = e \\ \lambda q_t.\lambda p_t.\lambda s.[p(s) = 1 \wedge q(s) = 1] & \text{if } \tau = t \\ \lambda Q_{\langle\sigma,\tau\rangle}.\lambda P_{\langle\sigma,\tau\rangle}.\lambda s.\exists x_\sigma \exists y_\sigma [P(x)(s) \sqcup Q(y)(s) \sqsubseteq & \\ \qquad P \sqcup Q(x \sqcup y)(s)] & \text{if } \tau = \langle\sigma,\tau\rangle \end{cases}$$

l. $[\![\text{live}]\!] = [\![\text{lives}]\!] = \lambda s.[^*\text{lives}(s)]$

m. $[\![[\text{agent}]]\!] = \lambda s.[^*\text{agent}(s)]$

n. $[\![[\text{theme}]]\!] = \lambda s.[^*\text{theme}(s)]$

o. $[\![\text{Gen}]\!] = \lambda C_{\langle s,\langle s,t\rangle\rangle}.\lambda p_{\langle s,\langle s,t\rangle\rangle}.\lambda s.\forall s'[s' \in B(s) \wedge s' \in \cup\text{min}(C(s)) \rightarrow s' \in \text{min}(p)]$

p. $[\![\text{QA}]\!] = \lambda p_{\langle s,t\rangle}.\lambda s.\lambda s'.\exists s''[s' \preceq s'' \wedge p(s'')]$

Rules (after Heim and Kratzer 1998; Büring 2004; Elbourne 2005, 2013)

1. *Function Application*

   If α is a branching node and $\{\beta, \gamma\}$ the set of its daughters, then, for any assignment g, α is in the domain of $[\![.]\!]^g$ if both β and γ are, and $[\![\beta]\!]^g$ is a function whose domain contains $[\![\gamma]\!]^{g,s}$. In that case, $[\![\alpha]\!]^g = [\![\beta]\!]^g([\![\gamma]\!]^g)$

2. *Predicate Modification*

   If α is a branching node and $\{\beta, \gamma\}$ the set of its daughters, then, for any assignment g, α is in the domain of $[\![.]\!]^{g,s}$ if both β and γ are, and $[\![\beta]\!]^g$ and $[\![\gamma]\!]^g$ are of type $\langle e, st\rangle$. In that case, $[\![\alpha]\!]^g = \lambda x.\lambda s.[\![\beta]\!]^g(x)(s) = 1 \wedge [\![\gamma]\!]^g(x)(s) = 1$.

3. *Predicate Abstraction*

   For all indices i and assignments g, $[\![\lambda_i\alpha]\!]^g = \lambda x.[\![\alpha]\!]^{g^{x/i}}$.

4. *Situation Binding*

   For all indices i and assignments g, $[\![\Sigma_i \alpha]\!]^g = \lambda s.\lambda s'.[\![\alpha]\!]^{g^{s'/i}}(s)(s')$.

5. *Traces and Pronouns*

   If α is a trace or a pronoun, g is a variable assignment, and $i \in \text{dom}(g)$, then $[\![\alpha_i]\!]^g = g(i)$.

6. *Lexical Terminals*

   If α is a terminal node occupied by a lexical item, then $[\![\alpha]\!]$ is specified in the lexicon.

We also need some type-shifting operations for when we need to shift the types of verbal projections and noun phrases. Following Landman (2000) and Champollion (2017), I shall assume the following type shifters that freely apply to thematic roles, verbal projections and noun phrases:

7. *Predicative type shifter*

   a. VP, then NP: $\lambda\theta_{\langle s,e\rangle}.\lambda V_{\langle s,t\rangle}.\lambda P_{\langle e,\langle s,t\rangle\rangle}.\lambda s.[V(s) \wedge P(\theta(s))]$

   b. NP, then VP: $\lambda\theta_{\langle s,e\rangle}.\lambda P_{\langle e,\langle s,t\rangle\rangle}.\lambda V_{\langle s,t\rangle}.\lambda s.[V(s) \wedge P(\theta(s))]$

8. *Referential type shifter*

   a. VP, then NP: $\lambda\theta_{\langle s,e\rangle}.\lambda V_{\langle s,t\rangle}.\lambda x_e.\lambda s.[V(s) \wedge \theta(s) = \mathcal{C}_s(x)]$

   b. NP, then VP: $\lambda\theta_{\langle s,e\rangle}.\lambda x_e.\lambda V_{\langle s,t\rangle}.\lambda s.[V(s) \wedge \theta(s) = \mathcal{C}_s(x)]$

Lastly, we will make use of the following rule to operate on the metalanguage when doing derivations:

9. *β-Reduction*

   $[\lambda u_\tau.M](N_\tau) = [N/u]M$

This conclues my presentation of the structured theory of generics.

5.5 Explaining Generic Conjunctions

With this exposition in hand, we can explore how the structured theory of generics makes sense of the wide variety of other generic conjunctions. I begin by showing precisely how the structured theory explains generics involving object-DP coordination. The explanation proceeds in a principle and predicative way, in virtue of a generalisation about algebraic semantics and their influence on the matrix clause. I then explain how other kinds of generic conjunctions are accommodated, although this discussion will be more informal, and I won't provide full details of the compositional process.

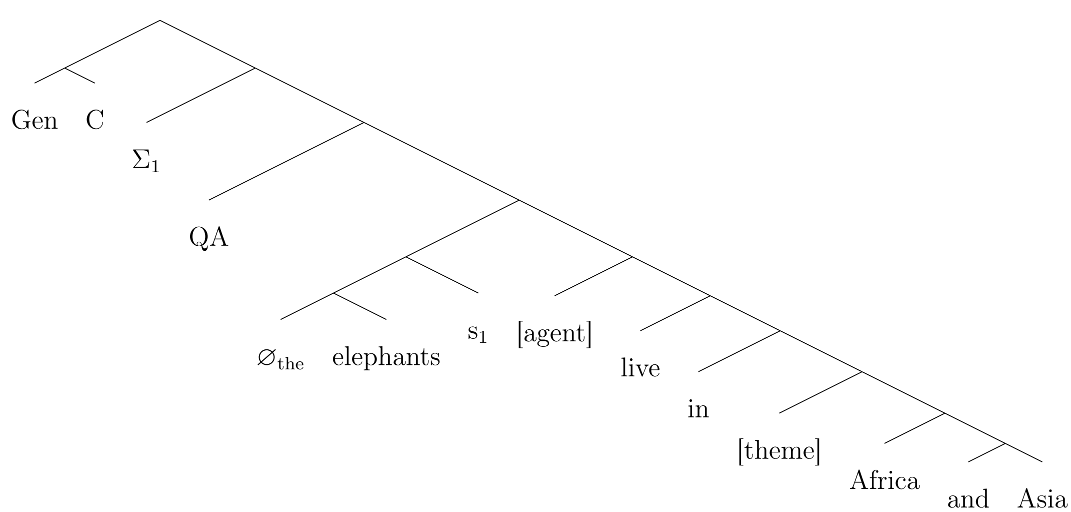
5.5.1 *Elephants live in Africa and Asia*

Recall the following generic conjunction:

(2) a. Elephants live in Africa and Asia

Let us suppose that the syntactic structure of (2a) is something like the (simplified) structure in (36):[52]

(36)



[52] Note that nothing essential hinges on this being exactly the right syntactic analysis of (2a), since we can adapt the relevant aspects of the semantics to fit the analysis delivered to us by our syntax

Aside from being a generic, this is a canonical example of a cumulative reading involving two plural NPs, and a relation R introduced by the verb. A cumulative reading of a distributive predicate licences the inference that R relatives every atomic part of the first plural NP to at least one atomic part of the second plural NP, and vice versa. If cumulative readings are modelled as scopeless relations, where no denotation takes scope over another, a rather lengthy calculation reveals that the LF in (36) has the truth-conditions in (37a).[53] Assuming, as we have been doing, that verbs and thematic roles are closed under sum formation, and that *live* is distributive down to atoms in both its agent and theme arguments, (37a) is equivalent to (37b).

(37) a. $\lambda s.\forall s'[s' \in B(s) \wedge s' \in \cup\text{min}(C(s))]\exists s''[s' \preceq s'' \wedge {}^*\text{live}(s'') \wedge$
$${}^*\text{agent}(s'') = \bigoplus\{x : \text{elephant}(x)(s')\} \wedge {}^*\text{theme}(s'') = \text{Africa} \oplus \text{Asia}]$$

b. $\Leftrightarrow$ $\lambda s.1$ iff for every minimal situation s' such that $s' \in B(s)$ and $s' \in \cup\text{min}(C(s))$,

there is a minimal situation s'' such that $s' \preceq s''$ and the elephants x in s' are such that, for some $y = \text{Africa} \oplus \text{Asia}$ in s'' such that,

for every $x' \preceq_{\text{atom}} x$, there is some $y' \in y$, there is a minimal situation s''' such that $s''' \preceq s''$ and x' is an elephant in s''' and y' is in s''' and x' lives in y' in s''',

and

for every $y' \preceq_{\text{atom}} y$, there is some $x' \preceq_{\text{atom}} x$, there is a minimal situation s''' such that $s''' \preceq s''$ and x' is an elephant in s''' and y' is in s''' and x' lives in y' in s'''.

Given a suitable question under discussion, these truth-conditions are intuitively adequate.

[53] See Appendix A for this computation.

Furthermore, unlike 'and-as-or' thesis that was floated in Section 5.3, the structured theory of generics does not predict that (2a) entails the false conclusion that the sentence 'Elephants live in Africa, Asia, and Antartica is true. This is because we have assumed that cumulative readings of distributive predicates license the inference that for every atomic part of the object DP of a relation R, there is some atomic part of the subject DP that is R-related to it. Consequently, my semantics predicts that the sentence 'Elephants live in Africa, Asia, and Antartica' is true only if each of Africa, Asia, and Antartica has some normal elephant living in it. Formally:

(38) a. (=(16b)) Elephants live in Africa, Asia, and Antarctica.

b. $\lambda s.\text{Gen } s'[s' \in B(s) \wedge \cup\text{min}(C(s))]\exists s''[s' \preceq s'' \wedge {}^*\text{live}(s'') \wedge$
$${}^*\text{agent}(s'') = \bigoplus\{x : \text{elephant}(x)(s')\} \wedge {}^*\text{theme}(s'') = \bigoplus(\{\text{Africa, Asia, Antarctica}\})]$$

c. $\Leftrightarrow \lambda s.1$ iff for every minimal situation s' such that $s' \in B(s)$ and $s' \in \cup\text{min}(C(s))$,

there is a minimal situation s'' such that $s' \preceq s''$ and the elephants x in s' are such that, for some $y = \bigoplus(\{\text{Africa, Asia, Antarctica}\})$ in s'' such that,

for every $x' \preceq_{\text{atom}} x$, there is some $y' \in y$, there is a minimal situation s''' such that $s''' \preceq s''$ and x' is an elephant in s''' and y' is in s''' and x' lives in y' in s''',

and

for every $y' \preceq_{\text{atom}} y$, there is some $x' \preceq_{\text{atom}} x$, there is a minimal situation s''' such that $s''' \preceq s''$ and x' is an elephant in s''' and y' is in s''' and x' lives in y' in s'''.

Given these truth-conditions, it is immediately clear that sentence (38a) is false, since there is some atomic individual of $\bigoplus(\{\text{Africa, Asia, Antarctica}\})$ such that there are no situations $s''' \preceq s''$ in which an elephant lives in it in s''', namely, Antarctica. In other words: the sentence is false because it is not the case that, for Antartica, there are some elephants such that in normal conditions they live in there. The structured theory of generics predicts exactly this result.

The reasoning in both of these cases is perfectly general and the explanation of the cumulative nature of phrasal conjunction did not rely on any special mechanism concerning genericity. It is exactly this structured theory of cumulative predication that can explain non-generic instances of the same phenomenon, as witnessed by the following example:

(39) a. John and Mary lifted the table and the chair.

b. $\lambda s.[{}^*\text{lift}(s) \ \wedge \ {}^*\text{agent}(s) = j \oplus m \ \wedge$
$${}^*\text{theme}(s) = (\iota x.\text{table}(x)(s) = 1 \oplus \iota x.\text{table}(x)(s) = 1)]$$

Let us step back for a moment and appreciate how the structured theory of generics handles these cases. Recall the problem that generic conjunctions pose to majority-based accounts of generics. They seem to split the members into two groups in such a way that neither of which satisfy the conjunctive property nor does a majority-based semantics predict that these groups may each satisfy just one conjunct of the complex property. But, if we evaluate the conjunction as coordinating DPs and have an algebraic understanding of the structure of objects, events, and situations, then we can understand such generics as making a claim about complex situations, which have parts that satisfy the relevant condition. Thus, we can accommodate these kinds of generic conjunctions (along with non-generic cumulative predications involving phrasal conjunction) without having to reject the standard approach to generics.

5.5.2 *Cardinals are red and lay eggs*

Recall that the problem with generic conjunctions involving VP coordination is that no majority of the kind satisfies either of the properties in question, nor are there any members of the kind that satisfy the conjunctive property. For example, in (2b), no cardinal is both red and lays eggs (since only the males are red and only the females lay eggs), and there is no majority of cardinals have any one of those properties.

(2) b. Cardinals are red and lay eggs.

I assume that there are (at least) two possible syntactic structures for (2b), which I consider each in turn. The first possible syntactic structure is represented in Figure 5.2. This syntactic structure is taken to involve sentential coordination and the second occurrence of *cardinals* has been phonologically deleted using the kind of mechanism posited in Section 5.3. Furthermore, I assume the generic operator *Gen* appears twice in the logical form. I take this assumption as dialectically harmless, since other theorists such as Nickel (2016) also need it to accommodate (2b). Following the strategy outlined in Section 5.3, I argue that this structure corresponds to the intuitively true reading of (2b).

Recall that according to the structured theory of generics, the restrictor of a generic sentence is an anaphor whose reference is pragmatically determined by the context. In principle, there is no reason why the referent of the two anaphors C and C' must have the same value. In fact, if the pragmatic mechanism for anaphor resolution is sensitive to the local predicates or focal stress of the sentence, the restrictor of the first conjunct may be determined by alternatives to how cardinals exhibit stereotypical features including colour, whereas the restrictor of the second conjunct may be determined by alternatives to how cardinals produce offspring. If this is the case, then the sentential reading of (2b) is true in a situation s iff:

(40) for every minimal situation s' such that $s' \in B(s)$ and $s' \in \cup\min(C(s))$,

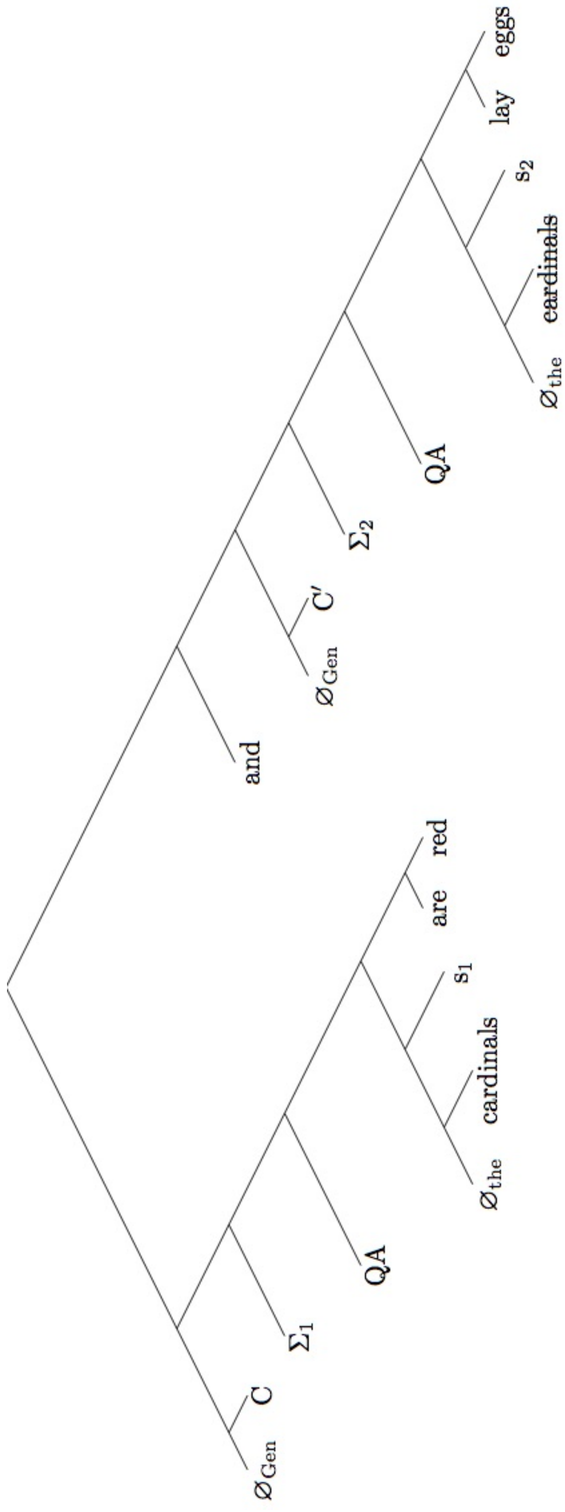


Figure 5.2: *Cardinals are red and lay eggs* (sentential coordination)

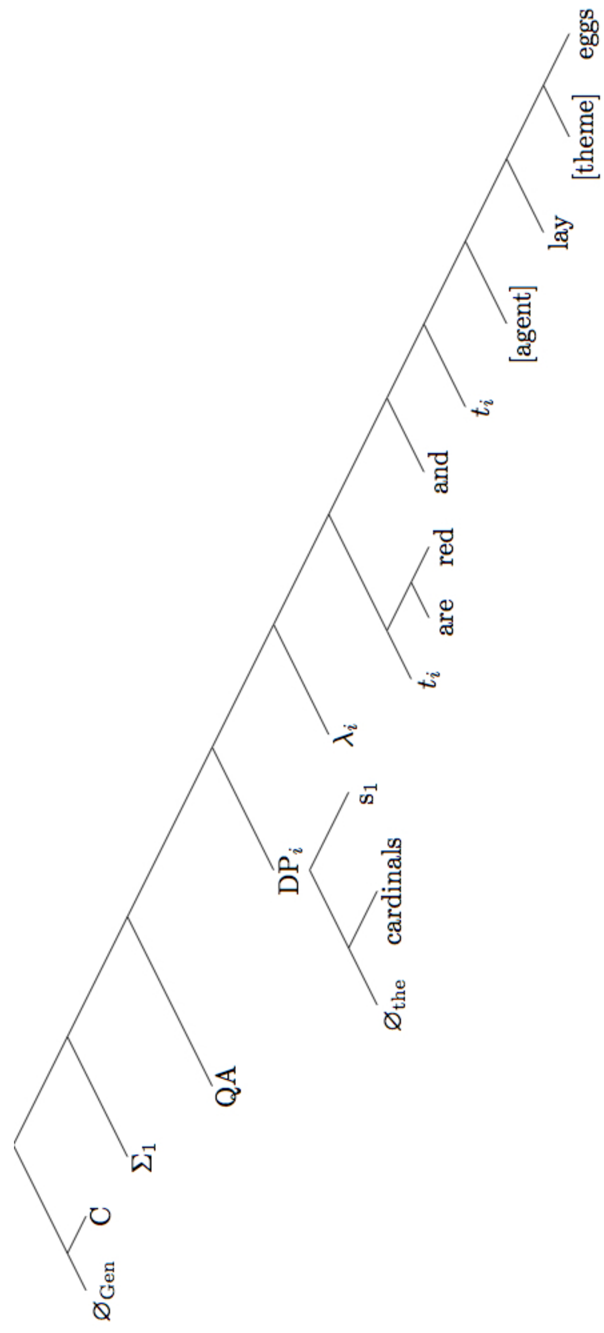


Figure 5.3: *Cardinals are red and lay eggs* (vP coordination)

there is a minimal situation s'' such that $s' \preceq s''$ and the cardinals x in s' are such that:

for every $x' \preceq_{\text{atom}} x$, there is a minimal situation s''' such that $s' \preceq s''' \preceq s''$ and x' is red in s''',

and for every minimal situation s' such that $s' \in B(s)$ and $s' \in \cup\min(C'(s))$,

there is a minimal situation s'' such that $s' \preceq s''$ and the cardinals x in s' are such that:

for every $x' \preceq_{\text{atom}} x$, there is a minimal situation s''' such that $s' \preceq s''' \preceq s''$ and x' is lays eggs in s'''.

While the description of the truth-conditions is admittedly vague, one can see how this account can be augmented to accommodate the truth of this reading.

The second possible syntactic structure is represented in Figure 5.3. The syntactic structure in this tree is taken to involve vP coordination.[54] According to this structure, the subject argument of both vPs are coindexed, and it can easily be verified that the λ-abstract in the VP position as the following denotation:

(41) $[\![$ λ_i [[t_i are red] [and [t_i lay eggs]]] $]\!]$

$$=\lambda x.\lambda s.[\text{red}(x)(s) \wedge {}^*\text{lay}(s) \wedge {}^*\text{agent}(s) = x \wedge \exists y[{}^*\text{egg}(y)(s) \wedge {}^*\text{theme}(s) = y]]$$

That is, it denotes a property that an individual has if that individual is red and lays eggs. Consequently, our semantics predicts that on this reading (2b) is true at a situation s iff:

(42) for every minimal situation s' such that $s' \in B(s)$ and $s' \in \cup\min(C(s))$,

there is a minimal situation s'' such that $s' \preceq s''$ and the cardinals x in s' are such that:

[54] For an account of how across-the-board extraction out of the conjunction results in long distance dependencies, see Kobele (2008).

for every $x' \preceq_{\text{atom}} x$, there is a minimal situation s''' such that $s' \preceq s''' \preceq s''$ and x' is red in s''' and x' lays eggs in s'''.

Since there are no cardinals that satisfy the predicate abstraction of (41), this sentence is intuitively false.

In sum, the structured theory explains the different readings of (2b) by following the strategy that I laid out for that sentence in Section 5.3, and the resulting truth-conditions seem to be empirically adequate.

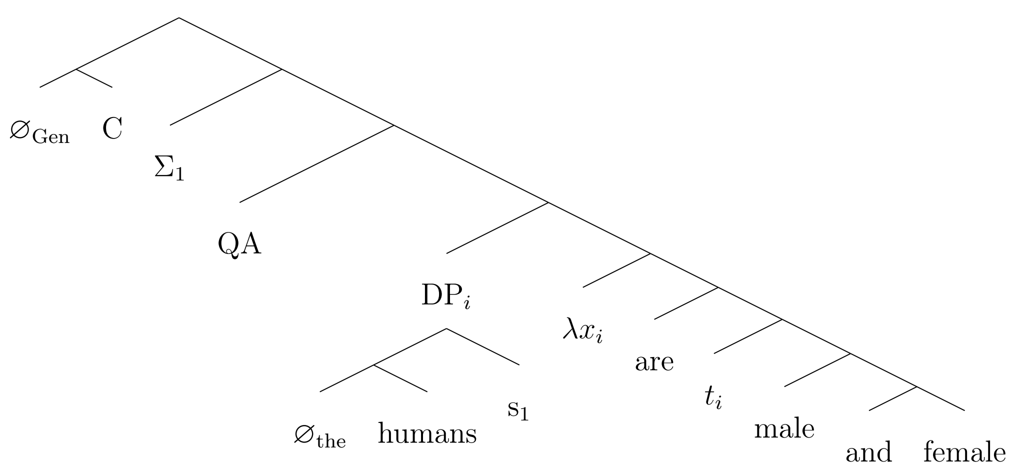
5.5.3 *Humans are male and female*

Let us now turn to generic conjunctions involve adjectival coordination, such as (2c):

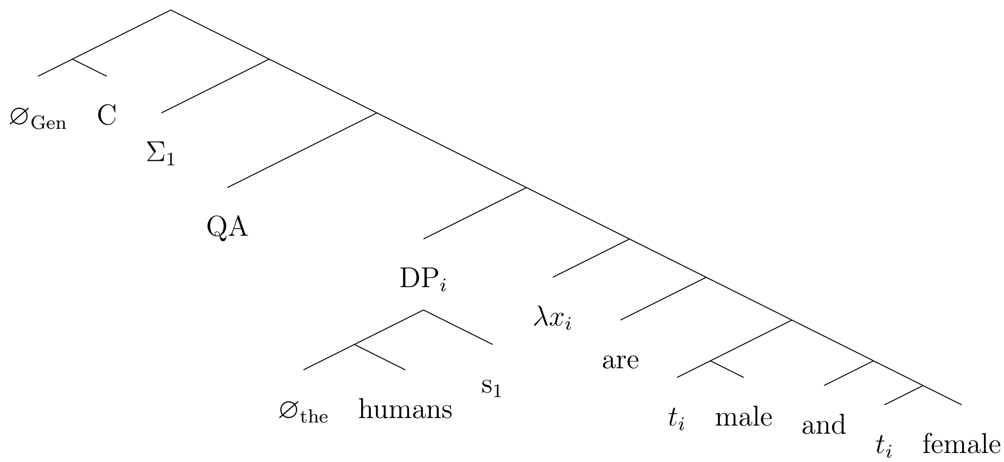
(2) c. Humans are male and female.

The structured theory accounts for these kinds of generic conjunctions by following a similar strategy as before. For sake of concreteness, I accept Stowell's (1978) analysis of copular sentences as small clauses and so assume that two possible syntactic structures for (2b) would be as follows:

(43) a.



b.



In (43a), a complex AP *male and female* is fed into the λ-abstract. Given our mereological semantics for *and*, the λ-abstract intuitively denotes the set of pluralities that have at least one male and female among them. Consequently, (43a) is true in a situation s iff

(44) for every minimal situation s' such that $s' \in B(s)$ and $s' \in \cup\text{min}(C(s))$,

there is a minimal situation s'' such that $s' \preceq s''$ and the humans x in s' are such that:

for every $x' \preceq_{\text{atom}} x$, there is a minimal situation s''' such that $s' \preceq s''' \preceq s''$ and x' is a male in s''' or x' is a female in s''',

and

there is at least one $x' \preceq_{atom} x$ such that, there is a minimal situation s''' such that $s' \preceq s''' \preceq s''$ and x' is a male in s'''

and

there is at least one $x' \preceq_{atom} x$ such that, there is a minimal situation s''' such that $s' \preceq s''' \preceq s''$ and x' is a female in s'''.

Contrastingly, in (43b), we have a coordination of small clauses, out of which the subject is extracted across the board. This yields the predicate that denotes the set of pluralities that are both male and female. Since humans are not normally members of this set, it is no surprise that (2c) is false on this reading. Instead, I submit that (43a) is the reading of (2c) that is intended to be intuitively true, and that these truth-conditions seem empirically adequate.

5.6 Alternative Solutions

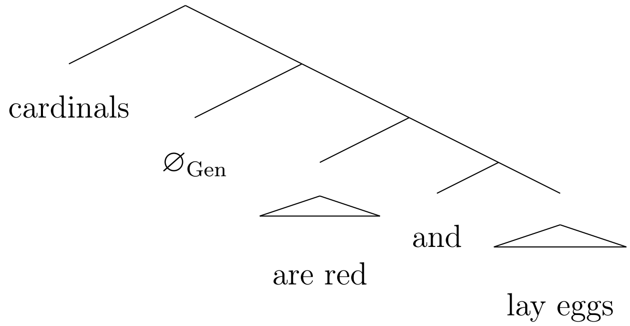
This concludes my exposition of the structured theory of generics. To close, I want to compare the structured theory with a prominent alternative approach to the data reviewed here, namely, Nickel's semantically revisionary theory of generics. I first introduce Nickel's theory, which I think is worth serious consideration, and argue that it does not adequately account for much of the data.

Let me begin by outlining the two key ideas to Nickel's theory.[55] The first idea is to reject the assumption that the generic operator is a determiner or a sentence-level adverb. More precisely, the generic operator adjoins to the left of a VP or V′, rather than to the left of an NP, IP, or I′ a determiner position. Allowing the generic operator to left adjoin a VP or V′ means that each generic conjunction can be associated with two LFs, one involving a single generic operator taking scope over the topmost VP, and one involving two generic operators, each taking scope over only one conjunct respectively. For example, (45) will receive the following (simplified) LFs, the second of which is equivalent to the LF that 'Cardinals are red and cardinals lay eggs' will receive:

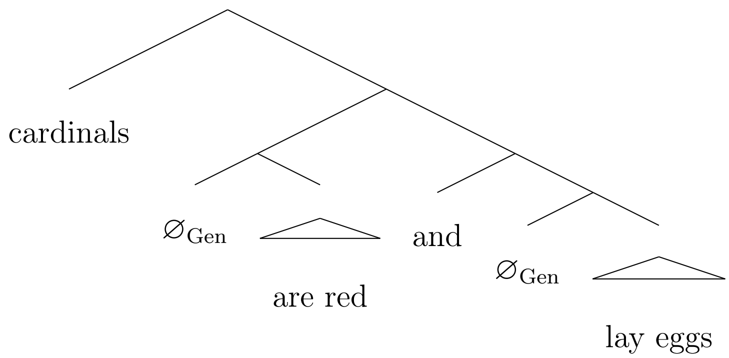
(45) (=(2b)) Cardinals are red and lay eggs.

[55] The exposition of Nickel's view is somewhat complicated by the fact that he presents a different, though complementary, solution in his 2016 book from his original 2008 paper. My exposition combines both aspects in what I take to be the best representation of his view.

(46) a.



b.



The second key idea of Nickel's theory is to replace the familiar majority-based semantics for characterising sentences with an existential analysis involving quantification over ways of being normal. For Nickel, characterising sentences of the form ⌜*Fs are G*⌝ are true at a context c iff, roughly speaking, there is a way of being a normal F that is salient in c, and all Fs that are normal in that way are G. Formally, let us specify Nickel's semantics as in (47), along with some other lexical entries for the compositional analysis of (46b) in (48):[56]

(47) a. $[\![\text{cardinals}]\!] = \text{cardinal}$

b. $[\![\text{red}]\!] = \lambda x_e.[\text{red}(x) = 1]$

c. $[\![\text{lay}]\!] = \lambda x_e.\lambda y_e.[\text{lay}(y)(x) = 1]$

d. $[\![\text{and}_{\langle et,\langle et,t\rangle\rangle}]\!] = \lambda g_{et}.\lambda f_{et}.\lambda x_e.[f(x) = g(x) = 1]$

e. $[\![\text{Gen}]\!] = \lambda g_{et}.\lambda y_k.$[there is a way w of being a normal k that is salient in context c, and for every x, if x is a member of y_k and x is normal in w, then $g(x) = 1$]

[56] Nickel (cf. 2008, 2016: 255). Note that Nickel remains neutral about whether kinds should be treated as abstract objects or further analysed as pluralities.

(48) ⟦(45)⟧ is true at a context c iff there is a c-salient way w_1 of being a normal cardinal with respect to its colour, and all cardinals that are normal in w_1 are red, and there is a way w_2 of being a normal cardinal with respect to its mode of reproduction, and all cardinals that are normal in w_2 lay eggs.

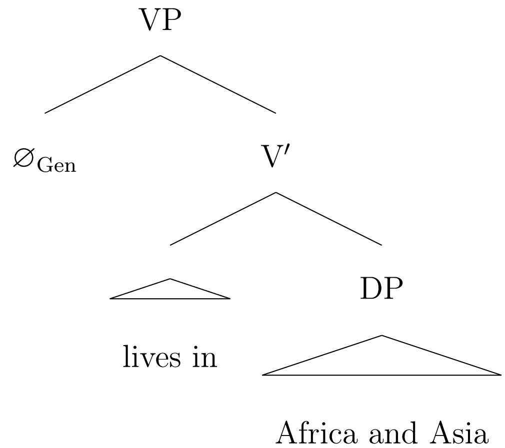
These truth-conditions for (45) seem empirically adequate.

However, despite the innovations and elegance of Nickel's theory, it has a number of problems. The overarching worry I have about Nickel's theory is a worry about fit. Nickel's theory is a tailor-made to handle generic conjunctions, and so it does not generalise to quasi-cumulative readings of phrasal coordination in non-generic environments. Once we take this larger data set into account, Nickel's theory appears quite *ad hoc*, and further motivates the more uniform approach to phrasal conjunction I advocate for in this chapter.

Furthermore, despite his claims, Nickel is unable to accommodate generic conjunctions that involve non-VP coordinations like (2a), (2c), and (2d). Nickel attempts to analyse generic conjunctions in terms of sentential coordination counterparts. For example, he claims that 'Elephants live in Africa and Asia' is equivalent to 'Elephants live in Africa and elephants live in Asia'. But, as I argued in Section 5.3, there is no empirical basis for this analysis. And Nickel's theory is not well placed to analyse phrasal coordinations *in situ*. To see this, I will consider what Nickel's theory predicts about (2a), (2c), and (2d) in turn.

First, consider generic conjunctions involving DP coordinations in object position, such as *Elephants live in Africa and Asia*. Given that *Africa and Asia* is a constituent, the generic operator *Gen* must occupy a site on the verb stem that directly c-commands both *Africa* and *Asia*, as in the (simplified) syntax in (49):

(49)

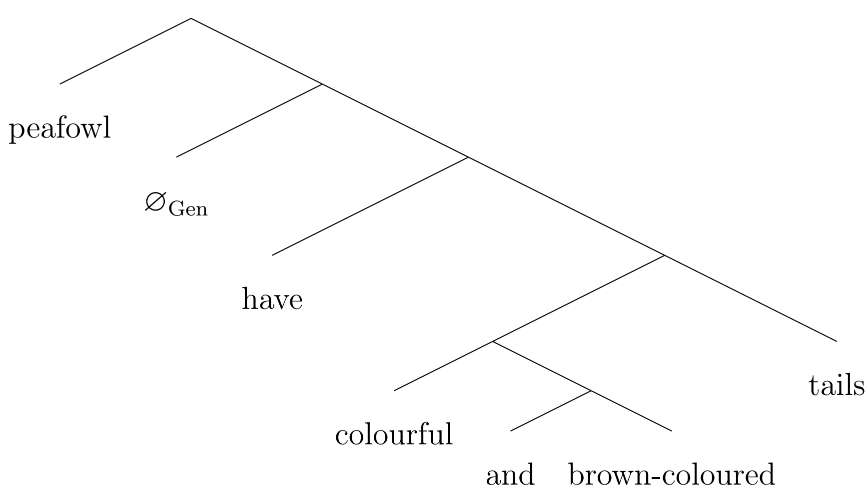


Given (49), Nickel's theory predicts that (2a) (= 'Elephants live in Africa and Asia') is true iff there is a way of being a normal with respect to elephant's habitats and all elephants that are normal in that way live in Africa *and* Asia. Consequently, Nickel's semantics does not accommodate (2a).

Second, consider generic conjunctions involving adjectival coordination such as (50a). Given Nickel's VP-hypothesis, the only site for *Gen* would be as in (50b):

(50) a. Peafowl have colourful and brown-coloured tails.

b.

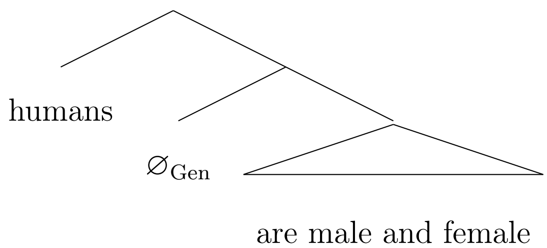


While (50a) is intuitively true, Nickel's theory predicts that it is false: its truth would require that a way of being a normal with respect to peafowl tails and every peafowl normal in that way has a colourful and brown tail. Consequently, Nickel's theory is unable to accommodate adjectival coordination.

Third, consider generic conjunctions involving NP coordination, such as (2c) (= ‘Humans are male and female’). Again, the only available site for *Gen* as a distributivity operator in (51a) is as in (51b):

(51) a. Humans are male and female.

b.



Given the LF in (51b), Nickel’s theory predicts that (51a) is true iff there is a way of being a normal with respect to sex and all humans that are normal in that way are both male *and* female.[57]

More generally, the main problem arises from Nickel’s assumption that generic conjunctions are covert sentential conjunctions, which I argued that this assumption is syntactically unwarranted. But without this assumption, it is hard to see how Nickel’s theory delivers the right predictions about these sentences, since he can no longer assume that generic conjunctions can contain multiple generic operators. Short of an alternative explanation for generating his favoured LFs, this problem seems like a serious one.[58]

[57] One might respond that ‘Humans are male and female’ is a surface structure abbreviation of ‘Humans are male and are female’, and the latter contains two possible sites for *Gen*. However, it is implausible that ‘Humans are male and female’ contains a covert *are* for a possible cite for *Gen*, since non-generic conjunctions of collective and distributive predicates do not have this possibility. Compare the following minimal pair:

(i) The children are surrounding the tree and skipping

(ii) ??The children are surrounding the tree and each skipping

If there were an implicit *are* in (i), then we would expect *each* to be felicitous.

[58] For further criticism of Nickel’s theory, see Hoeltje (2017).

5.7 Conclusion

There is strong reason to believe that generic conjunctions can be accommodated from within the standard approach to generics. My chosen implementation draws on independently motivated algebraic and situation-theoretic resources to develop a modal version of the orthodoxy. As well as handling the data on generic conjunctions with grace, the structured theory of generics is a relatively conservative extension of the kind of semantics needed to handle non-generic plurals and anaphor more generally. That said, I believe that the general strategy can be transposed to other theories of generics and other treatments of plurals. Consequently, there is strong reason to reject any explanation of generic conjunction that rely on some ad hoc amendment to the semantics of the generic operator, since the phenomenon of cumulative conjunction is not specific to generics. And, unlike Nickel's semantics, the structured theory of generics delivers exactly this, since it forms part of a general account of cumulative conjunction in any domain. Proponents of revisionary accounts of generics are free to help themselves to the explanatory resources outlined in the chapter. But I hope to have shown that generic conjunctions provide no pressing need to depart from an orthodox and semantically conservative approach to generic sentences.

Chapter 6

Generics and Sobel Sequences

6.1 A Problem

It is a familiar point that we can use generic sentences to express generalisations that are tolerant to exceptions, and then go on to state those exceptions explicitly.[1] Consider, for example, the following sentences:

(1) a. Ravens are black; but albino ravens aren't.

b. Birds fly; but birds with broken wings don't.

c. The duck lays eggs; but the male duck doesn't.

d. A lion has a mane; but a female lion doesn't.

Call such pairs of sentences *generic Sobel sequences*.[2] The sentences in (1) are perfectly felicitous and judged to be true, even though they each involve a true generic generalisation together with a sentence that expresses its exceptions in a single pointful

[1] As far as I am aware, this point was made as far back as Heim (1984: 103), although it has also been reported by Delgrande (1987b: 106) and Pelletier and Asher (1997: 1144).

[2] I appropriate the label 'Sobel sequence' from the literature on counterfactuals involving analogous chains of counterfactuals. David Lewis (1973: 10) credits J. Howard Sobel with having first noticed such combinations of counterfactuals; see Sobel (1970).

discourse. For example, the first conjunct in (1a) is true, even though albino ravens aren't black; the first conjunct in (1b) is true, even though flightless birds and birds with broken wings don't fly; the first conjunct in (1c) is true, even though less than half of ducks lay eggs, namely, the subset of those fertile female ducks of a certain age; and the first conjunct in (1d) is true, even though more than half of lions do not have a mane. The second conjuncts of each of these sentences express exactly these exceptions. Any theory capable of accommodating the exception-permitting behaviour of generic sentences should also be able to explain the felicity of such sequences.

It is a less familiar point that switching the order of the conjuncts in (1) has deleterious effects for the felicity of the respective sentences. Observe the striking asymmetry between the acceptability of the sentences in (1) and their reverse counterparts in (2):[3]

(2) a. #Albino ravens aren't black; but ravens are.

b. #Birds with broken wings don't fly; but birds do.

c. #The male duck doesn't lay eggs; but the duck does.

d. #A female lion doesn't have a mane; but a lion does.

Call such pairs of sentences *reverse Sobel sequences.*[4] While utterances of the sentences in (1) are felicitous, the sentences in (2) are terrible and contradictory-sounding. This is somewhat unexpected since the sentences in (2) should convey just the same information as those in (1), albeit presented in a different order.

The contrast between the acceptability of Sobel and reverse Sobel sequences of generics is quite general and does not depend on any particular feature in the examples

[3] '#' indicates infelicity of some sort.

[4] The observation that the felicity of counterfactual Sobel sequences is sensitive to the order in which their conjuncts are presented was first observed by Irene Heim in a seminar presentation at MIT in 1994, as reported by von Fintel (2001). Consequently, reverse Sobel sequences of counterfactuals are sometimes called 'Heim sequences' in homage. For discussion of indicative and counterfactual Sobel sequences, see Lewis (1973); von Fintel (2001); Gillies (2007); Williams (2008); Moss (2012); Willer (2017); Lewis (2018). For discussion of Sobel sequences of definite descriptions, see Lewis (1973); von Heusinger (1997a,b, 2004); Schlenker (2004); Holst (2013).

above. For example, the contrast does not seem to depend on the predicate in question. That is, generic sequences are felicitous and reverse generic sequences are infelicitous regardless of whether they involve an adjective like *are black*, as in (1a) and (2a), a habitual verb like *fly* or *lay eggs*, as in (1b–c) and (2b–c), or a predicative noun phrase like *have a mane*. Furthermore, the contrast does not depend on singular–plural morphology nor on the definite–indefinite distinction.[5] For example, generic sequences involving bare plurals, such as (1a) and (2a), pattern in the same way as generic sequences involving definite singular noun phrases, such as (1c) and (2c), and generic sequences involving indefinite singular noun phrases, such as (1d) and (2d).[6] Lastly, the contrast does not depend on how the subject noun phrase is modified to evoke the exceptions in question. That is, reverse Sobel sequences are infelicitous regardless of whether the exceptions are indicated using subsective adjectival modification, as in (3) and (4), or restrictive relative clauses, as in (5):[7]

(3) a. Ravens are black; but albino ravens aren't.

b. #Albino ravens aren't black; but ravens are.

[5] That said, I will focus primarily on generic sentences involving bare plural noun phrases, rather than indefinite and definite singular noun phrases. The semantics of these sentences differ in subtle ways that puts them outside the scope of this thesis. Nevertheless, the theory I defend should be extendable to these kinds of generics.

[6] Note that there is some difficulty in formulating felicitous Sobel sequences of *definite* singular generics. Some theorists have argued that not just any nominal constituent can form a kind-referring definite DP, with the nominal counterparts of 'well-established' or familiar kinds being most suited to the task; see Dahl (1975); Carlson (1977b). If so, then not just any nominal constituent will be a suitable adjectival modifier for the second conjunct, and some perfectly fine bare plural generic sequences will have marked definite generic counterparts. Witness the awkwardness of the generic reading of *The bird flies, but the bird with broken wings doesn't.* Nevertheless, with sufficient ingenuity, we can generate some examples.

[7] It is worth noting that non-subsective adjectival modification does not result in the same kind of infelicity:

(i) Ducks lay eggs, but rubber ducks don't.

(ii) Rubber ducks don't lay eggs, but ducks do.

On the assumption that noun phrases denote sets of individuals, given that the denotation of *rubber ducks* is neither a subset nor overlaps with the denotation of *ducks*, this fact is not surprising. Nevertheless, while a more systematic explanation is required, I will remain largely silent on this data point.

(4) a. Teachers care for their students; but bad teachers don't.

b. #Bad teachers don't care for their students; but teachers do.

(5) a. Ravens are black; but ravens with albinism aren't.

b. #Ravens with albinism aren't black; but ravens are.

Each of the a-sentences in (3)–(5) sound fine and each of the b-sentences in (3)–(5) sound terrible, even though they each use a different linguistic mechanism to demarcate the exceptions to the generalisation. The upshot is that the phenomenon under question is perfectly general.

Having laid out these observations about sequences of generics, I want to raise a novel challenge to extant theories of generics. The challenge for theories of generics is to capture the intuitive consistency of Sobel sequences and to accommodate the asymmetry between Sobel sequences and reverse Sobel sequences. This challenge can be stated more precisely with a little formalism. Suppose we tentatively use $\ulcorner \text{Gen}[\phi][\psi] \urcorner$ to represent the logical form of generic sentences of the schematic form $\ulcorner \phi' s\ \psi \urcorner$, formalising it as involving a covert generic operator called 'Gen' that is syntactically apt to combine with two open sentences (the sentence's *restrictor* and *nuclear scope*) and bind any relevant free variables in its scope.[8] Then the logical form of the sentences in (1) is roughly this:

$$\ulcorner \text{Gen}[\phi][\psi] \text{ and } \text{Gen}[\phi \wedge \chi][\neg\psi] \urcorner$$

and the logical form of the sentences in (2) is roughly this:

[8] More carefully, I take generic sentences as involve a covert quantifier called 'Gen' that relates two open sentences called the restrictor and nuclear scope. The nuclear scope makes the main assertion of the generic sentence, specifying the property attributed to the relevant members of the domain. The restrictor clause states the restricting cases relevant to the matrix. The *Gen* operator, then, unselectively binds any free variables in its scope, whether the variables range over individuals, worlds, (spatial-temporal) locations, events, or situations. Note, we will have to depart from this assumption briefly when considering kind-predication approaches to generics; see Section 6.2.1. For simplicity, I assume that the restrictor material is taken from the subject noun phrase, and the nuclear scope is taken from the verb phrase; for further discussion of and complications with this assumption, see, for example, Krifka et al. (1995); Kratzer (1995); Chierchia (1995); Rooth (1995).

$\ulcorner$Gen$[\phi \wedge \chi][\neg\psi]$ and Gen$[\phi][\psi]\urcorner$.

Observe that Sobel sequences immediately present a systematic class of counterexamples to the claim that generics are *left downwards monotonic*.[9] If generics are left downwards monotonic, then 'Ravens are black' entails 'Albino ravens are black'. But albino ravens are clearly not black. So it follows that generics are not left downwards monotonic. This observation places a strong constraint on the semantics of generic sentences: any empirically adequate semantics must invalidate left downwards monotonicity. Consequently, the semantics of the generic quantifier *Gen* cannot be equivalent to *all*, *every*, *always*, and the like, since each of these quantifiers are left downwards monotonic.

Any theory that invalidates left downwards monotonicity immediately faces the difficulty of explaining the infelicity of reverse Sobel sequences of generics. To fix ideas, focus on the sentence schema $\ulcorner$Gen$[\phi \wedge \chi][\neg\psi]$ and Gen$[\phi][\psi]\urcorner$ and hold the context fixed. Now either $\ulcorner$Gen$[\phi\wedge\chi][\neg\psi]\urcorner$ is truth-conditionally compatible with $\ulcorner$Gen$[\phi][\psi]\urcorner$, or it is not. Suppose first that the two are truth-conditionally compatible. Then, their conjunction is true. There is some good reason to think this; after all, the original sentence $\ulcorner$Gen$[\phi][\psi]$ and Gen$[\phi \wedge \chi][\neg\psi]\urcorner$ is perfectly fine, and a classical conjunction commutes, so the reverse should be true as well. However, if the reverse sequence could be true, then there should be nothing preventing us from hypothetically entertaining that these conditions obtain. But we cannot. This can be demonstrated by embedding reverse Sobel sequences under a supposition operator or in the antecedent of an indicative conditional, and observing that this does little to improve their felicity:[10]

(6) a. #Suppose albino ravens aren't black, but ravens are.

b. #Suppose birds with broken wings don't fly, but birds fly.

[9] More formally, we say that the generic operator *Gen* is *left downwards monotonic* iff, for any ϕ, ψ, if $\ulcorner$Gen$[\phi][\psi]\urcorner$ is true, then for all $\phi' \subseteq \phi$, $\ulcorner$Gen$[\phi'][\psi]\urcorner$ is true.
[10] I borrow this trick from Yalcin (2007).

(7) a. #If male ducks don't lay eggs, but ducks lay eggs, then . . . .

b. #Suppose a female lion doesn't have a mane, but a lion does, then . . . .

This suggests that we cannot hypothetically entertain reverse Sobel sequences, and so we should drop the assumption that reverse Sobel sequences are actually consistent. If we instead take it that $\ulcorner \text{Gen}[\phi \wedge \chi][\neg\psi] \urcorner$ is truth-conditionally incompatible with $\ulcorner \text{Gen}[\phi][\psi] \urcorner$, then we have a ready explanation for why we cannot entertain their conjunction. There simply is no situation in which they are both true, and this is why it is so hard to envisage such a situation. Moreover, this would explain why reverse Sobel sequences are infelicitous. But although this line covers our intuitions about reverse Sobel sequences, it comes at a seemingly unacceptably high price. If $\ulcorner \text{Gen}[\phi \wedge \chi][\neg\psi] \urcorner$ and $\ulcorner \text{Gen}[\phi][\psi] \urcorner$ are contradictory, then the truth of one entails the falsity of the other. On standard classical assumptions, that means that $\ulcorner \text{Gen}[\phi][\psi] \urcorner$ entails that $\ulcorner \neg\text{Gen}[\phi \wedge \chi][\neg\psi] \urcorner$. That is, the truth of the sentence 'Ravens are black' entails that the sentence 'Albino ravens are white' is false. But this is completely absurd: it is basically analytic that albino ravens are white.

So we face a dilemma. The conjuncts of reverse Sobel sequences of generics should be treated as having incompatible truth-conditions to explain their infelicity and why we cannot coherently entertain or embed the conjunction, but they should be treated as having compatible truth-conditions in order to explain the fact that they invalidate left downwards monotonicity. Any empirically adequate theory of generics should resolve this apparent tension.

This chapter proposes an analysis of these facts, which have never been considered in the literature on generics. Following Kai von Fintel's (2001) and Anthony Gillies's (2007) theories of counterfactuals, I propose to analyse generics as universally quantified strict conditionals, whose modal component ranges over normal situations and which builds in the potential for expanding this domain of quantification by bringing open but hitherto ignored possibilities into view. This theory accounts for the data by evaluating the generic claims with respect to a single dynamically evolving modal domain. Section 6.2 examines the problem that sequences of generics raise for existing theories. Section 6.3 explores in detail one way of accommodating these facts about generics. I argue that if the standard modal analysis of generics is given a dynamic spin, then it handles reverse Sobel sequences with grace, while preserving its treatment of Sobel sequences more generally. Section 6.4 illustrates how the resulting theory handles the puzzles introduced in this section. Section 6.5 considers whether reverse Sobel sequences can be handled pragmatically instead. Section 6.6 concludes.

6.2 Quandary for Standard Approaches

This section argues that while many extant theories of generic sentences can accommodate the felicity of Sobel sequences, these views do not account for reverse Sobel sequences. I will focus on four views that are representative of general approaches to the semantics of generics and consider what they predict: (i) the kind-predication theory, (ii) the probabilistic view, (iii) the cognition-based approach, and (iv) the modal approach. I argue that each of these are found wanting.

6.2.1 Kind-Predication Theory

First, let us consider the kind-predication approach. Broadly speaking, the kind-predication approach holds that the subject term of generic sentences of the form ⌜Ks are F⌝ refer to kinds, and such sentences are true iff the kind denoted by K satisfies the property denoted by F.[11] For example, the sentence *Ravens are black* is true iff raven-kind is black. Of course, this approach raises questions about the nature of kinds (for example, what is raven-kind?) and how they can instantiate

[11] For proponents of the kind-predication view, see Lawler (1972); Dahl (1975); Carlson (1977b,a); Liebesman (2011); Teichman (2016). For critical discussion of some other shortcomings of this view, see Krifka et al. (1995); Leslie (2015).

properties that are typically reserved for first-order individuals (for example, how could raven-kind be black?). Different versions of the kind-predication approach offer different solutions to these problems, but it is enough for present purposes to treat a kind as satisfying an individual-level property if it inherits that property from its members, under a suitable notion of property inheritance.

Let us check whether this account accommodates the felicity of Sobel sequences of generics, such as those in (1). The kind-predication approach captures the intuitive truth-value judgment of (1a), since it is plausible that raven-kind satisfies the property of being black, while albino-raven-kind (whatever that might be) does not satisfy the property of being black. That is, it is plausible that raven-kind inherits the property of being black from its members, while albino-raven-kind does not inherit the property of being black from its members. Similar remarks apply to the other sentences in (1). Consequently, the kind-predication approach accommodates the felicity of generic Sobel sequences.

However, the kind-predication approach does not accommodate the infelicity of the reverse Sobel sequences, like in (2). Since the first conjunct of (2a) is the same sentence as the second conjunct of (1a), by parity of reasoning, the kind-predication account predicts that it is true. Similarly, since the second conjunct of (2a) is the same sentence as the first conjunct of (1a), by parity of reasoning, the kind-predication account predicts that it is true. These observations stand up to scrutiny because this approach is not sensitive to the order in which sentences uttered. Consequently, the kind-predication approach predicts that there is no difference between utterances of (1a) and (2a). But this conflicts with the judgment that uttering (2a) sounds terrible. Similar remarks apply to the other sentences in (2). Therefore, the kind-predication approach does not accommodate the infelicity of reverse Sobel generics.

6.2.2 Probabilistic Approach

Second, let us consider the probabilistic approach. Broadly speaking, proponents of the probabilistic approach argue that generic sentences have probabilistic truth-conditions, and generics of the ⌜Ks are F⌝ are true iff the probability that an arbitrary δ has the property denoted by F, given that δ has the property denoted by K, is greater than 0.5.[12] Different implementations of the approach offer different accounts of the kind of probability involved and identify different suitable reference classes. For example, Ariel Cohen (1995; 1996; 1999a; 1999b) is a frequentist about the probability claims that generics involve, and that actual and suitably relevant histories will generate the reference class within which the relevant frequency will be determined. To accommodate true generics like 'Ducks lay eggs', Cohen's account evokes the notion of a contextually supplied set of alternatives to the predicate in question, formalised as the set $\textsc{Alt}(\phi)$ for a property ϕ. Each predicate is associated with a set of alternatives that includes the predicate itself, and in evaluating the generic, we only consider those individuals that satisfy one of those alternatives. The notion behind these alternative sets is intuitive: being male is an alternative to being female; flying is an alternative to walking, taking the train, driving, and so on. For example, the alternatives invoked by 'Chickens lay eggs' include other ways of producing offspring, such as birthing live young, reproducing via cell-division, and so on. Consequently, when determining the truth-conditions of generics like 'Ducks lay eggs', we are concerned with the probability that something lays eggs, conditional on the fact that it is a duck and that it satisfies one of the alternatives in the set associated with the predicate. With these tools, Cohen's probabilistic analysis can accommodate troublesome generics like 'Ducks lay eggs' and 'Lions have manes'. The truth-conditions can be stated more generally:

(8) Let ⌜*Ks are F*⌝ be a sentence, and $A = \textsc{alt}([\![F]\!])$ be the alternatives to the

[12] See Cohen (1995, 1996, 1999a,b).

property denoted by F. Then $\ulcorner$*Ks are F*$\urcorner$ is true iff $Pr((Fa|Ka) \wedge \bigvee Aa) > 0.5$, where a is an arbitrary individual.

Recall that Cohen is a frequentist about the probability claims involved in generics. Frequentism is the view that the probability of some event is determined by the ratio among favourable outcomes in a suitable reference class. Cohen (1999a: 232) specifies the relevant reference class in terms of histories. A history is a (possibly partial) temporal segment of a possible world. Cohen constructs the reference class by combining all the admissible histories. According to Cohen's account, admissible histories satisfy a number of different constraints. For example, admissible histories are extrapolations from the history of the actual world as that history has unfolded so far (Cohen 1999a: 235), and not just those stretches of the future that will actually take place. Consequently, the relevant extrapolations that generate the reference class are those that occur assuming that history will go on as things have gone so far, even if the future history of the actual world includes sudden, significant changes (Cohen 1999a: 235–40).

With this in place, let us first check whether this semantics accommodates the felicity of Sobel sequences. According to the probabilistic account, the first conjunct in (1a) is true because, given the actual propensity of the colour of actual ravens, the conditional probability that an arbitrary individual is black, given that it is a raven, is greater than 0.5. Furthermore, the second conjunct in (1a) is also true because, given the actual propensity of the colour of actual albino ravens, the conditional probability that an arbitrary individual is not black, given that it is an albino raven, is greater than 0.5. Similar remarks apply to the other sentences in (1). Consequently, the probabilistic approach accommodates the felicity of generic Sobel sequences.

Let us now consider whether the probabilistic account accommodates the infelicity of reverse Sobel sequences of generics. Since the first conjunct of (2a) is the same sentence as the second conjunct of (1a), by parity of reasoning, the probabilistic account should predict that it is true. Similarly, since the second conjunct of (2a) is the same sentence as the first conjunct of (1a), by parity of reasoning, the probabilistic account should predict that it is true as well. Consequently, the probabilistic account predicts no difference between utterances of (1a) and (2a). However, this conflicts with our intuitions: uttering (2a) sounds awful and the probabilistic approach does not account for this fact. Consequently, the probabilistic approach does not accommodate the infelicity of reverse Sobel generics.

6.2.3 Cognitively Fundamental Generalisations

Third, let us consider the cognition-based approach, which has recently been championed by Sarah-Jane Leslie (2007; 2008). According to the cognition-based approach to generics, the cognitive system has an innate, default mode of generalising and it is to these generalisations that generics give voice. Moreover, the default mode of generalising informs the semantics of generics by encoding their truth-conditions in the accuracy conditions of this cognitive system. The accuracy conditions of the default mode of generalising is sensitive to a number of interesting features. The mechanism is sensitive to the relevant characteristic dimensions of the kind in question, such as modes of reproduction, locomotion, or diet, and once the mechanism has identified a characteristic dimension for a kind, it fills in the value with ease. For instance, despite the large numbers of male ducks and barren female ducks that do not lay eggs, we are eager to find a value for how ducks gestate and so we seize on the only positive instances available and conclude that ducks lay eggs. Regarding more neutral information that is neither characteristic nor striking, the mechanism requires that the majority of the kind instantiates the property for it to be generalisable. For example, we judge that ravens are black only because the majority of ravens are black; if only a small percentage of ravens were black, then we would not form this generalisation. Indeed, the mechanism requires that any exceptions to generic generalisations are ‘negative’ counterinstances that merely fail to have the property in question, rather than individuals who have an equally psychologically salient positive property instead. For example, galloping is a way of having a positive alternative to the property of flying, since both are alternative modes of locomotion, whereas the property of not flying is negative alternative property.

Leslie claims that the conditions under which generics are true reflect the quirks of the default mechanism of generalisation, and so we can understand that the ‘worldly truth specifications’ of generics — Leslie’s phrase for descriptions of how the world must be for the sentence to be true — in terms of the nature of the default mechanism of generalisation:[13]

> the circumstances under which a generic of the form ‘Ks are F’ is true are as follows:
>
> > The counterinstances are negative, and:
> >
> > If F lies along a characteristic dimension for the Ks, then some Ks are F, unless K is an artefact or social kind, in which case F is the function or purposes of the kind K;
> >
> > If F is striking, then some Ks are F and the others are disposed to be F;
> >
> > Otherwise, almost all Ks are F. (Leslie 2008: 43)

With this in place, let us check what the cognition-based approach predicts about Sobel sequences, like (1b):

(1) b. Birds fly; but birds with broken wings don’t.

According to the cognition-based account, the first conjunct of (1b) is true because (i) the property of flying lies along a characteristic dimension for birds, since locomotion is a characteristic dimension for birds; (ii) some birds do fly; and (iii) the counterinstances,

[13] Also see Leslie (2007: 386).

such as, flightless birds and birds with broken wings, are negative.[14] Furthermore, the cognition-based account holds that the second conjunct of (1b) is true. For the property of not flying most certainly lies along a characteristic dimension for birds with broken wings, since it is almost analytic that such birds don't fly. And since some birds with broken wings don't fly and there are no positive counterinstances, the second conjunct is predicted to be true. Similar remarks apply to the other sentences in (1). Consequently, the cognition-based approach accommodates the felicity of generic Sobel sequences.

However, the cognition-based approach does not accommodate the infelicity of reverse Sobel sequences, like in (2). Since the first conjunct of (2a) is the same sentence as the second conjunct of (1a), by parity of reasoning, the cognition-based account should predict that it is true. Similarly, since the second conjunct of (2a) is the same sentence as the first conjunct of (1a), by parity of reasoning, the cognition-based account should predict that it is true as well. Consequently, the cognition-based account predicts no difference between utterances of (1a) and (2a). However, this conflicts with our intuitions: uttering (2a) sounds awful and the probabilistic approach does not account for this fact. Consequently, the cognition-based approach does not accommodate the infelicity of reverse Sobel generics.

6.2.4 Modal Approach

Lastly, let us consider the modal approach to generics, according to which generic sentences are analogous to modal conditionals, or should be analysed in terms of a

[14] One might argue that ostriches engender a positive counterinstance to the generic 'Birds fly'. The primary modes of locomotion for ostriches are walking and running, the latter of which they can do at over 70 km/h. Presumably, merely *not-flying* constitutes a negative counterinstance of *flying*, but *running 70 km/h* plausibly counts as a positive counterinstance, since to possess that property would be to possess a 'positive alternative property' Leslie (2007: 34). This poses a dilemma for Leslie. Either she rejects that ostriches are a positive counterinstance, in which case she needs to provide a more detailed explanation of what counts as negative and positive counterinstances, or else she accepts that ostriches are a positive counterinstance, in which case her account cannot accommodate the intuitive truth of 'Birds fly'.

covert modal.[15] Roughly speaking, a generic of the form *Ks are F* is true iff all normal Ks are F. For example, the sentence *Ravens are black* is true iff all normal ravens are black. Different implementations provide alternative accounts for the relevant conditions of normality, but this is the central claim of the view.

Let us consider whether this approach accounts for the felicity of the generic Sobel sequences, such as in (1a). Given the rough truth-conditions above, the modal approach predicts that the first conjunct 'Ravens are black' is true, since all normal ravens are black. (Note that due to the presence of a congenital disorder, albino ravens do not count as biologically normal, and so they are not in the domain of the quantifier.) Furthermore, the modal approach predicts that the second conjunct 'Albino ravens are not black' is true, since all normal albino ravens are not black. Indeed, given that albinism is the congenital absence of any pigmentation or colouration in an organism, albino ravens are not black by definition. Consequently, the modal approach predicts that (1a) is true. Similar remarks apply to the other sentences in (1). Consequently, the modal approach accommodates the felicity of generic Sobel sequences.

However, the modal approach does not accommodate the infelicity of reverse Sobel sequences, like in (2). Since the first conjunct of (2a) is the same sentence as the second conjunct of (1a), by parity of reasoning, the modal account should predict that it is true. Similarly, since the second conjunct of (2a) is the same sentence as the first conjunct of (1a), by parity of reasoning, the modal account should predict that it is true as well. Consequently, the modal account predicts no difference between utterances of (1a) and (2a). However, this conflicts with our intuitions: uttering (2a) sounds awful and the modal approach does not account for this fact. Consequently, the modal approach does not accommodate the infelicity of reverse Sobel generics.

[15] This theory has been developed by philosophers, linguists, and computer scientists alike; see, for example, Heim (1982); Delgrande (1987b); Boutilier (1994b,a); Asher and Morreau (1995); Krifka et al. (1995); Pelletier and Asher (1997); Eckardt (2000); Greenberg (2004).

6.2.5 Summary

So far, we have seen that the most prominent accounts of generic sentences fail to explain the infelicity of reverse Sobel sequences. This failure counts against such approaches. A general diagnosis of this failure is as follows. None of the semantics outlined above are sensitive to the dynamics of discourse. That is, they are not sensitive to the order in which generic sentences are uttered. Consequently, they cannot explain why changing the order of Sobel sequences makes previously felicitous utterances infelicitous.

6.3 Dynamic Genericity

How can we explain the felicity of Sobel sequences, while simultaneously explaining the infelicity of their reverse counterparts? One simple explanation would be that reverse Sobel sequences are contradictions, whereas Sobel sequences are not. This would immediately explain the infelicity of the former and the felicity of the latter, since contradictions are generally infelicitous, whereas non-contradictions are often fine. This reaction might seem extremely surprising given that exactly the same sentences are involved in Sobel and reverse Sobel sequences, and, on any classical conception of consistency, the order in which sentences are presented should not affect their felicity. But I will argue that this is exactly what must be rejected; the order in which generic sentences are uttered affects their interpretation.

The goal of this section is to sketch a semantics that does exactly this, one that makes reverse sequences of generics inconsistent, without predicting that the original sequences are also inconsistent. I will provide a dynamic implementation of my solution, an implementation that treats the meaning of sentences in terms of their effects on a context or body of information, as well as their truth-conditions.[16] My theory, which

[16] For the *loci classici* for dynamic approaches to meaning, see Kamp (1981); Heim (1982). Also see

I call the *dynamic theory*, is comprised of two parts. The first part concerns the meaning of generic sentences: building on the modal approach to generic sentences, I propose to treat generic sentences as universally quantified strict conditionals over contextual possibilities. Roughly speaking, a generic of the form ⌜Ks are F⌝ is true iff for every individual, the most normal worlds in which it is a K are also worlds where it is an F. The second part concerns the underlying architecture of the contextual possibilities. I propose that generics have the potential to bring hitherto ignored possibilities into view, and evoke a shift in the context against which they are assessed. More specifically, generics of the form ⌜Ks are F⌝ carry a semantic constraint that ensures that the domain over which a generic quantifies will include some possibilities containing K-individuals. Consequently, rather than being evaluated with respect to disjoint modal domains, sequences of generics are evaluated with respect to a single dynamically evolving modal domain.

In the rest of this section, I flesh out these two ideas. I begin with a brief characterisation of dynamic semantics and the kind of approach that I will take; then I spell out my dynamic theory of generics in more detail; I then return to generic sentences to show how my semantics handles them.

6.3.1 Dynamic Semantics: The Basics

The dynamic system that I will set out owes much to von Fintel's (2001) and Gillies's (2007) analyses of counterfactuals. In particular, I treat generic sentences as universally quantified strict material conditionals over a domain that evolves as discourse proceeds. While the basic idea can be articulated in different ways, I choose a dynamic semantic implementation of the modal theory of the meaning of generics. My central interest is not to claim that this is the only semantic approach that can accommodate our data, but rather to isolate a relatively minimal dynamic semantics that is adequate for the

Karttunen (1969); Stalnaker (1974, 1975, 1978), for important theoretical precursors.

puzzles outlined above, one that construes the meaning of a sentence partly in terms of its effects on the context. As it turns out, this is easiest to implement from within a modal approach.

When theorising about natural language, it is standard to assume that the interpretation of an utterance depends on the *context of utterance*. For example, the semantic contribution of indexicals like *I* and *now* to the information carried by utterances containing them depend on who the speaker is and when the sentence is uttered. While there are different ways of spelling out the notion of a discourse context, it is common to treat it as a set of possible worlds that represents the mutually accepted presuppositions of the participants of the discourse (Stalnaker 1970, 1974, 1998, 2002). For example, if all the participants presuppose ϕ, then the discourse context will contain only ϕ-worlds; if the participants are agnostic or disagree about ϕ, the discourse context will contain both ϕ and $\neg\phi$-worlds. However, starting in the 1980s, a variety of theorists began questioning the traditional asymmetric relationship between context and content according to which context could affect the meaning of sentences, but not vice versa.[17] In particular, they rejected the idea that the meaning of a sentence is its truth-conditions, and instead constructing its meaning in terms of its potential effect on a discourse. The motivation for this was the phenomenon of discourse anaphora and donkey anaphora.

This suffices to give a sense of the original motivation for dynamic semantics. I shall take a slightly different tact to dynamic effects. While well-known dynamic effects in semantics involve the sequential elimination of worlds from a context set or tests to see whether a variable assignment concerns a discourse referent, we will be concerned with a more minimal operation. Recall that I am treating generics as universally quantified strict material conditionals over contextual possibilities. I also claim that generics have the potential to expand the contextual parameter against which they are evaluated.

[17] See, for example, Kamp (1981); Heim (1982); Groenendijk and Stokhof (1991).

Following von Fintel, call this the *modal horizon*. According to my account, the modal horizon expands and is kept track of throughout a generic sequence. As more generics are considered, the modal horizon widens to encompass more worlds into its domain. Each of these generics are evaluated against the resulting expansion that they invoke. While my semantics will predict that discourse-initial generics have the same truth-conditions as those from more familiar static semantics, a difference emerges when we consider sequences of generics. According to the standard static semantics, each generic in the sequence is evaluated in isolation to the surrounding discourse, whereas my semantics predicts that prior discourse will effect the interpretation of subsequent generics. The following section outlines these ideas in more detail.

6.3.2 The Dynamic Theory

My theory of generic sentences builds on a version of the modal approach developed by Asher and Morreau (1995), Pelletier and Asher (1997), and Asher and Pelletier (2013). But it interprets generics as universally quantified *strict* conditionals, rather than *variably strict* conditionals. And it claims that the domain over which generics quantify can change across a discourse.

The Language

To make these ideas precise, I will present the semantics for a simple formal language that is intended to model the relevant aspects of natural language for present purposes. Our formal language will be a first-order language augmented with a binary conditional operator '>' with which generic sentences will be represented.

Definition 6.3.1 (Language)**.** $\mathcal{L}_>$ is the smallest set that contains a set of constants $\{c, c_1, c_2, \ldots\}$, a set of variables $\{x, x_1, x_2, \ldots\}$ and, for every $n \in \mathbb{N}$, a set of n-place predicates $\{F_1^n, F_2^n, \ldots\}$, and is closed under negation ($\neg$), conjunction ($\wedge$), the universal quantifier ($\forall$), and the generic conditional operator $>$. Well-formed formula of $\mathcal{L}_>$ are defined as follows:

$$\phi ::= F_i^k t_1, \ldots, t_k | \neg\phi | (\phi \wedge \phi) | \forall v\phi | (\phi > \phi)$$

where $t_1, \ldots, t_k$ are terms (either constants or variables).

The only unfamiliar formula type in $\mathcal{L}_>$ is $\ulcorner\phi > \psi\urcorner$, which has the intended interpretation that wherever ϕ holds, ψ normally holds as well. Less frugally, if ϕ were to hold along with everything that would normally be the case where ϕ holds, then ψ would hold. This formulation brings out the counterfactual and normative character of generic sentences; after all, we are treating generic sentences as universally quantified, normative conditionals of this kind. With this in mind, the sentence 'Ravens are black' can be represented in our language of $\mathcal{L}_>$ (augmented with suitable predicate letters) as:

$$\forall x(Rx > Bx)$$

and we take it to mean: anything would be black, if it were a raven and all other things were to hold which would normally hold if it were a raven. I will use the Greek letters 'ϕ', 'ψ' as metalanguage variables for formula of $\mathcal{L}_>$, 'Π', 'ξ', 'ζ' for metalanguage variables over its predicate letters, and '$v_1, v_2, \ldots$' as metalanguage variables ranging over object language variables.

The Framework

To give the dynamic semantics for our language, we need to state what our models are and define the notion of a variable assignment. Here we use the standard Kripke models for possible worlds semantics. Our intention is, in the first instance, that for any monadic predicates ξ and ζ, the sentence $\ulcorner\forall v(\xi v > \zeta v)\urcorner$ is true at a world just in case, at that world, being a normal ξ involves being a ζ. We shall encode the notion of being a normal ξ using a set-selection function '*', which assigns to each possible world and proposition p the set of worlds where p holds along with everything which, at w, is normally the case where p holds. Formally:[18]

Definition 6.3.2 (Model)**.** Let a *model* $\mathcal{M} = \langle W, D, I, * \rangle$ be a tuple consisting of:

- a non-empty set W, *the set of possible worlds*,
- a non-empty set D, *the set of possible individuals*,
- a classical *valuation function* I mapping non-logical constants of $\mathcal{L}_{>}$ to appropriate denotations, such that
  - if α is a constant, then $I(\alpha) \in D$
  - if Π_i^n is an n-place predicate, then $I(\Pi_i^n)$ is a set of $n+1$-tuples of the form $\langle u_1, \ldots, u_n, w \rangle$, where $u_1, \ldots, u_n \in D$ and $w \in W$.
- a *selection function* $* : W \times \wp(W) \mapsto \wp(W)$.

We impose only the following constraint on the selection function $*$, namely, the following:[19]

Facticity: $*(w, p) \subseteq p$

Informally, Facticity says that p is one of the things that normally holds in worlds where p holds along with everything else that are normally associated with p relative to w. This is an extremely plausible constraint for the kinds of models we are considering.

My treatment for the semantics of variables is not dynamic in character, but rather will be more like the treatment found in ordinary first-order predicate logic. This is in contrast to more standard dynamic accounts of quantification that postulate a domain of discourse referents that gets dynamically updated in the process of interpretation.

[18] For simplicity, we assume a constant domain semantics for our language, that is, each world has exactly the same stock of individuals.

[19] See Chapter 2, for other discussion of possible constraints and alternatives to the present semantics.

Of course, I do not exclude the possibility that the present account can be extended in such a direction. Formally:

Definition 6.3.3 (Variable Assignment)**.** A *variable assignment* α is a total function mapping variables v_i to some $\alpha(v_i) \in D$. We adopt the standard notation for a *modified* variable assignment: for all $d \in D$, let $\alpha[v_i/d]$ be the variable assignment just like α, except that it assigns d to v_i; that is, $\alpha[v_i/d](v_i) = d$ and $\alpha[v_i/d](v_j) = \alpha(v_j)$, for all v_j in the set of variables, $v_j \neq v_i$.

With these structural features in place, we turn now to the two semantic components of my theory of generic sentences: (i) the context change potential of generics and (ii) their truth-conditions.

Context Change Potentials

Let us turn to the first component of my semantics: context change potentials (CCPs). Typically, CCPs can be thought of as updating the *common ground* of a conversation, broadly construed as the set of worlds that represents the mutually accepted presuppositions of the participants of the discourse. On this model, conversation determines a body of mutually shared information and declarative speech acts usually update this body by adding more information to it. Standardly, the common ground determines a set of open possibilities, those possibilities that are not excluded by what is presupposed by the conversational participants. Then we can model the addition of information in terms of eliminating possibilities, and we can view some assertions as testing the common ground for whether certain conditions obtain.

However, since I am only concerned with modelling the expansive nature of generic sentences, the operative concept of an update in this chapter will be more restricted. In particular, I am only concerned with modelling a particular kind of expansion operation. More specifically, I propose that a generic sentence of the form $\ulcorner \phi$*'s* $\psi \urcorner$ expands the model horizon of the context of utterance to include some normal $\phi\underline{\delta}$-worlds, for each δ in the domain, if there aren't any ϕ-worlds in the horizon initially.[20]

To model this operation, I assume that generics (and indeed all well-formed formula) are evaluated against a contextual parameter, namely, an *accessibility function* $f : W \mapsto \wp(W)$ mapping worlds to sets of worlds. Intuitively, we may think of f as selecting the set of accessible worlds relative to w. Call the set of f-accessible worlds relation to w, f_w, the *information state* of w relative to f. Then the CCP of a sentence ϕ is a function that maps information states to information states (relative to a model and variable assignment). Context change potentials will be given by a recursive definition of the *update* of any information state f_w on any well formed formula ϕ relative to any model $\mathcal{M}$ and variable assignment α, written as $f_w[\phi]^{\mathcal{M},\alpha}$.[21] I will state the CCP clauses for the language and then discuss each clause one by one.

Definition 6.3.4 (Update)**.** An *update function* [.] is a function from wffs of $\mathcal{L}_>$ to functions from information states to informations states (relative to a given model $\mathcal{M}$ and variable assignment α), subject to the following constraints:

(i) $f_w[\Pi_i^n t_1, \ldots, t_n]^{\mathcal{M},\alpha} = f_w$

(ii) $f_w[\neg\phi]^{\mathcal{M},\alpha} = f_w[\phi]^{\mathcal{M},\alpha}$

(iii) $f_w[\phi \wedge \psi]^{\mathcal{M},\alpha} = f_w[\phi]^{\mathcal{M},\alpha}[\psi]^{\mathcal{M},\alpha}$

(iv) $f_w[\forall v\phi]^{\mathcal{M},\alpha} = \bigcup_{d\in D} f_w[\phi]^{\mathcal{M},\alpha[v/d]}$

(v) $$f_w[\phi > \psi]^{\mathcal{M},\alpha} = \begin{cases} f_w \cup *(w, [\![\phi]\!]^{\mathcal{M},f_w,\alpha}) & \text{if } \neg\exists w' \in f_w : w' \in [\![\phi]\!]^{\mathcal{M},f_w,\alpha} \\ f_w & \text{otherwise.} \end{cases}$$

[20] Sometimes I cheat and use '$\underline{\delta}$' as an *ad hoc* name for the individual δ, even though there is no provision in our language to have a name for every one of infinitely many objects. This is a matter of convenience and can be ratified with more careful, but more convoluted, notation or perhaps a system of arbitrary objects; see, for example, Fine (1985).

[21] That is, $[.]^{\mathcal{M},\alpha} : \mathcal{L}_> \mapsto (\wp(W) \mapsto \wp(W))$, is a function from well-formed formula of $\mathcal{L}_>$ to a function from information states to information states.

where $[\![\phi]\!]^{\mathcal{M},f_w,\alpha}$, *the proposition expressed by* ϕ *in* $\mathcal{M}$ *relative to* f_w, α, is defined as the following set of worlds: $\{w' \in W : [\![\phi]\!]^{\mathcal{M},f_w,w'\alpha} = 1\}$; see the following section for the relevant definitions of satisfaction. I will abstract from the relativity of CCPs to models and variable assignments below wherever it is harmless and convenient.

Let us consider each clause above, beginning with the atomic case. This clause reflects the idea that an ordinary, non-generic assertion has no effect on the modal horizon. An update on an information state with an atomic sentence is essentially a hole that allows the input information state to fall through as output.

The update clauses for propositional operators and the universal quantifier are designed to allow any dynamic effects of constituents to be taken into consideration. For example, the CCP for negation is the same as the CCP of the sentence in the negation's scope. Consequently, the change to the information state induced by 'It's not the case that ravens are black' is the same as the updating information state with 'Ravens are black'.

The CCP for conjunction is inspired by Heim (1982), which in turn is inspired by Stalnaker (1974). The idea is that updating an information state on a conjunction involves first updating it on the first conjunct, and then updating the resulting information state on the second conjunct.

The CCP for the universal quantifier is a little more complex. The idea here is that to update an information state on a formula $\ulcorner\forall v\phi\urcorner$, we union the various results of updating the information state with $[\phi]^{\alpha[d/x]}$, for all $d \in D$. While it may be initially surprising to see a union operation here, rather than intersection, the reason will become clear when we consider updates for $\ulcorner\forall v(\xi v > \zeta v)\urcorner$. Briefly, we want the CCP of this sentence to include normal $\xi\underline{\delta}$ worlds, for each $\delta \in D$, and it is extremely likely that $\bigcap_{\delta \in D} *(w, [\![\xi\underline{\delta}]\!]^{\mathcal{M},f_w}) = \varnothing$. Contrastingly, a union operation prevents inconsistency and, moreover, it is in the spirit of the expansionist role that CCPs play in the current system.

Notice that for each of the novel propositional and quantificational update rules, if the embedded sentence has no dynamic effects, then the input information state falls through as output. That is the desired result. However, things change when we consider the CCP for the conditional $>$.[22] Here, the idea is that if an utterance of a conditional is accepted as an assertion, then it tests the context to see whether some antecedent-confirming worlds are accessible; if the test is positive, then the input information state simply falls through as output; if the test is negative, then we add the most normal antecedent-confirming worlds to the information state. For example, if an utterance of the sentence 'If Nevermore is a raven, then normally he is black' in a world w, translated in our language as '$(Rn > Bn)$', is accepted as an assertion, then it tests the contextually provided information state f_w to see whether there is some accessible world in which Nevermore is a raven. If there is, then everything is fine and the information state is allowed through. If not, then the information state is expanded to include $*(w, [\![\text{Rn}]\!]^{\mathcal{M},f_w})$.

To close this section, note that I have only focused on the idea that an utterance of $\ulcorner\phi > \psi\urcorner$ *expands* the modal horizon of the context to include the most normal ϕ-worlds. It is an interesting question whether the modal horizon can only expand or whether it can shrink back once expanded. However, I do not have a general theory about how the modal horizon can be contracted by generics, nor how it can be expanded and contracted by expressions other than generics. Nor do I have a view on

[22] A Complication: Part I. Eagle-eyed readers will notice that the CCP clause for $>$ has no provision for embedded conditionals. While such cases are not my primary concern, they will be needed to account for so-called embedded or 'nested' generics, like 'Postmen are scared of dogs that attack postmen' and 'People who don't like to eat out don't like to eat out'. Consequently, we should amend the CCP clause as follows:

$$f_w[\phi > \psi]^{\mathcal{M},\alpha} = \begin{cases} f_w^{\phi}[\phi]^{\mathcal{M},\alpha}[\psi]^{\mathcal{M},\alpha} & \text{if } \neg\exists w' \in f_w : w' \in [\![\phi]\!]^{\mathcal{M},f_w,\alpha} \\ f_w & \text{otherwise} \end{cases}$$

where $f_w^{\phi} = f_w \cup *(w, [\![\phi]\!]^{\mathcal{M},f_w,\alpha})$. However, since embedded generics are orthogonal to present issues, I will retain the simpler clause. (Keep an eye out for a similar amendment for the satisfaction clause for $>$ in ft. 24.)

whether 'resetting' the modal horizon is a semantic or pragmatic phenomenon.[23]

Truth-Conditions

Let us turn to the second component of my semantics: the truth-conditions. The semantics for our language take the form of a recursive definition of truth-conditions relative to a model, a world of evaluation, an accessibility function relative to the world of evaluation, and a variable assignment. Even though the meanings of sentences are still ultimately truth-conditions, the semantics nevertheless counts as dynamic because it incorporates a notion of context change that is alien to static semantics. I will state the satisfaction clauses for the language and then discuss each clause one by one. The semantics is as follows:[24]

Definition 6.3.5 (Satisfaction)**.** For any base model $\mathcal{M}$, any accessibility function f, any possible world w, and any variable assignment α:

(i) $[\![\Pi^n_i t_1, \ldots, t_n]\!]^{\mathcal{M}, f_w, \alpha} = 1$ iff $\langle [\![t_1]\!]^{\mathcal{M}, f_w, \alpha}, \ldots, [\![t_n]\!]^{\mathcal{M}, f_w, w, \alpha}, w \rangle \in [\![\Pi^n_i]\!]^{\mathcal{M}, f_w, \alpha}$

(ii) $[\![\neg\phi]\!]^{\mathcal{M}, f_w, w, \alpha} = 1$ iff $[\![\phi]\!]^{\mathcal{M}, f_w, w, \alpha} = 0$

(iii) $[\![\phi \wedge \psi]\!]^{\mathcal{M}, f_w, w, \alpha} = 1$ iff $[\![\phi]\!]^{\mathcal{M}, f_w, w, \alpha} = 1$ and $[\![\psi]\!]^{\mathcal{M}, f_w[\phi]^{\mathcal{M}, \alpha}, w, \alpha} = 1$

(iv) $[\![\forall v \phi]\!]^{\mathcal{M}, f_w, w, \alpha} = 1$ iff, for all $d \in D$, $[\![\phi]\!]^{\mathcal{M}, f_w, w, \alpha[d/v]} = 1$

(v) $[\![\phi > \psi]\!]^{\mathcal{M}, f_w, w, \alpha} = 1$ iff, for all $w' \in f_w[\phi > \psi]^{\mathcal{M}, \alpha}$, if $[\![\phi]\!]^{\mathcal{M}, f_w, w', \alpha} = 1$, then $[\![\psi]\!]^{\mathcal{M}, f_w[\phi > \psi]^{\mathcal{M}, \alpha}, w', \alpha} = 1$

The semantic clauses for atomic formula, negation, and the universal quantifier should be familiar. The semantics for conjunction is more interesting. Again, it is influenced

[23] For relevant discussion, see Lewis (1979, 1996).

[24] A Complication, Part II. Here is the more complex satisfaction clause for $>$ promised in ft. 22:

$$[\![\phi > \psi]\!]^{\mathcal{M}, f_w, w, \alpha} = 1 \text{ iff for all } w' \in f^{\phi}_w[\phi]^{\mathcal{M}, \alpha}, \text{ if } [\![\phi]\!]^{\mathcal{M}, f_w, w', \alpha} = 1, \text{ then } [\![\psi]\!]^{\mathcal{M}, f^{\phi}_w[\phi]^{\mathcal{M}, \alpha}, w', \alpha} = 1.$$

by the clause in Heim (1982), which is inspired by Stalnaker (1974). The idea is that a conjunction is true in a context just in case the first conjunct is true in that context and the second conjunct is true in a context that has been updated with the CCP of the first conjunct.

The semantics for the conditional is based on von Fintel's (2001) and Gillies's (2007) semantics for counterfactuals. The idea is that a conditional of the form $\ulcorner\phi > \psi\urcorner$ is true at a context just in case, if every ϕ-world in the context's modal horizon is a ψ-world, where the modal horizon has potentially been expanded to include the most normal ϕ-worlds relative to the context, if it doesn't have any ϕ-worlds to begin with. More precisely, we first take the accessibility function f at the world of evaluation w (which, in discourse-initial contexts, is empty by default) and check whether it contains any ϕ-worlds: if it doesn't, then we expand it to include $*(w, [\![\phi]\!]^{\mathcal{M},f_w,\alpha})$, and check if every ϕ-world in $f_w \cup *(w, [\![\phi]\!]^{\mathcal{M},f_w,\alpha})$ is also a ψ-world; if it does, then we check whether every ϕ-world in f_w is a ψ-world.

Finally, truth is defined as satisfaction with respect to all variable assignments.

Definition 6.3.6 (Truth)**.** For any model $\mathcal{M}$, accessibility function f, world w, and any $\phi \in \mathcal{L}_>$,

$$[\![\phi]\!]^{\mathcal{M},f_w,w} = 1 \text{ iff } [\![\phi]\!]^{\mathcal{M},f_w,w,\alpha} = 1, \text{ for all variable assignments } \alpha.$$

With these elements in place, let us turn to see how this semantics deals with generic sentences *tout court*.

6.3.3 Generic Sentences Revisited

Suppose that a discourse-initial utterance of 'Ravens are black' is accepted as an assertion in w. Recall that this is translated into $\mathcal{L}_>$ as the following:

(10) $\forall x(Rx > Bx)$

Then, according to my semantics, (10) is true at w, relative to an accessibility function f, just in case, for every variable assignment α and individual $d \in D$, $[\![(Rx > Bx)]\!]^{f_w,w,\alpha[d/x]} = 1$. That is: for every individual $d \in D$: for all $w' \in f_w[(Rx > Bx)]^{\alpha[d/x]}$:[25]

$$\text{if } [\![Rx]\!]^{f_w,w',\alpha[d/x]} = 1, \text{ then } [\![Bx]\!]^{f_w[(Rx>Bx)]^{\alpha[d/x]},w',\alpha[d/x]} = 1,$$

for every variable assignment α.

Let us process these truth-conditions more slowly. Suppose, for simplicity, that in discourse-initial contexts $f_w = \varnothing$.[26] This assumption corresponds to the intuitive idea that nothing is on the horizon before conversation has started. Then to see whether (10) is true, we must take each individual and check whether the modal horizon encoded by the information state f_w needs to be expanded to include the most normal worlds where that individual is a raven, and then see whether all the worlds in the potentially updated modal horizon where that individual is raven are also worlds in which it is black. That is, we take Nevermore and see whether f_w includes some worlds in which Nevermore is a raven. Since $f_w = \varnothing$ by default, we must expand the modal horizon to include the most normal worlds where Nevermore is a raven along with everything else that is normally associated with Nevermore being a raven. That is, $f_w[(Rn > Bn)] = *(w, [\![Rn]\!])$. We then check whether all the Nevermore-raven-worlds in this newly expanded modal horizon are also worlds in which Nevermore is black. That is, we check whether the following holds:[27]

$$\forall w' \in *(w, [\![Rn]\!]) \text{: if } [\![Rn]\!]^{w'} = 1, \text{ then } [\![Bn]\!]^{w'} = 1.$$

We then follow this procedure for the remaining individuals in the domain. In discourse-initial contexts, this semantics is equivalent to its static counterpart. This is the

[25] I leave off model superscripts throughout.
[26] As we shall see below, this entails the rejection of *Centering*.
[27] For readability, I omit the model, modal base, and variable assignments from the following, especially since the latter play no essential role in the interpretation of the relevant formula.

desired result. The only differences emerge when we consider sequences of generics. The following section examines these cases.

6.4 The Data

With this exposition in hand, we can explore how the dynamic theory makes sense of Sobel and reverse Sobel sequences of generics. I begin by explaining how the dynamic theory pulls off the tricky task of predicting that reverse Sobel sequences are infelicitous, while also predicting that the original order are felicitous.

6.4.1 Reverse Sobel Sequences

Consider a discourse-initial utterance of (2a), repeated below for convenience, as evaluated in a world w relative to an information state f_w. We translate this sentence as (11) in our language:[28]

(2) a. #Albino ravens aren't black, but ravens are.

(11) $\forall x(Ax \wedge Rx > \neg Bx) \wedge \forall x(Rx > Bx)$

The basic idea is as follows. Recall that the semantic clause for conjunction requires that the right conjunct is evaluated against an information state (in this case f_w) updated on the left conjunct (in this case $\forall x(Ax \wedge Rx > \neg Bx)$). Thus, the updated information state for the right conjunct in (11) will be $f_w[\forall x(Ax \wedge Rx > \neg Bx)]$, which we label f'_w for short. The CCP clauses in our semantics thus ensures that the right conjunct is evaluated against an information state (namely, f'_w) that contains the most normal albino-raven-worlds in its image, for every individual in the domain. And so the right conjunct is guaranteed to be false. This is because, for any w and f, for

[28] Since the order of the conjuncts in a conjunction can matter in the dynamic theory, the reader might wonder weather (2a) should instead be translated with '$Rx \wedge Ax$' in place of '$Ax \wedge Rx$'. Of course, it does not actually matter in the present case.

every individual in the domain, there will be a world w' in the information state f_w where that individual is a raven and is not black, and so $\forall x(Rx > Bx)$ will be false. And so the whole conjunction will be false.

Let us go through this reasoning more carefully, presenting some key calculations to aid comprehension. According to the dynamic theory, (11) is true at a world w and information state f_w iff, for every variable assignment α, the following holds:

(12) $$[\![(11)]\!]^{w,f_w,\alpha} = 1 \text{ iff } [\![\forall x(Ax \wedge Rx > \neg Bx)]\!]^{w,f_w,\alpha} = 1 \text{ and } [\![\forall x(Rx > Bx)]\!]^{w,f'_w,\alpha} = 1,$$

where $f'_w = f_w[\forall x(Ax \wedge Rx > \neg Bx)]$.

To calculate the truth-conditions for the second conjunct, we must first calculate $f'_w = f_w[\forall x(Ax \wedge Rx > \neg Bx)]$:

(13) $$f_w[\forall x(Ax \wedge Rx > \neg Bx)]^\alpha = \bigcup_{d \in D} f_w[(Ax \wedge Rx > \neg Bx)]^{\alpha[d/x]} = \bigcup_{d \in D} f_w \cup *(w, [\![Ax \wedge Rx]\!]^{\alpha[d/x]})$$

This is the information state against which the right conjunct will be evaluated. Thus, the truth-conditions for the right conjunct are as follows:

(14) $$[\![\forall x(Rx > Bx)]\!]^{w,f'_w,\alpha} = 1 \text{ iff for every } d \in D: \text{for all } w' \in f'_w[Rx > Bx]^{\alpha[d/x]}, \text{ if } [\![Rx]\!]^{f'_w,w',\alpha[d/x]} = 1, \text{ then } [\![Bx]\!]^{f'_w[Rx>Bx]^{\alpha[d/x]},w',\alpha[d/x]} = 1.$$

These truth-conditions require us to calculate more updates, namely, $f'_w[Rx > Bx]^{\alpha[d/x]}$, for each $d \in D$. Importantly, given that, for each $d \in D, \exists w' \in f'_w : w' \in [\![Rx]\!]^{\alpha[d/x]}$, the updated information state passes the test that each conditional imposes on the input information state, and so, $f'_w[(Rx > Bx)]^{\alpha[d/x]} = f'_w$, for each $d \in D$. Thus, the truth-condition for the second conjunct amounts to the following:

(15) $[\![\forall x(Rx > Bx)]\!]^{w,f'_w,\alpha} = 1$ iff for every $d \in D$: for all $w' \in f'_w$,

$$\text{if } [\![Rx]\!]^{f'_w,w',\alpha[d/x]} = 1, \text{ then } [\![Bx]\!]^{f'_w,w',\alpha[d/x]} = 1.$$

In English: the sentence 'Ravens are black' is true relative to an information state f'_w that has been updated on the CCP of 'Albino ravens are not black' iff every individual and every world w' in f'_w, if that individual is a raven in w', then it is also black in w'. But observe that, for every individual, there is some world in the expanded modal horizon in which it is an albino raven, and so is not black. Consequently, when the 'Ravens are black' is evaluated against the expanded modal horizon, it is guaranteed to be false. And so the whole conjunction (11) will be false.

Notice that this reasoning relied on nothing in particular about the specific predicates in (11) and so it can be generalised to show that any reverse Sobel sequence of the form $\ulcorner \forall v(\xi v \wedge \xi' v > \neg \zeta v) \wedge \forall v(\xi v > \zeta v) \urcorner$ will be false at any world and accessibility function f. Thus, this reasoning shows that on the dynamic theory, any reverse Sobel sequence is a contradiction; that is, it is false at any point(s) of evaluation. Since contradictions are generally infelicitous, this explains why (2a) is generally unassertable and unentertainable.

6.4.2 Sobel Sequences

Contrastingly, the original Sobel sequence is completely fine.

(1) a. Ravens are black, but albino ravens aren't.

(16) $\forall x(Rx > Bx) \wedge \forall x(Ax \wedge Rx > \neg Bx)$

Unlike reverse Sobel sequences, the embedded conditionals in the right conjunct of (1a) have a non-trivial effect on the information state that it inherits from the left conjunct. That is, when we calculate the following truth-condition:

(17) $[\![\forall x(Ax \wedge Rx > \neg Bx)]\!]^{w,f''_w,\alpha} = 1$ iff:

$$\text{for every } d \in D \text{, for all } w' \in f''_w[Ax \wedge Rx > \neg Bx]^{\alpha[d/x]},$$
$$\text{if } [\![Ax \wedge Rx]\!]^{w',f''_w,\alpha[d/x]} = 1 \text{, then } [\![\neg Bx]\!]^{w',f''_w[(Ax\wedge Rx > \neg Bx)]^{\alpha[d/x]},\alpha[d/x]} = 1.$$

where $f''_w = f_w[\forall x(Rx > Bx)]$. Since no world $w' \in f''_w$ is such that $[\![Ax \wedge Rx]\!]^{w',f''_w} = 1$, the modal horizon is expanded further to contain the most normal albino-raven-worlds, for each individual in the domain. Thus, the second conjunct is calculated with respect to an information state consisting in the union of the most normal raven-worlds and the most normal albino-raven-worlds:

(18) $$f''_w[(Ax \wedge Rx > \neg Bx)]^{\alpha[d/x]} = f''_w \cup *(w, [\![Ax \wedge Rx]\!]^{f''_w,\alpha[d/x]})$$
$$= *(w, [\![Rx]\!]^{f,\alpha[d/x]}) \cup *(w, [\![Ax \wedge Rx]\!]^{f''_w,\alpha[d/x]})$$

And because no world $w' \in f''_w$ is such that $[\![Ax \wedge Rx]\!]^{w',f''_w} = 1$, the embedded conditionals in the right conjunct of the Sobel sequence are essentially evaluated only with respect to the worlds that they introduce to the modal horizon. In effect, the truth-conditions of the right conjunct are equivalent to its truth-conditions in the unembedded case:

(19) $[\![\forall x(Ax \wedge Rx > \neg Bx)]\!]^{w,f''_w} = 1$ iff

for every $d \in D$, for all $w' \in *(w, [\![Rx]\!]^{f_w,\alpha[d/x]}) \cup *(w, [\![Ax \wedge Rx]\!]^{f''_w,\alpha[d/x]})$

if $[\![Ax \wedge Rx]\!]^{w',f''_w} = 1$, then $[\![\neg Bx]\!]^{w',f''_w[(Ax\wedge Rx > \neg Bx)]^{\alpha[d/x]}} = 1$.

Thus, the second conjunct is true whenever, for all $d \in D$, $*(w, [\![Ax \wedge Rx]\!]^{f''_w,\alpha[d/x]}) \subseteq [\![\neg Bx]\!]^{f''_w[(Ax\wedge Rx > \neg Bx)]^{\alpha[d/x]}}$. Since this is clearly possible along with the truth of the left conjunct, (1a) can be true, and so it is entertainable and assertable.

6.4.3 Summary

Let us take a step back to appreciate how the dynamic theory solves our puzzles. Recall the puzzle laid out above. On the one hand, 'Albino ravens are not black, but ravens are' should be consistent, since the original order is completely fine. But on the other hand, it strikes us as blatantly inconsistent. The dynamic theory makes sense of these facts by predicting that 'Ravens are black' and 'Albino ravens are not black' are indeed consistent, but only when taken in that order. But if we evaluate their conjunction in reverse Sobel sequence form, the result is a contradiction. And so, despite the joint consistency of the two conjuncts, when taken in a certain order, the conjunction ends up being a contradiction.[29]

Thus, I submit that the dynamic theory makes sense of the surprising behaviour of sequences of generics. I take it that this is confirmation that reverse Sobel sequences of generics are genuine contradictions, when taken in that order, even though they are consistent when taken in their original order.

6.5 Alternative Solutions

This completes my exposition of the dynamic theory. In closing, I compare the dynamic theory to what I consider to be the most promising alternative approaches to the phenomena examined here. Each approach claims that reverse Sobel sequences are infelicitous because they are pragmatically inappropriate, rather than semantically inconsistent. Such explanation of reverse Sobel sequences are initially appealing, since they allow us to retain a conservative semantics for generics. Nevertheless, we need to provide a specific pragmatic account that explains the infelicity of reverse Sobel sequences of generics.

Three pragmatic explanations immediately present themselves. The first strategy stems from the Gricean pragmatic tradition and explains the infelicity of reverse Sobel sequences by appealing to Grice's Maxim of Quantity; call this the *Gricean*

[29] Indeed, it is enough to show that this semantics can handle the infelicity of reverse Sobel sequences by illustrating that the conjuncts in such sequences are inconsistent when taken in that order. I prove this in Appendix B.

approach.[30] The second approach attempts to explain the infelicity of reverse Sobel sequences by appealing to purportedly pragmatic principles governing the anaphoric uses of generic bare plural noun phrases; call this the *anaphora approach*. The third strategy attempts to explain the infelicity of reverse Sobel sequences by appealing to the epistemic status of one's utterance, in particular, whether one's utterances are epistemically irresponsible; call this the *epistemic approach*. I argue that none of these approaches explain the infelicity of reverse Sobel sequences.

6.5.1 The Gricean Approach

The first suggestion is as follows: the impropriety of such sequences are conversational in nature, and so it can be explained by appeal to Gricean pragmatics.[31] The rough idea is as follows. Contrary to appearances, the conjuncts in reverse Sobel sequences are semantically consistent. However, reverse Sobel sequences are infelicitous because they generate implicatures that are inconsistent with some aspect of their literal content. For this explanation to be convincing, a full story must be given. This section aims to develop and criticise two such stories drawing upon Grice's (1975) account of implicature.

Grice (1975) famously distinguishes between *what is said* and *what is implicated* by an utterance of a sentence. This distinction is motivated by the following observation:

> [W]hile it is no doubt true that the formal devices are especially amenable to systematic treatment by the logician, it remains the case that there are very many inferences and arguments, expressed in natural language and not in terms of these devices, that are nevertheless recognisably valid. (Grice 1975: 43)

[30] The approach that I have labeled 'Gricean' might be more accurately labelled as the 'Neo-Gricean' or 'Post-Gricean' approach. The distinction lies in the modifications that Neo-Griceans have made to Grice's original Principles of Conversation; see, for example, Levinson (2000); Horn (2004). Since such differences are orthogonal to the task at hand, I nevertheless retain the 'Gricean' label.

[31] This discussion is not intended as a comprehensive survey of the literature on Gricean pragmatics: it merely serves to highlight the aspects relevant for the discussion at hand. For a more nuanced and involved discussion of Gricean pragmatics, see Fox (2007); Geurts (2010); Chierchia (2013).

The distinction between what is said and what is implicated can be characterised as a distinction between the explicitly-encoded literal content and the non-literal content of an utterance (Recanati 1989; Bach 1997, 1999). Whilst the question of how to distinguish between literal and non-literal content is a tricky and controversial issue, the idea that there are linguistic phenomena that goes beyond the truth-conditional content of an utterance of a sentence is compelling. Consider, for example, an utterance of the sentence 'Wilma got married and had a baby'. In addition to its truth-conditional content—*that Wilma got married* and *that Wilma had a baby*—it is strongly suggested that these events occurred in that order. On the assumption that *and* makes its usual truth-functional contribution to the sentence, this suggestion is not explicitly encoded in the literal content of the utterance.

With respect to *what is implicated*, Grice develops the notion of conversational implicatures.[32] Conversational implicatures are derived from more general features of discourse and they are based on particular utterances; they are more loosely derived from *what is said* and disappear across contexts. In particular, Grice holds that language users recognise particular cooperative efforts in an attempt to achieve "a common purpose or set of purposes, or at least a mutually accepted direction" (1975: 45). Grice (1975: 45–46) postulates a general principle of conversation, the Cooperation Principle, and four maxims, which he claims people follow for effective communication:

Cooperation Principle. Make your contribution such as required, at the stage at which it occurs, by the accepted purpose or direction of the talk exchange in

[32] Grice actually distinguishes between two types of implicature: conventional implicature and conversational implicature. Conventional implicatures are tied to lexical items which introduce them; they always occur with a particular word and are not defeasible. Consider, for example, the classic conventional implicature of 'even'. Suppose Bert says 'Even Ernie could win'. While his utterance entails that Ernie could win, he conventionally implicates that Ernie is the least likely to win. Here Bert's utterance would not be, strictly speaking, false if Ernie was a more promising candidate. In this sense, Grice called such implicatures 'conventional' (Grice 1975: 44–45).

However, adequate pragmatic explanations for the infelicity of reverse Sobel sequences must be general enough to apply to any particular such sequence, and so ny explanation involving conventional implicatures is committed to modified lexical entries for each NP involved in any Sobel sequence. This kind of explanation is particularly unparsimonious and generally should not be preferred if simpler explanations are available. For this reason, I do not pursue this approach here.

which you are engaged.

Maxim of Quantity.

1. Make your contribution as informative as is required.
2. Do not make your contribution more informative than is required.

Maxim of Quality.

1. Do not say what you believe to be false.
2. Do not say that for which you lack adequate evidence

Maxim of Relation.

1. Be relevant.

Maxim of Manner.

1. Avoid obscurity of expression.
2. Avoid ambiguity.
3. Be brief.
4. Be orderly.

One of the underlying assumptions of Grice's framework is that interlocutors generally follow these maxims, or at least the Cooperation Principle, in their communication. Nevertheless, maxims are occasionally flouted, and this generates a conversational implicature by allowing a speaker to exploit these principles of conversation as we shall see below.

By appealing to Grice's maxims of conversation, the Gricean hopes to develop an account of reverse Sobel sequences. According to one version of the Gricean approach, the infelicity of reverse Sobel sequences arises due to quantity implicatures in the following sense. Quantity implicatures are generally derived from an utterance of a sentence by negating some alternatives that could have been said instead of what was actually said.[33] For example, when Bert says 'Some of Elmo's friends are over', he could have said 'All of Elmo's friends are over', but didn't. Since *all* is informationally stronger than *some*, Griceans assume that Bert isn't epistemically well-positioned enough to assert *all*, and so he believes that not all of Elmo's friends are over.[34] Thus, they derive the quantity implicature 'Not all of Elmo's friends are over', by negating the stronger alternative *all*.

Similarly, one might attempt to derive a quantity implicature by claiming that *raven* is stronger than *albino raven* in the same way that *all* is stronger than *some*. The rough idea is that uttering something weaker than *raven* would implicate that one is not in a position to utter the strong statement. For example, when I utter 'Albino ravens aren't black', I could have said something stronger, namely 'Ravens aren't black', but didn't. On the assumption that *raven* is stronger than *albino raven*, the Gricean would assume that I am not epistemically well-positioned enough to assert 'Ravens aren't black' and so I believe that it is not the case that ravens aren't black. Thus, the Gricean derives the quantity implicature that it is not the case that ravens aren't black.

While this predication seems desirable, this approach cannot derive an inconsistency required to explain the infelicity of reverse Sobel sequences. For the truth of 'It is not the case that ravens aren't black' does not exclude the truth of 'Ravens are black'. Consequently, even if my initial utterance of 'Albino ravens aren't black' implicates that it is not the case that ravens aren't black, this is not inconsistent with my subsequent utterance of 'Ravens are black'. Since there is no inconsistency, this version of the Gricean approach cannot explain the infelicity of my utterance.

---

[33] For an explanation on how the alternatives are decided, see Horn (1972, 1989).

[34] In what sense is *all* informationally stronger than *some*? Well, if an *all*-sentence is true, then the corresponding *some*-sentence is true, but not *vice versa*. For example, if 'All of Elmo's friends are over' is true, then, trivially, some of Elmo's friends are over; but if two out of three of Elmo's friends are over. Then 'Some of Elmo's friends are over' is true, but 'All of Elmo's friends are over' is false. Of course this is only true for the natural language *all* and *some*; the universal quantifier (∀) is not stronger than the existential quantifier (∃) in this ways.

Instead, one might be tempted to explain away the infelicity of reverse Sobel sequences by claiming that, on some suitable notion of 'information', the first conjuncts of (2) are strictly more 'informative' than the second conjuncts, and following a more informative statement with a less informative one is generally infelicitous. However, there are a number of mechanisms that immediately increase the felicity of reverse Sobel sequences of generics that would be left unexplained if something like this explanation were correct. More specifically, observe that the infelicity of a reverse Sobel sequence like (2b) immediately sound better when their second conjunct contains either an explicit quantificational adverb, such as *generally*, *usually*, or *normally*, as in (20a), emphatic assertion, as in (20b), or an weak ability modal like *can*, as in (20c):[35]

(20) a. Birds with broken wings don't fly; but birds generally/usually/normally fly.

b. Birds with broken wings don't fly; but birds $[\text{do}]_f$ fly.

c. Birds with broken wings don't fly; but birds can fly.

While these facts call for explanation, any adequate explanation surely does not depend on the claim that second conjuncts are more informative than the first, a claim that is directly entailed by a pragmatic approach based on informativeness. That is, the following ranking of informativeness is implausible:[36]

$$\text{(21) Birds fly} < \text{Birds with broken wings don't fly} < \text{Birds} \left\{ \begin{array}{c} \text{generally/etc.} \\ [\text{do}]_f \\ \text{can} \end{array} \right\} \text{fly,}$$

[35] '$[.]_f$' indicates focal stress around the bracketed constituent.

[36] The data in (20) has some interesting upshots for the semantics of generics. For example, the fact that (2a) can be made felicitous by adding a quantificational adverb, as in (20a), draws doubt on the idea that the meaning of any covert generic operator is identical in meaning to any particular explicit quantificational adverb. The fact that such mechanisms remove the infelicity of reverse Sobel sequences is evidence that covert forms of such mechanisms are not present in bare instances of those sentences. That is, the sentence 'Birds fly' cannot have the same truth-conditions as 'Birds generally fly', or else (20a) and (2a) would be equally felicitous.

While a full explanation of the felicity of the sentences in (20) is outside the scope of this chapter, it is plausible that the addition overt material introduces additional modality that, in turn, expands the modal horizon to include certain bird-flying-possibilities.

where ‘$<$’ means ‘is less informative than’. But this is exactly what would be required to explain the infelicity of reverse Sobel sequences in terms of informativeness, while admitting that the sentences in (20) are felicitous. Consequently, this version of the Gricean view also fails.

6.5.2 The Anaphora Approach

Let us now turn to an approach inspired by Mirja Holst’s (2013) anaphora-based account of the infelicity of reverse Sobel sequences of incomplete descriptions, such as in (22):[37]

(22) #The pig with floppy ears is not grunting, but the pig is grunting.

Holst’s solution draws upon the fact that incomplete descriptions can be used as anaphors. This phenomenon occurs most plausibly in cases where the antecedent description has the conjunctive form ⌜*the F-and-H*⌝ and the potential anaphoric description has the form ⌜*the F*⌝ resulting from the elimination of one of the conjuncts. For example, in the sentence ‘The pig with pretty pink spots on it is grunting. The pig looks happy’, the incomplete description *the pig* can be interpreted as an anaphor for the initial description *the pig with pretty pink spots on it*. Holst then notices an asymmetry between Sobel and reverse Sobel sequences of definite descriptions: in Sobel sequences of the form ⌜*The F is G; but the F-and-H is not G*⌝, ⌜*the F-and-H*⌝ cannot be used as an anaphor for ⌜*the F*⌝, but in reverse Sobel sequences of the form ⌜The F-and-H is not G; but the F is G⌝, ⌜*the F*⌝ can be used as an anaphor for ⌜*the F-and-H*⌝. Consequently, reverse Sobel sequences are ambiguous between the anaphoric reading and the non-anaphoric reading, but the Sobel sequence is not. Furthermore, on the anaphoric reading, where ⌜*the F*⌝ and ⌜*the F-and-H*⌝ refer to the same object, the reverse Sobel sequence is false. Finally, Holst appeals to

[37] For other discussion of Sobel and reverse Sobel sequences of definite descriptions, see Lewis (1973); von Heusinger (1997a,b, 2004); Schlenker (2004).

some pragmatic principles to argue for the primacy of the anaphoric reading: (i) that anaphoric readings are chosen if available, and (ii) that speakers should avoid ambiguities that make a difference to truth-value. If Holst is correct that the primary interpretation of (22) involves anaphora, then such interpretations of (22) will end up in a contradiction. And since contradictions are generally infelicitous, this explains the markedness of such sequences.

Can this approach be adapted for sequences of generic sentences? For this approach to work, we would need to be able to use bare plural noun phrases as anaphors for one another. In particular, we would need to be able to use bare plural noun phrases of the form *Fs* as anaphors for noun phrases of the form *F-and-Hs*. If so, then it is plausible that *Fs* can be used as an anaphor for *F-and-Hs* in (24), but 'F-and-Hs' cannot be used as anaphor in (23).

(23) ⌜Fs are Gs; but F-and-Hs are not Gs.⌝

(24) ⌜F-and-Hs are not Gs; but Fs are Gs.⌝

That is, (24) has an anaphoric reading in addition to its usual reading, whereas (23) does not allow for any anaphoric reading. Now according to the anaphor approach, the interpretation of *Fs* in (24) is anaphorically constrained by *F-and-Hs*, and so they both refer to the same set of objects. When we pair this constraint with any of the standard semantics outlined in Section 6.2, this results in a straightforward contradiction. Consider, for example, an utterance of 'Albino ravens aren't black, but ravens are' and assume that the interpretation of *ravens* is anaphorically constrained by *albino ravens*, that is, they both refer to the same set of objects in this context of use. Then this utterance of 'Albino ravens aren't black, but ravens are' asserts of those objects that they both are black and aren't black. Proponents of the anaphoric approach can appeal to the same pragmatic principles to which Holst appeals to explain the primacy of the anaphoric reading. This account seems to adequately accommodate the infelicity of reverse Sobel sequences of generics.

Importantly, the anaphor approach basically emulates the way that the dynamic theory handles reverse Sobel sequences, except it uses a pragmatic account of anaphora, rather than by rewriting the semantics of generics. As a result, the anaphor approach relies on the assumption that bare plural noun phrases can be used as anaphora. However, this assumption is dubious for two reasons. First, it is difficult to see how to introduce the pragmatic constraint on anaphora resolution with a compositional semantics for generics. Most theorists typically deal with anaphora using the tools of formal semantics. Indeed, as I highlighted above, dynamic semantics was originally motivated by concerns with intersentential anaphora and donkey anaphora. Consequently, the most natural implementation of the anaphor approach would be something like the dynamic theory, rather than augmenting the standard static semantics with a pragmatic account of anaphora.

Second, (Holst 2013: 28) motivates her claim that incomplete descriptions can be used as anaphor with sentences like 'The pig with the pretty pink spots on it is grunting away merrily and the pig looks happy'. But, generic equivalents of these conjunctions do not seem to have anaphoric readings:

(25) a. Dogs with three legs don't run quickly and dogs bark.

b. Birds with broken wings get deserted and birds tweet.

c. Male pigs have corkscrew penises and pigs grunt.

In each of (25), the set of individuals referred to by the bare plural NP in the first conjunct seems to be different to the set of individuals referred by the bare plural NP in the second conjunct. For example, the first conjunct of (25a) makes a claim about (roughly) those normal three-legged dogs, whereas the second conjunct makes a claim about (roughly) dogs regardless of leg number; the first conjunct of (25b) makes a claim about (roughly) those normal broken-winged birds, while the second conjunct makes a claim about birds more generally; and finally the first conjunct of (25c) makes a claim about (roughly) normal male pigs, whereas the second conjunct seems to make a more general claim about pigs regardless of gender. Consequently, the claim that bare plural NPs can be used anaphorically lacks independent motivation. For these reasons, I doubt that the anaphoric approach provides the correct account of the infelicity of reverse Sobel sequences of generics.

6.5.3 The Epistemic Approach

Finally, let us turn to the third pragmatic approach to reverse Sobel sequences, *the epistemic approach*, which I have adapted from a proposal by Sarah Moss (2012). Moss is concerned with developing a pragmatic account of the infelicity reverse Sobel sequences of counterfactuals, like in (26):

(26) #If Sally were to go to the concert and get stuck behind a tall person, she wouldn't see the band, but if Sally were to go to the concert, she would see the band.

Moss begins by assuming the following independently motivated pragmatic principle governing assertability:

Epistemic Irresponsibility. It is *epistemically irresponsible* to utter sentence S in context C if there is some proposition ϕ and possibility μ such that when the speakers utters S:

(i) S expresses ϕ in C.

(ii) ϕ is incompatible with μ.

(iii) μ is a salient possibility

(iv) The speaker of S cannot rule out μ.

Moss claims that the speaker of (26) generally cannot rule out certain salient possibilities that are incompatible with the content of her utterance. For example, an utterance of (26) expresses the proposition that if Sally had gone to the concert, she would have seen the band. But this proposition is incompatible with the possibility that Sally might have got stuck behind a tall person if she had gone to the concert.[38] Furthermore, the possibility that Sally might have been stuck behind a tall person if she had gone to the concert is a salient possibility. This is because it was previously made salient by an utterance of (26). Lastly, the speaker of (26) plausibly cannot rule out the possibility that Sally might have been stuck behind a tall person if she had gone to the concert. Thus, given (EI), this explains why uttering reverse Sobel sequences are inappropriate.

Let us consider whether appealing to (EI) explains the infelicity of reverse Sobel sequences of generics. The rough idea is that if it is epistemically irresponsible to utter 'Ravens are black' in reverse Sobel sequences, then such sequences are infelicitous. And for it to be epistemically irresponsible to utter 'Ravens are black' in reverse Sobel sequences, the following conditions must be met:

(i) 'Ravens are black' expresses some proposition ϕ in C

(ii) ϕ is incompatible with the proposition expressed by 'Albino ravens aren't black'

(iii) The proposition expressed by 'Albino ravens aren't black' is a salient possibility

(iv) The speaker of S cannot rule out the proposition expressed by 'Albino ravens aren't black' .

[38] Moss demonstrates two ways of deriving this incompatible: (a) by appealing to the Lewisian analysis of counterfactuals and his logic of counterfactuals **VC** (Moss 2012: 569); (b) by appealing to the law of conditional excluded middle—either if p were the case, then q would be the case, or if p were the case, then not-q would be the case (Moss 2012: 572). These precise details do not concern us. The important point is whether reverse Sobel sequences of generic sentences result in similar inconsistencies.

Given uncontroversial assumptions about generics and facts about discourse, conditions (i), (iii), and (iv) are trivially met. First, assuming that generic sentences express propositions, then there is some proposition ϕ that is expressed by an utterance of 'Ravens are black', and so condition (i) is met. Second, assuming that the antecedent utterance of 'Albino ravens aren't black' makes salient the possibility that albino ravens aren't black, then condition (iii) is met. Third, the speaker is not obviously in a position to rule out the proposition expressed by 'Albino ravens aren't black' . Consequently, the only condition left to satisfy is (ii), that 'Ravens are black' expresses a proposition that is incompatible with the proposition expressed by 'Albino ravens aren't black' .

It is unclear whether the sentence 'Ravens are black' expresses a proposition that is inconsistent with the proposition expressed by 'Albino ravens aren't black' . I have argued extensively in Section 6.2 that the static semantics for generics that are prevalent in the literature treat these sentences as consistent. Instead, the static semantics must be altered to predict that 'Ravens are black' expresses a proposition that requires for its truth that albino ravens are black, for example, the proposition that all normal ravens regardless of their genetic predispositions are black. For if 'Ravens are black' expresses this proposition, then the two utterances would be incompatible: 'Albino ravens aren't black' expresses the proposition that albino ravens aren't black, which is inconsistent with the proposition that normal ravens regardless of their genetic predispositions are black.

But this suggestion is ultimately inadequate. As we saw above, 'Ravens are black' cannot express the proposition that normal ravens regardless of their genetic predispositions are black, or else our intuition that 'Ravens are black' is true *tout court* would be incorrect. Furthermore, if 'Ravens are black' does not express the proposition that normal ravens regardless of their genetic predispositions are black (or a similar proposition), then no inconsistency can be derived. For it is plausible that

‘Ravens are black’ expresses something like the proposition that all normal ravens are black, where what counts as ‘normal’ excludes albino ravens. And this proposition is consistent with the proposition that albino ravens aren’t black. For this reason, the epistemic approach to reverse Sobel sequences of generics fails.

6.6 Conclusion

Generic Sobel sequences present a challenge to the standard ways of thinking about generic sentences. I have argued that there is good reason to suspect that generics evoke non-trivial changes to the context in which they are assessed, and so we should adopt a semantic analysis that reflects this dynamic behaviour. More specifically, I have argued that there is good reason to think that reverse Sobel sequences are contradictions and their conjuncts, when taken in a certain order, are inconsistent. This account of the fact is exactly what the dynamic theory provides. The interpretation of generics is constrained by contextual possibilities that have been raised in preceding discourse. The live salience of certain counterinstances makes certain generalisations conversationally inappropriate. And so the dynamic theory resolves the puzzles.

I do not pretend that the precise implementation I have chosen is the only account of the facts. For example, I have focused on retooling the modal approach to generics in a dynamic framework, and I have not shown that a similarly dynamic approach cannot be taken for the other theories of generics. Proponents of those views are welcome to make use of the framework that I have developed here and see how their theories face. Furthermore, I have not argued that a compelling static solution to the present theory could not be developed. A natural question is: what kind of non-dynamic revision to any of the standard static semantics for generics could resolve the problems above? I argued in the previous section that the most promising extant accounts of the infelicity of reverse Sobel sequences of counterfactuals and incomplete descriptions do not extend to the generic case. Moreover, it is exactly this kind of phenomena that motivated dynamic semantics in the first place. Consequently, this question is of interest if we want to understand the extent to which facts about Sobel sequences support an essentially dynamic approach to meaning more generally.

Chapter 7

Conclusion

This thesis has argued in favour of the modal theory of generic sentences. I have shown how this theory can be integrated into an explicit compositional semantics for a fragment of English, and I hope to have shown how it can accommodate a wide range of data that has recently been taken to be devastating for it.

Over the course of this thesis, I have developed two implementations of the modal theory. In Chapter 2, I introduced two extant theories of generics, one based on a selection function that determines a set of contextually salient 'normal' worlds, and one based on a family of normality functors that determine the normal instances of properties. I argued that these theories can handle a wide range of generic phenomena. These theories have formed the basis for the subsequent chapters, and I adopted each of them at different points in the argumentation to best illustrate the new ideas that I wanted to introduce. In Chapter 5, I combined the 'normal objects' version of the modal theory with an algebraic treatment of plurality, all of which was set against a situation-based framework, and I argued that the resulting theory gracefully handles generic conjunctions. In Chapter 6, I developed a dynamic implementation of the 'normal worlds' version of the modal theory that takes seriously the dynamics of conversation, and I argued that the resulting theory elegantly handles sequences of generic sentences. The decision to develop two different frameworks has allowed me to illustrate the underlying algebraic and dynamic mechanisms against a minimal background. Either of theories developed in Chapter 2 could have been used in place of the other, and reconciling the two resulting theories is a matter of implementing the technology of one theory in the framework of the other. I have argued that these novel theories handle the data that I have considered better than any extant theory, and I know of no phenomena that extant theories handle better than these theories.

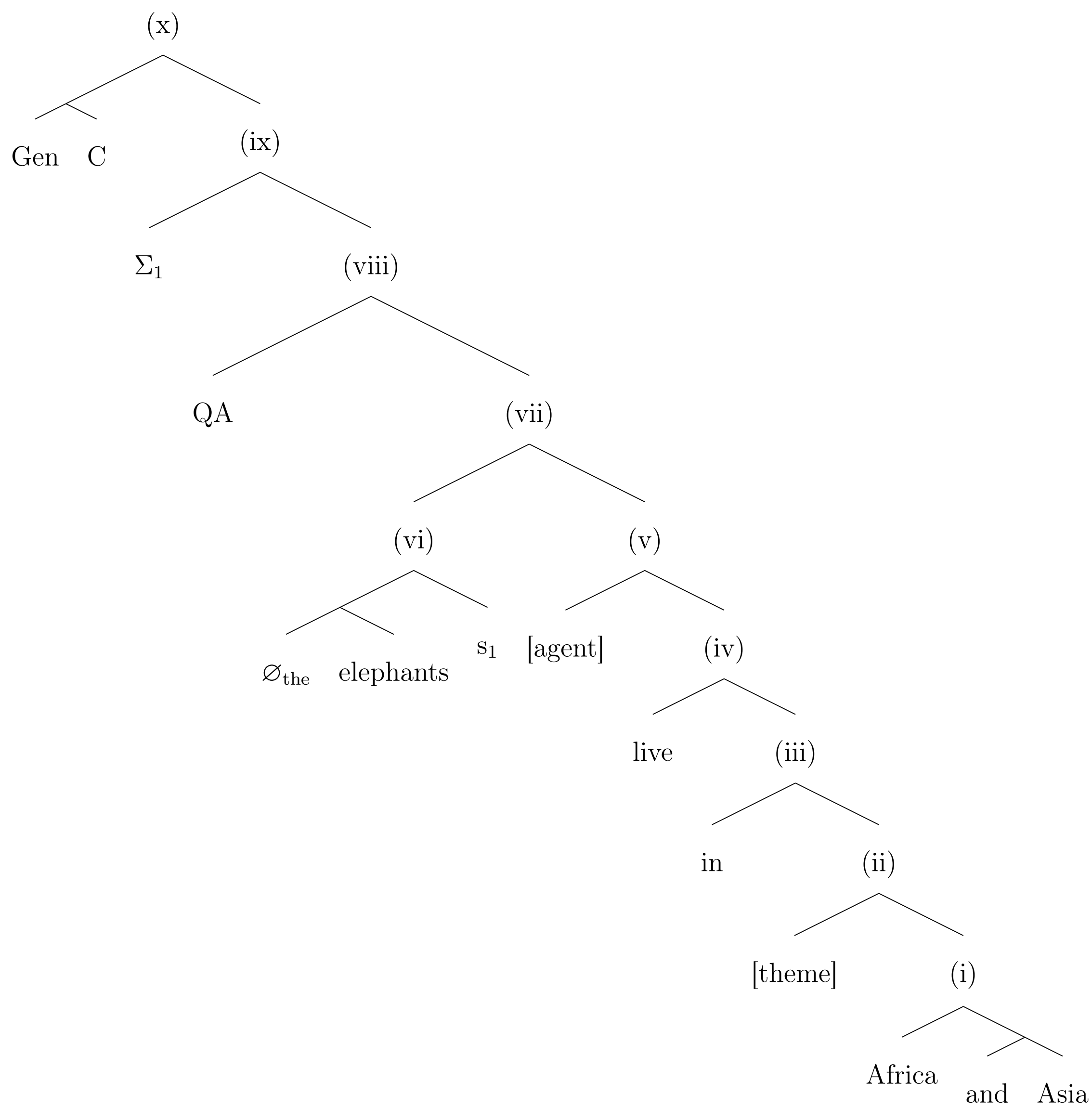
A central theme running throughout this thesis is unification and conciliation. I have suggested that the differences between the kind-predication and the quantificational approaches to generics are not as dramatic as recent literature would suggest; any kind-predicational theory of generics must allow for some covert quantification, and quantificational approaches like the modal theory can help themselves to the ontology of kinds without tarnishing their image (Chapter 3). I argued that recent empirical research on the acquisition of generics does not undermine quantificational and mainstream formal semantical approaches to theorising about generics. On the contrary, the recent cognitive turn in theorising about generics should be seen as complementary to more formal approaches to their meaning (Chapter 4). I have suggested that implementing the modal semantics for generics in an algebraic, situation-theoretic framework can comfortably handle a wide range of data that is the central motivation for a more revisionary rival (Chapter 5). I have also suggested that implementing the modal semantics in a dynamic framework can handle novel data about sequences of generics with grace (Chapter 6). In this thesis, I have tried to show that these algebraic and dynamic approaches result in elegant and descriptively adequate theories of the meaning of generic sentences. The necessity of these frameworks in natural language semantics is not fully established, but I have illustrated their usefulness for the phenomenon of generics. More generally, this thesis has argued that the modal theory prevails as a much more serious competitor than for what it is often credited, and it has opened new directions for future research in generics.

Appendix A

A Generic Conjunction

Here follows a calculation establishing the truth-conditions of a generic conjunction from Chapter 5.5.

(1)



(i) Function application

$a \oplus a'$

(ii) Referential type shifter, NP first

$\lambda V_{\langle s,t\rangle}.\lambda s.[V(s) \wedge {}^{*}\text{theme}(s) = \mathcal{C}_s(a \oplus a')]$

(iii) Vacuity

$\lambda V_{\langle s,t\rangle}.\lambda s.[V(s) \wedge {}^{*}\text{theme}(s) = \mathcal{C}_s(a \oplus a')]$

(iv) Function application

$\lambda s.[{}^*\text{live}(s) \wedge {}^*\text{theme}(s) = \mathcal{C}_s(a \oplus a')]$

(v) Referential type shifter, VP first

$\lambda x_e.\lambda s.[{}^*\text{live}(s) \wedge {}^*\text{agent}(s) = \mathcal{C}_s(x) \wedge {}^*\text{theme}(s) = \mathcal{C}_s(a \oplus a')]$

(vi) Function application

$\bigoplus\{x : \text{elephant}(x)(s_1)\}$

(vii) Function application

$\lambda s.[{}^*\text{live}(s) \wedge {}^*\text{agent}(s) = \mathcal{C}_s(\bigoplus\{x : {}^*\text{elephant}(x)(s_1)\}) \wedge {}^*\text{theme}(s) = \mathcal{C}_s(a \oplus a')]$

(viii) Function application

$\lambda s.\lambda s'.\exists s''[s' \preceq s'' \wedge {}^*\text{live}(s'') \wedge {}^*\text{agent}(s'') = \mathcal{C}_{s''}(\bigoplus\{x : {}^*\text{elephant}(x)(s_1)\}) \wedge$
${}^*\text{theme}(s'') = \mathcal{C}_{s''}(a \oplus a')]$

(ix) Situation Binding

$\lambda s.\lambda s'.\exists s''[s' \preceq s'' \wedge {}^*\text{live}(s'') \wedge {}^*\text{agent}(s'') = \mathcal{C}_{s''}(\bigoplus\{x : {}^*\text{elephant}(x)(s')\}) \wedge$
${}^*\text{theme}(s'') = \mathcal{C}_{s''}(a \oplus a')]$

(x) Function application

$\lambda s.\forall s'[s' \in B(s) \wedge s' \in \cup\text{min}(C(s))]\exists s''[s' \preceq s'' \wedge {}^*\text{live}(s'') \wedge$
${}^*\text{agent}(s'') = \mathcal{C}_{s''}(\bigoplus\{x : {}^*\text{elephant}(x)(s')\}) \wedge {}^*\text{theme}(s'') = \mathcal{C}_{s''}(a \oplus a')]$

Appendix B

Consistency and Inconsistency

This appendix shows how the dynamic theory from Chapter 6.6 renders the conjuncts of reverse Sobel sequences as inconsistent, while taking them to be consistent in their original order.

First, we must state the notion of logical consequence and consistency more precisely. Here I will follow a familiar approach in the literature on dynamic semantics and say that a sequence $\phi_1, \ldots, \phi_n$ *entails* ψ just in case in any context where the premises are successively asserted and accepted, the context is sequentially updated into one whose context set is included in the proposition expressed by the conclusion in that resulting context.[1] Formally:

Definition B.0.1 (Entailment)**.** A sequence $\phi_1, \ldots, \phi_n$ *entails* ψ, $\phi_1, \ldots, \phi_n \vDash \psi$, iff for all contexts c:

$$[\![\phi_1]\!]^c \cap \ldots \cap [\![\phi_n]\!]^{c[\phi_1]\ldots[\phi_{n-1}]} \subseteq [\![\psi]\!]^{c[\phi_1]\ldots[\phi_n]}.$$

A similar idea applies to consistency. A sequence $\phi_1, \ldots, \phi_n$ is consistent just in case in any context where the sentences in the sequence are successively asserted and accepted, the resulting context is not empty. Formally:

[1] See for example Stalnaker (1975); von Fintel (2001).

Definition B.0.2 (Consistency)**.** A sequence $\phi_1, \ldots, \phi_n$ is *consistent* iff there is a context c such that:

$$[\![\phi_1]\!]^c \cap \ldots \cap [\![\phi_n]\!]^{c[\phi_1]\cdots[\phi_{n-1}]} \neq \varnothing.$$

With this dynamic notion of consistency, we can show the conjuncts of reverse Sobel sequences of generics are dynamically inconsistent. That is, we can prove the following proposition:[2]

Proposition B.0.1. A sequence of the form $\ulcorner \forall v(\xi v \wedge \xi' v > \neg \zeta v), \forall v(\xi v > \zeta v)\urcorner$ is inconsistent.[3]

Proof. To prove this, we need to show that for any information state f_w,

$$[\![\forall v(\xi v \wedge \xi' v > \neg \zeta v)]\!]^{f_w} \cap [\![\forall v(\xi v > \zeta v)]\!]^{f'_w} = \varnothing.$$

where $f'_w = f_w[\forall v(\xi v \wedge \xi' v > \neg \zeta v)]$.

First, let us calculate the meaning of the first member of the sequence. That is, for any information state f_w and variable assignment α:

$$\begin{aligned} [\![\forall v(\xi v \wedge \xi' v > \neg \zeta v)]\!]^{f_w} = \{w : \forall d \in D, \forall w' \in *(w, [\![\xi v \wedge \xi' v]\!]^{f_w, \alpha[d/v]}) : \\ \text{if } [\![\xi v \wedge \xi' v]\!]^{f_w, w', \alpha[d/v]} = 1, \text{ then } [\![\zeta v]\!]^{f_w[\xi v \wedge \xi' v > \neg \zeta v]^{\alpha[d/v]}, w', \alpha[d/v]} = 0\}. \end{aligned}$$

Next, let us calculate the meaning of the second member of the sequence. That is, for any information state f_w and variable assignment α:

$$\begin{aligned} [\![\forall v(\xi v > \zeta v)]\!]^{f'_w} = \{w : \forall d \in D, \forall w' \in \textstyle\bigcup_{d' \in D} *(w, [\![\xi v \wedge \xi' v]\!]^{\alpha[d'/v]}) : \\ \text{if } [\![\xi v]\!]^{f'_w, w', \alpha[d/v]} = 1, \text{ then } [\![\zeta v]\!]^{f'_w[\xi v > \zeta v]^{\alpha[d/v]}, w', \alpha[d/v]} = 1\}. \end{aligned}$$

Thus, for any information state f_w and variable assignment α, the intersection of these meanings is:

[2] In this appendix, I omit corner quotes for readability.
[3] I occasionally drop corner quotes in the proof to improve readability.

$$\{w : \forall d \in D, \forall w' \in *(w, [\![\xi v \wedge \xi' v]\!]^{\alpha[d/v]}) :$$
$$\text{if } [\![\xi v \wedge \xi' v]\!]^{f_w, w', \alpha[d/v]} = 1, \text{ then } [\![\zeta v]\!]^{f_w[\xi v \wedge \xi' v > \neg\zeta v]^{\alpha[d/v]}, w', \alpha[d/v]} = 0$$
$$\text{and}$$
$$\forall d \in D, \forall w' \in \bigcup_{d' \in D} *(w, [\![\xi v \wedge \xi' v]\!]^{\alpha[d'/v]}) :$$
$$\text{if } [\![\xi v]\!]^{f'_w, w', \alpha[d/v]} = 1, \text{ then } [\![\zeta v]\!]^{f'_w[\xi v > \zeta v]^{\alpha[d/v]}, w', \alpha[d/v]} = 1\}.$$

Given that the superscripted information states have no truth-conditional import at present, it follows that, for any information state f_w and variable assignment α, the intersection of the meanings of the sentences is:

$$\{w : \forall d \in D, \forall w' \in \bigcup_{d' \in D} *(w, [\![\xi v \wedge \xi' v]\!]^{\alpha[d'/v]}) :$$
$$\text{if } [\![\xi v]\!]^{w', \alpha[d/v]} = 1, \text{ then } [\![\zeta v]\!]^{w', \alpha[d/v]} = 0 \text{ and } [\![\zeta v]\!]^{w', \alpha[d/v]} = 1\}.$$

which is a straight-up contradiction. Thus, the intersection of these two sets is empty. □

Moreover, we can show that the very same conjuncts are dynamically consistent, when they are taken in Sobel sequence order. That is, we can prove the following proposition:

Proposition B.0.2. A sequence of the form $\ulcorner \forall v(\xi v > \zeta v), \forall v(\xi v \wedge \xi' v > \neg\zeta v)\urcorner$ is consistent.

Proof. To prove this, we need to show that there is some information state f_w such that:

$$[\![\forall v(\xi v > \zeta v)]\!]^{f_w} \cap [\![\forall v(\xi v \wedge \xi' v > \neg\zeta v)]\!]^{f'_w} \neq \varnothing$$

where $f'_w = f_w[\forall v(\xi v > \zeta v)]$. Let $\mathcal{M} = \langle W, D, *, V\rangle$ be a model such that:

$$W = \{w_1, w_2\}$$

$$D = \{a\}$$

$$I(n) = a$$

$$I(\xi) = \{\langle a, w_1\rangle, \langle a, w_2\rangle\}$$

$$I(\xi') = \{\langle a, w_2\rangle\}$$

$$I(\zeta) = \{\langle a, w_1\rangle\}$$

$$*(w_1, [\![\xi n]\!]) = \{w_1\}$$

$$*(w_1, [\![\xi n \wedge \xi' n]\!]) = \{w_2\}$$

Then it is easily verifiable that, in such a model, $f_w = \varnothing$ for all $w \in W$ is such an information state. $\square$

Bibliography

Anscombe, G. E. M. 1958. Modern moral philosophy. *Philosophy 33*(124): 1–19.

Antinucci, F. and R. Miller. 1976. How children talk about what happened. *Journal of Child Language 3*(2): 167–189.

Arnauld, A. and P. Nicole. 1996. *Logic or the Art of Thinking*. Cambridge: Cambridge University Press.

Asher, N. and M. Morreau. 1991. Commonsense entailment: A modal theory of nonmonotonic reasoning. In *Proceedings of the 12th International Joint Conference on Artifical Intelligence*, 387–392. San Francisco, CA.: Morgan Kaufman Press.

Asher, N. and M. Morreau. 1995. What some generic sentences mean. In *The Generic Book*, 300–339. Chicago: Chicago University Press.

Asher, N. and F. J. Pelletier. 2013. More truths about generics. In *Genericity*, eds. A. Mari, C. Beyssade, and F. del Prete, 312–333. Oxford: Oxford University Press.

Bach, E., E. Jelinek, A. Kratzer, and B. B. H. Partee. 1995. *Quantification in Natural Languages*. Studies in Linguistics and Philosophy. Dordrecht: Kluwer Academic Publishers.

Bach, K. 1997. The semantics–pragmatics distinction: What it is and why it matters. In *The Semantics-Pragmatics Interface From Different Points of View*, ed. K. Turner, 65–84. Oxford: Elsevier Science.

Bach, K. 1999. The myth of conventional implicature. *Linguistics and Philosophy 22*(4): 327–366.

Baldwin, D. A., E. M. Markman, and R. L. Melartin. 1993. Infants' ability to draw inferences about nonobvious object properties: Evidence from exploratory play. *Child Development 64*(3): 711–728.

Bar-Shalom, E. 2002. Tense and aspect in early child Russian. *Language Acquisition 10*(4): 321–337.

Barwise, J. and J. Perry. 1983. *Situations and Attitudes*. Cambridge, MA.: The MIT Press.

Bennett, M. and B. Partee. 1972. Toward the logic of tense and aspect in English.

Bloom, L., K. Lifter, and J. Hafitz. 1980. Semantics of verbs and the development of verb inflection in child language. *Language 56*(2): 386–412.

Boutilier, C. 1994a. Conditional logics of normality: A modal approach. *Artificial Intelligence 68*(1): 87–154.

Boutilier, C. 1994b. Unifying default reasoning and belief revision in a modal framework. *Artificial Intelligence 68*(1): 33–85.

Breckenridge, W. and O. Magidor. 2012. Arbitrary reference. *Philosophical Studies 158*(3): 377–400.

Brown, R. 1973. *A First Language: The Early Stages.* Cambridge, MA.: Harvard University Press.

Büring, D. 2004. Crossover situations. *Natural Language Semantics 12*(1): 23–62.

Carlson, G. N. 1977a. *Reference to Kinds in English.* Phd thesis, University of Massachusetts, Amherst, MA.

Carlson, G. N. 1977b. A unified analysis of the English bare plural. *Linguistics and Philosophy 1*(3): 413–457.

Carlson, G. N. 1989. On the semantic composition of English generic sentences. In *Properties, Types and Meaning*, eds. G. Chierchia, B. Partee, and R. Turner, 167–192. Dordrecht: Kluwer Academic Publishers.

Carlson, G. N. and F. J. Pelletier. 1995. *The Generic Book.* Chicago, IL.: The University of Chicago Press.

Champollion, L. 2017. *Parts of a Whole: Distributivity as a Bridge Between Aspect and Measurement.* Oxford: Oxford University Press.

Chierchia, G. 1995. Individual-level predicates as inherent generics. In *The Generic Book*, eds. G. N. Carlson and F. J. Pelletier, 176–223. Chicago, IL.: Chicago University Press.

Chierchia, G. 1998. Reference to kinds across language. *Natural Language Semantics 6*(4): 339–405.

Chierchia, G. 2006. Broaden your views: Implicatures of domain widening and the "logicality" of language. *Linguistic Inquiry 37*(4): 535–590.

Chierchia, G. 2013. *Logic in Grammar: Polarity, Free Choice, and Intervention.* Oxford: Oxford University Press.

Chomsky, N. 1975. *The Logical Structure of Linguistic Theory.* New York: Plenum.

Chomsky, N. 1981. *Lectures on Government and Binding: The Pisa Lectures.* Dordrecht: Foris.

Chomsky, N. 1986. *Knowledge of Language: Its Nature, Origin, and Use.* New York: Praeger.

Chomsky, N. 1995. *The Minimalist Program.* Cambridge, MA.: MIT Press.

Cimpian, A. and E. M. Markman. 2008. Preschool children's use of cues to generic meaning. *Cognition 107*(1): 19–53.

Cohen, A. 1995. Generics and frequency adverbs as probability judgments. In *Proceedings of the 10th Amsterdam Colloquium*, eds. P. Dekker and M. Stokhof, 163–182. Amsterdam: ILLC/Department of Philosophy, University of Amsterdam.

Cohen, A. 1996. *Think Generic: The Meaning and Use of Generic Sentences.* Phd dissertation, Carnegie Mellon University, Pittsburgh, PA.

Cohen, A. 1997. Default reasoning and generics. *Computational Intelligence 13*(4): 506–533.

Cohen, A. 1999a. Generics, frequency adverbs, and probability. *Linguistics and Philosophy 22*(3): 221–253.

Cohen, A. 1999b. *Think Generic!: The Meaning and Use of Generic Sentences.* Cambridge: Cambridge University Press.

Cohen, A. 2004. Generics and mental representations. *Linguistics and Philosophy 27*(5): 529–556.

Cohen, A. 2007. The information structure of bare plurals in English and Italian. In *On Information Structure, Meaning, and Form*, eds. K. Schuwabe and S. Winkler, 509–521. Amsterdam: John Benjamins Publishing.

Cohen, A. 2013. No quantification without reinterpretation. In *Genericity*, eds. A. Mari, C. Beyssade, and F. del Prete, 334–351. Oxford: Oxford University Press.

Comrie, B. 1976. *Aspect: An Introduction to the Study of Verbal Aspect and Related Problems*. Cambridge: Cambridge University Press.

Cresswell, M. J. 1990. *Entities and Indices*. Number 41 in Studies in Linguistics and Philosophy. Dordrecht: Springer Netherlands.

Cromer, R. F. 1968. *The Development of Temporal Reference During the Acquisition of Language*. Phd thesis, Harvard University, Cambridge, MA.

Dahl, Ö. 1975. On generics. In *Formal Semantics of Natural Language*, ed. E. Keenan, 99–111. Cambridge: Cambridge University Press.

Dahl, Ö. 1995. The marking of the episodic generic distinction in tense–aspect systems. In *The Generic Book*, eds. G. N. Carlson and F. J. Pelletier, 412–425. Chicago, IL: Chicago University Press.

Dayal, V. 1992. The singular-plural distinction in Hindi generics. *Semantics and Linguistic Theory 2*(0): 39–58.

Dayal, V. 1999. Bare NPs, reference to kinds, and incorporation. In *Proceedings from Semantics and Linguistics Theory 9*, eds. T. Matthews and D. Strolovitch, 34–51. Ithaca, NY.: Cornell University Press.

Dekker, P. 2004. Cases, adverbs, sitautions, and events. In *Context Dependence in the Analysis of Linguistic Meaning*, eds. H. Kamp and B. Partee, 383–404. Amsterdam: Elsevier.

Delgrande, J. P. 1987a. An approach to default reasoning based on a first-order conditional logic. *AAAI-87 Proceedings*.

Delgrande, J. P. 1987b. A first-order conditional logic for prototypical properties. *Artificial Intelligence* 33: 105–130.

Diesing, M. 1992. *Indefinites*. Cambridge, MA: MIT Press.

Drewery, A. 1998. *Generics, Laws and Context*. Phd dissertation, Univeristy of Edinburgh, Edinburgh.

Eckardt, R. 2000. Normal objects, normal worlds and the meaning of generic sentences. *Journal of Semantics* 16: 237–278.

Elbourne, P. 2005. *Situations and Individuals*. Cambridge, MA.: The MIT Press.

Elbourne, P. 2013. *Definite Descriptions*. Oxford: Oxford University Press.

Elbourne, P. 2016. Incomplete descriptions and indistinguishable participants. *Natural Language Semantics 24*(1): 1–43.

Farkas, D. F. and Y. Sugioka. 1983. Restrictive If/When Clauses. *Linguistics and Philosophy 6*(2): 225–258.

Farkas, D. F. and H. de Swart. 2010. The semantics and pragmatics of plurals. *Semantics & Pragmatics* 3: 1–54.

Fine, K. 1985. *Reasoning with Arbitrary Objects*. Oxford: Blackwell.

Fine, K. 2012. Counterfactuals without possible worlds. *The Journal of Philosophy 109*(3): 221–246.

von Fintel, K. 1994. *Restrictions on Quantifier Domains.* Phd thesis, University of Massachusetts, Amherst.

von Fintel, K. 1997. Bare plurals, bare conditionals and *only*. *Journal of Semantics* 14: 1–56.

von Fintel, K. 2001. Counterfactuals in a dynamic context. In *Ken Hale: A Life in Language*, ed. M. Kenstowicz, 123–152. Cambridge, MA.: MIT Press.

von Fintel, K. 2004a. A minimal theory of adverbial quantification. In *Context Dependence in the Analysis of Linguistic Meaning*, eds. B. Partee and H. Kamp, Volume 11 of *Current Research in the Semantics/Pragmatics Interface*, 137–175. Elsevier.

von Fintel, K. 2004b. Would you believe it? The King of France is back! (Presuppositions and truth-value intuitions). In *Descriptions and Beyond*, eds. M. Reimer and A. Bezuidenhout, 315–341. Oxford: Clarendon Press.

Fletcher, P. 1979. The development of the verb phrase. In *Language Acquisition*, eds. P. Fletcher and M. Garman. Cambridge: Cambridge University Press.

Fodor, J. 1970. *The Linguistic Description of Opaque Contexts.* Phd thesis, MIT, Cambridge, MA.

Fox, D. 2007. Free choice and the theory of scalar implicatures. In *Presupposition and Implicature in Compositional Semantics*, eds. U. Sauerland and P. Stateva, Palgrave Studies in Pragmatics, Language and Cognition, 71–120. London: Palgrave Macmillan.

van Fraassen, B. 1974. Hidden variables in conditional logic. *Theoria* 40: 176–190.

Gelman, S. A. 2010. Generics as a window onto young children's concepts. In *Kinds, Things, and Stuff: Mass Terms and Generics*, 100–120. Oxford: Oxford University Press.

Gelman, S. A., P. J. Goetz, B. W. Sarnecka, and J. Flukes. 2008. Generic language in parent–child conversations. *Language Learning and Development 4*(1): 1–31.

Gelman, S. A., S.-J. Leslie, A. M. Was, and C. M. Koch. 2015. Children's interpretations of general quantifiers, specific quantifiers, and generics. *Language, cognition and neuroscience 30*(4): 448–461.

Gelman, S. A. and L. Raman. 2003. Preschool children use linguistic form class and pragmatic cues to interpret generics. *Child Development 74*(1): 308–325.

Gerhardt, J. 1988. From discourse to semantics: The development of verb morphology and forms of self-reference in the speech of a two-year-old. *Journal of Child Language 15*(2): 337–393.

Gerstner, C. and M. Krifka. 1993. Genericity. In *Handbuch Der Syntax*, eds. J. Jacobs, A. von Stechow, W. Sternefeld, and T. Vennemann, 966–978. Berlin: De Gruyter.

Geurts, B. 1985. Generics. *Journal of Semantics* 4: 247–255.

Geurts, B. 2010. *Quantity Implicatures.* Cambridge: Cambridge University Press.

Gillies, A. S. 2007. Counterfactual scorekeeping. *Linguistics and Philosophy* 30: 329–360.

Gotham, M. 2015. *Copredication, Quantification and Individuation.* Phd thesis, UCL, London.

Graham, S. A., C. S. Kilbreath, and A. N. Welder. 2001. Words and shape similarity guide 13-month-olds' inferences about nonobvious object properties. In *Proceedings of the Twenty Third Annual Conference of the Cognitive Science Society*, eds. J. D. Moore and K. Stenning, 352–357. Hillsdale, NJ.: Erlbaum.

Greenberg, Y. 2004. *Manifestations of Genericity.* New York, NY.: Routledge.

Greenberg, Y. 2007. Exceptions to generics: Where vagueness, context dependence and modality interact. *Journal of Semantics* 24: 131–167.

Grice, H. P. 1975. Logic and conversation. In *Syntax and Semantics, 3: Speech Acts*, eds. P. Cole and J. L. Morgan, 41–58. New York, NY.: Academic Press.

Groenendijk, J. and M. Stokhof. 1991. Dynamic predicate logic. *Linguistics and Philosophy 14*(1): 39–100.

Guasti, M. T. 2002. *Language Acquisition: The Growth of Grammar.* Cambridge, MA.: MIT Press.

Hamblin, C. L. 1973. Questions in Montague English. *Foundations of Language 10*(1): 41–53.

Harner, L. 1982. Talking about the past and the future. In *The Developmental Psychology of Time*, ed. W. J. Friedman. New York: New York Academic Press.

Haslanger, S. 2011. Ideology, generics, and common ground. In *Feminist Metaphysics*, ed. C. Witt, 179–207. Springer Netherlands.

Haslanger, S. 2014. The normal, the natural and the good: Generics and ideology. *Politica & Società* 3: 365–392.

Heim, I. 1982. *The Semantics of Definite and Indefinite Noun Phrases.* Phd dissertation, University of Massachusetts, Amherst, MA.

Heim, I. 1984. A note on negative polarity and downward entailingness. In *NELS*, Volume 14, 98–107.

Heim, I. 1990. E-type pronouns and donkey anaphora. *Linguistics and Philosophy 13*(2): 137–177.

Heim, I. 1997. Predicates or formulas? Evidence from ellipsis. In *Proceedings from Semantics and Linguistic Theory*, ed. A. Lawson, Volume 7, 197–221. Ithaca, NY.: Cornell University.

Heim, I. 2001. Semantics and morphology of person and logophoricity.

Heim, I. and A. Kratzer. 1998. *Semantics in Generative Grammar.* Oxford: Blackwell Publishers.

Herzberger, H. G. 1979. Counterfactuals and consistency. *The Journal of Philosophy 76*(2): 83–88.

von Heusinger, K. 1997a. Definite descriptions and choice functions. In *Logic, Language and Computation*, ed. S. Akama, Volume 5 of *Applied Logic Series*, 61–91. Dordrecht: Kluwer.

von Heusinger, K. 1997b. *Salienz Und Referenz. Der Epsilonoperator in Der Semantik Der Nominalphrase Und Anaphorischer Pronomen.* Berlin: Akademie-Verlag.

von Heusinger, K. 2004. Choice functions and the anaphoric semantics of definite NPs. *Research on Language and Computation* 2: 309–329.

Hoeltje, M. 2017. Generics and ways of being normal. *Linguistics and Philosophy 40*(2): 101–118.

Hollander, M. A., S. A. Gelman, and J. Star. 2002. Children's interpretation of generic noun phrases. *Developmental Psychology 38*(6): 883–894.

Holst, M. A. 2013. Incomplete descriptions and (reverse) Sobel sequences. *Analysis 73*(1): 26–32.

Horn, L. R. 1972. *On the Semantic Properties of Logical Operators in English.* Phd thesis, University of California, Los Angeles, Los Angeles, CA.

Horn, L. R. 1989. *A Natural History of Negation.* Chicago, IL.: Chicago University Press.

Horn, L. R. 2004. Implicature. In *The Handbook of Pragmatics*, eds. L. R. Horn and G. Ward, 3–28. Oxford: Blackwell.

Hovda, P. 2009. What is classical mereology? *Journal of Philosophical Logic 38*(1): 55–82.

Iwabe, K. 2002. Genericity and homogeneity. *English Linguistics 19*(2): 461–480.

Jesperson, O. 1927. *A Modern English Grammar.* Heidelberg: Carl Winter's Universitätsbuchhandlung.

Kamp, H. 1981. A theory of truth and semantic representation. In *Formal Methods in the Study of Language*, eds. J. Groenendijk, T. M. V. Janssen, and M. Stokhof, Mathematical Centre Tracts 135, 277–322. Amsterdam: Mathematisch Centrum. Also reprinted in *Formal Semantics*: 189–222. (Oxford: Wiley-Blackwell, 2008).

Karttunen, L. 1969. Discourse referents. In *Proceedings of the 1969 Conference on Computational Linguistics*, 1–38. Association for Computational Linguistics.

Katsos, N., C. Cummins, M.-J. Ezeizabarrena, A. Gavarró, J. K. Kraljević, G. Hrzica, K. K. Grohmann, A. Skordi, K. J. de López, L. Sundahl, A. van Hout, B. Hollebrandse, J. Overweg, M. Faber, M. van Koert, N. Smith, M. Vija, S. Zupping, S. Kunnari, T. Morisseau, M. Rusieshvili, K. Yatsushiro, A. Fengler, S. Varlokosta, K. Konstantzou, S. Farby, M. T. Guasti, M. Vernice, R. Okabe, M. Isobe, P. Crosthwaite, Y. Hong, I. Balčiūnienė, Y. M. A. Nizar, H. Grech, D. Gatt, W. N. Cheong, A. Asbjørnsen, J. v. K. Torkildsen, E. Haman, A. Miękisz, N. Gagarina, J. Puzanova, D. Anđelković, M. Savić, S. Jošić, D. Slančová, S. Kapalková, T. Barberán, D. Özge, S. Hassan, C. Y. H. Chan, T. Okubo, H. van der Lely, U. Sauerland, and I. Noveck. 2016. Cross-linguistic patterns in the acquisition of quantifiers. *Proceedings of the National Academy of Sciences 113*(33): 9244–9249.

Klinedinst, N. 2011. Quantified conditionals and conditional excluded middle. *Journal of Semantics* 28: 149–170.

Kobele, G. M. 2008. Across-the-board extraction in Minimalist grammars. In *Proceedings of the Ninth International Workshop on Tree Adjoining Grammar and Related Frameworks (TAG+9)*, 113–120. Tübingen: Association for Computational Linguistics.

Kratzer, A. 1977. What 'must' and 'can' must and can mean. *Linguistics and Philosophy 1*(3): 337–355.

Kratzer, A. 1981. The notional category of modality. In *Words, Worlds, and Contexts. New Approaches in Words Semantics*, eds. H. Eikmeyer and H. Rieser. Berlin: De Gruyter.

Kratzer, A. 1986. Conditionals. In *Proceedings of the Chicago Linguistics Society*, eds. A. Farley, P. Farley, and K. E. McCollough, Volume 22, 115–135. Chicago, IL.: Chicago Linguistics Society.

Kratzer, A. 1989. An investigation of the lumps of thought. *Linguistics and Philosophy 12*(5): 607–653.

Kratzer, A. 1991. Modality. In *Semantics: An International Handbook of Contemporary Research*, 639–650. Berlin: De Gruyter Mouton.

Kratzer, A. 1995. Stage-level and individual-level predicates. In *The Generic Book*, eds. G. N. Carlson and F. J. Pelletier, 125–176. Chicago, IL.: University of Chicago Press.

Kratzer, A. 2012. *Modals and Conditionals.* Oxford: Oxford University Press.

Krifka, M. 1990. Boolean and non-boolean 'and'. In *Papers from the Second Symposium of Logic and Language*, eds. L. Kálmán and L. Pólos, 161–188. Budapest: Akadémiai Kiadó.

Krifka, M. 1995. Focus and the interpretation of generic sentences. In *The Generic Book*, eds. G. N. Carlson and F. J. Pelletier, 238–264. Chicago, IL.: Chicago University Press.

Krifka, M. 1998. The origins of telicity. In *Events and Grammar*, Studies in Linguistics and Philosophy, 197–235. Springer, Dordrecht.

Krifka, M., F. J. Pelletier, A. ter Meulen, G. Chierchia, and G. Link. 1995. Genericity: An introduction. In *The Generic Book*, 1–124. Chicago, IL.: Chicago University Press.

Kuczaj, S. A. and M. P. Maratsos. 1983. Initial verbs of yes-no questions: A different kind of general grammatical category. *Developmental Psychology 19*(3): 440–444.

Landman, F. 1989a. Groups I. *Linguistics and Philosophy 12*(6): 559–605.

Landman, F. 1989b. Groups, II. *Linguistics and Philosophy 12*(6): 723–744.

Landman, F. 2000. *Events and Plurality: The Jerusalem Lectures*. Studies in Linguistics and Philosophy. Springer Netherlands.

Lasersohn, P. 1995. *Plurality, Conjunction and Events*. Studies in Linguistics and Philosophy. Springer Netherlands.

Lasersohn, P. 1989. On the readings of plural noun phrases. *Linguistic Inquiry 20*(1): 130–134.

Lawler, J. M. 1972. Generic to a fault. In *Papers from the Eighth Annual Meeting, Chicago Linguistic Society*. Chicago, IL.: Chicago Linguistics Society.

Lawler, J. M. 1973. *Studies in English Generics*. Number 1 in University of Michigan Papers in Linguistics. Ann Arbor, MI.: University of Michigan.

Lazaridou-Chatzigoga, D., N. Katsos, and L. Stockall. 2015. Genericity is Easy? Formal and Experimental Perspectives. *Ratio 28*(4): 470–494.

Leslie, S.-J. 2007. Generics and the structure of the mind. *Philosophical Perspectives 21*(1): 375–403.

Leslie, S.-J. 2008. Generics: Cognition and acquisition. *The Philosophical Review 117*(1): 1–47.

Leslie, S.-J. 2015. Generics oversimplified. *Noûs 49*(1): 28–54.

Leslie, S.-J. and S. A. Gelman. 2012. Quantified statements are recalled as generics: Evidence from preschool children and adults. *Cognitive Psychology* 64: 186–214.

Levinson, C., S. 2000. *Presumptive Meanings: The Theory of Generalized Conversational Implicature*. Cambridge, MA.: MIT Press.

Lewis, D. 1968. Counterpart theory and quantified modal logic. *The Journal of Philosophy 65*(5): 113–126.

Lewis, D. 1973. *Counterfactuals*. Cambridge, MA: Harvard University Press.

Lewis, D. 1975. Adverbs of quantification. In *Formal Semantics of Natural Language*, ed. E. L. Keenan, 3–15. Cambridge: Cambridge University Press.

Lewis, D. 1979. Scorekeeping in a language game. *Journal of Philosophical Logic 8*(1): 339–359.

Lewis, D. 1986. *On the Plurality of Worlds*. Oxford: Wiley-Blackwell.

Lewis, D. 1996. Elusive knowledge. *Australasian Journal of Philosophy 74*(4): 549–567.

Lewis, K. S. 2018. Counterfactual discourse in context. *Noûs 52*(3): 481–507.

Liebesman, D. 2011. Simple generics. *Noûs 45*(3): 409–442.

Liebesman, D. and O. Magidor. 2017. Copredication and property inheritance. *Philosophical Issues 27*(1): 131–166.

Link, G. 1983. The logical analysis of plurals and mass terms: A lattice-theoretical approach. In *Meaning, Use, and Interpretation of Language*, 303–323. Berlin: Walter De Gruyter & Co.

Link, G. 1998. *Algebraic Semantics in Language and Philosophy*. Stanford, CA.: CSLI Publications.

Lobeck, A. 1995. *Ellipsis*. Oxford: Oxford University Press.

MacWhinney, B. and C. Snow. 1985. The Child Language Data Exchange System. *Journal of Child Language 12*(2): 271–295.

MacWhinney, B. and C. Snow. 1990. The Child Language Data Exchange System: An update. *Journal of Child Language 17*(2): 457–472.

Mari, A., C. Beyssade, and F. del Prete. 2013a. *Genericity*, Volume 43 of *Oxford Studies in Theoretical Linguistics*. Oxford: Oxford University Press.

Mari, A., C. Beyssade, and F. del Prete. 2013b. Introduction. In *Genericity*, eds. A. Mari, C. Beyssade, and F. del Prete, Oxford Studies in Theoretical Linguistics, 1–92. Oxford: Oxford University Press.

McCormack, T. and C. Hoerl. 1999. Memory and temporal perspective: The role of temporal framewokrs in memory development. *Developmental Review* 19: 154–182.

Mills, A. E. 1985. The acquisition of German. In *The Crosslinguistic Study of Language Acquisition*, ed. D. I. Slobin, Volume Volume 1: The Data, 141–254. Hillsdale, NJ.: Lawrence Erlbaum Associates, Publishers.

Moltmann, F. 1995. *Parts and Wholes in Semantics*. Oxford: Oxford University Press.

Moltmann, F. 2013. *Abstract Objects and the Semantics of Natural Language*. Oxford: Oxford University Press.

Montague, R. 1973. The proper treatment of quantification in ordinary English. In *Approaches to Natural Language*, eds. J. Hintikka, J. Moravcsik, and P. Suppes, 221–242. Dordrecht: Kluwer Academic Publishers.

Moss, S. 2012. On the pragmatics of counterfactuals. *Noûs 46*(3): 561–586.

Nickel, B. 2008. Generics and the ways of normality. *Linguistics and Philosophy 31*(6): 629–648.

Nickel, B. 2010a. Generic comparisons. *Journal of Semantics* 27: 207–242.

Nickel, B. 2010b. Generically free choice. *Linguistics and Philosophy* 33: 479–512.

Nickel, B. 2016. *Between Logic and the World: An Integrated Theory of Generics*. Oxford: Oxford University Press.

Oliver, A. and T. Smiley. 2013. *Plural Logic*. Oxford: Oxford University Press.

Partee, B. 1991a. Domains of quantification and semantic typology. In *Proceedings of the 1990 Mid-America Linguistics Conference*, ed. F. Ingeman. University of Kansas.

Partee, B. 1991b. Topic, focus and quantification. *Proceedings of the First Conference on Semantics and Linguistic Theory*: 158–87.

Partee, B. 1995. Quantificational structures and compositionality. In *Quantification in Natural Languages*, eds. E. Bach, E. Jelinek, A. Kratzer, and B. Partee, 541–601. Kluwer Academic Publishers.

Peano, G. 1906. Super theorema de Cantor-Bernstein et additione. *Rivista de matematica* 8: 136–157.

Pelletier, F. J. and N. Asher. 1997. Generics and defaults. In *Handbook of Logic and Language*, 1125–1177. Cambridge, MA.: The MIT Press.

Percus, O. 2000. Constraints on some other variables in syntax. *Natural Language Semantics* 8: 173–229.

Phillips, J. and F. Cushman. 2017. Morality constrains the default representation of what is possible. *Proceedings of the National Academy of Sciences 114*(18): 4649–4654.

Phillips, J. and J. Knobe. 2018. The psychological representation of modality. *Mind & Language 33*(1): 65–94.

Pollock, J. 1976. *Subjunctive Reasoning.* Boston, MA.: D. Reibel Publishing Company.

Prior, A. N. 1967. *Past, Present, and Future.* Oxford: Clarendon Press.

Recanati, F. 1989. The pragmatics of what is said. *Mind & Language 4*(4): 295–329.

Roeper, T., U. Strauss, and B. Z. Pearson. 2006. The acquisition path of the determiner quantifier *every*: Two kinds of spreading. In *Current Issues in First Language Acquisition*, ed. T. Heizmann, Volume 34 of *University of Massachusetts Occassional Papers*, 97–129. Amherst, MA.: Graduate Linguistic Student Association.

Rooth, M. 1985. *Association with Focus.* Phd thesis, University of Massachusetts, Amherst, MA.

Rooth, M. 1995. Indefinites, adverbs of quantification, and focus semantics. In *The Generic Book*, eds. G. N. Carlson and F. J. Pelletier, 265–299. Chicago, IL.: University of Chicago Press.

Sauerland, U. 2014. Counterparts block some 'de re' readings. In *The Art and Craft of Semantics: A Festschrift for Irene Heim*, Volume 2, 65–85.

Scha, R. 1981. Distributive, collective and cumulative quantification. In *Formal Methods in the Study of Language, Part 2*, eds. J. A. G. Groenendijk, Jeroen, T. M. V. Janssen, and M. Stokhof, 483–512. Mathematisch Centrum.

Schein, B. 1986. *Event Logic and the Interpretation of Plurals.* Phd thesis, MIT, Cambridge, MA.

Schein, B. 1993. *Plurals and Events.* Cambridge, MA.: MIT Press.

Schlenker, P. 2004. Conditionals as definite descriptions. *Research on Language and Computation 2*(3): 417–462.

Schlenker, P. 2006. Ontological symmetry in language: A brief manifesto. *Mind & Language 21*(4): 504–539.

Schubert, L. K. and F. J. Pelletier. 1987. Problems in the represetnation of the logical forms of generics, plurals, and mass nouns. In *New Directions in Semantics*, 385–451. London: Academic Press.

Scupin, E. and G. Scupin. 1907. *Bubis Erste Kindheit*, Volume Volume 1. Leipzig: Dürr.

Scupin, E. and G. Scupin. 1910. *Bubis Erste Kindheit*, Volume Volume 2. Leipzig: Dürr.

Shatz, M. and S. A. Wilcox. 1991. Constraints on the acquisition of English modals. In *Perspectives on Language and Thought: Interrelations in Development*, eds. S. A. Gelman and S. A. Wilcox, 319–353. Cambridge: Cambridge University Press.

Shtulman, A. and J. Phillips. 2018. Differentiating "could" from "should": Developmental changes in modal cognition. *Journal of Experimental Child Psychology* 165: 161–182.

Simons, P. 1987. *Parts: A Study in Ontology.* Oxford: Clarendon Press.

Slobin, D. I. 1985. *The Crosslinguistic Study of Language Acquisition*, Volume Volume 1: The Data. Hillsdale, NJ.: Lawrence Erlbaum Associates, Publishers.

Sobel, J. H. 1970. Utilitarianisms: Simple and general. *Inquiry* 13: 394–449.

Spector, B. 2007. Aspects of the pragmatics of plural morphology: On higher-order implicatures. In *Presupposition and Implicature in Compositional Semantics*, eds. U. Sauerland and P. Stateva, Palgrave Studies in Pragmatics, Language and Cognition, 243–281. London: Palgrave Macmillan UK.

Stalnaker, R. 1968. A theory of conditionals. In *Studies in Logical Theory*, ed. N. Rescher, 98–112. Oxford: Oxford University Press.

Stalnaker, R. 1970. Pragmatics. *Synthese 22*(1): 272–289.

Stalnaker, R. 1974. Pragmatic presuppositions. In *Semantics and Philoosphy: Essays*, eds. M. Munitz and P. Unger, 197–213. New York, NY.: New York University Press.

Stalnaker, R. 1975. Indicative conditionals. *Philosophia 5*(3): 269–286.

Stalnaker, R. 1978. Assertion. In *Pragmatics*, ed. P. Cole, 315–332. New York: Academic Press.

Stalnaker, R. 1998. On the representation of context. *Journal of Logic, Language and Information* 7: 3–19.

Stalnaker, R. 2002. Common ground. *Linguistics and Philosophy* 25: 701–721.

Stalnaker, R. and R. H. Thomason. 1970. A semantic analysis of conditional logic. *Theoria 36*(1): 23–42.

Sterken, R. K. 2015a. Generics, content and cognitive bias. *Analytic Philosophy 56*(1): 75–93.

Sterken, R. K. 2015b. Generics in context. *Philosophers' Imprint 15*(21): 1–30.

Sterken, R. K. 2015c. Leslie on generics. *Philosophical Studies 172*(9): 2493–2512.

Sterken, R. K. 2016. Generics, covert structure and Logical Form. *Mind & Language 31*(5): 503–529.

Stone, M. 1997. The anaphoric parallel between modality and tense. Technical Report MS-CIS-97-09, Department of Computer & Information Science Technical Reports, University of Pennsylvania.

Stowell, T. 1978. What there was before there was there. In *Papers from the Fourteenth Regional Meeting, Chicago Linguistics Society*, eds. D. F. Farkas, W. Jacobson, and K. Todrys, Volume 14, 458–471. Chicago, IL.: Chicago Linguistics Society.

Teichman, M. 2015. *Characterizing Kinds: A Semantics for Generic Sentences.* Phd thesis, University of Chicago, Chicago.

Teichman, M. 2016. The sophisticated kind theory. *Inquiry*.

Vaillette, N. 2001. Flexible summativity: A type-logical approach to plural semantics. In *OSU Working Papers in Lingusitics*, Volume 56, 135–157. Columbus, OH.: Ohio State University.

Varzi, A. 2016. Mereology. In *The Stanford Encyclopedia of Philosophy* (Winter 2016 Edition ed.)., ed. E. N. Zalta. Metaphysics Research Lab, Stanford University.

Veltman, F. 1996. Defaults in update semantics. *Journal of Philosophical Logic 25*(3): 221–261.

Wagner, L. and L. Lakusta. 2009. Using language to navigate the infant mind. *Perspectives on Psychological Science: A Journal of the Association for Psychological Science 4*(2): 177–184.

Wagner, L., L. D. Swensen, and L. R. Naigles. 2009. Children's early productivity with verbal morphology. *Cognitive Development 24*(3): 223–239.

Weist, R. M., M. Atanassova, H. Wysocka, and A. Pawlak. 1999. Spatial and temporal systems in child language and thought: A cross-linguistic study. *First Language* 19: 267–311.

Weist, R. M., P. Lyytinen, J. Wysocka, and M. Atanassova. 1997. The interaction of language and thought in children's language acquisition: A crosslinguistic study. *Journal of Child Language 24*(1): 81–121.

Weist, R. M., H. Wysocka, and P. Lyytinen. 1991. A cross-linguistic perspective on the development of temporal systems. *Journal of Child Language 18*(1): 67–92.

Weist, R. M., H. Wysocka, K. Witkowska-Stadnik, E. Buczowska, and E. Konieczna. 1984. The defective tense hypothesis: On the emergence of tense and aspect in child Polish. *Journal of Child Language 11*(2): 347–374.

Wells, G. 1979. Learning and using the auxiliary verb in English. In *Language Development*, ed. V. Lee, 250–270. London: Croom Helm.

Whitehead, A. N. and B. Russell. 1925. *Principia Mathematica* (2nd edition ed.), Volume 1. Cambridge: Cambridge University Press.

Willer, M. 2017. Lessons from Sobel sequences. *Semantics and Pragmatics* 10.

Williams, J. R. G. 2008. Conversation and conditionals. *Philosophical Studies 138*(2): 211–223.

Williams, J. R. G. 2010. Defending Conditional Excluded Middle. *Noûs 44*(4): 650–668.

Winter, Y. 2001. *Flexibility Principles in Boolean Semantics.* Cambridge, MA.: The MIT Press.

Winter, Y. 2002. Atoms and sets: A characterization of semantic number. *Linguistic Inquiry 33*(3): 493–505.

Yalcin, S. 2007. Epistemic modals. *Mind 116*(464): 983–1026.

Yi, B.-U. 2005. The logic and meaning of plurals. Part I. *Journal of Philosophical Logic* 34: 459–506.

Yi, B.-U. 2006. The logic and meaning of plurals. Part II. *Journal of Philosophical Logic 35*(2): 239–288.