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MASTERARBEIT / MASTER'S THESIS

Titel der Masterarbeit / Title of the Master's Thesis

„Quantificational DP arguments of opaque predicates in
German“

verfasst von / submitted by

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angestrebter akademischer Grad / in partial fulfilment of the requirements for the degree of
Master of Arts (MA)

Wien, 2019 / Vienna 2019

Studienkennzahl lt. Studienblatt /
degree programme code as it appears on
the student record sheet:

A 066 867

Studienrichtung lt. Studienblatt /
degree programme as it appears on
the student record sheet:

Allgemeine Linguistik: Grammatiktheorie und kognitive
Sprachwissenschaft

Betreut von / Supervisor:

Univ.-Prof. Dr. Daniel Buring

Acknowledgements

If this thesis contains anything of interest, this is due to the exceptionally nice and productive environment I encountered at the Vienna linguistics department. Over the years, many people have contributed to this environment in different ways.

My supervisor, Daniel Buring, introduced me to formal semantics and always encouraged me to pursue my own interests within the field. His contribution to this work takes many different forms: in addition to many helpful discussions and comments on the content of this thesis, he helped create a great working environment in the department, gave me the time I needed to come up with a suitable topic and something new to say about it, and put up with several abrupt changes of topic.

I might not have written a thesis if it had not been for the many entertaining conversations about practically any topic in linguistics (and beyond linguistics) that I had with Viola Schmitt. Besides providing many helpful comments and literature recommendations, she hired me as a research assistant on the FWF project ‘Conjunction and disjunction from a typological perspective’, which allowed me to focus more on my work in linguistics. I would like to thank her and my colleagues on this project, Enrico Flor, Eva Rosina and Magdalena Roszkowski, for the opportunity to collaborate with them for two and a half years.

This thesis is obviously indebted to the work of Thomas Ede Zimmermann on intensional transitive verbs, which I first encountered in a seminar he taught in Vienna in 2017. In addition to providing me with an intriguing topic to work on, he gave me the opportunity to present an earlier version of this work in Frankfurt, where I received valuable comments and criticism from him, Kristina Liefke, Jan Köpping, Frank Sode and several others. For reasons of time, I could not follow up on all of their suggestions – I hope to be able to do so in future work. Similarly, Magdalena Kaufmann provided many valuable comments and critical remarks on an early version of some of the material presented here, which encouraged me to be more precise about my claims. I also thank the audience of the 20th Szklarska Poręba Workshop on the Roots of Pragmasemantics for their insightful comments on a very confused presentation of parts of this work.

Further, I want to thank my first linguistics teachers, Katharina Hartmann and Martin Prinzhorn. Katharina’s classes in the Department of German Studies were one of the reasons I decided to pursue a degree in linguistics. Martin supported my interest in formal semantics right from the beginning and introduced me to many intriguing topics both within and outside linguistics. This thesis has particularly benefited from a class on ‘Complement Clauses’ which he taught in 2018. I also had the great opportunity to learn from Benjamin Spector and Susi Wurmbrand.

Many of my colleagues have contributed significantly to this thesis by commenting on earlier versions of parts of this work, by providing judgments and discussing confusing examples with me, or simply by motivating me during the writing process: Muriel Assmann, Kübra Atasoy, Enrico Flor, Jovana Gajić, James Gray, Izabela Jordanoska, Eva Rosina, Magdalena Roszkowski, Marcin Wągiel and Valerie Wurm. I am sure there are many more people whose contributions I

forgot to mention.

But there were also many colleagues who helped shape my views and interests within linguistics before I started working on this project. They are probably too many to list, but here, I would especially like to mention Hagen Blix, Simon Huber, Martin Köberl and Anna Kocher.

I would also like to thank Magdalena Roszkowski, Viola Schmitt, Jakob Steixner, Marcin Wągiel, Muriel Assmann, Izabela Jordanoska, Svitlana Antonyuk, Eva Rosina and Max Prüller for putting up with me as an office-mate at various times, which must have been exhausting.

Finally, I want to thank my family for supporting my decision to spend several years of my life on this obscure field of research and for helping me through a difficult situation near the end of the writing process.

I acknowledge the support of the Austrian Science Fund (FWF), project P-29240.

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Chapter 1

Introduction

1.1 Higher-order DPs

This thesis is about German sentences in which opaque predicates combine with certain types of DP complements, such as *etwas* ‘something’ in (1.1). I will focus on three classes of predicates: **intensional transitive verbs (ITV)** like *suchen* ‘look for’ (1.2-a) which, on their ‘unspecific’ readings, take DP complements that are thought to denote quantifiers (Montague 1974) or properties (Zimmermann 1993); **attitude predicates**, which usually combine with declarative, proposition-denoting complement clauses (1.2-b); and **question-embedding predicates**, which usually take interrogative complement clauses (1.2-c).

- (1.1) a. *Der Hans sucht etwas.*
the Hans seeks something
‘Hans is looking for something.’
b. *Der Hans glaubt etwas.*
the Hans believes something
‘Hans believes something.’
c. *Dem Hans ist etwas unklar.*
the.DAT Hans is something unclear
‘Something is unclear to Hans.’
- (1.2) a. *Der Hans sucht ein Einhorn.*
the Hans seeks a unicorn
‘Hans is looking for a unicorn.’
b. *Der Hans glaubt, dass es regnet.*
the Hans believes that it rains
‘Hans believes it is raining.’
c. *Dem Hans ist unklar, wer morgen kommt.*
the.DAT Hans is unclear who tomorrow comes
‘It is unclear to Hans who will come tomorrow.’

In recent linguistic studies that rely on some version of possible-worlds semantics, the denotations assigned to the complements of opaque predicates are typically sets or set-valued functions of some kind. For instance, the complement clause in (1.2-b) is thought to denote a set of possible worlds (or a partial function from possible worlds to truth values); the denotation of the complement in (1.2-a), on a property analysis of ITV, can be modeled as a function from possible

worlds to sets of individuals; and interrogative clauses have been analyzed as denoting functions from possible worlds to propositions (Groenendijk & Stokhof 1984) or to sets of propositions (e.g. Hamblin 1973, Karttunen 1977).

The phenomenon I am interested in here is that there are certain DPs that systematically occur as arguments of all three classes of opaque predicates. Besides *etwas* ‘something’, this class includes DPs lacking a lexical noun such as *alles* ‘everything’ or *dasselbe* ‘the same thing(s)’, the pro-form *das* ‘that’, free relatives with *wh*-pronouns and also DPs with certain lexical nouns, such as *Ding* or *Sache* ‘thing’. Some more examples are given in (1.3)-(1.5).

- (1.3) a. *Der Hans sucht **alles**, was auf der Liste steht.*
the Hans seeks everything REL on the list stands
‘Hans is looking for everything on the list.’
b. *Der Hans und die Maria suchen **dasselbe**.*
the Hans and the Maria seek the.same
‘Hans and Maria are looking for the same thing(s).’
c. *Der Hans sucht **das** auch.*
the Hans seeks that also
‘Hans is looking for that, too.’
d. *Der Hans sucht, **was die Maria sucht**.*
the Hans seeks REL the Maria seeks
‘Hans is looking for the thing(s) Maria is looking for.’
e. *Der Hans sucht **zwei Dinge/Sachen**.*
the Hans seeks two things
‘Hans is looking for two things.’
- (1.4) a. *Der Hans glaubt **alles**, was der Peter sagt.*
the Hans believes everything REL the Peter says
‘Hans believes everything Peter says.’
b. *Der Hans und die Maria glauben **dasselbe**.*
the Hans and the Maria believe the.same
‘Hans and Maria believe the same thing(s).’
c. *Der Hans glaubt **das** auch.*
the Hans believes that also
‘Hans believes that, too.’
d. *Der Hans glaubt, **was die Maria glaubt**.*
the Hans believes REL the Maria believes
‘Hans believes what Maria believes.’
e. *Der Hans glaubt **zwei Dinge/Sachen**.*
the Hans believes two things
‘Hans believes two things.’
- (1.5) a. *Dem Hans ist **alles** unklar, was der Peter sagt.*
the.DAT Hans is everything unclear REL the Peter says
‘Everything Peter says is unclear to Hans.’
b. *Dem Hans und der Maria ist **dasselbe** unklar.*
the.DAT Hans and the.DAT Maria is the.same unclear
‘The same thing is/the same things are unclear to Hans and Maria.’
c. *Dem Hans ist **das** auch unklar.*
the.DAT Hans is that also unclear
‘That is unclear to Hans, too.’

- d. *Dem Hans ist unklar, was auch der Maria unklar ist.*
the.DAT Hans is unclear REL also the.DAT Maria unclear is
‘The things that are unclear to Hans are also unclear to Maria.’
- e. *Dem Hans sind zwei Dinge/Sachen unklar.*
the.DAT Hans are two things unclear
‘Two things are unclear to Hans.’

The observation that these DPs systematically combine with predicates that select for several different intensional types appears to show that there is more to the semantics of DPs than just reference to individuals or quantification over individuals. Taken at face value, such data suggest that DPs can quantify over (or, in the case of the pro-form *das*, denote) all kinds of semantic objects that opaque predicates combine with in canonical examples like (1.2). If so, the DPs in (1.3) would be quantifiers over properties or pro-forms denoting properties; the DPs in (1.4) would be quantifiers over propositions or pro-forms denoting propositions; and the DPs in (1.5) would quantify over, or in the case of (1.5-c) denote, question meanings (in this thesis, I will use the term **semantic questions** as a theory-neutral way of referring to the denotations of questions).

More generally, examples like (1.3)-(1.5) suggest a naive hypothesis about the interpretation of the DPs under discussion: It seems that, whenever they occur as arguments of a verb or some other lexical predicate, such as the adjective *unklar*, these DPs denote (in the case of pro-forms like *das*) or quantify over (in the case of the other DPs shown above) semantic objects of the argument type required by the predicate. For instance, the quantificational DPs in (1.4) quantify over propositions, since the verb requires a proposition argument.

If this naive hypothesis is correct, natural languages have a relatively simple way of expressing higher-order quantification – quantification over sets or set-valued functions. This raises the question whether the potential to express higher-order quantification is a property of DP semantics in general or whether there are grammatical restrictions on the DPs that can occur in configurations like (1.3)-(1.5). As we will see in Chapter 2, the pattern in (1.3)-(1.5) is restricted to a small subclass of DPs which I will call **higher-order DPs**, to distinguish them from **ordinary DPs** that do not exhibit the same amount of type-flexibility. With the exception of a small number of nouns such as *Ding* and *Sache* ‘thing’, DPs with lexical head nouns are usually not higher-order DPs. The three opaque predicates I used in the previous examples can take DP complements with lexical head nouns as well (1.6), but a closer look at examples of this kind will show that the DPs in (1.3)-(1.5) are ‘special’ in that they exhibit more type-flexibility than the ordinary DPs in (1.6).

- (1.6) a. *Der Hans sucht ein Buch.*
the Hans seeks a book
‘Hans is looking for a book.’
- b. *Der Hans glaubt Marias Behauptung.*
the Hans believes Maria’s claim
‘Hans believes Maria’s claim.’
- c. *Dem Hans ist die Abfahrtszeit unklar.*
the.DAT Hans is the departure.time unclear
‘Hans is unsure about the departure time.’

The distinction between ordinary and higher-order DPs is not new – for instance, the English counterparts of the DPs in (1.3)-(1.5) are called ‘special quantifiers’ and ‘special pro-forms’ in Moltmann (2008, 2013) and ‘propositional DPs’ in Elliott (2017).¹ However, it is controversial whether this distinction should be expressed in type-theoretic terms: In several recent works, the claim that natural languages allow for quantification over sets or set-valued functions is explicitly rejected. Apparent instances of higher-order quantification are then reanalyzed as quantification over semantic objects thought to be primitive, such as kinds or eventualities. For instance, Landman (2006) argues that several constructions in English that appear to involve variables of ‘higher types’, such as properties, can actually be shown to involve variables ranging over kinds of individuals or of events. While Landman does not discuss examples like (1.3)-(1.5) in any detail, such data are at the center of Moltmann’s (2013) study, which makes a distinct, but closely related claim. According to Moltmann, many cases of apparent quantification over abstract objects like sets or functions actually involve quantification over objects she assumes to be concrete, such as kinds. For instance, examples like (1.4) are claimed to involve quantification over ‘attitudinal objects’, which can be thought of as something akin to mental states, and examples like (1.3) are claimed to involve quantification over kinds of situations rather than properties.

In this study, I will not attempt to contribute to this ontological debate. Rather, I will concentrate on two descriptive linguistic questions that arise regardless of whether or not the elements of the quantificational domains of higher-order DPs are conceived of as primitives. The first question was already mentioned above: How general are the linguistic parallels between higher-order DPs and the ‘canonical’ arguments of opaque predicates that we see in examples like (1.2), and are there any contrasts between examples like (1.3)-(1.5) and examples like (1.6) that might show that DPs form a semantically heterogeneous class? The second question relates more directly to the truth conditions of examples like (1.3)-(1.5). All three of the classes of opaque predicates under discussion take their arguments from a domain that is structured by some kind of entailment relation. Quantifiers ranging over a set with this property give rise to an individuation problem: Can two denotations p and q such that p asymmetrically entails q count as separate elements of the quantificational domain? For instance, if we quantify over propositions some individual believes, do $\llbracket \text{John left} \rrbracket$ and $\llbracket \text{John and Mary left} \rrbracket$ ever count as distinct beliefs? In Chapters 3 and 4, we will see that the quantificational domains of higher-order DPs are subject to non-trivial, partly context-dependent restrictions that exclude many, but not all cases of entailment relations between elements of the domain.

Note that the individuation problem at issue here cannot be circumvented by simply denying that DP objects of attitude verbs literally quantify over propositions. Even if their domain actually consists of primitives of the given semantic theory, such as belief states or Moltmann’s ‘attitudinal objects’, these entities have to be associated with propositional content, which means that we can define entailment relations between them. Therefore, while such approaches do not

¹My main reason for not adopting Moltmann’s terminology is that I wanted to have a single term that covers quantificational and non-quantificational DPs. Elliott’s term ‘propositional DPs’, on the other hand, seems too narrow given data like (1.3) and (1.5), where the predicate does not seem to combine with propositions.

literally face the question under which conditions $\llbracket \textit{John left} \rrbracket$ and $\llbracket \textit{John and Mary left} \rrbracket$ can be in the domain of a higher-order DP at the same time, they give rise to the analogous question under which conditions a higher-order DP can quantify over a domain that includes, say, $\llbracket \textit{Peter's belief that John left} \rrbracket$ and $\llbracket \textit{Peter's belief that John and Mary left} \rrbracket$. So the empirical issue I am interested in is largely independent from the ontological questions about quantification over derived types or ‘abstract objects’.

In this thesis, I will therefore take the ‘naive’ view that higher-order DPs directly quantify over elements of the derived semantic categories selected by opaque predicates, such as properties, propositions or semantic questions, as my starting point. In the remainder of this introduction, I will first give a short preview of the empirical claims I will defend and their theoretical consequences (Section 1.2). Then, in Section 1.3, I will introduce the theoretical assumptions about the syntax and semantics of DPs that form the background for the main part of the thesis.

1.2 Main claims and structure of the thesis

Chapter 2: The category/type correspondence Taking the seemingly cross-categorical nature of expressions like *etwas* ‘something’, *zwei Sachen* ‘two things’ and *dasselbe* ‘the same thing(s)’ as my starting point, I will first address the question whether this cross-categorical behavior is a property of DP semantics in general. Based on arguments taken from the literature on English, as well as new data from German that involve unspecific readings of ITV, I will show that it is in fact characteristic of a small, circumscribed class of higher-order DPs, which excludes most DPs with lexical head nouns. If so, the category DP forms a semantically heterogeneous class that does not correspond to any unique set of semantic types. While ordinary DPs do exhibit a certain amount of type-flexibility, I will argue that this is the result of type-shifting operations that apply to a basic meaning of type $\langle\langle e, t \rangle, t \rangle$. Higher-order DPs, in contrast, can have basic meanings of type $\langle\langle \tau, t \rangle, t \rangle$ for any type τ that is selected as an argument type by a lexical predicate. They can therefore appear in the object positions of opaque predicates without any recourse to type-shifting.

The behavior of intensional transitive verbs like *look for* provides an interesting test case for this distinction: While ordinary DP objects of such verbs, like *a unicorn* in (1.7-a), are usually analyzed as denoting quantifiers over individuals or properties of individuals, Zimmermann (1993) argues that examples like (1.7-b) have a reading on which the indefinite denotes a quantifier over properties. More recently, however, Zimmermann (2006) has defended an analysis on which all unspecific objects of ITV quantify over properties – including the ordinary DP in (1.7-a).

- (1.7) a. *John is looking for a unicorn.*
 b. *John is looking for something Mary is looking for.*

In Section 2.2 of this thesis, I will argue that there are systematic semantic differences between ordinary DPs like *a unicorn* in (1.7-a) and higher-order DPs like *something Mary is looking for* in (1.7-b). While Zimmermann’s (2006) analysis, which assigns a uniform type to all unspecific indefinites, does not predict these differences, they would easily fall out from a type distinction

between ordinary and higher-order DPs. This data pattern therefore supports an analysis that maintains the type distinction.

Chapter 3: The monotonicity puzzle An analysis of ITV that assigns distinct types to the object DPs in (1.7-a) and (1.7-b) has to face Zimmermann’s (2006) reasons for rejecting this distinction. In Chapters 3 and 4 of this thesis, I will therefore sketch the beginnings of an alternative approach to the data that motivated his proposal.

Zimmermann’s argument is based on a semantic puzzle raised by examples like (1.7-b), which I will call the **monotonicity puzzle**. The basic problem is this: ITV like *look for* are commonly analyzed as **upward-monotonic** – in other words, they license inferences from logically stronger to logically weaker properties. For instance, (1.8), on its unspecific reading, seems to entail (1.7-a).

(1.8) *John is looking for a pink unicorn.*

Zimmermann points out that, if the ability to license such inferences is part of the lexical meaning of *look for*, the truth conditions predicted for sentences like (1.9-c) are too weak. For instance, (1.9-a) and (1.9-b) would be predicted to jointly entail (1.9-c), for the following reason: Assume that P is some property that is weaker than the property of being a sweater, and also weaker than the property of being a bottle of wine. Possible choices for P include the property $\lambda w.\lambda x.\text{sweater}(w)(x) \vee \text{bottle-of-wine}(w)(x)$ or the property of being a concrete object. Then, if *look for* is analyzed as upward-monotonic, (1.9-a) entails that John is looking for a P and (1.9-b) entails that Mary is looking for a P . Therefore, if P is in the quantificational domain of *something* in (1.9-c), we predict (1.9-c) to follow from (1.9-a) and (1.9-b), contrary to intuition.

- (1.9) a. *John is looking for a sweater.*
 b. *Mary is looking for a bottle of wine.*
 c. *John is looking for something Mary is looking for.*

In order to avoid this problem, Zimmermann (2006) rejects the assumption that monotonicity is part of the lexical semantics of the verb. In effect, he proposes that ordinary DPs and higher-order DPs differ in their monotonicity properties: The inference from (1.8) to (1.7-a) is valid by virtue of the meanings of the ordinary indefinites, while the higher-order indefinite in (1.9-c) has a different semantics that does not license analogous inferences.

Zimmermann’s implementation of this distinction requires a unified semantic type for ordinary and higher-order DPs, which makes it incompatible with the type distinction between the two classes of DPs that I will propose in Chapter 2. To maintain this distinction, we therefore need an alternative analysis of the monotonicity puzzle. In Chapters 3 and 4 of this thesis, I will sketch an approach to this puzzle that attributes the invalidity of inferences like (1.9) to the meanings of higher-order DPs, but is compatible with the assumption that monotonicity properties are part of the lexical meanings of opaque predicates. While this approach is compatible with established analyses of opaque verbs and ordinary DPs, the semantics I will ultimately propose for higher-order DPs is highly nonstandard. In Chapter 3, I will therefore motivate this

semantics in several steps.

First, I will show that the problem is not restricted to ITV, but extends to several other classes of opaque predicates (Section 3.1). The remainder of the thesis will concentrate on higher-order DP objects of proposition-embedding predicates. In Section 3.2, I present an initial generalization about the quantificational domains of such DPs: The domain consists of propositions that partially answer a contextually provided question. For instance, in the German sentence (1.10), the domain of quantification associated with *etwas* will be a subset of the partial answers to the question who will come to dinner.

- (1.10) *Zur Frage, wer heute zum Essen kommt, glaubt der Hans etwas, das*
to.the question who today to.the dinner comes believes the Hans something REL
auch die Maria glaubt.
also the Maria believes
'As for the question who will come to dinner tonight, Hans believes something Maria
also believes.'

Data like (1.10), which are not studied systematically in earlier linguistic works on higher-order DPs, allow us to investigate the truth-conditional contribution of higher-order DPs in a more precise manner, since they give us more control over the values of the relevant contextual parameters. In Section 3.3, I will use examples of this kind to motivate a new generalization about the truth conditions of sentences with higher-order indefinite objects of *glauben* 'believe'.

Chapters 4-5: Competing analyses of the monotonicity puzzle In Chapter 4, I provide a preliminary analysis of sentences like (1.10) that involves a more restrictive semantics for the DP than usually assumed. Higher-order indefinites are analyzed as non-monotonic operators, which accounts for the invalidity of inferences like (1.9). More specifically, I argue that the quantificational domain of such DPs depends on what I call a '**canonical subquestion decomposition**' of the contextually provided question, which is computed on the basis of the restrictor and the nuclear scope of the determiner. The DP ranges only over those propositions that answer a subquestion in the decomposition. This allows us to exclude certain weak propositions from the quantificational domain in a principled way. Chapter 4 also provides independent motivation for the view that canonical subquestion decompositions play a role in the semantics of DPs.

In Chapter 5, I discuss Zimmermann's (2006) analysis of the puzzle in more detail. I show how it can be extended to proposition-embedding verbs and how it can account for the context-dependent aspects of the semantics of sentences like (1.10). Further, I discuss potential arguments in favor of a DP-based approach of the kind presented in Chapter 4. Finally, Chapter 6 concludes the thesis and briefly discusses a few open problems raised by the DP-based approach.

1.3 Background assumptions

In this section, I will first summarize my general assumptions about semantic composition and the syntax-semantics interface. I will then give a preliminary syntax and semantics for certain subclasses of higher-order DPs, using cross-categorical schemata to describe the semantic

contribution of determiners and of the other functional elements within the DP.

1.3.1 The semantic framework

The interpretation function In line with mainstream assumptions in syntax (cf. e.g. [Chomsky 1981](#)), I will assume that semantic interpretation applies to a syntactic level of Logical Form (LF), derived from a structure that forms the input for morphological and phonological spell-out. I further assume that there is no additional semantic representation that mediates between syntactic LFs and the model theory. In particular, while the metalanguage I will use to describe the denotations of natural language expressions will be enriched by expressions of a logical language, more specifically typed λ -terms, these logical expressions do not form a separate, grammatically relevant level of representation. For simplicity, I will occasionally also use English, enriched with typed λ -terms, as the metalanguage. Connectives and quantifiers occurring in the λ -terms are meant to have their classical interpretation.

For any variable assignment g and any utterance context $\mathbf{c}$, the interpretation function $\llbracket \cdot \rrbracket^{g,\mathbf{c}}$ will be a partial function that maps the Logical Forms of object-language expressions to their intensions relative to g and $\mathbf{c}$. So, the intension of an expression α relative to $\mathbf{c}$ and g will be written as $\llbracket \alpha \rrbracket^{g,\mathbf{c}}$; I will omit the parameters g and $\mathbf{c}$ in case the intension does not depend on them. In case of a presupposition failure, it might be the case that α is not in the domain of $\llbracket \cdot \rrbracket^{g,\mathbf{c}}$, in which case $\llbracket \alpha \rrbracket^{g,\mathbf{c}}$ is undefined.

Notational conventions For the most part, I will use italic letters ($x, y, z, \dots, P, Q, \dots, p, q, \dots$) for metalanguage variables; metalanguage constants will be written in boldface (**a**, **b**, **c**, $\dots$, **book**, **find**, $\dots$) if they are meant to be counterparts of object-language expressions that are not analyzed further, and in small caps (**PA**, **DOX**, $\dots$) if they are not direct counterparts of a salient object-language expression. The first occurrence of a variable in a λ -term will usually have a subscript indicating the semantic type of the variable, unless the type is obvious from the context. In general, the functions characterized by λ -terms may be partial; following [Heim & Kratzer \(1998\)](#), I will write $\lambda x : \phi. \psi$ to denote a function that is defined for an argument x only if the condition ϕ is met, and yields the value described by ψ when it is defined.

Semantic domains and type theory I use a type-theoretic semantics with the three basic types e (individuals), t (truth values) and s (possible worlds). When I speak of an ‘expression of type τ ’, this is intended to mean that the expression has extensions of type τ and an intension of type $\langle s, \tau \rangle$. Thus, declarative sentences are expressions of type t , but their intensions are of type $\langle s, t \rangle$. The interpretation function $\llbracket \cdot \rrbracket^{g,\mathbf{c}}$ therefore maps every expression of type τ in its domain to an element of $D_{\langle s, \tau \rangle}$.

I will assume the composition rules from [Heim & Kratzer \(1998\)](#), but make two linguistically significant changes to their system. First, while I will follow them in assuming that pronouns and traces bear an index and receive their semantic values from the variable assignment, I need a system that allows for pro-forms and traces of higher types. To implement this, I will take the

indices on pronouns and traces to be pairs of a natural number and a type (an idea suggested, but ultimately not adopted, in Heim & Kratzer 1998:213).²

The second major deviation from Heim & Kratzer (1998) concerns plural semantics. In order to be able to give a uniform semantics for numerals that works for ordinary as well as higher-order DPs, I will assume, following Schmitt (2017), that every semantic domain D_τ is equipped with a ‘sum’ operation $\oplus_\tau$ which forms **pluralities**. This means that $D_{\langle s, et \rangle}$ contains pluralities of properties such as $\llbracket \text{smoke} \rrbracket \oplus \llbracket \text{drink} \rrbracket$ in addition to ‘atomic’ properties like $\llbracket \text{drink} \rrbracket$, $D_{\langle s, t \rangle}$ contains pluralities of propositions such as $\llbracket \text{John smokes} \rrbracket \oplus \llbracket \text{John drinks} \rrbracket$ in addition to ‘atomic’ propositions, and so on. Pluralities of a semantic type τ will stand in a one-to-one correspondence with nonempty sets of the atomic (non-plural) elements of D_τ . For instance, the predicate plurality $\llbracket \text{smoke} \rrbracket \oplus \llbracket \text{drink} \rrbracket$ corresponds to the set of its atomic parts, $\{\llbracket \text{smoke} \rrbracket, \llbracket \text{drink} \rrbracket\}$. For any domain D_τ , the operation $\oplus_\tau$ will be isomorphic to the union of nonempty sets of atomic meanings from D_τ . However, pluralities must be distinct from such sets since they will be treated as elements of D_τ , not of $D_{\langle \tau, t \rangle}$, by the composition rules. For any $x, y \in D_\tau$, I will write $x \oplus y$ to denote the sum $\oplus_\tau(\{x, y\})$, and $x \leq_a y$ to express that x is an atomic part of y , i.e. the sum y corresponds to a set of atomic meanings that contains x .³

Resolving type mismatches In case the surface-syntactic structure of an expression is uninterpretable due to a type mismatch, I will assume that there are two ways of resolving this mismatch at LF. The first option is **Quantifier Raising** (QR): If there is a type mismatch between a generalized quantifier – an expression with a semantic type of the form $\langle \langle \tau, t \rangle, t \rangle$ – and its sister, the quantifier may move and adjoin to a dominating node. Following Heim & Kratzer (1998), I will further assume that in this case, the trace of the quantifier is indexed with a pair of the form (i, τ) (for some previously unused natural number i) and the same index is adjoined

²The rules and definitions necessary to implement this more formally are given in (i):

- (i)
 - a. An index is a pair (i, τ) , where i is a natural number and τ a semantic type.
 - b. A variable assignment is a partial function g from the set of indices to the set of all denotations such that, for every $(i, \tau) \in \text{dom}(g)$, $g(i, \tau) \in D_\tau$. (adapted from Heim & Kratzer 1998:213, (v))
 - c. If α is a trace or pro-form, and i and τ are a number and a type respectively, then, for any assignment g , $\llbracket \alpha_{(i, \tau)} \rrbracket^g = g(i, \tau)$. (adapted from Heim & Kratzer 1998:213, (vi))
 - d. If α is a branching node with daughters β and γ , where β (apart from vacuous material) dominates only an index (i, τ) , then for any assignment g : $\llbracket \alpha \rrbracket^g = \lambda x \in D_\tau. \llbracket \gamma \rrbracket^{g[x/(i, \tau)]}$. (adapted from Heim & Kratzer 1998:213, (vii))

³A formal definition of the semantic domains needed for a cross-categorial plural semantics of this kind is given in (i). Clause (i-c) says that the sum operation on D_τ is isomorphic to the union of nonempty sets of atomic meanings from A_τ . Clause (i-e) ensures that pluralities are not identified with such sets.

- (i) Let A be the (nonempty) set of atomic individuals and let W be the (nonempty) set of possible worlds. For each type τ , there is an **atomic domain** A_τ and a **full domain** D_τ with the following properties:
 - a. $A_e = A$, the set of individuals; $A_t = \{0, 1\}$; $A_s = W$
 - b. D_τ is a set such that $A_\tau \subseteq D_\tau$ and there is an operation $\oplus_\tau : \mathcal{P}(D_\tau) \setminus \{\emptyset\} \rightarrow D_\tau$.
 - c. There is a function $pl_\tau : \mathcal{P}(A_\tau) \setminus \{\emptyset\} \rightarrow D_\tau$ such that:
 - 1.1) $pl_\tau(\{x\}) = x$ for each $x \in A_\tau$
 - 1.2) and pl_τ is an isomorphism from $(\mathcal{P}(A_\tau) \setminus \{\emptyset\}, \cup)$ to $(D_\tau, \oplus_\tau)$.
 - d. For any types σ, τ : $A_{\langle \sigma, \tau \rangle} = D_\tau^{D_\sigma}$, the set of partial functions from D_σ to D_τ .
 - e. For any types σ, τ , D_τ and D_σ are disjoint, with the possible exception of the empty partial function.

immediately below the quantifier. This operation creates a structure that can be interpreted by means of the Predicate Abstraction rule.

- (1.11) a. $[John\ [believes\ everything]]$
 b. $[everything\ [(2, \langle s, t \rangle)\ [John\ [believes\ t_{(2, \langle s, t \rangle)}]]]]$

In (1.11), *believe* requires an argument of type $\langle s, t \rangle$, but *everything*, when interpreted as a quantifier over propositions, has type $\langle \langle \langle s, t \rangle, t \rangle, t \rangle$ and hence gives rise to a type mismatch. The mismatch is resolved by adjoining *everything* to the next higher node of type t and leaving a trace of type $\langle s, t \rangle$ in the base position of *everything*. I will assume that the same coindexing procedure takes place in case a quantifier moves overtly and is not reconstructed at LF.

The second way of resolving type mismatches is to insert one of a small set of **type-shifting operators**. For instance, in Chapter 2 I will adopt Partee’s (1987) type-shifting operator BE that maps quantifiers over individuals (type $\langle s, \langle \langle e, t \rangle, t \rangle \rangle$) to properties of individuals (type $\langle s, et \rangle$). For simplicity, I will assume that type-shifting operators are inserted in the syntax. That is, if there is a type-mismatch between two sister nodes in the syntactic tree, this mismatch can be resolved by adjoining a type-shifting operator to either of the two nodes at LF. The type-shifter then combines with its sister by means of the usual composition rules.

In some cases of type mismatches, multiple ways of resolving the mismatch seem to be available. For instance, as we will see in Section 2.2.4, this is arguably the case when a verb that requires a property argument (type $\langle s, et \rangle$) combines with a quantifier over individuals (type $\langle \langle e, t \rangle, t \rangle$), as in (1.12-a). Given the type-shifting theory of Partee (1987), combined with my assumptions about QR, there are at least two ways of resolving this mismatch: Either the aforementioned operator BE is inserted, directly shifting the intension of the quantifier to a property (1.12-b), or the quantifier is raised, leaving a trace of type e , and another independently motivated type-shifting operator maps the denotation of the trace to a property (1.12-c). I will assume that in such situations, there is no competition between derivations that require QR and derivations that merely involve type-shifting. Both derivations are available and potentially correspond to distinct readings of the sentence. For sentences like (1.12-a), the LFs (1.12-b) and (1.12-c) correspond to what are usually called ‘unspecific’ and ‘specific’ readings, respectively.

- (1.12) a. *Der Hans sucht ein Buch.*
 ‘Hans is looking for a book.’ (= (1.6-a))
 b. $[Hans\ [[BE\ [ein\ Buch]]\ sucht]]$
 c. $[[ein\ Buch]\ [(1, e)\ [Hans\ [[IDENT\ t_{(1, e)}]\ sucht]]]]$

It is worth noting that most of the claims of this thesis are logically independent of one’s general assumptions about the division of labor between semantics and covert syntax. In particular, the semantic analyses to be proposed can be translated into a framework without QR.

1.3.2 The ‘standard analysis’ of higher-order DPs

The analysis I will take as a starting point is a straightforward implementation of the ‘naive generalization’ about higher-order DPs that I adopted in Section 1.1. I will refer to it as the ‘**standard analysis**’ of higher-order DPs, not because it is in any way standard in the literature

– in particular, the treatment of plural higher-order DPs is not – but because it is in large part a generalization of mainstream assumptions about the semantics of ordinary DPs that quantify over individuals.

DP syntax Most of the examples to be discussed will involve either indefinite DPs or DPs with *dasselbe* ‘the same thing(s)’. Since the semantics and LF syntax of *dasselbe* is not well understood for reasons that are beyond the scope of this work (cf. e.g. Beck 2000), I will focus on indefinite DPs here.

I will assume that indefinite DPs denote generalized quantifiers and thus have a type of the form $\langle\langle\tau, t\rangle, t\rangle$. An indefinite of type $\langle\langle\tau, t\rangle, t\rangle$ is headed by an abstract determiner $\exists_\tau$, as illustrated in (1.13) for indefinites quantifying over individuals. Following earlier works on contextual domain restriction such as von Stechow (1994), I assume that the D head contains a covert indexed pro-form $C_{(i, \langle\tau, t\rangle)}$, which is interpreted as a variable of type $\langle\tau, t\rangle$. This pro-form contributes a contextually provided set that restricts the domain of the existential quantifier.

- (1.13) a. *ein Buch* ‘a book’
 b. $[_{DP} [_{D} \exists_e C_{(1, \langle e, t \rangle)}] [_{NP} \text{Buch}]]$

In German, the determiner $\exists_\tau$ is usually spelled out as *ein-*. However, I will assume that it is also present in the underlying syntax of DPs with *etwas* ‘something’. I take such DPs to involve a bound morpheme *-was* of category N, which undergoes head movement to D in the PF branch of the derivation. The expression *etwas* spells out the complex head formed from $\exists_\tau$ and *-was*. At LF, *-was* remains in its base position (1.14).

- (1.14) a. *etwas* ‘something’
 b. $[_{DP} [_{D\exists_e} C_{(1, \langle e, t \rangle)}] [_{NP} \text{-was}_e]]$

The motivation for this analysis of *etwas* is that the syntactic distribution of *etwas* resembles that of a determiner – in particular, it precedes pronominal modifiers, such as adjectives, as illustrated in (1.15).

- (1.15) a. *etwas Schlechtes* ‘something bad’
 b. $[_{DP} [_{D} \exists_e C_{(1, \langle e, t \rangle)}] [[_{AP} \text{Schlechtes}] [_{NP} \text{-was}_e]]]$

Indefinites modified by numerals also involve $\exists_\tau$, which is spelled out as the empty string in the presence of a numeral (1.16). The decision not to analyze numerals as determiners is motivated by the fact that they may follow overt determiners such as definites or *alle* ‘all’. The exact syntactic position of numerals within the DP is not crucial for my purposes.

- (1.16) a. *zwei Bücher* ‘two books’
 b. $[_{DP} [_{D} \exists_e C_{(1, \langle e, t \rangle)}] [[_{NumP} \text{zwei}] [_{NP} \text{Bücher}]]]$

The LF syntax of higher-order DPs does not differ from that of ordinary DPs. For now, the only difference is the semantic type of the determiner, the NP and any modifiers appearing below the determiner. In (1.17) and (1.18), this is exemplified for the higher-order DPs *etwas* ‘something’ and *zwei Sachen* ‘two things’, given a context in which these DPs range over propositions.

- (1.17) a. *etwas* ‘something’

- b. $[_{DP} [_{D} \exists_{\langle s,t \rangle} C_{(1, \langle \langle s,t \rangle, t \rangle)}] [_{NP} \text{-was}_{\langle s,t \rangle}]]$
- (1.18) a. *zwei Sachen* ‘two things’
b. $[_{DP} [_{D} \exists_{\langle s,t \rangle} C_{(1, \langle \langle s,t \rangle, t \rangle)}] [[_{NumP} \text{zwei}_{\langle s,t \rangle}] [_{NP} \text{Sachen}_{\langle s,t \rangle}]]]$

Semantics of indefinites For now, I will assume that the meanings of functional elements within a DP, like determiners and numerals, as well as the meanings of higher-order NPs such as *-was* and *Sache*, are provided by cross-categorial schemata of the following kind:

- (1.19) For any argument type τ :
- a. $\llbracket \exists_{\tau} \rrbracket = \lambda w. \lambda C_{\langle \tau, t \rangle}. \lambda P_{\langle \tau, t \rangle}. \lambda Q_{\langle \tau, t \rangle}. \exists x_{\tau} [C(x) \wedge P(x) \wedge Q(x)]$
b. $\llbracket \text{-was}_{\tau} \rrbracket = \llbracket \text{Sache}_{\tau} \rrbracket = \lambda w. \lambda x_{\tau}. 1$

During semantic composition, the determiner $\exists_{\tau}$ combines with three arguments, all of which are functions of type $\langle \tau, t \rangle$. The first argument corresponds to the covert domain-restriction variable $C_{(i, \langle \tau, t \rangle)}$ within the D head; the second and third arguments correspond to the overt restrictor and the overt nuclear scope of the determiner, respectively.⁴ The higher-order nouns *-was* and *Sache* express trivial predicates that are true of any object of the right type; as we will see in Chapter 2, however, this is not a property of higher-order NPs in general. To exemplify this semantics, the intension assigned to *etwas* ‘something’, when used to quantify over propositions, is given in (1.20).

$$(1.20) \quad \llbracket [\exists_{\langle s,t \rangle} C_{(1, \langle \langle s,t \rangle, t \rangle)}] \text{-was}_{\langle s,t \rangle} \rrbracket^g = \lambda w. \lambda Q_{\langle \langle s,t \rangle, t \rangle}. \exists p_{\langle s,t \rangle} [g(1, \langle \langle s,t \rangle, t \rangle)(p) \wedge Q(p)]$$

Relative pronouns can have higher-order readings as well – for instance, this is arguably the case in examples like (1.21-a). I will assume that the relative clause in (1.21-a) adjoins to the NP *-was*. Since the trace of the relative pronoun occurs in the object position of a proposition-embedding predicate, it is interpreted as a variable over propositions. Abstraction over this variable yields a predicate of propositions, which combines intersectively with this NP (1.21-b,c).

- (1.21) a. *etwas, das der Hans glaubt*
something REL the Hans believes
‘something Hans believes’
b. $\llbracket [\exists_{\langle s,t \rangle} C_{(1, \langle \langle s,t \rangle, t \rangle)}] [\text{-was}_{\langle s,t \rangle} [(2, \langle s, t \rangle) [\text{Hans } [t_{(2, \langle s,t \rangle)} \text{ glaubt}]]]] \rrbracket$
c. $\lambda w. \lambda Q_{\langle \langle s,t \rangle, t \rangle}. \exists p_{\langle s,t \rangle} [g(1, \langle \langle s,t \rangle, t \rangle)(p) \wedge \llbracket \text{glauben} \rrbracket(w)(p)(\text{hans}) \wedge Q(p)]$

Plural semantics: Numerals and *dasselbe* Since numerals freely occur in higher-order DPs, the present approach leads us to expect that their interpretation should also follow a cross-categorial schema. If pluralities of any semantic type are available, this schema can be defined as in (1.22): *zwei* ‘two’ denotes the property of being a plurality with two atomic parts.⁵

⁴For my purposes, it is crucial that the domain-restriction variable forms a separate semantic argument of the determiner, rather than combining intersectively with the NP. This is because in Chapter 4, I will propose an analysis of higher-order DPs quantifying over propositions in which the domain-restriction variable is identified with the Hamblin set of a contextually salient question. The domain of the DP is then restricted to a certain subset of the partial answers to this question. The mechanism determining this subset is quite involved and requires separate access to the value of the domain-restriction variable and the NP denotation.

⁵Under the assumption that separate semantic types for properties, propositions and semantic questions have to be distinguished, the fact that higher-order DPs of all three types are compatible with expressions that are

(1.22) For any argument type τ : $\llbracket \text{zwei}_\tau \rrbracket = \lambda w. \lambda x_\tau. |\{y \mid y \leq_a x\}| = 2$

Following much of the literature on plural semantics, I assume that semantically plural NPs involve a **pluralization operator** $*$. The effect of this operator is to map a predicate P to a predicate that is true of all pluralities whose atomic parts satisfy P (1.23).

(1.23) For any argument type τ : $\llbracket *_\tau \rrbracket = \lambda w. \lambda P_{\langle \tau, t \rangle}. \lambda x_\tau. \forall y_\tau [y \leq_a x \rightarrow P(y)]$

In DPs involving a numeral, like (1.24-a), the pluralization operator applies below the numeral (1.24-b). The numeral then combines intersectively with the pluralized predicate, so that the DP ends up quantifying existentially over pluralities of two people (1.24-c).

(1.24) a. *zwei Leute* ‘two people’
 b. $\llbracket [\exists_e C_{(1, \langle e, t \rangle)}] [\text{zwei}_e [*_e \text{Leute}_e]] \rrbracket$
 c. $\llbracket (1.24\text{-b}) \rrbracket^g = \lambda w. \exists x_e [g(1, \langle e, t \rangle)(x) \wedge |\{y \mid y \leq_a x\}| = 2 \wedge \forall y [y \leq_a x \rightarrow \text{person}(w)(y)]]$

The treatment of plural higher-order DPs like *zwei Sachen* ‘two things’ is completely analogous: When it combines with a proposition-embedding predicate, *zwei Sachen* has the LF in (1.25-b) and quantifies over sums of two propositions (1.25-c).

(1.25) a. *zwei Sachen* ‘two things’
 b. $\llbracket [\exists_{\langle s, t \rangle} C_{(1, \langle \langle s, t \rangle, t \rangle)}] [\text{zwei}_{\langle s, t \rangle} [*_{\langle s, t \rangle} \text{Sachen}_{\langle s, t \rangle}]] \rrbracket$
 c. $\llbracket (1.25\text{-b}) \rrbracket^g = \lambda w. \exists p_{\langle s, t \rangle} [g(1, \langle \langle s, t \rangle, t \rangle)(p) \wedge |\{q_{\langle s, t \rangle} \mid q \leq_a p\}| = 2]$

In sum, I will take the formal similarities between ordinary and higher-order DPs at face value. Mainstream assumptions about the semantics of ordinary DPs with numerals are extended straightforwardly to higher-order DPs.

At several points, particularly in Chapters 3 and 4, I will have occasion to discuss examples with a third, less well-understood type of higher-order DP: higher-order uses of *dasselbe* ‘the same thing(s)’, as illustrated in (1.26). The readings of such examples that Beck (2000) calls ‘NP-dependent’ readings – for instance, the reading of (1.26-a) on which it asserts that Hans has the same beliefs as Maria – give rise to a well-known compositionality problem. Pre-theoretically, the NP-dependent reading of *dasselbe* seems to involve a relation between an arbitrary number of sets. For instance, (1.26-a) says that the set of relevant propositions Hans believes and the set of relevant propositions Maria believes are identical, and (1.26-b) can be paraphrased as saying that there is a set S such that for every person, the set of relevant questions that are unclear to that person is identical to S .

(1.26) a. *Hans und Maria glauben dasselbe.*
 Hans and Maria believe the.same
 ‘Hans and Maria believe the same thing.’
 b. *Den Leuten ist dasselbe unklar.*
 the.DAT people is the.same unclear
 ‘The people are unsure about the same thing.’

Since this compositionality problem is not directly relevant to my claims about higher-order DPs and since I am not aware of a simple, generalizable solution to this problem, I will leave

sensitive to semantic plurality, like numerals, provides an independent argument for Schmitt’s (2017) extension of the sum operation to arbitrary types (cf. also von Stechow 1980 for an early discussion of related issues).

it unresolved and assume that in sentences like (1.26), *dasselbe* can somehow combine with a plurality of predicates. In (1.26-a), for instance, *dasselbe* combines with a sum of two predicates of propositions, given in (1.27-a). More generally, the cross-categorial meaning I will assume for *dasselbe*, given in (1.27-b), takes two arguments – a set C corresponding to the contextual domain restriction, and a plurality P of sets – and expresses the requirement that the restrictions of all the sets in P to C must be the same.

- (1.27) a. $(\lambda p_{\langle s,t \rangle}.\mathbf{believe}(w)(p)(\mathbf{hans})) \oplus (\lambda p_{\langle s,t \rangle}.\mathbf{believe}(w)(p)(\mathbf{maria}))$
 b. For any argument type τ : $\llbracket dasselbe_\tau \rrbracket = \lambda w.\lambda C_{\langle \tau,t \rangle}.\lambda P_{\langle \tau,t \rangle}.\exists S_{\langle \tau,t \rangle}.\forall Q_{\langle \tau,t \rangle}[Q \leq_a P \rightarrow C \cap Q = S]$
 c. $\llbracket [dasselbe_{\langle s,t \rangle}] C_{(1, \langle \langle s,t \rangle, t \rangle)} \rrbracket [(2, \langle s, t \rangle) [\mathbf{Hans\ und\ Maria} \ [t_{(2, \langle s,t \rangle)} \mathbf{glauben}]]]$

However, the question how the required plurality of sets can be derived from a plausible LF for sentences like (1.26-a), such as (1.27-c), must be left open here.⁶

⁶In principle, the plural semantics presented in Haslinger & Schmitt (2018) provides a systematic way of deriving denotations of this kind – for instance, *want to see John and Mary* is predicted to denote the sum of the property of wanting to see John and the property of wanting to see Mary. However, this system has not yet been extended to configurations involving variable binding, and doing so is beyond the scope of this work.

Chapter 2

Why higher-order DPs are special

In Chapter 1, I presented a data pattern which suggests that some DPs in German, such as *etwas* ‘something’ or *zwei Sachen* ‘two things’, can quantify over semantic objects of higher types like predicates, propositions or semantic questions. This chapter addresses two questions related to this observation: First, is there really a grammatically relevant distinction between ‘ordinary DPs’ and ‘higher-order DPs’, or is the apparent cross-categorical nature of expressions like *etwas* characteristic of DP semantics more generally? Second, if higher-order DPs are really special, how can we test whether a given DP counts as a higher-order DP or not?

This chapter makes two main claims. First, there are systematic semantic differences between higher-order DPs and ordinary DPs. This motivates the preliminary distinction made in Chapter 1. Second, the special behavior of higher-order DPs can easily be captured in a type-theoretical semantics, by assuming that they show a higher degree of type flexibility than other DPs.

I will discuss two classes of arguments in support of a semantic distinction between higher-order DPs and ordinary DPs. The first, taken from the literature and discussed in Section 2.1, concerns selectional restrictions imposed by clause-embedding predicates: Several predicates disallow certain readings for ordinary DP complements, but do license them when the argument is a higher-order DP. The second, discussed in Section 2.2, concerns the objects of intensional transitive verbs (ITV) like *suchen* ‘look for’ or *bestellen* ‘order’. I will argue that in certain configurations, ordinary DP objects of such verbs only have ‘specific’ readings that involve quantification over individuals or individual concepts, while higher-order DP objects still allow for ‘unspecific’ readings with quantification over properties. To see this contrast, we will have to distinguish between genuine quantification over properties and quantification over the ‘types’ involved in type/token ambiguities. Since some of the arguments in this section are new, I will also develop a partial semantic analysis that accounts for the contrast between the two classes of DPs. Finally, in Section 2.3, the tests that can be used to identify higher-order DPs are summarized and applied to some new cases.

2.1 Selectional restrictions on clause-embedding verbs

The simplest argument for an exceptional status of higher-order DPs is based on selectional restrictions: Several opaque verbs impose restrictions on their complements that seem to distinguish between higher-order DPs and other DP complements. In this section, I will recapitulate two versions of this argument found in the literature and provide relevant examples from German. The first version (Nathan 2006, Elliott 2017) involves verbs that are compatible with higher-order DP complements, but fail to select other kinds of DPs. The second version (Elliott 2017) involves the verb *explain* (German *erklären*) which seems to assign distinct thematic roles to (declarative) CP complements and ordinary DPs, but is less restrictive with higher-order DPs.

2.1.1 Question-embedding verbs

Many question-embedding verbs can also take DP complements, which then receive a ‘concealed question’ (CQ) interpretation. In (2.1) and (2.2), for instance, the (a) sentences have readings that can be roughly paraphrased by the (b) sentences (ignoring potential tense differences).

- (2.1) a. *John asked the height of the building.* (Grimshaw 1979:299, (74))
b. *John asked what height the building was.* (Grimshaw 1979:299, (76))

- (2.2) a. *James figured out the plane’s arrival time.* (Grimshaw 1979:297, (67-a))
b. *James figured out what the plane’s arrival time would be.* (Grimshaw 1979:298, (68-a))

As Grimshaw (1979) notes, not all question-embedding verbs are compatible with CQ DPs. For instance, as (2.3) and (2.4) show, the verbs *wonder* and *inquire* disallow CQs.

- (2.3) a. *I wonder what answer he gave.* (Grimshaw 1979:302, (92-a))
b. **I wonder the answer he gave.* (Grimshaw 1979:302, (93-a))

- (2.4) a. *John inquired what the number of students in the class was.* (Grimshaw 1979:302, (92-b))
b. **John inquired the number of students in the class.* (Grimshaw 1979:302, (93-b))

At first sight, these data seem to show that some question-embedding verbs are subcategorized for CP complements only, while others may select both DPs and CPs. These subcategorization requirements might be reducible to some other idiosyncratic property of lexical items, such as lexical Case. But Nathan (2006) makes an observation that is hard to reconcile with any syntactic explanation of this kind: At least some of the verbs disallowing CQ complements can combine with higher-order DPs (2.5).

- (2.5) a. *Kim wondered who left, and Sandy wondered that as well.* (Nathan 2006:42, (23-a))
b. *Kim wondered who left, and Sandy wondered the same thing.* (Nathan 2006:42, (23-b))

This pattern can be replicated in German, although the data are a bit less straightforward than in English. For instance, *sich fragen* ‘wonder’ (lit. ‘ask oneself’) disallows CQ complements (2.6), although they are found with other verbs such as *wissen* ‘know’ (2.7). But higher-order DPs are

fine with *sich fragen* (2.8).

- (2.6) a. *Der Hans fragt sich schon lange, was die Uhrzeit ist.*
 the Hans asks REFL already a.long.time what the time.of.day is
 ‘For a long time, Hans has been wondering what the time is.’
 b. *#Der Hans fragt sich schon lange die Uhrzeit.*
 the Hans asks REFL already a.long.time the time.of.day
 ‘For a long time, Hans has been wondering what the time is.’
- (2.7) a. *Der Hans weiß, was die Uhrzeit ist.*
 the Hans knows what the time.of.day is
 ‘Hans knows what the time is.’
 b. *Der Hans weiß die Uhrzeit.*
 the Hans knows the time.of.day
 ‘Hans knows the time.’
- (2.8) a. *Der Hans fragt sich etwas.*
 the Hans asks REFL something
 ‘Hans is wondering about something.’
 b. *Der Hans fragt sich vieles, was sich auch der Peter fragt.*
 the Hans asks REFL much REL REFL also the Peter asks
 ‘Hans is wondering about many things that Peter is also wondering about.’

It is worth noting that, since *sich fragen* is a reflexive verb construction containing the verb *fragen* ‘ask’, (2.6-b) has a reading on which it is grammatical: It is true, for instance, if for a long time, Hans has had the habit of talking to himself and asking himself what the time is. However, German also seems to have constructions that are ungrammatical with concealed-question DPs and still license higher-order DPs, such as the monotransitive use of non-reflexive *fragen* ‘ask’. When *fragen* selects an interrogative complement clause (2.9-a), it optionally takes an additional DP argument denoting the addressee of the question. But with a concealed-question DP, the version without an overt addressee argument is unacceptable (2.9-b). Crucially, the overt addressee object becomes optional again if the question is expressed by a higher-order DP rather than a concealed-question DP (2.10). So *fragen* provides another context in which higher-order DPs pattern like interrogative complement clauses, and unlike other DP complements.

- (2.9) a. *Der Hans hat (mich) schon oft gefragt, was die Uhrzeit ist.*
 the Hans has me.ACC already often asked what the time.of.day is
 ‘Hans has asked (me) many times what the time is.’
 b. *Der Hans hat *(mich) schon oft die Uhrzeit gefragt.*
 the Hans has me.ACC already often the time.of.day asked
 ‘Hans has asked (me) for the time many times.’
- (2.10) a. *Der Hans hat (mich) etwas gefragt.*
 the Hans has me something asked
 ‘Hans asked (me) something.’
 b. *Der Hans hat (mich) alles gefragt, was (mich) der Peter gefragt hat.*
 the Hans has me everything asked what me the Peter asked has
 ‘Hans asked (me) everything that Peter asked (me).’

The same point can be made with the verb *überlegen* ‘think about, reflect on’. When used without a reflexive pronoun, this verb takes interrogative complement clauses (2.11-a), but not

concealed-question DPs (2.11-b). Sentences in which *überlegen* combines with a higher-order DP are judged a bit marginal, but are clearly better than the CQ example (2.11-b), especially when presented in context as in (2.12).¹

- (2.11) a. *Der Hans hat überlegt, wer der nächste Wahlsieger sein wird.*
the Hans has reflected.on who the next election.winner be will
‘Hans was thinking about the question who will win the next election.’
b. **Der Hans hat den nächsten Wahlsieger überlegt.*
the Hans has the next election.winner reflected.on
‘Hans was thinking about the winner of the next election.’
- (2.12) a. ?*Der Hans überlegt irgendetwas – wahrscheinlich ob wir Mittagessen gehen sollen.*
the Hans reflects.on something probably whether we eat.lunch
go should
‘Hans is thinking about some question – probably whether we should go have lunch.’
b. ?*Der Hans hat gerade zwei Sachen überlegt – ob wir Mittagessen gehen sollen und was wir danach machen.*
the Hans has just two things reflected.on whether we eat.lunch go
sollen und was wir danach machen.
should and what we afterwards do
‘Hans was just thinking about two questions – whether we should go have lunch and what we should do afterwards.’

Summing up, we see that higher-order DPs are licensed in several constructions where interrogative complement clauses are licensed as well, but CQ DPs are disallowed. In the absence of independent evidence that higher-order DPs and CQ DPs differ systematically in their syntax, the simplest explanation of this contrast is that there is a semantic difference between the two. Semantically, higher-order DPs seem to pattern with interrogative complement clauses to the exclusion of CQ DPs, which is unexpected given Grimshaw’s (1979) claim that CQ DPs and interrogative complement clauses are semantically on a par. Grimshaw does not distinguish between CQ DPs and higher-order DPs, but she discusses one example of a higher-order DP, the pro-form *that*. She claims *that* has the distribution of a CQ DP when it combines with question-embedding predicates (Grimshaw 1979:306, fn. 24). However, Nathan (2006:41f.) argues against this claim for English, and (2.13) shows that the German counterpart of *that*, *das*, also patterns with the other higher-order DPs and not with CQs.

¹The verb *überlegen* has a reflexive use which does allow for concealed-question DPs, but differs in meaning from the non-reflexive use.

- (i) a. *Der Hans hat sich überlegt, wer der nächste Wahlsieger sein wird.*
the Hans has REFL reflected.on who the next election.winner be will
‘Hans thought about the question who will win the next election.’
b. *Der Hans hat sich den nächsten Wahlsieger überlegt.*
the Hans has REFL the next election.winner reflected.on
‘Hans thought about the winner of the next election.’

As pointed out by Valerie Wurm (p.c.), the sentences in (i) strongly suggest that Hans came to a conclusion as to who will win the election, and (i-b) even suggests that Hans picked the winner of the election. The sentences in (2.11-a) and (2.12) carry no such implications and can mean that Hans reflected on the respective question without coming to a conclusion. To me, this suggests that (i) involves a different lexical meaning of *überlegen*.

- (2.13) a. *Der Peter fragt sich, wie spät es ist. Der Hans fragt sich **das** auch.*
 the Peter asks REFL how late EXPL is the Hans asks REFL that also
 ‘Peter is wondering what time it is. Hans is wondering about that, too.’
 b. *Der Peter hat gefragt, wie spät es ist. Der Hans fragt **das** auch immer.*
 the Peter has asked how late EXPL is the Hans asks that also always
 ‘Peter asked what time it is. Hans always asks that too.’

In summary, higher-order DPs seem to have a wider distribution than concealed-question DPs. Evidence that this pattern reflects a systematic property of higher-order DPs, rather than just an idiosyncratic fact about certain question-embedding predicates, comes from the observation – discussed by Elliott (2017) – that we find similar patterns in the domain of attitude verbs.

2.1.2 Proposition-embedding verbs

Elliott’s starting point is the well-known fact that some attitude verbs, like *believe*, can combine with so-called ‘content DPs’ – DPs denoting individuals or eventualities with propositional content – while others, like *think*, cannot. This contrast is illustrated in (2.14) and (2.15). (2.14-b) can mean that Abed believes that the propositional content of the rumour is true, while (2.15-b) cannot.

- (2.14) a. *Abed believes that Shirley is upset.* (Elliott 2017:173, (8-a))
 b. *Abed believes the rumour that Shirley is upset.* (Elliott 2017:173, (8-b))
 (2.15) a. *Abed thinks that Shirley is upset.* (Elliott 2017:173, (9-a))
 b. **Abed thinks the rumour that Shirley is upset.* (Elliott 2017:173, (9-b))

Again, the simplest explanation of this contrast would be that verbs like *think* have some idiosyncratic syntactic property that prevents them from selecting a DP. However, Elliott points out that the contrast disappears once we use higher-order DPs: Both sentences in (2.16) are grammatical.

- (2.16) a. *Abed believes everything that Troy believes.* (Elliott 2017:173, (8-c))
 b. *Abed thinks everything that Troy thinks.* (Elliott 2017:173, (9-c))

This pattern can be replicated in German, where *glauben* ‘believe’ easily selects content DPs, while *denken* ‘think’ does not (2.17), (2.18).

- (2.17) a. *Der Hans glaubt, dass der Paul verrückt geworden ist.*
 the Hans believes that the Paul crazy become is
 ‘Hans believes that Paul went mad.’
 b. *Der Hans glaubt das Gerücht, dass der Paul verrückt geworden ist.*
 the Hans believes the rumour that the Paul crazy become is
 ‘Hans believes the rumour that Paul went mad.’
 c. *Der Hans glaubt Evas Behauptung, dass der Paul verrückt geworden ist.*
 the Hans believes Eva’s claim that the Paul crazy become is
 ‘Hans believes Eva’s claim that Paul went mad.’
 (2.18) a. *Der Hans denkt, dass der Paul verrückt geworden ist.*
 ‘Hans thinks/believes that Paul went mad.’
 b. #*Der Hans denkt das Gerücht, dass der Paul verrückt geworden ist.*
cannot mean: ‘Hans believes the rumour that Paul went mad.’

- c. #*Der Hans denkt Evas Behauptung, dass der Paul verrückt geworden ist.*
cannot mean: ‘Hans believes Eva’s claim that Paul went mad.’

Denken has a use on which it may select DPs and means roughly ‘conceive of, conceptualize’, as in *Politik neu denken* ‘conceptualize politics in a new way’, but this is arguably a case of lexical ambiguity. This second reading is not restricted to content DPs and is not easy to get for the examples in (2.18). Importantly, the following examples with higher-order DPs are grammatical and give rise to the usual attitude interpretation of *denken* rather than the ‘conceive of’ reading available with any kind of DP.

- (2.19) a. *Der Hans denkt dasselbe wie die Eva.*
the Hans thinks the.same as the Eva
‘Hans thinks/believes the same thing as Eva.’
b. *Der Hans denkt zu diesem Thema zwei Sachen.*
the Hans thinks on this topic two things
‘Hans thinks/believes two things about this issue.’
c. *Der Hans denkt zu diesem Thema alles, was die Eva denkt.*
the Hans thinks on this topic everything REL the Eva thinks
‘On this issue, Hans thinks/believes everything that Eva thinks/believes.’

A similar argument can be constructed using the verb *meinen*, which is ambiguous between an attitude interpretation on which it means ‘think, opine’ and a second interpretation that can be roughly paraphrased as ‘intend to refer to’ and resembles the English verb *mean* in *I meant John, not Bill*. The two readings of *meinen* differ in their selectional restrictions. To see this, consider the examples in (2.21) and the two contexts in (2.20-a,b), which are supposed to bring out the ‘intended reference’ reading and the attitude reading, respectively.

- (2.20) a. CONTEXT: Eva started the rumour that Paul has gone mad. Paul’s brother Hans does not believe this at all, but in a recent conversation he made a cryptic reference to ‘the thing about Paul’. His conversation partner asks what Hans might have meant by that, and is told that ...
(attitude reading **false**, intended reference reading **true**)
b. CONTEXT: Eva started the rumour that Paul has gone mad. Paul’s brother Hans does not know about this rumour, but also came to the conclusion that Paul has gone mad, for independent reasons. When asked what Hans thinks about Paul’s mental health, one of Hans’s friends explains ...
(attitude reading **true**, intended reference reading **false**)

While the attitude reading is available with complement clauses (2.21-a), content DPs as in (2.21-b,c) disallow this reading and only have the intended-reference reading.² These judgments might lead one to believe that the attitude reading of *meinen* requires a special lexical entry that does not have the necessary syntactic features to select a DP. However, this is falsified by the behavior of higher-order DPs, which can have both readings (2.21-d,e).

- (2.21) a. *Der Hans meint, dass der Paul verrückt geworden ist.*
the Hans thinks that the Paul crazy become is
‘Hans thinks that Paul has gone mad.’ **true** in (2.20-a), **true** in (2.20-b)

²It seems to me that the intended-reference reading is available in (2.21-a) as well. This issue does not affect the argument made here.

- b. *Der Hans meint das Gerücht, dass der Paul verrückt geworden ist.*
the Hans means the rumour that the Paul crazy become is
‘Hans means the rumour that Paul has gone mad.’
true in (2.20-a), **inadequate** in (2.20-b)
- c. *Der Hans meint Evas Aussage, dass der Paul verrückt geworden ist.*
the Hans means Eva’s claim that the Paul crazy become is
‘Hans means Eva’s claim that Paul has gone mad.’
true in (2.20-a), **inadequate** in (2.20-b)
- d. *Der Hans meint etwas, das die Eva (auch) glaubt – dass der Paul verrückt geworden ist.*
the Hans means/thinks something that the Eva also believes that the
Paul crazy become is
‘Hans means/thinks something that Eva (also) believes – that Paul has gone mad.’
true in (2.20-a), **true** in (2.20-b)
- e. *Der Hans meint, was (auch) die Eva behauptet hat – dass der Paul verrückt geworden ist.*
the Hans means/thinks what also the Eva claimed has that the Paul
crazy become is
‘Hans means/thinks what Eva (also) claimed – that Paul has gone mad.’
true in (2.20-a), **true** in (2.20-b)

An additional argument for this hybrid status of higher-order DPs is provided by Elliott’s (2017) study of the verb *explain*. What makes this example interesting is that here, unlike with *meinen*, there is no strong case for a lexical ambiguity of the verb. The basic semantic observation, attributed to Pietroski (2000), is that *explain* selects both declarative complement clauses and content DPs, but systematically assigns different thematic roles to the two. Two possible interpretations for complements of *explain* are paraphrased in (2.22). According to Pietroski and Elliott, content DPs only allow for the explanandum reading, while only the explanation reading is available for complement clauses (2.23).

- (2.22) a. ‘explanation’ reading: The object of *explain* denotes the propositional content of an explanation the subject gives (for something else).
b. ‘explanandum’ reading: The object of *explain* denotes the eventuality or fact to be explained (by something else).
- (2.23) a. *Angela explained the fact that Boris resigned.* (Elliott 2017:171, (1-a))
(explanation reading **unavailable**, explanandum reading **ok**)
b. *Angela explained that Boris resigned.* (Elliott 2017:171, (1-b))
(explanation reading **ok**, explanandum reading **unavailable**)

Elliott’s crucial claim is that higher-order DPs in English can have both readings when they combine with *explain*. It is based on the observation that the following inferences are valid:

- (2.24) a. *Angela explained the fact that Boris resigned, therefore Angela explained something.*
(Elliott 2017:174, (13-a))
b. *Angela explained that Boris resigned, therefore Angela explained something.*
(Elliott 2017:174, (13-b))

The inferences in (2.24) are meant to illustrate Elliott’s claim that *something* can quantify over propositional contents of explanations, as well as over facts or eventualities to be explained. It should be noted that the validity of the inference in (2.24-b) by itself is not sufficient to show

that *something* has the ‘explanation’ reading here. At least superficially, it seems plausible to assume that every explaining event involves an explanandum – a fact, eventuality or individual to be explained. If so, (2.24-b) would come out valid even without the additional assumption that *something* can quantify over propositional contents: Whenever *Angela explained that Boris resigned* is true, there is an explaining event and therefore an explanandum.

I think the case for a second reading of *something* can be made more convincing (although not fully conclusive) by adding modifiers within the higher-order DP and considering scenarios in which the modifying predicate is true of the explanation, but not of the entity that is the obvious choice for the explanandum. I will use the German counterpart of *explain*, *erklären*, to illustrate this. If we limit ourselves to double-object uses of *erklären* with an animate subject that denotes the person giving the explanation, the thematic role alternation observed for *explain* can be replicated in German. The scenarios in (2.25) are meant to unambiguously bring out the two interpretations. For content DPs as in (2.26-a), the explanation reading is hard to get if it is available at all. Declarative complement clauses (2.26-b), on the other hand, seem to *require* the explanation reading.³

- (2.25) a. SCENARIO: Bea died unexpectedly at age 50. Her neighbour has been wondering what the cause of her early death was. Now the police have found out that Bea was murdered. A policewoman is explaining this discovery to Bea’s neighbour.
(2.26-a) true, (2.26-b) false
 b. SCENARIO: Bea died unexpectedly at age 50. The police have no idea what the circumstances and the causes of her death were. Bea’s neighbour asks the police what happened to her. The neighbour had not seen Bea in the building for a few days, but had not suspected anything out of the ordinary. So a policewoman has to tell the neighbour that Bea is dead.
(2.26-a) ??, (2.26-b) true
- (2.26) a. *Die Polizistin hat der Nachbarin Beas plötzlichen Tod erklärt.*
 the policewoman has the neighbour Bea’s sudden death explained
 ‘The policewoman explained Bea’s unexpected death to the neighbour.’
 b. *Die Polizistin hat der Nachbarin erklärt, dass die Bea plötzlich gestorben ist.*
 the policewoman has the neighbour explained that the Bea suddenly died
 is
 ‘The policewoman explained to the neighbour that Bea died unexpectedly.’

Interestingly, a sentence with a higher-order DP like (2.27) can also be judged true in scenario

³As [Pietroski \(2000\)](#) already points out for English, interrogative complements of *explain* allow for the explanandum reading (i-a), and so do declarative complements if the subject of *explain* is itself a declarative clause or content DP (i-b). While the analysis of such patterns is beyond the scope of this work, they support the general point that even in the case of *erklären*, there is no strict correspondence between the syntactic category of the complement and its thematic role.

- (i) a. *Die Polizistin hat der Nachbarin erklärt, warum/wie die Bea plötzlich gestorben ist.*
 the policewoman has the neighbour explained why/how the Bea suddenly died is
 ‘The policewoman explained to the neighbour why/how Bea had unexpectedly died.’
 b. *Diese Vermutung der Polizei würde auch erklären, dass die Bea plötzlich gestorben ist.*
 this conjecture the.GEN police would also explain that the Bea suddenly died is
 ‘This conjecture by the police would also explain why Bea died unexpectedly.’

(2.25-b).⁴ This is surprising since the obvious choice for the explanandum in scenario (2.25-b) is the fact that Bea’s neighbour has not seen her in a while. The scenario (2.25-b) stipulates that this fact is neither shocking nor unusual. What is shocking and unusual is the propositional content of the policewoman’s explanation.

- (2.27) *Die Polizistin hat der Nachbarin etwas Schockierendes und Unerwartetes*
 the policewoman has the neighbour something shocking and unusual
erklärt.
 explained
 ‘The policewoman explained something shocking and unusual to the neighbour.’
 %true in (2.25-b)

This argument relies on an assumption that is not immediately obvious: that scenario (2.25-b) does not make available *any* eventuality that would make (2.27) true on the explanandum reading. One such eventuality would presumably be Bea’s sudden death. Since (2.26-a) is dispreferred in scenario (2.25-b), this event doesn’t seem to count as an explanandum in this scenario. However, one may wonder whether this really shows that the propositional-content reading is unavailable in (2.26-a), or whether we are dealing with a pragmatic inference triggered by the contrast with (2.26-b), which unambiguously expresses the propositional-content reading. In the latter case, these data would not motivate a distinction between content DPs and higher-order DPs.

Regardless of the status of the argument involving *erklären*, we can conclude that content DPs contrast with higher-order DPs in a way that parallels the contrast involving concealed-question DPs. In both cases, we find a selectional restriction that excludes a certain class of DP arguments, but this restriction cannot be accounted for by a general syntactic ban against DP arguments, since higher-order DPs are exempt from it.

2.1.3 Discussion

We have seen that several predicates in English and German give rise to the following pattern:

- (2.28) a. The predicate may select a (declarative or interrogative) clausal complement.
 b. Certain kinds of DP complements (content DPs or concealed-question DPs) are not available, even if they are selected by other verbs that are very similar in meaning.
 c. Higher-order DP complements are available. If clausal complements and ‘ordinary’ DP complements differ in their semantics, higher-order DPs tend to allow for both interpretations.

Clearly, accounts of (2.28-a) and (2.28-b) that are based on syntactic c-selection, such as the one proposed in Grimshaw (1979), do not extend to (2.28-c). The same holds for theories attempting to reduce c-selection to another purely syntactic property of predicates, such as the ability to assign accusative Case (Pesetsky 1983): As Nathan (2006:42f.) and Elliott (2017) point out, higher-order DPs behave just like other DPs when it comes to syntactic processes claimed to be triggered by Case requirements, such as raising.

This is not to say that c-selection has no role to play in explaining the distribution of higher-

⁴Not everyone shares this judgment, however – hence the % mark.

order DPs. As Moulton (2009:84ff.) and Elliott (2017:173) show, some predicates do impose a syntactic ban against DP arguments even if the special status of higher-order DPs is controlled for. One of their examples is *complain*, which, like its German counterpart *sich beschweren*, may combine with an embedded clause or a PP, but not with a DP. In the object position of *complain*, higher-order DPs and content DPs are both bad. So are topicalized clauses, which Moulton (2009) argues involve movement of a null operator of category DP. To me, such data suggest that idiosyncratic restrictions against selecting a DP exist and should receive a syntactic explanation, but something different is going on in the examples discussed in Sections 2.1.1 and 2.1.2 above.

Since I do not see any independent reasons to assume that higher-order DPs differ from other DPs in their syntactic feature composition, an explanation in terms of semantic categories seems more parsimonious: Interpreted semantically, the data pattern summarized in (2.28) simply shows that content DPs are not of the same semantic category as declarative embedded clauses, and concealed-question DPs are not of the same semantic category as interrogative embedded clauses. We can then take higher-order DPs to be ambiguous between the semantic categories of clausal complements and the categories of other DP complements.⁵ There are several ways of implementing this idea in type-theoretic terms. For instance, Nathan (2006) concludes for independent reasons that concealed-question DPs denote propositions, not semantic questions. Simplifying slightly, *the capital of Austria* on its concealed-question reading is assumed to denote a proposition expressing that a certain individual is a capital of Austria (2.29). The contextual restriction variable C in (2.29) is usually identified with the set of propositions that are true in the utterance situation. Given this additional assumption about C , (2.29-b) is predicted to be true if, for an individual x that is actually the capital of Austria, John knows that the capital of Austria is identical to x .

- (2.29) a. $\llbracket \text{the capital of Austria} \rrbracket = \iota p_{\langle s, t \rangle} . [\exists x_e [p = (\lambda w . \llbracket \text{capital of Austria} \rrbracket (w)(x))] \wedge C_{\langle \langle s, t \rangle, t \rangle} (p)]$ (cf. Nathan 2006:18, (4))
 b. *John knows the capital of Austria.*

Given this analysis, the cross-categorical semantics for higher-order DPs proposed in Chapter 1, together with the assumption that analogous interpretations are unavailable for ordinary DPs, predicts a contrast between concealed-question and higher-order DPs: Higher-order DPs, but not concealed-question DPs, can quantify over semantic questions, objects of the type $\langle s, \langle \langle s, t \rangle, t \rangle \rangle$. Example (2.30) illustrates higher-order quantification over (pluralities of) questions. Assuming that *fragen* ‘ask’ has a lexical entry with the structure in (2.30-a) (to be expanded by further semantic analysis), CQ DPs in its object position would give rise to a type mismatch.

- (2.30) Example of higher-order quantification over questions (to be revised!)

⁵There is one problem that could probably be solved more easily within syntactic (e.g. Case-based) analyses of the selectional pattern just discussed. Grimshaw (1979:317, fn. 33) claims that, while there are question-embedding or proposition-embedding predicates that fail to select DPs, there are no predicates that are semantically question- or proposition-embedding and require a DP complement while disallowing clausal complements (cf. Moulton 2009:4ff. for discussion of syntactic approaches to this issue). If true, this does not fall out from a mixed syntactic/semantic account of the kind I am proposing. For instance, content DPs differ from complement clauses in their semantic type, and nothing would preclude the existence of predicates that select for the semantic type of a content DP.

- a. $\llbracket \text{fragen} \rrbracket = \lambda w. \lambda q_{\langle s, \langle \langle s, t \rangle, t \rangle \rangle}. \lambda x. \text{ask}(w)(q)(x)$
- b. $\llbracket \text{zwei Sachen} \rrbracket^g = \llbracket [\exists_{\langle s, \langle \langle s, t \rangle, t \rangle \rangle} C(1, \langle \langle s, \langle \langle s, t \rangle, t \rangle \rangle, t))] \llbracket \text{zwei}_{\langle s, \langle \langle s, t \rangle, t \rangle \rangle} \text{ Sache}_{\langle s, \langle \langle s, t \rangle, t \rangle \rangle} \rrbracket^g \rrbracket^g$
 $= \lambda w. \lambda P_{\langle \langle s, \langle \langle s, t \rangle, t \rangle \rangle, t \rangle}. \exists Q_{\langle s, \langle \langle s, t \rangle, t \rangle \rangle}. g(1, \langle \langle s, \langle \langle s, t \rangle, t \rangle \rangle, t))(Q) \wedge |\{Q' \mid Q' \leq_a Q\}| = 2 \wedge P(Q)$
- c. $\llbracket \text{Hans fragt zwei Sachen} \rrbracket^g = \lambda w. \exists Q_{\langle s, \langle \langle s, t \rangle, t \rangle \rangle}. g(1, \langle \langle s, \langle \langle s, t \rangle, t \rangle \rangle, t))(Q) \wedge |\{Q' \mid Q' \leq_a Q\}| = 2 \wedge \forall Q' \leq_a Q : \text{ask}(w)(Q')(\text{hans})$

This predicts that predicates that semantically require an argument of type $\langle s, \langle \langle s, t \rangle, t \rangle \rangle$ (or $\langle \langle s, t \rangle, t \rangle$) will be able to combine with higher-order DPs, but not with concealed questions. This is exactly the pattern we found with certain uses of *fragen* ‘ask’ and *sich fragen* ‘wonder’ in German. The case of non-reflexive *überlegen* ‘think about, reflect on’ is somewhat problematic for Nathan’s (2006) analysis: In order to account for the incompatibility with concealed questions and the acceptability of higher-order DPs at the same time, Nathan’s theory forces us to assume that this verb selects an argument of type $\langle s, \langle \langle s, t \rangle, t \rangle \rangle$, but does not allow for propositional arguments (type $\langle s, t \rangle$). This predicts that *überlegen* should be unable to take declarative complement clauses. However, it seems to me that (2.31) is acceptable. If so, this is a potential problem for the generalization underlying Nathan’s analysis (see Nathan (2006) for a discussion of other counterexamples in English). But these issues with Nathan’s (2006) specific theory of CQ DPs are independent of the general point that the special status of higher-order DPs can easily be explained in type-theoretic terms.

- (2.31) ?*Wir haben gerade überlegt, dass es nett wäre, Mittagessen zu gehen.*
 we have just reflected.on that EXPL nice were.SUBJ lunch.eat to go
 ‘We were just thinking that it would be nice to go for lunch.’

A similar account is possible for the contrast between content DPs and higher-order DPs in the object position of attitude verbs. Elliott (2017) proposes an analysis based on the idea that content DPs denote or quantify over semantic objects of primitive types – individuals or eventualities – rather than propositions. If we assume that declarative clauses must be interpreted as propositions, the contrast between higher-order and content DPs can be reduced to a semantic category distinction: While complement clauses directly denote propositions, content DPs denote individuals or eventualities that are associated indirectly with propositional content, but not identified with propositions.⁶ The idea is that a verb like *denken* ‘think’ takes arguments of type $\langle s, t \rangle$, but not arguments of type e (or for eventuality arguments, if eventualities and individuals are taken to form distinct semantic domains). If so, *think* must have a lexical entry with the structure in (2.32-a), to be expanded by further analysis. This combines with a higher-order DP meaning like (2.32-b) without further complications, but fails to combine with an eventuality-

⁶This is not actually the analysis Elliott (2017) proposes: In order to derive both readings of *explain* from a single lexical entry and capture the correlation between the category of the object of *explain* and its thematic role, he assumes that verbs denote sets of eventualities and all arguments are introduced in a neo-Davidsonian manner. Content DPs, which denote individuals or eventualities, must be introduced by a thematic role head, while declarative complement clauses are interpreted as properties of individuals or eventualities (for instance, *that p* denotes the property an individual or eventuality has iff it has the propositional content $\llbracket p \rrbracket$). In effect, Elliott assumes that the relation between the eventualities introduced by an attitude verb and the content of the attitude is expressed within the complement clause and hence is not part of the verb semantics. In Chapter 5 of this thesis, I will argue against this assumption for independent reasons involving higher-order DPs. For now, the assumption that there is *some* type distinction between declarative complement clauses and content DPs is sufficient to derive the contrast and the precise implementation of the distinction does not matter.

denoting DP like *das Gerücht, dass der Paul verrückt geworden ist* for type reasons.

- (2.32) a. $\llbracket \text{denken} \rrbracket = \lambda w. \lambda p_{\langle s, t \rangle}. \lambda x_e. \mathbf{think}(w)(p)(x)$
 b. $\llbracket \text{zwei Sachen} \rrbracket^g = \llbracket [\exists_{\langle s, t \rangle} C_{(1, \langle \langle s, t \rangle, t \rangle)}] [\text{zwei}_{\langle s, t \rangle} \text{ Sache}_{\langle s, t \rangle}] \rrbracket^g$
 $= \lambda w. \lambda \mathcal{P}_{\langle \langle s, t \rangle, t \rangle}. \exists p_{\langle s, t \rangle}. g(1, \langle \langle s, t \rangle, t \rangle)(p) \wedge |\{p' \mid p' \leq_a p\}| = 2 \wedge \mathcal{P}(p)$
 c. $\llbracket \text{Hans denkt zwei Sachen} \rrbracket^g = \lambda w. \exists p_{\langle s, t \rangle}. g(1, \langle \langle s, t \rangle, t \rangle)(p) \wedge |\{p' \mid p' \leq_a p\}| = 2 \wedge \forall p' \leq_a p : \mathbf{think}(w)(p')(\mathbf{hans})$

In the case of the verb *explain*, which appears to allow for arguments of both types – correlated with distinct readings – without being obviously lexically ambiguous, Elliott assumes that declarative complement clauses can combine directly with the verb by virtue of their semantic type. On his account, content DPs, which denote entities of basic types, must be introduced by means of a thematic role head. The semantics of this head, and of declarative complement clauses, accounts for the difference in thematic roles between content DPs and complement clauses. Again, even if these particular assumptions should turn out to be flawed, the general point is that the contrast falls out if we ascribe a cross-categorial semantics to higher-order DPs, but not to content DPs.

Before we turn to the next group of arguments for a special status of higher-order DPs, I would like to stress that the data discussed so far support a semantic category distinction between higher-order and other DPs, but do not show conclusively that the distinction must be expressed in type-theoretic terms. For instance, all the empirical claims I have made about higher-order DPs with attitude verbs would also be compatible with a theory in which certain propositions have correlates in the individual domain, and type $\langle s, t \rangle$ arguments must always be mapped to their type e correlate before they can combine with a predicate. As far as I can see, the arguments for such a system (see e.g. Chierchia & Turner 1988) are mostly logically independent of the linguistic phenomena discussed in this thesis.

2.2 Semantics of indefinites in the object position of ITV

This section is concerned with higher-order DPs in the object position of intensional transitive verbs. For the most part, I will focus on the verb *suchen* ‘look for’. As a starting point, I will assume Zimmermann’s (1993) property analysis of this verb, which assigns it a denotation along the lines of (2.33-a). Informally speaking, the predicate in (2.33) is true of an individual x and a property P in w if every world w' in which x ’s attempts in w are successful is such that x finds something with property P in w' . In order to apply this analysis to sentences like (2.34-a), *ein Buch* has to be interpreted as denoting the property of being a book (see Section 2.2.4 for one possible way of deriving property readings of indefinites). The truth conditions the analysis predicts, given this interpretation of the DP, are paraphrased in (2.34-b,c).

- (2.33) a. $\llbracket \text{suchen} \rrbracket = \lambda w. \lambda P_{\langle s, et \rangle}. \lambda x. \forall w' [w' \in \text{TRY}(w)(x) \rightarrow \exists y [P(w')(y) \wedge \mathbf{find}(w')(y)(x)]]$
 b. $\text{TRY}(w)(x) = \{w' \mid x\text{'s attempts in } w \text{ are successful in } w'\}$

- (2.34) a. *Der Peter sucht ein Buch.*
 the Peter seeks a book
 ‘Peter is looking for a book.’
 b. $\lambda w. \forall w' [w' \in \text{TRY}(w)(\mathbf{peter}) \rightarrow \exists y [\mathbf{book}(w')(y) \wedge \mathbf{find}(w')(y)(x)]]$

- c. ‘Every world w' in which Peter’s attempts in w are successful is such that Peter finds a book in w' .’

Given this analysis, the naive hypothesis about higher-order DPs that I took as my starting point in Chapter 1 predicts that when higher-order DPs occur in the object position of *suchen* and similar ITV, they should be able to quantify over properties. Zimmermann (1993, 2006) argues that such readings are indeed available. His argument is based on examples like (2.35), in which a higher-order indefinite object of an ITV is modified by a relative clause and the relative pronoun is associated with the object position of another ITV.

- (2.35) *Der Peter sucht etwas, das auch die Maria sucht.*
 the Peter seeks something REL also the Maria seeks
 ‘Peter is looking for something that Maria is also looking for.’

Zimmermann points out that (2.35) can be true in a scenario like (2.36). However, if we interpret the indefinite as denoting a property of individuals, in analogy to *ein Buch* in (2.34-a), this judgment is not predicted. The relevant property of individuals would have to be the property of being an individual Maria is looking for. This would make two incorrect predictions: First, it would predict that for (2.35) to be true, Maria must be engaged in a search directed towards a specific individual. This is not the case in scenario (2.36), where no T-shirts matching her search criteria exist. Second, it would predict that in all possible worlds in which Maria is not looking for anything, Peter’s search must be unsuccessful. In other words, Peter’s search criteria have to depend on Maria’s search criteria, a situation that is explicitly ruled out in scenario (2.36).

- (2.36) SCENARIO: Peter and Maria both went shopping, independently of each other. Peter is looking for a light blue T-shirt with a picture of Kim Kardashian. Maria is also looking for a light blue T-shirt with a picture of Kim Kardashian. Their search will be unsuccessful since no such T-shirts have ever been produced. Neither of the two knows about the other’s search. (2.35) **true**

Therefore, (2.35) has a reading that cannot be derived via a straightforward application of the property analysis. Intuitively, it seems that this reading can be paraphrased as follows: There is a property that characterizes Peter’s search criteria and also characterizes Maria’s search criteria. The most obvious way of deriving this reading is to treat the indefinite DP in (2.35) as a quantifier over properties, and interpret the relative clause as a predicate of properties, as suggested by our naive hypothesis from Section 1.1. The LF corresponding to this reading is given in (2.37-a), and the truth conditions we predict for it, given the analysis of *suchen* in (2.33-a), are paraphrased in (2.37-b) and (2.37-c).

- (2.37) a. $[[[\exists_{\langle s, et \rangle} C_{(2, \langle \langle s, et \rangle, t \rangle)}] [(1, \langle s, et \rangle) [Maria [t_{(1, \langle s, et \rangle)} sucht]]] [(1, \langle s, et \rangle) [Peter [t_{(1, \langle s, et \rangle)} sucht]]]]]$
 b. $[[(2.37-a)]]^g = \lambda w. \exists P_{\langle s, et \rangle} [g(1, \langle \langle s, et \rangle, t \rangle)(P) \wedge \forall w' [w' \in \text{TRY}(w)(\mathbf{maria}) \rightarrow \exists y_e [P(w')(y) \wedge \mathbf{find}(w')(y)(\mathbf{maria})]] \wedge \forall w' [w' \in \text{TRY}(w)(\mathbf{peter}) \rightarrow \exists y_e [P(w')(y) \wedge \mathbf{find}(w')(y)(\mathbf{peter})]]]$
 c. ‘There is a property P (in the contextually restricted domain) such that every world w' in which Maria’s attempts in w are successful is such that Maria finds a P in w' , and every world w' in which Peter’s attempts in w are successful is such that Peter finds a P in w' .’

Does this reading reflect a special property of higher-order DPs when they combine with an ITV like *suchen*, or does it tell us something about DP semantics more generally? There is a potential argument for the latter conclusion, pointed out to me by Magdalena Kaufmann and Ede Zimmermann (p.c.): DPs with ordinary lexical nouns allow for type/token ambiguities and the ‘type’ construals involved in such ambiguities can easily be modeled as involving quantification over properties. As (2.38) illustrates, the type/token ambiguity is detectable even with clearly extensional predicates like *trinken* ‘drink’. (2.38-b) can be true even if Peter and Maria did not consume the same physical portion of drink. Pre-theoretically, (2.38-b) could be paraphrased as saying that for some salient property *P* of portions of drink, Peter consumed a *P* and Maria also consumed a *P*.

- (2.38) a. SCENARIO: Peter and Maria went to a bar. First, Peter drank wine and Maria drank beer. Later, they switched to cocktails. Maria drank two margaritas and Peter drank three margaritas.
- b. *Der Peter hat ein Getränk getrunken, das auch die Maria getrunken hat.*
 the Peter has a drink drunk REL also the Maria drunk has
 ‘Peter had a drink that Maria also had.’ true

Here I will argue that despite appearances to the contrary, higher-order DPs and ordinary indefinite DPs systematically show different semantic behavior. However, the distinction is obscured by the special semantic properties of the object position of ITV, and by the fact that ordinary indefinite DPs may be subject to type/token ambiguities. I will therefore start with a general discussion of type/token ambiguities (Section 2.2.1) and then motivate the main claim of this chapter (Section 2.2.2): In some syntactic configurations, ordinary indefinite DPs can only quantify over certain sets of so-called **individuating properties** determined by the lexical semantics of the noun, while the quantificational domains of higher-order DPs may contain arbitrary properties that are not in these sets. In Section 2.2.3 I discuss, and reject, the hypothesis that compatibility with higher-order DPs can be used as a test that indicates whether a given verb is intensional (cf. Moltmann 1997).

In principle, the contrast between ordinary and higher-order DPs could also be modeled in a semantics that assigns a unified semantic type to both classes of DPs. However, there is another relevant observation, discussed in Section 2.2.4, which is much easier to accommodate if we assume a type distinction: The semantic contrast between ordinary and higher-order indefinites is neutralized in simple examples involving unspecific indefinites in the object position of *suchen*. In Sections 2.2.4 and 2.2.5 I briefly sketch a potential way of formalizing the distinction between quantifiers over individuating properties and ‘genuine’ higher-order quantifiers, which can range over arbitrary properties. I will argue that individuating properties are sometimes treated as individuals by the grammar and can therefore have the semantic type *e*. ‘Real’ quantifiers over properties, on the other hand, range over semantic objects of type $\langle s, et \rangle$. The contrasts observed in Section 2.2.2 will be derived from the assumption that ordinary NPs can only express predicates of individuals (type *e*) or other primitive types, while higher-order NPs can express predicates of properties of type $\langle s, et \rangle$. The fact that this contrast disappears with unspecific indefinite objects of *suchen* is derived from the assumption that *suchen* semantically selects an

object of type $\langle s, et \rangle$ (Zimmermann 1993). Since indefinites quantifying over individuals may be shifted to this type, and higher-order indefinites may leave a trace of this type, both give rise to unspecific readings.

If the analysis proposed in this section can be maintained, the behavior of the object position of *suchen* provides another argument for my claim that higher-order DPs exhibit more type flexibility than other DP arguments of opaque verbs.

2.2.1 Type/token ambiguities and individuating properties

Many lexical NPs give rise to type/token ambiguities, as exemplified by the contrast between (2.38) and (2.39). While the plausible reading of (2.38) can be paraphrased as involving quantification over ‘types’ or ‘kinds’ of drinks, the DP *ein Getränk* ‘a drink’ can also quantify over physical portions of drink, as in (2.39).

- (2.39) *Der Peter hat ein Getränk getrunken, das leider schon warm war.*
 the Peter has a drink drunk REL unfortunately already warm was
 ‘Peter had a drink which, unfortunately, was already warm.’

The most plausible reading of (2.39) does not entail that portions of the type of drink Peter had are (or were) warm in general. It just says that the specific portion he consumed was warm. Since drinks in the sense of (2.38) can be conceptualized as types that are instantiated by physical portions of drink, and the instances of such a type may differ across times and possible worlds, it seems plausible to model the ‘type’ reading of *ein Getränk* as involving quantification over properties of physical portions of drink.⁷ As Magdalena Kaufmann and Ede Zimmermann (p.c.) pointed out to me, is therefore not obvious that there is any sense in which ordinary unspecific indefinites lack a property reading. Further, since the predicate in (2.38) and (2.39) is extensional, it would seem that the property reading has nothing to do with intensionality and is a generally available interpretative option for DPs. In order to be able to discuss these ideas in more detail, I will briefly introduce some relevant properties of type/token ambiguities.

Type/token ambiguities of NPs give rise to logically independent construals of the sentences they occur in. Further, despite the term ‘type/token ambiguity’, there may be more than one plausible ‘type’ construal associated with a given NP. This can be demonstrated using sentences with modified numerals, like (2.40)-(2.42). Here, I use the numeral modifier *gerade mal* ‘no more than’, which seems more natural than *genau* ‘exactly’ in the contexts provided. This modifier forces an exact, i.e. upper-bounded, reading of the numeral and adds the implication that the numeral is relatively low on the contextually relevant scale. Interestingly, (2.40)-(2.42) can all

⁷In this thesis, I don’t want to take a stand on the philosophical question whether the semantics of the ‘type’ construals involved in type/token ambiguities should involve abstract objects such as properties. The main aim of this discussion of type/token ambiguities is to provide background for linguistic arguments which aim to show that the type/token ambiguity is orthogonal to the distinction between ‘higher-order’ and ‘ordinary’ indefinites. This, by itself, does not tell us much about the ontology of ‘types’ and properties. A discussion of philosophical arguments for and against identifying ‘types’ with universals, like properties, can be found in Wetzel (2006). It seems to me that most of these arguments merely show that the standard examples of expressions thought to denote ‘types’, and the standard examples of property-denoting expressions, differ in their syntactic distribution and their role in semantic composition – a result that, by itself, does not commit us to any metaphysical claims about differences between ‘types’ and properties.

be judged true in their respective scenarios.

- (2.40) a. SCENARIO: Hans went to a bar with his friends and drank two beers and two glasses of white wine. Now the group is discussing whether they should go to a dance club afterwards. One of his friends claims that Hans is too drunk to dance. But his girlfriend disagrees:
b. *Der Hans hat gerade mal vier alkoholische Getränke getrunken.*
the Hans has no.more.than four alcoholic drinks drunk
'Hans has had no more than four alcoholic drinks.' **true**
- (2.41) a. SCENARIO: Hans's girlfriend took him to a fancy bar that is well known for its wine list and its extensive cocktail menu. But he didn't seem that interested in trying something new. First, he drank several glasses of the cheapest white wine on the menu. Then, he drank one glass of a more expensive white wine from the same producer, and finally, he had two vodka shots before he left. His girlfriend is disappointed:
b. *Der Hans hat gerade mal drei alkoholische Getränke getrunken.*
the Hans has no.more.than three alcoholic drinks drunk
'Hans has had no more than three alcoholic drinks.' **true**
- (2.42) a. SCENARIO: Hans's girlfriend is bothered by his habit of mixing different kinds of alcoholic drinks. She thinks that if you mix wine and beer, for instance, your hangover will be worse. But today, Hans finally listened to her advice: He tried various different white wines and had several shots of vodka, but at least he didn't drink beer or cocktails in between. Surprised, she says:
b. *Der Hans hat gerade mal zwei alkoholische Getränke getrunken.*
the Hans has no.more.than two alcoholic drinks drunk
'Hans has had no more than two alcoholic drinks.' **true**

In (2.40), Hans was served four physical portions of drink. The sentence is true even though there are fewer than four types of drinks involved. In (2.41), the numeral counts types of drinks: The cheap and the expensive white wine count as different drinks, while the two vodka shots do not. Finally, context (2.42-a) is an attempt to make salient a very coarse-grained partition into types of drinks, in which all portions of white wine count as being of the same type. In sum, such examples show us i) that we are dealing with a real ambiguity or polysemy of the NP and ii) that there is no unique linguistically relevant partition of 'tokens' into 'types'. A similar polysemy can be observed with predicates of physical objects that are associated with content, such as *book*. This is illustrated by (2.43-b)-(2.45-b), which may all be judged true in their respective scenarios.

- (2.43) a. SCENARIO: Hans is a literature student who claims to be an expert on the work of Franz Kafka. However, his professor noticed that he only ever mentions two of Kafka's works: 'The Trial' and 'The Castle'. She also noticed that Hans makes incoherent claims about the order of the different chapters of 'The Trial', and concludes Hans must have read this unfinished novel in two different editions. Frustrated, the professor says:
b. *Der Hans hat gerade mal zwei Bücher von Kafka gelesen.*
the Hans has no.more.than two books of Kafka read
'Hans has read no more than two books by Kafka.'
- (2.44) a. SCENARIO: Hans is a bookseller who is taking an inventory of his stock. At the

moment, the bookshop has only three items in stock that relate to Kafka’s work: one edition of ‘The Castle’, of which there are five copies left, and two different editions of ‘The Trial’. Hans says to his colleague:

- b. *Wir haben gerade mal drei Bücher von Kafka im Lager.*
 we have no.more.than three books of Kafka in.the storage
 ‘We have no more than three books by Kafka in stock.’

- (2.45) a. SCENARIO: Hans is an expert on the work of Franz Kafka. His snobbish colleague is shocked to find out that Hans doesn’t have Kafka’s collected works in his office. He only has one copy each of ‘The Trial’ and Kafka’s diaries, and two identical-looking copies of ‘The Castle’. His colleague says:

- b. *Der Hans hat gerade mal vier Bücher von Kafka im Regal stehen.*
 the Hans has no.more.than four books of Kafka in.the shelf standing
 ‘Hans has no more than four books by Kafka on his shelf.’

The most plausible readings of (2.43-b) and (2.44-b) in the given contexts involve quantification over types of books, which could be modeled as properties of physical copies of books. In a context like (2.43-a), in which knowledge about literary texts is at issue, the two editions of ‘The Trial’ may be counted as one and the same book. A context like (2.44-a), however, invites us to count them as distinct, since what matters here is the number of different items listed in the inventory. Finally, (2.45-a) is meant to bring out a reading on which we quantify over physical copies of books, no matter whether they contain the same text or belong to the same edition. From such examples, it seems clear that the set of properties that count as ‘types’ of books depends partly on context.⁸ In this thesis, I will not discuss individuation criteria associated with specific predicates any further and simply note that the different construals in (2.40)-(2.42) and (2.43)-(2.45) can be described in terms of a distinction between what I’ll call **low-level individuals** and **individuating properties**. While (2.43) and (2.44) involve quantification over individuating properties, (2.45) involves quantification over low-level individuals (or, alternatively, properties of the form $\lambda w.\lambda x.x = y$ for some low-level individual y). In the case of books, the low-level individuals are physical copies, and in the case of drinks, the low-level individuals are standard portions of drinks. I use this non-standard terminology for two reasons: First, I don’t want to use the unqualified term ‘individuals’ for the objects we quantify over on the token reading, since I will ultimately claim that the different construals involved in type/token ambiguities do not involve different semantic types for the DPs. Second, I want to avoid terms like ‘natural properties’ that carry philosophical commitments not directly relevant to descriptive linguistics.

We have seen that the lexical semantics of nouns makes several sets of individuation criteria salient, but in a given context, we have to choose one of them. For concreteness, I will provide a simple (and probably inadequate) way of modeling this observation, based loosely on a handout by Kaufmann & Zimmermann (2009). I assume that the semantic domain A contains only low-level individuals, such as physical portions of drink and concrete copies of books. Countable nouns are assigned their lexical semantics in the following way. First, a function LI maps each

⁸Another class of predicates that systematically show this behavior, pointed out by Nathan (2006), involves planned means of transportation such as buses and trains. Here, there are several plausible sets of individuation criteria: One might include the time of departure or even the exact date of departure or restrict the individuation criteria to the itinerary or line number.

lexical noun α to a property of low-level individuals, i.e. a function from W to $\mathcal{P}(A)$. Then in any world w , the extension of α on the individuating-property reading is a set of subproperties of $\text{LI}(\alpha)$. Different individuation criteria correspond to different sets of properties. For instance, for the noun *book*, we could assume that $\text{LI}(\text{book})$ is the property of being a physical copy of a book, and each of the relevant subproperties applies to all the copies of a certain text, or all the copies of a certain edition of a text.

In order to account for the observation that different individuation criteria may be relevant in different contexts, I assume that the interpretation of nouns is relativized to a parameter $\mathbf{c}$ indicating the utterance context. However, even the utterance context does not uniquely determine a method of individuation for each NP, since the same noun may be used with two different sets of individuation criteria within a sentence, as in the most plausible reading of (2.46-b).

- (2.46) a. SCENARIO: Hans works in a bookstore. Today, he has sold 500 (physical) books. Almost 200 of them were copies of the two current bestsellers. He therefore decides to order 100 more copies of each of these two bestsellers.
- b. *Ich habe heute 500 Bücher verkauft und dann zwei Bücher jeweils 100-mal nachbestellt.*
 I have today 500 books sold and then two books each 100-times reordered
 ‘Today, I sold 500 books and then ordered 100 more copies (each) of two books.’

For simplicity, I therefore assume that nouns come with an index indicating the method of individuation, following Aloni’s (2001) treatment of the different methods of *identification* that have to be distinguished in double-vision scenarios.⁹ More specifically, each context $\mathbf{c}$ will be associated with a finite sequence $\text{IP}(\mathbf{c})$ of functions that map each lexical noun α and each world w to a set of properties of low-level individuals that are instantiated in w .¹⁰ These functions will be written as $\text{IP}(\mathbf{c})(1)$, $\text{IP}(\mathbf{c})(2)$ etc. Following Kaufmann & Zimmermann (2009), I assume that these functions have to satisfy certain postulates, given in (2.47):¹¹

- (2.47) For each lexical noun α , context $\mathbf{c}$ and natural number i , there is a subset $\mathcal{N}_\alpha(\mathbf{c}, i)$ of $\mathcal{P}(A)^W$ – i.e. a set of properties of low-level individuals – such that:
- for each world $w \in W$, $\text{IP}(\mathbf{c})(i)(\alpha)(w) = \{P \in \mathcal{N}_\alpha(\mathbf{c}, i) \mid P(w) \neq \emptyset\}$
 For any world w , the individuating-property reading of the noun yields those properties in $\mathcal{N}_\alpha(\mathbf{c}, i)$ that have a nonempty extension in w .
 - $\forall w. \forall P, Q \in \mathcal{N}_\alpha(\mathbf{c}, i). P(w) \cap Q(w) = \emptyset$
 The properties in $\mathcal{N}_\alpha(\mathbf{c}, i)$ are pairwise disjoint in every world.
 - $\forall w. \forall x_e [\text{LI}(\alpha)(w)(x) \leftrightarrow \exists P \in \mathcal{N}_\alpha(\mathbf{c}, i). P(w)(x)]$
 For each world, the properties in $\mathcal{N}_\alpha(\mathbf{c}, i)$ cover all the low-level individuals associated with the noun α in that world, and are not true of any other individuals.

⁹Since it is not clear that such indices play any role in the syntax, a plausible alternative approach might be to allow the context parameter to change within a sentence, a move Kratzer (1978) motivates using indexicals.

¹⁰The question whether we should also allow for properties that do not have any instances in w arguably depends on the interaction between individuating-property readings of NPs and intensional operators, which I have not been able to study in detail yet. Allowing properties with empty extensions here would let us quantify over ‘books’ of which no physical copies exist, for instance. I am not sure whether this is empirically motivated.

¹¹There is an additional postulate in Kaufmann & Zimmermann (2009) which states that for any property P , if P is an individuating property, then there is no world w such that $P(w)$ is the set of all individuals. I will not assume this postulate here since I do not fully understand its linguistic motivation.

The disjointness condition (2.47-b) can be motivated by the observation that (2.48) (repeated from (2.42)) is unequivocally false if all Hans drank was one glass of wine, even if there are two salient properties applying to that wine (for instance, the property of being white wine and the property of being from a certain producer). At least in the simple cases discussed here, it seems that we cannot count a single low-level individual more than once.

- (2.48) *Der Hans hat gerade mal zwei alkoholische Getränke getrunken.*
the Hans has no.more.than two alcoholic drinks drunk
‘Hans has had no more than two alcoholic drinks.’

The condition (2.47-c) ensures, among other things, that (2.49) does not have any reading that is false if Hans drank a physical portion of an alcoholic drink. Every portion of alcoholic drink has to satisfy at least one individuating property and is therefore in one of the sets provided by the individuation method.

- (2.49) *Der Hans hat ein alkoholisches Getränk getrunken.*
the Hans has an alcoholic drink drunk
‘Hans has had an alcoholic drink.’

Given this setup, we can now interpret lexical nouns as denoting functions from possible worlds to sets of individuating properties:

- (2.50) For any lexical noun α , any context $\mathbf{c}$ and any natural number i : $\llbracket \alpha_i \rrbracket^{\mathbf{c}} = \text{IP}(\mathbf{c})(i)(\alpha)$

To illustrate this context-dependency, consider example (2.46-b), repeated in (2.51-a). In the context described above, this sentence involves two different methods of individuation, which are illustrated in (2.51-c) and (2.51-d) (here I only give the extensions of the individuating properties in w , although individuating properties are actually intensions). The first method treats any two physical books as distinct (2.51-c), while the second method lumps together different copies of one and the same text (as sketched in (2.51-d), under the assumption that 300 copies of each relevant book were printed).

- (2.51) a. *Ich habe heute 500 Bücher₁ verkauft und dann zwei Bücher₂ jeweils 100-mal nachbestellt.*
‘Today, I sold 500 books and then ordered 100 more copies (each) of two books.’
b. $\text{LI}(\text{Buch})(w) = \{\mathbf{b}_1, \mathbf{b}_2, \mathbf{b}_3, \mathbf{b}_4, \dots\}$
c. $\llbracket \text{Bücher}_1 \rrbracket^{\mathbf{c}}(w) = \text{IP}(\mathbf{c})(1)(\text{Buch})(w) = \{\{\mathbf{b}_1\}, \{\mathbf{b}_2\}, \{\mathbf{b}_3\}, \dots, \{\mathbf{b}_{500}\}, \dots\}$
d. $\llbracket \text{Bücher}_2 \rrbracket^{\mathbf{c}}(w) = \text{IP}(\mathbf{c})(2)(\text{Buch})(w) = \{\{\mathbf{b}_1, \mathbf{b}_2, \dots, \mathbf{b}_{300}\}, \{\mathbf{b}_{301}, \dots, \mathbf{b}_{600}\}, \{\mathbf{b}_{601}, \dots, \mathbf{b}_{900}\}, \dots\}$

There are a couple of technical issues involved in modeling the context dependency of individuation criteria that I will not discuss in detail here. For instance, the proposal in Kaufmann & Zimmermann (2009) does not include restriction (2.47-a) and hence allows one and the same property to count as an individuating property of books in the actual world, but not in other possible worlds in which the property is instantiated as well. Informally speaking, for Kaufmann & Zimmermann (2009), the choice of individuation method depends on the world parameter rather than the utterance context. (2.47-a) is meant to ensure that the set of properties provided by an individuation method does not differ across worlds, except for properties that are not

instantiated in a given world. At this point, it is not clear to me which option is to be preferred on linguistic grounds and, more generally, how the choice of individuating properties interacts with embedding in intensional contexts. However, the arguments to be provided in the rest of this chapter are largely independent of this choice.

There is another important question that remains unanswered: What is the role of individuating properties in the type system? Are they treated as individuals – i.e. as elements of the semantic domain D_e – or do ‘type’ readings of NPs pattern with other cases of predicates taking property arguments? In order to find out how the semantic phenomenon discussed in this section relates to the property readings of higher-order DPs, we need to address the question to what extent higher-order DPs differ from other DPs once we control for type/token ambiguities.

2.2.2 Differences between higher-order and ordinary indefinites

In this section, I discuss a class of configurations where higher-order indefinites and ordinary indefinites behave differently. The generalization behind these differences is that in several configurations, ordinary indefinites can only quantify over individuating properties provided by the lexical meaning of the NP. Higher-order indefinites also quantify over properties that do not count as individuating. In the second half of the section, I discuss some data from [Moltmann \(1997, 2008\)](#) which seem to reflect the same generalization.¹²

Relative clauses

The first contrast concerns the higher-order relative clause construction discussed by [Zimmermann \(2006\)](#) and at the beginning of Section 2.2. In this construction, both the main clause and the relative clause involve an ITV like *suchen* ‘look for’, and the objects of both ITV are interpreted unspecifically. Informally speaking, the relative clause seems to express a predicate of unspecific search goals, which I analyze as properties, following [Zimmermann \(1993\)](#). For instance, (2.52-a) is true in scenario (2.52) even if Hans and Peter are both trying to find an arbitrary copy of the novel. It does not have to be the case that there is a copy that they are both trying to find, or that there is a definite description such that they both want to find the unique copy matching the description. The same goes for (2.52-b).

- (2.52) SCENARIO: Literature scholars Hans and Peter heard from their colleague that a previously unknown novel by Beckett, called ‘The Bog’, has now been published for the first time. They are each trying to track down a copy of this book. But actually, this

¹²The earliest discussion of differences between ordinary and higher-order objects of ITV that I have seen cited in the linguistic literature appears in [Geach \(1972b:135\)](#). Geach notes that while the inference in (i-a) is intuitively invalid, (i-b) seems more plausible:

- (i) a. *I owe you a horse.* $\Rightarrow$ *There is a horse I owe you.*
 b. *I owe you something.* $\Rightarrow$ *There is something I owe you.*

Ultimately, however, he claims that despite appearances, (i-b) is invalid. His main reason for rejecting (i-b) seems to be the analogy with (i-a): “[...] there are, I think, very many instances in which from “*b* *F*’s an *A*” or “*b* *F*’s something or other” [...] we may by no means infer that there is an identifiable something or other which *b* is *F*’ing.” ([Geach 1972b:136](#)) Interestingly, in a discussion of Frege’s notion of ‘concepts’, [Geach \(1972a:227f.\)](#) seems to suggest that *something* can quantify over concepts: “If *A* and *B* are both red, then *there is something*, referred to by the common predicate, *that A and B both are*”.

claim was part of a hoax and the novel does not exist.

- a. *Der Hans sucht etwas, das der Peter auch sucht.*
the Hans seeks something REL the Peter also seeks
'Hans is looking for something that Peter is also looking for.' **true**
- b. *Der Hans sucht ein Buch, das der Peter auch sucht.*
the Hans seeks a book REL the Peter also seeks
'Hans is looking for a book that Peter is also looking for.' **true**

In this case, the property characterizing the subjects' search goals is an individuating property – the property of being a copy of Beckett's lost novel. The judgments change, however, when non-individuating properties are used. In the scenario (2.53), (2.53-a) is clearly true, while (2.53-b) is not. So at least in my dialect¹³, ordinary indefinites with a relative clause cannot quantify over arbitrary non-individuating properties.

- (2.53) SCENARIO: Hans and Peter work at a large publishing company that wants to improve its sales figures in Austria. Their bosses told them that the ideal way to do so would be to reissue a book that sold at least 20 million copies when it first came out. Now Hans and Peter are each trying to come up with an arbitrary book that sold 20 million copies in Austria before 1960. However, their search is unsuccessful since no such books exist.
- a. *Der Hans sucht etwas, das der Peter auch sucht.*
'Hans is looking for something that Peter is also looking for.' **true**
 - b. *Der Hans sucht ein Buch, das der Peter auch sucht.*
'Hans is looking for a book that Peter is also looking for.' **not true**

Importantly, we are dealing with a contrast between two kinds of intensional readings: In both (2.52) and (2.53), the subjects are looking for something that does not exist, so the extensional readings would be false in both scenarios. The scenario in (2.54) exemplifies the same contrast: The property of having a light green cover is usually not taken to be individuating.

- (2.54) SCENARIO: Hans and Peter are both reorganizing their bookshelves. Both of them decided independently to sort the books by color rather than title or genre, following the latest interior design trend. Hans is almost done sorting his books, but now needs an arbitrary book with a light green cover in order to complete his color scheme. Peter is in the same situation and is also looking for a book with a light green cover.
- a. *Der Hans sucht etwas, das der Peter auch sucht.*
'Hans is looking for something that Peter is also looking for.' **true**
 - b. *Der Hans sucht ein Buch, das der Peter auch sucht.*
'Hans is looking for a book that Peter is also looking for.' **not true**

The ITV *bestellen* 'order' shows the same pattern as *suchen*.¹⁴ Again, there is no distinction

¹³For some speakers, contrasts like (2.53) are not as clear-cut. A more systematic investigation of this variation and what it correlates with must be left to future work.

¹⁴That this is an intensional verb can be shown using examples like (i) and (ii): (i) can be true if there is no wine from Antarctica, showing that *bestellen* has no existential entailment. Further, even if we assume that there is no wine from Antarctica and no whisky produced in Vienna, (i) and (ii) can have different truth values.

- (i) *Der Hans hat ein Glas Wein aus der Antarktis bestellt.*
the Hans has a glass wine out.of the Antarctica ordered
'Hans ordered a glass of wine from Antarctica.' $\nRightarrow$ There is some wine from Antarctica that Hans ordered.
- (ii) *Der Hans hat ein Glas in Wien produzierten Whisky bestellt.*
the Hans has a glass in Vienna produced whisky ordered
'Hans ordered a glass of whisky produced in Vienna.'

between higher-order and ordinary indefinites with relative clauses if the property describing the search goal is an individuating one.¹⁵ But higher-order indefinites contrast with ordinary indefinites once we use non-individuating properties: The property of being served in a one-liter pitcher is not individuating and hence cannot be in the domain of quantification for the indefinite in (2.55-b). The indefinite in (2.55-a), however, clearly has this property in its domain.

- (2.55) SCENARIO: Hans and Peter are at a bar where all mixed drinks are served in one-liter pitchers. Intrigued by this novelty, Hans decides to order a pitcher of gin and tonic. Peter orders a pitcher of mulled wine.
- a. *Der Hans hat etwas bestellt, was der Peter auch bestellt hat.*
the Hans has something ordered REL the Peter also ordered has
‘Hans ordered something that Peter also ordered.’ **true**
 - b. *Der Hans hat ein Getränk bestellt, das der Peter auch bestellt hat.*
the Hans has a drink ordered REL the Peter also ordered has
‘Hans ordered a drink that Peter also ordered.’ **true**

Summing up, it seems that indefinite DPs with higher-order relative clauses can only quantify over low-level individuals or individuating properties. They cannot quantify over properties that are not individuating. Higher-order DPs, on the other hand, show no such restriction.

Numerals

Indefinites modified by numerals provide another instructive test. As we saw in Section 2.2.1 above, numerals can count either low-level individuals (‘tokens’) or individuating properties (‘types’), depending on the context. (2.56) illustrates this again with the ITV *suchen*. Here, the numerals count individuating properties, i.e. ‘types’ of books individuated by their titles and authors. This is possible with the higher-order DP *zwei Sachen* ‘two things’, but also with the ordinary indefinite *zwei Bücher* ‘two books’.

- (2.56) SCENARIO: Literature scholar Hans heard from his colleague that a previously unknown novel by Beckett, called ‘The Bog’, has now been published for the first time. He has also heard of a previously unknown essay collection by Joyce. He is now trying to track down several copies of these two books for his university library. But actually, the literary world was hoaxed and the two books do not exist.
- a. *Der Hans sucht nur zwei Sachen.*
the Hans seeks only two things
‘Hans is looking for only two things.’ **true**

¹⁵This is illustrated in (i), where two different kinds of white wine can count as ‘the same drink’.

- (i) SCENARIO: Hans and Peter are at a bar in a small Austrian town that they believe to be well known for its wine production. In fact, however, no alcoholic drinks are produced in the town at all. They both decide to try the local white wine. Hans orders a local riesling and Peter orders a local grüner veltliner.
- a. *Der Hans hat etwas bestellt, was der Peter auch bestellt hat.*
the Hans has something ordered REL the Peter also ordered has
‘Hans ordered something that Peter also ordered.’ **true**
 - b. *Der Hans hat ein Getränk bestellt, das der Peter auch bestellt hat.*
the Hans has a drink ordered REL the Peter also ordered has
‘Hans ordered a drink that Peter also ordered.’ **true**

- b. *Der Hans sucht nur zwei Bücher.*
 the Hans seeks only two books
 ‘Hans is looking for only two books.’ **true**

The situation changes when we consider non-individuating properties. In scenario (2.57), there are two salient non-individuating properties. For each of the two properties, Hans wants to find several books that have it. While the numeral in the higher-order DP in (2.57-a) can count the two properties, the numeral in the ordinary indefinite DP in (2.57-b) cannot.¹⁶

- (2.57) SCENARIO: Hans works at a large publishing company that wants to improve its sales figures in Austria. His boss told him that he should do two things: reissue books by local writers that sold at least 20 million copies when they first came out, and commission new translations of books that were very successful internationally. So now he is looking for three books that sold 20 million copies in Austria, and three books that have been translated into every European language except German. However, his search is unsuccessful since no books with these properties exist.
- a. *Der Hans sucht nur zwei Sachen.*
 ‘Hans is looking for only two things.’ **true**
- b. *Der Hans sucht nur zwei Bücher.*
 ‘Hans is looking for only two books.’ **false**

Like the contrast involving relative clauses, this contrast can be replicated with *bestellen* ‘order’ and is therefore not specific to a single ITV: In scenario (2.58), we are dealing with individuating properties, which can be counted by the numerals in both (2.58-a) and (2.58-b).

- (2.58) SCENARIO: Hans is at a bar in a small Austrian town that he believes to be well known for its production of alcoholic drinks. In fact, however, no alcoholic drinks are produced in the town at all. He orders two different kinds of local white wine, and two gin and tonics with local gin. He does not know that all the drinks are in fact imported.
- a. *Der Hans hat nur zwei Sachen bestellt.*
 the Hans has only two things ordered
 ‘Hans ordered only two things.’ **true**
- b. *Der Hans hat nur zwei Getränke bestellt.*
 the Hans has only two drinks ordered
 ‘Hans ordered only two drinks.’ **true**

When we introduce non-individuating properties, however, the contrast emerges again. In (2.59), the properties of being served in a one-liter pitcher and being served in a shot glass do not count as individuating and therefore can only be counted by a numeral if the numeral appears in a higher-order DP.

- (2.59) SCENARIO: Hans is at a bar that is known for serving mixed drinks in one-liter pitchers

¹⁶(i) makes the same point with a different set of non-individuating properties.

- (i) SCENARIO: Hans is arranging the new window display for his local library. He decides to use only books with covers in black and white. To complete the arrangement he has in mind, he still needs three books with white covers and two books with black covers. Unfortunately, no books in these colors are left.
- a. *Der Hans sucht nur zwei Sachen.*
 ‘Hans is looking for only two things.’ **true**
- b. *Der Hans sucht nur zwei Bücher.*
 ‘Hans is looking for only two books.’ **false**

and wine in shot glasses. Intrigued by this novelty, Hans decides to try both kinds of untypical drinks. He orders a pitcher of mulled wine, a pitcher of gin and tonic, five shots of red wine and five shots of white wine.

- a. *Der Hans hat nur zwei Sachen bestellt.*
‘Hans ordered only two things.’ **true**
- b. *Der Hans hat nur zwei Getränke bestellt.*
‘Hans ordered only two drinks.’ **false**

While the relevant reading for *zwei Sachen* might be a bit marginal here, it can be brought out by adding a continuation that explicitly mentions the two properties (2.60). This does not improve (2.59-b) to the same extent, however. This shows that, for the ordinary indefinite DP *zwei Getränke*, a reading with quantification over non-individuating properties is not or only marginally available.

- (2.60) *Der Hans hat nur zwei Sachen/#Getränke bestellt – Mischgetränke in*
the Hans has only two things/drinks ordered mixed-drinks in
Ein-Liter-Krügen und Wein in Schnapsgläsern.
one-liter-pitchers and wine in schnapps-glasses
‘Hans ordered only two things: mixed drinks in one-liter pitchers and wine in shot glasses.’

As with the relative clause examples, this contrast cannot be attributed to the extensional/intensional distinction since in scenario (2.58), there are actually no drinks with the properties Hans mentioned in his order. Another argument against connecting the contrast to intensionality is that it is also found in examples like (2.61), which illustrate the higher-order readings of extensional verbs discussed by Kaufmann & Zimmermann (2009).

- (2.61) *Der Hans hat nur zwei Sachen/#Getränke getrunken – Wein in Schnapsgläsern und*
Mischgetränke in Ein-Liter-Krügen.
‘Hans drank only two things/#drinks: wine in shot glasses and mixed drinks in one-liter pitchers.’

In summary, there are two uses of numerals on which they seem to count properties. One of them is restricted to the ‘individuating properties’ involved in type/token ambiguities, but available with any DP. The second one is restricted to higher-order DPs, but allows for quantification over non-individuating properties.

Wide scope of indefinites

The third configuration in which higher-order indefinites contrast with ordinary indefinites is a bit harder to test. It involves sentences in which the indefinite object of an ITV has scope over a negation or another quantifier. The generalization seems to be that a wide-scope indefinite object can quantify over individuating properties, but not over arbitrary subproperties of the NP extension. In other words, while unspecific readings wrt. individuating properties are still possible, a ‘genuine’ unspecific reading where the verb combines with a non-individuating property is not available. Higher-order indefinites constitute an exception to this restriction.

To illustrate this claim, we need examples with ITV in which the indefinite clearly has a wide-scope reading. It seems to me that the wide-scope reading is particularly salient in examples in

which the indefinite is overtly scrambled over the other quantifier and the indefinite determiner is prosodically marked as a contrastive topic, as in (2.62-a) and (2.62-b).

- (2.62) SCENARIO: The administrator of a database of literary works is asked what the most popular search queries were in the last few months. He has found that in the last three months, every user used the database at least once. Further, although there were almost no searches for particular books, one topic was unexpectedly popular recently: Almost half of the users have tried to use the database to find out about forgotten Austrian novels from the inter-war period. Usually, they looked for arbitrary novels from this country and period, without specifying any author or title.

CONTEXT: What type of books do people usually look for in the database?

- a. *Es ist auffällig, dass /EIN Buch fast jeder \ZWEITE gesucht hat.*
it is striking that one book almost every second searched has
‘It is striking that there was one book that almost every second person searched for.’ false
- b. *Es ist auffällig, dass /EINE Sache fast jeder \ZWEITE gesucht hat.*
it is striking that one thing almost every second searched has
‘It is striking that there was one thing that almost every second person searched for.’ true

For reasons discussed in [Büring \(1997\)](#), the intonational contour associated with contrastive topics does not disambiguate these sentences towards one of the two scope options. However, the scenario in (2.62) excludes narrow-scope readings of the indefinites: A narrow-scope reading restricted to individuating properties of books would be false in this scenario since it is not the case that almost half of the users were looking for particular books. A narrow-scope reading without this restriction is also ruled out since *every* user, not just less than half of the users, searched for books with some property.

Given this kind of context, (2.62-a) is false – apparently because it implies that there was a particular book that almost half of the users were looking for. It is not sufficient if there was a more general search query that almost half of the users were interested in. However, (2.62-b), with a higher-order indefinite, can describe the scenario in (2.62), presumably because there is a property of books that matches the search goal of almost half of the users. Since the property of being a forgotten Austrian novel from the inter-war period is not specific enough to count as individuating, this falls under the same pattern as the numeral and relative clause examples.

That the relevant distinction here is one between two different kinds of property readings – more ‘specific’ and less ‘specific’ ones – and not one between extensional and intensional readings can be shown using scenarios like (2.63), where people are trying to find the book matching a certain definite description, but the description fails to refer. In such cases, there is no contrast between the higher-order indefinite and the ordinary indefinite even though the relevant reading is clearly intensional.

- (2.63) SCENARIO: The administrator of a database of literary works is asked what the most popular search queries were in the last few months. He has found that in the last three months, every user used the database at least once and almost half of the users searched for a novel by Beckett called ‘The Bog’. However, it turned out that the literary world was hoaxed and this novel does not exist.

- a. *Es ist auffällig, dass /EIN Buch fast jeder \ZWEITE gesucht hat.*

- ‘It is striking that there was one book that almost every second person searched for.’ **true**
- b. *Es ist auffällig, dass /EINE Sache fast jeder \ZWEITE gesucht hat.*
 ‘It is striking that there was one thing that almost every second person searched for.’ **true**

Again, the contrast can be replicated with *bestellen* ‘order’.

- (2.64) SCENARIO: At a festival, there is a popular bar selling drinks in one-liter pitchers. Almost all people have already ordered drinks there. There are many different drinks – beer, mixed drinks, mulled wine – and none of them is clearly the most popular one. But almost half of the people at the festival ordered something in a one-liter pitcher.
- a. *Es ist auffällig, dass /EIN Getränk bisher fast jeder \ZWEITE bestellt hat.*
 it is striking that one drink so far almost every second ordered has
 ‘It is striking that there was one drink that almost every second person ordered so far.’ **false**
- b. *Es ist auffällig, dass /EINE Sache bisher fast jeder \ZWEITE bestellt hat.*
 it is striking that one thing so far almost every second ordered has
 ‘It is striking that there was one thing that almost every second person ordered so far.’ **true**

The scenario excludes narrow-scope readings of the indefinite since in fact almost everyone, not less than half of the people, ordered a drink. While (2.64-b) is true on its wide-scope reading, (2.64-a) is not, presumably because the property of being served in a one-liter pitcher is not specific enough to count as individuating.

Pro-forms (Moltmann 1997)

Moltmann (1997, 2008) discusses two additional tests that arguably distinguish between higher-order DPs and other DPs (although this is not exactly what she takes to be the pertinent generalization, as I will discuss in more detail below). The first criterion distinguishes higher-order pronouns from other pronouns. As already noted by Montague (1974), the ‘unspecific’ reading of indefinite objects of ITV is blocked if the indefinite object serves as the antecedent of a personal pronoun, as in (2.65). Moltmann gives the analogous example (2.66) and says that it lacks an intensional reading.¹⁷

- (2.65) *John seeks a unicorn and Mary seeks it.* (Montague 1974:32, (1))

- (2.66) *John is looking for a horse. Mary is looking for it too.* (Moltmann 1997:6, (7-a))

Further, Moltmann (2008:241) shows that the higher-order pro-form *that* does not have this effect. According to Moltmann, (2.67-a) is compatible with an unspecific reading, while (2.67-b) is not.

- (2.67) (Moltmann 2008:241, (5-b))
- a. *John needs a very good secretary. Bill needs that too.*
- b. *John needs a very good secretary. Bill needs her too.*

¹⁷Moltmann (1997) often uses the mark # to indicate lack of an intensional reading, not unacceptability. However, some of her examples with # do not involve intensional predicates at all, which suggests that sometimes # does mark unacceptability. In this thesis, I will deviate from Moltmann’s convention and only use # to indicate unacceptability, even in examples cited from Moltmann’s work.

A similar effect can be observed in German. However, in order to see what exactly the semantic phenomenon picked out by this test is, it is important to control for the distinction between intensional readings involving individuating properties and those involving arbitrary properties. In scenario (2.68) (repeated from (2.53) above) the ordinary personal pronoun *es* has the expected effect (2.68-a). Further, it seems to me that the version (2.68-b) with the higher-order pro-form *das* is more adequate in this scenario.

- (2.68) SCENARIO: Hans and Peter work at a large publishing company that wants to improve its sales figures in Austria. Their bosses told them that the ideal way to do so would be to reissue a book that sold at least 20 million copies when it first came out. Now Hans and Peter are each trying to come up with an arbitrary book that sold 20 million copies in Austria before 1960. However, their search is unsuccessful since no such books exist.
- a. *Der Hans sucht ein Buch. Der Peter sucht es auch.*
the Hans seeks a book the Peter seeks it too
‘Hans is looking for a book. Peter is looking for it too.’ **not true**
- b. *Der Hans sucht ein Buch. Der Peter sucht das auch.*
the Hans seeks a book the Peter seeks that too
‘Hans is looking for a book. Peter is looking for that too.’ **true**

However, the contrast disappears if the search is directed towards an individuating property, e.g. the property of being a copy of a certain literary text. Scenario (2.69), repeated from (2.52) above, shows that intensional readings involving such properties are unaffected by anaphoric pronouns. Note that in scenario (2.69), there is no book actually matching the description, so the relevant reading is definitely not extensional.

- (2.69) SCENARIO: Literature scholars Hans and Peter heard from their colleague that a previously unknown novel by Beckett, called ‘The Bog’, has now been published for the first time. They are each trying to track down a copy of this book. But actually, this claim was part of a hoax and the novel does not exist.
- a. *Der Hans sucht ein Buch. Der Peter sucht es auch.*
‘Hans is looking for a book. Peter is looking for it too.’ **true**
- b. *Der Hans sucht ein Buch. Der Peter sucht das auch.*
‘Hans is looking for a book. Peter is looking for that too.’ **true**

In summary, the semantic property that interacts with anaphoric pronouns seems to be the ability of indefinites to quantify over arbitrary properties, not intensionality *per se*. The semantic effect of pronouns referring back to an indefinite object of an ITV therefore exemplifies the same pattern as higher-order relative clauses, numerals and wide-scope readings of indefinites.

Higher-order DPs have a second exceptional property related to anaphoric pronouns. It seems to me that higher-order indefinites do not lose their ‘unspecific’ reading when we add a personal pronoun anteceded by the indefinite (2.70). Note that the scenario in (2.70-a), based on (2.57) above, requires quantification over arbitrary (non-individuating) properties.

- (2.70) a. SCENARIO: Hans and Peter work at a large publishing company that wants to improve its sales figures in Austria. Their bosses told them that they should do two things: reissue books by local writers that sold at least 20 million copies when they first came out, and commission new translations of books that were very successful internationally. So now Hans is looking for some books that sold 20 million copies in Austria, and some books that have been translated into every

European language except German. Peter is looking for books with these properties too. However, their search is unsuccessful since no such books exist.

- b. *Der Hans sucht zwei ungewöhnliche Sachen und der Peter sucht sie/die auch.*
 the Hans seeks two unusual things and the Peter seeks them/those too
 ‘Hans is looking for two unusual things and Peter is looking for them/those things too.’ **true**

I have not investigated examples like (2.70-b) further yet, but if the judgment reported here should turn out to be stable, this shows us that ordinary personal pronouns do not generally disallow property antecedents: If *zwei ungewöhnliche Sachen* ‘two unusual things’ in (2.70-b) can quantify over pluralities of properties, as we assumed, then the pronoun in (2.70-b) presumably denotes such a plurality as well. If so, the contrast in (2.68) cannot be due to a type requirement of the pronoun. Instead, the data pattern suggests that if an ordinary personal pronoun is anteceded by an indefinite, it can only range over elements of the quantificational domain of the indefinite, as predicted by standard theories of dynamic semantics (Heim 1982). If so, the contrast between (2.68-a) and (2.70) tells us that the quantificational domain of ordinary indefinites cannot contain non-individuating properties, while the domain of higher-order indefinites can.

Animacy (Moltmann 1997)

Moltmann (1997, 2008) identified another semantic property that sets higher-order DPs apart from ordinary DPs: In effect, she argues that higher-order DPs can express, or quantify over, properties of human beings even if they are morphosyntactically ‘impersonal’, while ordinary indefinites cannot. This generalization is motivated by examples like (2.71), where the ‘impersonal’ indefinite *something* can be used even though the goal of John’s search is to find a human being with a certain property. With verbs like *meet* that are clearly not ITV, such sentences are unacceptable (2.72-a) and a ‘personal’ (or [+human]) indefinite has to be used, as in (2.72-b).¹⁸

- (2.71) a. *John is looking for something, namely a secretary.* Moltmann (1997:6, (8-a))
 b. *John is looking for someone, namely a secretary.* Moltmann (1997:6, (8-b))
- (2.72) a. *#John met something, namely a secretary.* Moltmann (1997:6, (8-c))
 b. *John met someone, namely a secretary.* Moltmann (1997:6, (8-d))

Moltmann takes the contrast between (2.71-a) and (2.72-a) to show that the relevant distinguishing factor is intensionality. Further, she claims that the correlation between ‘impersonal’ morphosyntactic form and intensionality goes both ways: According to Moltmann, (2.71-b) actually lacks an intensional reading – a claim that is probably too strong once a broader variety of non-extensional readings is considered.¹⁹ The same pattern is discussed with respect to higher-order DPs like *two things*, which are contrasted with ordinary [+human] DPs like *two people* (2.73). Again, (2.73-c) is unacceptable and (2.73-b) is claimed to disallow an intensional rea-

¹⁸Moltmann marks (2.72-a) with #, which usually indicates absence of an intensional reading in her notation, but since *meet* is not an intensional verb to start with, I think the # has to indicate unacceptability.

¹⁹Elsewhere, Moltmann relativizes this claim and suggests that the relevant notion is ‘specificity’ rather than intensionality.

ding, while this reading is present in (2.73-a). Further, similar judgments are reported for *what* vs. *who(m)* and *the same person* vs. *the same thing*.

(2.73) Moltmann (1997:6, (10))

- a. *John is looking for two things, a secretary and an assistant.*
- b. *John is looking for two people, a secretary and an assistant.*
- c. *#John met two things, a secretary and an assistant.*
- d. *John met two people, a secretary and an assistant.*

This is in line with the general pattern in German that I argued for in the previous subsections, with two qualifications. First, some speakers don't accept higher-order DPs like *etwas* 'something' or *zwei Sachen* 'two things' as objects of ITV if the relevant property is one restricted to human individuals. Thus, there is some variation wrt. the acceptability of sentences like (2.74).²⁰

(2.74) %*Die Firma X sucht zwei Sachen – einen Programmierer und einen Buchhalter.*
 the company X seeks two things a programmer and an accountant
 'Company X is looking for two things – a programmer and an accountant.'

Second, in German, animate DPs like *jemand* 'someone' or *zwei Leute* 'two people' clearly allow for unspecific intensional readings. This is illustrated in (2.75) and (2.76).

(2.75) a. SCENARIO: Company X has published a job offer for an accountant. The expectations are absurdly high: They are looking for someone who is under 20, speaks five languages and has at least seven years of experience in accounting. They do not have any specific person in mind and unsurprisingly, there is nobody who meets the description.
 b. *Die Firma X sucht jemanden für die Buchhaltung.*
 the company X seeks someone for the accounting
 'Company X is searching for someone for the accounting department.' **true**

(2.76) a. SCENARIO: Company X has published two job offers for accountants. The expectations are absurdly high: The first offer requires potential applicants to be under 20, speak five languages and have at least seven years of experience in accounting. The second offer is for an experienced accountant who also has a degree in astrophysics. They do not have any specific person in mind and unsurprisingly, there is nobody who meets either of the descriptions.
 b. *Die Firma X sucht zwei Leute für die Buchhaltung.*
 the company X seeks two people for the accounting
 'Company X is searching for two people for the accounting department.' **true**

At least for German, the claim that [+human] DP objects of ITV disallow intensional or unspecific readings is therefore too strong.

To summarize this section, we have seen five criteria that distinguish between higher-order DPs and ordinary DPs in the object position of opaque verbs like *suchen* 'look for' and *bestellen* 'order'. The emerging generalization is that there are two distinct kinds of property readings: In the configurations discussed, ordinary DPs can only quantify over what I called 'individuating' properties, i.e. the properties involved in the 'token' reading in type/token ambiguities. Higher-order DPs can quantify over arbitrary properties, no matter whether they count as individuating.

²⁰I would like to thank Magdalena Kaufmann, Kristina Liefke and Ede Zimmermann for pointing this out to me.

In the rest of this chapter, I will discuss how these restrictions can be implemented, and how to account for certain simple constructions in which the semantic distinction between ordinary and higher-order DPs seems to be neutralized. But before, I will briefly discuss Moltmann’s (1997) interpretation of the facts involving pronominal antecedence and animacy, and explain why I take the relevant semantic property to be ‘specificity’ rather than intensionality.

2.2.3 Unspecificity vs. intensionality

The special status of higher-order DPs is already discussed in detail in Moltmann (1997, 2008), but with somewhat different theoretical conclusions. In Moltmann’s work, the ability to combine with higher-order DPs is taken to be a test for intensionality, and ordinary (non-higher-order) animate DPs are claimed to disallow intensional readings. My hypothesis in this work, on the other hand, is that the special properties of higher-order DPs tell us something about the semantic type of the DP, no matter whether the embedding predicate is intensional or not.²¹ It is not clear to me to what extent this position is really that different from the views expressed in Moltmann (2008), since Moltmann (2008:241) says that “the linguistically relevant criterion of intensionality of NP complements” is “a certain form of nonspecificity” and goes on to suggest that her criteria are actually tests for this form of nonspecificity. This weaker claim would allow for the possibility of readings that are intensional in the traditional sense – i.e. they do not have existential entailments and do not allow for substitution of coextensional expressions – but can be expressed by a non-higher-order DP. In this section, I will discuss some arguments showing that intensionality does not always correlate with the kind of quantification over properties that higher-order DPs express, and argue that higher-order DPs indicate a higher semantic type of the object, not intensionality. For the most part, the data discussed in Moltmann (1997) actually support this conclusion.

Copula sentences As Moltmann (1997:15f.) notes, indefinite objects of *be* in copula constructions pass some of the tests for higher-order DPs: For instance, in (2.77), the relative clause is apparently able to apply to the property of being a lawyer: The natural reading of this sentence does not involve any claim about a specific lawyer, and does not entail that John and Bill are the same person. It seems to me that this is possible in German as well (2.78).

(2.77) *John is what Bill is, a lawyer.* (Moltmann 1997:15, (31-c))

(2.78) *Der Hans ist dasselbe wie der Peter, nämlich Jurist.*
 the Hans is the.same as the Peter namely lawyer
 ‘Hans is the same thing as Peter, namely a lawyer.’

The object position of *be* and German *sein*, however, is clearly extensional as far as the traditional criteria are concerned. First, examples like (2.79) have existential entailments, and second, this

²¹The claim that the formal distinction between ordinary and higher-order DPs in English and German correlates with semantic type, rather than intensionality, seems to fit the cross-linguistic pattern: According to Deal (2008), languages in which the objects of ITV are formally marked as specific or non-specific exhibit the same morphosyntactic distinction with extensional verbs. Deal argues that both for extensional and for intensional verbs, (non-)specificity marking correlates with a type distinction between type *e* and type $\langle s, et \rangle$ arguments.

position allows for substitution of coextensional expressions: In a scenario where Vienna is the only Austrian city with a million inhabitants, (2.80-a) and (2.80-b) cannot differ in truth value.

- (2.79) *Der Hans ist ein Einhornzüchter.*
the Hans is a unicorn-breeder
‘Hans is a unicorn breeder.’ $\Rightarrow$ There are people who breed unicorns.
- (2.80) a. *Der Hans ist ein Politiker aus einer österreichischen Millionenstadt.*
the Hans is a politician from an Austrian million-city
‘Hans is a politician from an Austrian city of at least one million people.’
b. *Der Hans ist ein Politiker aus Wien.*
the Hans is a politician from Vienna
‘Hans is a politician from Vienna.’

Definite and specific indefinite objects of *look for* Intensional readings of definites don’t pattern with unspecific indefinites, as Moltmann (1997:9f.) notes. For instance, (2.81) can be true in a scenario where John and Mary are unsure who the dean is, and hence there is no individual that they are both looking for. Further, sentences like (2.82) with ordinary indefinites are also compatible with such scenarios, while a higher-order indefinite DP is bad here, according to Moltmann.²²

- (2.81) *John is looking for the dean. Mary is looking for him too.* (Moltmann 1997:10, (17))
- (2.82) *John is looking for someone/#something, namely the dean.*
(Moltmann 1997:10, (18-a))

The contrast is perhaps even clearer when we consider scenarios in which the definite description does not refer, such as (2.83). Both the use of a personal pronoun anteceded by the definite description (2.83-a) and the use of the ‘personal’ or [+human] DP *jemand* (2.83-b) seem fine in this scenario.

- (2.83) SCENARIO: Due to a political crisis, there is no mayor of Vienna at the moment. Hans and Peter are foreign journalists who are unaware of this crisis. Both of them are walking around the town hall because they want to interview the mayor.
- a. *Der Hans sucht den Wiener Bürgermeister. Der Peter sucht ihn auch.*
the Hans seeks the Viennese mayor the Peter seeks him too
‘Hans is looking for the Viennese mayor. Peter is looking for him too.’ **true**
- b. *Der Hans und der Peter suchen jemanden, nämlich den Wiener Bürgermeister.*
the Hans and the Peter seek someone namely the Viennese
mayor
‘Hans and Peter are looking for someone, namely the Viennese mayor.’ **true**

²²Moltmann (1997:30) reports a judgment that seems to point into the opposite direction, namely that (i) lacks an intensional reading. She says that (i) cannot describe a situation in which John is trying to get married. She suggests that this is because of a presupposition introduced by the definite determiner, which says that the domain of quantification contains only entities whose existence is ‘accepted’ by both the speaker and the addressee. If so, we predict that definites always come with existential implications. In view of examples like (2.83), this seems too strong. I don’t have a solution for the puzzle posed by (i), however.

- (i) *John is looking for his wife.* (Moltmann 1997:31, (67-a))

In sum, there are certain readings of definites and indefinites in the object position of *look for* and *suchen* in which the search goal can be characterized via a definite description. These readings may be intensional, in the sense that there doesn't have to be an individual that actually satisfies the definite description. Nonetheless, such DPs do not pattern with higher-order DPs.²³

Functional DP objects As noted by Moltmann (1997:19), there is another case in which anaphoric personal pronouns do not affect an intensional reading of an object DP. It involves verbs like *change* that are usually analyzed as expressing predicates of individual concepts (cf. e.g. Montague 1974). Even though the object positions of such verbs are clearly not extensional, they can serve as antecedents of personal pronouns.

(2.84) *John changed his address. Mary changed it too.* (Moltmann 1997:19, fn. 14, (i))

Moltmann reports that certain functional NPs, like *his trainer*, cannot serve as the antecedents of personal pronouns when they co-occur with *change*-type verbs. But examples like (2.85) seem fine in German (thanks to Viola Schmitt (p.c.) for pointing this out to me).

(2.85) *Der Hans hat seinen Zahnarzt gewechselt und der Peter hat ihn auch gewechselt.*
 the Hans has his dentist changed and the Peter has him also changed
 'Hans changed his dentist. Peter changed his dentist too.'

More research on potential inter-speaker variation wrt. such examples is clearly needed, but the main point here is that if antecedent relations with a personal pronoun generally blocked intensional readings, examples like (2.84) and (2.85) should be uncontroversially bad.

Property readings of extensional verbs If higher-order DPs are sensitive to quantification over properties rather than intensionality *per se*, we might expect them to be compatible with property readings of extensional verbs (cf. Kaufmann & Zimmermann 2009). Several of Moltmann's examples, such as (2.73-c) (repeated here as (2.86)), show that this prediction does not hold in general. Some extensional verbs are incompatible with higher-order DPs.

(2.86) *#John met two things, a secretary and an assistant.*

However, it is less clear whether examples of this kind are really ruled out with all extensional verbs. One interesting case are extensional readings of perception verbs such as *see*, because they can take both human and non-human individuals as their arguments. In such cases, quantification over properties seems possible, as illustrated in (2.87).

(2.87) a. SCENARIO: Two small children, Anna and Bea, go to a costume party. Anna believes she saw a ghost at the party, but actually it was her mother wearing a

²³This raises the question how the reading exemplified in (2.83) should be analyzed. Since I argued earlier that ordinary pro-forms anteceded by an ordinary DP do not denote properties of type $\langle s, et \rangle$, we cannot consistently let the pronoun *ihn* in (2.83-a) denote the property of being the unique mayor of Vienna. At first sight, the relevant reading of (2.83-a) and (2.83-b) appears to be paraphrasable in terms of partial individual concepts: (2.83-b) is true iff there is a partial individual concept c such that for every world w in the domain of c , $c(w)$ is a person, Peter finds $c(w)$ in every world w where Peter's search is successful, and Hans finds $c(w)$ in every world w where Hans's search is successful. Spelling this out and addressing the problems raised by this kind of approach is a matter for future work; see Aloni (2001), Schwager (2007) for potentially relevant work exploring the idea that the semantics of ordinary DPs is quite generally relativized to 'covers' of individual concepts that yield distinct values at every world.

costume. Bea believes that she saw a zombie, but it was actually her father in a costume.

- b. *Tatsächlich hat die Anna gesehen, was auch die Bea gesehen hat, nämlich*
 actually has the Anna seen REL also the Bea seen has namely
einen verkleideten Menschen.
 a disguised human
 ‘Actually Anna saw what Bea also saw, a human in disguise.’

The reading of *sehen* ‘see’ in (2.87) is arguably not the intensional reading discussed by Moltmann (1997), since Anna and Bea do not believe that they saw humans in disguise. So it seems that the higher-order relative clause in (2.87) can quantify over properties that are true both of the individual that Anna actually saw, and of the individual that Bea actually saw.

Here, I will not pursue the question how the contrast between (2.86) and (2.87) should be explained. One difference between *meet* and *see* that might be relevant is that perception verbs have been argued to take event or situation arguments, while *meet* requires an individual argument. If this is on the right track, we are again dealing with a type distinction rather than a distinction between extensional and intensional readings.

To sum up, we looked at several examples in which intensionality and quantification over (arbitrary, non-individuating) properties can be dissociated. Although there are some unresolved empirical and theoretical questions here, particularly regarding the properties of functional DP objects, most of the data in Moltmann (1997, 2008) are compatible with the hypothesis presented in Section 2.2.2: The conditions on the distribution of higher-order DPs have to do with the semantic category selected by the verb, not with intensionality. This generalization can be seen more clearly if one controls for type/token ambiguities and for the distinction between different intensional types, such as properties and individual concepts.

2.2.4 Type/token ambiguities and specificity

At the beginning of Section 2.2, we saw that the object of *suchen* may be a quantifier over properties (Zimmermann 1993, 2006). The example I gave there involved a higher-order DP with a relative clause. But it has been argued that unspecific objects of *suchen* always denote such higher-order quantifiers, even in the absence of higher-order relative clauses or other straightforward evidence for this reading (Zimmermann 2006). Under this kind of analysis, all unspecific objects of *suchen* – ordinary as well as higher-order ones – have the same semantic type. In the present framework, this type is $\langle\langle s, et \rangle, t \rangle, t$. I will call this the **uniform-type analysis**.

In the last subsection, however, we saw that there seem to be two distinct kinds of quantification over properties in German: One of them, the ‘type’ reading involved in type-token ambiguities, is restricted to individuating properties, but can be found with basically any DP as long as the lexical noun allows for some context-dependent flexibility in its individuation conditions. The second one, which is not restricted to individuating properties, is only found with higher-order DPs. This distinction suggests an alternative to the uniform-type analysis: One natural way of accounting for the restrictions on quantification over arbitrary subproperties would be to say that individuating properties can be treated as individuals – i.e. as elements of

D_e – for the purposes of semantic composition, while non-individuating properties are only in $D_{\langle s, et \rangle}$, not in D_e . We could then try to derive the distribution of genuine higher-order readings from the assumption that higher-order indefinite DPs, but not ordinary indefinites, may have the type $\langle \langle s, et \rangle, t \rangle$. I will call this the **distinct-type analysis**.

Problems for simple versions of the uniform-type analysis

In this section, I present an argument against the most obvious way of deriving the data in Section 2.2.2 from the uniform-type analysis. At first sight, the argument supports the distinct-type analysis, although a uniform-type analysis could also accommodate it given additional syntactic assumptions (to be discussed in Chapter 5).

Under a uniform-type analysis, the restrictions discussed in Section 2.2.2 could easily be built into the semantics of the NP. For instance, the lexical noun *Buch* ‘book’ would denote a predicate that applies to properties of type $\langle s, et \rangle$, and is true of exactly those properties that are individuating properties of books in the given context and world (2.88-a). When an indefinite determiner combines with this denotation, we get the DP meaning in (2.88). For the higher-order indefinite *etwas*, we derive a denotation of the same type, but without the restriction to individuating properties, which we assume to hold only for lexical NPs (2.89).

$$(2.88) \quad \begin{aligned} \text{a. } \llbracket Buch_i \rrbracket^c &= IP(c)(i)(Buch) = \lambda w. \lambda P_{\langle s, et \rangle}. IP(c)(i)(Buch)(w)(P) \\ \text{b. } \llbracket ein Buch_i \rrbracket^c &= \llbracket [\exists_{\langle s, et \rangle} C_{(1, \langle \langle s, et \rangle, t \rangle)}] Buch_i \rrbracket^c \\ &= \lambda w. \lambda P_{\langle \langle s, et \rangle, t \rangle}. \exists P_{\langle s, et \rangle} [g(1, \langle \langle s, et \rangle, t \rangle)(P) \wedge IP(c)(i)(Buch)(w)(P) \wedge \mathcal{P}(P)] \end{aligned}$$

$$(2.89) \quad \llbracket etwas \rrbracket^{c,g} = \llbracket [\exists_{\langle s, et \rangle} C_{(1, \langle \langle s, et \rangle, t \rangle)}] -was_{\langle s, et \rangle} \rrbracket = \lambda w. \lambda P_{\langle \langle s, et \rangle, t \rangle}. \exists P_{\langle s, et \rangle}. g(1, \langle \langle s, et \rangle, t \rangle)(P) \wedge \mathcal{P}(P)$$

Under these assumptions, the two sentences in (2.90-a) and (2.91-a) have the completely analogous LFs in (2.90-b) and (2.91-b). Given a context c and an assignment g , (2.90-b) expresses the proposition in (2.90-c) and (2.91-b) expresses the proposition in (2.91-c).

$$(2.90) \quad \begin{aligned} \text{a. } & \textit{Der Hans sucht ein Buch.} \\ & \text{‘Hans is looking for a book.’} \\ \text{b. } & \llbracket [\exists_{\langle s, et \rangle} C_{(2, \langle \langle s, et \rangle, t \rangle)}] Buch_i \rrbracket [(1, \langle s, et \rangle) [Hans [t_{(1, \langle s, et \rangle)} sucht]]] \\ \text{c. } & \lambda w. \exists P. g(2, \langle \langle s, et \rangle, t \rangle)(P) \wedge IP(c)(i)(Buch)(w)(P) \wedge \forall w' [w' \in \text{TRY}(w)(\mathbf{hans}) \rightarrow \\ & \exists x [P(w')(x) \wedge \mathbf{find}(w')(x)(\mathbf{hans})]] \end{aligned}$$

$$(2.91) \quad \begin{aligned} \text{a. } & \textit{Der Hans sucht etwas.} \\ & \text{‘Hans is looking for something.’} \\ \text{b. } & \llbracket [\exists_{\langle s, et \rangle} C_{(2, \langle \langle s, et \rangle, t \rangle)}] -was_{\langle s, et \rangle} \rrbracket [(1, \langle s, et \rangle) [Hans [t_{(1, \langle s, et \rangle)} sucht]]] \\ \text{c. } & \lambda w. \exists P. g(2, \langle \langle s, et \rangle, t \rangle)(P) \wedge \forall w' [w' \in \text{TRY}(w)(\mathbf{hans}) \\ & \rightarrow \exists x [P(w')(x) \wedge \mathbf{find}(w')(x)(\mathbf{hans})]] \end{aligned}$$

While (2.91-c) seems basically correct as a paraphrase of the truth conditions of (2.91-a), (2.90-c) is problematic: It says that there is an individuating property P of books such that Hans wants to find an individual that satisfies P . Unless further assumptions are made, we therefore predict (2.90) to be false if the property characterizing the goal of Hans’s search is too weak to count as individuating. Further, we predict that in every world in which Hans’s search is successful,

he finds what we called a low-level individual – a physical copy of some book. Neither of these predictions is borne out: (2.90-a) is true in scenario (2.92), in which the search goal is characterized by a property that was shown to be non-individuating in Section 2.2.2. In this respect, (2.90-a) contrasts with the examples discussed in the last section that involve relative clauses, numerals or wide scope of the indefinite, such as (2.93-b) (repeated from (2.53)).

(2.92) SCENARIO: Hans works at a large publishing company that wants to improve its sales figures in Austria. His boss told him that the ideal way to do so would be to reissue a book that sold at least 20 million copies when it first came out. Now Hans is searching his database for an arbitrary book that sold 20 million copies in Austria before 1960. However, his search is unsuccessful since no such books exist. (2.90-a) **true**

(2.93) a. SCENARIO: Hans and Peter work at a large publishing company that wants to improve its sales figures in Austria. Their bosses told them that the ideal way to do so would be to reissue a book that sold at least 20 million copies when it first came out. Now Hans and Peter are each trying to come up with an arbitrary book that sold 20 million copies in Austria before 1960. However, their search is unsuccessful since no such books exist.
 b. *Der Hans sucht ein Buch, das der Peter auch sucht.*
 the Hans seeks a book REL the Peter also seeks
 ‘Hans is looking for a book that Peter is also looking for.’ **false**

Assuming the judgments from Section 2.2.2, the relative clause in (2.93) is unable to express a predicate that can be true of arbitrary properties. It is limited to individuating properties. The uniform-type analysis, together with the assumption that the restriction to individuating properties is built into the NP semantics, predicts this judgment, but incorrectly predicts analogous judgments for cases like (2.90).

As mentioned above, the analysis sketched in (2.88) also predicts that (2.90) can only be true if Hans’s goal is to find what I called a low-level individual, i.e. a physical copy of a book. This does not seem correct: (2.90) can also be true if his goal is simply to find the title and author, or the ISBN, of a book with a certain property and he is not interested in acquiring a copy of the book. It thus seems that the property characterizing the search goal may have individuating properties in its domain, not just low-level individuals. Additional evidence for this conclusion comes from examples with relative clauses that express predicates unlikely to be true of any low-level individual (2.94):

(2.94) *Der Hans sucht ein Buch, das sich in Japan 5 Millionen Mal verkauft hat.*
 the Hans seeks a book REL REFL in Japan 5 million times sold has
 ‘Hans is looking for a book that sold 5 million copies in Japan.’

On its most plausible reading, (2.94-a) says that Hans wants to identify a book, in the ‘type’ sense, that sold five million copies in Japan, not a single copy that was sold five million times. In summary, if we try to adapt the NP semantics required by the uniform-type analysis in such a way that it predicts the data from Section 2.2.2, the following two observations remain unexplained:

(2.95) a. Unspecific indefinites in the object position of *suchen* can have a reading that is not restricted to individuating properties. This holds even if the indefinite contains an NP that *is* restricted to individuating properties in the configurations discussed

in Section 2.2.2.

- b. When *suchen* occurs with an unmodified unspecific indefinite, the search criteria may be characterized by a property of individuating properties, not just by a property of low-level individuals.

That (2.95-b) is not predicted does not reflect any ‘deep’ property of the uniform-type analysis; it is just a consequence of the specific way of modeling type/token ambiguities that I adopted above. However, it indicates that there are two forms of quantification over properties that should not be treated as being on a par – the one involved in the type/token ambiguity and the one exemplified by higher-order indefinites. In the object position of ITV, ordinary indefinites can have a reading that apparently combines both of them. In a sense, the semantic distinction between ordinary and higher-order indefinites is neutralized in this position. I will now argue that the special status of this configuration is unsurprising under the distinct-type analysis.

Unspecific indefinites under the distinct-type analysis

The distinct-type analysis is based on the assumption that the semantic domain D_e should not be identified with the set A of low-level individuals, but also contains the ‘types’ involved in type/token ambiguities, which I called ‘individuating properties’. A simplistic way of doing this is sketched in (2.96). Here the domain D_e is identified with a set of individuating properties. For each low-level individual x , this set contains the property of being identical to x , but it may also contain less specific individuating properties if they are needed for the interpretation of noun phrases, such as the property of being white wine or the property of being a copy of “The Trial”.

$$(2.96) \quad D_e = \{\lambda w.\lambda y.y = x \mid x \in A\} \cup \{P \mid \exists c.\exists i.\exists w.IP(c)(i)(N)(w)(P) \text{ for some lexical noun } N\}$$

Since the set D_e may contain overlapping properties, properties standing in inclusion relations with one another and even properties that have no instances in the evaluation world, we will assume that DPs actually never quantify over the entire domain. Nominal quantifiers over individuals always involve a domain restriction, usually contributed by an NP, which makes sure that we have a “well-behaved” domain of quantification satisfying the postulates in (2.47). Here, I will write these restrictions into the lexical entries of the nouns; however, this clearly misses a generalization and the restrictions should ultimately follow from general properties of DP semantics.

In this setup, DPs quantifying over individuals, such as *ein Buch* ‘a book’, can be interpreted as in (2.97). The interpretation of higher-order *etwas*, however, remains the same as before (2.98).

$$(2.97) \quad \begin{aligned} \text{a.} \quad & \llbracket Buch_i \rrbracket^c = IP(c)(i)(Buch) = \lambda w.\lambda x_e.IP(c)(i)(Buch)(w)(x) \\ \text{b.} \quad & \llbracket ein Buch_i \rrbracket^{c,g} = \llbracket [\exists_e C_{(2,\langle e,t \rangle)}] Buch_i \rrbracket^{c,g} \\ & = \lambda w.\lambda P_{\langle e,t \rangle}.\exists x.g(2,\langle e,t \rangle)(x) \wedge IP(c)(i)(Buch)(w)(x) \wedge P(x) \end{aligned}$$

$$(2.98) \quad \llbracket etwas \rrbracket^g = \llbracket [\exists_{\langle s,et \rangle} C_{(2,\langle \langle s,et \rangle, t \rangle)}] -was_{\langle s,et \rangle} \rrbracket = \lambda w.\lambda P_{\langle \langle s,et \rangle, t \rangle}.\exists P.g(2,\langle \langle s,et \rangle, t \rangle)(P) \wedge P(P)$$

There are two reasons why the type distinction between (2.97) and (2.98) makes a difference for the analysis of ITV. First, the relation **find** we used in the lexical entry for *suchen* – repeated

in (2.99)– can now take individuating properties, not just low-level individuals, as its second argument.²⁴

$$(2.99) \quad \llbracket \text{suchen} \rrbracket = \lambda w. \lambda P_{\langle s, et \rangle}. \lambda x. \forall w' [w' \in \text{TRY}(w)(x) \rightarrow \exists y [P(w')(y) \wedge \mathbf{find}(w')(y)(x)]]$$

The second effect of the type distinction is more important for our purposes in this chapter: If ordinary quantificational DPs are generally of type $\langle \langle e, t \rangle, t \rangle$, but quantificational higher-order DPs can have other types, we might expect the two classes of DPs to differ in their LF syntax. In particular, the type mismatch triggered by higher-order DPs in the object position of *suchen* (2.100-a,b) can be resolved by LF movement, which produces the interpretable structure in (2.100-c).

- (2.100)a. *Hans sucht etwas.*
 ‘Hans is looking for something.’
 b. $\llbracket \text{Hans} \llbracket [\exists_{\langle s, et \rangle} C_{(2, \langle \langle s, et \rangle, t \rangle)}] \text{-was}_{\langle s, et \rangle} \rrbracket \text{ sucht} \rrbracket$
 c. $\llbracket [\exists_{\langle s, et \rangle} C_{(2, \langle \langle s, et \rangle, t \rangle)}] \text{-was}_{\langle s, et \rangle} \rrbracket \llbracket (1, \langle s, et \rangle) \llbracket \text{Hans} \llbracket t_{(1, \langle s, et \rangle)} \text{ sucht} \rrbracket \rrbracket \rrbracket$

For a non-higher-order indefinite DP like *ein Buch* ‘a book’, however, LF movement is not sufficient to resolve the mismatch: In the derived structure in (2.101-c), the sister of *suchen* is a trace of type e , but *suchen* requires an argument of type $\langle s, et \rangle$.²⁵

- (2.101)a. *Hans sucht ein Buch.*
 ‘Hans is looking for a book.’
 b. $\llbracket \text{Hans} \llbracket [\exists_e C_{(2, \langle e, t \rangle)}] \text{Buch}_i \rrbracket \text{ sucht} \rrbracket$
 c. $\llbracket [\exists_e C_{(2, \langle e, t \rangle)}] \text{Buch}_i \rrbracket \llbracket (1, e) \llbracket \text{Hans} \llbracket t_{(1, e)} \text{ sucht} \rrbracket \rrbracket \rrbracket$

Here, I assume that the mismatch is resolved via type-shifts that map the denotations of DPs to properties, as proposed in Partee (1987). Initial motivation for these shifts comes from the observation that both referential DPs, which are usually assumed to be of type e , and quantificational DPs of type $\langle \langle e, t \rangle, t \rangle$ seem to have predicative uses in copula sentences. Further, Partee notes that they can systematically occur in coordinations with uncontroversially predicative expressions, as in (2.102-a) and (2.103-a). Partee proposes that there are two type-shifting

²⁴This raises a general question: If a DP that exhibits a type/token ambiguity combines with an extensional predicate, does the ‘type’ reading entail any instances of the ‘token’ reading? It seems that this is at least partly a lexical matter. For instance, there is a sense in which one can find a book without finding a copy of the book – by identifying the book’s author, title, ISBN etc. –, but there is no sense in which one can consume a drink without consuming a physical portion of the drink. The question what a general theory of the relation between type and token readings should look like is left open here. For now, the important thing is that we no longer make the prediction that an individual who is looking for a book or a drink must be trying to find a low-level individual, i.e. a copy of the book or a portion of the drink.

²⁵There are several plausible analytical options on which (ordinary, non-higher-order) unspecific objects of opaque verbs do not trigger a type mismatch at all. For instance, Zimmermann’s (1993) discussion of the property analysis is formulated in a version of dynamic semantics in which indefinites can primitively denote properties. This would also be compatible with the argument I am making here since it also predicts the syntax-semantics interface to be different for ordinary property-denoting DPs and quantifiers over properties. My choice to assign type $\langle \langle e, t \rangle, t \rangle$ to ordinary indefinites is motivated merely by compatibility with the mainstream position in the literature. Another way of eliminating the need for a type-shift would be to revert to a quantifier analysis of ITV (Montague 1974), which would allow us to interpret (2.101-b) directly even under a mainstream (type $\langle \langle e, t \rangle, t \rangle$) semantics for the indefinite. However, there are several arguments against the quantifier analysis, discussed in Zimmermann (1993). See Moltmann (1997) for arguments against the property analysis, and van Geenhoven & McNally (2005:section 4) for a reply to Moltmann. Since I found many of the arguments in Zimmermann (1993) and van Geenhoven & McNally (2005) convincing, I am discussing a variant of the property analysis here despite the need for an additional type-shift.

operators involved in mapping DP meanings to properties: IDENT maps an individual to the property of being identical to that individual, as illustrated in (2.102), and BE maps a quantifier of type $\langle\langle e, t \rangle, t\rangle$ to the property of being an individual x such that the quantifier applies to the singleton set containing x (2.103). The effects of these shifts are illustrated in (2.102-c,d) and (2.103-c,d).

- (2.102)a. *Hans is 60 years old and the mayor of Vienna.*
 b. $\llbracket \text{IDENT} \rrbracket = \lambda w. \lambda x. \lambda y. y = x$
 c. *Hans* $\llbracket [60 \text{ years old}] \text{ and } [\text{IDENT } [the \text{ mayor of Vienna}]] \rrbracket$
 d. $\llbracket \text{IDENT } [the \text{ mayor of Vienna}] \rrbracket = \lambda w. \lambda y_e. y = \mathbf{mayor}(w)(\mathbf{vienna})$
- (2.103)a. *Hans is a linguist and constantly drunk.*
 b. $\llbracket \text{BE} \rrbracket = \lambda w. \lambda Q_{\langle\langle e, t \rangle, t\rangle}. \lambda x_e. Q(\lambda y_e. y = x)$
 c. *Hans* $\llbracket [\text{BE } [a \text{ linguist}]] \text{ and } [constantly \text{ drunk}] \rrbracket$
 d. $\llbracket \text{BE } [a \text{ linguist}] \rrbracket = \lambda w. \lambda x_e. (\lambda P_{\langle e, t \rangle}. \exists y_e [\mathbf{linguist}(w)(y) \wedge P(y)])(\lambda y_e. y = x)$
 $= \lambda w. \lambda x_e. \mathbf{linguist}(w)(x)$

The type-shift BE therefore constitutes an independently motivated way of resolving the mismatch triggered by the type requirement of ITV. The DP meaning is shifted to the property of being an individuating property of books in the given context and world (2.104-b). The whole structure (2.104-a) then expresses the proposition paraphrased in (2.104-c).

- (2.104)a. $[Hans \llbracket [\text{BE } [\exists_e C_{(2, \langle e, t \rangle)}] \text{ Buch}_i] \text{ sucht} \rrbracket]$
 b. $\llbracket \text{BE } [\exists_e C_{(2, \langle e, t \rangle)}] \text{ Buch}_i \rrbracket^{\mathbf{c}, g} = \lambda w. \lambda x_e. \text{IP}(\mathbf{c})(i)(\text{Buch})(w)(x) \wedge g(2, \langle e, t \rangle)(x)$
 c. $\llbracket (2.104\text{-a}) \rrbracket^{\mathbf{c}, g} = \lambda w. \forall w' [w' \in \text{TRY}(w)(\mathbf{hans})$
 $\rightarrow \exists x_e [\text{IP}(\mathbf{c})(i)(\text{Buch})(w')(x) \wedge g(2, \langle e, t \rangle)(x) \wedge \mathbf{find}(w')(x)(\mathbf{hans})]$
 ‘In every world w' in which Hans’s search in w is successful, he finds something that counts as an individuating property of books in w' relative to the context $\mathbf{c}$ and the individuation method i .’

This predicts that the truth conditions of (2.104-a) depend on the contextually provided individuation method: Depending on the parameters $\mathbf{c}$ and i , Hans’s goal might be to find a book in the ‘type’ sense, or to find a physical copy of a book. Importantly, however, the property characterizing his search goal can be an arbitrary property of books in the contextually relevant sense. For instance, the paraphrase (2.104-c) is satisfied if Hans is trying to find an arbitrary book with a green cover, even if the property of having a green cover is not individuating: In this case, every world in which his search is successful is a world in which he finds a book, which is sufficient to make (2.104-c) true. This analysis therefore avoids the problem discussed above that affects simple versions of the uniform-type analysis.

There is a second possible derivation for (2.101-a) which involves LF movement of the quantifier and application of IDENT to its trace. This is one possible way of deriving a specific reading for (2.101-a), paraphrased in (2.105-b).

- (2.105)a. $\llbracket [\exists_e C_{(2, \langle e, t \rangle)}] \text{ Buch}_i \rrbracket [(1, e) [Hans \llbracket [\text{IDENT } t_{(1, e)}] \text{ sucht} \rrbracket]]$
 b. $\llbracket (2.105\text{-a}) \rrbracket^{\mathbf{c}, g} = \lambda w. \exists x. \text{IP}(\mathbf{c})(i)(\text{Buch})(w)(x) \wedge g(2, \langle e, t \rangle)(x)$
 $\wedge \forall w' [w' \in \text{TRY}(w)(\mathbf{hans}) \rightarrow \mathbf{find}(w')(x)(\mathbf{hans})]$
 ‘There is an x that counts as an individuating property of books in w relative to the context $\mathbf{c}$ and the individuation method i and is such that in every world w' in which

Hans's search in *w* is successful, he finds *x*.'

Note that, depending on the context and the individuation method associated with index *i*, this specific reading might involve quantification over properties corresponding to low-level individuals, or over more general individuating properties. On the present approach, the type/token ambiguity is therefore orthogonal to the specific/unspecific ambiguity and we generate all four logically possible combinations of these two parameters.

In summary, the distinct-type analysis, although less elegant overall, has a potential advantage over the uniform-type analysis: It predicts that ordinary and higher-order DPs may differ in their LF syntax, even if they occur in the same surface position. This feature of the distinct-type analysis helps explain a systematic exception to the generalization I argued for in Section 2.2.2, according to which property readings of ordinary DPs always involve individuating properties, while higher-order DPs may have arbitrary non-individuating properties in their domain. For simple indefinite objects of *suchen*, the search goal may be characterized by a non-individuating property, no matter which kind of indefinite is used. I claimed that this can be derived from the assumption that ordinary indefinite objects of ITV may be interpreted in situ and shifted to a property interpretation. Further, I argued that the type/token distinction and the specific/unspecific distinction are logically independent of each other and that this falls out from a simple version of the distinct-type analysis. This argument raises the question how the generalizations from Section 2.2.2 can be derived from the distinct-type analysis. This will be the topic of the next section.

2.2.5 Consequences of the distinct-type analysis

Contrasts between ordinary and higher-order DPs

Wide-scope indefinites We will start with the contrast involving wide-scope readings of indefinites, illustrated in (2.106) (= (2.64)).

(2.106) SCENARIO: At a festival, there is a popular bar selling drinks in one-liter pitchers. Almost all people have already ordered drinks there. There are many different drinks – beer, mixed drinks, mulled wine – and none of them is clearly the most popular one. But almost half of the people at the festival ordered something in a one-liter pitcher.

- a. *Es ist auffällig, dass /EIN Getränk bisher fast jeder \ZWEITE bestellt hat.*
it is striking that one drink so far almost every second ordered has
'It is striking that there was one drink that almost every second person ordered so far.'
false
- b. *Es ist auffällig, dass /EINE Sache bisher fast jeder \ZWEITE bestellt hat.*
it is striking that one thing so far almost every second ordered has
'It is striking that there was one thing that almost every second person ordered so far.'
true

In such sentences, the object of the ITV *bestellen* has overtly moved over the subject. Since a narrow-scope reading of the indefinites is ruled out by the scenario in (2.106), the relevant readings of (2.106-a,b) cannot involve reconstruction of this movement step. The crucial difference between (2.106-a) and (2.106-b) can then be reduced to the assumption that ordinary

indefinites, which are interpreted as quantifiers over individuals, leave traces of type e when they move. Since the verb requires an argument of type $\langle s, et \rangle$, the type mismatch between the verb and the movement trace must be resolved via type-shifting, as in (2.107-a). Higher-order indefinites as in (2.106-b), on the other hand, may leave a trace of type $\langle s, et \rangle$, which combines directly with the verb (2.107-b). (I ignore tense and complementizers in the following discussion.)

- (2.107)a. $[dass \llbracket [\exists_e C_{(2, \langle e, t \rangle)}] \textit{Getränk}_i \rrbracket [(1, e) \llbracket [fast \textit{jeder Zweite}] \llbracket IDENT \textit{t}_{(1, e)} \rrbracket \textit{bestellt}] \rrbracket]$
 b. $[dass \llbracket [\exists_{\langle s, et \rangle} C_{(2, \langle \langle s, et \rangle, t \rangle)}] \textit{Sache} \rrbracket [(1, \langle s, et \rangle) \llbracket [fast \textit{jeder Zweite}] \llbracket t_{(1, \langle s, et \rangle)} \rrbracket \textit{bestellt}] \rrbracket]$

Let us see how the truth conditions of (2.107-a) and (2.107-b) are derived. In (2.108), I give preliminary denotations for the constituents in (2.107) that were not discussed in Chapter 1. The proposed meaning for *bestellen* ‘order’ is analogous to Zimmermann’s (1993) meaning for *look for*. These denotations are probably inadequate in several respects and just serve to illustrate the general predictions the present approach makes.²⁶

- (2.108)a. $\llbracket \textit{bestellen} \rrbracket = \lambda w. \lambda P_{\langle s, et \rangle}. \lambda y_e \forall w' [w' \in \text{REQUEST}(w)(y) \rightarrow \exists x [P(w')(x) \wedge \text{get}(w')(x)(y)]]$,
 where $\text{REQUEST}(w)(y)$ is the set of all worlds in which y ’s requests in w are satisfied
 b. $\llbracket [fast \textit{jeder Zweite}] \rrbracket^c = \lambda w. \lambda P_{\langle e, t \rangle}. |\{x \mid \text{person}(w)(x) \wedge P(w)(x)\}| / |\{x \mid \text{person}(w)(x)\}|$
 $\approx \frac{1}{2} - t(c)$, where $t(c)$ is a contextually given small percentage

The derivation for (2.107-a) is given in (2.109) and the derivation for (2.107-b) in (2.110). Note that the truth conditions in (2.109) involve quantification over a set of individuating properties, while there is no such restriction in (2.110).

- (2.109)a. $\llbracket \llbracket IDENT \textit{t}_{(1, e)} \rrbracket \textit{bestellt} \rrbracket^g = \lambda w. \lambda y_e \forall w' [w' \in \text{REQUEST}(w)(y) \rightarrow \exists x [x = g(1, e) \wedge \text{get}(w')(x)(y)]]$
 $= \lambda w. \lambda y_e \forall w' [w' \in \text{REQUEST}(w)(y) \rightarrow \text{get}(w')(g(1, e))(y)]$
 b. $\llbracket [fast \textit{jeder Zweite}] \llbracket \llbracket IDENT \textit{t}_{(1, e)} \rrbracket \textit{bestellt} \rrbracket^g \rrbracket^{g, c}$
 $= \lambda w. |\{x \mid \text{person}(w)(x) \wedge \forall w' [w' \in \text{REQUEST}(w)(x) \rightarrow \text{get}(w')(g(1, e))(x)]\}|$
 $/ |\{x \mid \text{person}(w)(x)\}| \approx \frac{1}{2} - t(c)$
 c. $\llbracket \llbracket (1, e) \rrbracket \llbracket [fast \textit{jeder Zweite}] \llbracket \llbracket IDENT \textit{t}_{(1, e)} \rrbracket \textit{bestellt} \rrbracket^g \rrbracket^g \rrbracket^{g, c}$
 $= \lambda w. \lambda y_e. |\{x \mid \text{person}(w)(x) \wedge \forall w' [w' \in \text{REQUEST}(w)(x) \rightarrow \text{get}(w')(y)(x)]\}|$
 $/ |\{x \mid \text{person}(w)(x)\}| \approx \frac{1}{2} - t(c)$
 $=$ the property which, for each world w , returns the set of individuals (including individuating properties) that almost half of the people requested in w
 d. $\llbracket (2.107\text{-a}) \rrbracket^{g, c} = \lambda w. \exists y. \text{IP}(c)(i)(\textit{Getränk})(w)(y) \wedge g(2, \langle e, t \rangle)(y)$
 $\wedge |\{x \mid \text{person}(w)(x) \wedge \forall w' [w' \in \text{REQUEST}(w)(x) \rightarrow \text{get}(w')(y)(x)]\}|$
 $/ |\{x \mid \text{person}(w)(x)\}| \approx \frac{1}{2} - t(c)$
 ‘There is an y that counts as an individuating property of drinks (i.e. a type of drink) with respect to the individuation method i in context c and the world w and that is such that almost half of the people in w requested y .’

- (2.110)a. $\llbracket t_{(1, \langle s, et \rangle)} \textit{bestellt} \rrbracket^g = \lambda w. \lambda y_e \forall w' [w' \in \text{REQUEST}(w)(y) \rightarrow \exists x [g(1, \langle s, et \rangle)(w')(x) \wedge \text{get}(w')(x)(y)]]$
 b. $\llbracket [fast \textit{jeder Zweite}] \llbracket t_{(1, \langle s, et \rangle)} \textit{bestellt} \rrbracket^g \rrbracket^{g, c}$
 $= \lambda w. |\{y \mid \text{person}(w)(y) \wedge \forall w' [w' \in \text{REQUEST}(w)(y) \rightarrow \exists x [g(1, \langle s, et \rangle)(w')(x) \wedge \text{get}(w')(x)(y)]]\}|$
 $/ |\{y \mid \text{person}(w)(y)\}| \approx \frac{1}{2} - t(c)$

²⁶ Again, the implications the meta-language predicate **get** gives rise to when its argument is an individuating property are not explicitly modeled here. For instance, the implication that ordering a drink means requesting a physical portion of that drink would need to be built into a more detailed analysis of **get**.

- c. $\llbracket (1, \langle s, et \rangle) \llbracket [fast\ jeder\ Zweite] [t_{(1, \langle s, et \rangle)}\ bestellt] \rrbracket \rrbracket^{g, c}$
 $= \lambda w. \lambda P_{\langle s, et \rangle}. |\{y \mid \mathbf{person}(w)(y) \wedge \forall w' [w' \in \text{REQUEST}(w)(y) \rightarrow \exists x [P(w')(x) \wedge \mathbf{get}(w')(x)(y)]]\}|$
 $/ |\{y \mid \mathbf{person}(w)(y)\}| \approx \frac{1}{2} - t(c)$
 $= \text{the property which, for each world } w, \text{ returns the set of all properties } P \text{ such that}$
 $\text{almost half of the people requested a } P \text{ in } w$
- d. $\llbracket (2.107\text{-}b) \rrbracket^{g, c} = \lambda w. \exists P_{\langle s, et \rangle}. g(2, \langle \langle s, et \rangle, t \rangle)(P) \wedge |\{y \mid \mathbf{person}(w)(y)$
 $\wedge \forall w' [w' \in \text{REQUEST}(w)(y) \rightarrow \exists x [P(w')(x) \wedge \mathbf{get}(w')(x)(y)]]\}| / |\{y \mid \mathbf{person}(w)(y)\}| \approx$
 $\frac{1}{2} - t(c)$
 $\text{'There is a property } P \text{ such that almost half of the people in } w \text{ requested a } P \text{ in } w.'$

In sum, the contrast in (2.106) is reduced to two assumptions: First, a DP of type $\langle \langle \tau, t \rangle, t \rangle$ must leave a trace of type τ , and ordinary indefinite DPs have type $\langle \langle e, t \rangle, t \rangle$, unlike higher-order DPs. Second, individuating properties, unlike other properties, can be elements of D_e . Given the possibility of resolving the verb-object mismatch in (2.107-a) via type-shifting, it follows that the object of the ITV in (2.110-a) ranges over individuating properties, while the object in (2.110-b) ranges over arbitrary properties.²⁷

Relative clauses We now turn to the two diagnostics involving the internal semantic composition of the DP – relative clauses and numerals. Intuitively, the difference between the examples in (2.111) (= (2.54)) seems to be that the relative clause in (2.111-a) can express arbitrary properties of books, while the one in (2.111-b) cannot.

(2.111)SCENARIO: Hans and Peter are both reorganizing their bookshelves. Both of them decided independently to sort the books by color rather than title or genre, following the latest interior design trend. Hans is almost done sorting his books, but now needs an arbitrary book with a light green cover in order to complete his color scheme. Peter is in the same situation and is also looking for a book with a light green cover.

- a. *Der Hans sucht etwas, das der Peter auch sucht.*
the Hans seeks something REL the Peter also seeks
‘Hans is looking for something that Peter is also looking for.’ **true**
- b. *Der Hans sucht ein Buch, das der Peter auch sucht.*
the Hans seeks a book REL the Peter also seeks
‘Hans is looking for a book that Peter is also looking for.’ **not true**

This contrast can be attributed to the type distinction between the two DPs as well, if we assume that the meanings of restrictive relative clauses combine intersectively with the NP, below the determiner. Since the noun *Buch* in (2.111-b) has type $\langle e, t \rangle$, the relative clause must be of type $\langle e, t \rangle$ as well. This can only be achieved by abstraction over a trace of type e , which must combine with the ITV via type-shifting again. We therefore have the LF in (2.112-b). In (2.111-a), on the other hand, the higher-order NP *-was* can be of type $\langle \langle s, et \rangle, t \rangle$, giving rise to the LF in (2.112-a). Here the traces inside the relative clause and in the main clause are both of type $\langle s, et \rangle$.

- (2.112)a. $\llbracket [\exists_{\langle s, et \rangle} C_{(1, \langle \langle s, et \rangle, t \rangle)}] [-was_{\langle s, et \rangle} [(2, \langle s, et \rangle) [\llbracket [der\ Peter] [t_{(2, \langle s, et \rangle)}\ sucht] \rrbracket]]] \rrbracket [(1, \langle s, et \rangle)$
 $\llbracket [der\ Hans] [t_{(1, \langle s, et \rangle)}\ sucht] \rrbracket] \rrbracket$

²⁷Here, I assume that there are no freely available type-shifts that map a property of type $\langle e, t \rangle$ to the set containing all its subproperties, which has type $\langle \langle s, et \rangle, t \rangle$. Such a shift is part of the analysis in Zimmermann (2006), which therefore can only predict the contrasts under discussion here if it is supplemented with further assumptions about LF syntax. See Chapter 5 for more discussion.

- b. $[[\exists_e C_{(1,\langle e,t \rangle)}] [Buch_i [(2,e) [[der\ Peter] [[IDENT\ t_{(2,e)}] sucht]]]] [(1,e) [[der\ Hans] [[IDENT\ t_{(1,e)}] sucht]]]$

The relevant steps of the compositional derivations for (2.112-a) and (2.112-b) are given in (2.113) and (2.114), respectively.

- (2.113)a. $[[[der\ Peter] [t_{(2,\langle s,et \rangle)}] sucht]]^g = \lambda w. \forall w' [w' \in TRY(w)(\mathbf{peter}) \rightarrow \exists x [g(2, \langle s, et \rangle)(w')(x) \wedge \mathbf{find}(w')(x)(\mathbf{peter})]]$
- b. $[[(2, \langle s, et \rangle) [[der\ Peter] [t_{(2,\langle s,et \rangle)}] sucht]] = \lambda w. \lambda P. \forall w' [w' \in TRY(w)(\mathbf{peter}) \rightarrow \exists x [P(w')(x) \wedge \mathbf{find}(w')(x)(\mathbf{peter})]]$
 = the property which, for each world w , returns the set of properties P of individuals such that Peter is looking for a P in w
- c. $[[-was_{\langle s,et \rangle} [(2, \langle s, et \rangle) [[der\ Peter] [t_{(2,\langle s,et \rangle)}] sucht]]]]^g = (2.113-b)$
- d. $[[[\exists_{\langle s,et \rangle} C_{(1,\langle \langle s,et \rangle, t \rangle)}] [-was_{\langle s,et \rangle} [(2, \langle s, et \rangle) [[der\ Peter] [t_{(2,\langle s,et \rangle)}] sucht]]]]]]^g = \lambda w. \lambda P_{\langle \langle s,et \rangle, t \rangle}. \exists P [g(1, \langle \langle s, et \rangle, t \rangle)(P) \wedge \forall w' [w' \in TRY(w)(\mathbf{peter}) \rightarrow \exists x [P(w')(x) \wedge \mathbf{find}(w')(x)(\mathbf{peter})]] \wedge \mathcal{P}(P)]$
 = the property which, for each world w , returns the set of all sets $\mathcal{P}$ of properties of individuals such that for some property P in $\mathcal{P}$, Peter is looking for a P in w
- e. $[[(1, \langle s, et \rangle) [[der\ Hans] [t_{(1,\langle s,et \rangle)}] sucht]]]]^g = \lambda w. \lambda P. \forall w' [w' \in TRY(w)(\mathbf{hans}) \rightarrow \exists x [P(w')(x) \wedge \mathbf{find}(w')(x)(\mathbf{hans})]]$
 = the property which, for each world w , returns the set of properties P of individuals such that Hans is looking for a P in w
- f. $[[(2.112-a)]]^g = \lambda w. \exists P_{\langle s,et \rangle} [g(1, \langle \langle s, et \rangle, t \rangle)(P) \wedge \forall w' [w' \in TRY(w)(\mathbf{peter}) \rightarrow \exists x [P(w')(x) \wedge \mathbf{find}(w')(x)(\mathbf{peter})]] \wedge \forall w' [w' \in TRY(w)(\mathbf{hans}) \rightarrow \exists x [P(w')(x) \wedge \mathbf{find}(w')(x)(\mathbf{hans})]]]$
 ‘There is a property P of individuals such that Hans is looking for a P in w , and Peter is looking for a P in w .’
- (2.114)a. $[[[IDENT\ t_{(2,e)}] sucht]]^g = \lambda w. \lambda y_e. \forall w' [w' \in TRY(w)(y) \rightarrow \exists x_e [x = g(2, e) \wedge \mathbf{find}(w')(x)(y)]]$
 $= \lambda w. \lambda y_e. \forall w' [w' \in TRY(w)(y) \rightarrow \mathbf{find}(w')(g(2, e))(y)]$
- b. $[[[der\ Peter] [[IDENT\ t_{(2,e)}] sucht]]]]^g = \lambda w. \forall w' [w' \in TRY(w)(\mathbf{peter}) \rightarrow \mathbf{find}(w')(g(2, e))(\mathbf{peter})]$
- c. $[[(2, e) [[der\ Peter] [[IDENT\ t_{(2,e)}] sucht]]]]^g = \lambda w. \lambda x_e. \forall w' [w' \in TRY(w)(\mathbf{peter}) \rightarrow \mathbf{find}(w')(x)(\mathbf{peter})]$
 = the property which, for each world w , returns the set of individuals (including individuating properties) that Peter is trying to find in w
- d. $[[Buch_i [(2, e) [[der\ Peter] [[IDENT\ t_{(2,e)}] sucht]]]]]]^{g,c} = \lambda w. \lambda x_e. IP(\mathbf{c})(i)(Buch)(w)(x) \wedge \forall w' [w' \in TRY(w)(\mathbf{peter}) \rightarrow \mathbf{find}(w')(x)(\mathbf{peter})]$
 = the property which, for each world w , returns the set of individuating properties of books (i.e. types of books) with respect to the individuation method i in context $\mathbf{c}$ that Peter is trying to find in w
- e. $[[[\exists_e C_{(1,\langle e,t \rangle)}] [Buch_i [(2, e) [[der\ Peter] [[IDENT\ t_{(2,e)}] sucht]]]]]]^{g,c} = \lambda w. \lambda P_{\langle e,t \rangle}. \exists x_e [g(1, \langle e, t \rangle)(x) \wedge IP(\mathbf{c})(i)(Buch)(w)(x) \wedge \forall w' [w' \in TRY(w)(\mathbf{peter}) \rightarrow \mathbf{find}(w')(x)(\mathbf{peter})] \wedge P(x)]$
- f. $[[(1, e) [[der\ Hans] [[IDENT\ t_{(1,e)}] sucht]]]] = \lambda w. \lambda x_e. \forall w' [w' \in TRY(w)(\mathbf{hans}) \rightarrow \mathbf{find}(w')(x)(\mathbf{hans})]$
 = the property which, for each world w , returns the set of individuating properties of books (i.e. types of books) with respect to the individuation method i in context $\mathbf{c}$ that Hans is trying to find in w
- g. $[[(2.112-b)]]]^{g,c} = \lambda w. \exists x_e [g(1, \langle e, t \rangle)(x) \wedge IP(\mathbf{c})(i)(Buch)(w)(x) \wedge \forall w' [w' \in TRY(w)(\mathbf{peter}) \rightarrow \mathbf{find}(w')(x)(\mathbf{peter})] \wedge \forall w' [w' \in TRY(w)(\mathbf{hans}) \rightarrow \mathbf{find}(w')(x)(\mathbf{hans})]]]$
 ‘There is an individuating property of books (i.e. a type of books) x relative to the

individuation method i in context $\mathbf{c}$ and the world w such that Peter is trying to find x in w and Hans is trying to find x in w .’

Given our previous assumptions, an ordinary indefinite with a relative clause containing another ITV can therefore quantify over individuals in the usual sense or over individuating properties, but not over arbitrary properties. Higher-order indefinites containing relative clauses with an ITV, on the other hand, can quantify over arbitrary properties.

Numerals Finally, the contrast involving numerals, illustrated in (2.115) (= (i) from footnote 16), is also accounted for in terms of distinct semantic types of the NP. In Chapter 1, I gave a simplified LF syntax and cross-categorial semantics for DPs with numerals. Following the assumptions made there, *zwei* ‘two’ must have type $\langle e, t \rangle$ to combine with the NP in (2.115-b), but may have type $\langle \langle s, et \rangle, t \rangle$ in (2.115-a). The relevant LFs, ignoring the semantic contribution of *nur* ‘only’ for simplicity, are given in (2.116).

(2.115)SCENARIO: Hans is arranging the new window display for his local library. He decides to use only books with covers in black and white. To complete the arrangement he has in mind, he still needs three books with white covers and two books with black covers. Unfortunately, no books in these colors are left.

- a. *Der Hans sucht nur zwei Sachen.*
the Hans seeks only two things
‘Hans is looking for only two things.’ true
- b. *Der Hans sucht nur zwei Bücher.*
the Hans seeks only two books
‘Hans is looking for only two books.’ false

- (2.116)a. $[[\exists_{\langle s, et \rangle} C_{(2, \langle \langle s, et \rangle, t \rangle)}] [zwei_{\langle s, et \rangle} Sachen_{\langle s, et \rangle}] [* [(1, \langle s, et \rangle) [[der Hans] [t_{(1, \langle s, et \rangle)} sucht]]]]]$
- b. $[[\exists_e C_{(2, \langle e, t \rangle)}] [zwei_e [* Bücher_i]] [* [(1, e) [[der Hans] [[IDENT t_{(1, e)}] sucht]]]]]$

(2.117) and (2.118) show how these LFs give rise to the expected truth conditions.

- (2.117)a. $[[zwei_{\langle s, et \rangle} Sachen_{\langle s, et \rangle}]] = \lambda w. \lambda P_{\langle s, et \rangle}. |\{Q \mid Q \leq_a P\}| = 2$
- b. $[[[\exists_{\langle s, et \rangle} C_{(2, \langle \langle s, et \rangle, t \rangle)}] [zwei_{\langle s, et \rangle} Sachen_{\langle s, et \rangle}]]]^g = \lambda w. \lambda P_{\langle \langle s, et \rangle, t \rangle}. \exists P_{\langle s, et \rangle}. g(2, \langle \langle s, et \rangle, t \rangle)(P) \wedge |\{Q \mid Q \leq_a P\}| = 2 \wedge \mathcal{P}(P)$
- c. $[[[(1, \langle s, et \rangle) [[der Hans] [t_{(1, \langle s, et \rangle)} sucht]]]]] = \lambda w. \lambda P_{\langle s, et \rangle}. \forall w' [w' \in \text{TRY}(w)(\mathbf{hans}) \rightarrow \exists x [P(w')(x) \wedge \mathbf{find}(w')(x)(\mathbf{hans})]]]$
- d. $[[* [(1, \langle s, et \rangle) [[der Hans] [t_{(1, \langle s, et \rangle)} sucht]]]]] = \lambda w. \lambda P_{\langle s, et \rangle}. \forall Q_{\langle s, et \rangle} \leq_a P. \forall w' [w' \in \text{TRY}(w)(\mathbf{hans}) \rightarrow \exists x [Q(w')(x) \wedge \mathbf{find}(w')(x)(\mathbf{hans})]]]$
= the property which returns, for each world w , the set of pluralities P of properties such that for each atomic part Q of P , Hans is looking for a Q in w
- e. $[[(2.116-a)]]^g = \lambda w. \exists P_{\langle s, et \rangle}. g(2, \langle \langle s, et \rangle, t \rangle)(P) \wedge |\{Q \mid Q \leq_a P\}| = 2 \wedge \forall Q_{\langle s, et \rangle} \leq_a P. \forall w' [w' \in \text{TRY}(w)(\mathbf{hans}) \rightarrow \exists x [Q(w')(x) \wedge \mathbf{find}(w')(x)(\mathbf{hans})]]]$
‘There is a plurality P of two properties such that for each atomic part Q of P , Hans is looking for a Q in w .’

- (2.118)a. $[[zwei_e [* Bücher_i]]]^c = \lambda w. \lambda x_e. |\{y \mid y \leq_a x\}| = 2 \wedge \forall y_e \leq_a x. \text{IP}(\mathbf{c})(i)(\text{Buch})(w)(y)$
= the set of all pluralities of two individuating properties of books (= two types of books) wrt. the individuation method i in context $\mathbf{c}$ and the world w
- b. $[[[\exists_e C_{(2, \langle e, t \rangle)}] [zwei_e [* Bücher_i]]]^c]^g = \lambda w. \lambda P_{\langle e, t \rangle}. \exists x_e. g(2, \langle e, t \rangle)(x) \wedge |\{y \mid y \leq_a x\}| = 2 \wedge \forall y_e \leq_a x. \text{IP}(\mathbf{c})(i)(\text{Buch})(w)(y) \wedge P(x)$
- c. $[[(1, e) [[der Hans] [[IDENT t_{(1, e)}] sucht]]]]^c$

- $= \lambda w. \lambda x_e. \forall w' [w' \in \text{TRY}(w)(\mathbf{hans}) \rightarrow \mathbf{find}(w')(x)(\mathbf{hans})]$
 d. $\llbracket^* [(1, e) [\llbracket \text{der Hans} \rrbracket [\llbracket \text{IDENT } t_{(1,e)} \rrbracket \text{ sucht}]]] \rrbracket^c$
 $= \lambda w. \lambda x_e. \forall y_e \leq_a x. \forall w' [w' \in \text{TRY}(w)(\mathbf{hans}) \rightarrow \mathbf{find}(w')(y)(\mathbf{hans})]$
 $=$ the property which returns, for each world w , the set of pluralities x of individuals (including individuating properties) such that Hans is trying to find each atomic part of x in w
 e. $\llbracket (2.116\text{-b}) \rrbracket^{c,g} = \lambda w. \exists x_e. g(2, \langle e, t \rangle)(x) \wedge |\{y \mid y \leq_a x\}| = 2$
 $\wedge \forall y_e \leq_a x. \text{IP}(\mathbf{c})(i)(\text{Buch})(w)(y)$
 $\wedge \forall y_e \leq_a x. \forall w' [w' \in \text{TRY}(w)(\mathbf{hans}) \rightarrow \mathbf{find}(w')(y)(\mathbf{hans})]$
 ‘There is a plurality x of two individuating properties of books (= two types of books) wrt. the individuation method i in context $\mathbf{c}$ and the world w such that for each atomic part y of x , Hans is trying to find y in w .’

In sum, the distinct-type analysis distinguishes between quantification over arbitrary properties and quantification over individuals – including individuating properties – in a way that predicts contrasts of the kind discussed in Section 2.2.2, but also accounts for configurations in which these contrasts appear to be absent, as discussed in Section 2.2.4. An account of Moltmann’s (1997) contrasts involving animacy and pronouns is still missing, however. In this thesis, I will not give an analysis of Moltmann’s pronoun data, since I believe a more detailed empirical investigation of the higher-order pro-form *das* would be needed to develop a plausible approach. But I will briefly discuss an approach to the animacy contrast, to be implemented in future work.

The animacy effect Given the data in Section 2.2.2, the animacy restriction observed in Moltmann (1997, 2008) can be formulated as follows:

- (2.119) ‘Impersonal’/neuter DPs cannot denote or quantify over human individuals, but on a higher-order reading, they can denote or quantify over properties that are only true of human individuals.

Given the cross-categorial schema for the interpretation of higher-order DPs like *etwas* ‘something’ or *zwei Sachen* ‘two things’ that we discussed in Chapter 1, this restriction is surprising: Why would DPs that refer to or quantify over individuals involve a semantic restriction that, at least for some speakers, is absent for their formally identical higher-order counterparts? Ideally, we would like to account for this restriction without positing an additional condition that is only part of the lexical entry for, say, *Sache_e*, but not for *Sache_{\langle s, et \rangle}*.

It seems to me that the unacceptability of human referents for non-higher-order ‘impersonal’ DPs should somehow be attributed to competition with ‘personal’ or [+human] DPs. For instance, *something* cannot (usually) quantify over human beings because it competes with the stronger alternative *someone*, but when *something* quantifies over properties of human beings, it does not have an alternative of the same type since *someone* lacks a property reading. What is less clear is how exactly this competition should be implemented. It is clearly not a case of scalar implicature, since it is not affected by downward-entailing operators: In (2.120), the ‘impersonal’ indefinite is still odd.

- (2.120) *Niemand ist mit jemandem/#etwas aus Wien befreundet.*
 nobody is with someone/something from Vienna friendly
 ‘Nobody is friends with someone/#something from Vienna.’

However, it might be possible to reduce the effect to another pragmatic notion of competition that is based on comparing alternative meanings, such as Maximize Presupposition (Heim 1991, Sauerland 2008). If *jemand* ‘someone’ presupposes that its argument is [+human], but the type *e* version of *etwas* ‘something’ has no such presupposition, this might block the use of *etwas* to refer to humans. How this idea might be implemented in a way that is compatible with the other assumptions made in this chapter is a question for future work. A full analysis would also have to explain the inter-speaker variation we find with respect to animacy restrictions on higher-order indefinites.

2.2.6 Section summary

In this section, I tried to motivate the empirical claim in (2.121-a) and the theoretical claim in (2.121-b), using examples with the ITV *suchen* ‘look for’ and *bestellen* ‘order’.

- (2.121)a. In certain configurations, only higher-order DPs have genuine ‘unspecific’ readings that involve quantification over arbitrary properties.
- b. Higher-order DPs, but not ordinary DPs, can quantify over properties of type $\langle s, et \rangle$.

Following Zimmermann (1993), I assumed that the objects of such verbs – at least on their unspecific readings – denote properties.

Several contrasts between higher-order DPs and ordinary indefinite DPs were derived from the type distinction in (2.121-b), together with certain assumptions about composition and LF syntax. I also discussed Moltmann’s (1997) claim that compatibility with higher-order DPs can be used to test whether a given predicate is intensional, and concluded that her diagnostics are probably sensitive to ‘unspecificity’ – in the sense of allowing for property arguments of type $\langle s, et \rangle$ – rather than intensionality.

In order to exclude certain apparent counterexamples to (2.121-a), we had to control for the distinction between quantification over ‘individuating properties’ and quantification over arbitrary, possibly non-individuating, properties. Individuating properties correspond to the ‘types’ involved in type/token ambiguities. I argued that individuating properties can be treated as being of type *e* for the purposes of semantic composition, while this is not the case for other properties. The motivation for this is that even though there are several semantic criteria that could be used to test whether a given DP can denote a property or not, it turns out that none of these criteria are sensitive to type/token ambiguities. For instance, quantification over books in the sense of literary works (rather than individual copies) or over types of drinks (rather than portions of drinks) does not pattern with clear cases of quantification over properties. This raises the question whether semantic composition is sensitive to the type/token ambiguity at all.

2.3 Summary: Tests for higher-order DPs

The main goal of this chapter was to motivate the study of higher-order DPs as a semantically interesting subclass of DPs. To this end, I discussed several types of examples that reveal semantic differences between ordinary and higher-order DPs in the object positions of opaque

predicates. These tests are partly taken from the semantic literature on English and partly new. I will summarize them once more here:

Test 1: Attitude predicates incompatible with content DPs (Elliott 2017). Some attitude verbs, such as English *think* and *explain*, German *denken* ‘think’ and *meinen* ‘think, opine’ and certain uses of German *erklären* ‘explain’, do not allow for ordinary DP complements that express the content of the propositional attitude. Ordinary DPs with propositional content are either unacceptable or have a thematic role clearly distinguishable from that of CP complements. However, some verbs with this property allow higher-order DP complements to have the thematic role otherwise reserved for CPs.

- (2.122)a. *Der Hans denkt, dass der Paul verrückt geworden ist.*
 the Hans thinks that the Paul mad become is
 ‘Hans thinks/believes that Paul went mad.’
 b. #*Der Hans denkt das Gerücht, dass der Paul verrückt geworden ist.*
 the Hans thinks the rumour that the Paul mad become is
cannot mean: ‘Hans believes the rumour that Paul went mad.’
 c. *Der Hans denkt dasselbe wie die Eva.*
 the Hans thinks the.same as the Eva
 ‘Hans thinks/believes the same thing as Eva.’

Given an analysis of content DPs that takes them to denote semantic objects of a primitive type (e.g. Elliott 2017) rather than propositions, this suggests that higher-order DPs, unlike content DPs, can quantify directly over propositions.

Test 2: Question-embedding predicates incompatible with concealed questions (Nathan 2006). Some question-embedding predicates, such as English *wonder* and *inquire* and certain transitive uses of German *fragen* ‘ask’, *sich fragen* ‘wonder’ and *überlegen* ‘consider’, do not combine with concealed-question DPs. However, they do take higher-order DP complements, which receive an interpretation closely related to that of interrogative complement clauses.

- (2.123)a. *Der Hans hat schon oft gefragt, was die Uhrzeit ist.*
 the Hans has already often asked what the time.of.day is
 ‘Hans has asked many times what the time is.’
 b. ??*Der Hans hat schon oft die Uhrzeit gefragt.*
 the Hans has already often the time.of.day asked
 ‘Hans has asked for the time many times.’
 c. *Der Hans hat etwas gefragt.*
 the Hans has something asked
 ‘Hans asked (me) something.’

Given an analysis of concealed questions on which they denote propositions rather than semantic questions (Nathan 2006), this suggests that higher-order DPs are special in that they can quantify over semantic questions.

Test 3: Arbitrary-property readings of unspecific objects with relative clauses. This test involves a configuration discussed extensively by Zimmermann (2006), in which an indefinite object of an ITV like *look for* (or German *suchen* ‘look for’ or *bestellen* ‘order’) contains a relative

clause involving abstraction over the object of another ITV, as in (2.124) (= (2.54)).

(2.124)SCENARIO: Hans and Peter are both reorganizing their bookshelves. Both of them decided independently to sort the books by color rather than title or genre, following the latest interior design trend. Hans is almost done sorting his books, but now needs an arbitrary book with a light green cover in order to complete his color scheme. Peter is in the same situation and is also looking for a book with a light green cover.

- a. *Der Hans sucht etwas, das der Peter auch sucht.*
the Hans seeks something REL the Peter also seeks
‘Hans is looking for something that Peter is also looking for.’ **true**
- b. *Der Hans sucht ein Buch, das der Peter auch sucht.*
the Hans seeks a book REL the Peter also seeks
‘Hans is looking for a book that Peter is also looking for.’ **not true**

With ordinary indefinites, such constructions don’t seem to allow quantification over properties, with the exception of the ‘individuating properties’ involved in type/token ambiguities, which are restricted by the lexical meaning of the NP. With higher-order indefinites, however, we can quantify over properties that are not individuating. This suggests that only higher-order indefinites are treated as quantifiers over properties by the compositional system, and individuating properties are treated as belonging to the domain of individuals.

Test 4: Numerals in unspecific objects that count arbitrary properties. This test involves unspecific indefinite objects of ITV that include a numeral, as in (2.125) (= (i) from footnote 16). With ordinary indefinites, the numeral counts individuals or, if the NP exhibits a type/token ambiguity, the ‘individuating properties’ that satisfy the NP predicate on the type reading. With higher-order indefinites, the numeral may count non-individuating properties.

(2.125)SCENARIO: Hans is arranging the new window display for his local library. He decides to use only books with covers in black and white. To complete the arrangement he has in mind, he still needs three books with white covers and two books with black covers. Unfortunately, no books in these colors are left.

- a. *Der Hans sucht nur zwei Sachen.*
the Hans seeks only two things
‘Hans is looking for only two things.’ **true**
- b. *Der Hans sucht nur zwei Bücher.*
the Hans seeks only two books
‘Hans is looking for only two books.’ **false**

Again, this suggests that ordinary lexical nouns may only express predicates of type $\langle e, t \rangle$ (where individuating properties can be treated as being of type e), while higher-order NPs may express predicates of type $\langle \langle s, et \rangle, t \rangle$.

Test 5: Wide-scope unspecific objects quantifying over arbitrary properties. If an object of an ITV receives wide scope relative to another quantificational element, it usually quantifies only over individuals or individuating properties, not over arbitrary subproperties of the NP denotation. Higher-order object DPs are not subject to this restriction, as illustrated by the contrast in (2.126) (= (2.64)).

(2.126)SCENARIO: At a festival, there is a popular bar selling drinks in one-liter pitchers. Almost all people have already ordered drinks there. There are many different drinks – beer, mixed drinks, mulled wine – and none of them is clearly the most popular one. But almost half of the people at the festival ordered something in a one-liter pitcher.

- a. *Es ist auffällig, dass /EIN Getränk bisher fast jeder \ZWEITE bestellt hat.*
it is striking that one drink so.far almost every second ordered has
‘It is striking that there was one drink that almost every second person ordered so far.’ **false**
- b. *Es ist auffällig, dass /EINE Sache bisher fast jeder \ZWEITE bestellt hat.*
it is striking that one thing so.far almost every second ordered has
‘It is striking that there was one thing that almost every second person ordered so far.’ **true**

The obvious explanation for this is that the two kinds of unspecific objects differ in their LF syntax. While ordinary unspecific objects must leave a trace of type *e* if they move, the trace of a higher-order DP may have type $\langle s, et \rangle$ and hence receives an unspecific reading.

Test 6: Property readings of pro-forms. Normally, if an indefinite object of an ITV is used as the antecedent of a pronoun, a specific reading of the indefinite is forced (Montague 1974, Moltmann 1997). In other words, the indefinite can no longer quantify over non-individuating properties. However, there are two exceptions to this: First, an unspecific reading is possible if the pronoun is itself a higher-order DP. Second, it seems that the interpretation of higher-order objects of ITV is not affected in the same way by (ordinary) pro-forms.

In my dialect, the contrasts involving animacy that Moltmann (1997, 2008) discusses constitute another difference between ordinary and higher-order DPs. However, the acceptability of higher-order DPs with predicates that express properties of human beings appears to be subject to inter-speaker variation in German.

In this chapter, tests 1-6 were motivated by the contrast between DPs like *ein Buch* ‘a book’ or *zwei Getränke* ‘two drinks’ on the one hand and DPs like *etwas* ‘something’ or *zwei Sachen* ‘two things’ on the other hand. Now we can use these tests to identify new cases of higher-order DPs. Here I will not try to do this in any systematic way and limit myself to pointing out that the tests can be used to falsify a hypothesis about higher-order DPs that might seem plausible at this point.

The examples given so far might suggest that higher-order DPs never involve lexical nouns, with the exception of the semantically empty nouns *Ding* or *Sache*. It might therefore seem promising to connect the special properties of higher-order DPs to the lack of a semantically contentful N head. However, DPs containing an NP of the form *Art(en) von X* ‘kind(s) of X’ pass at least tests 3, 4 and 5, as illustrated in (2.127)-(2.129) below.²⁸ This suggests that such DPs can quantify over properties of type $\langle s, et \rangle$, although it is not obvious whether they show the full range of higher-type interpretations discussed in this chapter. Since NPs of the form *Art(en) von X* are not identical in meaning to the NP *X* they contain, it is hard to escape the conclusion that the noun is semantically contentful.

²⁸Thanks to Magdalena Kaufmann (p.c.) for reminding me of these NPs and convincing me that the claim about semantically empty nouns mentioned in the text is false.

- (2.127)a. SCENARIO: Hans and Peter are a bar where all mixed drinks are served in one-liter pitchers. Intrigued by this novelty, Hans decides to order a pitcher of gin and tonic. Peter orders a pitcher of mulled wine.
 b. *Der Hans hat eine Art von Getränken bestellt, die der Peter auch bestellt hat.*
 the Hans has a kind of drinks ordered REL the Peter also ordered has
 ‘Hans ordered a kind of drink that Peter also ordered.’ **true**
- (2.128)a. SCENARIO: Hans works at a large publishing company that wants to improve its sales figures in Austria. His boss told him that he should do two things: reissue books by local writers that sold at least 20 million copies when they first came out, and commission new translations of books that were very successful internationally. So now he is looking for three books that sold 20 million copies in Austria, and three books that have been translated into every European language except German. However, his search is unsuccessful since no books with these properties exist.
 b. *Der Hans sucht nur zwei Arten von Büchern.*
 the Hans seeks only two kinds of books
 ‘Hans is looking for only two kinds of books.’ **true**
- (2.129)a. SCENARIO: At a festival, there is a popular bar selling drinks in one-liter pitchers. Almost all people have already ordered drinks there. There are many different drinks – beer, mixed drinks, mulled wine – and none of them is clearly the most popular one. But almost half of the people at the festival ordered something in a one-liter pitcher.
 b. *Es ist auffällig, dass /EINE Art von Getränken bisher fast jeder \ZWEITE bestellt hat.*
 it is striking that one kind of drinks so far almost every second ordered has
 ‘It is striking that there was one kind of drink that almost every second person ordered so far.’ **true**

Nouns contributing a negative evaluation such as *Blödsinn* ‘nonsense, bullshit’ provide another interesting counterexample. They seem to pass tests 1-3 (2.130)-(2.132), suggesting that we can easily talk about nonsense of any semantic type. In this case, it is even harder to deny that the noun makes a lexical semantic contribution.

- (2.130)a. CONTEXT: Hans thinks that the gods will destroy the world in 2012 ...
 b. *Der Peter denkt diesen Blödsinn auch.*
 the Peter thinks this nonsense too
 ‘Peter thinks/believes this nonsense too.’
- (2.131)a. CONTEXT: Hans keeps going to town halls held by local politicians and asking them whether they also believe that the world will end in 2012 ...
 b. *Der Peter fragt diesen Blödsinn auch immer.*
 the Peter asks this nonsense also always
 ‘Peter asks this bullshit question all the time too.’
- (2.132)a. SCENARIO: Hans and Peter are a bar where all drinks can be served in one-liter pitchers decorated with fruit. Both of them are excited about this novelty. Hans orders a pitcher of rum and coke and Peter orders a pitcher of gin and tonic. The next day, when asked why they are both hungover, their friend explains:
 b. *Der Hans hat einen totalen Blödsinn bestellt, den der Peter auch bestellt hat.*
 the Hans has a total nonsense ordered REL the Peter also ordered has

‘Hans ordered some bullshit that Peter also ordered.’

In summary, it does not seem to be the case that only semantically empty NPs give rise to higher-order readings. However, this does not preclude the possibility that some other syntactic or semantic property of the noun will allow us to predict whether higher-order readings are available, a question that is left open in this thesis. For now, the main point of this chapter is to motivate the notion of higher-order DPs, and set the stage for a closer investigation of the way their quantificational domain is restricted in a given context. This will be the topic of the next two chapters.

Chapter 3

Domain restriction and the monotonicity puzzle

In the last chapter, I tried to show that so-called higher-order DPs like *etwas* ‘something’ or *dasselbe* ‘the same thing’ exhibit more type flexibility than ordinary DPs. In particular, there seems to be good reason to assume that higher-order DPs can quantify over elements of derived semantic domains, such as propositions, properties or semantic questions.¹

If natural languages have expressions that quantify over the elements of such domains, count them and express identity or non-identity between them, the question arises which conditions on the individuation of such objects are implicit in natural language semantics. Do higher-order DPs generally range over a restricted domain of propositions rather than the entire set $D_{\langle s,t \rangle}$, and if so, to what extent is this restriction context-dependent? One property of derived semantic domains that is particularly puzzling in this respect is that they are structured by an entailment relation: For instance, if a proposition p asymmetrically entails another proposition q , can p and q ever count as distinct elements of the quantificational domain when we quantify over someone’s beliefs in natural language?

At the beginning of Asher’s (1993) survey of linguistic constructions that appear to involve reference to or quantification over ‘abstract objects’ like propositions, we find the claim that “[t]he individuation of propositions depends strongly upon the means we use to describe them” (Asher 1993:2). Asher suggests that the individuation mechanism actually employed in natural language semantics is highly context-dependent and relative to “who is doing the thinking or the entertaining of the proposition and also what communicative purpose this proposition is used for” (Asher 1993:6). Such claims can be tested by studying the truth conditions of sentences containing higher-order DPs. In this chapter, I will argue that the relevant notion of individuation that is implicit in the semantics of higher-order DPs is indeed highly context-dependent. However, given a fixed context, there are clear restrictions on what can be in the quantificational domain. These restrictions are sensitive to contextually salient questions, but also to the extensions of the two predicates the higher-order determiner combines with. In the simple examples we will be looking at here, these extensions are usually sets of propositions that are related to a given individual by an attitude predicate.

To investigate these restrictions, I will focus on two specific types of sentences with higher-order DPs, which I will call **restricted higher-order existential statements** and **higher-**

¹But see Moltmann (2008, 2013) for a *prima facie* different view.

order identity statements. Restricted higher-order existential statements are sentences like (3.1-a), where an opaque predicate combines with a higher-order indefinite DP and the DP contains a relative clause that involves abstraction over another opaque argument position. In other words, both the restrictor and the nuclear scope of the indefinite are higher-order predicates. Higher-order identity statements are sentences like (3.1-b), where an opaque predicate combines with the higher-order DP *dasselbe* ‘the same’, and *dasselbe* has what Beck (2000) calls an ‘NP-dependent reading’ relative to a plural expression. While the main focus will be on examples involving attitude verbs, particularly belief ascriptions, I will also discuss examples of these constructions with other classes of opaque predicates.

- (3.1) a. *Der Hans glaubt etwas, das auch die Maria glaubt.*
 the Hans believes something REL also the Maria believes
 ‘Hans believes something that Maria also believes.’
 b. *Der Hans und die Maria glauben dasselbe.*
 the Hans and the Maria believe the.same
 ‘Hans and Maria believe the same thing.’

This chapter is structured as follows. In Section 3.1, I will introduce a particularly clear and interesting subcase of the individuation problem at hand, the ‘monotonicity puzzle’ from Zimmermann (2006), which shows that our standard semantics for higher-order DPs assigns excessively weak truth conditions to examples like (3.1-a). I will show that this problem generalizes to several classes of opaque verbs and that it results from the combination of two features of the standard semantics: First, this semantics involves unrestricted quantification over a domain structured by an entailment relation, and second, we analyzed opaque verbs as monotonic with respect to that relation.

The approach I will pursue in this thesis is to give up the first assumption. To account for the truth conditions of sentences like (3.1), I will assume that contextual domain restriction is achieved by a more powerful mechanism than usually assumed. The main aim of the rest of the chapter is to motivate this mechanism. In Section 3.2, I argue that higher-order DPs, like ordinary DPs, do not express unrestricted quantification over arbitrary meanings of the right type. Rather, their domains depend on parameters of the interpretation function that can either receive their values from context or be manipulated by modifiers of the form *zur Frage X* ‘concerning the question X’ or *was X betrifft* ‘as for X’. In the special case of higher-order objects of *glauben* ‘believe’, the context provides a question and the domain is restricted to propositions that partially answer that question. In Section 3.3, we will see that this is still not enough. I will motivate several additional restrictions on the domains of higher-order indefinites which, together, account for some interesting subcases of the monotonicity puzzle. These restrictions provide the empirical basis for the nonstandard analysis of higher-order DPs presented in the next chapter.

3.1 The monotonicity puzzle

3.1.1 The basic problem

The **monotonicity puzzle** studied by Zimmermann (2006) concerns the interpretation of restricted higher-order existential statements. In this section, I will first follow Zimmermann’s (2006) exposition of the puzzle, which concentrates on ITV like *look for*, and then extend it to two other classes of opaque predicates.

So far, we have been working with Zimmermann’s (1993) property analysis of ITV. For instance, we assigned the lexical entry in (3.2-a) to *suchen* ‘look for’.

- (3.2) a. $\llbracket suchen \rrbracket = \lambda w. \lambda P_{\langle s, et \rangle}. \lambda x_e. \forall w' [w' \in \text{TRY}(w)(x) \rightarrow \exists y_e [P(w')(y) \wedge \mathbf{find}(w')(y)(x)]]$
 b. $\text{TRY}(w)(x) = \{w' \mid x\text{'s attempts in } w \text{ are successful in } w'\}$

Like other classical analyses of this verb (such as Montague’s (1974) quantifier analysis), this semantics predicts that *suchen* is **upward-monotonic** with respect to its property argument: It licenses inferences from logically stronger to logically weaker properties. Since upward-monotonicity will become relevant several times in the discussion to follow, a more detailed definition might be helpful. We first define a notion of entailment that generalizes to properties (3.3).

- (3.3) Generalized entailment
 For any t -based type² τ and any $x, y \in D_\tau$:
 a. If $\tau = t$: $x \sqsubseteq y$ iff $x = 0$ or $y = 1$
 b. If $\tau = \langle \rho, \sigma \rangle$, where σ is t -based: $x \sqsubseteq y$ iff $\forall z \in D_\rho : x(z) \sqsubseteq y(z)$

Applied to two properties $P, Q \in D_{\langle s, et \rangle}$, (3.3) says that $P \sqsubseteq Q$ iff for all $w \in D_s$ and $x \in D_e$, if $P(w)(x) = 1$, then $Q(w)(x) = 1$. In other words, for each world w , the extension of P in w is a subset of the extension of Q in w . We can then define what it means for an operator to be upward-monotonic (with respect to its first argument):

- (3.4) Upward-monotonicity
 For any t -based types σ and τ , an operator P of type $\langle \sigma, \tau \rangle$ is upward-monotonic iff for all $x, y \in D_\sigma$, if $x \sqsubseteq y$, then $P(x) \sqsubseteq P(y)$.

The definition should be generalized to cover upward-monotonicity with respect to other argument positions as well, but for present purposes the simplified version in (3.4) will do. The lexical entry in (3.2-a) then has the consequence that for any world w , $\llbracket suchen \rrbracket(w)$ is upward-monotonic; in other words:

- (3.5) For any world w and all $P, Q \in D_{\langle s, et \rangle}$, if $P \sqsubseteq Q$, then $\llbracket suchen \rrbracket(w)(P) \sqsubseteq \llbracket suchen \rrbracket(w)(Q)$.

Informally speaking, the property analysis predicts that whenever P is logically stronger than Q , the individuals looking for a P in world w are a subset of the individuals looking for a Q in w . Empirical motivation for this prediction comes from inference patterns like (3.6), which speakers typically judge to be valid, while the reverse inference is not accepted. Importantly,

²The set of t -based types (called ‘conjoinable types’ in Partee & Rooth 1983:4, (4)) is the smallest set T such that $t \in T$ and for all types σ, τ , if $\tau \in T$, then $\langle \sigma, \tau \rangle \in T$. Informally, these are all the types that ‘end in t ’.

this holds even if both sentences are construed unspecifically, for instance if Peter’s goal is to find an arbitrary linguistics book and there is no book x such that Peter is trying to find x .³

(3.6) (3.6-a) $\Rightarrow$ (3.6-b)

- a. *Der Peter sucht ein Linguistikbuch.*
the Peter seeks a linguistics-book
‘Peter is looking for a linguistics book.’
- b. *Der Peter sucht ein Buch.*
the Peter seeks a book
‘Peter is looking for a book.’

Zimmermann (2006) observes that this analysis makes incorrect predictions about the truth conditions of restricted higher-order existential statements involving *look for*. For instance, in Chapter 2, we discussed examples like (3.7-a) and assigned them the truth conditions in (3.7-b,c).

- (3.7) a. *Der Peter sucht etwas, das auch die Maria sucht.*
the Peter seeks something REL also the Maria seeks
‘Peter is looking for something that Maria is also looking for.’ (= (2.4))
- b. $\lambda w. \exists P_{\langle s, et \rangle} [g(1, \langle \langle s, et \rangle, t \rangle)(P)$
 $\wedge \forall w' [w' \in \text{TRY}(w)(\mathbf{maria}) \rightarrow \exists y_e [P(w')(y) \wedge \mathbf{find}(w')(y)(\mathbf{maria})]]$
 $\wedge \forall w' [w' \in \text{TRY}(w)(\mathbf{peter}) \rightarrow \exists y_e [P(w')(y) \wedge \mathbf{find}(w')(y)(\mathbf{peter})]]]$
- c. ‘There is a property P such that every world w' in which Maria’s attempts in w are successful is such that Maria finds a P in w' , and every world w' in which Peter’s attempts in w are successful is such that Peter finds a P in w' .’

Zimmermann notes that these truth conditions are satisfied in *any* scenario in which Peter is engaged in a search and Maria is engaged in another, possibly unrelated, search. For instance, consider scenario (3.8), which does not provide any reason to accept (3.7-a) as true.

(3.8) SCENARIO: Peter is looking for a sweater. Maria is looking for a bottle of wine.
(3.7-a) **false**

Counterintuitively, we predict (3.7-a) to be true in this scenario for the following reason. Given (3.8), we have $\llbracket \text{suchen} \rrbracket(w)(\mathbf{sweater})(\mathbf{peter}) = 1$ and $\llbracket \text{suchen} \rrbracket(w)(\mathbf{bottle-of-wine})(\mathbf{maria}) = 1$. Now let P be a property that is logically weaker than **sweater** and also logically weaker than **bottle-of-wine**, i.e. **sweater** $\sqsubseteq P$ and **bottle-of-wine** $\sqsubseteq P$. Some examples of properties satisfying these requirements, but of course not the only ones, are the trivial property, the property of being a concrete object and the disjunctive property $\lambda w. \lambda x. \mathbf{sweater}(w)(x) \vee$

³Zimmermann (2006:732, fn. 32) reports that there are some speakers who reject inferences of the form (i) in English. However, it is not obvious whether this reflects genuine inter-speaker variation or just a pragmatic effect that is due to the underinformativity of (i-b) in a context where the stronger statement (i-a) is made salient. More generally, such data raise the question which pragmatic inferences we should expect speakers to make when we ask them for judgments about entailment. If a speaker is asked to judge whether a sequence A of sentences logically entails a sentence B when interpreted in context c , we might expect that their judgment will directly reflect whether $\llbracket A \rrbracket^c \sqsubseteq \llbracket B \rrbracket^c$, i.e. if the proposition expressed by A in c entails the proposition expressed by B in c . But a speaker might also behave in a way that resembles the interpretation of ordinary discourse more closely: Their judgment might actually depend on whether B adequately describes the context c' that would result from asserting A in c . In this case, the relevant notion of ‘adequately describes’ might either be a semantic one – roughly, whether $\llbracket B \rrbracket^{c'}$ follows from the common ground of c' – or a more pragmatic one that incorporates some aspects of the Maxim of Quantity. In the latter case, speakers would be expected to reject instances of weakening inference patterns even if their grammars validate the inference. Studies from the psychology of reasoning provide independent evidence that, when asked to give judgments about entailment, speakers often incorporate judgments of pragmatic adequacy; see Stenning & van Lambalgen (2008), Counihan (2008) for many examples.

bottle-of-wine(w)(x). No matter which such property P we choose, if $\llbracket \text{suchen} \rrbracket(w)(\text{sweater}(\text{peter})) = 1$, then $\llbracket \text{suchen} \rrbracket(w)(P)(\text{peter}) = 1$, due to upward-monotonicity. Analogously, we get $\llbracket \text{suchen} \rrbracket(w)(P)(\text{maria}) = 1$. But then, P verifies the existential statement in the paraphrase (3.7-b,c), at least for some possible values of the domain-restriction variable. In other words, the problem is that we can always find a property that is so weak that the property describing Peter’s search goal and the property describing Maria’s search goal both entail it, and due to its upward-monotonicity, the meaning of *suchen* will relate both Peter and Maria to this property. Intuitively, sentences like (3.7-a) require the two searches to have a ‘common goal’, but our semantics does not reflect this.

To see what went wrong, let us consider the two predictions of our present analysis that allowed us to derive this result. First, the two predicates of properties that the higher-order determiner combines with in each world w – $\lambda P_{\langle s,et \rangle}.\llbracket \text{suchen} \rrbracket(w)(P)(\text{peter})$ and $\lambda P_{\langle s,et \rangle}.\llbracket \text{suchen} \rrbracket(w)(P)(\text{maria})$ – are both upward-monotonic: Whenever some property satisfies one of these predicates, so do all weaker properties. Second, since the determiner quantifies over arbitrary properties, its domain is closed under entailment: Whenever a property P is in the domain, so are all the weaker properties entailed by P . This is what enabled us to find a sufficiently weak property *in the domain* in scenario (3.8). There are therefore at least two ways of blocking the problematic inference: First, we could claim that $\llbracket \text{suchen} \rrbracket$ is not actually upward-monotonic with respect to its property argument. In this case, the determiner would combine with two non-monotonic predicates. Second, we could claim that the meaning of the higher-order DP itself excludes certain ‘weak’ properties from the domain of quantification.

At this point, one might think that there is no real semantic puzzle here: Some properties are simply too weak to be a plausible goal of a search. It is hard to imagine a search for an arbitrary individual, or an arbitrary concrete object. But this objection does not extend to disjunctive properties like $\lambda w.\lambda x.\text{sweater}(w)(x) \vee \text{bottle-of-wine}(w)(x)$. As scenario (3.9-a) illustrates, such properties can easily serve as property arguments of *suchen*. Importantly, (3.9-b) has a reading on which the disjunction cannot take scope over *suchen*: It is not the case that in every world in which Peter’s search is successful, he finds a sweater, and neither is it the case that he finds a bottle of wine in every such world. The disjunction must therefore be interpreted within the property argument.

- (3.9) a. SCENARIO: Peter is looking for a birthday gift for his friend. Since she is a fashion victim and a wine lover, he decides to buy her either a bottle of some rare wine or a sweater with an interesting design – whichever he comes across first. He does not have any specific type of wine or sweaters in mind.
b. *Der Peter sucht einen Pullover oder eine Flasche Wein.*
the Peter seeks a sweater or a bottle wine
‘Peter is looking for a sweater or a bottle of wine.’ true in (3.9-a)

(3.9) shows that we cannot get rid of the problem by generally excluding ‘disjunctive’ or ‘weak’ properties from the set of possible arguments of *suchen*. Rather, there seems to be a genuine contrast between sentences in which *suchen* combines with ordinary indefinite objects and sentences in which it combines with higher-order DPs. With ordinary indefinite objects, *suchen* behaves

like an upward-monotonic operator, as the intuitive validity of (3.6) shows. But the inference pattern in (3.10), with a higher-order DP, is not valid, even though the standard semantics for higher-order DPs, together with an upward-monotonic verb meaning, predicts it to be.

- (3.10) *Peter is looking for a P.*
Maria is looking for a Q.
 $\Rightarrow$ *Peter is looking for something Maria is (also) looking for.*

This seemingly distinct behavior of ordinary indefinites and higher-order indefinites calls for a revision of the standard analysis from Section 1.3. Before I discuss the theoretical options available to us, it is worth asking how pervasive the problem is. It clearly is not an idiosyncratic property of the verb *suchen*: The second ITV discussed in Section 2.2, *bestellen* ‘order’, should arguably be analyzed as upward-monotonic as well, since inferences like (3.11) appear to be valid. Yet, the restricted higher-order existential statement in (3.12-b) is plainly false in scenario (3.12-a).

- (3.11) (3.11-a) $\Rightarrow$ (3.11-b)
- a. *Der Peter hat ein Glas österreichischen Weißwein bestellt.*
the Peter has a glass Austrian.ACC white.wine.ACC ordered
‘Peter ordered a glass of Austrian white wine.’
- b. *Der Peter hat ein Glas Wein bestellt.*
the Peter has a glass wine.ACC ordered
‘Peter ordered a glass of wine.’
- (3.12) a. SCENARIO: Peter ordered a glass of Austrian white wine. Maria ordered a schnitzel.
b. *Der Peter hat etwas bestellt, das die Maria auch bestellt hat.*
the Peter has something ordered REL the Maria also ordered has
‘Peter ordered something that Maria also ordered.’ **false** in (3.12-a)

In sum, we are clearly not dealing with a lexical idiosyncrasy. Next, we will see that the problem extends to two other classes of predicates that take their arguments from a domain structured by an entailment relation: proposition-embedding predicates and question-embedding predicates.

3.1.2 Proposition-embedding predicates

I will start with an extension of Zimmermann’s (2006) reasoning to upward-monotonic attitude predicates.⁴ My running example in this chapter will be *believe* and its German counterpart *glauben*. Following Hintikka (1969), linguists usually analyze this predicate as a universal quantifier over a set of accessible worlds (3.13).

- (3.13) a. $\llbracket \text{glauben} \rrbracket = \lambda w. \lambda p_{\langle s, t \rangle}. \lambda x_e. \forall w' [w' \in \text{DOX}(w)(x) \rightarrow p(w')]$
b. $\text{DOX}(w)(x) = \{w' \mid w' \text{ is compatible with } x\text{'s beliefs in } w\}$

According to (3.13-a), an individual x believes a proposition p iff p is true in all of x ’s doxastically accessible worlds. Clearly, if some p satisfies this condition, so does every proposition entailed by p . So we predict that for any world w , $\llbracket \text{glauben} \rrbracket(w)$ is an upward-monotonic operator. To some extent, this prediction is in line with linguistic intuitions: (3.14-b) seems to follow from

⁴According to Ede Zimmermann (p.c.), the observation that the monotonicity puzzle extends to attitude verbs was previously made by Maribel Romero.

(3.14-a), but (3.14-a) definitely does not follow from (3.14-b).

- (3.14) (3.14-a) $\Rightarrow$ (3.14-b)
- a. *Der Peter glaubt, dass es stark regnet.*
the Peter believes that EXPL strongly rains
'Peter believes that it is raining heavily.'
 - b. *Der Peter glaubt, dass es regnet.*
'Peter believes that it is raining.'

It should be noted that it is not obvious that the entailment from (3.14-a) to (3.14-b) is really semantically valid, due to the problem of logical omniscience – if we consider the possibility that Peter could be unaware of the entailment between the propositions $\llbracket \textit{dass es stark regnet} \rrbracket$ and $\llbracket \textit{dass es regnet} \rrbracket$, (3.14-a) might be judged true without (3.14-b) being true. While I do not have anything new to say about this objection in the present work, I discuss it briefly in Appendix A.1. For now, let us take the apparent upward-monotonicity of *glauben* to be a semantic fact. Then the predictions of the standard semantics for higher-order DPs are even worse than in the case of ITV: For the restricted higher-order existential statement in (3.15-a), we predict the truth conditions in (3.15-b,c), which on closer inspection turn out to be trivial.

- (3.15) a. *Der Peter glaubt etwas, das auch die Maria glaubt.*
the Peter believes something that also the Maria believes
'Peter believes something that Maria also believes.'
- b. $\lambda w. \exists p_{\langle s,t \rangle} [\forall w' [w' \in \text{DOX}(w)(\mathbf{maria}) \rightarrow p(w')] \wedge \forall w' [w' \in \text{DOX}(w)(\mathbf{peter}) \rightarrow p(w')]]$
- c. 'There is a proposition p such that Peter's belief state in w entails p , and Maria's belief state in w entails p .'

To see the problem, consider some proposition q that Peter believes and some (potentially completely unrelated) proposition r that Maria believes. For instance, we could simply let q and r be the sets $\text{DOX}(w)(\mathbf{peter})$ and $\text{DOX}(w)(\mathbf{maria})$, respectively. Then there is always some proposition p that is entailed both by q and by r – it could be the disjunction of q and r or some other, even weaker proposition. By upward-monotonicity, we must have $\llbracket \textit{glauben} \rrbracket(w)(p)(\mathbf{peter}) = 1$ and $\llbracket \textit{glauben} \rrbracket(w)(p)(\mathbf{maria}) = 1$. Hence p verifies the existential statement in (3.15-b,c), even though we made no assumptions about the content of Peter's and Maria's beliefs. Clearly, this prediction is descriptively inadequate: A scenario like (3.16), for instance, is not sufficient to make (3.15-a) true.

- (3.16) SCENARIO: Maria believes that France will win the next World Cup and has no beliefs about tomorrow's weather. Peter believes that it will rain tomorrow and has no beliefs about the World Cup.

In particular, the proposition $\lambda w. \llbracket \textit{it will rain tomorrow} \rrbracket(w) \vee \llbracket \textit{France will win the World Cup} \rrbracket(w)$ is true in all of Peter's belief worlds and in all of Maria's belief worlds, but it does not seem to count as a shared belief of Peter's and Maria's for the purpose of interpreting sentences like (3.15-a). In order to assign adequate truth conditions to (3.15-a), we have to find some way of excluding propositions like this from the domain of quantification.

Summing up, our standard semantics for higher-order DPs is incompatible with a Hintikka-style analysis of verbs like *believe* that takes them to be semantically upward-monotonic. To

see how general this problem is, it is instructive to consider proposition-embedding predicates that are clearly not upward-monotonic and hence outside the reach of the Hintikka semantics. Are such predicates subject to a version of our problem as well? This depends on the extent to which they license inferences in the opposite direction, from weaker to stronger propositions. The extreme case would be a predicate that always allows for such inferences, which would make it **downward-monotonic**:

(3.17) Downward-monotonicity

For any t -based types σ and τ , an operator P of type $\langle\sigma, \tau\rangle$ is downward-monotonic iff for all $x, y \in D_\sigma$, if $x \sqsubseteq y$, then $P(y) \sqsubseteq P(x)$.

As a simple example of how the problem extends to such predicates, consider the predicate *unmöglich* ‘impossible’. While this is not an attitude verb, it can combine with modifiers like *meiner Meinung nach* ‘in my opinion’ that relativize the conversational background (cf. Kratzer 1978) to an attitude subject. At least at first sight, this predicate seems to license downward-monotonic inferences if the conversational background is kept constant (3.18). Now what happens when we quantify existentially over the propositional argument of *unmöglich*, using a higher-order DP (3.19)?

(3.18) (3.18-a) $\Rightarrow$ (3.18-b)

- a. *Peters Meinung nach ist es unmöglich, dass es morgen regnen wird.*
Peter’s opinion after is EXPL impossible that EXPL tomorrow rain will
‘In Peter’s opinion, it is impossible that it will rain tomorrow.’
- b. *Peters Meinung nach ist es unmöglich, dass es morgen stark regnen wird.*
Peter’s opinion after is EXPL impossible that EXPL tomorrow strongly rain will
will
‘In Peter’s opinion, it is impossible that it will rain heavily tomorrow.’

- (3.19) a. CONTEXT: Peter and Maria have very different interests and opinions ...
b. ... *aber manche Sachen, die Peters Meinung nach unmöglich sind, sind auch*
but some things REL Peter’s opinion after impossible are are also
Marias Meinung nach unmöglich.
Maria’s opinion after impossible
‘...but there are some things that Peter considers impossible and that Maria also considers impossible.’

If examples like (3.18) really reflect semantic downward-monotonicity, the standard semantics of higher-order DPs leads us to expect very weak truth conditions for (3.19-b). Let us assume that p is a proposition Peter considers impossible, and m is a proposition Maria considers impossible. Then, whatever the actual content of these propositions is, we can always find a proposition that entails both p and m – for instance, $\lambda w.p(w) \wedge m(w)$. If *unmöglich* is semantically downward-monotonic, we can then conclude that Peter considers the proposition $\lambda w.p(w) \wedge m(w)$ impossible, since it entails p , and Maria also considers that proposition impossible, since it entails m . So there are some propositions that both Peter and Maria consider impossible, which should make (3.19-b) true.⁵

⁵For those who think that the plural indefinite *manche* ‘some’ only quantifies over pluralities of two or more

The argument just presented did not involve any reference to the actual content of Peter's and Maria's beliefs about what is possible. This means that we can apply this reasoning whenever we can find some propositions Peter considers impossible and some other (possibly completely unrelated) propositions Maria considers impossible. The prediction, then, is that (3.19-b) is always true in such scenarios. Yet, a sentence like (3.20), which explicitly expresses the premises of the reasoning in the last paragraph, does not seem to entail (3.19-b). In particular, in a scenario like (3.21) which intuitively fails to specify whether Peter and Maria have shared beliefs about any topic, (3.20) is clearly true, while it is hard to judge whether (3.19-b) is true.

- (3.20) *Manche Sachen sind Peters Meinung nach unmöglich und manche Sachen sind Marias Meinung nach unmöglich.*
 some things are Peter's opinion after impossible and some things are Maria's opinion after impossible
 'There are some things Peter considers impossible, and there are some things Maria considers impossible.'

- (3.21) SCENARIO: Peter thinks that it is impossible that it will snow tomorrow. Maria thinks that it is impossible that Germany will win the next World Cup.
 (3.20) **true**, (3.19-b) ??

In sum, the assumption that higher-order DPs quantify over arbitrary propositions proves just as problematic for downward-monotonic predicates. Next, I will argue that the puzzle reappears even with some attitude verbs that are not obviously strictly downward-monotonic.

The German attitude verb *ausschließen* 'exclude, rule out' comes very close in meaning to *impossible*. Roughly speaking, *ausschließen* is true of an individual x and a proposition p iff x rules out the possibility that p . This predicate is clearly not upward-monotonic – for instance, if Peter is convinced that there will be light rain, but no heavy rain tomorrow, (3.22-b) is true while (3.22-a) is false. But is it downward-monotonic?

- (3.22) (3.22-a) ? $\Rightarrow$ (3.22-b)
 a. *Peter schließt aus, dass es morgen regnen wird.*
 Peter rules out that EXPL tomorrow rain will
 'Peter excludes the possibility that it will rain tomorrow.'
 b. *Peter schließt aus, dass es morgen stark regnen wird.*
 Peter rules out that EXPL tomorrow strongly rain will
 'Peter excludes the possibility that it will rain heavily tomorrow.'

It seems that in most contexts, (3.22-b) can be inferred from (3.22-a). What is less clear is whether *ausschließen* comes with a requirement that the subject must have, in some sense, considered the question whether the embedded proposition is true. In a typical scenario, this requirement would be met for both embedded propositions in (3.22). (3.23-a) is an attempt to construct a scenario in which the requirement is not met. While (3.23-b) is not clearly false or inadequate in this scenario, a modalized or subjunctive sentence like (3.23-c) seems more appropriate.⁶

propositions, an analogous argument can be constructed, starting from the premise that there are at least two distinct propositions Peter considers impossible, and at least two distinct propositions Maria considers impossible.

⁶Thanks to Magdalena Roszkowski (p.c.) for discussing such examples with me.

- (3.23) a. SCENARIO: Peter agrees with the scientific consensus on basically any topic and likes to argue with flat-earthers on the internet. Even though he has explained many times why the earth cannot be flat, he has never had to think about the question whether other celestial bodies, like the moon, are also flat, since nobody ever tried to start an argument about this issue with him.
- b. *?Der Peter schließt aus, dass der Mond flach ist.*
the Peter rules out that the moon flat is
‘Peter excludes the possibility that the moon is flat.’
- c. *Der Peter würde ausschließen, dass der Mond flach ist.*
the Peter would rule.out that the moon flat is
‘Peter would exclude the possibility that the moon is flat.’

Further research on such predicates is needed to determine whether the effect in (3.23) is systematic enough to be modeled as a lexical presupposition. For now, the relevant point is that *if* we decide to do so, *ausschließen* no longer comes out as strictly downward-monotonic.⁷ For instance, we would no longer predict (3.24-a) to contextually entail (3.24-b): Peter might have thought about, and dismissed, the possibility that the earth is flat without ever considering the question whether it might be the case that all celestial bodies are flat.

- (3.24) a. *Der Peter schließt aus, dass die Erde flach ist.*
the Peter rules out that the earth flat is
‘Peter excludes the possibility that the earth is flat.’
- b. *Der Peter schließt aus, dass alle Himmelskörper flach sind.*
the Peter rules out that all celestial.bodies flat are
‘Peter excludes the possibility that all celestial bodies are flat.’

In sum, plausible candidates for downward-monotonic attitude verbs in German, like *ausschließen* ‘exclude’, could be argued to have a non-downward-monotonic presupposition. This raises the question whether such verbs still give rise to the monotonicity puzzle: If we provide a context in which the putative presuppositions are met for all the propositions involved, are the truth conditions we predict for higher-order existential statements still too weak? (3.25-a) is an attempt to construct such a scenario for *ausschließen*:

- (3.25) a. SCENARIO: In a criminal investigation, detectives Peter and Maria have identified

⁷There is one apparent complication for the view that *ausschließen* is non-monotonic: It licenses NPIs like *auch nur irgendein* in (i), which were originally thought to be restricted to downward-monotonic contexts. However, it has been argued on independent grounds that NPI licensing is sensitive to a weaker notion of downward-monotonicity (Heim 1984). One such notion, from von Stechow (1999), is defined in (ii). The basic idea is that, when we determine whether a given operator is downward-monotonic, cases in which the stronger argument x does not meet the presupposition of the operator are excluded from consideration. If so, cases in which the monotonicity inference fails due to presupposition failure do not count as real counterexamples. What this means for *ausschließen* is that, if we want to model the inference discussed above in the semantics, we can model it as a presupposition and thus account for the effect of downward-monotonicity in (i) and the apparent failure of downward-monotonicity in (3.24) at the same time.

- (i) *Der Peter schließt aus, dass auch nur irgendein Himmelskörper flach ist.*
the Peter rules out that also just any celestial.body flat is
‘Peter excludes the possibility that any celestial body is flat.’
- (ii) Strawson Downward-Monotonicity (based on von Stechow 1999:104, (14))
For any t -based types σ and τ , a partial function P of type $\langle\sigma, \tau\rangle$ is Strawson downward-monotonic iff for all $x, y \in D_\sigma$, if $x \sqsubseteq y$ and $x \in \text{dom}(P)$ (i.e. $P(x)$ is defined) then $P(y) \sqsubseteq P(x)$.

ten suspects. They want to know which of the suspects were near the crime scene when the crime happened, and whether it is possible that any two of the suspects were there together. Now they have both discovered evidence which they have not discussed with one another yet: Peter has found out that suspect 1 could not have been anywhere near the crime scene, but does not know anything about the other suspects yet. Maria's only finding so far is that suspect 2 could not have been anywhere near the crime scene.

- b. *Der Peter schließt etwas aus, das die Maria auch ausschließt.*
 the Peter rules something out REL the Maria also rules.out
 'Peter rules something out that Maria also rules out.' ?? in (3.25-a)

In scenario (3.25-a), both Peter and Maria presumably consider it impossible that suspects 1 and 2 went to the crime scene together. Since the scenario makes it clear that it is a relevant question for them which groups of suspects could have been at the crime scene together, the hypothetical presupposition of *ausschließen* should be satisfied. Yet, the truth value of (3.25-b) in this scenario seems hard to judge. This suggests that the proposition that suspects 1 and 2 both went to the crime scene is not necessarily included in the domain of quantification for the higher-order existential statement in (3.25-b). Summing up, there are some instances of the monotonicity puzzle with non-upward-monotonic predicates that cannot easily be explained away by positing a non-upward-monotonic presupposition of the predicate. At first sight, the puzzle seems to extend both to upward-monotonic attitude predicates like *glauben* and to non-upward-monotonic predicates like *unmöglich* or *ausschließen*. However, further empirical work is needed to see how stable the judgments on examples like (3.25) are and how pervasive the analogy between upward-monotonic and non-upward-monotonic predicates really is. I will therefore focus on upward-monotonic attitude predicates for the rest of this section and revisit non-upward-monotonic predicates briefly in Chapter 4.

3.1.3 Question-embedding predicates

As a final illustration of how general the problem discussed by Zimmermann (2006) is, let us consider question-embedding predicates like *offen* 'open, unresolved' or *unklar* 'unclear'. There is a sense in which question-embedding predicates give rise to 'monotonicity' inferences that is independent of the specific semantics one assumes for questions. All we need is the notion of a **strongly exhaustive answer** to a question (as discussed e.g. in Groenendijk & Stokhof 1984:85f.). On any plausible semantic theory of questions, the intension of a question determines an equivalence relation on the set of possible worlds.⁸ For instance, the semantic question $\llbracket who\ left \rrbracket$ determines a relation that treats two worlds as equivalent if the extension of *left* is the same in both worlds (3.26-a). Similarly, a polar question like $\llbracket whether\ Mary\ left \rrbracket$ identifies two worlds iff the proposition that Mary left receives the same truth value in both worlds (3.26-b).

⁸Of course, semantic theories of questions differ in whether the meanings of questions are, in some sense, identified with such relations or whether they encode additional information that is not preserved in the equivalence relation. See Bäuerle & Zimmermann 1991 for a survey of semantic theories of interrogatives and how they differ on this point. In Section 3.3, I will argue that the analysis of higher-order DPs requires a more expressive theory of interrogative semantics which cannot be reconstructed from a partition semantics along the lines of Groenendijk & Stokhof (1984).

- (3.26) a. $\llbracket \text{who left} \rrbracket \rightsquigarrow \{(w, w') \mid \llbracket \text{left} \rrbracket(w) = \llbracket \text{left} \rrbracket(w')\}$
 b. $\llbracket \text{whether Mary left} \rrbracket \rightsquigarrow \{(w, w') \mid \llbracket \text{Mary left} \rrbracket(w) = \llbracket \text{Mary left} \rrbracket(w')\}$

For any non-trivial question, this relation provides a partition of W . To give an example, each possible extension of the predicate *left* corresponds to a class of the partition induced by (3.26-a). (3.26-b), on the other hand, corresponds to a partition with only two equivalence classes, $\llbracket \text{Mary left} \rrbracket$ and $\llbracket \text{Mary didn't leave} \rrbracket$. The strongly exhaustive answer to a question Q in world w , then, is the cell of the partition that w belongs to. So, given the domain in (3.27-a), (3.27-b) and (3.27-c) are strongly exhaustive answers because they determine for each individual in D_e whether or not that individual left. The answers in (3.27-d) and (3.27-e), on the other hand, are not strongly exhaustive since they fail to uniquely determine the extension of *left*: (3.27-d) does not determine whether or not **c** left, and (3.27-e) fails to determine whether or not **a** and **b** left.

- (3.27) a. $D_e = \{\mathbf{a}, \mathbf{b}, \mathbf{c}\}$
 b. $\lambda w. \mathbf{left}(w)(\mathbf{a}) \wedge \mathbf{left}(w)(\mathbf{b}) \wedge \mathbf{left}(w)(\mathbf{c})$
 c. $\lambda w. \mathbf{left}(w)(\mathbf{a}) \wedge \mathbf{left}(w)(\mathbf{b}) \wedge \neg \mathbf{left}(w)(\mathbf{c})$
 d. $\lambda w. \mathbf{left}(w)(\mathbf{a}) \wedge \mathbf{left}(w)(\mathbf{b})$
 e. $\lambda w. \neg \mathbf{left}(w)(\mathbf{c})$

The notion of a strongly exhaustive answer is relevant for us because the meanings of certain question-embedding predicates seem to be sensitive to it. For instance, traditional analyses of question-embedding *know* such as the one proposed in Groenendijk & Stokhof (1984) require the subject to know the strongly exhaustive answer to the embedded question that is true in the actual world. Thus, (3.28) is predicted to be true iff John knows for each contextually relevant individual x whether or not x left. Similarly, (3.29) is true only if the subject does not believe any of the strongly exhaustive answers to the embedded question. This entails that, for some contextually relevant individuals, the subject doesn't know whether or not they left.

- (3.28) *Der Hans weiß, wer gegangen ist.*
 the Hans knows who gone is
 'Hans knows who left.'

- (3.29) *Dem Hans ist unklar, wer gegangen ist.*
 the.DAT Hans is unclear who gone is
 'It is unclear to Hans who left.'

This property of predicates like *wissen* and *unklar* will now allow us to construct examples of the monotonicity puzzle. To clarify the relevant notion of monotonicity, let us define a relation between questions that relies on entailments between their strongly exhaustive answers (3.30). Some examples of this relation, which I call **subsumption**, are given in (3.31).⁹ To discuss one of them in more detail, if a proposition is a strongly exhaustive answer to the question $\llbracket \text{who ate what} \rrbracket$, it determines, for all individuals x and y , whether or not x ate y . In particular, then, it will also determine what Mary ate and what she did not eat, and will therefore entail

⁹I will use this more neutral term instead of Groenendijk & Stokhof's (1984) term 'inclusion' in order to avoid any confusion with set-theoretic inclusion. Unlike set-theoretic inclusion between question meanings, the relation in (i) is insensitive to the specific semantic theory of questions assumed, as long as we limit the discussion to theories in which the notion of a strongly exhaustive answer can be defined.

a strongly exhaustive answer to the question $\llbracket \textit{what Mary ate} \rrbracket$. So the question $\llbracket \textit{who ate what} \rrbracket$ subsumes the question $\llbracket \textit{what Mary ate} \rrbracket$. Intuitively, a question Q subsumes a question R if Q asks for all the information R asks for, and potentially some additional information that R is insensitive to.¹⁰

- (3.30) A semantic question p **subsumes** a semantic question q iff every strongly exhaustive answer to p entails a strongly exhaustive answer to q .

(cf. Groenendijk & Stokhof 1984:220, (7))

- (3.31) a. $\llbracket \textit{who left} \rrbracket$ subsumes $\llbracket \textit{whether Mary left} \rrbracket$
 b. $\llbracket \textit{who ate what} \rrbracket$ subsumes $\llbracket \textit{who ate pizza} \rrbracket$ and $\llbracket \textit{what Mary ate} \rrbracket$
 c. $\llbracket \textit{who owns a car} \rrbracket$ does not subsume $\llbracket \textit{who owns a red car} \rrbracket$
 (cf. Guerzoni & Sharvit 2007)
 d. $\llbracket \textit{who owns a red car} \rrbracket$ does not subsume $\llbracket \textit{who owns a car} \rrbracket$
 (cf. Guerzoni & Sharvit 2007)

Interestingly, some question-embedding predicates seem to give rise to general inference patterns based on subsumption relations between the embedded questions. For instance, if John knows the true strongly exhaustive answer to the semantic question $\llbracket Q \rrbracket$ and $\llbracket Q \rrbracket$ subsumes $\llbracket R \rrbracket$, then John's knowledge must entail the true strongly exhaustive answer to $\llbracket R \rrbracket$. So, if the semantics of question-embedding *know* can really be expressed in terms of strongly exhaustive answers as suggested above, then whenever a question $\llbracket Q \rrbracket$ subsumes a question $\llbracket R \rrbracket$, *John knows Q* should entail *John knows R*.¹¹ Some plausible instances of this inference pattern are given in (3.32).

- (3.32) a. *John knows who left.* $\Rightarrow$ *John knows whether Mary left.*
 b. *John knows who ate what.* $\Rightarrow$ *John knows who ate pizza.*
 c. *John knows who ate what.* $\Rightarrow$ *John knows what Mary ate.*
 d. *John knows who owns a car.* $\nRightarrow$ *John knows who owns a red car.*
 e. *John knows who owns a red car.* $\nRightarrow$ *John knows who owns a car.*

Above, I gave an informal paraphrase of the German predicate *unklar* 'unclear': It is true of a subject and an embedded question only if the subject does not believe any strongly exhaustive answer to the embedded question. If this is on the right track, we expect to find the reverse entailment pattern: Whenever a question $\llbracket Q \rrbracket$ subsumes a question $\llbracket R \rrbracket$, we should find $\llbracket \textit{unklar R} \rrbracket \sqsubseteq \llbracket \textit{unklar Q} \rrbracket$. Indeed, inferences like (3.33) and (3.34) appear to be valid, and in cases like (3.35), where neither of the two questions subsumes the other, it seems that there is no entailment in either direction: If Peter has an exhaustive list of all car owners, but the list does not indicate the colours of their cars, (3.35-a) may be true while (3.35-b) is false; and if he has managed to track down all owners of red cars, but does not have any information about the owners of cars in other colours, (3.35-a) may be false while (3.35-b) is true.

¹⁰(3.31-c) demonstrates that the subsumption relation is not obviously connected to the usual notion of entailment between predicates: Even though we have $\llbracket \textit{own a red car} \rrbracket \sqsubseteq \llbracket \textit{own a car} \rrbracket$, there is no subsumption relation between the corresponding wh-questions.

¹¹Arguably, there are readings of question-embedding *know* that do not require knowledge of a strongly exhaustive answer: For English, Cremers & Chemla (2016) report experimental results that support the existence of an additional 'intermediate exhaustive' reading. In the case of a simple wh-question like *John knows who left*, this reading requires John to know every true proposition of the form $\lambda w.\textit{left}(w)(x)$ for some individual x and also requires that he does not believe any false propositions of this form, but does not require him to know every true proposition of the form $\lambda w.\neg\textit{left}(w)(x)$. That is, for some individuals who didn't leave, John might not know whether or not they left.

(3.33) (3.33-a) $\Rightarrow$ (3.33-b)

- a. *Dem Peter ist unklar, ob die Maria gegangen ist.*
the.DAT Peter is unclear whether the Maria gone is
'It's unclear to Peter whether Maria left.'
- b. *Dem Peter ist unklar, wer gegangen ist.*
the.DAT Peter is unclear who gone is
'It's unclear to Peter who left.'

(3.34) (3.34-a) $\Rightarrow$ (3.34-b)

- a. *Dem Peter ist unklar, was die Maria gegessen hat.*
the.DAT Peter is unclear what the Maria eaten has
'It's unclear to Peter what Maria ate.'
- b. *Dem Peter ist unklar, wer was gegessen hat.*
the.DAT Peter is unclear who what eaten has
'It's unclear to Peter who ate what.'

(3.35) (3.35-a) $\nRightarrow$ (3.35-b); (3.35-b) $\nRightarrow$ (3.35-a)

- a. *Dem Peter ist unklar, wer ein rotes Auto hat.*
the.DAT Peter is unclear who a red car has
'It's unclear to Peter who owns a red car.'
- b. *Dem Peter ist unklar, wer ein Auto hat.*
the.DAT Peter is unclear who a car has
'It's unclear to Peter who owns a car.'

We can then formulate a generalization about *unklar* that is independent of the specific question semantics assumed:

(3.36) For any world w , individual x and question extensions Q, R :
If Q subsumes R , then $\llbracket \text{unklar} \rrbracket(w)(R)(x)$ entails $\llbracket \text{unklar} \rrbracket(w)(Q)(x)$.

Given this background, consider a restricted higher-order existential statement with *unklar*, such as (3.37). If we take the apparent type flexibility of higher-order DPs at face value, it is natural to assume that the indefinite in (3.37) quantifies over semantic questions. The standard semantics proposed in Chapter 1 then predicts (3.37) to be true in a world w iff there is a semantic question Q such that $\llbracket \text{unklar} \rrbracket(w)(Q)(\mathbf{peter}) = 1$ and $\llbracket \text{unklar} \rrbracket(w)(Q)(\mathbf{maria}) = 1$.

(3.37) *Dem Peter ist etwas unklar, das auch der Maria unklar ist.*
the.DAT Peter is something unclear REL also the.DAT Maria unclear is
'Something is unclear to Peter that is also unclear to Maria.'

We don't have to go into the details of interrogative semantics to see the problem. Let P and Q be two arbitrary semantic questions such that Peter does not believe a strongly exhaustive answer to P , and Maria does not believe a strongly exhaustive answer to Q . Then we can construct a semantic question R that is fine-grained enough to subsume both P and Q . Since the strongly exhaustive answers for R will be even more specific than those for P and Q , neither Peter nor Maria can know any of them. In this situation, (3.36) predicts that $\llbracket \text{unklar} \rrbracket(w)(R)(\mathbf{peter}) = 1$ and $\llbracket \text{unklar} \rrbracket(w)(R)(\mathbf{maria}) = 1$ – in other words, (3.37) is predicted to be true regardless of the content of the questions P and Q . As a concrete example, consider the sentences in (3.38). The sets of strongly exhaustive answers for the embedded questions in (3.38-a) and (3.38-b) are

sketched in (3.39-a) and (3.39-b), respectively.

- (3.38) a. *Der Maria ist unklar, ob es gestern geregnet hat.*
the.DAT Maria is unclear whether EXPL yesterday rained has
‘It is unclear to Maria whether it rained yesterday.’
b. *Dem Peter ist unklar, wer die letzte WM gewonnen hat.*
the.DAT Peter is unclear who the last World.Cup won has
‘It is unclear to Peter who won the last World Cup.’
- (3.39) a. $\{\llbracket it \text{ rained yesterday} \rrbracket, \llbracket it \text{ didn't rain yesterday} \rrbracket\}$
b. $\{\llbracket Germany \text{ was the winner of the last World Cup} \rrbracket,$
 $\llbracket Brazil \text{ was the winner of the last World Cup} \rrbracket,$
 $\llbracket France \text{ was the winner of the last World Cup} \rrbracket, \dots\}$

How can we construct a question that subsumes both of these embedded questions? One way of doing so is to take all the intersections of an answer in (3.39-a) and an answer in (3.39-b), as indicated in (3.40). The set in (3.40) constitutes a partition of the set of possible worlds that is more fine-grained than either of the two partitions in (3.39-a) and (3.39-b). Given (3.36), we would expect both Peter and Maria to stand in the relation expressed by *unklar* to the question corresponding to this partition, leading to the counterintuitive prediction that (3.38-a) and (3.38-b) jointly entail (3.37).

- (3.40) $\{\lambda w. \llbracket it \text{ rained yesterday} \rrbracket(w) \wedge \llbracket Germany \text{ was the winner of the last World Cup} \rrbracket(w),$
 $\lambda w. \llbracket it \text{ didn't rain yesterday} \rrbracket(w) \wedge \llbracket Germany \text{ was the winner of the last World Cup} \rrbracket(w),$
 $\lambda w. \llbracket it \text{ rained yesterday} \rrbracket(w) \wedge \llbracket France \text{ was the winner of the last World Cup} \rrbracket(w),$
 $\lambda w. \llbracket it \text{ didn't rain yesterday} \rrbracket(w) \wedge \llbracket France \text{ was the winner of the last World Cup} \rrbracket(w),$
 $\dots\}$

Note that we cannot argue that this question is too fine-grained to be relevant for natural language interpretation, since there are simple ways of expressing questions that are even more fine-grained (3.41). Therefore, we either have to deny that the lexical meaning of *unklar* satisfies generalization (3.36), or we have to assume that the quantificational domain of higher-order DPs can be restricted in a more flexible way, since the semantic question expressed by (3.41) is evidently not always in the domain.

- (3.41) *Was ist in den letzten Wochen alles passiert?*
‘What happened during the last few weeks?’

Question-embedding predicates therefore give rise to a problem that closely resembles the dilemma Zimmermann (2006) describes with reference to ITV.¹² The different classes of predicates that

¹²Interestingly, it is not obvious whether subsumption corresponds to the notion of ‘entailment’ between questions that matters in other areas of grammar. For instance, neither of the embedded questions in (i) (= (3.35)) subsumes the other, and there is no entailment relation between the matrix clauses, but nonetheless the question complement of *unklar* seems to count as a downward-monotonic context for the purposes of NPI licensing (ii) (see Guerzoni & Sharvit 2007, Mayr 2013 a.o. for discussion).

- (i) (i-a) $\not\Rightarrow$ (i-b); (i-b) $\not\Rightarrow$ (i-a)
a. *Dem Peter ist unklar, wer hier ein rotes Auto besitzt.*
the.DAT Peter is unclear who here a red car owns
‘It’s unclear to Peter who owns a red car here.’
b. *Dem Peter ist unklar, wer hier ein Auto besitzt.*
the.DAT Peter is unclear who here a car owns

give rise to this puzzle are listed again in (3.42). In each case, the predicates give rise to a seemingly stable inference pattern which, however, seems to be blocked in restricted existential higher-order statements.

- (3.42)
- a. ITV like *suchen* ‘look for’ and *bestellen* ‘order’
 - b. upward-monotonic attitude predicates like *glauben* ‘believe’
 - c. certain non-upward-monotonic proposition-embedding predicates like *unmöglich* ‘impossible’ and possibly also *ausschließen* ‘rule out’
 - d. question-embedding predicates that are ‘downward-monotonic’ wrt. subsumption relation between embedded questions, like *unklar* ‘unclear’

The examples discussed in this section suggest that we are dealing with a quite general pattern that requires a unified account. While I will concentrate on proposition-embedding predicates in the analytical part of this thesis, I believe that the basic idea I will defend there – that higher-order DPs involve a special, partly context-dependent domain-restriction mechanism – carries over to quantification over properties and semantic questions, even though the details of my analysis might not. Before I turn to the motivation for this specific approach, however, I want to take a closer look at the different possible solutions of the puzzle and the conceptual differences between them.

3.1.4 Ways out of the dilemma

The dilemma we find ourselves in is that several opaque predicates seem to show certain monotonicity properties when they combine with ‘ordinary’, non-quantificational complements, but these monotonicity properties make wrong predictions once higher-order quantification enters the picture. In Section 3.1.2 I mentioned one particularly easy way of avoiding this conclusion, namely to attribute the apparent validity of the monotonicity inferences to non-semantic factors. But, as Zimmermann (2006) points out, this is not a plausible option: Many linguistic facts would remain unexplained if the monotonicity properties of opaque predicates were outside the domain of semantics altogether. Somehow, we have to account for the judgment that (3.43-a) seems contradictory – even on an unspecific reading that does not entail the existence of pink unicorns – while (3.43-b) is consistent. Similar contrasts for the other classes of predicates are provided in (3.44)-(3.46).

- (3.43)
- a. #*Peter sucht ein pinkes Einhorn, aber ein Einhorn sucht er nicht.*
 Peter seeks a pink unicorn but a unicorn seeks he not
 ‘Peter is looking for a pink unicorn, but he is not looking for a unicorn.’
 - b. *Peter sucht ein Einhorn, aber ein pinkes Einhorn sucht er nicht.*
 Peter seeks a unicorn but a pink unicorn seeks he not

‘It’s unclear to Peter who owns a car here.’

- (ii) *Dem Peter ist unklar, wer hier auch nur irgendein Auto besitzt.*
 the.DAT Peter is unclear who here also just any car owns
 ‘It is unclear to Peter who owns any car at all here.’

This suggests that there is more than one linguistically relevant sense in which an operator can create a monotonic context, and Zimmermann’s puzzle applies to at least two notions of monotonicity – the ‘classical’ one defined in (3.4) and (3.17) above, which is arguably relevant for NPI licensing, and the notion of subsumption between questions.

‘Peter is looking for a unicorn, but he is not looking for a pink unicorn.’

- (3.44) a. *#Der Peter glaubt, dass es stark regnet, aber dass es regnet, glaubt er*
the Peter believes that EXPL strongly rains but that EXPL rains believes he
nicht.
not
‘Peter believes that it’s raining heavily, but he doesn’t believe it’s raining.’
b. *Der Peter glaubt, dass es regnet, aber dass es stark regnet, glaubt er*
the Peter believes that EXPL rains but that EXPL strongly rains believes he
nicht.
not
‘Peter believes that it’s raining, but he doesn’t believe it’s raining heavily.’
- (3.45) a. *#Der Peter schließt aus, dass es regnet, aber dass es stark regnet,*
the Peter excludes PRT that EXPL rains but that EXPL strongly rains
schließt er nicht aus.
excludes he not PRT
‘Peter rules out the possibility that it’s raining, but he doesn’t rule out the possi-
bility that it’s raining heavily.’
b. *Der Peter schließt aus, dass es stark regnet, aber dass es regnet,*
the Peter believes that EXPL rains but that EXPL strongly rains believes
schließt er nicht aus.
he not
‘Peter rules out the possibility that it’s raining heavily, but he doesn’t rule out the
possibility that it’s raining.’
- (3.46) a. *#Dem Peter ist unklar, wer Pizza gegessen hat, aber wer was gegessen hat,*
the.DAT Peter is unclear who pizza eaten has but who what eaten has
ist ihm klar.
is him.DAT clear
‘It’s unclear to Peter who ate pizza, but it’s clear to him who ate what.’
b. *Dem Peter ist unklar, wer was gegessen hat, aber wer Pizza gegessen hat,*
the.DAT Peter is unclear who what eaten has but who what eaten has
ist ihm klar.
is him.DAT clear
‘It’s unclear to Peter who ate what, but it’s clear to him who ate pizza.’

A semantic analysis of opaque predicates should be able to capture these judgments, even if the monotonicity inferences are not exceptionless (an issue I discuss briefly in Appendix A.1). We are therefore still facing the question how to account for the distinct monotonicity behavior of non-quantificational complements and higher-order DPs. Our current analysis gets the judgments in (3.43)-(3.46) right, but assigns excessively weak truth conditions to restricted higher-order existential statements. Two assumptions inherent in this analysis jointly give rise to this wrong prediction. First, since we attributed the monotonicity inferences licensed by opaque predicates to their lexical meanings, we expect these inferences to be available in quantificational sentences as well. Second, we assumed that higher-order DPs quantify over a relatively unrestricted domain which is structured by some relation $\prec$ that is akin to entailment. In the case of ITV, $\prec$ is the generalized entailment relation defined in (3.3). For upward-monotonic attitude predicates like *believe*, $\prec$ is the subset relation among propositions; for predicates like *ausschließen* ‘exclude’,

$\prec$ is its converse, the superset relation among propositions. Finally, for question-embedding predicates like *unklar* $\prec$ is the converse of the subsumption relation. The problem is that unless the domain of the higher-order DP is contextually restricted, it has the property that for any domain elements p and q , there is some r such that $p \prec r$, $q \prec r$ and r is also in the domain.

This ‘closure property’ with respect to the relation $\prec$ makes it easy to find a domain element that is sufficiently weak to make a restricted higher-order existential statement true. For *glauben* ‘believe’, this corresponds to the prediction that, at least in some contexts, the inference in (3.47) is valid regardless of our choice of p and q . Analogously, we predict the inference pattern in (3.48) for *unklar* ‘unclear’.

(3.47) (3.47-a), (3.47-b) $\Rightarrow$ (3.47-c)

- a. *Peter glaubt, dass p.*
‘Peter believes that p .’
- b. *Maria glaubt, dass q.*
‘Maria believes that q .’
- c. *Peter glaubt etwas, das (auch) Maria glaubt.*
Peter believes something REL also Maria believes
‘Peter believes something that Maria also believes.’

(3.48) (3.48-a), (3.48-b) $\Rightarrow$ (3.48-c)

- a. *Peter ist unklar, ob p.*
‘It is unclear to Peter whether p .’
- b. *Maria ist unklar, ob q.*
‘It is unclear to Maria whether q .’
- c. *Peter ist etwas unklar, das (auch) Maria unklar ist.*
Peter is something unclear REL also Maria unclear is
‘Something is unclear to Peter that is also unclear to Maria.’

Since inference patterns like (3.47) and (3.48) appear to be invalid for all four classes of predicates surveyed in this section, we have to give up one of the two assumptions leading to the prediction that they are valid. We could either accept that monotonicity inferences are not due to the lexical meanings of opaque predicates, or we could find a way of making the quantificational domains of higher-order DPs small enough to block the inferences.

The approach I will pursue in this chapter and Chapter 4 is basically of the second type, but it also involves a departure from the standard semantics for higher-order DPs. Before I start discussing the motivation for this approach, it might be helpful to describe the basic idea. Higher-order DPs that quantify over objects of type τ range over a certain subset of D_τ . The mechanism that determines this subset is sensitive to the extensions of the restrictor and the nuclear scope of the higher-order DP, but also to a contextual parameter. Importantly, this subset will not be closed under relation $\prec$, which means that inferences like (3.47) and (3.48) no longer come out as valid: In the case of (3.47), if $\llbracket p \rrbracket$ and $\llbracket q \rrbracket$ are in the quantificational domain, it might not be the case that their disjunction, or any weaker proposition, is in the domain as well. The crucial role of contextual parameters will in this approach be motivated by the fact that judgments about the acceptability of instances of the pattern (3.47) are highly context-dependent.

Since the main function of the contextual parameters will be to restrict the domain of higher-order DPs, the truth conditions of sentences without higher-order DPs will generally not depend on the same parameters. Hence, our assumptions about the LF and truth conditions of sentences like (3.49-a) or (3.49-b) will not change substantially and (3.49-a) is still predicted to entail (3.49-b).

- (3.49) (3.49-a) $\Rightarrow$ (3.49-b)
- a. *Der Peter sucht ein Linguistikbuch.*
the Peter seeks a linguistics-book
'Peter is looking for a linguistics book.'
 - b. *Der Peter sucht ein Buch.*
the Peter seeks a book
'Peter is looking for a book.'

On this approach, the contrast between the upward-monotonicity in (3.49) and the apparent non-monotonicity in (3.50) is ultimately attributed to a type distinction. In a restricted higher-order existential statement like (3.50-c), the DP object has type $\langle\langle s, et \rangle, t \rangle, t$. I will assume that such DPs contain a domain variable of type $\langle\langle s, et \rangle, t \rangle$ whose value depends on the context. A sketch of the LF I assume for (3.50-c) is given in (3.51-a), where the interpretation of the higher-order determiner will be sensitive to the set of properties assigned to the index $(3, \langle\langle s, et \rangle, t \rangle)$ (see Section 1.3 for a more detailed discussion of my assumptions about LF syntax).

- (3.50) (3.50-a), (3.50-b) $\nRightarrow$ (3.50-c)
- a. *Die Maria sucht eine Flasche Wein.*
the Maria seeks a bottle wine
'Maria is looking for a bottle of wine.'
 - b. *Der Peter sucht ein Buch.*
the Peter seeks a book
'Peter is looking for a book.'
 - c. *Der Peter sucht etwas, das auch die Maria sucht.*
the Peter seeks something REL also the Maria seeks
'Peter is looking for something that Maria is also looking for.'

- (3.51) $[[[\exists_{\langle s, et \rangle} C_{(3, \langle\langle s, et \rangle, t \rangle)}] [-was_{\langle s, et \rangle} [(1, \langle s, et \rangle) [Maria [t_{(1, \langle s, et \rangle)} sucht]]]] [(2, \langle s, et \rangle) [[der Peter] [t_{(2, \langle s, et \rangle)} sucht]]]]$

In contrast, a sentence like (3.49-b) does not have any reading that involves higher-order quantification. Given the analysis of ITV adopted in Chapter 2, (3.49-b) is ambiguous between two readings: a 'specific' reading on which it quantifies over individual books or individuating properties of books, corresponding to the LF in (3.52-a), and an 'unspecific' reading on which it directly takes a property argument of type $\langle s, et \rangle$, expressed by the LF in (3.52-b). Since the interpretation of ordinary DPs is subject to contextual domain restriction as well (cf. Westerstähl 1985, von Stechow 1994 a.o. for discussion), it makes sense to assume that their LFs also contain restriction variables. (See Section 2.2 for a more detailed discussion of these LFs and, in particular, the interpretation of the type-shifts IDENT and BE.)

- (3.52) a. $[[[\exists_e C_{(3, \langle e, t \rangle)}] Buch_i] [(1, e) [Peter [[IDENT t_{(1, e)}] sucht]]]]$
b. $[Peter [[BE [[\exists_e C_{(3, \langle e, t \rangle)}] [Buch_i]]] sucht]]$

But then, if ordinary DPs involve restriction variables as well, why would we expect inferences like (3.49) to be judged valid? On the analysis proposed here, the premise and the conclusion of (3.49) are both interpreted relative to two contextual parameters: one that determines the individuation method for books corresponding to index i , and another one that determines the value of index $(3, \langle e, t \rangle)$ and hence the domain restriction. Thus, one might think that if the invalidity of (3.50) is due to domain restriction, (3.49) should be invalid by the same token.

However, this objection loses force when we consider the semantic types of the contextual parameters in (3.49) and (3.50). In (3.49), both the premise and the conclusion depend on an individuation method and a domain variable that denotes a set of individuals. Then, if we interpret (3.49-b) in the context of (3.49-a), the most obvious strategy for the choice of these parameter values is to use the same values for both sentences. If we follow this strategy, (3.49) comes out as valid. For (3.50), this strategy is not available: While both premises involve domain restriction variables of type $\langle e, t \rangle$, the conclusion depends on a contextual parameter of type $\langle \langle s, et \rangle, t \rangle$. Hence, the restriction variable in (3.50-c) cannot take its value from the restriction variables in the sentences (3.50-a) and (3.50-b) that precede it in the discourse. Instead, when we interpret (3.50-c) in the context of (3.50-a) and (3.50-b) (on their unspecific readings), it is plausible to assume that the domain of the quantifier in (3.50-c) will contain the properties expressed by the object DPs in (3.50-a) and (3.50-b). On the approach to be developed here, this will ‘block’ the disjunction of these two properties, and any weaker properties, from being in the domain unless they are made salient by the preceding context.¹³

In sum, the invalidity of inference (3.50) will be attributed to partly pragmatic restrictions on the domains of higher-order quantifiers. The inference in (3.49) is unaffected by these restrictions because it does not involve higher-order quantification. This view of the monotonicity puzzle presupposes the main claims of Chapter 2: 1) that higher-order DPs exhibit more type flexibility than ‘ordinary’ DPs and 2) that, with the exception of a few lexical items that can be used to form higher-order DPs, DP arguments of opaque predicates cannot express genuine higher-order quantification. In this context, it might help to briefly highlight the main differences between my approach and the proposal in Zimmermann (2006), which I will discuss in more detail in Chapter 5. On Zimmermann’s account, the higher-order DP in (3.50-c) expresses unrestricted quantification over properties. Instead of giving up the assumption that the quantificational domains of higher-order DPs can contain arbitrarily weak elements, being ‘closed’ under an entailment-like relation $\prec$, he rejects the assumption that the opaque predicate is monotonic with respect to $\prec$. As he notes, the *existence* of monotonicity inferences is empirically well motivated, but it is not obvious that they derive directly from the lexical meaning of the predicate.

The basic idea behind Zimmermann’s (2006) analysis is to give the predicate a non-monotonic lexical semantics. The monotonicity behavior of ordinary indefinite DPs is accounted for by reanalyzing them as quantifiers over properties. So this analysis also relies on a systematic semantic distinction between higher-order DPs and ordinary complements of opaque predicates, but it is a distinction between two classes of higher-order DPs with different properties, rather

¹³This explanation was suggested to me by Daniel Büring (p.c.).

than a type distinction. Ordinary DPs denote higher-order quantifiers that have monotonicity inferences ‘built in’, while the expressions that I call ‘higher-order DPs’ denote higher-order quantifiers that do not.

This account of the puzzle differs from the one I will present in three respects. First, are intuitively valid monotonicity inferences like the one in (3.49) licensed by the predicate meaning or the DP meaning? Second, do higher-order DPs differ from ordinary DPs in their semantic type? Third, do higher-order DPs express unrestricted quantification?

The first question will be discussed in more detail in Chapter 5. As for the second question, I gave some motivation for a distinction between more type-flexible and less type-flexible DPs in Chapter 2, but as we will see in Chapter 5, this is not a knock-down argument against the type of analysis defended in Zimmermann (2006). In the rest of this chapter, I will try to address the third question and argue that, once we study sentences with higher-order DPs in context, previously understudied restrictions on the domain of higher-order quantifiers emerge.

3.2 Question-introducing modifiers and their truth-conditional effects

In the last section, I suggested that the monotonicity puzzle should be explained in terms of a mechanism for contextual domain restriction. If so, we need a systematic way of manipulating the context in order to study this restriction mechanism. To address this issue, I will concentrate on higher-order identity statements like (3.53), which allow us to see contextual domain restrictions more clearly than higher-order existential statements. I will start by showing that the quantificational domains of higher-order DPs depend on contextual parameters (Section 3.2.1). These parameters can be shifted by means of explicit modifiers, such as *zur Frage X* ‘concerning the question X’ or *was X betrifft* ‘as for X’. Taking this observation as a starting point, I will take a closer (but informal) look at the semantic contribution of such modifiers in Section 3.2.2, concentrating on examples with attitude predicates. The analysis sketch in Chapter 4 will also be limited to such examples, since they allow us to draw connections between conditions on higher-order quantification and the comparatively well-understood domain of interrogative semantics.

- (3.53) *Zur Frage, wer Weltmeister wird, glauben Hans und Maria dasselbe.*
to.the question who world.champion will.be believe Hans and Maria the.same
‘As for the question who will win the World Cup, Hans and Maria believe the same thing.’

In examples like (3.53), the quantificational domain of the higher-order DP must be a set of propositions which, in some sense, address the embedded question. Since there are many possible notions of addressing a question, the goal of Section 3.2.2 is to formulate an initial hypothesis about the relation between the embedded question and the domain of the higher-order DP. This hypothesis will provide the background for a closer look at certain less obvious restrictions on the domains of higher-order DPs (Section 3.3).

3.2.1 Implicit and explicit domain restrictions

Attitude predicates and domain-restricting questions We will focus on higher-order identity statements with *dasselbe* ‘the same thing(s)’. This DP fits our current purposes better than higher-order indefinites like *etwas* or *zwei Sachen* since it largely behaves like a definite plural or a definite mass term, and the ‘maximality’ inferences associated with definites make it easier to draw conclusions about what is *not* in the quantificational domain. For illustration, consider the scenarios in (3.54) and example (3.55), which involves a non-higher-order use of *dasselbe*. In the scenario in (3.54-a) and the linguistic context (3.55-a), (3.55-b) may be judged true even though Maria read something Hans didn’t read, because the question (3.55-a) leads us to restrict the domain of *dasselbe* to books on the reading list. A comparison with scenario (3.54-b) shows that the source of this effect is really domain restriction, and not a weaker semantics for *dasselbe* that merely requires some overlap between the books Hans read and the books Maria read. In (3.54-b), (3.55-b) is simply false, while the existential statement (3.55-c) is still true. So *dasselbe* does have a ‘maximizing’ semantics and the judgment that (3.55-b) is true in scenario (3.54-a) must be due to domain restriction.

- (3.54) a. SCENARIO: There were ten books on the reading list. Hans and Maria both read only book 1 and book 2. In addition, Maria read a paper that was not on the reading list.
 b. SCENARIO: There were ten books on the reading list. Hans read books 1, 2 and 3, while Maria read books 3, 4 and 5. In addition, Maria read a paper that was not on the list.
- (3.55) a. CONTEXT: Which books from the reading list did Hans and Maria read?
 b. *Hans und Maria haben dasselbe gelesen.*
 Hans and Maria have the.same read.PTCP
 ‘Hans and Maria have read the same thing(s).’ **true** in (3.54-a), **false** in (3.54-b)
 c. *Der Hans hat etwas gelesen, was die Maria auch gelesen hat.*
 the Hans has something read.PTCP REL the Maria also read.PTCP has
 ‘Hans has read something that Maria has also read.’ **true** in (3.54-a) and (3.54-b)

These observations suggest that sentences like (3.55-b) should be assigned paraphrases of the following kind: Given a quantificational domain *C*, (3.55-b) is true iff the set of all individuals in *C* that Hans read is identical to the set of all individuals in *C* that Maria read (cf. Section 1.3). Given this description, the fact that (3.55-b) can be judged true in scenario (3.54-a) shows that the additional paper Maria read is not in the domain in context (3.55-a). The truth conditions of identity statements involving *dasselbe* therefore provide a simple way of testing what is excluded from the quantificational domain in a certain scenario or linguistic context. For instance, (3.55) shows us that the domain of *dasselbe* can be narrowed down to match the restrictor of a wh-phrase in the preceding sentence.

Unsurprisingly, the observation that DPs like *dasselbe* can ‘pick up’ their domain restrictions from the preceding discourse carries over to higher-order identity statements. Consider examples (3.57)-(3.59) and the scenarios in (3.56). In each example, the preceding context raises a question

and asks for Hans and Maria's beliefs about this question.¹⁴

- (3.56) SCENARIOS: Hans and Maria are German soccer 'experts' who were just interviewed on TV about the upcoming World Cup final ...
- a. They both believe that France and Germany will make it to the final. Hans believes France will win, and Maria believes Germany will win.
 - b. Hans believes that France and Germany will make it to the final, and France will win. Maria believes that Brazil and Germany will make it to the final, and Brazil will win.
 - c. Hans believes that France and Germany will make it to the final, and Germany will win. Maria believes that Brazil and Germany will make it, and Germany will win.
- (3.57) a. CONTEXT: *Und was meinen unsere Experten dazu, von welchem Kontinent der nächste Weltmeister kommen wird?*
'So what do our experts think about the question which continent the next world champion will come from?'
- b. *Hans und Maria glauben dasselbe ...*
Hans and Maria believe the same
'Hans and Maria believe the same thing ...' **true** in (3.56-a) and (3.56-c), **false** in (3.56-b)
 - c. Propositions in the domain: $\llbracket \textit{the world champion will come from South America} \rrbracket$, $\llbracket \textit{the world champion will come from Europe} \rrbracket$...
 - d. Not in the domain: $\llbracket \textit{France will make the final} \rrbracket$, $\llbracket \textit{Brazil will become world champion} \rrbracket$...
- (3.58) a. CONTEXT: *Und was meinen unsere Experten dazu, wer es ins Finale schaffen wird?*
'So what do our experts think about the question who will make it to the final?'
- b. *Hans und Maria glauben dasselbe ...* **true** in (3.56-a), **false** in (3.56-b) and (3.56-c)
 - c. Propositions in the domain: $\llbracket \textit{France will make the final} \rrbracket$, $\llbracket \textit{Brazil will make the final} \rrbracket$...
 - d. Not in the domain: $\llbracket \textit{the world champion will come from Europe} \rrbracket$, $\llbracket \textit{Brazil will become world champion} \rrbracket$...
- (3.59) a. CONTEXT: *Und was meinen unsere Experten dazu, wer Weltmeister wird?*
'So what do our experts think about the question who will win the World Cup?'
- b. *Hans und Maria glauben dasselbe ...* **true** in (3.56-c), **false** in (3.56-a) and (3.56-b)
 - c. Propositions in the domain: $\llbracket \textit{Brazil will become world champion} \rrbracket$, $\llbracket \textit{Germany will become world champion} \rrbracket$...
 - d. Not in the domain: $\llbracket \textit{France will make the final} \rrbracket$, $\llbracket \textit{Brazil will make the final} \rrbracket$...

Informally speaking, contexts like (3.57-a)-(3.59-a) restrict the quantificational domain of *dasselbe* to propositions that answer the embedded question. For instance, in scenario (3.56-c), the answer in (3.57) can be judged true even though Hans has some salient beliefs Maria does not share, for

¹⁴On their own, the higher-order identity statements are pragmatically infelicitous in the given contexts, since they do not fully specify the experts' exact beliefs and the scenarios suggest that these beliefs are known to the speaker. But they are fine when they are followed by a more precise description of what Hans and Maria believe. In (3.57)-(3.59) I omitted this description for reasons of space. As we will see, the point illustrated by (3.57)-(3.59) can also be made using examples that consist of a single declarative utterance, not a question-answer sequence, and therefore do not give rise to this problem.

instance that France will make it to the final. Given our assumption that *dasselbe* behaves like a definite plural or mass term, we can conclude that the proposition $\llbracket \textit{France will make the final} \rrbracket$ is not in the domain of *dasselbe* in (3.57). If it were, the sum of those propositions in *C* that Hans believes would not be the same as the sum of the propositions in *C* that Maria believes, and we would therefore expect (3.57-b) to be judged false. Intuitively, this proposition does not count because it is uninformative relative to the question which continent the world champion will come from. But there is yet another restriction: The answer in (3.57-b) can also be judged true in scenario (3.56-a), which tells us that propositions like $\llbracket \textit{Germany will win the final} \rrbracket$ or $\llbracket \textit{France will win the final} \rrbracket$ are not in the relevant domain either – if they were, the plurality of propositions believed by Hans and the plurality of propositions believed by Maria would be distinct. Our background assumptions about the semantics of *dasselbe* force us to exclude such propositions from the domain even though they clearly entail (or at least contextually entail) an answer to the question which continent the winner will come from. So propositions that are ‘overinformative’ relative to the contextually salient question are excluded as well. These restrictions can be tested further by varying the context, as in (3.58) and (3.59). The judgments on these examples provide additional support for the restrictions I just illustrated with reference to (3.57).

In (3.57)-(3.59), the question that actually provides the domain restriction is introduced as a subconstituent of another, more complex question in the preceding discourse. There is, however, a less laborious way of introducing such restrictions: explicit modifiers of the form *zur Frage X* ‘concerning the question X’ or *was X betrifft* ‘as for X’. Judgments for the sentences in (3.60) follow the same pattern as the judgments on question-answer sequences reported in (3.57)-(3.59). If anything, they are more clear-cut.

- (3.60) a. *Zur Frage, von welchem Kontinent der Weltmeister kommen wird,*
to.the question from which continent the world.champion come will
glauben Hans und Maria dasselbe.
believe Hans and Maria the.same
‘Concerning the question which continent the world champion will come from, Hans and Maria believe the same thing.’ **true** in (3.56-a) and (3.56-c), **false** in (3.56-b)
- b. *Zur Frage, wer es ins Finale schaffen wird, glauben Hans und*
to.the question who EXPL into.the final manage will believe Hans and
Maria dasselbe.
Maria the.same
‘Concerning the question who will make it to the final, Hans and Maria believe the same thing.’ **true** in (3.56-a), **false** in (3.56-b) and (3.56-c)
- c. *Zur Frage, wer Weltmeister wird, glauben Hans und Maria dasselbe.*
to.the question who world.champion becomes believe Hans and Maria the.same
‘Concerning the question who will win the World Cup, Hans and Maria believe the same thing.’ **true** in (3.56-c), **false** in (3.56-a) and (3.56-b)

As (3.61) shows, modifiers of the form *was X betrifft* ‘as for X’ have a similar domain-restricting effect.

- (3.61) *Was die Frage betrifft, von welchem Kontinent der Weltmeister kommen*
what the question concerns from which continent the world.champion come

wird, glauben Hans und Maria dasselbe.
 will believe Hans and Maria the.same
 ‘As for the question which continent the world champion will come from, Hans and Maria believe the same thing.’ **true** in (3.56-a) and (3.56-c), **false** in (3.56-b)

Both syntactically and semantically, the *was X betrifft* construction is more flexible than the modifiers shown in (3.60). For instance, it has additional uses on which it does not embed a question (3.62).

(3.62) *Was das WM-Finale betrifft, glauben Hans und Maria dasselbe.*
 what the World.Cup.final concerns believe Hans and Maria the.same
 ‘As for the World Cup final, Hans and Maria believe the same thing.’

While a unified semantics of *was X betrifft* phrases is beyond the scope of the present work, it is worth noting that the construction in (3.62) seems to have a construal that is closely related to the question-embedding construction in (3.61). Crucially, (3.62) does not necessarily mean that Hans and Maria must have completely identical belief states as far as propositions ‘about’ the World Cup final are concerned. Rather, the higher-order DP seems to quantify only over those propositions that address a certain salient question related to the World Cup final. Two examples of plausible contexts for a sentence like (3.62) are given in (3.63-a) and (3.64-a). Importantly, in context (3.63-a), (3.62) can be judged true as long as Hans and Maria agree on the question which teams will make it to the final – even if their belief states differ with respect to other questions such as whether it will be worth watching or whether their friend Peter got tickets. In contrast, (3.63-b) sets up a context in which *dasselbe* quantifies over answers to the question whether Peter got tickets, while Hans and Maria’s beliefs about the question which teams will make it to the final do not necessarily influence the truth conditions.

- (3.63) a. CONTEXT: Hans and Maria usually have completely different opinions about soccer. They just had a long argument about the question who will make it to the Champions League final this year, but ...
 b. CONTEXT: Peter claims that he got tickets for the Champions League final and the World Cup final, but his friends suspect he is just showing off. Hans and Maria have different opinions on the question whether he will actually be able to attend the Champions League final, but ...

Summing up, one of the semantic functions of *was X betrifft* phrases is to introduce a semantic question that restricts the domain of a higher-order DP ranging over propositions. When *X* is an embedded interrogative, it can express the domain-restricting question more or less directly; when *X* is an ordinary DP, the domain is restricted by some contextually salient question related to $\llbracket X \rrbracket$. Since I do not fully understand the pragmatic mechanism behind the DP-embedding use of *was X betrifft*, I will mostly limit the discussion to the comparatively well-understood question-embedding cases.

Intensional transitive verbs At this point, the question arises whether we can find similarly explicit domain-restricting devices for the other classes of opaque predicates discussed in Section 3.1. After all, if the context dependency we just observed were limited to attitude predicates, it would not be a plausible basis for a generalizable pragmatic approach to the monotonicity

puzzle.

In (3.60) and (3.61), we used embedded interrogatives to make certain sets of propositions salient. To extend the present empirical picture to ITV like *suchen*, we therefore have to find linguistic expressions that can make sets of *properties* salient. One such expression is the DP-embedding use of *was X betrifft* phrases. Consider the scenarios in (3.64-a,b), in which two companies are looking for employees and their search criteria overlap only partially.¹⁵ The unmodified higher-order identity statement in (3.65-a) does not seem true in such scenarios (especially when modified by *genau* ‘exactly’; without such modifiers, the judgments are not clear-cut). But once we add modifiers of the form *was X betrifft*, we obtain clearly distinct truth value judgments for the two scenarios.

- (3.64) a. SCENARIO: Two companies are each looking for a new employee. Company A is looking for someone who is under 21, has an MA in astrophysics and speaks three languages, including Russian. Company B is looking for someone who is under 21, has an MA in astrophysics and speaks five languages, including Japanese. Unsurprisingly, there have not been many applications yet since nobody meets all these requirements.
- b. SCENARIO: Two companies are each looking for a new employee. Company A is looking for someone who is under 21, has a PhD in mathematics and speaks five languages, including Japanese. Company B is looking for someone who is under 21, has an MA in astrophysics and also speaks five languages, including Japanese. Unsurprisingly, there have not been many applications yet since nobody meets all these requirements.
- (3.65) a. *Firma A und Firma B suchen (genau) dasselbe.*
company A and company B seek exactly the same
‘Company A and company B are looking for (exactly) the same thing.’
false in (3.64-a) and (3.64-b)
- b. *Was die Sprachkenntnisse der Bewerber betrifft, suchen Firma A und Firma B (genau) dasselbe.*
what the language.skills the.GEN candidates concerns seek company A and
company B exactly the same
‘As far as the candidates’ language skills are concerned, company A and company B are looking for (exactly) the same thing.’ **false in (3.64-a), true in (3.64-b)**
- c. *Was die Studienrichtung betrifft, suchen Firma A und Firma B (genau) dasselbe.*
what the study.field concerns seek company A and company B exactly
the same
‘As far as the field of study is concerned, company A and company B are looking for (exactly) the same thing.’ **true in (3.64-a), false in (3.64-b)**

Pre-theoretically, the truth-conditional differences between (3.65-a-c) show that higher-order *dasselbe* is not an unrestricted quantifier over properties, but quantifies over a restricted set of potential search criteria. If we model search criteria as properties of individuals, this can be expressed as follows: In (3.65-b), *dasselbe* ranges only over properties related to language skills

¹⁵The judgments in (3.65) describe a dialect like mine in which *dasselbe* can be used to quantify over properties of human individuals. Here, I used predicates of human beings in order to force a higher-order reading of *dasselbe*, which would otherwise also have a reading on which it ranges over non-human individuals. An alternative way of forcing a higher-order reading would be to use properties of inanimate individuals that are known to be non-individuating, as discussed in Chapter 2.

and the sentence asserts that the set of all such properties required by company A is the same as the set of all such properties required by company B. If so, higher-order identity statements with *suchen* do not generally require the individual subjects to have identical search goals. Rather, we compare only those of their search criteria that fall into a certain restricted set of properties, which can be manipulated by explicit modifiers.¹⁶

The judgment that (3.65-a) is not true in either of the scenarios in (3.64) suggests that, if there is no explicit modifier, the domain usually includes all properties that are salient in the given context. For instance, given the scenarios in (3.64) in which language skills are explicitly mentioned, we usually assume a domain for *dasselbe* that also contains properties related to language skills, unless they are excluded by an explicit domain-restricting device as in (3.65-c). However, this is just a default assumption and there are ways of manipulating the domains of quantifiers over properties that do not involve modifiers like *was X betrifft*. One of them is to introduce the restricted domain in a preceding sentence. Another strategy is provided by appositive modifiers, as in (3.66), which can be judged true in scenario (3.64-a).

- (3.66) *Firma A und Firma B suchen dasselbe, nämlich einen Astrophysiker mit sehr guten Fremdsprachenkenntnissen.*
 company A and company B seek the.same namely an astrophysicist with very good foreign.language.skills
 ‘Company A and company B are looking for the same thing, an astrophysicist with very good foreign language skills.’ **?true in (3.66-a)**

The effect of the appositive *nämlich* ‘namely’ phrase in (3.66) seems to be to fully specify those of the subjects’ search goals that correspond to properties in the restricted domain. If so, the use of this modifier forces us to assume a smaller domain, which does not include properties that exactly specify the language skills required.¹⁷

¹⁶I do not mean to suggest that the definite DPs *die Studienrichtung*, *das genaue Alter* etc. in (3.65) literally denote sets of properties. The question which semantic type we should assign to modifiers of the form *was X betrifft*, and how they end up restricting a variable over sets of properties, would require a more detailed investigation of the different uses of this construction which I cannot provide in this thesis.

¹⁷The English examples provided in Moltmann (1997:7), including (i-b) and (ii), also illustrate this strategy. According to Moltmann, (i-b) is true in scenario (i-a) and the inference in (ii-a) appears valid, while the inference in (ii-b) does not.

- (i) a. SCENARIO: John intends to hire a French assistant, but Mary wants a German assistant.
 b. *John is looking for what Mary is looking for, namely a new assistant.* (Moltmann 1997:7, (12-a))
- (ii) a. *John is looking for a German assistant, and Mary is looking for a French assistant.*
 $\Rightarrow$ *John and Mary are looking for the same thing (an assistant).* (Moltmann 1997:7, fn. 4, (i))
 b. *John is looking for an assistant and Mary is looking for two assistants.*
 $\nRightarrow$ *John and Mary are looking for the same thing.* (Moltmann 1997:7, (13-a))

Moltmann takes this to show that higher-order identity statements are sensitive to the structure of the DPs used to describe the different subjects’ search criteria. These DPs do not have to be identical, but the two head nouns, as well as the two determiners, must be cointensional. The reason why (i-b) is true in the given scenario and the inference in (ii-a) is acceptable, according to Moltmann, is that the DPs *a French assistant* and *a German assistant* have the same head noun and determiner, which is enough to license a higher-order identity statement. The inference in (ii-b), on the other hand, is unacceptable because the two determiners differ. However, Moltmann’s examples for this generalization have an interesting property that she does not discuss explicitly: (i-b) and (ii-a) both contain appositive modifiers, while (ii-b) does not. While Moltmann does not comment on this property of her examples, I suspect that the acceptability of (i-b) and (ii-a) (assuming the judgments reported by Moltmann) might be due to these modifiers: On my assumptions, the *namely* phrase in (i-b) must provide a full specification of the subjects’ search goals relative to the restricted domain, and therefore leads us to assume

Question-embedding predicates Finally, let's turn to higher-order DPs ranging over semantic questions, for instance in the object position of *unklar* 'unclear'. As discussed in Section 3.1, if higher-order DPs can quantify over arbitrarily fine-grained semantic questions, these predicates give rise to a version of the monotonicity puzzle since, given two semantic questions, the domain will always contain a semantic question that subsumes both of them. To see whether domain restriction might contribute to the unavailability of monotonicity inferences in such cases, we thus have to look for modifiers that introduce a set of questions of limited 'granularity'.

Earlier in this section, I discussed two classes of modifiers that introduce semantic questions: modifiers containing an embedded interrogative, and DP-embedding modifiers of the form *was X betrifft*, which serve to introduce some contextually salient question relating to $\llbracket X \rrbracket$. Both types of modifiers can also be used to restrict the domain of higher-order DPs ranging over questions. (3.67) and (3.68) illustrate the effect for modifiers with embedded interrogatives. Scenario (3.67) sets up several questions that Hans and Maria cannot answer. The contrast between (3.68-a) and (3.68-b) in this scenario suggests that, in the presence of a question-embedding modifier, *dasselbe* does not quantify over all such questions, but only over 'subquestions' of the semantic question introduced by the modifier.

- (3.67) SCENARIO: Hans and Maria are organizing a party for their friends and relatives. They both know which of their relatives will come, with one exception – Maria's parents did not reply to the invitation. Hans knows which of his own friends will come, but has no idea about Maria's friends. Maria knows which of her friends will come, but does not know about Hans's friends.
- (3.68) a. *Zur Frage, wer zur Party kommt, ist dem Hans und der Maria dasselbe unklar.*
to.the question who to.the party comes is the.DAT Hans and the.DAT Maria the.same unclear
'As for the question who will come to the party, Hans and Maria are unsure about the same thing.' **not true** in (3.67)
- b. *Zur Frage, welche Verwandten von ihnen zur Party kommen, ist dem Hans und der Maria dasselbe unklar.*
to.the question which relatives of them to.the party come is the.DAT Hans and the.DAT Maria the.same unclear
'As for the question which of their relatives will come to the party, Hans and Maria are unsure about the same thing.' **true** in (3.67)

In scenario (3.68), the question $\llbracket \textit{who will come to the party} \rrbracket$ has several subquestions that Hans and Maria cannot answer: Hans does not know which of Maria's friends will come, Maria does not know which of Hans's friends will come and neither of them knows whether Maria's parents will show up. While (3.68-a) does not adequately describe this scenario, (3.68-b) seems adequate

a restricted domain that does not include properties related to nationality. At least for the German counterparts of these examples, one can introduce domain-restricting modifiers that make them unequivocally false in the contexts provided, as illustrated in (iii) for a variant of (ii-a).

- (iii) *Was die Nationalität ihrer Assistenten betrifft, suchen Hans und Maria dasselbe.*
what the nationality their.GEN assistants concerns seek Hans and Maria the.same
'As for the nationality of their assistants, Hans and Maria are looking for the same thing.' **false** in (i-a)

and true. This is presumably because the questions about Hans’s and Maria’s friends, which only one of them can answer, are subquestions of $\llbracket \textit{who will come to the party} \rrbracket$, but not of the more specific question $\llbracket \textit{which of their relatives will come to the party} \rrbracket$ introduced in (3.68-b). One notion of ‘subquestion’ that accounts for cases like (3.68) is provided by the subsumption relation defined in Section 3.1. For instance, any complete answer to the embedded question in (3.68-a) will entail a complete answer to the question which of Maria’s friends will come, but a complete answer to the embedded question in (3.68-b) will not entail such an answer. So the embedded question in (3.68-a) subsumes the question which of Maria’s friends will come, while the embedded question in (3.68-b) does not. However, further research is needed to determine whether this is really the right notion of ‘subquestion’ to describe the effect of the modifiers in (3.68), or whether a more permissive notion is required.

As with attitude predicates, we can also use the *was X betrifft* construction as an indirect way of introducing a contextually salient question, as illustrated in (3.69).

- (3.69) a. CONTEXT: As always, Hans and Maria are not sure who will be at their party. Hans expects that, as usual, there will be a few surprise guests ...
 b. *Und was die eingeladenen Personen betrifft, ist dem Hans und der Maria dasselbe unklar ...*
 and what the invited people concerns is the.DAT Hans and the.DAT Maria the.same unclear
 ‘And as for the people they invited, Hans and Maria are unsure about the same thing.’ **not true in (3.67)**
 c. *Und was die eingeladenen Verwandten betrifft, ist dem Hans und der Maria dasselbe unklar ...*
 and what the invited relatives concerns is the.DAT Hans and the.DAT Maria the.same unclear
 ‘And as for the relatives they invited, Hans and Maria are unsure about the same thing.’ **true in (3.67)**

The context (3.69-a) sets up the question $Q = \llbracket \textit{who will be at the party} \rrbracket$. Given this context, a modifier of the form *was X betrifft* can be used to introduce certain subquestions of Q – in (3.69-b), it introduces the question which of the invited guests will come, and in (3.69-c), the question which of the relatives Hans and Maria invited will come. As in (3.68), the overall effect is that the domain of *dasselbe* is restricted to subquestions of the question made salient by the modifier. Importantly, if we assume that ‘subquestions’ are characterized by the notion of subsumption defined above, this has the consequence that the domain no longer contains arbitrarily fine-grained questions, since a question subsumed by Q cannot be more fine-grained than Q itself.

Interim summary and theoretical consequences We have now seen several illustrations of a simple point: Like ordinary DPs, higher-order DPs usually do not express unrestricted quantification, even if there is no overt restrictor predicate in the DP. We saw that in German, there are at least two systematic ways of manipulating the domain of a higher-order DP without introducing an overt restrictor predicate: First, the DP can pick up its restrictor from a constituent in the preceding discourse, such as an embedded question. Second, modifiers of the form *zur Frage*

X and *was X betrifft* can be used to introduce a set of propositions, properties or questions that restricts the domain.

Since these modifiers influence the truth conditions of higher-order identity statements, any semantic analysis of higher-order DPs has to account for them. An obvious way of doing so, given what we know about the context-dependency of other quantificational expressions in natural languages (cf. e.g. [Westerståhl 1985](#), [von Fintel 1994](#) for discussion), is to claim that these modifiers shift a parameter of the evaluation function that is responsible for domain restriction, or introduce a presupposition constraining the possible values of that parameter. So far, I have been assuming that determiners always combine with a domain-restriction variable. Given this view, the relevant parameter of the evaluation function is simply the variable assignment, and we are led to an analysis on which the modifiers are coindexed with a domain variable within the higher-order DP and either bind this variable or constrain its possible values.

Here is a simplified illustration of what this would mean (a more involved analysis will be proposed in Chapter 4). If higher-order objects of attitude predicates really quantify over propositions, the domain-restriction variables they contain will denote sets of propositions. Following theories such as [Hamblin \(1973\)](#), I will take questions to denote sets of propositions.¹⁸ For simplicity, I will assume that modifiers of the form *zur Frage Q* or *was die Frage Q betrifft* have the same denotation as the question Q (3.70).

$$(3.70) \quad \llbracket \text{zur Frage} \rrbracket = \lambda w. \lambda Q_{\langle \langle s, t \rangle, t \rangle}. Q$$

If so, the modifiers can directly bind the domain-restriction variables in higher-order DPs that quantify over propositions. These variables usually receive their values from the contextually given assignment function, which maps an index of type $\langle \langle s, t \rangle, t \rangle$ to the extension of some semantic question that was made salient in the preceding discourse. The quantificational domain of higher-order DPs is then restricted to the set of all propositions that, in a sense yet to be specified, ‘address’ the question provided by the restriction variable. As we will see later, this set should not be identified with the question denotation.¹⁹

$$(3.71) \quad \llbracket \exists_{\langle s, t \rangle} \rrbracket = \lambda w. \lambda C_{\langle \langle s, t \rangle, t \rangle}. \lambda \mathcal{P}_{\langle \langle s, t \rangle, t \rangle}. \lambda \mathcal{Q}_{\langle \langle s, t \rangle, t \rangle}. \exists p_{\langle s, t \rangle}. p \text{ addresses the question } C \wedge p \in \mathcal{P} \cap \mathcal{Q}$$

As mentioned in Section 1.3, I will assume that the restriction variable appears in the LF syntax as an additional argument of the determiner (following [von Fintel 1994:30f.](#)). As a placeholder for a more plausible analysis, I will take domain-restricting modifiers to bind this variable due to a binder index that must be adjoined to the sister of the modifier at LF. The effect of such modifiers is illustrated in (3.72): (3.72-a) is predicted to be true iff there is a proposition p such that p addresses the question and both Hans and Maria believe p . While we will see that domain

¹⁸Further motivation for this choice will be given in Section 3.3 below. I will focus on question extensions rather than intensions, ignoring the index-dependence of the set of propositions assigned to a question.

¹⁹One could also try to encode the restriction to propositions that ‘address the question’ in the semantics of the modifier. There are two reasons not to do this, however: First, the domain restriction can also depend on questions introduced earlier in the discourse in the absence of an overt modifier. Since there is no reason to believe that the semantic impact of domain-restricting questions is different in such cases, the restriction to partial answers shouldn’t be an accidental lexical property of the modifiers. Second, in the next section we will see that question-introducing modifiers can also appear with non-quantificational complements, and the semantic restrictions they impose in such cases appear to be weaker than those for quantificational complements. This distinction should presumably be attributed at least partly to the meaning of higher-order quantifiers.

restriction by itself does not provide a general solution to the monotonicity puzzle, for now it is worth noting that the truth conditions in (3.72-c) are no longer trivial: If Hans and Maria do not share any beliefs that address the question who will win the World Cup, (3.72-a) comes out false.

- (3.72) a. *Zur Frage, wer Weltmeister wird, glaubt der Hans etwas, das*
to.the question who world.champion becomes believes the Hans something REL
auch die Maria glaubt.
also the Maria believes
‘Concerning the question who will win the World Cup, Hans believes something that Maria also believes.’
b. $[[\text{zur Frage } [\text{wer Weltmeister wird}]] [(1, \langle \langle s, t \rangle, t \rangle)] [[\exists_{\langle s, t \rangle} C_{(1, \langle \langle s, t \rangle, t \rangle)}] [-\text{was}_{\langle s, t \rangle} [(2, \langle s, t \rangle) [\text{Maria } [t_{(2, \langle s, t \rangle)} \text{ glaubt}]]]] [(2, \langle s, t \rangle) [\text{Hans } [t_{(2, \langle s, t \rangle)} \text{ glaubt}]]]]]$
c. $[(3.72\text{-b})] = \lambda w. [\exists p_{\langle s, t \rangle}. p \text{ addresses the question } [[\text{wer Weltmeister wird}]] \wedge \forall w' [w' \in \text{DOX}(w)(\mathbf{hans}) \rightarrow p(w') = 1] \wedge \forall w' [w' \in \text{DOX}(w)(\mathbf{maria}) \rightarrow p(w') = 1]]$

My motivation for positing a domain variable within each higher-order DP, rather than a single contextual parameter that fixes the domains of all higher-order DPs of a certain type, is purely semantic: The traditional arguments for having a separate domain restriction for each DP, rather than a ‘flexible universe’ determined only once for the entire sentence (cf. [Westerstahl 1985](#), [von Fintel 1994:28ff.](#)) seem to extend to higher-order DPs. For instance, there can be multiple higher-order DPs with distinct domains within a sentence. In (3.73), the higher-order indefinite *etwas* is modified by a relative clause that contains another higher-order DP. While the modifier constrains the domain of the *etwas* DP, this cannot be the only set of propositions that is relevant for the interpretation of this DP, since the definite higher-order DP *den Sachen, die in seinem Buch stehen* is not restricted to propositions about the election.²⁰

- (3.73) a. SCENARIO: Paul is a political analyst who has recently published an apolitical book about soccer. He was interviewed on TV. Peter, who did not see the interview and only knows his political writings, asks:
b. CONTEXT: Did Paul make any predictions about the upcoming election? And does he say anything about it in his new book?
c. *Was die Wahl betrifft, hat der Paul etwas gesagt, das nichts mit*
what the election concerns has the Paul something said REL nothing with
den Sachen zu tun hat, die in seinem Buch stehen. In dem Buch geht es
the things to do has REL in his book stand in the book goes EXPL
ja nur um Fußball.
PRT only about soccer
‘As for the election, Paul said something that has nothing to do with the things he writes in his book. The book is just about soccer.’

Summing up, regardless of the question whether the restricted domains of higher-order DPs should be represented in the syntax, it is clear that they depend on parameters that can be shifted during semantic composition. This brings us closer to an analysis of the monotonicity puzzle that does not require a new semantics for the predicates, since it lets us reduce failures of monotonicity inferences to general constraints on the possible values of these parameters. My

²⁰See [Westerstahl \(1985\)](#) and [von Fintel \(1994\)](#) for a discussion of similar arguments concerning ordinary DP quantification over individuals.

strategy in the rest of this chapter will be to use examples with domain-restricting modifiers, like *zur Frage X* or *was X betrifft*, to study these constraints and then generalize the results to examples without them. This approach is modeled on Kratzer's (1978, 2012) research on the context dependency of modal expressions. Kratzer uses sentences with the modifier *in view of X* to motivate the notion of conversational backgrounds and study their role in the semantics of modals, and then generalizes the resulting semantics to examples lacking this modifier. For higher-order DPs, the assumption that examples without explicit modifiers also exhibit the relevant kind of context-dependency receives independent support from question-answer sequences like (3.57)-(3.59), where the domain restriction is introduced in the preceding sentence.

3.2.2 What is the relevant notion of addressing a question?

In this section, I will try to describe the effect of domain-restricting modifiers in slightly more precise terms. I will concentrate on examples involving attitude predicates and use modifiers that contain an embedded interrogative, since this configuration makes it easiest to manipulate the value of the domain variable. In the last section, I discussed higher-order identity statements like (3.74) and suggested that *dasselbe* quantifies over propositions that 'address the question' introduced by the modifier.

- (3.74) *Zur Frage, wer es ins Finale schaffen wird, glauben Hans und Maria*
to.the question who EXPL into.the final manage will believe Hans and Maria
dasselbe.
the.same
'As for the question who will make it to the final, Hans and Maria believe the same thing.'
(= (3.60-b))

This generalization raises two questions: First, the semantic and pragmatic literature contains many different notions of addressing a question – which of them, if any, is relevant for the truth conditions of (3.74)? Second, is the same notion of addressing a question relevant for other linguistic constructions in which embedded questions are used to restrict a set of propositions? At least two such constructions come to mind. The first one, shown in (3.75), is discussed in the literature under the heading '**quantificational variability effects**' (QVE). Pre-theoretically, the quantificational adverbial *zum Großteil* 'for the most part' seems to quantify over certain answers to the semantic question $\llbracket \text{wer eine Chance hat} \rrbracket$ (cf. Lahiri 2002, Beck & Sharvit 2002 for discussion). The second construction, exemplified in (3.76), involves question-embedding modifiers of the kind discussed above. But here, the modifiers introduce a constraint on a non-quantificational complement of an opaque predicate – such as the embedded proposition in (3.75) – rather than restricting the domain of a quantifier.

- (3.75) *Hans und Maria wissen zum Großteil, wer eine Chance hat.*
Hans and Maria know to.the large.part who a chance has
'Hans and Maria mostly know who will stand a chance.'
- (3.76) *Zur Frage, wer es ins Finale schaffen wird, glauben Hans und Maria,*
to.the question who EXPL into.the final manage will believe Hans and Maria

dass Deutschland keine Chance hat.
that Germany no chance has
‘As for the question who will make it to the final, Hans and Maria believe that Germany won’t stand a chance.’

In the following paragraphs, I will try to pin down the notion of answerhood at work in examples like (3.74) and compare it to the constructions in (3.75) and (3.76) in order to tease apart the semantic contributions of the modifier, the embedded question and the higher-order DP. Of course this comparison can only scratch the surface, since the constructions in (3.75) and (3.76) give rise to many interesting semantic/pragmatic questions in their own right.

Background: Interrogative semantics In Section 3.1, we already discussed one linguistically relevant notion of answerhood: strongly exhaustive answers. We saw that the subsumption relation, which relies on strongly exhaustive answers, is helpful to understand why even question-embedding predicates like *unklar* give rise to the monotonicity puzzle. But this notion of answerhood is clearly too strong to characterize the domains of higher-order quantifiers like *dasselbe* in (3.74). We have to explore weaker notions. In order to be able to define these notions explicitly, I will briefly introduce a specific semantics for questions here.

In this thesis, I will adopt the view that the extensions of semantic questions are sets of propositions as described in Hamblin (1973) (**Hamblin sets**). This means that we will interpret questions as being of type $\langle\langle s, t \rangle, t\rangle$.²¹ Informally speaking, the Hamblin set of a *wh*-question will contain all those propositions that can be obtained by treating all *wh*-expressions as distinct, otherwise unused free variables and interpreting the resulting expression relative to different assignment functions that differ only in the values of these variables.²² Some examples are given in (3.77-a) (which corresponds to extensions like (3.77-b)) and (3.77-c). Polar questions are assigned a set containing two alternatives – the positive and the negative answer – as exemplified in (3.77-d,e).

- (3.77) a. $\llbracket \textit{who will come to dinner} \rrbracket = \lambda w. \lambda p_{\langle s, t \rangle}. \exists x_e [\textbf{person}(w)(x) \wedge p = (\lambda w'. \llbracket \textit{will come to dinner} \rrbracket (w')(x))]$
b. $\{\lambda w. \textbf{come}(w)(\mathbf{a}), \lambda w. \textbf{come}(w)(\mathbf{b}), \lambda w. \textbf{come}(w)(\mathbf{c}), \dots\}$
c. $\llbracket \textit{who ate what} \rrbracket = \lambda w. \lambda p_{\langle s, t \rangle}. \exists x_e \exists y_e [\textbf{person}(w)(x) \wedge p = (\lambda w'. \llbracket \textit{ate} \rrbracket (w')(y)(x))]$
d. $\llbracket \textit{whether it is raining} \rrbracket = \lambda w. \lambda p_{\langle s, t \rangle} [p = \llbracket \textit{it is raining} \rrbracket \vee p = (\lambda w'. \neg \llbracket \textit{it is raining} \rrbracket (w'))]$
e. $\{\lambda w. \textbf{rain}(w), \lambda w. \neg \textbf{rain}(w)\}$

In this framework, the notion of a strongly exhaustive answer can be reconstructed as follows. Two possible worlds w and w' can be said to be equivalent relative to a question Q iff w and w' satisfy exactly the same propositions in Q ’s Hamblin set. The equivalence classes induced by this relation are the strongly exhaustive answers to the question. In other words, a strongly

²¹The intensions of questions must then be of type $\langle s, \langle\langle s, t \rangle, t\rangle \rangle$. In this thesis, I will not have anything interesting to say about the intensional aspects of this approach to question semantics, since they are connected to the problem how the restrictor of a *wh*-phrase enters into semantic composition, which gives rise to several technical issues. I will sidestep this issue by always using scenarios in which the *wh*-phrases range over a fixed, explicitly specified set of individuals.

²²While the procedure described in the text is of course not compositional, a compositional way of deriving such sets is described in Hamblin (1973).

exhaustive answer to Q is a proposition that specifies for each element of Q 's Hamblin set whether or not it is true, and does not provide any other information. This is formalized in (3.78):

- (3.78) The set of **strongly exhaustive answers** to a question extension $Q \in D_{\langle\langle s, t \rangle, t \rangle}$, $\text{SEA}(Q)$, is defined as follows:

$$\text{SEA}(Q) = \{p \in D_{\langle s, t \rangle} \mid \exists S \subseteq Q : p = (\bigcap S \cap \bigcap \{\lambda w. \neg p(w) \mid p \in Q \setminus S\}) \wedge p \neq \emptyset\}$$

For instance, the embedded interrogative in (3.79-b) denotes a set of propositions, each of which specifies for a given individual whether that individual is a person who will come to dinner. An example of such an extension is given in (3.79-b). The corresponding set of strongly exhaustive answers is given in (3.79-c): Each equivalence class corresponds to a proposition that exhaustively specifies which people will come to dinner and which people will not.

- (3.79) a. **person**(w) = {**a**, **b**, **c**}
 b. $\llbracket \text{who will come to dinner} \rrbracket(w) = \{\lambda w'. \text{come}(w')(\mathbf{a}), \lambda w'. \text{come}(w')(\mathbf{b}), \lambda w'. \text{come}(w')(\mathbf{c})\}$
 c. $\text{SEA}(\llbracket \text{who will come to dinner} \rrbracket(w)) = \{\lambda w. \text{come}(w)(\mathbf{a}) \wedge \text{come}(w)(\mathbf{b}) \wedge \text{come}(w)(\mathbf{c}), \lambda w. \text{come}(w)(\mathbf{a}) \wedge \text{come}(w)(\mathbf{b}) \wedge \neg \text{come}(w)(\mathbf{c}), \lambda w. \text{come}(w)(\mathbf{a}) \wedge \neg \text{come}(w)(\mathbf{b}) \wedge \neg \text{come}(w)(\mathbf{c}) \dots\}$

But this view of question semantics also allows us to give several weaker definitions of ‘addressing a question’. These notions differ along at least three dimensions: We can distinguish (i) between propositions that provide a unique strongly exhaustive answer and propositions that merely rule out one or more strongly exhaustive answers; (ii) between propositions that are identical to an answer in either of these senses and propositions that merely entail one, and (iii) between propositions that provide an answer purely by virtue of the semantics of the question and propositions that do so relative to a set of worlds provided by the common ground or a subject’s epistemic state. Given this variety of potentially relevant notions of question-answering, we need to determine which of them could form the basis for an analysis of higher-order quantification.

Partial vs. complete answers A proposition can address a question without providing a strongly exhaustive answer. For instance, given question (3.80-a), which corresponds to the partition in (3.79-c), each of the propositions expressed in (3.80-b-g) addresses the question, but only (3.80-f) and (3.80-g) provide strongly exhaustive answers.

- (3.80) a. *Who is coming to dinner tonight?*
 b. *Anna is coming.*
 c. *Anna or Bea is coming, maybe even both of them.*
 d. *At least two people are coming.*
 e. *Anna definitely isn’t coming.*
 f. *Only Anna and Bea are coming.*
 g. *Nobody is coming.*

We will say that all of these propositions **partially answer** question (3.80-a). One way of making this notion precise is to say that partial answers are propositions that are incompatible with at least one strongly exhaustive answer, i.e. that allow us to rule out one or more cell(s) of the partition. For instance, $\llbracket (3.80-b) \rrbracket$ partially answers $\llbracket (3.80-a) \rrbracket$ because it is incompatible with all those strongly exhaustive answers that entail that Anna will not come, and $\llbracket (3.80-d) \rrbracket$ is a partial

answer because it is incompatible with strongly exhaustive answers such as $\lambda w. \neg \mathbf{come}(w)(\mathbf{a}) \wedge \neg \mathbf{come}(w)(\mathbf{b}) \wedge \mathbf{come}(w)(\mathbf{c})$. This is expressed in definition (3.81), which characterizes partial answers as (non-trivial) disjunctions of strongly exhaustive answers that exclude at least one strongly exhaustive answer.

(3.81) The set $\text{PA}(Q)$ of **partial answers** to a question extension $Q \in D_{\langle \langle s, t \rangle, t \rangle}$ is defined as follows:

$$\text{PA}(Q) = \{\bigvee R \mid R \subsetneq \text{SEA}(Q) \wedge R \neq \emptyset\} \quad (\text{cf. Groenendijk \& Stokhof 1984:338, (2)})$$

Given a definition of this kind, all of the utterances in (3.80-b-g) express partial answers. Two simple observations show that it is this weaker notion of answerhood that we need to analyze higher-order DPs. First, the restricted higher-order existential statement in (3.82-c) is true in scenarios like (3.82-a) where neither Hans nor Maria knows a strongly exhaustive answer to the embedded question. This motivates the hypothesis that the domain consists of propositions that address the question, but are not necessarily strongly exhaustive answers.²³ That the domain is in fact restricted to propositions that address the question is shown in (3.82-b), where Hans and Maria have no information about the question and (3.82-c) is not true.

- (3.82) a. SCENARIO: Hans and Maria invited three people for dinner: Anna, Bea and Carl. They both know that Anna and Bea will come. Neither of them has any idea whether Carl will come.
- b. SCENARIO: Hans and Maria invited three people for dinner: Anna, Bea and Carl. Neither Hans nor Maria has any idea who will come.
- c. *Zur Frage, wer heute zum Abendessen kommt, weiß der Hans etwas,*
to.the question who today to dinner comes knows the Hans something
das die Maria auch weiß.
REL the Maria also knows
‘As for the question who will come to dinner tonight, Hans knows something that Maria also knows.’ **true** in (3.82-a), **not true** in (3.82-b)

The second observation concerns higher-order identity statements. Since any two strongly exhaustive answers to a given question are logically incompatible, an individual cannot know more than one strongly exhaustive answer. If the domain of higher-order DPs were restricted to strongly exhaustive answers, we would predict (3.83-b) to entail (3.83-a): Under this assumption, (3.83-b) would require both Hans and Maria to know a strongly exhaustive answer to the question who will come to dinner. It would then follow that neither Hans nor Maria knows any strongly exhaustive answers other than p , which would make (3.83-a) true.

- (3.83) a. *Zur Frage, wer heute zum Abendessen kommt, wissen Hans und Maria*
to.the question who today to.the dinner comes know Hans and Maria
dasselbe.
the.same

²³The literature contains even weaker notions of answerhood, which allow for answers that do not rule out any cell of the partition. One example is the notion of answer suggested in Büring (2003:517), according to which a declarative sentence A is an answer to a question Q if A “shifts the probabilistic weights among the propositions denoted by Q ”. A declarative can shift the probabilistic weights among the strongly exhaustive answers to a question Q without being logically incompatible with any of them. In this thesis, I will not investigate probabilistic notions of answerhood in more detail, because I lack the theoretical background to derive precise predictions from them, but I would like to mention the possibility that they could give us a better understanding of the relevant notion of addressing a question.

- ‘As for the question who will come to dinner tonight, Hans and Maria know the same thing.’
- b. *Zur Frage, wer heute zum Abendessen kommt, weiß der Hans etwas,*
 to.the question who today to.the dinner comes knows the Hans something
das die Maria auch weiß.
 REL the Maria also knows
 ‘As for the question who will come to dinner tonight, Hans knows something that Maria also knows.’

Intuitively, of course, (3.83-b) is logically weaker than (3.83-a). This intuition can be substantiated by considering a scenario like (3.84), where neither Hans nor Maria knows a strongly exhaustive answer to the question who will come to dinner. In such a scenario, (3.83-b) is judged true and (3.83-a) is judged false, so the putative entailment does not hold. The contrast between (3.83-b) and (3.83-a) follows straightforwardly if we assume that the higher-order DPs in (3.83) both quantify over *partial* answers to the embedded question. In scenario (3.84), there are partial answers that Hans and Maria both know – such as $\llbracket \text{Bea will come} \rrbracket$ – but the sum of all partial answers Hans knows is clearly not identical to the sum of all partial answers Maria knows, so the ‘maximality’ requirement of *dasselbe* is not met.

- (3.84) SCENARIO: Hans and Maria invited three people for dinner: Anna, Bea and Carl. Hans knows that Anna and Bea will come, but has no idea whether Carl will come. Maria knows that Bea and Carl will come, but has no idea whether Anna will come.
 (3.83-a) **false**, (3.83-b) **true**

The observation that the domain of quantification consists of partial answers, rather than strongly exhaustive answers, carries over to QVE. For instance, (3.85) is true in scenario (3.84), and therefore cannot mean that Hans knows some of the strongly exhaustive answers to the embedded question. Instead, plausible analyses of examples like (3.85) involve quantification over a subset of the partial answers (Lahiri 2002) or over a set of subquestions corresponding to certain partial answers (Beck & Sharvit 2002).

- (3.85) *Der Hans weiß teilweise, wer heute zum Abendessen kommt.*
 the Hans knows partly who today to.the dinner comes
 ‘Hans knows in part who will come to dinner tonight.’

Examples with non-quantificational complements of opaque predicates follow the same pattern: (3.86) is acceptable (and true) in scenario (3.84), which shows that in the presence of the modifier *zur Frage X*, non-quantificational complements do not have to express a strongly exhaustive answer to $\llbracket X \rrbracket$.

- (3.86) *Zur Frage, wer heute zum Abendessen kommt, weiß der Hans (nur), dass*
 to.the question who today to.the dinner comes knows the Hans only that
Anna und Bea kommen.
 Anna and Bea come
 ‘Concerning the question who will come to dinner tonight, Hans only knows that Anna and Bea will come.’

In sum, the three linguistic phenomena at hand are all sensitive to a notion of partial answer, while the notion of strongly exhaustive answer as defined in (3.78) is not directly relevant. But

once we consider other properties of the relevant partial answers, differences between the three constructions emerge.

Non-monotonic vs. downward-monotonic notions of answerhood According to definition (3.81), (3.87-a) expresses a partial answer to the question given in (3.87), but the declaratives in (3.87-b-c) do not. The reason is that (3.81) requires partial answers to be identical to disjunctions of strongly exhaustive answers, while (3.87-b-c) merely entail such a disjunction. The notion of partial answerhood defined in (3.81) is ‘non-monotonic’ in the sense that, if a proposition p counts as a partial answer, it does not follow that any stronger $q \sqsubseteq p$ is a partial answer as well. In contrast, some notions of answerhood in the literature do have this property, such as the one in (3.88).

(3.87) CONTEXT: Who is coming to dinner tonight?

- a. *Die Anna kommt.*
the Anna comes
‘Anna is coming.’
- b. *#Die Anna kommt und das Wetter wird wahrscheinlich schlecht.*
the Anna comes and the weather will be probably bad
‘Anna is coming and the weather will probably be bad.’
- c. *Die Anna kommt und bringt eine Nachspeise mit.*
the Anna comes and brings a dessert with
‘Anna is coming and bringing a dessert.’

(3.88) A proposition p **determines a partial answer** to a question extension $Q \in D_{\langle\langle s,t \rangle, t \rangle}$ iff there is a nonempty set $R \subset \text{SEA}(Q)$ such that $p \sqsubseteq \bigvee R$.
(cf. Groenendijk & Stokhof 1984:338, (4))

It is not always obvious whether a given semantic phenomenon is sensitive to partial answers or to propositions that determine a partial answer. For instance, out of the blue, (3.87-b) sounds odd or ‘overinformative’. But clearly, this contrast does not show that question-answer sequences generally require a partial answer in the sense of (3.81). For instance, (3.87-c), while equally overinformative with respect to the explicit question, is easier to accept in the given context, presumably because the second conjunct in (3.87-c) is more easily construed as relevant for a broader question under discussion. It is therefore worth asking whether the quantificational domains of higher-order DPs are really restricted to partial answers, or whether they can also contain stronger propositions.

Higher-order identity statements provide an argument for restricting the domain to genuine partial answers in the sense of (3.81). Above, we compared them to restricted higher-order existential statements and concluded that *dasselbe* ‘the same’ has a ‘maximizing’ semantics: Given a quantificational domain C , a sentence like (3.89-b) (= (3.60-b)) asserts that the set of all propositions in C that Hans believes is the same as the set of all propositions in C that Maria believes.

(3.89) a. Hans and Maria are German soccer ‘experts’ who were just interviewed on TV about the upcoming World Cup final. They both believe that France and Germany will make it to the final. Hans believes France will win, and Maria believes Germany

- will win.
- b. *Zur Frage, wer es ins Finale schaffen wird, glauben Hans und Maria dasselbe.*
 to.the question who EXPL into.the final manage will believe Hans and Maria the.same
 ‘As for the question who will make it to the final, Hans and Maria believe the same thing(s).’ **true** in (3.89-a)

As observed in Section 3.2.1, (3.89-b) is true in scenario (3.89-a). But if the quantificational domain could contain arbitrary propositions that determine a partial answer, this judgment would not be predicted: In scenario (3.89-a), this domain would include the proposition *[[France will win the final]]*, which Maria does not believe, as well as *[[Germany will win the final]]*, which Hans does not believe. We therefore have to exclude such propositions to make the right predictions for scenarios like (3.89-a). Informally, the propositions in the domain should not express any additional information irrelevant to the embedded question. Thus, the pertinent notion of partial answer must be the ‘non-monotonic’ one in (3.81).

The same conclusion can be drawn for QVE examples. For instance, in a scenario like (3.90-a), where Hans knows all the true partial answers to the embedded question, (3.90-b) is unequivocally false – even though there are some salient stronger propositions that determine a partial answer and that Hans does not know, such as *[[Bea will come and bring pizza]]*. This shows that the adverbs in QVE sentences quantify over partial answers, not over propositions that asymmetrically entail them.

- (3.90) a. SCENARIO: Hans and Maria are wondering which of their dinner party guests will show up and which food they will bring. Hans knows that Anna, Bea and Carl will show up and the other people they invited will not come. But the three guests did not tell Hans whether they will bring any food.
- b. *Der Hans weiß nur teilweise, wer zum Abendessen kommt.*
 the Hans knows only partly who to.the dinner comes
 ‘Hans knows only in part who will come to dinner.’ **false** in (3.90-a)

Summing up, both higher-order DPs quantifying over propositions and QVE seem to be sensitive to a specific notion of answerhood: The quantificational domain consists of partial answers, while propositions that merely asymmetrically entail a partial answer are not in the domain. Interestingly, non-quantificational complements of attitude predicates behave differently. Examples like (3.91-b) seem unobjectionable even though the complement clause does not directly express a partial answer to the question introduced by the modifier, since the additional information that Anna will bring a dessert is irrelevant to that question.

- (3.91) a. SCENARIO: Hans and Maria are wondering which of their dinner party guests will show up and which food they will bring.
- b. *Zur Frage, wer zum Abendessen kommt, weiß der Hans, dass die Anna gegen 20 Uhr kommt und eine Nachspeise mitbringt.*
 to.the question who to.the dinner comes knows the Hans that the Anna around 20 o'clock comes and a dessert brings
 ‘As for the question who will come to dinner, Hans knows that Anna will come around 8pm and bring a dessert.’

This shows that the restriction to genuine partial answers is not due to the semantics of the question-embedding modifiers. It seems that when a modifier introduces a question, genuinely quantificational expressions, like higher-order DPs and the adverbials found in QVE sentences, quantify over a restricted set of answers to that question, while the behavior of non-quantificational complements is more liberal and possibly based on a more pragmatic notion of relevance to a question. I will now discuss some data that might pose problems for this neat semantics/pragmatics division, although the discussion will remain inconclusive.

An open problem: Indirect answers and *know* vs. *believe* There is yet another distinction between notions of question answering that we have not addressed so far. In conversation, a proposition may pragmatically count as an answer to a question even though it does not determine a partial answer in the sense defined in (3.88). For instance, in scenario (3.92), (3.92-b) counts as an answer to (3.92-a). Intuitively, what is going on here is that the conjunction of (3.92-b) and a proposition that is common knowledge – that Hans will come if the game is cancelled – determines a partial answer (see Groenendijk & Stokhof 1984:ch. IV for a discussion of such pragmatic notions of answering a question). This intuition is made precise in (3.93).

(3.92) SCENARIO: Peter and Maria invited some of their friends to dinner. Their friend Hans said that he probably won't make it, since he might have to play in a soccer game. But he promised them that he would come if the game is cancelled.

- a. Peter: *Wer kommt heute zum Abendessen?*
 who comes today to.the dinner
 'Who will come to dinner tonight?'
- b. Maria: *Das Fußballmatch vom Hans ist abgesagt worden.*
 the soccer.match of.the Hans is cancelled been
 'Hans's soccer game was cancelled.'

(3.93) A proposition p **indirectly determines a partial answer** to a question extension $Q \in D_{\langle\langle s,t \rangle, t \rangle}$ relative to a set S of possible worlds iff $p \cap S$ determines a partial answer to Q .

As (3.92) shows, a proposition may pragmatically count as a partial answer to a question Q if it indirectly determines a partial answer to Q relative to the set of possible worlds compatible with the common ground of the conversation. Above, I argued that two linguistic constructions involving quantification over answers – higher-order DPs and QVE – are sensitive to the partial answers themselves and not over arbitrary propositions that determine a partial answer. However, since notions like (3.93) are obviously relevant for natural language pragmatics, it is worth asking whether this picture changes once we consider propositions that indirectly determine a partial answer: Is the semantic notion of answerhood defined in (3.81) really sufficient for an analysis of higher-order DPs? Here, I will tentatively conclude that it is not, but that the problem should not be solved by assuming that propositions which indirectly determine a partial answer are generally included in the domain. Instead, the problematic data might require a semantic reanalysis of certain attitude verbs.

To see what is at issue, we have to consider two questions: First, can the domain of higher-order DPs include propositions that indirectly determine a partial answer relative to the common

ground of the conversation? Second, can it include propositions that indirectly determine a partial answer relative to the attitude subject's epistemic state?

To answer the first question, it is helpful to look at scenarios in which the proposition in question indirectly determines a partial answer relative to the common ground, but not relative to the attitude subject's belief state. In scenario (3.94-a), the higher-order existential statement in (3.94-b) does not seem to be true, while a corresponding sentence with a negative quantifier (3.94-c) can easily be judged true. Such examples show that if a pragmatic notion of answerhood is relevant for the interpretation of higher-order DPs, it must be relativized to the attitude subject's doxastic or epistemic state, not to a set of worlds provided by the discourse context.²⁴

- (3.94) a. SCENARIO: Peter invited his friends Anna, Bea and Carl to his party. He told Carl that Bea will come, but he has no idea whether Anna will come. But Carl knows that Anna hates Bea and makes a point of never coming to any event Bea attends. Carl describes the situation like this:
- b. *Der Peter weiß etwas zur Frage, ob die Anna zur Party kommt.*
the Peter knows something to.the question whether the Anna to.the party comes
‘Peter knows something concerning the question whether Anna will come to the party.’
not true
- c. *Zur Frage, ob die Anna zur Party kommt, weiß der Peter nichts.*
to.the question whether the Anna to.the party comes knows the Peter nothing.
‘As for the question whether Anna will come to the party, Peter doesn't know anything.’
true

The second question is a bit harder to answer. If one of the attitude subjects believes a proposition that indirectly determines a partial answer to *Q* relative to her own epistemic state, then due to the upward-monotonic semantics of *believe* we are assuming, she must also believe a genuine partial answer. Higher-order existential statements are therefore not a good test case. We can, however, use higher-order identity statements: If the domains of higher-order DPs can contain propositions that indirectly determine a partial answer, the truth conditions of higher-order identity statements with *dasselbe* should be sensitive to the indirect evidence the attitude subjects have for their partial answers. In other words, it should be possible to judge a higher-order identity statement false even if both attitude subjects would give the same partial answers, in case the evidence they have for their answers is not the same. Scenario (3.95-a) is an attempt to test this prediction. The judgment that (3.95-b) is true in this scenario suggests that propositions which indirectly determine an answer do not count, and the quantificational domain just consists of the partial answers themselves. However, it seems to me that (3.95-c), with *wissen* ‘know’, has a reading on which it is not true in this scenario. While I do not fully understand this contrast at present, it seems that higher-order DP complements of *wissen* have a reading on which they quantify over certain propositions that characterize the attitude subjects' evidence

²⁴This observation is due to Viola Schmitt (p.c.), who used a slightly different example.

for their partial answers, while this reading is not available for *glauben* ‘believe’.

- (3.95) a. SCENARIO: Anna, Bea, Carl and Dora were invited to a party. It is well known that Anna hates Bea and makes a point of never coming to any event Bea attends. Carl has heard from Anna that she doesn’t want to come, but he doesn’t know why. Dora knows that Bea will come and believes that for this reason Anna will not show up.
- b. *Zur Frage, ob die Anna zur Party kommt, glauben Carl und Dora*
to.the question whether the Anna to.the party comes believe Carl and Dora
dasselbe.
the.same
‘As for the question whether Anna will come to the party, Carl and Dora believe the same thing.’ **true**
- c. *Zur Frage, ob die Anna zur Party kommt, wissen Carl und Dora*
to.the question whether the Anna to.the party comes know Carl and Dora
dasselbe.
the.same
‘As for the question whether Anna will come to the party, Carl and Dora know the same thing.’ **??**

There is a second argument for the view that higher-order DP objects of *know* are sensitive to the evidence available to the attitude subjects, and not just to the semantic structure of the question itself. Consider scenario (3.96). In this situation, (3.96-a) can be judged true although Maria cannot know any partial answer to the explicitly provided question (unless the election is rigged, which is however not required for this judgment). Clearly, (3.96-a) does not mean that Maria knows almost all of the partial answers, or almost all of the true partial answers, to that question. This phenomenon is not due to the semantics of the embedded question itself, as demonstrated by the fact that the QVE sentence in (3.96-b), with the same embedded question, is false in this scenario.

- (3.96) SCENARIO: An election is coming up. Political scientist Maria is trying to predict which MPs will keep their seats. She looked at most of the data available to her, including polls and interviews with the MPs’ campaign staff. So she has almost all of the available information. But since there is not enough data to draw really reliable conclusions, she cannot be absolutely sure about any of her predictions.
- a. *Zur Frage, welche Abgeordneten wiedergewählt werden, weiß die Maria*
to.the question which MPs reelected will.be knows the Maria
fast alles.
almost everything
‘Concerning the question which MPs will be reelected, Maria knows almost everything.’ **true**
- b. *Die Maria weiß fast vollständig, welche Abgeordneten wiedergewählt*
the Maria knows almost completely which MPs reelected
werden.
will.be
‘Maria knows almost completely which MPs will get reelected.’ **false**

In (3.96-a), the higher-order DP *fast alles* appears to quantify over a set of propositions that express available information relevant to the embedded question, rather than over a set of partial an-

swers to the question. What is puzzling about this example is the fact that the propositions in the subset do not determine partial answers to the question – in the semantic sense – at all. The information Maria has might include propositions such as $\llbracket MP \text{ } X \text{ is ahead in the polls in her district} \rrbracket$ or $\llbracket X\text{'s campaign staff think she will keep her seat} \rrbracket$. Since the polls may be wrong and the campaign staff might be deluded, these propositions do not determine partial answers.

To sum up, when we introduce a domain-restricting question, higher-order DP objects of *glauben* ‘believe’ behave like quantifiers over partial answers to that question in the purely semantic sense. But with *wissen* ‘know’, the object DPs sometimes seem to be able to quantify over propositions that, informally speaking, express relevant pieces of evidence, even if these are not semantically answers to the question.²⁵ The contrast between QVE and higher-order DP quantification in (3.96) shows that this sensitivity to evidence is not a general interpretative property of interrogative complements of *wissen*. Therefore, I hypothesize that it is due to an additional reading or construal of higher-order DPs, which suggests that the link between the domain variable in a higher-order DP and the contextually salient question that provides the restriction is more indirect than I have been assuming. Since it is completely unclear to me at this point how to formally describe this ‘evidence’ reading, I will leave its analysis as an open problem and concentrate on *glauben* in the following sections. One potential way of justifying this omission is that the existence of this reading raises the question how we individuate ‘pieces of evidence’, which brings us back to the monotonicity puzzle and the other issues discussed earlier in this chapter. A closer look at more well-understood cases of higher-order quantification might therefore be helpful if we want to say something non-circular about the domains of higher-order DPs on the ‘evidence’ reading.

I would like to end this section with another example showing that the restrictions we have been discussing are due to the meanings of higher-order DPs, not the meanings of the question-introducing modifiers. Above, I argued that higher-order DP complements of *glauben* ‘believe’ cannot quantify over propositions that indirectly determine an answer. But, as (3.97) illustrates, ordinary complements of *glauben* can denote such propositions. In such cases, we infer that the proposition indirectly determines a partial answer relative to the attitude subject’s belief state.

- (3.97) a. SCENARIO: Peter and Maria invited some of their friends to dinner. Their friend Hans said that he probably won’t make it, since he might have to play in a soccer game. But he promised them that he would come in case the game is cancelled. Peter is convinced that the game will be cancelled, due to the bad weather.
- b. *Zur Frage, ob der Hans zum Essen kommt, glaubt der Peter, dass sein Fußballmatch noch abgesagt wird.*
his soccer.game still cancelled will.be
‘Concerning the question whether Hans will come to dinner, Peter believes that his soccer game will be cancelled.’

²⁵The use of ‘relevant’ here is meant to indicate that we still need a notion of addressing or answering a question that is non-monotonic: We still do not want to quantify over arbitrary propositions that *entail* the existence of a certain piece of evidence for a certain partial answer to the question. So I think that the behavior of *wissen* does not challenge my earlier conclusion that higher-order DPs do not generally allow ‘overinformative’ propositions in their domains.

It thus seems that, even though we find the same question-embedding modifiers in sentences with higher-order DPs and in sentences with ordinary complement clauses, the semantic impact of the questions they introduce is not the same in both constructions. Higher-order DPs in the object position of *believe* quantify over partial answers in the semantic sense; propositions that indirectly determine a partial answer, or propositions that determine a partial answer but are too strong to be in the set of partial answers themselves, are not included in the domain. Such propositions can, however, serve as the denotations of ordinary complement clauses in the presence of the same modifiers.

Interim summary In Section 3.1, I introduced Zimmermann’s (2006) monotonicity puzzle, illustrated once more in (3.98). The Hintikka semantics for *glauben* ‘believe’, when combined with an analysis of higher-order DPs as unrestricted quantifiers, incorrectly predicts that (3.98-a) and (3.98-b) jointly entail (3.98-c) for any choice of *p* and *q*. We saw that the puzzle extends to several classes of predicates: ITV, certain question-embedding predicates and probably even some non-upward-monotonic proposition-embedding predicates.

- (3.98) a. *Der Hans glaubt, dass p.*
 ‘Hans believes that *p*.’
 b. *Die Maria glaubt, dass q.*
 ‘Maria believes that *q*.’
 c. *Der Hans glaubt etwas, das auch die Maria glaubt.*
 the Hans believes something REL also the Maria believes
 ‘Hans believes something that Maria also believes.’

I compared two possible approaches to this problem: The first approach is to assign non-monotonic lexical meanings to the predicates and attribute any intuitively valid monotonicity inferences to factors independent of the predicate meaning (Zimmermann 2006). The second approach posits special restrictions on the quantificational domains of higher-order DPs, which ensure that in the context of (3.98-a) and (3.98-b), the domain of the indefinite in (3.98-c) does not contain the disjunction $\llbracket p \rrbracket \vee \llbracket q \rrbracket$ or anything even weaker. In Section 3.2, I showed that higher-order DPs, just like other DPs, usually do not express unrestricted quantification. It turns out that there are several ways of restricting the domain without introducing an overt restrictor predicate within the DP. One of them, modifiers of the form *was X betrifft* ‘as for X’ and *zur Frage X* ‘concerning the question X’, provides a convenient way of studying the semantics of higher-order DPs, since it allows us to concentrate on the truth conditions of single declarative sentences, rather than question-answer discourses.

Concentrating on examples with the verb *glauben* ‘believe’, I argued that modifiers of the form *zur Frage X* can introduce a quantificational domain that consists of partial answers to the question $\llbracket X \rrbracket$. The relevant notion of ‘partial answer’ is semantic rather than pragmatic and does not cover propositions that asymmetrically entail a partial answer. These restrictions do not seem to hold for examples in which the modifier *zur Frage X* introduces a restriction on a non-quantificational complement. This suggests that they reflect properties of higher-order quantification, rather than just the idiosyncratic meaning of the modifier. This point is also

supported by a comparison of higher-order DPs restricted by a question and quantificational variability effects. These observations will now provide the background for a closer empirical look at the monotonicity puzzle.

3.3 Which partial answers count?

3.3.1 Back to the monotonicity puzzle

The monotonicity puzzle, as described by Zimmermann (2006) and discussed in some later work such as Moltmann (2008), boils down to the question why, given certain mainstream semantic assumptions, inferences like (3.98) are not valid. But to develop a descriptively adequate approach to higher-order DPs, we need to ask a broader question: What are the precise truth conditions of sentences like (3.99-a), and of corresponding examples like (3.99-b) with an explicit domain restriction? And how does context influence speakers' truth-value judgments on such sentences? In particular, it is an open empirical question whether it is actually desirable to block monotonicity inferences across the board, or whether the semantics of higher-order DPs should license them under certain contextual conditions.

- (3.99) a. *Der Hans glaubt etwas, das auch die Maria glaubt.*
 'Hans believes something Maria also believes.'
 b. *Zur Frage Q glaubt der Hans etwas, das auch die Maria glaubt.*
 'Concerning the question Q, Hans believes something Maria also believes.'

As we will see in this section, sentences of the form (3.99-b) are not always rejected in scenarios in which Hans and Maria have different beliefs concerning the question Q . They are accepted in some scenarios of this kind and rejected in others. When we shift the focus from judgments of validity and entailment to truth value judgments relative to a context, and use modifiers to explicitly manipulate the domain restriction as in (3.99-b), we end up with an interesting data pattern that seems to reflect several interacting conditions on higher-order quantification.

As an initial hypothesis to be falsified, let us assume that restricted higher-order existential statements like (3.99) involve quantification over all propositions that partially answer question Q . This leads to the adapted lexical entry in (3.100) for the determiner. The LF of (3.99-b) is given in (3.101-a), and the truth conditions are paraphrased in (3.101-b) and (3.101-c).

$$(3.100) \llbracket \exists_{\langle s, t \rangle} \rrbracket = \lambda w. \lambda C_{\langle \langle s, t \rangle, t \rangle}. \lambda \mathcal{P}_{\langle \langle s, t \rangle, t \rangle}. \lambda \mathcal{Q}_{\langle \langle s, t \rangle, t \rangle}. \exists p_{\langle s, t \rangle}. p \in \text{PA}(C) \wedge p \in \mathcal{P} \cap \mathcal{Q}$$

- (3.101)a. $\llbracket \text{zur Frage } Q \rrbracket [(1, \langle \langle s, t \rangle, t \rangle) [\llbracket \exists_{\langle s, t \rangle} C_{(1, \langle \langle s, t \rangle, t \rangle)} \rrbracket [-was_{\langle s, t \rangle} [(2, \langle s, t \rangle) [Maria [t_{(2, \langle s, t \rangle)} glaubt]]]] [(2, \langle s, t \rangle) [Hans [t_{(2, \langle s, t \rangle)} glaubt]]]]]$
 b. $\llbracket (3.101\text{-a}) \rrbracket = \lambda w. \exists p_{\langle s, t \rangle}. p \in \text{PA}(\llbracket Q \rrbracket(w)) \wedge \forall w' [w' \in \text{DOX}(w)(\text{maria}) \rightarrow p(w') = 1] \wedge \forall w' [w' \in \text{DOX}(w)(\text{hans}) \rightarrow p(w') = 1]$
 c. 'There is a proposition p such that p partially answers the question $\llbracket Q \rrbracket$, p is true in all of Maria's belief worlds and p is true in all of Hans's belief worlds.'

This simple analysis no longer validates the inference pattern in (3.102), since the conclusion comes out false if one of the two subjects does not believe any partial answer to the question introduced by the modifier. However, this does not mean that we have a satisfactory solution

of the puzzle. Presumably, if we interpret (3.102-c) in the context of (3.102-a) and (3.102-b) – i.e. in a context in which p and q are explicitly mentioned – we can accommodate a question that has $\llbracket p \rrbracket$ and $\llbracket q \rrbracket$ among its partial answers. But if so, the disjunction of $\llbracket p \rrbracket$ and $\llbracket q \rrbracket$ will also be a partial answer (unless the negation of $\llbracket p \rrbracket$ entails $\llbracket q \rrbracket$, in which case their disjunction will be the trivial proposition). If this type of accommodation is generally possible, most instances of the inference pattern in (3.102) should be acceptable, even though the reasons for its acceptability are not part of semantics proper.

- (3.102)a. *Der Hans glaubt, dass p.*
‘Hans believes that p .’
b. *Die Maria glaubt, dass q.*
‘Maria believes that q .’
c. *Der Hans glaubt etwas, das auch die Maria glaubt.*
the Hans believes something REL also the Maria believes
‘Hans believes something that Maria also believes.’

The same problem can be illustrated with examples that contain an explicit domain-restricting question. In scenario (3.103-a), speakers judge (3.103-b) to be false. But there is a proposition that is true in all of Hans’s belief worlds and all of Maria’s belief worlds and that partially answers the question: the proposition that Anna or Brit, or both, will come. In this case, the incorrect prediction does not depend on assumptions about the way we accommodate values for contextual parameters.

- (3.103)a. SCENARIO: Hans and Maria invited three people for dinner: Anna, Brit and Carl. Hans believes that Anna will come and has no opinion as to whether the other two will come. Maria believes that Brit will come and has no opinion as to whether Anna and Carl will come.
b. *Zur Frage, wer heute zum Essen kommt, glaubt der Hans etwas, das*
to.the question who today to.the dinner comes believes the Hans something that
auch die Maria glaubt.
also the Maria believes
‘Concerning the question who will come to dinner tonight, Hans believes something that Maria also believes.’ **false** in (3.103-a)

The analysis presented so far has nothing to say about why such disjunctive answers are not always in the domain of the higher-order DP. The judgment in (3.103-b) could be explained by positing an additional mechanism that determines the domain jointly with the question-embedding modifier. But then, we need to describe this additional mechanism in more detail to make any predictions. It is definitely not enough to posit another context-dependent variable that is not bound by the modifier: Without additional assumptions, this would predict that speakers should be unsure about their judgments for examples like (3.103) (since the judgment would depend on the value of the additional variable and hence on context) and not reject them outright. Therefore, we need to ask what the additional restrictions on the domains of higher-order indefinites are. In this section, I will describe two such restrictions.

3.3.2 Disjunctions and the monotonicity puzzle

One hypothesis suggested by examples like (3.103) is that higher-order quantifiers could be sensitive to a distinction between ‘simpler’ and ‘more complex’ partial answers, or between ‘disjunctive’ and ‘non-disjunctive’ propositions. On this type of approach, the answer $\llbracket \textit{Anna or Brit will come} \rrbracket$ is not in the domain for (3.103-b) because it can be expressed as a disjunction of two simpler answers. This notion would have to be implemented in such a way that $\llbracket \textit{Anna or Brit will come} \rrbracket$ counts as ‘disjunctive’ even though, given the restriction to the three individuals mentioned in scenario (3.103-a), it can easily be expressed by sentences that do not contain a disjunction. One possible way of doing so would be to restrict the domain to the propositions in the Hamblin set and their negations.

This kind of approach cannot work in general, however: There are two classes of situations in which disjunctive answers *can* be included in the domain. The first one contains scenarios in which neither of the attitude subjects believes a partial answer that is logically stronger than the disjunction. In such scenarios, sentences like (3.102-b) are judged true. This is illustrated in (3.104), where the quantificational domain has to include the disjunctive answer $\llbracket \textit{Anna or Brit will come} \rrbracket$ – precisely the answer we have to exclude to make the right prediction for (3.102).²⁶

- (3.104)a. SCENARIO: Hans and Maria invited three people for dinner: Anna, Brit and Carl. Both of them believe that at least one of Anna and Brit will come, although they are not sure who it will be.
- b. ?*Zur Frage, wer heute zum Essen kommt, glaubt der Hans etwas, das auch die Maria glaubt.*
 ‘Concerning the question who will come to dinner tonight, Hans believes something that Maria also believes.’ **true** in (3.104-a)

Intensional transitive verbs like *suchen* give rise to the same pattern: When we interpret (3.105-c) in scenario (3.105-a), the property of speaking Japanese or Russian is, by default, not included in the domain of the higher-order DP, but it must be in the domain when (3.105-c) is evaluated in (3.105-b). This shows that the contrast in (3.103) and (3.104) reflects a general property of higher-order DPs and cannot be attributed to question semantics or some property specific to attitude predicates.

²⁶Sentence (3.104-b) seems a bit odd in the context (3.104-a). I think this is because scenario (3.104-a) does not mention any differences between Hans’s and Maria’s belief states that concern the question who will come to dinner. Assuming that there are, indeed, no other partial answers on which their beliefs differ, the identity statement in (i) is also true:

- (i) *Zur Frage, wer heute zum Essen kommt, glauben Hans und Maria dasselbe.*
 to.the question who today to.the dinner comes believe Hans and Maria the.same
 ‘Concerning the question who will come to dinner tonight, Hans and Maria believe the same thing(s).’

The oddness of (3.104-b) in the scenario provided could then be attributed to a scalar implicature triggered by the contrast with stronger statements like (i). If so, such examples should improve in a scenario where Hans and Maria have different beliefs regarding some other, unrelated subquestion:

- (ii) SCENARIO: Hans and Maria invited three people for dinner: Anna, Brit and Carl. Both of them believe that at least one of the two women, Anna and Brit, will come, although they are not sure who it will be. Hans thinks that Carl will come as well, while Maria thinks he won’t.

I think this is correct, but have not investigated the matter in detail.

- (3.105)a. SCENARIO: Companies A and B are each looking for a new employee. Company A is looking for someone who speaks Japanese. Company B is looking for someone who speaks Russian.
- b. SCENARIO: Companies A and B are each looking for a new employee. Both of them are only interested in candidates who speak Japanese, Russian or ideally both.
- c. *Was die Sprachkenntnisse der Bewerber betrifft, sucht Firma A etwas, das auch Firma B sucht.*
 what the language.skills the.GEN candidates concerns seeks company A something REL also company B seeks
 ‘As for the candidates’ language skills, company A is looking for something that company B is also looking for.’ **false** in (3.105-a), **true** in (3.105-b)

Examples like (3.104) show that the choice of a quantificational domain depends not just on the question, but also on the subjects’ actual belief states in the scenario. Similarly, whether ‘disjunctive’ properties are included in the domain of a higher-order indefinite quantifying over properties depends on how ‘specific’ the subjects’ search goals are, as the contrast between (3.105-a) and (3.105-b) shows. These contrasts suggest that a relational condition is at work: In the case of quantification over beliefs, a ‘disjunctive’ answer p can be in the domain of quantification if neither of the attitude subjects believes another partial answer that asymmetrically entails p . Similarly, in the case of *suchen*, the disjunction of two properties $\llbracket p \rrbracket$ and $\llbracket q \rrbracket$ in the set introduced by the modifier may be in the quantificational domain if neither subject has a search goal that can be described by $\llbracket p \rrbracket$ or by $\llbracket q \rrbracket$.

We could try to account for this contrast by claiming that, for whatever reason, higher-order DPs block any kind of monotonicity inferences. If so, (3.104-b) would only be true if the strongest partial answer Hans believes is the same as the strongest partial answer Maria believes. This, however, would not account for the second type of situation in which ‘weak’ or ‘disjunctive’ elements may be included in the domain, illustrated in (3.106).

- (3.106)a. SCENARIO: Hans and Maria are discussing the upcoming World Cup with their friend Fritz. They have a long-standing disagreement about the question which continent(s) the teams in the final will come from. Hans believes that France will make the final and Maria believes that Germany will make it. But Fritz believes the two finalists will be South American teams like Brazil or Uruguay.
- b. *Zur Frage, wer ins WM-Finale kommt, glaubt der Hans etwas, das auch die Maria glaubt.*
 to.the question who into.the World.Cup-final comes believes the Hans something REL also the Maria believes
 ‘As for the question who will make it to the World Cup final, Hans believes something Maria also believes.’ **true**

In (3.106-a), Maria’s strongest partial answer to the question who will make the final is not the same as Hans’s partial answer. Presumably, (3.106-b) is judged true in this scenario because Hans and Maria believe the same partial answer to a second question introduced in the scenario, namely which continent the teams in the final will come from. This question is subsumed by the question $\llbracket \text{who will make it to the final} \rrbracket$ but is less fine-grained, which means that its partial answers are disjunctions of partial answers to the question explicitly introduced in (3.106-b).

The fact that disjunctive answers can be in the domain in such scenarios suggests a plau-

sible candidate for the additional context-dependent factor posited above: It seems that the interpretation of higher-order DPs relative to a question Q is sensitive to the relative salience of different ‘subquestions’ of Q . In scenarios (3.103-a) and (3.104-a), no subquestion of the question $\llbracket \textit{who will come to dinner} \rrbracket$ is particularly salient.²⁷ In such cases, ‘weak’ partial answers, like disjunctions, are excluded from the domain of quantification if one of the attitude subjects believes a stronger partial answer that is also in the domain. In (3.106-a), on the other hand, weak answers like $\llbracket \textit{the world champion will come from Europe} \rrbracket$ or $\llbracket \textit{the world champion will come from South America} \rrbracket$ are not excluded by this constraint because they answer a salient subquestion, and neither of the subjects believes a stronger answer *to that subquestion*. In sum, we end up with the following preliminary generalization:

(3.107) Generalization about restricted existential higher-order statements (to be revised!)

For any world w , any question extension C and any predicates $\mathcal{P}, \mathcal{Q} \in D_{\langle\langle s,t \rangle, t \rangle}$:

$\llbracket \exists_{\langle s,t \rangle} \rrbracket(w)(C)(\mathcal{P})(\mathcal{Q}) = 1$ iff there is a proposition p such that:

- a. $p \in \text{PA}(C) \cap \mathcal{P}$ and there is a question C' such that either $C' = C$ or C' is a salient subquestion of C and no element of $\text{PA}(C') \cap \mathcal{P}$ is stronger than p
- b. $p \in \text{PA}(C) \cap \mathcal{Q}$ and there is a question C' such that either $C' = C$ or C' is a salient subquestion of C and no element of $\text{PA}(C') \cap \mathcal{Q}$ is stronger than p

So far, we have only looked at scenarios in which both attitude subjects are, in a sense, equally opinionated about the explicit question, even if their actual beliefs are distinct. But generalization (3.107) also makes predictions about scenarios in which there is an informational asymmetry between the two subjects’ belief states. For instance, this is the case if one of the attitude subjects believes a partial answer p , while the other subject merely believes the disjunction of p and another partial answer q . If there are no contextually salient subquestions, restricted higher-order existential statements should be judged false in such scenarios. Two examples of this kind are given in (3.108) and (3.109). Interestingly, while such examples were indeed mostly rejected by my consultants, judgments were less consistent than for the data discussed in the preceding paragraphs.

- (3.108)a. SCENARIO: Hans and Maria invited three people for dinner: Anna, Brit and Carl.
Hans believes that at least one of Anna and Brit will come, but does not know who.
Maria is convinced that Brit will come. Neither of them have an opinion about the question whether Carl will come.
- b. *Zur Frage, wer heute Abend zum Essen kommt, glaubt der Hans etwas, das auch die Maria glaubt.*
‘Concerning the question who will come to dinner tonight, Hans believes something that Maria also believes.’ **false**

²⁷One could argue that in example (3.104), a subquestion like $\llbracket \textit{whether at least one of Anna and Brit will come} \rrbracket$ is made salient simply because the ‘disjunctive’ proposition that at least one of them will come is mentioned in the scenario. However, I suspect that the judgment in (3.104-b), unlike some of the other effects to be discussed below, does not depend on the contextual salience of the disjunctive answer. In this thesis, I will assume that this is correct and treat the contrast between (3.103) and (3.104) as a (partly) semantic phenomenon. This predicts, for instance, that the judgments on examples like (3.104) would not be affected by presenting the sentence without linguistic context and then describing the scenario in a non-linguistic manner. Since I only tested examples like (3.104) by presenting the scenarios to my consultants in linguistic (spoken or written) form, and the disjunctive answer was therefore always explicitly mentioned, I do not have any data bearing on this issue.

- (3.109)a. SCENARIO: Hans and Maria are taking place in a betting game about the World Cup that their friend Fritz is organizing. Each participant has to tell Fritz which teams they are betting on, without knowing who the other players bet on. Among other things, everyone has to name at one or two candidates for the world champion and one candidate for the other finalist. Hans tells Fritz that he thinks Germany or France will win the final against Russia. Maria tells Fritz that she thinks France will win the final against Brazil.
- b. *Zur Frage, wer ins WM-Finale kommen wird, glaubt der Hans*
 to.the question who into.the World.Cup.final come will believes the Hans
etwas, das auch die Maria glaubt.
 something REL also the Maria believes
 ‘Concerning the question who will make it to the World Cup final, Hans believes something that Maria also believes.’ %false

Of course, one possible explanation for the unclear judgments is simply that the scenarios are relatively complex compared to my earlier examples, which makes them harder to judge. But generalization (3.107) allows us view this variation as a non-accidental, pragmatic phenomenon: In both (3.108-a) and (3.109-a), a disjunctive answer is mentioned in the scenario. I suspect that this sometimes leads speakers to evaluate the example sentence in a context in which a subquestion answered by the disjunction – e.g. the polar question *[[whether Germany or France will win the World Cup]]* in (3.109)– counts as salient. However, since the scenario does not make it clear that the speaker or the attitude subjects are independently interested in this disjunctive subquestion, such a context is not required, which is why restricted higher-order existential statements still tend to be rejected in scenarios like (3.108-a) and (3.109-a).

To take a closer look at the effect of generalization (3.107), consider a slightly simplified variant of the contrast in (3.103)/(3.104).

- (3.110)a. *Zur Frage, wer heute Abend zum Essen kommt, glaubt der Hans etwas, das auch die Maria glaubt.*
 ‘Concerning the question who will come to dinner tonight, Hans believes something that Maria also believes.’
- b. SCENARIO: Hans and Maria invited two people for dinner, Anna and Brit. Hans believes Anna will come and has no opinion about Brit. Maria believes Brit will come and has no opinion about Anna. (3.110-a) **false**
- c. SCENARIO: Hans and Maria invited two people for dinner, Anna and Brit. Both of them believe that at least one of them will show up, but they have no idea who it will be. (3.110-a) **true**

We assume that, for the purposes of interpreting the embedded question in (3.110-a), the domain of individuals is restricted to $\{\mathbf{a}, \mathbf{b}\}$. The set of partial answers to the embedded question is given in (3.111). Let us first consider scenario (3.110-b). The partial answers in the extension of the restrictor and the nuclear scope of the indefinite, respectively, are given in (3.111-b) and (3.111-c). Our earlier analysis in (3.100) would predict (3.110-a) to be true in scenario (3.110-b) iff the sets in (3.111-b) and (3.111-c) have a nonempty intersection. Since this is not the case – the proposition $\lambda w.\text{come}(w)(\mathbf{a}) \vee \text{come}(w)(\mathbf{b})$ is in both sets – it cannot account for the judgment that (3.110-a) is false in this scenario. Generalization (3.107), however, tells us to restrict the domain even further and only consider the strongest partial answers from each set.

When we do this, we end up with the disjoint sets in (3.111-d). In scenario (3.110-a), on the other hand, neither Hans nor Maria believes anything stronger than the disjunction (3.111-e). Since the set of partial answers Hans believes and the set of partial answers Maria believes have their strongest element in common, we correctly predict (3.110-a) to be true in this scenario.

- (3.111)a. $\text{PA}(\llbracket \text{who will come to dinner} \rrbracket) = \{\lambda w.\text{come}(w)(a) \vee \text{come}(w)(b), \lambda w.\text{come}(w)(a) \vee \neg \text{come}(w)(b), \lambda w.\neg \text{come}(w)(a) \vee \text{come}(w)(b), \lambda w.\neg \text{come}(w)(a) \vee \neg \text{come}(w)(b), \lambda w.\text{come}(w)(a), \lambda w.\neg \text{come}(w)(a), \lambda w.\text{come}(w)(b), \lambda w.\neg \text{come}(w)(b), \lambda w.\text{come}(w)(a) = \text{come}(w)(b), \lambda w.\text{come}(w)(a) \neq \text{come}(w)(b), \lambda w.\text{come}(w)(a) \wedge \text{come}(w)(b), \lambda w.\text{come}(w)(a) \wedge \neg \text{come}(w)(b), \lambda w.\neg \text{come}(w)(a) \wedge \text{come}(w)(b), \lambda w.\neg \text{come}(w)(a) \wedge \neg \text{come}(w)(b)\}$
- b. $(3.111\text{-a}) \cap \lambda p_{\langle s,t \rangle}.\llbracket \text{believe} \rrbracket(w)(p)(\text{maria}) = \{\lambda w.\text{come}(w)(a) \vee \text{come}(w)(b), \lambda w.\neg \text{come}(w)(a) \vee \text{come}(w)(b), \lambda w.\text{come}(w)(b)\}$
- c. $(3.111\text{-a}) \cap \lambda p_{\langle s,t \rangle}.\llbracket \text{believe} \rrbracket(w)(p)(\text{hans}) = \{\lambda w.\text{come}(w)(a) \vee \text{come}(w)(b), \lambda w.\text{come}(w)(a) \vee \neg \text{come}(w)(b), \lambda w.\text{come}(w)(a)\}$
- d. $\{\lambda w.\text{come}(w)(a)\}, \{\lambda w.\text{come}(w)(b)\}$
- e. $(3.111\text{-a}) \cap \lambda p_{\langle s,t \rangle}.\llbracket \text{believe} \rrbracket(w)(p)(\text{hans}) = (3.111\text{-a}) \cap \lambda p_{\langle s,t \rangle}.\llbracket \text{believe} \rrbracket(w)(p)(\text{maria}) = \{\lambda w.\text{come}(w)(a) \vee \text{come}(w)(b)\}$

In this example, the restrictor and the nuclear scope were both restricted to a singleton set, since there were no salient subquestions. However, if the context makes certain subquestions salient, generalization (3.107) allows us to select multiple propositions from the restrictor predicate, as well as multiple propositions from the scope predicate. This is why (3.107) is not just a restatement of a hypothesis we rejected earlier – that the two subjects must believe exactly the same partial answers to the question. For instance, consider example (3.106) again. Here, generalization (3.107) in its current form predicts that, for each subject, we pick out that subject’s strongest answer to the domain-restricting question, but also their strongest answer to the salient subquestion which continents the teams in the final will come from. We end up with the two overlapping sets in (3.112), which correctly predicts the judgment in (3.106).

- (3.112)a. $\{\llbracket \text{France will make the final} \rrbracket, \llbracket \text{a European team will make the final} \rrbracket\}$
- b. $\{\llbracket \text{Germany will make the final} \rrbracket, \llbracket \text{a European team will make the final} \rrbracket\}$

Generalization (3.107) thus constitutes a further step towards an account of the monotonicity puzzle that does not rely on non-monotonic meanings for the predicates. However, it is still not descriptively adequate. To see why, we have to take a closer look at the predictions (3.107) makes for some of the examples discussed earlier in this chapter.

3.3.3 Hamblin sets and canonical partial answers

Consider scenario (3.113-a), repeated from (3.84) above. In this scenario, our running example, (3.113-b), is judged true, since both Hans and Maria believe that Bea will come to dinner.

- (3.113)a. SCENARIO: Hans and Maria invited three people for dinner: Anna, Bea and Carl. Hans thinks that Anna and Bea will come, but has no idea whether Carl will come. Maria thinks that Bea and Carl will come, but has no idea whether Anna will come.
- b. *Zur Frage, wer heute Abend zum Essen kommt, glaubt der Hans etwas, das auch die Maria glaubt.*
‘Concerning the question who will come to dinner tonight, Hans believes something

that Maria also believes.’

true in (3.113-a)

Generalization (3.107), however, does not predict this judgment. Since (3.113-a) does not make any subquestion of the embedded question $Q = \llbracket \text{who will come to dinner} \rrbracket$ particularly salient, the restrictor predicate and the nuclear scope predicate will each be narrowed down to a singleton set containing their strongest element. We end up with the strongest partial answer Hans believes (3.114-a) and the strongest partial answer Maria believes (3.114-b).

- (3.114) a. $\lambda w.\text{come}(w)(\mathbf{a}) \wedge \text{come}(w)(\mathbf{b})$
 b. $\lambda w.\text{come}(w)(\mathbf{c}) \wedge \text{come}(w)(\mathbf{b})$

Since these propositions are distinct, we predict (3.113-b) to be false. Intuitively, given scenario (3.113-a), the proposition $\lambda w.\text{come}(w)(\mathbf{b})$ should be in the domain of the higher-order indefinite, but it is excluded since it is neither maximal relative to the restrictor predicate nor maximal relative to the scope predicate. There is a contrast between (3.113) and our earlier examples involving disjunction that generalization (3.107) cannot capture: A disjunction of two Hamblin answers p and q , $p \vee q$, is ‘blocked’ from the domain of a higher-order indefinite if a stronger partial answer, p or q , is contained in the restrictor or the nuclear scope of the indefinite determiner. But a single Hamblin answer p is not ‘blocked’ if the conjunction of p and another partial answer satisfies one of the two predicates related by the determiner. Since the entailment relations between the individual propositions involved are the same in both situations, we have to adapt generalization (3.107) to distinguish between them.

For now, I will address this issue by defining a set of ‘sufficiently weak’ partial answers on the basis of the Hamblin set. Generalization (3.107) will be updated as follows: As before, we remove partial answers that are not ‘maximal’ (with respect to logical strength) among the answers to the domain-restricting question or a salient subquestion. Generalization (3.107) applies this ‘maximization’ operation to the two sets formed by intersecting the restrictor predicate and the nuclear scope predicate with the set of all partial answers to the domain-restricting question. But now, we will intersect the two arguments of the determiner with a smaller set – which I will call the set of **canonical partial answers** – before we apply the ‘maximization’ operation. Canonical partial answers include all the propositions in the Hamblin set and their negations, plus all the non-trivial disjunctions that can be formed from them, but crucially do not include conjunctions of Hamblin answers.²⁸

(3.115) Given a question extension $Q \in D_{\langle \langle s, t \rangle, t \rangle}$, the set $\text{CPA}(Q)$ of **canonical partial answers** to Q is defined as follows:

$$\text{CPA}(Q) = \{ \bigvee S \mid S \subseteq (Q \cup \{ \lambda w. \neg p(w) \mid p \in Q \}) \wedge S \neq \emptyset \wedge \bigvee S \neq W \}$$

As an example of what definition (3.115) does, consider the question $\llbracket \text{who will come to dinner} \rrbracket$, interpreted relative to a toy domain with only two individuals, **a** and **b**. The corresponding Hamblin set is given in (3.116-a), and the canonical partial answers are listed in (3.116-b).

²⁸In some versions of the question semantics assumed here, conjunctive answers such as $\lambda w.\text{come}(w)(\mathbf{a}) \wedge \text{come}(w)(\mathbf{b})$ are primitively included in the question denotation (see Lahiri (2002) for a discussion of such a system and its potential advantages). Definition (i) could be adapted to such a system by stipulating that only those elements of the Hamblin set that are minimal wrt. logical strength can be used to define canonical partial answers.

- (3.116)a. $\llbracket \textit{who will come to dinner} \rrbracket(w) = \{\lambda w.\textbf{come}(w)(a), \lambda w.\textbf{come}(w)(b)\}$
 b. $\{\lambda w.\textbf{come}(w)(a), \lambda w.\textbf{come}(w)(b), \lambda w.\neg\textbf{come}(w)(a), \lambda w.\neg\textbf{come}(w)(b),$
 $\lambda w.\textbf{come}(w)(a) \vee \textbf{come}(w)(b), \lambda w.\textbf{come}(w)(a) \vee \neg\textbf{come}(w)(b),$
 $\lambda w.\neg\textbf{come}(w)(a) \vee \textbf{come}(w)(b), \lambda w.\neg\textbf{come}(w)(a) \vee \neg\textbf{come}(w)(b)\}$

We can now relativize our generalization to exclude non-canonical partial answers (3.117).

(3.117) Generalization about restricted existential higher-order statements (to be revised!)

For any world w , any question extension C and any predicates $\mathcal{P}, \mathcal{Q} \in D_{\langle\langle s,t \rangle, t \rangle}$:

$\llbracket \exists_{\langle s,t \rangle} \rrbracket(w)(C)(\mathcal{P})(\mathcal{Q}) = 1$ iff there is a proposition p such that:

- a. $p \in \text{CPA}(C) \cap \mathcal{P}$ and there is a question C' such that either $C' = C$ or C' is a salient subquestion of C and no element of $\text{CPA}(C') \cap \mathcal{P}$ is stronger than p
 b. $p \in \text{CPA}(C) \cap \mathcal{Q}$ and there is a question C' such that either $C' = C$ or C' is a salient subquestion of C and no element of $\text{CPA}(C') \cap \mathcal{Q}$ is stronger than p

Let us see what this generalization predicts for example (3.113-b). The canonical partial answers satisfying the restrictor predicate and the nuclear scope predicate are sketched in (3.118-a) and (3.118-b), respectively (for reasons of space, not all disjunctions in these sets are listed). Since there are no particularly salient subquestions, generalization (3.117) instructs us to select the maximal elements in each of these two sets. We end up with the sets in (3.119), which have a nonempty intersection. This correctly predicts (3.113-b) to be true in scenario (3.113-a).

- (3.118)a. Canonical partial answers Maria believes: $\{\lambda w.\textbf{come}(w)(b), \lambda w.\textbf{come}(w)(c),$
 $\lambda w.\textbf{come}(w)(b) \vee \textbf{come}(w)(a), \lambda w.\textbf{come}(w)(b) \vee \neg\textbf{come}(w)(a),$
 $\lambda w.\textbf{come}(w)(b) \vee \textbf{come}(w)(c), \lambda w.\textbf{come}(w)(b) \vee \neg\textbf{come}(w)(c),$
 $\lambda w.\textbf{come}(w)(c) \vee \textbf{come}(w)(a), \lambda w.\textbf{come}(w)(c) \vee \neg\textbf{come}(w)(a), \dots\}$
 b. Canonical partial answers Hans believes: $\{\lambda w.\textbf{come}(w)(a), \lambda w.\textbf{come}(w)(b),$
 $\lambda w.\textbf{come}(w)(a) \vee \textbf{come}(w)(c), \lambda w.\textbf{come}(w)(a) \vee \neg\textbf{come}(w)(c),$
 $\lambda w.\textbf{come}(w)(a) \vee \textbf{come}(w)(b), \lambda w.\textbf{come}(w)(a) \vee \neg\textbf{come}(w)(b),$
 $\lambda w.\textbf{come}(w)(b) \vee \textbf{come}(w)(c), \lambda w.\textbf{come}(w)(b) \vee \neg\textbf{come}(w)(c), \dots\}$
 (3.119)a. Maximal elements of (3.118-a): $\{\lambda w.\textbf{come}(w)(b), \lambda w.\textbf{come}(w)(c)\}$
 b. Maximal elements of (3.118-b): $\{\lambda w.\textbf{come}(w)(a), \lambda w.\textbf{come}(w)(b)\}$

Generalization (3.117) also works for cases in which the attitude subjects have both ‘disjunctive’ and ‘non-disjunctive’ beliefs. For instance, consider scenario (3.120-a), repeated from footnote 26. In this scenario, (3.120-b) should be true because both subjects share the belief that Anna or Brit will come.

- (3.120)a. SCENARIO: Hans and Maria invited three people for dinner: Anna, Brit and Carl. Both of them believe that at least one of the two women, Anna and Brit, will come, although they are not sure who it will be. Hans thinks that Carl will come as well, while Maria thinks he won’t.
 b. *Zur Frage, wer heute Abend zum Essen kommt, glaubt der Hans etwas, das auch die Maria glaubt.*
 ‘Concerning the question who will come to dinner tonight, Hans believes something that Maria also believes.’ true in (3.120-a)

Our earlier generalization (3.107) did not get this kind of example right: Since Hans and Maria have incompatible opinions concerning the question whether Carl will come, the strongest partial answer Hans believes is different from the strongest partial answer Maria believes. Hence,

(3.107) predicts (3.120-b) to be false in (3.120-a) – unless we assume that the subquestion $\llbracket \text{whether at least one of Anna and Brit will come} \rrbracket$ is made sufficiently salient merely by mentioning the disjunctive belief in the scenario. But since the judgment in (3.120-b) is quite clear-cut and no subquestion is mentioned in the scenario, it is not clear to me whether it is plausible to rely on the comparative salience of subquestions here. Generalization (3.117), in contrast, makes the right prediction: It instructs us to compute the sets of canonical partial answers both for the restrictor predicate and the nuclear scope predicate, and then select the maximal elements (with respect to entailment) from each set. We end up with the two sets in (3.121), which have a nonempty intersection, as required by the determiner meaning.

- (3.121)a. Maximal canonical partial answers Maria believes:
 $\{\lambda w.\mathbf{come}(w)(\mathbf{a}) \vee \mathbf{come}(w)(\mathbf{b}), \lambda w.\neg\mathbf{come}(w)(\mathbf{c})\}$
 b. Maximal canonical partial answers Hans believes:
 $\{\lambda w.\mathbf{come}(w)(\mathbf{a}) \vee \mathbf{come}(w)(\mathbf{b}), \lambda w.\mathbf{come}(w)(\mathbf{c})\}$

While generalization (3.117) is more liberal than its predecessor, it still accounts for the ‘blocking’ effect introduced in Section 3.3.2 above: In scenario (3.122-a), (3.122-b) is clearly false even though the disjunctive partial answer $\lambda w.\mathbf{come}(w)(\mathbf{a}) \vee \mathbf{come}(w)(\mathbf{b})$ is true in all of Hans’s belief worlds and in all of Maria’s belief worlds. The reason is that while this proposition is a canonical partial answer, it is not maximal within the set of canonical partial answers believed by one of the subjects, and therefore not considered when we evaluate the quantifier.

- (3.122)a. SCENARIO: Hans and Maria invited three people for dinner: Anna, Brit and Carl. Hans believes that Anna and Carl will come. He is not sure whether Brit will come. Maria thinks that Brit will come and Carl will not come. She is not sure whether Anna will come.
 b. *Zur Frage, wer heute Abend zum Essen kommt, glaubt der Hans etwas, das auch die Maria glaubt.*
 ‘Concerning the question who will come to dinner tonight, Hans believes something that Maria also believes.’ **false** in (3.122-a)
- (3.123)a. Maximal canonical partial answers Maria believes:
 $\{\lambda w.\mathbf{come}(w)(\mathbf{b}), \lambda w.\neg\mathbf{come}(w)(\mathbf{c})\}$
 b. Maximal canonical partial answers Hans believes:
 $\{\lambda w.\mathbf{come}(w)(\mathbf{a}), \lambda w.\mathbf{come}(w)(\mathbf{c})\}$

Summing up, in this section and Section 3.3.2 we took a closer look at the way natural language (or at least German) addresses the individuation problem raised by higher-order DPs. When we evaluate the semantic contribution of a higher-order indefinite determiner, only a certain subset of the relevant semantic domain is considered. The choice of this subset appears to be not just context-sensitive, but also relativized to the extensions of the restrictor predicate and the nuclear scope of the higher-order determiner. In particular, in Section 3.3.2, I posited a ‘maximizing’ operation that applies to a certain restricted domain of propositions, which I provisionally identified with the set of partial answers to a domain-restricting question. The relevant notion of maximality is influenced by the salience of different subquestions of that question.

I showed that this ‘maximization’ mechanism seems to ignore certain partial answers, par-

ticularly conjunctions of Hamblin answers. Based on this observation, I argued that the domain of quantification is restricted to what I called ‘canonical partial answers’. In (3.115), this notion was defined in terms of the Hamblin set, but in Chapter 4 I will try to derive its effects from a rather different kind of question denotation, following Beck & Sharvit (2002), which has certain descriptive advantages over Hamblin-style alternative semantics. In any case, to distinguish ‘simple’ partial answers from their conjunctions and disjunctions, we need an interrogative semantics that allows us to give certain partial answers a special status. In certain more restrictive theories of question semantics, such as Groenendijk & Stokhof’s (1984) partition semantics, the set of canonical partial answers would not be definable.²⁹

Of course, generalization (3.117) does not amount to an analysis of higher-order DPs. In the next chapter, I will present a preliminary analysis of the maximization mechanism proposed here and its role in semantic composition. While this proposal will not be a direct implementation of generalization (3.117), it will derive the same effects.

3.4 Chapter summary

This chapter started with a familiar question: how we individuate the elements of derived semantic domains, such as the domain $D_{\langle s,et \rangle}$ of properties or the domain $D_{\langle s,t \rangle}$ of propositions, which are structured by an entailment relation. In Chapter 2, I argued that the distinction between quantification over derived semantic domains and ‘ordinary’ quantification over individuals is reflected in the grammar of German, which appears to have a restricted class of ‘higher-order DPs’. The existence of such DPs allows us to view the individuation problem as an empirical question: How is the domain of higher-order DPs restricted in a given context? More specifically, how do natural languages deal with entailment relations among different elements of the quantificational domain?

The main goals of this chapter were to describe part of the relevant data pattern in German and to take some initial steps towards an approach to the individuation problem that encodes the relevant restrictions in the meanings of higher-order DPs. The starting point was a particularly clear statement of this problem due to Zimmermann (2006), who presents it as a semantic puzzle about restricted higher-order existential statements involving opaque verbs. Zimmermann observes that, if we analyze opaque verbs as monotonic operators, we predict very weak truth conditions for sentences like (3.124-c), with the effect that inferences like (3.124) (= (3.50)) are wrongly predicted to be valid.

(3.124)(3.124-a), (3.124-b) $\nRightarrow$ (3.124-c)

a. *Die Maria sucht eine Flasche Wein.*

²⁹To see this, consider a Hamblin set $\{p, q\}$, where p and q are logically independent. On the theory proposed in Groenendijk & Stokhof (1984), a question denotation is a function mapping each world w to the strongly exhaustive answer to that question that is true in w . For our example, the range of this function would be $\{p \wedge q, \neg p \wedge q, p \wedge \neg q, \neg p \wedge \neg q\}$. Since the Hamblin set $\{p, \lambda w.p(w) = q(w)\}$ corresponds to the same set of strongly exhaustive answers, the set of strongly exhaustive answers – and hence the kind of question denotation assumed by Groenendijk & Stokhof (1984) – does not uniquely determine the Hamblin set. Neither does it determine the set of canonical partial answers: The proposition $\lambda w.p(w) = q(w)$ is a canonical partial answer relative to the Hamblin set $\{p, \lambda w.p(w) = q(w)\}$, but not relative to the Hamblin set $\{p, q\}$.

- the Maria seeks a bottle wine
'Maria is looking for a bottle of wine.'
- b. *Der Peter sucht ein Buch.*
the Peter seeks a book
'Peter is looking for a book.'
- c. *Der Peter sucht etwas, das auch die Maria sucht.*
the Peter seeks something REL also the Maria seeks
'Peter is looking for something that Maria is also looking for.'

In Section 3.1, I summarized Zimmermann's description of the puzzle, using the German ITV *suchen* 'look for', and then observed that it extends to several other classes of opaque predicates: upward-monotonic attitude predicates, question-embedding predicates and probably certain non-upward-monotonic proposition-embedding predicates. I observed that the wrong predictions about inference patterns like (3.124) are the result of two assumptions: First, the monotonicity properties of the opaque predicates involved are encoded in their lexical entries. Second, the indefinite determiners receive a classical interpretation as unrestricted quantifiers over semantic objects of a higher type.

In Section 3.2.1, we saw that there are independent reasons to reject the second assumption, since higher-order DPs do not generally express unrestricted quantification: They may pick up their restriction from a constituent earlier in the discourse, or from modifiers like *zur Frage* *X* 'concerning the question *X*' or *was X betrifft* 'as for *X*'. This property made it possible to take a closer look at the truth conditions of restricted higher-order existential statements like (3.124-c). While this issue has of course been discussed before in the literature (Geach 1972a, Zimmermann 1993, 2006, Moltmann 2008, 2013 a.o.), the present data discussion differs from this earlier work in two respects. First, it concentrates on contrasts between individual instances of the inference pattern in (3.124) and the question why some of its instances seem more acceptable than others, whereas earlier discussions focus on the fact that inferences of this kind are not *generally* acceptable, without distinguishing between different subtypes of scenarios. Second, the focus is on truth value judgments on sentences like (3.124-c) relative to a scenario or a linguistic context, rather than judgments of validity or entailment.

In Section 3.2.2, I concentrated on higher-order identity statements with *believe* that contain an overt domain-restricting modifier, such as (3.125). I argued that they quantify over propositions that express a partial semantic answer to a contextually given question, although higher-order DP complements of *know* might have an additional construal quantifying over propositions that characterize available evidence. A comparison of higher-order DPs and two other constructions – quantificational variability effects (QVE) and ordinary complements of opaque verbs in the scope of a domain-restricting modifier – showed that the restriction to genuine partial answers, and to semantic rather than indirect answers, is part of the semantics of higher-order quantifiers and cannot be attributed to the modifiers.

- (3.125) *Zur Frage, wer heute zum Essen kommt, glauben Hans und Maria dasselbe.*
to.the question who today to.the dinner comes believe Hans and Maria the.same
'Concerning the question who will come to dinner tonight, Hans and Maria believe the same thing(s).'

Section 3.3 returns to the semantics of restricted higher-order existential statements with *believe*, like (3.126).

(3.126) *Zur Frage, wer heute Abend zum Essen kommt, glaubt der Hans etwas, das auch die Maria glaubt.*

‘Concerning the question who will come to dinner tonight, Hans believes something that Maria also believes.’

Using such examples, I argued for several additional constraints on the domains of higher-order quantifiers that do not follow from the restriction to partial semantic answers. First, certain types of partial answers, like conjunctions of Hamblin answers, do not seem to be in the domain at all. This led to the notion of ‘canonical partial answer’, which is designed to exclude them. Second, this restricted domain is subject to an additional ‘maximization’ mechanism: Both the restrictor and the nuclear scope are narrowed down to the set of their maximal elements with respect to entailment. Third, this ‘maximization’ mechanism is sensitive to the comparative salience of different subquestions in context.

In a sense, these observations, summarized in generalization (3.127) (= (3.117)), are a re-statement of the monotonicity puzzle rather than an explanatory solution. But importantly, they account for the observation that while the general inference pattern involved in the puzzle is invalid, some of its instances are judged more acceptable than others and these differences in acceptability depend on the relative contextual salience of different questions.

(3.127) Generalization about restricted existential higher-order statements (to be revised!)

For any world w , any question extension C and any predicates $\mathcal{P}, \mathcal{Q} \in D_{\langle\langle s,t \rangle, t \rangle}$:

$\llbracket \exists_{\langle s,t \rangle} \rrbracket(w)(C)(\mathcal{P})(\mathcal{Q}) = 1$ iff there is a proposition p such that:

- a. $p \in \text{CPA}(C) \cap \mathcal{P}$ and there is a question C' such that either $C' = C$ or C' is a salient subquestion of C and no element of $\text{CPA}(C') \cap \mathcal{P}$ is stronger than p
- b. $p \in \text{CPA}(C) \cap \mathcal{Q}$ and there is a question C' such that either $C' = C$ or C' is a salient subquestion of C and no element of $\text{CPA}(C') \cap \mathcal{Q}$ is stronger than p

In the next chapter, I will provide an analysis which derives the data from Section 3.3. While its predictions for sentences with *believe* coincide with those of generalization (3.127), it will also account for certain examples involving non-upward-monotonic attitude predicates that (3.127) does not extend to.

Chapter 4

A DP-based account of the monotonicity puzzle

4.1 Introduction and basic ideas

In this chapter, I develop a preliminary semantics for higher-order DPs that quantify over propositions. The main aim of this analysis is to address some simple cases of the monotonicity puzzle and predict the judgments involving *believe* from Section 3.3, but we will see that it can also handle several types of new data that were not discussed in Chapter 3. My main reason for concentrating on proposition-embedding predicates is that in this case, the contextual parameters needed to determine the domain restriction are sets of propositions, and can therefore be related directly to theories of interrogative semantics on which questions denote such sets (Hamblin 1973, Karttunen 1977 a.o.). While the implementation to be proposed faces several serious problems (to be discussed in Section 4.4 below and in Chapter 6), I think the general idea behind it still provides an interesting starting point for further work on the individuation mechanisms involved in the semantics of higher-order DPs.

The proposal involves a notion of ‘canonical subquestions’ of the domain-restricting question that will fulfil the function of the ‘canonical partial answers’ defined in Section 3.3. Instead of defining canonical partial answers directly on the basis of the Hamblin set, I will adopt Beck & Sharvit’s (2002) view that the meanings of questions have a part-whole structure analogous to the structures assumed for semantically plural expressions. In particular, I will claim that there are usually several semantically relevant ways of decomposing a given question into parts that are themselves questions. I will call them **canonical subquestion decompositions**. Since we saw that the comparative salience of certain subquestions can affect truth-value judgments on sentences with higher-order DPs, there is good reason to relativize the semantics of such DPs not just to a question, but also to a subquestion decomposition of that question. We can then assume that higher-order determiners quantify over the set of all propositions that partially answer a question in the relevant decomposition, and have their usual quantificational force relative to this set.

The simplest canonical subquestion decomposition of a question Q only contains subquestions of the form $\{p, \neg p\}$ for some answer p in the Hamblin set of Q , but there may be less fine-grained subquestion decompositions in which several Hamblin answers are lumped together into a ‘block’. This variation between different subquestion decompositions will account for the

differences between various subcases of the monotonicity puzzle, particularly the observation that disjunctive answers are sometimes, but not always excluded from the domain of a higher-order DP. To see what this means in practice, let us reconsider examples (4.1) (= (3.103-b)) and (4.2) (= (i) from footnote 26) from the preceding chapter.

- (4.1) *Zur Frage, wer heute zum Essen kommt, glaubt der Hans etwas, das auch die Maria glaubt.*
to.the question who today to.the dinner comes believes the Hans something that also the Maria believes
‘Concerning the question who will come to dinner tonight, Hans believes something that Maria also believes.’
- (4.2) *Zur Frage, wer heute zum Essen kommt, glauben Hans und Maria dasselbe.*
to.the question who today to.the dinner comes believe Hans and Maria the.same
‘Concerning the question who will come to dinner tonight, Hans and Maria believe the same thing(s).’

In (4.1), the higher-order existential $\llbracket \exists_{\langle s,t \rangle} \rrbracket$ combines with two predicates of propositions: the restrictor $\mathcal{P} = \lambda p_{\langle s,t \rangle} . \llbracket \text{glauben} \rrbracket(w)(p)(\mathbf{maria})$ and the nuclear scope $\mathcal{Q} = \lambda p_{\langle s,t \rangle} . \llbracket \text{glauben} \rrbracket(w)(p)(\mathbf{hans})$. Relative to a canonical subquestion decomposition $\mathcal{D}$ of the question $\llbracket \text{who will come to dinner} \rrbracket(w)$, the sentence will be true iff there is a proposition that satisfies $\mathcal{P}$ and $\mathcal{Q}$ and is a partial answer to some subquestion in $\mathcal{D}$. Similarly, if we assume (as suggested in Chapter 1) that $\llbracket \text{dasselbe}_{\langle s,t \rangle} \rrbracket$ in (4.2) combines with a plurality of two predicates, $\mathcal{P} \oplus \mathcal{Q}$, (4.2) will be true iff the set of propositions that satisfy $\mathcal{P}$ and partially answer a subquestion in $\mathcal{D}$ is the same as the set of propositions that satisfy $\mathcal{Q}$ and partially answer a subquestion in $\mathcal{D}$. The restriction to propositions that partially answer a subquestion in $\mathcal{D}$ is what allows us to exclude disjunctions from the domain in certain cases. For instance, let us assume a context in which the embedded question in (4.1) has the Hamblin set in (4.3). There are several canonical subquestion decompositions of (4.3), including the two in (4.4).¹

- (4.3) $\{\mathbf{a}, \mathbf{b}, \mathbf{c}\}$, where $\mathbf{a} = \llbracket \text{Anna will come to dinner} \rrbracket$, $\mathbf{b} = \llbracket \text{Brit will come to dinner} \rrbracket$,
 $\mathbf{c} = \llbracket \text{Carl will come to dinner} \rrbracket$
- (4.4) a. $\{\mathbf{a}, \neg \mathbf{a}\}, \{\mathbf{b}, \neg \mathbf{b}\}, \{\mathbf{c}, \neg \mathbf{c}\}$
‘Will Anna come? Will Brit come? Will Carl come?’
b. $\{\mathbf{a}, \mathbf{b}\}, \{\mathbf{c}, \neg \mathbf{c}\}$
‘Who in the set $\{\text{Anna}, \text{Brit}\}$ will come? Will Carl come?’

We will say that the decomposition in (4.4-a) is ‘more fine-grained’ than the one in (4.4-b), because (4.4-b) lumps two subquestions corresponding to Hamblin answers together. Now, for each of the decompositions in (4.4), let us see which propositions end up being in the restricted domain, that is, which propositions partially answer a question in the decomposition. For (4.4-a), these are simply the Hamblin answers and their negations (4.5-a). For (4.4-b), however, the set of partial answers is much broader (4.5-b). Since this decomposition lumps the semantic questions

¹As in the last chapter, I will ignore genuinely intensional aspects of interrogative semantics and base all examples and definitions on the *extensions* of questions, which I assume to be sets of propositions. This means that further work is needed to see to what extent the claims of this chapter are compatible with *de dicto* readings of questions.

$\{\mathbf{a}, \neg\mathbf{a}\}$ and $\{\mathbf{b}, \neg\mathbf{b}\}$ together, it allows for propositions in the domain that rule out certain strongly exhaustive answers to $\{\mathbf{a}, \mathbf{b}\}$, but do not rule out any strongly exhaustive answer to $\{\mathbf{a}, \neg\mathbf{a}\}$ or $\{\mathbf{b}, \neg\mathbf{b}\}$. This means that non-trivial Boolean combinations of $\mathbf{a}$ and $\mathbf{b}$, such as $\lambda w. \mathbf{a}(w) \vee \mathbf{b}(w)$ (abbreviated as $\mathbf{a} \vee \mathbf{b}$ below) will be in the domain if we use decomposition (4.4-b), but will not be in the domain relative to decomposition (4.4-a) since they are not partial answers to any of the questions in (4.4-a).

- (4.5) a. $\mathbf{a}, \neg\mathbf{a}, \mathbf{b}, \neg\mathbf{b}, \mathbf{c}, \neg\mathbf{c}$
 b. $\mathbf{a}, \neg\mathbf{a}, \mathbf{b}, \neg\mathbf{b}, \mathbf{a} \vee \mathbf{b}, \mathbf{a} \vee \neg\mathbf{b}, \neg\mathbf{a} \vee \mathbf{b}, \neg\mathbf{a} \vee \neg\mathbf{b}, \mathbf{a} \equiv \mathbf{b}, \mathbf{a} \not\equiv \mathbf{b}, \mathbf{a} \wedge \mathbf{b}, \mathbf{a} \wedge \neg\mathbf{b}, \neg\mathbf{a} \wedge \mathbf{b}, \neg\mathbf{a} \wedge \neg\mathbf{b}, \mathbf{c}, \neg\mathbf{c}, \dots$

As discussed in Section 3.2.2, the quantificational domains of higher-order DPs in sentences like (4.1) seem to be subject to a relational condition: In order to predict the right truth value for scenario (4.6-a), the domain has to contain the disjunctive partial answer $\mathbf{a} \vee \mathbf{b}$, but in (4.6-b), this disjunction must be excluded from the domain to account for the fact that (4.1) is judged false in this scenario. The difference seems to be that in (4.6-b), the individual disjuncts $\mathbf{a}$ and $\mathbf{b}$ each satisfy one of the two predicates of propositions related by the higher-order determiner, while this is not the case in (4.6-a).

- (4.6) a. SCENARIO: Hans and Maria each believe that at least one of Anna and Brit will come, but they are not sure who it will be. They have no opinion as to whether Carl will come. (4.1) **true**
 b. SCENARIO: Hans believes Anna will come and has no opinion about the other two. Maria believes Brit will come and has no opinion about the other two. (4.1) **false**

Under the assumptions sketched above, we have to conclude that scenario (4.6-a) licenses a decomposition like (4.4-b) that lumps the two subquestions $\{\mathbf{a}, \neg\mathbf{a}\}$ and $\{\mathbf{b}, \neg\mathbf{b}\}$ together, while scenario (4.6-b) forces us to use the more fine-grained decomposition in (4.4-a). This means that the extensions of the higher-order predicates related by the determiner must somehow influence the choice of a subquestion decomposition. By default, more fine-grained decompositions like (4.4-a) are preferred, but two subquestions Q_1 and Q_2 may be lumped together in case neither of the relevant predicates of propositions is true of an answer to Q_1 or of an answer to Q_2 . This is the case in scenario (4.6-a), where neither of the two subjects believes a partial answer to $\{\mathbf{a}, \neg\mathbf{a}\}$ or to $\{\mathbf{b}, \neg\mathbf{b}\}$, but both of them believe $\mathbf{a} \vee \mathbf{b}$, which is a partial answer to the subquestion $\{\mathbf{a}, \mathbf{b}\}$. So there must be a general semantic or pragmatic mechanism that determines when two or more subquestions are lumped together to form a ‘block’ of the subquestion decomposition. This mechanism, which must be sensitive both to the relative salience of different subquestions in context and to the extensions of the restrictor and the nuclear scope, will be the source of non-monotonicity.

In this thesis, I will not attempt to relate the selection of a subquestion decomposition to independently motivated constraints on quantification. Rather, I will simply encode the relevant conditions in the lexical semantics of higher-order determiners. This is not intended to be a serious proposal about semantic composition within the DP, but rather a placeholder for a more plausible analysis that will hopefully relate the present data pattern to general constraints on individuation in natural language.

The rest of this chapter spells out the approach just summarized. In Section 4.2, I elaborate on the notion of a canonical subquestion decomposition and motivate the idea that part-whole structures associated with questions play a role in the interpretation of higher-order DPs. In Section 4.3, the data involving *believe* from the last chapter are reanalyzed in terms of canonical subquestion decompositions. I formulate a new, descriptively more adequate generalization and show how the judgments from Section 3.3 can be derived from it. Finally, in Section 4.4, I discuss two open problems for the present approach: first, evidence from NPI licensing that is problematic for my prediction that higher-order DPs are semantically non-monotonic operators, and second, the question how the approach can be extended to examples lacking an explicit domain-restricting question.

4.2 Canonical subquestion decompositions

The goal of this section is to make the notion of a canonical subquestion decomposition precise and motivate its relevance for the analysis of higher-order DPs. In Section 4.2.1, I present a definition of this notion, which differs in several respects from the ‘divisions’ of questions studied by Beck & Sharvit (2002) (a detailed comparison with Beck & Sharvit’s (2002) definition is provided in Appendix A.2). I then discuss one reason to think that subquestions are relevant for the semantics of higher-order DPs: Attitude predicates that allow for downward-monotonic inferences in some contexts, like *ausschließen* ‘rule out’, pose a problem for the generalization (3.117) presented at the end of Chapter 3, which disappears if we characterize the quantificational domain in terms of subquestions. A second, more indirect argument for the relevance of subquestion decompositions is discussed in Appendix A.3: Beck & Sharvit (2002) show that the quantificational domain in QVE sentences is sensitive to the ‘part structures’ introduced by non-interrogative plural DPs. Higher-order existential statements seem to behave analogously. If Beck & Sharvit (2002) are right to claim that the semantics of QVE sentences involves subquestion decompositions, the assumption that such decompositions also influence the semantics of higher-order DPs naturally captures the analogy.

4.2.1 Basic definitions

In Section 3.3, we saw that disjunctive partial answers can be ‘blocked’ from the domain of a higher-order determiner if there is a stronger partial answer that satisfies one of the predicates related by the determiner. Hamblin answers, however, are not ‘blocked’ by stronger partial answers (such as conjunctions of Hamblin answers) in the same way. This data pattern is summarized once more in (4.7).

- (4.7) Given a domain-restricting question with Hamblin answers $\mathbf{a}, \mathbf{b}, \mathbf{c}, \dots$, a restricted higher-order existential statement with restrictor predicate $\mathcal{P}$ and nuclear scope predicate $\mathcal{Q}$ is
- ...
- a. **true** if $\{\mathbf{a}, \mathbf{b}, \mathbf{a} \wedge \mathbf{b}\} \subseteq \mathcal{P}, \mathbf{c} \notin \mathcal{P}, \{\mathbf{b}, \mathbf{c}, \mathbf{b} \wedge \mathbf{c}\} \subseteq \mathcal{Q}, \mathbf{a} \notin \mathcal{Q}$
 $\rightsquigarrow \mathbf{a} \wedge \mathbf{b}$ does not block $\mathbf{b}$, $\mathbf{b} \wedge \mathbf{c}$ does not block $\mathbf{b}$
 - b. **false** if $\{\mathbf{a}, \mathbf{a} \vee \mathbf{b}\} \subseteq \mathcal{P}, \{\mathbf{b}, \mathbf{a} \vee \mathbf{b}\} \subseteq \mathcal{Q}, \mathbf{b} \notin \mathcal{P}, \mathbf{a} \notin \mathcal{Q}$

$$\rightsquigarrow \mathbf{a} \text{ blocks } \mathbf{a} \vee \mathbf{b}, \mathbf{b} \text{ blocks } \mathbf{a} \vee \mathbf{b}$$

We will model this asymmetry by making the semantics of higher-order determiners sensitive to subquestion decompositions and restricting the relevant class of subquestion decompositions in such a way that Hamblin answers get a special status. So far, I have implicitly been using a notion of ‘subquestion’ that can be characterized by the **subsumption** relation, defined once more in (4.8).

- (4.8) A question extension $Q \in D_{\langle\langle s, t \rangle, t \rangle}$ **subsumes** a question extension $Q' \in D_{\langle\langle s, t \rangle, t \rangle}$ iff for every $p \in \text{SEA}(Q)$ (i.e. every strongly exhaustive answer to Q) there is a $p' \in \text{SEA}(Q')$ such that $p \subset p'$.

At first sight, this relation gives us a plausible notion of parthood for questions, exemplified in (4.9) (repeated from (3.31)). Given the data discussed in the last chapter, it makes sense that, for instance, $\llbracket \textit{whether Anna will come to dinner} \rrbracket$ can be part of a subquestion decomposition of $\llbracket \textit{who will come to dinner} \rrbracket$.

- (4.9) a. $\llbracket \textit{who will come to dinner} \rrbracket$ subsumes $\llbracket \textit{whether Anna will come to dinner} \rrbracket$
 b. $\llbracket \textit{who ordered what} \rrbracket$ subsumes $\llbracket \textit{who ordered pizza} \rrbracket$
 c. $\llbracket \textit{who owns a car} \rrbracket$ does not subsume $\llbracket \textit{who owns a red car} \rrbracket$
 (cf. Guerzoni & Sharvit 2007)
 d. $\llbracket \textit{who owns a red car} \rrbracket$ does not subsume $\llbracket \textit{who owns a car} \rrbracket$
 (cf. Guerzoni & Sharvit 2007)

However, this notion of subquestion is not restrictive enough to address the monotonicity puzzle, since it is insensitive to the Hamblin set and hence fails to distinguish between the two situations schematized in (4.7). For instance, the question with the Hamblin set $\{\mathbf{a}, \mathbf{b}, \mathbf{c}\}$ subsumes *wh*-questions derived from subsets of this Hamblin set (4.10-a) or polar questions derived from Hamblin answers (4.10-b), but also polar questions derived from disjunctions (4.10-c) or conjunctions (4.10-d) of Hamblin answers. Given a conception of propositions as unstructured sets of possible worlds, there are no structural differences between the three subquestion extensions in (4.10) that would allow us to express the intuition that (4.10-b) is more ‘basic’ than (4.10-c) or (4.10-d).

- (4.10) For logically independent Hamblin answers **a**, **b**, **c**:
- a. **{a, b, c}** subsumes **{a, b}**
 - b. **{a, b, c}** subsumes **{b, ¬b}**
 - c. **{a, b, c}** subsumes **{a ∨ b, ¬a ∧ ¬b}**
 - d. **{a, b, c}** subsumes **{a ∧ b, ¬a ∨ ¬b}**

This means that the ‘blocking’ effect illustrated in (4.7) cannot be modeled by restricting the domain to propositions that answer a question in an arbitrary, contextually given subquestion decomposition: Since there are perfectly fine subquestion decompositions that include the polar question $\{\mathbf{a} \vee \mathbf{b}, \neg \mathbf{a} \wedge \neg \mathbf{b}\}$, the use of arbitrary subquestion decompositions will not help us distinguish between ‘disjunctive’ and ‘non-disjunctive’ partial answers. Therefore, in order to capture the marked status of subquestions like (4.10-c,d), I will assume that higher-order DPs are sensitive to the ‘canonical subquestions’ corresponding to subsets of the Hamblin set, as

defined in (4.11).²

- (4.11) Given a question extension $Q \in D_{\langle\langle s,t \rangle, t \rangle}$ and a nonempty subset $Q' \subseteq Q$:
 The **canonical subquestion** corresponding to Q' , $\text{sq}(Q')$, is defined by $\text{sq}(Q') = \{p, \lambda w. \neg p(w)\}$ if Q' is a singleton set $\{p\}$ and $\text{sq}(Q') = Q'$ otherwise.

While the subquestions in (4.10-a) and (4.10-b) are canonical subquestions – $\text{sq}(\{\mathbf{a}, \mathbf{b}\})$ and $\text{sq}(\{\mathbf{b}\})$ respectively – those in (4.10-c) and (4.10-d) are not, although they are subsumed by the canonical subquestion $\{\mathbf{a}, \mathbf{b}\}$. So, given definition (4.11), there is a sense in which the subquestions in (4.10-c) and (4.10-d) are ‘less basic’ than (4.10-b), even though all three are polar questions with no discernible part structure. This will be a crucial part of our account of the monotonicity puzzle.

Let us now return to the issue of dividing questions into parts. On the basis of QVE data, Beck & Sharvit (2002) argue at length that the interpretation of a question Q may be sensitive to a contextually determined subquestion decomposition of Q – a set of subquestions of Q such that answering all of the subquestions is enough to answer Q , and the subquestions are in some sense logically independent. The definition in (4.12) is intended to preserve this basic intuition, although it differs from the definition in Beck & Sharvit (2002) in several linguistically relevant respects. The most important difference for our purposes is that (4.12) involves a restriction to canonical subquestions that has no counterpart in Beck & Sharvit’s system. But there are other differences, which I discuss briefly in Appendix A.2.

- (4.12) Given a question extension Q , a set $\mathcal{D} \subseteq D_{\langle\langle s,t \rangle, t \rangle}$ is a **canonical subquestion decomposition** of Q iff
- $\mathcal{D} \subseteq \{\text{sq}(Q') \mid Q' \subseteq Q \wedge Q' \neq \emptyset\}$
 - and for every world w , the strongly exhaustive answers to all $Q' \in \mathcal{D}$ that are true in w jointly entail the strongly exhaustive answer to Q that is true in w
 - and there are no $Q', Q'' \in \mathcal{D}$ such that Q' subsumes Q'' .

(4.12-a) says that the decomposition must consist of canonical subquestions. This entails that a complete answer to Q determines a complete answer to each of its parts – in other words, Q asks for ‘at least as much information’ as each of the subquestions. (4.12-b) states that complete answers to the parts must jointly determine a complete answer to the whole, that is, the original question Q . Finally, (4.12-c) is meant to exclude decompositions in which the questions are not pairwise logically independent. For instance, given a question Q with Hamblin set $\{\mathbf{a}, \mathbf{b}, \mathbf{c}\}$, a decomposition that includes both $\text{sq}(\{\mathbf{a}, \mathbf{b}\})$ and $\text{sq}(\{\mathbf{b}\})$ would be ruled out since the former subsumes the latter. Some examples of canonical subquestion decompositions of the Hamblin set $\{\mathbf{a}, \mathbf{b}, \mathbf{c}\}$ are given in (4.13).

- (4.13)
- $\{\text{sq}(\{\mathbf{a}\}), \text{sq}(\{\mathbf{b}\}), \text{sq}(\{\mathbf{c}\})\} = \{\{\mathbf{a}, \lambda w. \neg \mathbf{a}(w)\}, \{\mathbf{b}, \lambda w. \neg \mathbf{b}(w)\}, \{\mathbf{c}, \lambda w. \neg \mathbf{c}(w)\}\}$
 ‘Will Anna come? Will Brit come? Will Carl come?’
 - $\{\text{sq}(\{\mathbf{a}, \mathbf{b}\}), \text{sq}(\{\mathbf{c}\})\} = \{\{\mathbf{a}, \mathbf{b}\}, \{\mathbf{c}, \lambda w. \neg \mathbf{c}(w)\}\}$
 ‘Who among Anna and Brit will come? Will Carl come?’
 - $\{\text{sq}(\{\mathbf{a}, \mathbf{b}\}), \text{sq}(\{\mathbf{b}, \mathbf{c}\})\} = \{\{\mathbf{a}, \mathbf{b}\}, \{\mathbf{b}, \mathbf{c}\}\}$

²Following much of the literature, I assume that the Hamblin sets of *wh*-questions do not contain ‘negative instances’. For instance, $\llbracket \text{who will come to dinner} \rrbracket(w)$ does not contain the proposition $\lambda w. \neg \llbracket \text{Anna will come to dinner} \rrbracket(w)$. This decision, however, does not matter for the analysis I will propose.

- ‘Who among Anna and Brit will come? Who among Brit and Carl will come?’
- d. $\{\text{SQ}(\{\mathbf{a}, \mathbf{b}, \mathbf{c}\})\} = \{\{\mathbf{a}, \mathbf{b}, \mathbf{c}\}\}$
‘Who among Anna, Brit and Carl will come?’

Canonical subquestion decompositions differ in how fine-grained they are – in other words, which of the subquestions corresponding to Hamblin answers are lumped together and which are kept separate. For instance, decomposition (4.13-c) is more fine-grained than (4.13-d), decomposition (4.13-b) is even more fine-grained than (4.13-c) and decomposition (4.13-a) is more fine-grained than all the other decompositions in (4.13). The relevant notion of more and less fine-grained subquestion decompositions is formalized in definition (4.14). For instance, according to (4.14), (4.13-a) is at least as fine-grained as (4.13-b) since $\text{SQ}(\{\mathbf{a}, \mathbf{b}\})$ subsumes both $\text{SQ}(\{\mathbf{a}\})$ and $\text{SQ}(\{\mathbf{b}\})$ and $\text{SQ}(\{\mathbf{c}\})$ subsumes itself. On the other hand, (4.13-b) is not at least as fine-grained as (4.13-a), since (4.13-a) does not contain any subquestion that subsumes $\text{SQ}(\{\mathbf{a}, \mathbf{b}\})$. Thus, (4.13-a) comes out as more fine-grained than (4.13-b).

- (4.14) Let S and S' be two canonical subquestion decompositions of a question Q .
- S is **at least as fine-grained** as S' iff for every $Q' \in S$, there is a $Q'' \in S'$ such that Q'' subsumes Q' .
 - S is **more fine-grained** than S' iff S is at least as fine-grained as S' and S' is not at least as fine-grained as S .

The notion of canonical subquestion decompositions will help us account for the observation that Hamblin answers have a special status with respect to monotonicity inferences. Further, the ‘blocking’ effects we observed with disjunctive answers can be attributed to a preference for more fine-grained subquestion decompositions: The idea will be that by default, we choose a subquestion decomposition that is so fine-grained that the disjunction does not provide a partial answer to any question in the decomposition. But before I turn to the implementation of these restrictions, I will give an argument for an analysis of higher-order DPs that relies on the part structures of domain-restricting questions.

4.2.2 Subquestion decompositions and non-upward-monotonic predicates

Let us return to generalization (3.117) from the last chapter, repeated once more below.

- (4.15) Generalization about restricted existential higher-order statements (to be revised!)
- For any world w , any question extension C and any predicates $\mathcal{P}, \mathcal{Q} \in D_{\langle\langle s, t \rangle, t \rangle}$:
- $\llbracket \exists_{\langle s, t \rangle} \rrbracket(w)(C)(\mathcal{P})(\mathcal{Q}) = 1$ iff there is a proposition p such that:
- $p \in \text{CPA}(C) \cap \mathcal{P}$ and there is a question C' such that either $C' = C$ or C' is a salient subquestion of C and no element of $\text{CPA}(C') \cap \mathcal{P}$ is stronger than p
 - $p \in \text{CPA}(C) \cap \mathcal{Q}$ and there is a question C' such that either $C' = C$ or C' is a salient subquestion of C and no element of $\text{CPA}(C') \cap \mathcal{Q}$ is stronger than p

The set $\text{CPA}(C)$ of ‘canonical partial answers’ was defined in such a way that disjunctions of Hamblin answers are included, but their conjunctions are not, since the data suggest that monotonicity inferences from such a conjunction to the individual conjuncts are generally possible and should not be blocked. Taken at face value, (4.15) predicts that the domain of a higher-order DP restricted by a question C never contains any propositions that asymmetrically entail a Hamblin

answer to C . For upward-monotonic predicates like *believe*, this is fine: If a subject believes a conjunction of Hamblin answers to a question Q , they also believe the individual conjuncts, and hence their belief state with respect to C can be fully characterized by a subset of $\text{CPA}(C)$. But it is problematic for non-upward-monotonic predicates like *unmöglich* ‘impossible’ or *ausschließen* ‘exclude’: For instance, if p and q are distinct canonical partial answers, a subject may consider $p \wedge q$ impossible without considering it impossible that p is true or that q is true.

This raises the question whether higher-order DP objects of such verbs are also subject to generalization (4.15) – that is, whether their domain is restricted to canonical partial answers and whether they exhibit the blocking effect. I hypothesize that for predicates that license downward-monotonic inferences in certain contexts, a version of generalization (4.15) holds, but in this case, weaker partial answers block stronger ones and not the other way around. In other words, the direction of the entailments we need to block depends on the monotonicity properties of the embedding predicate. As we will see, this pattern can easily be described if we reformulate generalization (4.15) in such a way that it models a preference for more fine-grained over less fine-grained subquestions in the subquestion decomposition, rather than a general preference for logically stronger over logically weaker propositions.

Motivation for this change comes from data involving *ausschließen* ‘rule out’. In scenario (4.16-a), the proposition Hans and Maria both rule out is that both Anna and Brit visited Vienna, while neither of them excludes the possibility that only Anna visited Vienna or that only Brit visited Vienna. So in scenarios like this, conjunctive propositions can clearly be in the domain of a higher-order DP even though they are not canonical partial answers.

- (4.16) a. SCENARIO: Peter and Maria heard that their two sisters, Anna and Brit, visited Vienna together last weekend. Both of them are quite surprised to hear this: While they think it is possible that one of them went to Vienna, they know that Anna and Brit hate each other and take care not to travel to the same place at the same time. For this reason, they are convinced that this story cannot be true.
- b. *Zur Frage, wer von Peters und Marias Schwestern in Wien war, schließt*
to.the question who of Peter’s and Maria’s sisters in Vienna was rules
er etwas aus, das auch sie ausschließt.
he something out REL also she out.rules
‘As for the question which of Peter’s and Maria’s sisters went to Vienna, there is
something they both rule out.’ **true**

It thus seems that, at the very least, the restriction to canonical partial answers cannot hold for objects of non-upward-monotonic verbs. There are two potential ways of capturing this observation that make different predictions: First, one could revise (4.15) so that, for non-upward-monotonic predicates, all partial answers rather than just the canonical ones are taken into account. Second, one could claim that we always quantify over a restricted subset of the partial answers, but the choice of this restricted set depends on the monotonicity properties of the predicate. For upward-monotonic predicates, it may contain disjunctions, but not conjunctions of Hamblin answers; if the predicate licenses downward-monotonic inferences, the reverse holds.

In this chapter, I will choose the second option. That is, I will assume that both in the case of upward-monotonic and in the case of non-upward-monotonic verbs, we quantify over a

restricted subset of answers. One reason for this is conceptual: This approach allows us to treat downward-monotonic inferences and upward-monotonic inferences in a completely analogous manner. Empirically, the two options are hard to distinguish since, as we saw in Section 3.1, judgments on the monotonicity puzzle are less clear for higher-order DP objects of non-upward-monotonic predicates. The relevant test cases are examples like (4.17), in which the subjects rule out distinct Hamblin answers to the domain-restricting question, but there are some conjunctions of Hamblin answers that they both rule out.

- (4.17) a. SCENARIO: Peter and Maria are discussing the upcoming World Cup. Being Austrian, Maria is convinced that Austria will not qualify. Otherwise, she has no opinions on the question which European teams will qualify. Peter, who is Swiss, is convinced that Switzerland will not make it, but also has no opinions on the other European teams.
- b. *Zur Frage, welche europäischen Teams sich qualifizieren werden, schließt*
to.the question which European teams REFL qualify will rules
der Peter etwas aus, das auch die Maria ausschließt.
the Peter something out REL also the Maria out.rules
‘As for the question which European teams will qualify, there is something Peter
and Maria both rule out.’ ??

If (4.17-b) involved quantification over arbitrary partial answers, it should be true in scenario (4.17-a), since there are answers that Peter and Maria both rule out, e.g. that both Austria and Switzerland will qualify. Further, even if we only consider the logically strongest partial answers each subject rules out, (4.17-b) comes out true, since Peter and Maria can both rule out all complete answers which entail that Austria and Switzerland will qualify, and each of them is among the logically strongest partial answers.

It seems to me that (4.17-b) can be judged false in scenario (4.17-a), although the judgment is less stable than in the cases with *believe* discussed above and further empirical work is needed. If this judgment should turn out to be well supported, it would provide additional evidence that we need to block monotonicity inferences in either direction, depending on the monotonicity properties of the verb: In (4.17), we would need to block a conjunction of Hamblin answers from the domain of quantification because the domain contains the individual conjuncts. But even if it should turn out that something else is going on in examples like (4.17), the observation in (4.16) would already be sufficient to rule out a simple extension of (4.15) to non-upward-monotonic predicates.

The problem with generalization (4.15) is that, since it instructs us to compare the *strongest* canonical partial answers, and since the notion of canonical partial answer is designed to exclude conjunctions, but not disjunctions, it is tailored to upward-monotonic predicates and does not take the different monotonicity properties of different predicates into account. To address the monotonicity puzzle in a unified way, we therefore need a way of determining the quantificational domain that blocks the monotonicity inferences licensed by the predicate meaning while at the same time allowing for some contextual flexibility. This can be achieved by using subquestion decompositions. The basic idea will be that there is a default preference for fine-grained subquestion decompositions, but this preference can be overruled depending on the ‘granularity’ of

the propositions we quantify over: A set S of subquestions has to be lumped together into one subquestion if the restrictor or the nuclear scope of the higher-order DP contains a partial answer to S , but does not contain a partial answer to any subquestion induced by a proper subset of S . As a first illustration, consider the ‘blocking effect’ with disjunction. The basic data pattern is repeated in (4.18):

- (4.18) Given a domain-restricting question with Hamblin answers $\mathbf{a}, \mathbf{b}$, a restricted higher-order existential statement with restrictor predicate $\mathcal{P}$ and nuclear scope predicate $\mathcal{Q}$ is ...
- a. **true** if $\{\mathbf{a} \vee \mathbf{b}\} \subseteq \mathcal{P}, \mathbf{a}, \mathbf{b} \notin \mathcal{P}, \{\mathbf{a} \vee \mathbf{b}\} \subseteq \mathcal{Q}, \mathbf{a}, \mathbf{b} \notin \mathcal{Q}$
 - b. **false** if $\{\mathbf{a}, \mathbf{a} \vee \mathbf{b}\} \subseteq \mathcal{P}, \mathbf{b} \notin \mathcal{P}, \{\mathbf{b}, \mathbf{a} \vee \mathbf{b}\} \subseteq \mathcal{Q}, \mathbf{a} \notin \mathcal{Q}$

In situation (4.18-a), neither $\mathcal{P}$ nor $\mathcal{Q}$ is true of an answer to either of the questions $\text{sq}(\{\mathbf{a}\})$ and $\text{sq}(\{\mathbf{b}\})$. We therefore have to lump these subquestions together and choose a decomposition of the type (4.19-b), rather than a decomposition of the type (4.19-a). Since the disjunction $\mathbf{a} \vee \mathbf{b}$ counts as a partial answer relative to this less fine-grained decomposition, the restricted higher-order existential statement is predicted to be true. Given (4.18-b), on the other hand, $\mathcal{P}$ is true of an answer to $\text{sq}(\{\mathbf{a}\})$ and $\mathcal{Q}$ is true of an answer to $\text{sq}(\{\mathbf{b}\})$. Therefore the default preference for a more fine-grained subquestion decomposition kicks in. We have to use a decomposition of the type (4.19-a), which does not license the partial answer $\mathbf{a} \vee \mathbf{b}$.

- (4.19) a. $\text{sq}(\{\mathbf{a}\}), \text{sq}(\{\mathbf{b}\}), \dots$
b. $\text{sq}(\{\mathbf{a}, \mathbf{b}\}), \dots$

The predictions for non-upward-monotonic predicates are analogous. Let us first consider example (4.16-b), where Peter and Maria both rule out a conjunctive proposition without ruling out either of the conjuncts. The situation is summarized abstractly in (4.20). Just like in (4.19-a), neither the restrictor predicate nor the nuclear scope predicate is true of an answer to $\text{sq}(\{\mathbf{a}\})$ or $\text{sq}(\{\mathbf{b}\})$. This licenses the use of a subquestion decomposition of the type (4.19-b) that lumps $\mathbf{a}$ and $\mathbf{b}$ together. Given such a decomposition, $\mathbf{a} \wedge \mathbf{b}$ counts as a partial answer since it partially answers $\text{sq}(\{\mathbf{a}, \mathbf{b}\})$.³ We therefore correctly predict (4.16-b) to be true in scenario (4.16-a).

- (4.20) Given a domain-restricting question with Hamblin answers $\mathbf{a}, \mathbf{b}$, a restricted higher-order existential statement with restrictor predicate $\mathcal{P}$ and nuclear scope predicate $\mathcal{Q}$ is ...
- true** if $\{\mathbf{a} \wedge \mathbf{b}\} \subseteq \mathcal{P}, \mathbf{a}, \mathbf{b} \notin \mathcal{P}, \{\mathbf{a} \wedge \mathbf{b}\} \subseteq \mathcal{Q}, \mathbf{a}, \mathbf{b} \notin \mathcal{Q}$

Finally, let us return to (4.17-b), a potential example of ‘blocking’ with a non-upward-monotonic verb. The situation is summarized again in (4.21). Peter rules out an answer to $\text{sq}(\{\mathbf{a}\})$ and Maria rules out an answer to $\text{sq}(\{\mathbf{b}\})$, which means that we have to use a decomposition of the type (4.19-a) again. Relative to this decomposition, $\mathbf{a}$ and $\mathbf{b}$ count as partial answers, while $\mathbf{a} \wedge \mathbf{b}$ does not. We therefore predict (4.17-b) to be false in the given scenario, since there is no answer to a question in this decomposition that both Peter and Maria rule out. Further empirical work is needed to see whether this type of prediction is generally borne out. The difficulty here is that

³While $\mathbf{a} \wedge \mathbf{b}$ entails partial answers to both $\text{sq}(\{\mathbf{a}\})$ and $\text{sq}(\{\mathbf{b}\})$, we saw in Section 3.2 that higher-order DPs quantify only over propositions which themselves constitute partial answers, not over propositions that asymmetrically entail partial answers.

contexts of the type we would need to test such predictions typically also make a conjunctive subquestion salient, which blurs the judgments (cf. Section 3.3).

- (4.21) Given a domain-restricting question with Hamblin answers $\mathbf{a}, \mathbf{b}$, a restricted higher-order existential statement with predicates $\mathcal{P}$ and $\mathcal{Q}$ is ...
not true [?] if $\{\mathbf{a}, \mathbf{a} \wedge \mathbf{b}\} \subseteq \mathcal{P}, \mathbf{b} \notin \mathcal{P}, \{\mathbf{b}, \mathbf{a} \wedge \mathbf{b}\} \subseteq \mathcal{Q}, \mathbf{a} \notin \mathcal{Q}$

In sum, subquestion decompositions offer a way of generalizing the data pattern from Section 3.3 to attitude predicates with different monotonicity properties.⁴ Instead of restricting the quantificational domain to the logically strongest partial answers in a certain set, we restrict it to all propositions that partially answer a question in a certain subquestion decomposition. The ‘blocking’ effect from Section 3.3.2 can then be attributed to a mechanism that chooses the most fine-grained subquestion decomposition ‘compatible’ with the two predicates related by the higher-order determiner. The next step is to give a more precise description of this mechanism.

4.2.3 Interim summary

In this section, I introduced the idea that the interpretation of higher-order DPs is sensitive to decompositions of the domain-restricting question into subquestions. More specifically, instead of always quantifying over the strongest answers in a certain set, higher-order DPs are interpreted relative to what I called a canonical subquestion decomposition and quantify over those propositions that partially answer a question in the decomposition. More fine-grained subquestion decompositions correspond to smaller and more constrained sets of partial answers. Instead of a preference for stronger over weaker partial answers, we then have to model a preference for more fine-grained over less fine-grained subquestion decompositions. Canonical subquestion decompositions of a question are defined on the basis of its Hamblin set, as in (4.22) and (4.23) (repeated from Section 4.2.1 above).

- (4.22) Given a question extension $Q \in D_{\langle\langle s, t \rangle, t \rangle}$ and a nonempty subset $Q' \subseteq Q$:
The **canonical subquestion** corresponding to Q' , $\text{sq}(Q')$, is defined by $\text{sq}(Q') = \{p, \lambda w. \neg p(w)\}$ if Q' is a singleton set $\{p\}$ and $\text{sq}(Q') = Q'$ otherwise.
- (4.23) Given a question extension Q , a set $\mathcal{D} \subseteq D_{\langle\langle s, t \rangle, t \rangle}$ is a **canonical subquestion decomposition** of Q iff
- $\mathcal{D} \subseteq \{\text{sq}(Q') \mid Q' \subseteq Q \wedge Q' \neq \emptyset\}$
 - and for every world w , the strongly exhaustive answers to all $Q' \in \mathcal{D}$ that are true in w jointly entail the strongly exhaustive answer to Q that is true in w
 - and there are no $Q', Q'' \in \mathcal{D}$ such that Q' subsumes Q'' .

In Section 4.2.2, I discussed linguistic examples that support the use of subquestion decompositions. We saw that the ‘blocking effect’ from Section 3.3.2 is sensitive to the monotonicity properties of the embedding predicate. If the embedding predicate is upward-monotonic, stronger answers block weaker ones, but this is not what we want for non-monotonic or downward-

⁴In earlier versions of this work (Haslinger 2018) I proposed an analysis that was a direct implementation of generalization (4.15) and therefore did not extend to predicates like *ausschließen*. I would like to thank Frank Sode for his comments which convinced me to try an approach that generalizes to non-upward-monotonic predicates at least in principle.

monotonic predicates. I suggested that the ‘blocking effect’ reflects a condition on our choice of a subquestion decomposition: More fine-grained subquestion decompositions are preferred over less fine-grained ones. This allows us to model the ‘blocking effect’ in a way that is insensitive to the direction of any monotonicity inferences licensed by the predicate: Relative to the fine-grained subquestion decomposition in (4.24-a), only $\mathbf{a}$, $\mathbf{b}$, $\neg\mathbf{a}$ and $\neg\mathbf{b}$ are in the quantificational domain, but the less fine-grained decomposition in (4.24-b) allows us to add weaker partial answers like $\mathbf{a} \vee \mathbf{b}$ as well as stronger partial answers like $\mathbf{a} \wedge \mathbf{b}$.

- (4.24) a. $\{\text{SQ}(\{\mathbf{a}\}), \text{SQ}(\{\mathbf{b}\})\}$
 b. $\{\text{SQ}(\{\mathbf{a}, \mathbf{b}\})\}$

In Appendix A.3, I discuss a second argument for the idea that subquestion decompositions influence the interpretation of higher-order DPs. It is based on an analogy between the ‘parts of questions’ that we quantify over in QVE sentences and the ‘parts of questions’ involved in determining the domain of higher-order DPs. In both cases, semantically plural expressions inside the embedded question contribute to the relevant part structure, even if they are not *wh*-expressions and are therefore not assigned any special status by traditional theories of question semantics. Beck & Sharvit (2002) argue that such effects of plurals on the interpretation of QVE sentences call for a revision of the semantics of questions in general. Given the assumptions about question semantics I have made in this thesis, this would mean that we need to revise the way Hamblin sets are derived. If higher-order DPs are sensitive to subquestion decompositions as well, we predict that plural subexpressions have an analogous effect on the domain restrictions of higher-order DPs – a prediction that seems to be borne out.

4.3 Implementing the domain-restriction mechanism

4.3.1 General outline

On the present approach, the quantificational domain of higher-order DPs depends on a subquestion decomposition of the domain-restricting question. This decomposition is adapted to the ‘granularity’ of the propositions that satisfy the DP’s restrictor or its nuclear scope. In addition, it is influenced by the relative salience of different questions in the utterance context. In this section, I describe a mechanism which, given the utterance context and the extensions of the higher-order predicates, determines a suitable subquestion decomposition. This mechanism will be encoded in the lexical entries of the higher-order determiners, but this is meant to be a mere placeholder for a more plausible implementation, rather than an explanatory semantic analysis of the determiners. In particular, the general descriptive picture outlined in Chapters 1 and 2 of this thesis calls for a cross-categorical semantics of the determiners, but it remains an open question how the mechanism described here can best be generalized to other semantic types.

For concreteness, a partial analysis of the indefinite determiner $\exists_{\langle s,t \rangle}$ and of *dasselbe* _{$\langle s,t \rangle$} is given in (4.25). I will continue to assume that higher-order DPs contain a question variable, represented by the argument C in (4.25), which has type $\langle \langle s,t \rangle, t \rangle$ and is instantiated by the Hamblin set of the domain-restricting question. According to (4.25), higher-order DPs involve

quantification over a set $\text{ANSWERS}(\mathbf{c}, C, \mathcal{P})$ of propositions. This set contains exactly those propositions that answer a question in the subquestion decomposition determined by the utterance context $\mathbf{c}$, the domain-restricting question C and the set $\mathcal{P}$ of all propositions that satisfy at least one of the relevant higher-order predicates. In case of a typical determiner like $\exists_{\langle s, t \rangle}$, which combines with a restrictor predicate $\mathcal{P}$ and a nuclear-scope predicate $\mathcal{Q}$, the decomposition of C is determined on the basis of $\mathcal{P} \cup \mathcal{Q}$; in the case of *dasselbe* $_{\langle s, t \rangle}$, which combines with a plurality $\mathcal{P}$ of higher-order predicates on the analysis proposed here, it is determined on the basis of the union of all the predicates in the plurality.

$$(4.25) \quad \begin{aligned} \text{a.} \quad & \llbracket \exists_{\langle s, t \rangle} \rrbracket^{\mathbf{c}} = \lambda w. \lambda C_{\langle \langle s, t \rangle, t \rangle}. \lambda \mathcal{P}_{\langle \langle s, t \rangle, t \rangle}. \lambda \mathcal{Q}_{\langle \langle s, t \rangle, t \rangle}. \exists p_{\langle s, t \rangle}. p \in \text{ANSWERS}(\mathbf{c}, C, \mathcal{P} \cup \mathcal{Q}) \wedge \\ & \mathcal{P}(p) \wedge \mathcal{Q}(p) \\ \text{b.} \quad & \llbracket \textit{dasselbe}_{\langle s, t \rangle} \rrbracket^{\mathbf{c}} = \lambda w. \lambda C_{\langle \langle s, t \rangle, t \rangle}. \lambda \mathcal{P}_{\langle \langle s, t \rangle, t \rangle} : |\{\mathcal{Q} \mid \mathcal{Q} \leq_a \mathcal{P}\}| > 1. \exists S_{\langle \langle s, t \rangle, t \rangle}. \forall \mathcal{Q}[\mathcal{Q} \leq_a \\ & \mathcal{P} \rightarrow \{p_{\langle s, t \rangle} \mid p \in \text{ANSWERS}(\mathbf{c}, C, \bigcup\{\mathcal{Q} \mid \mathcal{Q} \leq_a \mathcal{P}\}) \wedge \mathcal{P}(p)\} = S] \end{aligned}$$

On this analysis, the assumption that the extensions of $\mathcal{P}$ and $\mathcal{Q}$ in (4.25-a) can influence the subquestion decomposition, and hence the set $\text{ANSWERS}(\mathbf{c}, C, \mathcal{P} \cup \mathcal{Q})$, is what blocks unwanted monotonicity inferences, and makes higher-order indefinites semantically non-monotonic. However, once relativized to the set of answers to questions in the relevant subquestion decomposition, the determiners have their usual quantificational force – thus, the lexical entry for $\exists_{\langle s, t \rangle}$ in (4.26-a) says that $\mathcal{P}$ and $\mathcal{Q}$ have a nonempty intersection when restricted to $\text{ANSWERS}(\mathbf{c}, C, \mathcal{P} \cup \mathcal{Q})$. For *dasselbe* ‘the same thing(s)’, I give a lexical entry that allows it to combine with a plurality $\mathcal{P}$ of higher-order predicates in the way sketched in Chapter 1 above. This lexical meaning requires that all predicates in the plurality must have the same intersection with $\text{ANSWERS}(\mathbf{c}, C, \bigcup\{\mathcal{Q} \mid \mathcal{Q} \leq_a \mathcal{P}\})$. This resembles the quantificational force *dasselbe* has when it combines with predicates of individuals. So the analysis under discussion here could be seen as an initial step towards a cross-categorical DP semantics. It remains to be seen in future work how the individuation mechanism implicit in the function ANSWERS can be reduced to constraints on individuation that are also at work in other semantic domains.

In order to define the function ANSWERS , we start with a subquestion decomposition of C that ‘covers’ all the contextually salient subquestions of C . I will use the notation $\mathcal{D}_{\mathbf{c}}(C)$ for a decomposition of a question C that covers all subquestions of C that are salient in context $\mathbf{c}$, and is otherwise maximally fine-grained. In Section 4.3.3 below, I will give a definition of $\mathcal{D}_{\mathbf{c}}(C)$ and show how it accounts for the examples involving context-dependency from the last chapter. For now, I will limit myself to contexts in which no subquestion is particularly salient and assume that in such contexts, $\mathcal{D}_{\mathbf{c}}(C)$ is the maximally fine-grained canonical subquestion decomposition – in other words, a decomposition that contains a polar subquestion for each of the Hamblin answers (4.26). This is exemplified in (4.27).

$$(4.26) \quad \text{For any utterance context } \mathbf{c} \text{ and any Hamblin set } C \in D_{\langle \langle s, t \rangle, t \rangle} \text{ of a question: If no question } C' \text{ subsumed by } C \text{ is salient in } \mathbf{c}, \mathcal{D}_{\mathbf{c}}(C) = \{\text{sq}(\{p\}) \mid p \in C\}.$$

$$(4.27) \quad \text{Let } Q = \{\mathbf{a}, \mathbf{b}, \mathbf{c}\}. \text{ In a context } \mathbf{c} \text{ where no subquestion of } Q \text{ is salient:} \\ \mathcal{D}_{\mathbf{c}}(Q) = \{\text{sq}(\{\mathbf{a}\}), \text{sq}(\{\mathbf{b}\}), \text{sq}(\{\mathbf{c}\})\} = \{\{\mathbf{a}, \neg \mathbf{a}\}, \{\mathbf{b}, \neg \mathbf{b}\}, \{\mathbf{c}, \neg \mathbf{c}\}\}.$$

This contextually provided subquestion decomposition is then adapted to the ‘granularity’ of the

set $\mathcal{P}$ of all propositions that satisfy at least one of the higher-order predicates. For instance, two subquestions $\text{SQ}(\{\mathbf{a}\})$ and $\text{SQ}(\{\mathbf{b}\})$ are lumped together in case $\mathcal{P}$ does not contain an answer to either of them, but does contain a combination of an answer to $\text{SQ}(\{\mathbf{a}\})$ and an answer to $\text{SQ}(\{\mathbf{b}\})$, such as the disjunction $\mathbf{a} \vee \mathbf{b}$ or the conjunction $\mathbf{a} \wedge \mathbf{b}$. I will describe this ‘lumping’ mechanism in terms of a relation $\text{ADAPT}_C(\mathcal{D}, S, \mathcal{D}')$ between a question extension C , two subquestion decompositions $\mathcal{D}$ and $\mathcal{D}'$ of C and a set S of propositions. The set $\text{ANSWERS}(\mathbf{c}, C, \mathcal{P})$ then contains all the propositions that partially answer a question in the adapted subquestion decomposition. We thus end up with the following definition of our quantificational domain:

$$(4.28) \quad \text{For any utterance context } \mathbf{c}, \text{ any Hamblin set } C \in D_{\langle\langle s, t \rangle, t \rangle} \text{ of a question and any } \mathcal{P} \in D_{\langle\langle s, t \rangle, t \rangle}: \\ \text{ANSWERS}(\mathbf{c}, C, \mathcal{P}) = \{p \mid \exists \mathcal{D}. \mathcal{D} \text{ is a canonical subquestion decomposition of } C \\ \wedge \text{ADAPT}_C(\mathcal{D}_c(C), \mathcal{P}, \mathcal{D}) \wedge \exists C' \in \mathcal{D}. p \in \text{PA}(C')\}$$

The crucial missing piece here is a definition of the relation ADAPT_C . In the next subsection, I will give such a definition and show how it predicts the data involving the ‘blocking effect’ from Section 3.3.2. Then, in Section 4.3.3, I will turn to a more precise characterization of the contextually provided subquestion decomposition $\mathcal{D}_c$. Together with definitions (4.25) and (4.28), these sections will provide an analysis of higher-order DP quantification over propositions that predicts both the influence of context on the quantificational domain and the conditions under which monotonicity inferences are blocked.

4.3.2 Adapting a subquestion decomposition to a set of propositions

As we saw in Section 3.3, disjunctive answers can be ‘blocked’ from the domain of a higher-order DP in case the restrictor or the nuclear scope of the DP contains one or both of the disjuncts. One of our crucial examples was (4.29). If both subjects merely have a disjunctive belief, as schematized in (4.30-a), the disjunction is clearly in the domain, but if each subject believes a single disjunct as in (4.30-b), it is blocked. Further, if one of the attitude subjects has a disjunctive belief and the other one is committed to one of the disjuncts, as schematized in (4.30-c), the disjunction is usually blocked from the domain as well: While the judgments I obtained for such scenarios were more varied, I think this can be attributed to the fact that in contexts of this kind, disjunctive subquestions become contextually salient. Finally, we observed that no comparable ‘blocking’ effect occurs if the logically weaker answers in question are single Hamblin answers rather than disjunctions thereof, as in (4.30-d).

$$(4.29) \quad \begin{array}{l} \text{Zur Frage, wer heute zum Essen kommt, glaubt der Hans etwas, das} \\ \text{to.the question who today to.the dinner comes believes the Hans something that} \\ \text{auch die Maria glaubt.} \\ \text{also the Maria believes} \\ \text{‘Concerning the question who will come to dinner tonight, Hans believes something} \\ \text{that Maria also believes.’} \end{array}$$

$$(4.30) \quad \begin{array}{l} \text{Given the Hamblin set } \llbracket \text{wer heute zum Essen kommt} \rrbracket = \{\mathbf{a}, \mathbf{b}, \mathbf{c}\}, (4.29) \text{ is } \dots \\ \text{a. true if } \{\mathbf{a} \vee \mathbf{b}\} \subseteq \mathcal{P}, \mathbf{a}, \mathbf{b} \notin \mathcal{P}, \{\mathbf{a} \vee \mathbf{b}\} \subseteq \mathcal{Q}, \mathbf{a}, \mathbf{b} \notin \mathcal{Q} \quad (\text{cf. example (3.104)}) \\ \text{b. false if } \{\mathbf{a}, \mathbf{a} \vee \mathbf{b}\} \subseteq \mathcal{P}, \mathbf{b} \notin \mathcal{P}, \{\mathbf{b}, \mathbf{a} \vee \mathbf{b}\} \subseteq \mathcal{Q}, \mathbf{a} \notin \mathcal{Q} \quad (\text{cf. example (3.103)}) \end{array}$$

- c. **false** [?] if $\{\mathbf{b}, \mathbf{a} \vee \mathbf{b}\} \subseteq \mathcal{P}, \mathbf{a} \notin \mathcal{P}, \{\mathbf{a} \vee \mathbf{b}\} \subseteq \mathcal{Q}, \mathbf{a}, \mathbf{b} \notin \mathcal{Q}$ (cf. example (3.108))
- d. **true** if $\{\mathbf{b}, \mathbf{c}, \mathbf{b} \wedge \mathbf{c}\} \subseteq \mathcal{P}, \mathbf{a} \notin \mathcal{P}, \{\mathbf{a}, \mathbf{b}, \mathbf{a} \wedge \mathbf{b}\} \subseteq \mathcal{Q}, \mathbf{c} \notin \mathcal{Q}$ (cf. example (3.113))

Definitions In order to derive this data pattern, we will assume that the higher-order determiner is sensitive to an adaptation of the contextually provided subquestion decomposition. This adapted decomposition depends on the ‘granularity’ of the set S of all propositions that satisfy either the restrictor of the determiner or its nuclear scope. The relevant properties of this set S in scenarios (4.30-a-d) are summarized in (4.31).

- (4.31) a. In situation (4.30-a): $\{\mathbf{a} \vee \mathbf{b}\} \subseteq S, \mathbf{a}, \mathbf{b} \notin S$
- b. In situation (4.30-b): $\{\mathbf{a}, \mathbf{a} \vee \mathbf{b}, \mathbf{b}\} \subseteq S$
- c. In situation (4.30-c): $\{\mathbf{a} \vee \mathbf{b}, \mathbf{b}\} \subseteq S, \mathbf{a} \notin S$
- d. In situation (4.30-d): $\{\mathbf{a}, \mathbf{b}, \mathbf{c}, \mathbf{b} \wedge \mathbf{c}, \mathbf{a} \wedge \mathbf{b}\} \subseteq S$

In particular, we are interested in the most fine-grained canonical subquestions that have a partial answer in S . Let us introduce some definitions to make this notion precise:

- (4.32) Let $Q \in D_{\langle\langle s, t \rangle, t \rangle}$ be a Hamblin set of a question and S a set of propositions. S **answers** Q if $S \cap \text{PA}(Q) \neq \emptyset$, i.e. S contains at least one partial answer to Q .
- (4.33) Let $Q \in D_{\langle\langle s, t \rangle, t \rangle}$ be a Hamblin set of a question and S a set of propositions. Q is a **minimal informative question** relative to S iff
 - a. S answers Q
 - b. and there is no proper subset $Q' \subsetneq Q$ such that S answers $\text{sq}(Q')$.

The idea will be to adapt the contextually given subquestion decomposition in such a way that every minimal informative question relative to S is covered – i.e. all the answers to minimal informative questions relative to S will be in our quantificational domain. This is formalized in definitions (4.34) and (4.35). The relativization to minimal informative questions ensures that disjunctions or other ‘weak’ partial answers are only blocked from the domain if stronger partial answers are available, not in general.

- (4.34) A subquestion decomposition $\mathcal{D}$ **covers** a question $Q \in D_{\langle\langle s, t \rangle, t \rangle}$ iff some question in $\mathcal{D}$ subsumes Q .
- (4.35) Let $\mathcal{D}$ be a canonical subquestion decomposition of a question $Q \in D_{\langle\langle s, t \rangle, t \rangle}$ and let S be a set of propositions.
Then $\mathcal{D}$ is **adapted** to S relative to Q iff $\mathcal{D}$ covers every canonical subquestion of Q that is a minimal informative question relative to S .

In order to systematically derive the ‘blocking effect’ involving disjunctions, we define the relation ADAPT_C in such a way that we end up with an adapted subquestion decomposition, but one that is otherwise maximally fine-grained. In other words, we want to satisfy (4.35) without making the ‘blocks’ of the decomposition bigger than necessary. This is formalized in (4.36).

- (4.36) Let $\mathcal{D}$ and $\mathcal{D}'$ be canonical subquestion decompositions of a question $C \in D_{\langle\langle s, t \rangle, t \rangle}$ and let S be a set of propositions.
Then $\text{ADAPT}_C(\mathcal{D}, S, \mathcal{D}') = 1$ iff all of (a)-(c) hold:
 - a. $\mathcal{D}$ is at least as fine-grained as $\mathcal{D}'$

- b. and $\mathcal{D}'$ is adapted to S relative to C
- c. and there is no canonical subquestion decomposition $\mathcal{D}''$ of C such that $\mathcal{D}''$ is more fine-grained than $\mathcal{D}'$ and $\mathcal{D}''$ is adapted to S relative to C

Restricted higher-order existential statements with *glauben* ‘believe’ Now let us see how definition (4.36) predicts the data pattern in (4.30). For simplicity, we assume that the decomposition $\mathcal{D}_c$ provided by the context contains only the polar questions corresponding to Hamblin answers.

In situation (4.30-a), where both subjects have the same disjunctive belief, the relevant set S of propositions does not answer $\text{sq}(\{\mathbf{a}\})$ or $\text{sq}(\{\mathbf{b}\})$, but does answer $\text{sq}(\{\mathbf{a}, \mathbf{b}\})$: The subjects’ beliefs do not determine whether Anna will come to dinner or whether Brit will come to dinner, but do rule out certain combinations of answers to these two questions. This means that $\text{sq}(\{\mathbf{a}, \mathbf{b}\})$ is a minimal informative question relative to S . So a subquestion decomposition adapted to S has to contain a canonical subquestion Q of $\{\mathbf{a}, \mathbf{b}, \mathbf{c}\}$ that subsumes $\text{sq}(\{\mathbf{a}, \mathbf{b}\})$. This means that it must contain either $\text{sq}(\{\mathbf{a}, \mathbf{b}\})$ itself or $\text{sq}(\{\mathbf{a}, \mathbf{b}, \mathbf{c}\})$. Since (4.36-c) forces us to choose a maximally fine-grained subquestion decomposition that satisfies this restriction, the adapted decomposition must be $\{\text{sq}(\{\mathbf{a}, \mathbf{b}\}), \text{sq}(\{\mathbf{c}\})\}$. We then end up with (4.37) as our restricted domain of propositions.

$$(4.37) \quad \text{Partial answers to a question in the adapted subquestion decomposition for (4.30-a):} \\ \mathbf{c}, \neg \mathbf{c}, \mathbf{a}, \neg \mathbf{a}, \mathbf{b}, \neg \mathbf{b}, \mathbf{a} \vee \mathbf{b}, \mathbf{a} \vee \neg \mathbf{b}, \neg \mathbf{a} \vee \mathbf{b}, \neg \mathbf{a} \vee \neg \mathbf{b}, \mathbf{a} \wedge \mathbf{b}, \mathbf{a} \wedge \neg \mathbf{b}, \neg \mathbf{a} \wedge \mathbf{b}, \neg \mathbf{a} \wedge \neg \mathbf{b}, \mathbf{a} \equiv \mathbf{b}, \mathbf{a} \not\equiv \mathbf{b}$$

Since this domain contains all non-trivial Boolean combinations of answers to $\text{sq}(\{\mathbf{a}\})$ and answers to $\text{sq}(\{\mathbf{b}\})$, $\mathbf{a} \vee \mathbf{b}$ is also an element of the domain, which accounts for the judgment in (4.30-a). To sum up, $\text{sq}(\{\mathbf{a}\})$ and $\text{sq}(\{\mathbf{b}\})$ must be lumped together because the subjects believe a combination of partial answers to these questions, but neither subject can answer one of the individual questions.

In situation (4.30-b), Maria’s beliefs include $\mathbf{a}$ and Peter’s beliefs include $\mathbf{b}$, so $\text{sq}(\{\mathbf{a}\})$ and $\text{sq}(\{\mathbf{b}\})$ are both minimally informative questions. The most fine-grained canonical subquestion decomposition, which simply contains all the polar questions corresponding to Hamblin answers, covers both $\text{sq}(\{\mathbf{a}\})$ and $\text{sq}(\{\mathbf{b}\})$. According to definition (4.36), we therefore have to use this decomposition. The relevant set $\text{ANSWERS}(\mathbf{c}, C, \mathcal{P})$ will then be restricted to Hamblin answers and their negations (4.38). Since $\mathbf{a} \vee \mathbf{b}$ is not in this set, we correctly predict (4.29) to be false in this situation.

$$(4.38) \quad \text{Partial answers to a question in the adapted subquestion decomposition for (4.30-b):} \\ \mathbf{c}, \neg \mathbf{c}, \mathbf{a}, \neg \mathbf{a}, \mathbf{b}, \neg \mathbf{b}$$

The ‘asymmetric’ scenario (4.30-c) makes (4.29) false for a similar reason. Here Maria’s beliefs include $\mathbf{b}$, while Peter only has the disjunctive belief $\mathbf{a} \vee \mathbf{b}$. Since the relevant set S indicated in (4.31-c) answers $\text{sq}(\{\mathbf{b}\})$, $\text{sq}(\{\mathbf{b}\})$ is a minimally informative question wrt. this set. Definition (4.36) then forces us to use the maximally fine-grained subquestion decomposition – $\{\text{sq}(\{\mathbf{a}\}), \text{sq}(\{\mathbf{b}\}), \text{sq}(\{\mathbf{c}\})\}$ – even though $\text{sq}(\{\mathbf{a}\})$ is not a minimal informative question. Since Peter does not believe any proposition in the set (4.38), (4.29) is predicted to be false.

Finally, let us consider scenario (4.30-d), which shows that conjunctions of Hamblin answers do not ‘block’ the individual Hamblin answers in the same way that disjunctions are ‘blocked’ by their disjuncts. This is predicted by definition (4.36): Since the relevant set S , sketched in (4.31-d), contains the Hamblin answers $\mathbf{a}, \mathbf{b}$ and $\mathbf{c}$, $\text{SQ}(\{\mathbf{a}\})$, $\text{SQ}(\{\mathbf{b}\})$ and $\text{SQ}(\{\mathbf{c}\})$ are all minimal informative subquestions. We therefore have to use a subquestion decomposition that contains all of them, which means that our domain of quantification is yet again (4.38). The fact that S also contains conjunctions of Hamblin answers does not matter since the subquestions partially answered by these conjunctions, $\text{SQ}(\{\mathbf{a}, \mathbf{b}\})$ and $\text{SQ}(\{\mathbf{b}, \mathbf{c}\})$, are not minimal informative subquestions.

In sum, the analysis proposed above predicts the basic data pattern from 3.3: Disjunctions of Hamblin answers are ‘blocked’ from the domain if the restrictor or the nuclear scope of the higher-order determiner contains one of their disjuncts, since this forces us to use a more fine-grained subquestion decomposition on which the disjunction no longer counts as a partial answer. Further, since definition (4.36) implements a preference for more fine-grained subquestion decompositions, not a general preference for stronger propositions in the domain, conjunctions of Hamblin answers do not ‘block’ their conjuncts.

Non-upward-monotonic predicates In Section 4.2.2 above, I discussed some examples that are problematic for our earlier generalization formulated on the basis of *glauben* ‘believe’. They involve the non-upward-monotonic predicate *ausschließen* ‘rule out’. The basic pattern is repeated below.

- (4.39) Given a domain-restricting question with Hamblin answers $\mathbf{a}, \mathbf{b}, \dots$, a restricted higher-order existential statement with predicates $\mathcal{P}$ and $\mathcal{Q}$ is ...
- a. **true** if $\{\mathbf{a} \wedge \mathbf{b}\} \subseteq \mathcal{P}, \mathbf{a}, \mathbf{b} \notin \mathcal{P}, \{\mathbf{a} \wedge \mathbf{b}\} \subseteq \mathcal{Q}, \mathbf{a}, \mathbf{b} \notin \mathcal{Q}$ (cf. example (4.16))
 - b. **not true** [?] if $\{\mathbf{a}, \mathbf{a} \wedge \mathbf{b}\} \subseteq \mathcal{P}, \mathbf{b} \notin \mathcal{P}, \{\mathbf{b}, \mathbf{a} \wedge \mathbf{b}\} \subseteq \mathcal{Q}, \mathbf{a} \notin \mathcal{Q}$ (cf. example (4.17))

In (4.39-a), neither of the attitude subjects rules out a partial answer to $\text{SQ}(\{\mathbf{a}\})$ or to $\text{SQ}(\{\mathbf{b}\})$, but the proposition $\mathbf{a} \wedge \mathbf{b}$, which partially answers $\text{SQ}(\{\mathbf{a}, \mathbf{b}\})$, is ruled out by both of them. Therefore, $\text{SQ}(\{\mathbf{a}, \mathbf{b}\})$ is a minimal informative subquestion and the higher-order DP quantifies over all partial answers to this question, which correctly predicts that $\mathbf{a} \wedge \mathbf{b}$ is in the domain of the existential.

In (4.39-b), on the other hand, each of the answers $\mathbf{a}$ and $\mathbf{b}$ is ruled out by an attitude subject, which means $\text{SQ}(\{\mathbf{a}\})$ and $\text{SQ}(\{\mathbf{b}\})$ are both minimally informative subquestions. All else being equal, we therefore have to use a maximally fine-grained subquestion decomposition of the form $\{\text{SQ}(\{\mathbf{a}\}), \text{SQ}(\{\mathbf{b}\}), \dots\}$, which means $\mathbf{a} \wedge \mathbf{b}$ is not in the domain of the existential. In sum, the present analysis predicts that the data pattern for predicates licensing downward-monotonic inferences should be the mirror image of the data pattern for upward-monotonic predicates: Conjunctions of Hamblin answers can be in the quantificational domain, but only if they are not ‘blocked’ by the individual conjuncts.

Higher-order identity statements Finally, let us take a closer look at the semantic differences between restricted higher-order existential statements and higher-order identity state-

ments, such as (4.40). Like our lexical entry for *etwas*, the lexical entry for *dasselbe* ‘the same thing(s)’ in (4.25-b) is relativized to a subquestion decomposition, which is adapted to the set of all propositions that satisfy at least one predicate in the predicate plurality it combines with. In (4.40), where we have a plurality of two predicates $\mathcal{P}$ and $\mathcal{Q}$, the quantificational domain will be the set $\text{ANSWERS}(\mathbf{c}, C, \mathcal{P} \cup \mathcal{Q})$. Since *dasselbe* _{$\langle s, t \rangle$} has its usual quantificational force relative to this set, the lexical entry is more restrictive than the one for $\exists_{\langle s, t \rangle}$: It requires the two sets $\text{ANSWERS}(\mathbf{c}, C, \mathcal{P} \cup \mathcal{Q}) \cap \mathcal{P}$ and $\text{ANSWERS}(\mathbf{c}, C, \mathcal{P} \cup \mathcal{Q}) \cap \mathcal{Q}$ to be identical. This correctly predicts that the quantificational domain of *dasselbe*, like the domain of higher-order indefinites, may contain disjunctive answers (4.41-a), but it also correctly predicts (4.40) to be false in scenarios like (4.41-c,d) in which the corresponding restricted higher-order existential statement, (4.29), would be true.

(4.40) *Zur Frage, wer heute zum Essen kommt, glauben Peter und Maria dasselbe.*
to.the question who today to dinner comes believe Peter and Maria the.same
‘Concerning the question who will come to dinner tonight, Peter and Maria believe the same thing(s).’

(4.41) Given the Hamblin set $\llbracket \text{wer heute Abend zum Essen kommt} \rrbracket = \{\mathbf{a}, \mathbf{b}, \mathbf{c}\}$, (4.40) is ...
a. **true** if $\{\mathbf{a} \vee \mathbf{b}\} \subseteq \mathcal{P}, \mathbf{a}, \mathbf{b} \notin \mathcal{P}, \{\mathbf{a} \vee \mathbf{b}\} \subseteq \mathcal{Q}, \mathbf{a}, \mathbf{b} \notin \mathcal{Q}$ (cf. example (3.104))
b. **false** if $\{\mathbf{a}, \mathbf{a} \vee \mathbf{b}\} \subseteq \mathcal{P}, \mathbf{b} \notin \mathcal{P}, \{\mathbf{b}, \mathbf{a} \vee \mathbf{b}\} \subseteq \mathcal{Q}, \mathbf{a} \notin \mathcal{Q}$ (cf. example (3.103))
c. **false** if $\{\mathbf{a} \vee \mathbf{b}, \mathbf{c}\} \subseteq \mathcal{P}, \mathbf{a}, \mathbf{b} \notin \mathcal{P}, \{\mathbf{a} \vee \mathbf{b}, \neg \mathbf{c}\} \subseteq \mathcal{Q}, \mathbf{a}, \mathbf{b} \notin \mathcal{Q}$
d. **false** if $\{\mathbf{b}, \mathbf{c}, \mathbf{b} \wedge \mathbf{c}\} \subseteq \mathcal{P}, \mathbf{a} \notin \mathcal{P}, \{\mathbf{a}, \mathbf{b}, \mathbf{a} \wedge \mathbf{b}\} \subseteq \mathcal{Q}, \mathbf{c} \notin \mathcal{Q}$ (cf. scenario (3.113-a))

In scenarios like (4.41-a) and (4.41-c), in which neither of the attitude subjects believes a partial answer to $\text{SQ}(\{\mathbf{a}\})$ or to $\text{SQ}(\{\mathbf{b}\})$, definition (4.36) yields the subquestion decomposition $\{\text{SQ}(\{\mathbf{a}, \mathbf{b}\}), \text{SQ}(\{\mathbf{c}\})\}$. In (4.41-a), Peter and Maria believe exactly the same partial answers to subquestions in this decomposition; in (4.41-c), this is not the case since Peter and Maria disagree on the subquestion $\text{SQ}(\{\mathbf{c}\})$.

In scenarios like (4.41-b) and (4.41-d), definition (4.36) forces us to use the maximally fine-grained subquestion decomposition $\{\text{SQ}(\{\mathbf{a}\}), \text{SQ}(\{\mathbf{b}\}), \text{SQ}(\{\mathbf{c}\})\}$. However, the lexical entry for *dasselbe* requires Peter and Maria to agree on *each* of the subquestions in this decomposition, which is why (4.40) is false even in scenarios like (4.41-d), where their shared beliefs include a Hamblin answer.

Generally speaking, the present account predicts higher-order identity statements to have stronger truth conditions than restricted existential higher-order statements. Data like (4.41) are yet another reason why we do not want a semantics that simply compares the strongest propositions satisfying the two higher-order predicates in question. This would not account for the fact that higher-order DPs may differ in their quantificational force.

Interim summary To sum up, we defined a relation $\text{ADAPT}_C(\mathcal{D}, S, \mathcal{D}')$ that relates two subquestion decompositions of a question C and a set S of propositions. Roughly speaking, $\mathcal{D}'$ is the most fine-grained canonical subquestion decomposition of C that ‘lumps together’ all the sets of subquestions that are already ‘lumped together’ in $\mathcal{D}$ and also respects the ‘granularity’ of the propositions in S . That is, if C has a canonical subquestion C' such that C' is answered

by S , but no smaller subset $C'' \subsetneq C'$ is answered by S , then C' must be ‘lumped together’ in the adapted subquestion decomposition. This has the effect that a disjunctive answer is included in the domain of quantification, but only if neither of the higher-order predicates involved is true of one of the disjuncts.

The present approach raises the question whether there is independent evidence for the idea that the interpretation of higher-order DPs involves a choice between different subquestion decompositions of varying ‘granularity’. One type of example that supports this was already discussed in Section 3.3: There, we saw that the interpretation of a higher-order DP can be influenced by making certain subquestions of the domain-restricting question salient. These effects of contextual salience are the topic of the next section.

4.3.3 Adapting a subquestion decomposition to a context

According to definition (4.28) above, the adapted subquestion decomposition of the domain-restricting question C is computed on the basis of a decomposition $\mathcal{D}_c(C)$ made salient by the utterance context $\mathbf{c}$. So far, I have been assuming a context that makes no subquestion of C particularly salient. Then $\mathcal{D}_c(C)$ is simply the most fine-grained subquestion decomposition available, i.e. the decomposition consisting of polar questions corresponding to the Hamblin answers of C . But in general, $\mathcal{D}_c(C)$ should be defined in a way that takes the contextual salience of different subquestions of C into account.

One example that illustrates this is repeated in (4.42) (= (3.106)). The Hamblin set of the domain-restricting question is given in (4.43-a). Intuitively, (4.42) is true in the given scenario because Hans and Maria both believe a European team will make it to the final. However, the analysis developed above does not predict this: Since Hans believes the Hamblin answer $\llbracket \textit{France will make the final} \rrbracket$ and Maria believes the Hamblin answer $\llbracket \textit{Germany will make the final} \rrbracket$, we have to use the maximally fine-grained subquestion decomposition, sketched in (4.43-b). Since the proposition $\llbracket \textit{a European team will make the final} \rrbracket$ is not a partial answer to any of the questions in this decomposition, the restricted domain corresponding to this decomposition does not contain any proposition that both Hans and Maria believe.

- (4.42) a. SCENARIO: Hans and Maria are discussing the upcoming World Cup with their friend Fritz. They have a long-standing disagreement about the question which continent(s) the teams in the final will come from. Hans believes that France will make the final and Maria believes that Germany will make it. But Fritz believes the two finalists will be South American teams like Brazil or Uruguay.
- b. *Zur Frage, wer ins WM-Finale kommt, glaubt der Hans*
to.the question who into.the World.Cup-final comes believes the Hans
etwas, das auch die Maria glaubt.
something REL also the Maria believes
‘As for the question who will make it to the World Cup final, Hans believes something Maria also believes.’ **true**

- (4.43) a. Hamblin set: $\{\llbracket \textit{France will make the final} \rrbracket, \llbracket \textit{Germany will make the final} \rrbracket, \llbracket \textit{Brazil will make the final} \rrbracket, \llbracket \textit{Uruguay will make the final} \rrbracket \dots\} = \{\mathbf{f}, \mathbf{g}, \mathbf{b}, \mathbf{u} \dots\}$
- b. $\{\text{sq}(\{\mathbf{f}\}), \text{sq}(\{\mathbf{g}\}), \text{sq}(\{\mathbf{b}\}), \text{sq}(\{\mathbf{u}\}), \dots\}$

Clearly, we want the context to determine a subquestion decomposition according to which $\llbracket a \text{ European team will make the final} \rrbracket$ and $\llbracket a \text{ South American team will make the final} \rrbracket$ count as partial answers. We can characterize this decomposition using the relation ADAPT_C from the preceding section, which ‘lumps together’ subquestions to match a certain set of propositions. The definition of this relation is repeated in (4.44). In the case under discussion here, we need to adapt the subquestion decomposition to the Hamblin set of the contextually salient subquestion. A first attempt at formalizing this idea is given in (4.45).

- (4.44) a. Let $\mathcal{D}$ be a canonical subquestion decomposition of a question $Q \in D_{\langle\langle s, t \rangle, t \rangle}$ and let S be a set of propositions.
Then $\mathcal{D}$ is **adapted** to S relative to Q iff $\mathcal{D}$ covers every canonical subquestion of Q that is a minimal informative question relative to S . (= (4.35))
- b. Let $\mathcal{D}$ and $\mathcal{D}'$ be canonical subquestion decompositions of a question $C \in D_{\langle\langle s, t \rangle, t \rangle}$ and let S be a set of propositions.
Then $\text{ADAPT}_C(\mathcal{D}, S, \mathcal{D}') = 1$ iff all of (i)-(iii) hold:
(i) $\mathcal{D}$ is at least as fine-grained as $\mathcal{D}'$
(ii) and $\mathcal{D}'$ is adapted to S relative to C
(iii) and there is no canonical subquestion decomposition $\mathcal{D}''$ of C such that $\mathcal{D}''$ is more fine-grained than $\mathcal{D}'$ and $\mathcal{D}''$ is adapted to S relative to C (= (4.36))
- (4.45) For any utterance context $\mathbf{c}$ and any Hamblin set $C \in D_{\langle\langle s, t \rangle, t \rangle}$ of a question:
a. $\mathcal{D}_0(C) = \{\text{sq}(\{p\}) \mid p \in C\}$
b. $S_{\mathbf{c}}(C) = \{p \mid \exists C'. C \text{ subsumes } C' \text{ and } C' \text{ is maximally salient in } \mathbf{c} \text{ among the questions subsumed by } C \wedge p \in C'\}$
c. $\mathcal{D}_{\mathbf{c}}(C)$ is some subquestion decomposition $\mathcal{D}$ such that $\text{ADAPT}_C(\mathcal{D}_0(C), S_{\mathbf{c}}(C), \mathcal{D}) = 1$

While (4.45) is far from a well-motivated analysis of the contextual salience effect under discussion – for one thing, I did not discuss examples with more than one salient subquestion, for which (4.45) arguably makes incorrect predictions, and the notion ‘maximally salient in $\mathbf{c}$ ’ requires explication – it accounts for simple examples like (4.42). Let us assume that the maximally salient question subsumed by the question who will make the final in (4.42-a) is (4.46-a). The Hamblin set in (4.46-a) is then identical to the set $S_{\mathbf{c}}(\llbracket \text{wer ins WM-Finale kommt} \rrbracket)$ as defined in (4.45-b). In order to apply definition (4.44), we have to find the canonical subquestions of $\llbracket \text{wer ins WM-Finale kommt} \rrbracket$ that are minimally informative questions relative to this set. Since minimal informative questions are questions for which (4.46-a) *contains* a partial answer, not just questions with a partial answer that *entail* an element of (4.46-a), we obtain them by lumping together all the subquestions corresponding to European teams, all the subquestions corresponding to South American teams, and so on. We thus end up with a subquestion decomposition along the lines of (4.46-b). Since propositions like $\llbracket a \text{ European team will make the final} \rrbracket$ or $\llbracket \text{France or Germany will make the final} \rrbracket$ are clearly in the quantificational domain corresponding to decomposition (4.46-b), the judgment in (4.42) is predicted.

- (4.46) a. $\{\llbracket a \text{ European team will make the final} \rrbracket, \llbracket an \text{ African team will make the final} \rrbracket, \llbracket a \text{ South American team will make the final} \rrbracket, \dots\}$
b. Minimal informative questions relative to (4.46): $\text{sq}(\{\mathbf{f}, \mathbf{g}, \dots\}), \text{sq}(\{\mathbf{b}, \mathbf{u}, \dots\}), \dots$

As a final point, note that the effect of contextual salience described here might also give us a partial explanation of the inconsistent judgments I obtained for ‘asymmetric’ scenarios – scenarios in which one of the attitude subjects believes a disjunctive partial answer, while the other one believes one of the disjuncts. This situation is summarized again in (4.47) (= (4.30-c)).

- (4.47) Given a domain-restricting question with Hamblin set $\{\mathbf{a}, \mathbf{b}, \mathbf{c}\}$, a restricted higher-order existential statement with restrictor predicate $\mathcal{P}$ and nuclear scope predicate $\mathcal{Q}$ is ...
false [?] if $\{\mathbf{b}, \mathbf{a} \vee \mathbf{b}\} \subseteq \mathcal{P}, \mathbf{a} \notin \mathcal{P}, \{\mathbf{a} \vee \mathbf{b}\} \subseteq \mathcal{Q}, \mathbf{a}, \mathbf{b} \notin \mathcal{Q}$ (cf. example (3.108))

As noted in Section 3.3, while examples of this type are usually judged false, some speakers I consulted accepted some of the examples or reported that they were unsure about their judgments. I think that the reason for this might be that, in order to set up a context of the type described in (4.47), I had to explicitly mention the disjunctive belief $\mathbf{a} \vee \mathbf{b}$. For some speakers, this might have made the polar question $C_V = \{\mathbf{a} \vee \mathbf{b}, \neg \mathbf{a} \wedge \neg \mathbf{b}\}$ contextually salient. In a context $\mathbf{c}$ where C_V is the unique maximally salient subquestion of $\{\mathbf{a}, \mathbf{b}, \mathbf{c}\}$, definition (4.45) states that we must use a subquestion decomposition $\mathcal{D}$ such that $\text{ADAPT}(\mathcal{D}_0, C_V, \mathcal{D})$. Since the set C_V does not answer $\text{SQ}(\{\mathbf{a}\})$ or $\text{SQ}(\{\mathbf{b}\})$, but does contain partial answers to $\text{SQ}(\{\mathbf{a}, \mathbf{b}\})$, $\text{SQ}(\{\mathbf{a}, \mathbf{b}\})$ is a minimal informative subquestion relative to this set. This means that the decomposition $\mathcal{D}$ must contain a subquestion that subsumes $\text{SQ}(\{\mathbf{a}, \mathbf{b}\})$. Thus, if no other questions subsumed by $\{\mathbf{a}, \mathbf{b}, \mathbf{c}\}$ are as salient as C_V , we end up with the subquestion decomposition $\mathcal{D} = \{\text{SQ}(\{\mathbf{a}, \mathbf{b}\}), \text{SQ}(\{\mathbf{c}\})\}$. Given this decomposition, $\mathbf{a} \vee \mathbf{b}$ is in $\text{ANSWERS}(\mathbf{c}, \{\mathbf{a}, \mathbf{b}, \mathbf{c}\}, \mathcal{P} \cup \mathcal{Q})$, which predicts that the restricted higher-order existential statement should be accepted.

More generally, this example suggests an explanation for the fact that judgments on sentences with higher-order DPs may still vary even if the domain-restricting question is fixed. The variability might be due to the existence of more than one plausible way of accommodating a value for the context parameter $\mathbf{c}$ – in particular, more than one plausible choice of contextually salient subquestions. However, further empirical work is needed to determine whether such effects show up in examples without disjunction as well and what happens in contexts where multiple subquestions are made equally salient. Since the definitions above were not tested on examples with more than one salient subquestion, they will need to be revised once more data on such contexts are available.

Regardless of the details of definition (4.45), however, contextual salience effects provide independent motivation for the relevance of subquestion decompositions in the semantics of higher-order DPs. As we saw in Section 4.3.3 above, this notion is a crucial part of the present account of the monotonicity puzzle: To interpret a higher-order DP, we first select a subquestion decomposition. Then the determiner applies, with its usual quantificational force, to the set of all propositions that are partial answers to some question in the decomposition. Since the selection of a subquestion decomposition depends on the extensions of the two higher-order predicates related by the determiner, the higher-order determiner ends up as a semantically non-monotonic operator, even if the quantifier applied to the partial answers is a simple existential or another monotonic quantifier. This is why the present approach avoids Zimmermann’s (2006) puzzle even though opaque predicates and ordinary DP complements receive their standard analyses.

Before I turn to the main problems with this analysis, I would like to briefly recapitulate the guiding idea behind it. In Chapter 3, we saw that the monotonicity puzzle arises from two assumptions: a predicate meaning that is monotonic relative to some entailment-like relation $\prec$ and a quantificational domain in which any two domain elements have a common upper bound with respect to $\prec$. If the quantificational domain is restricted by a subquestion decomposition as proposed in this chapter, the second prerequisite for the puzzle is no longer met: Two domain elements cannot have a common upper bound unless they are both partial answers to the same subquestion in the decomposition. Thus, we predict that the problematic inference pattern in (4.48) is accepted if $\llbracket p \rrbracket$ and $\llbracket q \rrbracket$ are answers to the same subquestion in the relevant adapted decomposition (and have a non-trivial disjunction), but not otherwise.

- (4.48) a. *Peter believes that p.*
 b. *Maria believes that q.*
 c. *Peter believes something Maria also believes.*

On the present approach, the monotonicity puzzle can be viewed as an individuation problem: More fine-grained and less fine-grained subquestion decompositions correspond to stricter and less strict ways of individuating ‘pieces of information’ that one can believe or rule out. Under a less fine-grained subquestion decomposition, certain propositions count as distinct pieces of information that would not count under a stricter decomposition. The definition of ADAPT_C is thus a description of the way we choose a suitable individuation method in a given scenario. If this approach to the monotonicity puzzle is on the right track, the semantics of higher-order DPs provide a new way of studying the individuation mechanisms at work in natural language semantics. But there is an important difference between the phenomenon under discussion here and most recent work on individuation conditions in linguistics: Usually, constraints on what counts as an individual in a given context are studied in the context of distributivity (see e.g. [Schwarzschild 1996](#)) or of the count-mass distinction (see [Rothstein 2017](#) for a recent survey), which raises the question whether we are dealing with general constraints on the domains of natural language quantifiers or with constraints specific to counting or plural individuals. While some higher-order DPs, like *zwei Sachen* ‘two things’, are clearly count DPs, *etwas* and *dasselbe* do not seem to be count expressions, to the extent the distinction can be tested with DPs that do not license numerals. For instance, higher-order *etwas* ‘something’ is like abstract mass DPs like *viel Information* ‘much information’, but unlike abstract count DPs like *viele Informationen* ‘many pieces of information’ in that it allows for relative clauses with reflexives, but not with reciprocals (4.49).⁵

- (4.49) a. *Der Peter glaubt etwas, das sich/*einander widerspricht.*
 the Peter believes something REL REFL/each.other contradicts
 ‘Peter believes something that contradicts itself.’
 b. *Der Peter hat viel Information, die sich/*einander widerspricht.*
 the Peter has much information REL REFL/each.other contradicts
 ‘Peter has a lot of information that contradicts itself.’

⁵Thanks to Peter Sutton (p.c.) for pointing out the potential relevance of abstract mass nouns like *Information* and their countable counterparts.

- c. *Der Peter glaubt viele Sachen, die sich/einander widersprechen.*
the Peter believes many things REL REFL/each.other contradict
‘Peter believes many things that contradict themselves/each other.’
- d. *Der Peter hat viele Informationen, die sich/einander widersprechen.*
the Peter has many information.PL REL REFL/each.other contradict
‘Peter has many pieces of information that contradict themselves/each other.’

This suggests that the semantic constraints on the interpretation of higher-order DPs with *etwas* that we have been studying are unrelated to counting, atomicity, semantic plurality and similar notions. If so, a more detailed study of higher-order DPs and the monotonicity puzzle could potentially help us distinguish between conditions on the domains of natural language quantifiers that are related to counting or plurality and those that are not.⁶

4.4 Open problems

While I think the approach developed here represents a step forward in terms of its descriptive coverage, there are many reasons why it cannot be the last word on the semantics of higher-order DPs. In this section, I want to draw attention to two of the most obvious open problems with the present analysis. The first problem concerns the prediction that higher-order DPs create a semantically non-monotonic context (Section 4.4.1). The second problem (Section 4.4.2) has to do with the fact that my approach relies on contextual parameters: If the truth conditions of restricted higher-order existential statements depend on a contextually provided question, it is unclear why speakers have clear-cut judgments about instances of the monotonicity puzzle even if the premises and conclusion are presented out of the blue, without an explicit question (as in Zimmermann 2006).

4.4.1 Non-monotonic DP meanings and polarity licensing

As I discussed at length in Section 3.1, there are two obvious ways of interpreting (4.50-c) in such a way that the inference pattern in (4.50) comes out as invalid. First, one could analyze *believe* as semantically non-monotonic, following Zimmermann’s (2006) approach to intensional transitive verbs. On this approach, (4.50) is invalid because $\llbracket \text{believe} \rrbracket(w)(\llbracket p \rrbracket)(\text{peter})$ does not entail $\llbracket \text{believe} \rrbracket(w)(\llbracket p \rrbracket \vee \llbracket q \rrbracket)(\text{peter})$, and similarly for Maria’s belief that $\llbracket q \rrbracket$. Thus, the proposition $\llbracket p \rrbracket \vee \llbracket q \rrbracket$ does not satisfy the existential statement in (4.50-c), and neither does any other proposition entailed by both $\llbracket p \rrbracket$ and $\llbracket q \rrbracket$.

- (4.50)
- a. *Peter believes that p.*
 - b. *Maria believes that q.*
 - c. *Peter believes something Maria also believes.*

The second approach, taken in this thesis, is to stick to the traditional assumption that $\llbracket \text{believe} \rrbracket(w)$ is upward-monotonic and build non-monotonicity into the semantics of the higher-order DP. The analysis developed in this chapter predicts that higher-order determiners, unlike ordinary determiners that quantify over individuals, are semantically non-monotonic both with respect to their

⁶See Wągiel (2018) for a recent study of this distinction in a (superficially) different empirical domain.

restrictor and with respect to their nuclear scope. Its predictions are formulated more precisely in (4.51) and (4.52).

- (4.51) If w is a possible world and C, P, Q are predicates of type $\langle e, t \rangle$:
- a. If $\llbracket \exists_e \rrbracket^c(w)(C)(P)(Q)$ and $P \sqsubseteq P'$, then $\llbracket \exists_e \rrbracket^c(w)(C)(P')(Q)$.
 - b. If $\llbracket \exists_e \rrbracket^c(w)(C)(P)(Q)$ and $Q \sqsubseteq Q'$, then $\llbracket \exists_e \rrbracket^c(w)(C)(P)(Q')$.
- (4.52) If w is a possible world and $C, \mathcal{P}, \mathcal{Q}$ are predicates of type $\langle \langle s, t \rangle, t \rangle$:
- a. If $\llbracket \exists_{\langle s, t \rangle} \rrbracket^c(w)(C)(\mathcal{P})(\mathcal{Q})$ and $\mathcal{P} \sqsubseteq \mathcal{P}'$, it is not necessarily the case that $\llbracket \exists_{\langle s, t \rangle} \rrbracket^c(w)(C)(\mathcal{P}')(\mathcal{Q})$.
 - b. If $\llbracket \exists_{\langle s, t \rangle} \rrbracket^c(w)(C)(\mathcal{P})(\mathcal{Q})$ and $\mathcal{Q} \sqsubseteq \mathcal{Q}'$, it is not necessarily the case that $\llbracket \exists_{\langle s, t \rangle} \rrbracket^c(w)(C)(\mathcal{P})(\mathcal{Q}')$.

Unfortunately, the prediction that formally identical determiners of different semantic types have distinct monotonicity properties does not seem to be empirically supported. To give a concrete example of its counterintuitive results, consider (4.53).

- (4.53) (4.53-a) $\Rightarrow$ (4.53-b)
- a. *Zur Frage, wer ins WM-Finale kommt, glaubt der Peter etwas, das die Maria auch schon lange glaubt.*
to.the question who into.the World.Cup.final comes believes the Peter
etwas, *das die Maria auch schon lange glaubt.*
something REL the Maria also already long believes
‘As for the question who will make the World Cup final, Peter believes something Maria has also believed for a long time.’
 - b. *Zur Frage, wer ins WM-Finale kommt, glaubt der Peter etwas, das die Maria auch glaubt.*
‘As for the question who will make the World Cup final, Peter believes something Maria also believes.’

The present analysis does not account for this intuitively valid inference. For instance, in the scenario described in (4.54), and given an utterance context in which no subquestion is particularly salient, we predict the premise (4.53-a) to be true and the conclusion (4.53-b) to be false.

- (4.54) SCENARIO: Peter believes that either Germany or France will make it to the World Cup final, but has no idea which of the two. For a long time, Maria has had the same belief and was also unable to decide whether Germany or France will make it. But now, having watched the group stage, Maria is convinced that only France will make the final.

Consider the LFs in (4.55) for the two sentences in (4.53) and let $\mathbf{a} = \llbracket \textit{Germany will win} \rrbracket$ and $\mathbf{b} = \llbracket \textit{France will win} \rrbracket$. Given scenario (4.54), Peter believes $\mathbf{a} \vee \mathbf{b}$ and does not believe any logically stronger partial answer to the question who will make it to the final. So the predicate $\llbracket (2, \langle s, t \rangle) [\textit{Peter } [t_{(2, \langle s, t \rangle)} \textit{ glaubt}]] \rrbracket$ is true of $\mathbf{a} \vee \mathbf{b}$, but not of $\mathbf{a}$ or $\mathbf{b}$. The same holds for the restrictor predicate $\llbracket (1, \langle s, t \rangle) [\textit{Maria } [\textit{schon lange}] [t_{(1, \langle s, t \rangle)} \textit{ glaubt}]] \rrbracket$ in (4.55-a): While Maria now believes $\mathbf{b}$, it is not the case that she has believed it for a long time. The strongest partial answer that she has believed for a long time is $\mathbf{a} \vee \mathbf{b}$. Given the analysis of $\exists_{\langle s, t \rangle}$ in Section 4.3, we thus predict (4.55-a) to be true in scenario (4.54), since $\text{sq}(\{\mathbf{a}, \mathbf{b}\})$ is a minimal informative subquestion. However, since Maria now believes $\mathbf{b}$ as well, the restrictor predicate in (4.55-b), $\llbracket (1, \langle s, t \rangle) [\textit{Maria } [t_{(1, \langle s, t \rangle)} \textit{ glaubt}]] \rrbracket$, is true of $\mathbf{b}$ as well as $\mathbf{a} \vee \mathbf{b}$. Therefore,

given this restrictor predicate, $\text{sq}(\{\mathbf{a}, \mathbf{b}\})$ is no longer a minimal informative subquestion. The minimal informative subquestion is $\text{sq}(\{\mathbf{b}\})$, which means that we need to choose a subquestion decomposition that includes $\text{sq}(\{\mathbf{a}\})$ and $\text{sq}(\{\mathbf{b}\})$. Given such a decomposition, $\mathbf{a} \vee \mathbf{b}$ is not in the relevant quantificational domain and (4.55-b) comes out as false.

- (4.55) a. $[[[\exists_{\langle s, t \rangle} C_{(3, \langle s, t \rangle)}] [(1, \langle s, t \rangle) [Maria [\textit{schon lange}] [t_{(1, \langle s, t \rangle)} \textit{glaubt}]]]] [(2, \langle s, t \rangle) [Peter [t_{(2, \langle s, t \rangle)} \textit{glaubt}]]]]]$
 b. $[[[\exists_{\langle s, t \rangle} C_{(3, \langle s, t \rangle)}] [(1, \langle s, t \rangle) [Maria [t_{(1, \langle s, t \rangle)} \textit{glaubt}]]]] [(2, \langle s, t \rangle) [Peter [t_{(2, \langle s, t \rangle)} \textit{glaubt}]]]]]$

For reasons outlined in Section 4.3.3 above, truth-value judgments on scenarios like (4.54) are not the optimal way to test predictions about monotonicity: Arguably, the description of the scenario makes the disjunctive subquestion $\{\mathbf{a} \vee \mathbf{b}, \neg \mathbf{a} \wedge \neg \mathbf{b}\}$ salient, which might affect the judgment. However, there are independent reasons to be highly skeptical about the prediction in (4.52): The restrictor argument of $\exists_e$ behaves like an upward-monotonic context for the purposes of polarity licensing. In particular, in the absence of additional intervening operators, a negation taking scope above the indefinite DP can license NPIs within the restrictor. If the restrictor argument of $\exists_{\langle s, t \rangle}$ were really a non-monotonic context, we would expect to see a clear contrast between higher-order indefinites and ordinary indefinites with respect to NPI licensing. This does not seem to be the case: In my judgment at least, the NPI *auch nur irgendein* ‘any[one] at all’ is equally acceptable in (4.56-a), where the DP is an ordinary indefinite quantifying over individuals, and (4.56-b), where the DP is higher-order.⁷

- (4.56) a. *Der Hans isst nie etwas, was auch nur irgendein anderer Mensch*
 the Hans eats never something REL any.at.all other person
angefasst hat.
 touched has
 ‘Hans never eats anything anyone else has touched.’
 b. *Der Hans glaubt nie etwas, was auch nur irgendein anderer Mensch*
 the Hans believes never something REL any.at.all other person
behauptet.
 claims
 ‘Hans never believes anything anyone else claims.’

Further, negative quantifiers appear to license NPIs in their restrictor, no matter whether they are higher-order or not (4.57). While I did not discuss negative higher-order DPs in this thesis, the default expectation would be that negative higher-order quantifiers should also be non-monotonic, if higher-order indefinites are. In particular, this is predicted by the common view that negative

⁷The claim that the restrictor of a higher-order DP is an upward-monotonic context and hence turns into a downward-monotonic context when embedded under negation could also be supported by certain inference patterns. For instance, it seems to me that the inference in (i) is valid. However, since judgments about the validity of inferences are arguably affected by assumptions about the contextual parameters involved (see footnote 3 in the preceding chapter), a grammatical phenomenon like NPI licensing provides a more reliable test.

- (i) a. *Der Hans glaubt nie etwas, was auch ein Wissenschaftler glaubt.*
 the Hans believes never something REL also a scientist believes
 ‘Hans never believes anything that a scientist (also) believes.’
 b. *Der Hans glaubt nie etwas, was auch ein Naturwissenschaftler glaubt.*
 ‘Hans never believes anything that a natural scientist (also) believes.’

quantifiers are semantically indefinites that are licensed by a covert negation (cf. [Penka 2011](#) among others). It is therefore surprising that the restrictor of a negative higher-order determiner behaves like a downward-monotonic context for the purposes of NPI licensing.

- (4.57) a. *Der Hans isst nichts, was der Peter **jemals** angefasst hat.*
 the Hans eats nothing REL the Peter ever touched has
 ‘Hans doesn’t eat anything Peter ever touched.’
 b. *Der Hans glaubt nichts, was der Peter **jemals** behauptet hat.*
 the Hans believes nothing REL the Peter ever claimed has
 ‘Hans doesn’t believe anything Peter ever claimed.’

In sum, there is an unresolved tension between the data discussed in [Zimmermann \(2006\)](#) and Chapter 3 of this thesis, which suggest that existential higher-order determiners create non-monotonic contexts, and the evidence from NPI licensing which suggests they do not. While I do not currently know what the best way of solving this problem is, I think the NPI-licensing data call for a closer look at the question how different operators within the restrictor and the scope of higher-order determiners affect our judgments on monotonicity, and whether higher-order DPs show any unexpected behavior when we embed them under non-upward-monotonic operators. This would tell us more about the ‘source’ of non-monotonicity in higher-order DPs – in particular, about the question whether the restrictions on subquestion decompositions might reflect general pragmatic constraints that can be motivated independently of higher-order DPs. It would also help us decide whether these restrictions should really be part of the asserted content, as suggested by my preliminary analysis. The latter question seems particularly relevant in the light of theories of NPI licensing that allow us to ignore non-monotonicity if it can be attributed to a presupposition (see e.g. [von Stechow 1999](#)).

4.4.2 Examples without explicit context

The second open problem I want to discuss is less serious, but also shows that the pragmatic aspects of the analysis require further development. The new aspect of the data discussion in this thesis that sets it apart from earlier works on higher-order DPs like [Zimmermann \(2006\)](#) and [Moltmann \(2008, 2013\)](#) is that I concentrated on examples where the domain of a higher-order DP is restricted by an explicit question. The analysis developed in this chapter requires the presence of some value for this question parameter, since it crucially relies on semantic objects that receive their independent motivation from the semantics of questions, like Hamblin sets and subquestion decompositions. What this means, however, is that in contexts lacking such an explicit question, the predictions of the analysis are not clear. Consider (4.58), a clear instance of the monotonicity puzzle. The judgment that (4.58-c) does not follow from (4.58-a) and (4.58-b) seems clear even without any explicitly indicated question. But without additional assumptions, it is unclear why. We need to exclude propositions like $\lambda w. \llbracket it \text{ will rain tomorrow} \rrbracket(w) \vee \llbracket France \text{ will win the World Cup} \rrbracket(w)$ from the domain of the higher-order indefinite. But whether or not such propositions are excluded depends on the Hamblin set of the domain-restricting question. If the Hamblin set contains the propositions expressed by the complement clauses in (4.58-a,b), as in (4.59-a), then the

two polar questions formed from these propositions are minimal informative questions wrt. Peter's and Maria's beliefs. This will force us to use a subquestion decomposition that excludes $\lambda w. \llbracket it \text{ will rain tomorrow} \rrbracket(w) \vee \llbracket France \text{ will win the World Cup} \rrbracket(w)$ from the domain. However, there is nothing in the present analysis that excludes a question that has this disjunction – or an even weaker proposition – in its Hamblin set, such as (4.59-b). Given a domain-restricting question of this kind, there is no way to block the inference in (4.58) since the disjunction will count as a partial answer regardless of the subquestion decomposition.

(4.58) (4.58-a), (4.58-b) $\not\models$ (4.58-c)

- a. *Peter glaubt, dass es morgen regnen wird.*
Peter believes that EXPL tomorrow rain will
'Peter believes that it will rain tomorrow.'
- b. *Maria glaubt, dass Frankreich die WM gewinnt.*
Maria believes that France the World.Cup wins
'Maria believes that France will win the World Cup.'
- c. *Der Peter glaubt etwas, das auch die Maria glaubt.*
the Peter believes something that also the Maria believes
'Peter believes something that Maria also believes.'

(4.59) a. $\{\llbracket it \text{ will rain tomorrow} \rrbracket, \llbracket France \text{ will win the World Cup} \rrbracket, \dots\}$
 b. $\{\lambda w. \llbracket it \text{ will rain tomorrow} \rrbracket(w) \vee \llbracket France \text{ will win the World Cup} \rrbracket(w),$
 $\lambda w. \llbracket it \text{ will rain tomorrow} \rrbracket(w) \vee \llbracket Germany \text{ will win the World Cup} \rrbracket(w), \dots\}$

To extend the account developed here to a general solution of the monotonicity puzzle, we therefore have to say something about the way we accommodate a value for the domain-restriction variable in case no value is explicitly provided by question-embedding modifiers or by the discourse context. A natural way of excluding questions like (4.59-b) would be to require the accommodated question C to be such that all the beliefs explicitly attributed to Peter and Maria in the preceding discourse are in $\text{PA}(C)$. But this would still allow for several different ways of determining C which have different, potentially testable consequences for the interpretation of any additional discourse following (4.58-c). One plausible option, suggested to me by Daniel Büring (p.c.), is to assume that the default strategy in the absence of a plausible value for C is to accommodate a question that has any beliefs explicitly attributed to the attitude subjects in its Hamblin set. For (4.58), this gives us a question with the Hamblin set in (4.60). Given this value for the question parameter of $\exists_{\langle s, t \rangle}$ in (4.58-c), the analysis developed above straightforwardly predicts (4.58-c) to be false.

(4.60) $\{\llbracket it \text{ will rain tomorrow} \rrbracket, \llbracket France \text{ will win the World Cup} \rrbracket\}$

However, at this point it is not obvious to me how this restriction should be implemented in a formal pragmatic theory, and how it relates to the accommodation mechanisms found with other semantic phenomena that have been claimed to involve unbound variables over sets of propositions, such as focus (cf. e.g. [Rooth 1992](#)). Another open question is how the meanings of the complement clauses themselves influence accommodation. For instance, it seems to me that inferences where the two complement clauses contain a common predicate, as in (4.61), are less clearly unacceptable than (4.58). Presumably, this is because they make it easier to

accommodate a plausible question that is answered by the disjunction of Peter’s and Maria’s beliefs, such as $\llbracket \textit{whether anyone will come to dinner} \rrbracket$.

- (4.61) (4.61-a), (4.61-b)? $\Rightarrow$ (4.61-c)
- a. *Peter glaubt, dass die Anna zum Essen kommt.*
Peter believes that the Anna to dinner comes
‘Peter believes that Anna will come to dinner.’
 - b. *Maria glaubt, dass die Brit zum Essen kommt.*
‘Maria believes that Brit will come to dinner.’
 - c. *Der Peter glaubt etwas, das auch die Maria glaubt.*
‘Peter believes something Maria also believes.’

In sum, the present solution to the monotonicity puzzle, unlike Zimmermann’s (2006) purely semantic approach, does not predict the unacceptability of the inference pattern in (4.62) (for logically independent propositions $\llbracket q \rrbracket$ and $\llbracket q \rrbracket$) to be a semantic fact. Rather, the acceptability of specific instances of this pattern depends on the value of the question parameter associated with the higher-order existential.

- (4.62) a. *Peter believes that p.*
b. *Maria believes that q.*
c. *Peter believes something Maria also believes.*

While this prediction is plausible for examples in which an overt modifier (or the preceding discourse) explicitly introduces a value for the parameter, it leads to a problem in other cases: We cannot explain why instances of the pattern (4.62) are clearly unacceptable in out-of-the-blue contexts in the absence of an additional theory of the way we accommodate sets of propositions.

4.5 Chapter summary

In this chapter, I developed a preliminary analysis of two types of higher-order DPs: existential DPs that quantify over propositions, and higher-order uses of *dasselbe* ‘the same thing(s)’ that range over propositions. The starting point for this account was the sensitivity of higher-order DPs to questions introduced by explicit modifiers or in the preceding discourse (cf. Section 3.2). The account crucially depends on the notion of a ‘canonical subquestion decomposition’ of the domain-restricting question. These decompositions can be defined on the basis of Hamblin sets. Roughly speaking, a canonical subquestion decomposition of a question Q is a set $\mathcal{D}$ of questions such that every question in $\mathcal{D}$ corresponds to a subset of the Hamblin set of Q , the questions in $\mathcal{D}$ are pairwise logically independent (in the sense that no question in the set subsumes any other element of the set) and complete answers to the questions in $\mathcal{D}$ always jointly determine a complete answer to Q .

The basic idea behind the present approach to the monotonicity puzzle is that the restrictor and the nuclear scope of the higher-order determiner jointly determine a subquestion decomposition. We then quantify over the set of all propositions that are partial answers to a question in the decomposition. Clearly, more fine-grained subquestion decompositions correspond to larger domains of quantification. In particular, Boolean combinations of multiple Hamblin answers can

be in the domain of quantification, but only if the Hamblin answers all belong to the same ‘block’ of the subquestion decomposition. Given this background, we can block monotonicity inferences by requiring the use of a subquestion decomposition with sufficiently small blocks. This will ensure that the quantificational domain does not contain arbitrary disjunctions (in the case of upward-monotonic predicates) or arbitrary conjunctions (in the case of predicates allowing for downward-monotonic inferences).

However, the choice of a subquestion decomposition is somewhat flexible in two respects: First, the size of the blocks in the decomposition is adapted to the set S of all partial answers that satisfy either the restrictor or the nuclear scope of the higher-order determiner. In case of an upward-monotonic predicate, this ensures that the maximal elements of S with respect to logical entailment all entail some element of the quantificational domain. Roughly speaking, this means that the higher-order quantifier does not ‘miss’ any relevant information encoded in S merely because the blocks of the decomposition are too small. Second, if the context makes certain subquestions salient, the decomposition is adapted to ensure that the answers to these subquestions are included in the quantificational domain.

In addition to spelling out this analysis of the monotonicity puzzle, I tried to provide some motivation for the use of subquestion decompositions. There are two reasons why the domain-restriction mechanism developed here is sensitive to the subsumption relation between subquestions, rather than the entailment relation between propositions. First, a description formulated directly in terms of stronger and weaker propositions would not extend to non-upward-monotonic predicates in a plausible way (Section 4.2.2). Second, contextually salient questions may influence the truth conditions of sentences with higher-order DPs (Section 4.3.3). An additional reason to make use of subquestion decompositions is discussed in Appendix A.3: Beck & Sharvit (2002) and Lahiri (2002) show that the part-whole structures associated with questions can be more fine-grained than usually thought, and the effects noted there can be replicated with questions that restrict higher-order DPs. Since Beck & Sharvit (2002) argue on independent grounds that questions are associated with pluralities of subquestions, it seems natural to assume that this plural structure of questions also influences the interpretation of higher-order DPs.

In Section 4.4, I briefly discussed two of the most worrying open problems facing the present account: the fact that it predicts existential higher-order determiners to create semantically non-monotonic contexts, and the question how it can be extended to contexts that do not determine a domain-restricting question. But since my approach to the monotonicity puzzle makes liberal use of notions from the semantics of questions, there are also many open problems from that area of semantics that carry over to the present analysis. These problems include foundational issues with Hamblin-style sets of propositions (Zimmermann 2017), but also the question how the account can be extended to questions for which a Hamblin-style projection mechanism does not provide us with a set of ‘atomic’, logically independent answers. This is the case when there are logical entailment relations between some elements of the Hamblin set (cf. Lahiri 2002 for a detailed discussion and an analysis of QVE sentences that takes this possibility into account). This issue is particularly striking in the case of *wh*-phrases with mass nouns and *where*- and

when-questions: Since mass individuals, places and time intervals do not seem to have atomic parts, there is arguably no context-independent way of constructing a set of logically independent Hamblin answers. So our analysis of higher-order DPs needs to be combined with a question semantics that takes context-dependent ‘partitions’ of the respective domain of the *wh*-phrase into account. This raises the question what the empirical generalizations about higher-order DPs restricted by such questions are.

Given these problems, the analysis developed above should not be taken as a fully developed account of higher-order DPs, but as a proof of concept: It shows that one can develop an account of the monotonicity problem that puts the explanatory burden on the semantics of higher-order DPs, rather than the semantics of opaque predicates and ordinary DPs, and is thus compatible with traditional approaches to opaque predicates and ordinary DP quantification. In the next chapter, I will briefly compare some aspects of this analysis with [Zimmermann’s \(2006\)](#) predicate-based account.

Chapter 5

The exact-match analysis (Zimmermann 2006)

In the preceding chapters, I developed an approach to the monotonicity puzzle that relies on a complex, non-standard semantics for higher-order DPs, but does not require any changes to the semantics of opaque predicates or of ordinary DPs. This is in stark contrast to the proposal in Zimmermann (2006), where higher-order DPs are interpreted along the lines of the standard analysis, but the semantics of opaque predicates and of ordinary DPs is revised. In this section, I will discuss Zimmermann’s analysis in more detail and focus on the question which of the differences between that approach and mine are really substantial. As we will see, it proves surprisingly hard to find a knock-down argument against either of the two approaches, which is why this chapter will remain somewhat inconclusive. An additional complication is that, while Zimmermann’s paper deals with ITV and does not extend the analysis to clause-embedding predicates, Chapters 3 and 4 of this thesis are mostly concerned with attitude predicates. Further study is needed to determine what a plausible extension of my approach to ITV would even look like, since it is not clear what the counterpart of a Hamblin set in the domain of properties is. Therefore, a fair comparison of the two approaches that takes the full range of relevant linguistic data into account will have to wait for future work.

Section 5.1 introduces Zimmermann’s solution of the monotonicity puzzle and shows that, in order to extend it to attitude verbs in a descriptively adequate way, it has to be ‘weakened’ to incorporate the context-dependent effects studied in Chapter 3 of this thesis. In Section 5.2, I show how these effects can be modeled within Zimmermann’s general approach, and provide a meaning for *glauben* ‘believe’ that is sensitive to canonical subquestions of a contextually provided question. For the data involving this verb that I discussed in Chapters 3 and 4, the predictions of the resulting analysis closely match those of my DP-based approach. In Sections 5.3 and 5.4, I discuss two potential advantages of a DP-based analysis: first, it allows us to derive the descriptive observations from Chapter 2 from a type distinction, and second, it allows us to model upward- and downward-monotonicity as lexical properties of verbs rather than shifting the explanatory burden to the semantics of the complements.¹

¹Some parts of this chapter are based on an unpublished paper that I wrote in 2019 for a seminar on ‘Complement Clauses’ taught by Martin Prinzhorn, with the title ‘Höherstufige DPn und Satzkomplemente’.

5.1 Zimmermann’s (2006) analysis

The main goal of Zimmermann (2006) is to solve the monotonicity puzzle for ITV like *suchen* ‘look for’. Here, I will first illustrate his approach with the verb *suchen*, and then discuss a problem that arises when we try to extend it to attitude verbs like *glauben* ‘believe’.

Restricted higher-order existential statements Consider again (5.1), on the reading where neither Peter’s nor Maria’s search is directed towards a particular individual (or an individuating property in the sense of Chapter 2). As discussed in more detail in Section 2.2, this reading requires an interpretation of the DP headed by *etwas* as a higher-order quantifier over properties. The relative clause then expresses a predicate of properties. Given this view, the contrasting judgments for scenarios (5.1-b) and (5.1-c) require an explanation.

- (5.1) a. *Der Peter sucht etwas, das auch die Maria sucht.*
the Peter seeks something REL also the Maria seeks
‘Peter is looking for something that Maria is also looking for.’
b. SCENARIO: Peter and Maria both went shopping, independently of each other. Peter is looking for an arbitrary light blue sweater. Maria is also looking for an arbitrary light blue sweater. Neither of the two knows about the other’s search.
(5.1-a) **true**
c. SCENARIO: Peter and Maria both went shopping, independently of each other. Peter is looking for an arbitrary sweater. Maria is looking for an arbitrary bottle of white wine.
(5.1-a) **false**

The basic idea behind Zimmermann’s analysis is that (5.1-a) asserts the existence of a property *P* such that *P* exactly characterizes Peter’s search goal, and *P* also exactly characterizes Maria’s search goal. In scenario (5.1-b), such a property exists, namely the property of being a light blue sweater. In (5.1-c), on the other hand, there is no property that *exactly* characterizes both Peter’s and Maria’s search goals.

The source of this ‘exact match’ requirement, on Zimmermann’s analysis, is the verb meaning: In his adapted lexical entry (5.2-a), the conditional statement about worlds in which the search is successful is replaced by a biconditional, making the lexical meaning of *suchen* non-monotonic. The truth conditions attributed to (5.1-a) are paraphrased in (5.2-b) and (5.2-c). Crucially, (5.2-a) requires that every world in which the subject finds something with property *P* must be a world in which the search is successful. For instance, if *P* is the property of being a bottle of wine, (5.2-a) is satisfied only if any arbitrary bottle of wine is good enough to satisfy the subject’s search. This strengthening of the verb meaning accounts for the contrast in (5.1-b,c): In scenario (5.1-b), the property *[[light blue sweater]]* appears to satisfy the existential statement in (5.2-b), at least at first sight², while there is no such property in scenario (5.1-c). In particular, a ‘disjunctive’

²One problem with the exact-match analysis that Zimmermann (2006:745f.) already notes is that its predictions about scenarios like (5.1-b) are too strong. For instance, if Maria is looking for a sweater in her size, Peter is looking for a sweater in his size and the two sizes are different, (5.1-a) can still be true as long as there are no further mismatches between their search criteria. Zimmermann (2006:746, fn. 54) suggests that this problem can be solved by analyzing *suchen* as involving a *de se* attitude towards properties. In other words, unspecific objects of *suchen* have to be reanalyzed as binary relations between individuals, such as $(\lambda w.\lambda x.\lambda y.y \text{ is a sweater in } x\text{'s size in } w)$. While the verb meaning can easily be adapted to allow for such objects, this would interfere with the solution of the monotonicity problem described in the text: Even in a

(5.2) a. $\llbracket suchen \rrbracket = \lambda w. \lambda P_{\langle s, et \rangle}. \lambda x_e [\forall w' [w' \in \text{TRY}(w)(x) \leftrightarrow \exists y_e [P(w')(y) \wedge \mathbf{find}(w')(y)(x)]]]$
(cf. Zimmermann 2006:724, (15))
 b. $\lambda w. \exists P_{\langle s, et \rangle}. [\forall w' [w' \in \text{TRY}(w)(\mathbf{maria}) \leftrightarrow \exists y_e [P(w')(y) \wedge \mathbf{find}(w')(y)(\mathbf{maria})]]$
 $\wedge \forall w' [w' \in \text{TRY}(w)(\mathbf{peter}) \leftrightarrow \exists y_e [P(w')(y) \wedge \mathbf{find}(w')(y)(\mathbf{peter})]]]$
 c. ‘There is a property P such that Peter’s search is successful in exactly those worlds where he finds a P , and Maria’s search is successful in exactly those worlds where she finds a P .’

(5.3) a. *Peter sucht ein Buch.*
 ‘Peter is looking for a book.’
 b. $[Peter \text{ } [[BE \text{ } [[\exists_e C_{(1,e)}] \text{ } Buch_i]] \text{ } sucht]]$
 c. $[[\langle 5.3\text{-b} \rangle]^{c,g} = \lambda w. \forall w' [w' \in \text{TRY}(w)(\mathbf{peter}) \leftrightarrow \exists y_e [\text{IP}(\mathbf{c})(i)(Buch)(w')(y) \wedge g(1, e)(y) \wedge \mathbf{find}(w')(y)(\mathbf{peter})]]$
 d. ‘Peter’s search is successful in all and only those worlds where he finds a book.’

(5.4) *Peter sucht ein Buch über Linguistik. $\Rightarrow$ Peter sucht ein Buch.*
 ‘Peter is looking for a linguistics book. $\Rightarrow$ Peter is looking for a book.’

scenario like (5.1-c), one can find a relation that is general enough to exactly describe both Peter's and Maria's search goals, such as $(\lambda w.\lambda x.\lambda y.y$ meets the criteria of x 's search in $w)$.

Peter finds a book in every world where his search is successful is equivalent to the statement that there is a property that exactly describes his search goals and entails the property of being a book. What this means is that we can derive the correct truth conditions for (5.3-b) by interpreting *ein Buch* as an existential quantifier over arbitrary subproperties of $\llbracket \text{Buch}_i \rrbracket^c = \lambda w. \lambda x. \text{IP}(\mathbf{c})(i)(\text{Buch})(w)(x)$. Importantly, the domain of this quantifier must include non-individuating subproperties, since the property that characterizes the subject's search criteria might be too weak to count as individuating under any plausible individuation method. For instance, this is the case if their goal is to find an arbitrary linguistics book or an arbitrary book with a green cover. On this approach, then, 'ordinary' unspecific objects of *suchen* have the same semantic type as higher-order DPs: quantifiers over properties. The only remaining semantic difference between ordinary unspecific objects and higher-order DPs is that the quantificational domain of the former is restricted to subproperties of the NP denotation.

Zimmermann implements this idea by positing a shift $\uparrow$ that maps a property of individuals to the set of its subproperties (5.5-a). As shown in (5.5-b), this operator applies immediately below the determiner, so that the internal semantics of the NP (or rather, of the highest functional projection below the determiner, if we assume additional functional structure within DPs) remains unchanged. The shifted NP meaning combines with the higher-order determiner $\exists_{\langle s, et \rangle}$, which is interpreted along the lines of the standard semantics from Chapter 1. The resulting DP meaning, (5.5-c), requires the existence of a property Q that entails the property of being a book (under the contextually relevant individuation method for books) and satisfies the nuclear scope of the DP.

- (5.5) a. $\llbracket \uparrow \rrbracket = \lambda w. \lambda P_{\langle s, et \rangle}. \lambda Q_{\langle s, et \rangle}. \forall w' \forall x [Q(w')(x) \rightarrow P(w')(x)]$
 b. $\llbracket \uparrow [\text{Buch}_i] \rrbracket^c = \lambda w. \lambda Q_{\langle s, et \rangle}. \forall w' \forall x [Q(w')(x) \rightarrow \text{IP}(\mathbf{c})(i)(\text{Buch})(w')(x)]$
 c. $\llbracket [\exists_{\langle s, et \rangle} C_{(2, \langle \langle s, et \rangle, t \rangle)}] [\uparrow \text{Buch}_i] \rrbracket^{c, g} = \lambda w. \lambda P_{\langle \langle s, et \rangle, t \rangle}. \exists Q_{\langle s, et \rangle}. g(2, \langle \langle s, \langle e, t \rangle \rangle, t \rangle)(Q) \wedge \forall w' \forall x [Q(w')(x) \rightarrow \text{IP}(\mathbf{c})(i)(\text{Buch})(w')(x)] \wedge \mathcal{P}(Q)$

Since the indefinite DP *ein Buch* now denotes a quantifier over properties, the semantic framework assumed here requires it to move at LF for type reasons, leaving a trace of type $\langle s, et \rangle$ (5.6-a). We end up with the truth conditions in (5.6-b) and (5.6-c) for this LF. (5.6-b) states that Peter finds a book in every world in which his search is successful. Since the semantic argument of *suchen* is now no longer the property of being a book, but rather one of its subproperties, however, (5.6-b) no longer requires that Peter must be satisfied with any arbitrary book. It thus makes the same predictions about ordinary unspecific objects as the original property analysis of Zimmermann (1993).³

- (5.6) a. $\llbracket [\exists_{\langle s, et \rangle} C_{(2, \langle \langle s, et \rangle, t \rangle)}] [\uparrow \text{Buch}_i] [(1, \langle s, et \rangle) [\text{Peter} [\text{t}_{(1, \langle s, et \rangle)} \text{ sucht}]]] \rrbracket$
 b. $\llbracket (5.6\text{-a}) \rrbracket^{c, g} = \lambda w. \exists Q_{\langle s, et \rangle}. g(2, \langle \langle s, \langle e, t \rangle \rangle, t \rangle)(Q) \wedge \forall w' \forall x [Q(w')(x) \rightarrow \text{IP}(\mathbf{c})(i)(\text{Buch})(w')(x)] \wedge \forall w' [w' \in \text{TRY}(w)(\mathbf{peter}) \leftrightarrow \exists x_e [Q(w')(x) \wedge \mathbf{find}(w')(x)(\mathbf{peter})]]$
 c. 'There is a property Q in the contextually restricted domain such that Q entails the

³However, the predictions of the two analyses may differ once we consider non-indefinite determiners like *jeder* 'every' or proportional DPs with *die meisten* 'most'. Here, I will not discuss this issue in detail since there is no consensus in the literature about the conditions under which non-existential determiners have unspecific readings to begin with and about the truth conditions of these readings (see e.g. Zimmermann 1993, Moltmann 1997, van Geenhoven & McNally 2005, Schwarz 2015).

property of being a book (under the contextually salient individuation method for books) and the worlds in which Peter finds a Q are exactly those worlds in which his search is successful.’

In sum, Zimmermann’s (2006) exact-match analysis provides an elegant solution of the monotonicity problem for indefinite objects of *suchen* ‘look for’ and similar ITV. However, some complications arise once we try to extend the approach to proposition-embedding predicates.

Extending the approach to attitude predicates As we saw in Section 3.1, proposition-embedding predicates, particularly attitude predicates, give rise to the monotonicity problem in the same way as intensional transitive verbs. For instance, scenario (5.7-b) is not sufficient to make (5.7-a) true, even though there must be propositions that Peter and Maria both ‘believe’ in the upward-monotonic sense, such as $\lambda w. \llbracket it\ will\ rain\ tomorrow \rrbracket(w) \vee \llbracket France\ will\ win\ the\ World\ Cup \rrbracket(w)$.

- (5.7) a. *Der Peter glaubt etwas, das die Maria auch glaubt.*
 the Peter believes something REL the Maria also believes
 ‘Peter believes something Maria also believes.’
 b. SCENARIO: Peter believes it will rain tomorrow. Maria believes that France will
 win the next World Cup. (5.7-a) ??

The natural way of extending Zimmermann’s (2006) strategy to an attitude verb like *believe* would be to give the verb a meaning that requires its complement to exactly describe the subject’s belief state, as in (5.8-a). The truth conditions this approach predicts for (5.7-a), given the standard semantics for the higher-order DP, are given in (5.8-b,c).

- (5.8) a. $\llbracket glauben \rrbracket = \lambda w. \lambda p_{\langle s, t \rangle}. \lambda x_e. \forall w' [w' \in \text{DOX}(w)(x) \leftrightarrow p(w') = 1]$
 b. $\lambda w. \exists p_{\langle s, t \rangle}. g(2, \langle \langle s, t \rangle, t \rangle)(p) \wedge \forall w' [w' \in \text{DOX}(w)(\mathbf{maria}) \leftrightarrow p(w') = 1]$
 $\wedge \forall w' [w' \in \text{DOX}(w)(\mathbf{peter}) \leftrightarrow p(w') = 1]$
 c. ‘There is a proposition p such that p contains all and only the worlds compatible with Maria’s belief state, and p contains all and only the worlds compatible with Peter’s belief state.’

This approach correctly predicts that (5.7-a) is not generally true in scenarios of the type (5.7-b). For instance, Peter’s beliefs are compatible with France not winning the World Cup, so if p is the set of all his belief worlds, p cannot simultaneously exactly characterize Maria’s belief state. However, it should be clear that this correct prediction comes at the price of unacceptably strong truth conditions: For (5.8-b) to be true, Peter’s and Maria’s belief states have to be completely identical. Intuitively, what we would like (5.7-a) to mean is that there is some proposition that exactly characterizes some natural ‘part’ of Peter’s belief state, as well as some natural ‘part’ of Maria’s belief state. What this means is that in order to extend Zimmermann’s (2006) approach to attitude verbs, we have to weaken the verb semantics in (5.8-a) somehow, in order to allow it to take a complement that characterizes only ‘part’ of the subject’s belief state. However, this idea leaves us with the question what ‘parts’ of belief states are. Ultimately, the paraphrase just given involves quantification over a set structured by an entailment relation, since ‘parts’ of belief states are presumably associated with propositional content. Whether this variant of the exact-match analysis actually addresses the monotonicity problem therefore depends on one’s

assumptions about the way belief states are individuated. In the next section, I will take a different route: Using some of the concepts from Chapter 4, I will formulate a context-dependent version of Zimmermann’s (2006) analysis, which makes use of canonical subquestions to address the monotonicity puzzle in a more direct way than an analysis based on belief states.

5.2 Adding canonical subquestions to the exact-match analysis

Since the analysis under discussion attributes non-monotonicity to the verb meaning rather than the DP, context-dependent constraints on monotonicity inferences (cf. Chapter 3) have to be modeled as part of the verb semantics as well. I will give *glauben* a question extension as an additional semantic argument and assume that this argument position is filled by a covert variable $C_{(i, \langle \langle s, t \rangle, t \rangle)}$ for some numerical index i – the same kind of domain-restriction variable that I posited for higher-order DPs. As discussed in Chapter 3, this variable can either pick up its value from the preceding discourse or be bound by an overt question-introducing modifier. We thus end up with an LF like (5.9) for (5.7-a).⁴

$$(5.9) \quad [[\exists_{\langle s, t \rangle} [-was_{\langle s, t \rangle} [(1, \langle s, t \rangle) [Maria [t_{(1, \langle s, t \rangle)} [C_{(2, \langle \langle s, t \rangle, t \rangle)} glaubt]]]]]] \\ [(1, \langle s, t \rangle) [Peter [t_{(1, \langle s, t \rangle)} [C_{(2, \langle \langle s, t \rangle, t \rangle)} glaubt]]]]]]$$

We can now replicate the effects of the analysis from Chapter 4 by giving the verb *glauben* a lexical semantics that is sensitive to canonical subquestions of the question Q introduced by the domain-restriction variable. The basic idea will be that the propositional complement of *glauben* must express the subject’s strongest belief about some canonical subquestion of Q that is a minimal informative question with respect to the subject’s beliefs. Some auxiliary definitions are given in (5.10):

- (5.10) a. For any individual x , possible world w and question extension Q :
 $\text{INFORMED}(w)(x)(Q) = 1$ iff $\exists q \in \text{PA}(Q). \text{DOX}(w)(x) \subseteq q$
 In words: An individual x is **informed** with respect to a question extension Q in w iff x ’s belief state in w entails a partial answer to Q .
- b. For any individuation x , possible world w and question extension Q :
 $\text{MINIMAL}(w)(x)(Q)(Q') = 1$ iff $Q' \subseteq Q \wedge Q' \neq \emptyset \wedge \text{INFORMED}(w)(x)(\text{SQ}(Q')) \wedge \neg \exists Q'' [Q'' \subsetneq Q' \wedge Q'' \neq \emptyset \wedge \text{INFORMED}(w)(x)(\text{SQ}(Q''))]$
 In words: A set Q' is **minimal** with respect to the question Q and the beliefs of an individual x in w iff Q' is a nonempty subset of Q , x is informed with respect to $\text{SQ}(Q')$ in w and there is no nonempty proper subset Q'' of Q' such that x is informed with respect to $\text{SQ}(Q'')$ in w .

Using the terminology from Chapter 4, (5.10-a) says that the set of propositions that follow from x ’s belief state in w answers Q . (5.10-b) says that Q' is a canonical subquestion of Q and also a minimal informative question with respect to the set of propositions that follow from x ’s belief state. The proposed meaning for *glauben* then says that the propositional complement must exactly describe the subject’s belief state relative to a question Q' that is minimal, in the sense of (5.10-b), with respect to the contextually provided question and the subject’s beliefs

⁴For simplicity, I suppress the domain-restriction variable introduced by $\exists_{\langle s, t \rangle}$, since it is not obvious whether we still need it if the verb meaning is already relativized to a contextually provided question.

(5.11). ‘Exactly describing the subject’s belief state relative to Q' ’, in this context, means that the propositional argument has to be identical to the logically strongest partial answer to Q' that the subject believes.

$$(5.11) \quad \llbracket \text{glauben} \rrbracket = \lambda w. \lambda Q_{\langle \langle s, t \rangle, t \rangle}. \lambda p_{\langle s, t \rangle}. \lambda x_e. \exists Q'_{\langle \langle s, t \rangle, t \rangle} [\text{MINIMAL}(w)(x)(Q)(Q') \\ \wedge p = (\lambda w'. \exists q \in \text{SEA}(\text{SQ}(Q')). q \cap \text{DOX}(w)(x) \neq \emptyset \wedge q(w'))]$$

The advantage of this analysis is that it still allows (5.9) to be true if Maria and Peter have distinct – even incompatible – beliefs as long as these beliefs are unrelated to the question Q . At the same time, it is strong enough to make (5.9) false in scenarios where Maria and Peter believe distinct, but compatible, Hamblin answers or disjunctive answers to Q . To illustrate the predictions of definition (5.11), let us return to our running example of the monotonicity puzzle, repeated from (4.29) above.

- (5.12) *Zur Frage, wer heute zum Essen kommt, glaubt der Peter etwas, das*
to.the question who today to.the dinner comes believes the Peter something that
auch die Maria glaubt.
also the Maria believes
‘Concerning the question who will come to dinner tonight, Peter believes something
that Maria also believes.’

On the analysis under discussion, the relevant part of (5.12) has the LF in (5.9), interpreted under a variable assignment g that assigns the Hamblin set $\llbracket \text{wer heute zum Essen kommt} \rrbracket$ to the index $(2, \langle \langle s, t \rangle, t \rangle)$. This set will serve as the question argument of *glauben*. Let us assume, for simplicity, that we are dealing with a three-element set $\{\mathbf{a}, \mathbf{b}, \mathbf{c}\}$. Then, given an interpretation of $\exists_{\langle s, t \rangle}$ as an unrestricted quantifier over propositions, we obtain the following truth conditions for (5.12):

- (5.13) a. $\llbracket (5.9) \rrbracket^g = \lambda w. \exists p_{\langle s, t \rangle}. \\ \exists Q'_{\langle \langle s, t \rangle, t \rangle} [\text{MINIMAL}(w)(\mathbf{peter})(\{\mathbf{a}, \mathbf{b}, \mathbf{c}\})(Q') \\ \wedge p = (\lambda w'. \exists q \in \text{SEA}(\text{SQ}(Q')). q \cap \text{DOX}(w)(\mathbf{peter}) \neq \emptyset \wedge q(w'))] \\ \wedge \exists Q'_{\langle \langle s, t \rangle, t \rangle} [\text{MINIMAL}(w)(\mathbf{maria})(\{\mathbf{a}, \mathbf{b}, \mathbf{c}\})(Q') \\ \wedge p = (\lambda w'. \exists q \in \text{SEA}(\text{SQ}(Q')). q \cap \text{DOX}(w)(\mathbf{maria}) \neq \emptyset \wedge q(w'))]$
b. ‘There is a proposition p such that there is a subquestion Q' of $\{\mathbf{a}, \mathbf{b}, \mathbf{c}\}$ that is a minimal informative question wrt. Peter’s beliefs and p is the strongest partial answer to Q' that Peter believes; and there is a subquestion Q'' of $\{\mathbf{a}, \mathbf{b}, \mathbf{c}\}$ that is a minimal informative question wrt. Maria’s beliefs and p is the strongest partial answer to Q'' that Maria believes.’

Let us now unpack this condition for some of the basic scenarios we used to test the DP-based analysis in Chapter 4, repeated again in (5.14).

- (5.14) Given the Hamblin set $\llbracket \text{wer heute zum Essen kommt} \rrbracket = \{\mathbf{a}, \mathbf{b}, \mathbf{c}\}$, the restrictor predicate $\mathcal{P}$ and the nuclear-scope predicate $\mathcal{Q}$, (5.12) is ...
- a. **true** if $\{\mathbf{a} \vee \mathbf{b}\} \subseteq \mathcal{P}, \mathbf{a}, \mathbf{b} \notin \mathcal{P}, \{\mathbf{a} \vee \mathbf{b}\} \subseteq \mathcal{Q}, \mathbf{a}, \mathbf{b} \notin \mathcal{Q}$ (cf. example (3.104))
 - b. **false** if $\{\mathbf{a}, \mathbf{a} \vee \mathbf{b}\} \subseteq \mathcal{P}, \mathbf{b} \notin \mathcal{P}, \{\mathbf{b}, \mathbf{a} \vee \mathbf{b}\} \subseteq \mathcal{Q}, \mathbf{a} \notin \mathcal{Q}$ (cf. example (3.103))
 - c. **true** if $\{\mathbf{b}, \mathbf{c}, \mathbf{b} \wedge \mathbf{c}\} \subseteq \mathcal{P}, \mathbf{a} \notin \mathcal{P}, \{\mathbf{a}, \mathbf{b}, \mathbf{a} \wedge \mathbf{b}\} \subseteq \mathcal{Q}, \mathbf{c} \notin \mathcal{Q}$ (cf. example (3.113))

In scenario (5.14-a), Peter and Maria each have the disjunctive belief $\mathbf{a} \vee \mathbf{b}$ without believing any of the disjuncts. Then $\text{sq}(\{\mathbf{a}, \mathbf{b}\})$ is a minimal informative subquestion relative to both

Peter’s beliefs and Maria’s beliefs, and $\{\mathbf{a}, \mathbf{b}\}$ can serve as the value of Q' in both conjuncts of (5.13-a). Since $\mathbf{a} \vee \mathbf{b}$ is the strongest partial answer to $\text{sq}(\{\mathbf{a}, \mathbf{b}\})$ that Peter believes, and also the strongest partial answer to $\text{sq}(\{\mathbf{a}, \mathbf{b}\})$ that Maria believes, it satisfies the existential claim about propositions in (5.13-a).

Scenario (5.14-b) represents a situation where monotonicity inferences fail: Even though Maria believes $\mathbf{a}$ and Peter believes $\mathbf{b}$, $\mathbf{a} \vee \mathbf{b}$ should not count as a relevant shared belief. In this situation, $\{\mathbf{a}, \mathbf{b}\}$ cannot be the right value of Q' for either of the two conjuncts in (5.13-a), since Maria also believes a partial answer to $\text{sq}(\{\mathbf{a}\})$ and Peter believes a partial answer to $\text{sq}(\{\mathbf{b}\})$. Hence, $\text{sq}(\{\mathbf{a}, \mathbf{b}\})$ is not a minimally informative question with respect to either of the two belief states. Since $\mathbf{a} \vee \mathbf{b}$ is not a partial answer to $\text{sq}(\{\mathbf{a}\})$ or to $\text{sq}(\{\mathbf{b}\})$, it cannot satisfy either of the two conjuncts in (5.13-a), making (5.13-a) false in this scenario.

Finally, in scenario (5.14-c), Peter and Maria believe distinct partial answers to $Q = \{\mathbf{a}, \mathbf{b}, \mathbf{c}\}$, but they believe the same partial answer to the canonical subquestion $\text{sq}(\{\mathbf{b}\})$, namely $\mathbf{b}$. Since $\text{sq}(\{\mathbf{b}\})$ is a polar question, there are no other canonical subquestions of $\{\mathbf{a}, \mathbf{b}, \mathbf{c}\}$ that it properly subsumes. Therefore, $\text{sq}(\{\mathbf{b}\})$ is a minimal informative question relative to Peter’s belief state, and also relative to Maria’s belief state. We therefore predict the existential claim in (5.13-a) to be true, with $\mathbf{b}$ as the relevant instantiation of the propositional variable p .

In sum, like the analysis presented in Chapter 4, this approach exploits the notion of canonical subquestions in order to distinguish between disjunctive and non-disjunctive answers. We adapted the lexical entry of *glauben* and built in a restriction to propositions that express the subject’s strongest partial answer to a canonical subquestion. Further, this subquestion was required to be minimally informative, which predicts that we have to use maximally fine-grained canonical subquestions, ideally subquestions that correspond to Hamblin answers.

While the lexical entry in (5.11) is rather complex, this analysis, unlike the DP-based analysis from Chapter 4, does not require any unusual assumptions about the meaning of higher-order DPs. In particular, there is no need to relativize the choice of a quantificational domain to the actual extensions of the overt arguments of the higher-order determiner. This arguably makes the present approach simpler and more elegant than the DP-based analysis. Since the two approaches make the same predictions for simple examples involving *glauben* ‘believe’, it might seem that this constitutes an argument for the exact-match analysis. In the remainder of this chapter, I will therefore try to defend the DP-based approach from Chapters 3 and 4 and discuss some generalizations that this approach captures more directly than the exact-match analysis.

In order to do this, however, I have to say something about the semantics of ordinary clausal complements of proposition-embedding predicates, since this is one of the most striking differences between the two approaches under discussion. Just as in the case of ITV, if we allowed the predicate to combine directly with the proposition expressed by the complement clause, we would end up with truth conditions that are too strong. For instance, if we gave (5.15-a) an LF in which *glauben* combines with the question variable $C_{(1, \langle \langle s, t \rangle, t \rangle)}$ and directly takes the intension of the embedded clause as its propositional argument, we would predict the truth conditions in (5.15-b).

- (5.15) a. *Der Peter glaubt, dass die Anna oder die Brit kommt.*
 the Peter believes that the Anna or the Brit comes
 ‘Peter believes that Anna or Brit will come.’
 b. $\llbracket (5.15\text{-a}) \rrbracket^g = \lambda w. \exists Q'_{\langle \langle s, t \rangle, t \rangle} [\text{MINIMAL}(w)(\mathbf{peter})(g(1, \langle \langle s, t \rangle, t \rangle))(Q') \wedge (\lambda w'. \mathbf{come}(w')(\mathbf{anna}) \vee \mathbf{come}(w')(\mathbf{brit})) = (\lambda w'. \exists q \in \text{SEA}(\text{SQ}(Q')). q \cap \text{DOX}(w)(\mathbf{peter}) \neq \emptyset \wedge q(w'))]$
 c. ‘There is a subset Q' of the contextually given question such that $\text{SQ}(Q')$ is a minimal informative question relative to Peter’s beliefs and the proposition that Anna or Brit will come is Peter’s strongest partial answer to $\text{SQ}(Q')$.’

Assuming a plausible value for the domain-restriction variable, such as the Hamblin set $\llbracket \text{who will come} \rrbracket$, the analysis in (5.15-b) predicts (5.15-a) to be false if Peter’s actual beliefs include an answer to that question that is stronger than the disjunction in (5.15-a). For instance, if Peter believes Anna will come, $\text{SQ}(\{\llbracket \text{Anna will come} \rrbracket\})$ is a minimal informative question with respect to Peter’s belief set. Therefore, $\llbracket \text{Anna or Brit will come} \rrbracket$ cannot be Peter’s strongest answer to any minimal informative question, and the truth conditions in (5.15-b) cannot be satisfied: If we let Q' be $\text{SQ}(\{\llbracket \text{Anna will come} \rrbracket\})$, the intension of the complement clause does not express Peter’s strongest answer to Q' , and if we let Q' be a less fine-grained canonical subquestion such as $\text{SQ}(\{\llbracket \text{Anna will come} \rrbracket, \llbracket \text{Brit will come} \rrbracket\})$, the minimality condition is not met.

This is problematic for two reasons: First, while (5.15-a) invites the inference that Peter does not believe either of the two disjuncts, this is usually assumed to be an implicature rather than part of the asserted content. Second, the truth conditions in (5.15) are too strong to validate monotonicity inferences. For instance, they make the counterintuitive prediction that (5.16) does not entail (5.15-a).

- (5.16) *Der Peter glaubt, dass die Anna kommt.*
 ‘Peter believes that Anna will come.’

As in the case of intensional transitive verbs, this issue can be addressed by shifting the meaning of the complement clause to a quantifier over propositions. More precisely, to get the required upward-monotonic inferences, we need an existential quantifier over propositions that entail the extension of the complement clause. I will assume that, unlike in Zimmermann’s (2006) analysis of ITV, this shift is performed by a single covert operator $\uparrow_{\langle s, t \rangle}$ that directly maps a proposition to a quantifier of type $\langle \langle \langle s, t \rangle, t \rangle, t \rangle$. While the result of the shift is a higher-order quantifier, it is not a higher-order DP with the determiner $\exists_{\langle s, t \rangle}$. The reason for this is that I do not know of any syntactic evidence for an indefinite determiner in the structure of declarative complement clauses. Following Zimmermann’s (2006) reasoning, I will assume that $\uparrow_{\langle s, t \rangle}$ is obligatory in complements of *glauben/believe*, since this predicate does not appear to be ambiguous between an upward-monotonic and a non-monotonic reading.

- (5.17) $\llbracket \uparrow_{\langle s, t \rangle} \rrbracket = \lambda w. \lambda p_{\langle s, t \rangle}. \lambda \mathcal{P}_{\langle \langle s, t \rangle, t \rangle}. \exists q_{\langle s, t \rangle}. q \subseteq p \wedge \mathcal{P}(q)$

In the framework assumed here, the quantifier type resulting from $\uparrow_{\langle s, t \rangle}$ forces the complement clause to move, resulting in an LF like (5.18-a). The crucial steps of the semantic derivation are given in (5.18-b) and (5.18-c). The truth conditions in (5.18-c) state that there is a canonical subquestion Q' of the contextually provided question such that Q' is a minimal informative

subquestion relative to Peter’s beliefs, and the strongest partial answer to Q' that Peter believes entails that Anna or Brit will come. Given a plausible value for the question parameter, such as $\llbracket \text{who will come} \rrbracket$, this condition is satisfied even if Peter actually believes an answer that asymmetrically entails the disjunction. Further, this analysis accounts for upward-monotonic inferences if the contextually provided question parameter is held constant.

- (5.18) a. $\llbracket [\uparrow_{\langle s,t \rangle} [\text{dass die Anna oder die Brit kommt}]] [(1, \langle s, t \rangle) [Peter [t_{(1, \langle s, t \rangle)} [C_{(2, \langle \langle s, t \rangle, t \rangle)} \text{glaubt}]]]] \rrbracket$
 b. $\llbracket [\uparrow_{\langle s,t \rangle} [\text{dass die Anna oder die Brit kommt}]] \rrbracket = \lambda w. \lambda \mathcal{P}_{\langle \langle s, t \rangle, t \rangle}. \exists q_{\langle s, t \rangle}. q \subseteq (\lambda w'. \text{come}(w')(\text{anna}) \vee \text{come}(w')(\text{brit})) \wedge \mathcal{P}(q)$
 c. $\llbracket (5.18\text{-a}) \rrbracket^g = \lambda w. \exists q_{\langle s, t \rangle}. q \subseteq (\lambda w'. \text{come}(w')(\text{anna}) \vee \text{come}(w')(\text{brit})) \wedge \exists Q'_{\langle \langle s, t \rangle, t \rangle} [\text{MINIMAL}(w)(\text{peter})(g(2, \langle \langle s, t \rangle, t \rangle))(Q')] \wedge q = (\lambda w'. \exists p \in \text{SEA}(\text{SQ}(Q')). p \cap \text{DOX}(w)(\text{peter}) \neq \emptyset \wedge p(w'))]$

Summing up, we first saw that a naive extension of the exact-match analysis to attitude verbs produces unacceptably strong truth conditions. To address this issue, I proposed a semantics for *glauben/believe* that is non-monotonic, but relativized to a contextually provided question and its canonical subquestions. I suggested that the propositional complement has to denote the subject’s strongest partial answer to a canonical subquestion and that subquestion has to be minimally informative relative to the subject’s belief state. For simple restricted higher-order existential statements involving *believe*, this approach makes the same predictions as the DP-based analysis from Chapter 4. However, in order to predict the right monotonicity properties for examples with ordinary declarative complement clauses, additional assumptions were needed: Following Zimmermann (2006), I proposed that the extension of the complement clause has to be shifted to a quantifier over propositions. The exact-match analysis therefore takes ordinary complements of opaque verbs to be of the same semantic type as higher-order DPs. In the next section, I will briefly discuss the theoretical consequences of this move.

5.3 Is there a type distinction between ordinary and higher-order DPs?

In Section 2.2, I used examples with the German ITV *suchen* ‘look for’ and *bestellen* ‘order’ to motivate a distinction between two classes of unspecific indefinites: Higher-order indefinites, which quantify over arbitrary properties of type $\langle s, et \rangle$, and ordinary unspecific indefinites, which quantify over what I called ‘individuating properties’. Individuating properties are a subclass of properties which seem to behave like individuals for the purposes of semantic composition, and which were therefore analyzed as elements of D_e , even though they are complex semantic objects constructed from what I called ‘low-level individuals’. The distinction was motivated by examples like (5.19) and (5.20), which show that only a restricted class of DPs behave like quantifiers over arbitrary properties.

- (5.19) SCENARIO: Hans is arranging the new window display for his local library. He decides to use only books with covers in black and white. To complete the arrangement he has in mind, he still needs three books with white covers and two books with black covers.

Unfortunately, no books in these colors are left.

- a. *Der Hans sucht nur zwei Sachen.*
the Hans seeks only two things
'Hans is looking for only two things.' true
- b. *Der Hans sucht nur zwei Bücher.*
the Hans seeks only two books
'Hans is looking for only two books.' false

(5.20) SCENARIO: Hans and Peter are both reorganizing their bookshelves. Both of them decided independently to sort the books by color rather than title or genre, following the latest interior design trend. Hans is almost done sorting his books, but now needs an arbitrary book with a light green cover in order to complete his color scheme. Peter is in the same situation and is also looking for a book with a light green cover.

- a. *Der Hans sucht etwas, das der Peter auch sucht.*
the Hans seeks something REL the Peter also seeks
'Hans is looking for something that Peter is also looking for.' true
- b. *Der Hans sucht ein Buch, das der Peter auch sucht.*
the Hans seeks a book REL the Peter also seeks
'Hans is looking for a book that Peter is also looking for.' not true

At first sight, the contrasts in (5.19) and (5.20) appear to create a problem for the exact-match analysis: After all, as discussed in Section 5.1 above, this analysis is committed to the claim that higher-order DPs express quantification over arbitrary, possibly non-individuating, subproperties of the NP extension. This raises the question why, for instance, *zwei Bücher* in (5.19-b) has to range over pluralities of *individuating* properties. If $\uparrow$ is a freely available type-shift, it should be possible to associate (5.19-b) with the LF in (5.21-a), where $\uparrow$ applies below the pluralizing operator and the numeral. Applying $\uparrow$ to the NP extension yields the set of all subproperties of the property of being a book (under the contextually salient individuation method) (5.21-b). Then the $*$ operator forms pluralities of arbitrary properties of books, and the set of all such pluralities combines intersectively with the numeral, yielding the set of all sums of two arbitrary properties of books (5.21-c). The covert determiner can now quantify existentially over this set. Since one element of this set is the sum of the property of being a book with a white cover and the property of being a book with a black cover, this analysis predicts a reading for (5.19-b) on which it is true in scenario (5.19).

- (5.21)
- a. $[[\exists_{\langle s, et \rangle} C_{(2, \langle \langle s, et \rangle, t \rangle)}]] [zwei_{\langle s, et \rangle} [* [\uparrow Buch_i]]]$
 - b. $[[\uparrow Buch_i]]^c = \lambda w. \lambda Q_{\langle s, et \rangle}. \forall w' \forall x [Q(w')(x) \rightarrow IP(\mathbf{c})(i)(Buch)(w')(x)]$
 - c. $[[zwei_{\langle s, et \rangle} [* [\uparrow Buch_i]]]^c = \lambda w. \lambda Q_{\langle s, et \rangle} [|\{Q' \mid Q' \leq_a Q\}| = 2$
 $\wedge \forall Q' [Q' \leq_a Q \rightarrow \forall w' \forall x [Q'(w')(x) \rightarrow IP(\mathbf{c})(i)(Buch)(w')(x)]]]$

The exact-match analysis therefore does not immediately predict the contrast in (5.19), whereas on the DP-based analysis, this contrast falls out from the type distinction between ordinary and higher-order DPs. However, as Magdalena Kaufmann (p.c.) has pointed out to me, this is not necessarily a serious problem for the exact-match analysis, since derivations of the type (5.21) could be blocked in the syntax. For instance, we could assume that, rather than being a freely available type-shift, the $\uparrow$ operator occupies a fixed syntactic position within the DP, which is higher than any possible position for $*$ or numerals. Regardless of implementation details, this

approach would generate (5.22-a) as the only available LF for the DP *zwei Bücher* in (5.19-b). Given this LF, the determiner has to combine with the higher-order predicate in (5.22-b), which is true of subproperties of the property of being a plurality of two books. Since the numeral in (5.22-b) counts parts of individual pluralities, not parts of pluralities of properties, this syntax allows us to correctly block (5.19-b) in scenario (5.19).

$$(5.22) \quad \begin{array}{ll} \text{a.} & [[\exists_{\langle s, et \rangle} C_{(2, \langle \langle s, et \rangle, t \rangle)}] [\uparrow [zwei_e [* Buch_i]]]] \\ \text{b.} & [[\uparrow [zwei_e [* Buch_i]]]]^c = \lambda w. \lambda Q_{\langle s, et \rangle} \forall w' \forall x [Q(w')(x) \rightarrow |\{y \mid y \leq_a x\}| = 2 \wedge \forall y [y \leq_a x \rightarrow IP(c)(i)(Buch)(w')(y)]] \end{array}$$

A similar account is possible for the contrast in (5.20). In (5.23-a), the relative clause combines with a predicate derived by means of $\uparrow$, which is true of arbitrary subproperties of books. The indefinite DP thus quantifies over arbitrary properties of books that match Peter's search criteria. As the judgment in (5.20-b) indicates, this reading is not available, at least in the variety of German under discussion here. In order to block (5.23-a), we have to assume that the syntactic position of the $\uparrow$ operator is higher than any possible attachment site for relative clauses. This assumption forces us to use the LF in (5.23-b), where the relative clause must be interpreted as a predicate of individuals to avoid a type mismatch.

$$(5.23) \quad \begin{array}{ll} \text{a.} & [[\exists_{\langle s, et \rangle} C_{(2, \langle \langle s, et \rangle, t \rangle)}] [[\uparrow [Buch_i] [(1, \langle s, et \rangle) [Peter [t_{(1, \langle s, et \rangle)} sucht]]]]]] \\ \text{b.} & [[\exists_{\langle s, et \rangle} C_{(2, \langle \langle s, et \rangle, t \rangle)}] [\uparrow [Buch_i] [(1, e) [Peter [[IDENT t_{(1, e)}] sucht]]]]]] \end{array}$$

Summing up, the exact-match analysis forces us to derive the contrasts in (5.19) and (5.20) from syntactic restrictions on the distribution of the operator $\uparrow$.⁵ There is one remaining data point in Section 2.2 that cannot be derived from restrictions on $\uparrow$, however: the observation that ordinary indefinites cannot express genuinely unspecific readings, with quantification over arbitrary subproperties of the NP extension, if they have scope over another quantifier (5.24-a).

$$(5.24) \quad (= (2.62))$$

SCENARIO: The administrator of a database of literary works is asked what the most popular search queries were in the last few months. He has found that in the last three months, every user used the database at least once. Further, although there were almost no searches for particular books, one topic was unexpectedly popular recently: Almost half of the users have tried to use the database to find out about forgotten Austrian novels from the inter-war period. Usually, they looked for arbitrary novels from this country and period, without specifying any author or title.

CONTEXT: What type of books do people usually look for in the database?

a. *Es ist auffällig, dass /EIN Buch fast jeder \ZWEITE gesucht hat.*
it is striking that one book almost every second searched has
'It is striking that there was one book that almost every second person searched for.'
false

⁵A potential alternative would be to eliminate $\uparrow$ from the grammar and give the determiners additional lexical entries that map a property of individuals to a quantifier over its subproperties, in analogy to the operator $\uparrow_{\langle s, t \rangle}$ in (5.17). This option is illustrated in (i).

(i) $[[\exists'_{\langle s, et \rangle}]] = \lambda w. \lambda P_{\langle s, et \rangle} . \lambda \mathcal{P}_{\langle \langle s, et \rangle, t \rangle} . \exists Q_{\langle s, et \rangle} . \forall w' \forall x_e [Q(w')(x) \rightarrow P(w')(x)] \wedge \mathcal{P}(Q)$

While this variant of the exact-match analysis does not require any syntactic stipulations, this advantage comes at a price: Since we need an additional lexical entry for the determiner, it is no longer obvious that the semantics of determiners can be captured in terms of a cross-categorial schema. In other words, this approach inherits one of the open problems of the DP-based analysis.

- b. *Es ist auffällig, dass /EINE Sache fast jeder \ZWEITE gesucht hat.*
 it is striking that one thing almost every second searched has
 ‘It is striking that there was one thing that almost every second person searched
 for.’ true

The exact-match analysis requires $\llbracket \text{ein Buch} \rrbracket$ to denote a quantifier over arbitrary, possibly non-individuating subproperties of books, no matter what the position of $\uparrow$ within the DP is. Further, since this analysis assigns the type $\langle\langle\langle s, et \rangle, t \rangle, t \rangle$ to both of the indefinites in (5.24), they should both leave traces of type $\langle s, et \rangle$ in the object position of *suchen*. This means that without further assumptions, we do not predict any substantial difference in meaning between (5.24-a) and (5.24-b), except that the quantificational domain in (5.24-a) is restricted to properties that can only be true of books. In particular, the property of being a forgotten Austrian novel from the inter-war period should be in the domain of the indefinite DP in (5.24-a), predicting (5.24-a) to be true in the above scenario.

But, as pointed out to me by Magdalena Kaufmann (p.c.), even (5.24) does not provide an airtight argument against all versions of the exact-match analysis. Kaufmann notes that the contrast in (5.24) could be derived from the assumption that traces of scrambled DPs contain a covert copy of the lexical noun (see e.g. Sauerland 2004). The idea would be that the trace of a higher-order DP can range over arbitrary properties, while the trace of an ordinary DP only ranges over individuating properties. This would correctly predict that (5.24-a) is not true in the given scenario, without having to assume a type distinction between ordinary and higher-order DPs. To make this work, one needs an assumption that I rejected in Section 2.2.3, namely that there is no type distinction between individuating and non-individuating properties; rather, lexical nouns express predicates of type $\langle s, \langle\langle s, et \rangle, t \rangle \rangle$ which are true only of individuating properties, as illustrated in (5.25-a). On this view, the operator $\uparrow$ is still needed, but it is no longer a type-shifting operator and simply maps, for instance, the set of individuating properties of books to the set of all properties of books, including non-individuating ones (5.25-b).

- (5.25) a. $\llbracket \text{Buch}_i \rrbracket^c = \lambda w. \lambda P_{\langle s, et \rangle}. P \in \text{IP}(\mathbf{c})(i)(\text{Buch})(w)$
 b. $\llbracket \uparrow \rrbracket = \lambda w. \lambda P_{\langle s, \langle\langle s, et \rangle, t \rangle \rangle}. \lambda P_{\langle s, et \rangle}. \forall w' \forall x [P(w')(x) \rightarrow \exists Q [\mathcal{P}(w')(Q) \wedge Q(w')(x)]]$

On this approach, (5.24-a) and (5.24-b) would have analogous LFs, sketched in (5.26-a,b). The operator $\text{DEF}_{(i, \tau)}$, defined in (5.27), is a cross-categorial version of the operator the_x assumed by Sauerland (2004). When it combines with a predicate $\mathcal{P}$, this operator introduces the presupposition that the value of the variable (i, τ) satisfies $\mathcal{P}$. If the presupposition is satisfied, the value of (i, τ) is the result of the composition. For (5.26-a), the presupposition introduced by $\text{DEF}_{(1, \langle s, et \rangle)}$ is that the variable $(1, \langle s, et \rangle)$ is mapped to an individuating property of books. Given mainstream assumptions about presupposition projection, the function created by abstracting over this index will be undefined for any argument that is not an individuating property of books, which predicts that (5.26-a) can only be true if there is an individuating property of books that almost half of the users looked for. This is more or less what we need to predict the judgment in (5.24-a). In (5.26-b), on the other hand, the presupposition introduced by $\text{DEF}_{(1, \langle s, et \rangle)}$ is merely that the value of the variable is in the extension of the semantically empty predicate $\text{Sache}_{\langle s, et \rangle}$, which is true of arbitrary properties. There is therefore nothing to stop the indefinite

from ranging over non-individuating properties.

$$(5.26) \quad \begin{array}{ll} \text{a.} & [\text{dass } [[\exists_{\langle s, et \rangle} [\uparrow \text{Buch}_i]] [(1, \langle s, et \rangle) [\text{fast jeder Zweite}]] [\text{DEF}_{(1, \langle s, et \rangle)} \text{Buch}_i] \text{sucht}]]]] \\ \text{b.} & [\text{dass } [[\exists_{\langle s, et \rangle} \text{Sache}_{\langle s, et \rangle}] [(1, \langle s, et \rangle) [\text{fast jeder Zweite}]] [\text{DEF}_{(1, \langle s, et \rangle)} \text{Sache}_{\langle s, et \rangle}] \\ & \text{sucht}]]]] \end{array}$$

$$(5.27) \quad \text{For any numerical index } i \text{ and type } \tau: \\ \llbracket \text{DEF}_{(i, \tau)} \rrbracket^g = \lambda w. \lambda \mathcal{P}_{\langle \tau, t \rangle} : \mathcal{P}(g(i, \tau)) = 1. g(i, \tau)$$

A crucial prerequisite for this explanation of the contrast in (5.24) is that, in examples like (5.26-a), the complex trace does not include a copy of $\uparrow$. This would follow from Sauerland’s (2004) assumption that only the minimal constituent containing the lexical noun and its arguments, but excluding adjuncts, is repeated in the trace position.

In sum, there are alternative accounts of the data discussed in Section 2.2 that do not require a type distinction between ordinary and higher-order DPs and are therefore compatible with the exact-match analysis. The contrasts involving modifiers within the DP – numerals and relative clauses – could be derived from syntactic restrictions on the covert operator $\uparrow$. The lack of genuine unspecific readings with wide-scope indefinite objects of ITV then requires a different explanation. For instance, it could be derived by assuming traces with lexical content.

That said, the exact-match analysis does not provide a unified account of the data pattern from Section 2.2: First, the syntactic position of $\uparrow$ vis-a-vis the relative clause, its position relative to numerals and the claims about traces with lexical content are arguably logically independent of one another. The DP-based analysis, on the other hand, derives all the data discussed above from the type distinction. Second, the fact that ordinary DPs systematically license monotonicity inferences, while higher-order DPs do not, can be described within the exact-match analysis, but not predicted – there is no theory-internal reason why it should not be the other way around. On the DP-based account, it is expected that higher-order DPs, but not ordinary DPs, should be able to interfere with the monotonicity properties of the opaque verb, since the verb is contained in their restrictor and their nuclear scope. I therefore think that the data from Section 2.2 still leave us with an argument for a DP-based analysis – but it is merely a non-empirical argument based on considerations of simplicity. In the next section, I discuss a potential way of distinguishing between the two accounts on empirical grounds.

5.4 Lexical variation in monotonicity properties

In Section 5.2, I showed how to analyze ordinary belief ascriptions within Zimmermann’s (2006) exact-match approach. The basic idea was that the proposition p expressed by the complement clause is shifted to an existential quantifier over propositions that entail p . On this view, upward-monotonicity is a semantic property of the complement clause, not of the predicate. This has counterintuitive consequences once we consider predicates with different monotonicity properties: Instead of attributing upward-monotonicity or downward-monotonicity to the lexical meaning of the predicate, we have to assume that the predicate selects for an upward-monotonic or a downward-monotonic complement.

To see why this is necessary, consider the predicate *unmöglich* ‘impossible’, which allows for downward-monotonic inferences. A simplified semantics for this predicate is given in (5.28-a), where R is a conversational background in the sense of Kratzer (1978). Since this semantics predicts *unmöglich* to be lexically downward-monotonic, it is subject to a version of the monotonicity puzzle (see Section 3.1 for an illustration of the puzzle with such predicates). The exact-match analysis therefore forces us to give *unmöglich* a non-monotonic semantics along the lines of the lexical entry for *glauben* ‘believe’ in (5.11). In particular, in order to block downward-monotonic inferences, this semantics has to ensure that the propositional complement expresses the *weakest* relevant proposition that is incompatible with the conversational background. In order to illustrate the logic of this approach, I will ignore the relativization to a contextually provided question and its canonical subquestions and focus on the lexical meaning predicted by a simple extension of Zimmermann (2006). This meaning, given in (5.28-b), strengthens the conditional in (5.28-a) to a biconditional and therefore requires the propositional complement to be true in any world that is not compatible with the conversational background.

$$(5.28) \quad \begin{array}{ll} \text{a.} & \llbracket \textit{unmöglich} \rrbracket = \lambda w. \lambda R_{\langle s, \langle \langle s, t \rangle, t \rangle \rangle}. \lambda p_{\langle s, t \rangle}. \forall w' [w' \in \bigcap R(w) \rightarrow p(w') = 0] \\ \text{b.} & \llbracket \textit{unmöglich} \rrbracket = \lambda w. \lambda R_{\langle s, \langle \langle s, t \rangle, t \rangle \rangle}. \lambda p_{\langle s, t \rangle}. \forall w' [w' \in \bigcap R(w) \leftrightarrow p(w') = 0] \end{array}$$

When combined with a higher-order DP complement, (5.28-b) correctly blocks downward-monotonic inferences. But we now have to explain why ordinary complement clauses do make such inferences available. Following the basic logic of the exact-match analysis, downward-monotonicity has to be built into the meaning of the complement clause. Unsurprisingly, the operator $\uparrow_{\langle s, t \rangle}$, which was introduced in order to model *upward*-monotonic inferences, does not achieve this: While nothing we have said so far excludes an LF like (5.29-b) for (5.29-a), the predicted truth conditions, given in (5.29-c,d), are clearly incorrect, since they require that *every* world in which it is not raining, no matter how far-fetched, must be compatible with the conversational background. In other words, we predict that (5.29-b) can only be true if the conversational background does not distinguish in any way between worlds where it is not raining.

$$(5.29) \quad \begin{array}{ll} \text{a.} & \textit{Es ist unmöglich, dass es regnet.} \\ & \text{EXPL is impossible that EXPL rains} \\ & \text{‘It is impossible that it is raining.’} \\ \text{b.} & \llbracket \uparrow_{\langle s, t \rangle} [\textit{dass es regnet}] \rrbracket [(1, \langle s, t \rangle) \llbracket \textit{unmöglich } C_{(2, \langle s, \langle \langle s, t \rangle, t \rangle \rangle)} \rrbracket t_{(1, \langle s, t \rangle)} \rrbracket] \\ \text{c.} & \llbracket (5.29-b) \rrbracket^g = \lambda w. \exists p_{\langle s, t \rangle}. p \subseteq \llbracket \textit{es regnet} \rrbracket \wedge \forall w' [w' \in \bigcap g(2, \langle s, \langle \langle s, t \rangle, t \rangle \rangle)(w) \leftrightarrow p(w') = 0] \\ \text{d.} & \text{‘There is a proposition } p \text{ such that } p \text{ entails that it is raining and } p \text{ is the weakest proposition that is incompatible with the conversational background.’} \end{array}$$

The problem is that (5.29-c) involves quantification over propositions that are stronger than the proposition expressed by the complement clause. To license downward-monotonic inferences, we need to quantify over *weaker* propositions. The complements of downward-monotonic predicates must therefore contain another type-shifting operator that has the reverse effect on monotonicity, given in (5.30).

$$(5.30) \quad \llbracket \downarrow_{\langle s, t \rangle} \rrbracket = \lambda w. \lambda p_{\langle s, t \rangle}. \lambda \mathcal{P}_{\langle \langle s, t \rangle, t \rangle}. \exists q_{\langle s, t \rangle}. p \subseteq q \wedge \mathcal{P}(q)$$

Further, since (5.29-d) is not a possible reading of (5.29-a), we have to find some way of blocking

the LF in (5.29-b). The simplest way of doing so would be to assume that different predicates syntactically select for different operators in the left periphery of their complement clause: A verb like *glauben* ‘believe’ is upward-monotonic not because of its lexical meaning, but because it selects for $\uparrow_{\langle s,t \rangle}$, while *unmöglich* is downward-monotonic by virtue of a syntactic feature that forces us to insert $\downarrow_{\langle s,t \rangle}$. This opens up the possibility of deciding between the exact-match analysis and the DP-based analysis on the basis of morphosyntactic evidence. In particular, if upward-monotonicity and downward-monotonicity correlate with different operators in the C-domain of the embedded clause, we would expect there to be languages where complements of upward-monotonic and downward-monotonic predicates systematically exhibit distinct formal marking. While I am not aware of any language where this is the case, the question has, to my knowledge, not been studied on a broad typological basis. If this pattern should really turn out to be unattested, there would be good reason to believe that (non-)monotonicity is a property of opaque predicates, not of the complements they embed. An evaluation of this question will have to wait for future typological work.⁶

The prediction that the quantificational force usually associated with attitude predicates is actually due to the complements also has consequences for the analysis of presuppositions associated with attitude predicates. For instance, (5.31) is unacceptable in a context where nobody ever claimed that the earth is flat or at least introduced this proposition into the discourse.

- (5.31) *Der Hans bestreitet, dass die Erde flach ist.*
 the Hans denies that the earth flat is
 ‘Hans denies that the earth is flat.’

Usually, this is modeled as a presupposition introduced by the verb: If a proposition was not introduced into the previous discourse, the function that serves as the extension of the verb is undefined for that proposition. This creates a problem for the exact-match analysis: Since *bestreiten* ‘deny’ licenses downward-monotonic inferences in contexts where its presupposition is satisfied, the exact-match analysis forces us to assume a non-monotonic semantics for this verb that resembles the analysis of *unmöglich* ‘impossible’ given above. In order to capture the downward-monotonic inferences, the proposition expressed by the complement clause must then be shifted to an existential quantifier over propositions it entails. What this means, however, is that the verb in (5.31) does not necessarily semantically combine with the proposition $\llbracket \text{the earth is flat} \rrbracket$. Rather, it combines with a bound variable ranging over propositions entailed by $\llbracket \text{the earth is flat} \rrbracket$. Since we need access to the proposition $\llbracket \text{the earth is flat} \rrbracket$ in order to evaluate the presupposition, it follows that the presupposition trigger cannot be the verb itself, but must also be an element within the complement clause. This is empirically less problematic than the prediction that upward-monotonicity and downward-monotonicity are part of the meaning of the complement clause, since there is morphosyntactic evidence that presuppositions of this kind

⁶The prediction that monotonicity properties of clause-embedding predicates are due to the semantics of the embedded clause, not the predicate, is not specific to Zimmermann (2006). In several recent works (e.g. Kratzer 2006, Moulton 2009, Elliott 2017) it is assumed on independent grounds that attitude verbs merely denote relations between individuals and possible worlds and the apparent quantificational force of attitude predicates is actually introduced by the complementizer or another operator within the embedded clause. The consequences of this assumption for the analysis of monotonicity inferences are usually not explored in detail in the literature.

can be introduced by elements within the complement clause, at least in some languages. For instance, [Bogal-Allbritten & Moulton \(2018\)](#) show that Korean has a nominalizing suffix that applies to complement clauses and introduces the presupposition that the proposition expressed by the complement clause was mentioned in the discourse. Factivity presuppositions can also be added by functional elements within the complement, for instance in Hebrew (see e.g. [Kastner 2015](#)). However, the exact-match analysis requires a much stronger claim that is not made in either of the works cited: It predicts that *all* apparent lexical presuppositions of attitude verbs are actually due to the meaning of the complement.

Summing up, in order to make the exact-match analysis work for proposition-embedding predicates, several aspects of what is usually thought to be the lexical semantics of such predicates have to be shifted to the meaning of the complement clause. Since there is, to my knowledge, little independent support for this view, the fact that the DP-based analysis does not require us to posit any ambiguity in the complement clause should count in favor of this analysis – unless cross-linguistic evidence for such an ambiguity turns up.

To conclude this chapter, I want to briefly comment on a remark in [Zimmermann \(2006:757\)](#) that suggests that lexical variation between verbs with different monotonicity properties might not be a serious problem for the exact-match analysis. Zimmermann hypothesizes that intensional transitive verbs, which his paper is concerned with, are generally upward-monotonic – a generalization which, if true, would actually be predicted by the exact-match analysis, but not by the DP-based approach. However, this reasoning is called into question by the behavior of proposition-embedding verbs, which do show lexical variation in their monotonicity properties. In principle, one could take this to indicate that the monotonicity puzzle is resolved in different ways for the two classes of predicates: Higher-order DP complements of proposition-embedding verbs could receive a DP-based analysis, while higher-order DP complements of ITV could be analyzed along the lines of [Zimmermann \(2006\)](#). But a theory of this type would fail to account for semantic/pragmatic similarities between the two classes of higher-order DPs, such as the parallel behavior of domain-restricting modifiers for both classes of DPs (see Section 3.1). Further, the question arises whether the generalization that ITV are generally upward-monotonic is actually empirically correct. [Zimmermann \(2006\)](#) discusses potential counterexamples, but the main focus of his discussion is the verb *prevent*, which has been claimed to be ambiguous between upward-monotonic and non-upward-monotonic readings (see [Condoravdi et al. 2001a,b](#) for discussion) and therefore does not provide a clear test case. However, there is a class of ITV that seems to provide a more convincing counterexample, namely verbs of resemblance, which [Zimmermann \(1993\)](#) argues require a property argument just like *suchen/look for*. Zimmermann’s argument for a property-based analysis of *resemble* arguably extends to the German predicate *sich unterscheiden* ‘differ from’. On its non-extensional use, *sich unterscheiden* cannot be upward-monotonic, as illustrated by the fact that the inference from (5.32-a) to (5.32-b) is invalid – scenario (5.32) makes (5.32-a) true and (5.32-b) false.

- (5.32) SCENARIO: Mathematician Anna is supposed to review an article whose author claims to have a proof of the famous XY conjecture. She is very surprised since she has always believed that this conjecture is false. Indeed, it turns out that the author of the article

misunderstood the XY conjecture. The proof in the article doesn't contain any errors, but it proves a completely different statement that is only superficially related to the XY conjecture. Anna calls the journal editor and says:

- | | | |
|----|---|--------------|
| a. | <i>Dieser Text unterscheidet sich doch sehr von einem Beweis der</i>
this text differs REFL PRT very from a proof the.GEN
<i>XY-Vermutung.</i>
XY-conjecture
'This text is very different from a proof of the XY conjecture.' | true |
| b. | <i>Dieser Text unterscheidet sich doch sehr von einem Beweis.</i>
this text differs REFL PRT very from a proof
'This text is very different from a proof.' | false |

While *sich unterscheiden* is probably not downward-monotonic and hence does not show that we find the full range of logically possible monotonicity patterns in the domain of ITV, data like (5.32) suggests that ITV, like proposition-embedding verbs, are subject to some lexical variation concerning monotonicity.⁷ This provides additional support for my view that higher-order DPs of different types should receive a unified analysis.

⁷It should be pointed out that verbs of resemblance differ from other classes of ITV in several respects (cf. [van Geenhoven & McNally 2005](#), [Meier 2009](#); [Moltmann 1997](#):18 also gives an argument to this effect, but her empirical claims are called into question by [van Geenhoven & McNally 2005](#)). Therefore, Zimmermann's generalization might still hold for a certain natural subclass of ITV, depending on one's assumptions about potential counterexamples like *prevent*. However, the differences between verbs of resemblance and other ITV that I have seen mentioned in the literature are all compatible with an analysis on which verbs of resemblance take property complements along the lines of [Zimmermann \(1993\)](#). To save the generalization that property-embedding verbs are generally upward-monotonic, one would therefore need to give independent motivation for an analysis of verbs of resemblance on which they do not take property complements. [Meier \(2009\)](#) takes *resemble* to be an 'extranuclear' predicate like *worship* rather than a genuinely intensional predicate, but her paper focuses on the gradability of verbs of resemblance and, as far as I can see, does not show conclusively that there is anything wrong with an intensional analysis.

Chapter 6

Conclusion and outlook

In this thesis, I tried to present and motivate a certain picture of the semantic behavior of higher-order DP complements and their relation to ordinary complements of opaque verbs. Some aspects of this picture will strike the reader as unsurprising. For instance, given a type-theoretic semantic framework in which the arguments of opaque predicates denote elements of derived semantic domains such as propositions or properties, the claim that certain DPs can quantify over such objects is simply the result of taking their distribution at face value. Here, the main contribution of the present work is to show that this approach can be maintained in spite of the challenge posed by the monotonicity puzzle.

On the other hand, the present approach to the monotonicity puzzle, and particularly the idea that the domain of higher-order DPs is constrained by a subquestion decomposition computed on the basis of their restrictor and nuclear scope, is highly nonstandard. I expect that further research will uncover new problems with this proposal, but also show how its empirical motivation can be related to other aspects of DP semantics, and of natural language quantification more generally. This will be necessary to develop a more plausible implementation of the basic idea behind the present proposal.

To conclude the thesis, I will first try to summarize its main claims, the relations between them and their consequences for our general picture of the semantics of DPs and of opaque predicates (Section 6.1). Then, I will briefly discuss two of the most obvious open questions raised by the present work (Section 6.2).

6.1 Main claims of this thesis

Context-dependency and the monotonicity puzzle The main goal of Chapter 3 and Section 4.2 of this thesis was to take a fresh look at the monotonicity puzzle studied in Zimmermann (2006), taking a broader range of examples into account. Concerning the **scope of the problem**, I noted that the puzzle is not restricted to ITV like *suchen*, but extends to predicates thought to require arguments of other types, such as propositions or semantic questions. There is a second respect in which the puzzle is more general than previously noted: It seems that it is not restricted to upward-monotonic predicates, but also found with some non-upward-monotonic ones, such as *unmöglich* ‘impossible’. However, further empirical work is needed to see whether

these two classes of predicates really show fully analogous behavior with respect to the puzzle.

Like earlier discussions of the monotonicity puzzle (Zimmermann 2006, Moltmann 2008, 2013), the present work focuses on restricted higher-order existential statements. Unlike these works, its claims are based on **acceptability judgments on such statements relative to a scenario**, rather than judgments about the (in-)validity of inferences in which they appear as conclusions. I argued that this is necessary because, even though the inference pattern studied by Zimmermann (2006) is clearly not generally valid, an analysis of restricted higher-order existential statements should account for the differences between acceptable and unacceptable instances of the pattern.

For this reason, I concentrated on a subcase of the monotonicity problem in which the contextual domain of the higher-order DP is particularly easy to manipulate: examples with higher-order objects of *glauben* ‘believe’, which appear in the context of a question introduced in the preceding discourse or by means of a modifier like *zur Frage X* ‘as for the question X’. I claimed that in such cases, the domain of the higher-order DP consists of partial (semantic) answers to the contextually provided question.

This restriction to partial answers was the starting point for a more precise descriptive generalization about the quantificational domains of higher-order DPs. Given my general hypothesis that the non-monotonic behavior of restricted higher-order existential statements is due to the DP, not the predicate, it is natural to attribute it to additional **semantic constraints on domain selection within a higher-order DP**. If so, these constraints are unlike most other conditions on the domains of natural language quantifiers in that they appear to depend on the nuclear scope, as well as the restrictor, of the higher-order determiner.

At first sight, it seemed that these constraints can be described in terms of logical strength: Stronger partial answers ‘block’ weaker ones from being in the domain of the higher-order DP. However, we saw that this cannot be quite right, for two reasons: First, the ‘blocking’ condition appears to be sensitive to the Hamblin set of the contextually provided question – Hamblin answers are not ‘blocked’ by stronger partial answers, while disjunctive answers are blocked by Hamblin answers. Second, some preliminary data suggest that the ‘blocking’ mechanism is sensitive to the monotonicity properties of the embedding predicate.

Therefore, I ultimately proposed a more complex approach on which the quantificational domain depends on certain ‘canonical subquestions’ of the contextually provided question – roughly, questions corresponding to subsets of the Hamblin set. I argued that the Hamblin set has to be decomposed into canonical subquestions in a way that depends on the set of propositions satisfying either the restrictor or the nuclear scope of the higher-order DPs. While individual Hamblin answers are always in the domain of a higher-order DP, combinations of Hamblin answers are not unless the answers all belong to the same ‘block’ of the subquestion decomposition. The non-monotonic behavior of such DPs can then be attributed to constraints on the choice of a subquestion decomposition. This approach, unlike a ‘blocking’ mechanism based on logical entailment, extends to downward-monotonic predicates.

While I think the use of subquestion decompositions in the present analysis is well motivated,

given the semantic similarities between higher-order existential statements and QVE sentences (cf. Appendix A.3), the implementation will have to be revised in future work to account for a broader range of data. For instance, I did not discuss higher-order existential statements that are not restricted by a relative clause, sentences with quantifiers in the restrictor or nuclear scope of the higher-order DP, or sentences with higher-order universal quantifiers like *alles* ‘everything’.

Theoretical consequences for the monotonicity puzzle There are two main differences between my approach to the monotonicity puzzle and the competing analysis in Zimmermann (2006). First, on my account, the non-monotonic behavior of restricted higher-order existential statements is due to the DP, while on Zimmermann’s account, it is due to the predicate. Second, I claimed that the set of propositions we quantify over in this construction depends on the Hamblin set of a contextually salient question. This motivates an analogy between higher-order DPs ranging over propositions and other constructions in which we seem to quantify over ‘parts’ of questions, such as quantificational variability effects (Lahiri 2002, Beck & Sharvit 2002). This parallel, and the conditions under which it breaks down, will clearly require further study.

It is worth noting that the choice between an approach that relies on canonical subquestions and one that does not is logically independent from the choice between DP-based and predicate-based accounts. In particular, in Chapter 5 I presented an analysis of the monotonicity puzzle that is sensitive to Hamblin sets in the same way as my DP-based analysis, but attributes non-monotonicity to the predicate, following Zimmermann (2006). Similarly, a DP-based, but non-context-sensitive approach to the puzzle would be possible. At this point, I believe that there is good empirical motivation for the relevance of Hamblin sets and of the subquestion structure of contextually given questions, while the empirical case for my choice of a DP-based approach over a predicate-based one is weaker.

The choice between a predicate-based and a DP-based approach to the monotonicity puzzle has clear consequences for the semantics, and possibly the syntax, of ‘ordinary’ – non-higher-order – complements of opaque verbs. If opaque predicates are generally non-monotonic, these complements need to be shifted to higher-order meanings in order to account for the monotonicity inferences they license (Zimmermann 2006). If so, there is no type distinction between higher-order DP complements and ordinary DP complements of the same opaque predicate. Therefore, the DP-based approach to the monotonicity puzzle is what allows me to maintain one of the main claims of this thesis – that higher-order DPs are ‘cross-categorical’ or ‘type-flexible’ in a way that ordinary DPs are not.

The category-type correspondence In Chapter 2, I argued that higher-order DPs, unlike other DPs, have a cross-categorical semantics. What this means is that the meanings of determiners, as well as other functional elements within the DP such as numerals, are given by cross-categorical schemata that are compatible with any NP of type $\langle \tau, t \rangle$, where τ is an argument type. So, while we still distinguish between referential and quantificational DPs on the basis of the determiner semantics, the determiners are compatible with reference to, or quantification over, elements of the domain of any argument type, including derived types such as $\langle s, et \rangle$ or

$\langle s, t \rangle$.

On this account, the degree of type-flexibility a given DP actually shows in practice depends on the meaning of the NP. Most DPs have a single basic meaning on which they refer to or quantify over individuals, due to a type restriction introduced by the NP. In this case, a restricted set of type-shifting operators is still available, such as the operator BE that derives property readings of certain DPs (Partee 1987) or certain type-shifters needed to derive concealed-question readings of DPs (Nathan 2006). However, these operators are not enough to derive all the different interpretations available for higher-order DPs. For instance, ordinary DPs cannot denote quantifiers over properties, while higher-order DPs can. The special property of higher-order DPs, on this view, is that they involve a ‘cross-categorial’ or ‘type-flexible’ NP in addition to a cross-categorial determiner.¹

The present work thus provides an additional argument for the view that the syntactic category DP is not a homogeneous class of expressions from a semantic perspective. This argument is independent of the question whether the distinction between referential and quantificational DPs reflects a type distinction (Partee 1987) or not (e.g. Montague 1974). It also has more general methodological consequences for future work on the syntax-semantics interface: If a certain syntactic position or context allows clausal arguments, but disallows DPs, higher-order DPs should be tested separately in order to determine whether we are dealing with a genuinely syntactic restriction or a ban against the semantic types available to ordinary DPs (Nathan 2006, Elliott 2017).

‘Unspecificity’, intensionality and individuating properties To motivate the apparent type distinction between ordinary and higher-order DPs, I introduced a set of data that involved ‘unspecific’ DP objects of ITV like *suchen* ‘look for’. These data showed that the interpretation of higher-order indefinite objects of such verbs differs systematically from the interpretation of ordinary unspecific indefinites – a pattern that I took to reflect a semantic category distinction.

I argued that this distinction is obscured by two aspects of the semantics of such sentences: First, in simple examples in which the indefinite appears *in situ*, higher-order DPs and ordinary indefinites can both have genuinely unspecific readings, but for different reasons: While higher-order indefinites bind a variable of $\langle s, et \rangle$ in the object position of the verb, ordinary indefinites – being of type $\langle \langle e, t \rangle, t \rangle$ – can be shifted to a property interpretation of type $\langle s, et \rangle$ and thus combine directly with the verb. However, when the indefinite is interpreted outside its base position, this shifted interpretation of ordinary indefinites is no longer available, while higher-order indefinites can still bind a variable of type $\langle s, et \rangle$, giving rise to an ‘unspecific’ reading.

The second factor we have to control for to reveal the type distinction is the difference between what I called ‘individuating’ and ‘non-individuating’ properties. Many lexical nouns give rise to

¹My use of the term ‘cross-categorial’ here is a bit misleading since the arguments from Chapter 2 do not show that the complements of different classes of opaque predicates – ITV, attitude predicates and question-embedding predicates – are actually distinct. My assumption that they are distinct was motivated merely by compatibility with the mainstream view in the literature. For instance, theories in which properties and propositions have ‘correlates’ in the domain of individuals and higher-order DPs actually quantify over these correlates (Chierchia & Turner 1988) are compatible with all the substantial claims of this thesis, as long as the distinction between ordinary DPs and higher-order DPs is still expressible.

type/token ambiguities which can be modeled by assuming that they can either denote a property of ‘low-level individuals’ or a property of pairwise disjoint properties that can only be true of these low-level individuals. For instance, books can be individuated in a way that distinguishes between any two physical copies of a book, but also in a way that identifies different copies of the same literary text as ‘the same book’. The latter reading can be modeled as an instance of quantification over properties of physical books. I introduced the term ‘individuating properties’ to refer to properties that correspond to the ‘types’ involved in type/token ambiguities.

At first sight, type/token ambiguities seem to show that *a book* has a higher-order reading – a reading on which it quantifies over properties of physical copies of books. However, there is a systematic difference between DPs like *a book* and genuine higher-order DPs: The quantificational domain of a higher-order DP like *something* may include properties that are too weak to count as individuating on any plausible individuation method, while such properties cannot be in the domain of an ordinary DP like *a book*. When such non-individuating properties are used, several tests reveal semantic differences between ordinary and higher-order DPs. From these contrasts, I concluded that individuating properties may be treated as elements of the individual domain D_e for the purposes of semantic composition, while this is not the case for non-individuating properties. Regardless on whether this type distinction turns out to be well motivated, it seems that the distinctive feature of ‘unspecific’ readings in the grammatically relevant sense is that they allow for non-individuating properties. The data from Chapter 2 might therefore have broader consequences for the study of ITV and related constructions, since they suggest that other grammatical phenomena related to ‘specificity’ or intensionality should be revisited in the light of the distinction between individuating and non-individuating properties.

6.2 Selected topics for further research

Generalizing the individuation mechanism across types The most urgent question that was not addressed in this thesis is whether the approach developed in Chapters 3 and 4 can be extended to question-embedding and property-embedding predicates. The generalization that higher-order DPs exhibit more type-flexibility than ordinary DPs strongly suggests that their semantic contribution should be describable in terms of a cross-categorical schema, as in the standard analysis from Chapter 1. But I did not provide such a schema in Chapter 4: The interpretation of higher-order DPs quantifying over propositions was relativized to the set $\text{ANSWERS}(\mathfrak{c}, C, \mathcal{P} \cup \mathcal{Q})$, where C is the Hamblin set of the contextually provided question and $\mathcal{P}$ and $\mathcal{Q}$ are the restrictor and the nuclear scope of the determiner, respectively. Any attempt to generalize this idea to question-embedding predicates and to ITV faces several theoretical and empirical questions.

First, the present approach leads us to expect that higher-order DP objects of these predicates should be sensitive to contextually given sets of properties or of questions. In Section 3.1, I argued that this is correct, since the domains of such DPs can be manipulated by means of modifiers like *was X betrieff* ‘as for X’. However, the approach actually makes a stronger prediction whose empirical status is unclear to me: The sets determined by these modifiers

should have certain ‘designated’ elements that play the role of Hamblin answers. Especially in the domain of properties, it is not obvious what the counterpart of a Hamblin answer would be. Let us assume that an expression like *was die Sprachkenntnisse betrifft* ‘as for the language skills’ somehow determines a set of properties that are related to language skills, and do not distinguish between any two individuals with identical language skills. Without further assumptions, this set might contain the property of speaking Japanese, the property of speaking Japanese fluently, the property of speaking Russian, the property of speaking both Japanese and Russian, the property of speaking Japanese, Russian or both, and so on. So, in order to generalize the analysis from Chapter 4 to such cases, we need the modifier to determine a set of ‘atomic’, logically independent properties related to language skills. But how is this set determined in a given context?

A related question is whether the empirical observations from Section 3.3, which were my main motivation for an analysis that is sensitive to the Hamblin set of a question rather than just its partial answers, can be shown to extend to quantification over properties in the first place. In the case of quantification over propositions, we can identify the possible values of the domain-restriction variable with a class of semantic objects – Hamblin sets – that have been proposed and studied independently. We can therefore draw conclusions about their properties by studying the interpretation of questions and question-embedding predicates in constructions that do not involve higher-order DPs. This is what allows the present account to make testable, non-circular claims about the role of domain-restriction variables in the semantics of higher-order DPs. But there does not seem to be a similarly well-understood class of expressions that denote sets of logically independent *properties*. This raises the question how we can draw independently motivated conclusions about the way higher-order determiners ranging over properties interact with their domain restrictions. Since we saw that modifiers of the form *was X betrifft* ‘as for X’ can be used to introduce sets of properties, a broader study of their semantic contribution in other contexts might help us see whether the relevant sets of properties are really analogous to Hamblin sets.

Apart from the question how the DP-based analysis can be generalized to other cases of higher-order quantification, it is also worth considering whether the restrictions on higher-order DPs observed in Chapters 3 and 4 have any counterparts in the domain of ordinary DP quantification. Linguistic work on the role of contextually salient ‘covers’ in the semantics of plurals and distributivity seems relevant (Schwarzschild 1996), as do recent studies investigating the question which of the constraints on individuation at work in natural language semantics are tied to countability and the count/mass distinction (Rothstein 2017, Wągiel 2018).

Cross-linguistic questions While the discussion in this thesis was restricted to data from German and English, I think that some aspects of the present work – particularly the tests for higher-order DPs developed in Chapter 2 – provide an interesting background for future cross-linguistic work. As far as I know, there are no systematic cross-linguistic studies on higher-order DPs yet, which would mean that even simple typological questions are unanswered. Apart from the obvious question whether higher-order DPs exist in all languages that have some kind of DP quantification, it would be interesting to know whether there are languages in which higher-order

DPs involve special morphological marking that is systematically absent from ordinary DPs, such as specialized classifiers or specialized morphosyntactic forms of the determiners, and what the distribution of these markers is. For instance, if the distinction between ordinary and higher-order DP quantification should turn out to be formally marked on structurally lower elements within the DP, such as classifiers, and not on the determiner, this would arguably support a uniform, cross-categorical semantics for determiners. Cross-linguistic evidence could also help us decide whether the complex lexical entries for determiners proposed in Chapter 4 should be decomposed into several elements with distinct semantic contributions, some of which might be covert in languages like English and German.

Another potentially interesting cross-linguistic question raised by the present work is how higher-order DP quantification is expressed in languages that make a formal distinction between specific and non-specific interpretations of the objects of ITV. Existing work in cross-linguistic semantics describes two types of formal marking that correlates with this distinction. First, in some languages, there are ITV which are restricted to a specific interpretation when unmodified, but obtain an unspecific interpretation when they are combined with intransitivizing morphology (see [van Geenhoven & McNally 2005:891ff.](#) for relevant data from West Greenlandic).² Second, unspecific objects of ITV may differ from specific ones in their case or agreement properties or undergo incorporation (see [Deal 2008](#) for a survey of such examples from typologically diverse languages). Interestingly, [Deal \(2008:16ff.\)](#) argues that across languages both types of formal marking correlate with a type distinction between type *e* and type $\langle s, et \rangle$ objects, rather than a distinction between extensional and intensional readings. So, if Deal is correct, these morphosyntactic contrasts are sensitive to a semantic type distinction. Data on higher-order DPs in languages that exhibit such marking might therefore allow us to see whether the type distinction between DPs proposed in Chapter 2 has any cross-linguistic validity. For instance, this distinction makes a clear prediction about the interpretation of quantificational objects of ITV in examples where they cannot plausibly be interpreted *in situ*. Ordinary quantificational DPs are predicted to leave a trace of type *e*, while the traces of higher-order DPs can have type $\langle s, et \rangle$. If specificity marking on DPs is really sensitive to this type distinction rather than, say, wide scope of the DP, we would expect higher-order DPs, but not ordinary quantificational DPs, to be marked as unspecific. Similarly, in languages where intransitivizing verb morphology is needed for a non-specific reading, quantificational higher-order DP arguments are predicted to be compatible with this morphology even if they are not interpreted *in situ*. In sum, higher-order DPs provide a new way of addressing the question to what extent natural language morphosyntax is sensitive to semantic type distinctions.

²In contrast, according to [Deal \(2008\)](#), verbal morphology that derives the specific from the unspecific interpretation is not attested. If true, this generalization suggests that the unspecific interpretation of the verb should be semantically derivable from the specific one. This leads to a picture of the specific/unspecific ambiguity that is rather different from the one I presented in Chapter 2, where the ambiguity was derived by applying type-shifting operators to the object. In my view, further work is needed to determine whether such a decomposition of ITV is well motivated in a language like German.

Appendix A

Appendix: Odds and ends

A.1 Upward-monotonicity and logical omniscience

This is an extended footnote about the status of examples like (3.43)-(3.46), which I took to show that the monotonicity behavior of opaque predicates should be modeled as part of semantics. There is a conflict between this claim and the well-known observation that there is a sense in which attitude predicates are generally non-monotonic: If an embedded declarative p entails another embedded declarative q , then it seems that we can consistently assert *Peter believes p* and *Peter does not believe q* in case Peter is unaware of the entailment. This phenomenon is usually illustrated with mathematical equivalences, as in (A.1) (modeled after an example from Bäuerle & Cresswell 2003). Arguably, (A.1-b) can be judged false in a situation where (A.1-a) is true, for instance if John is unaware of the definition of a square root.

- (A.1) a. *John believes that 3 times 3 is 9.*
 b. *John believes that 3 is the square root of 9.*

Could this observation help us avoid the monotonicity puzzle? I believe it cannot, for the following reason. *Believe* is not generally non-monotonic in the sense that q no longer counts as a belief of Peter's if Peter has some other belief p that is, say, logically stronger, more salient, closer to the meaning of what he would utter when asked to describe his belief state, etc. The only genuine counterexamples to upward-monotonicity are situations in which the attitude subject has some other belief p that entails q and the subject is unaware of this entailment relation. The need to model different degrees of awareness of logical relations between sentence meanings leads to a broader problem (cf. Partee 1979 for a general discussion): Even if p and q are truth-conditionally identical, the truth conditions of *Peter believes p* and *Peter believes q* might differ. In linguistics, this problem has usually been taken to require a more fine-grained notion of sentence meaning than the one provided by sets of possible worlds (see Bäuerle & Cresswell 2003 for a survey).

If apparent cases of non-monotonicity with attitude predicates are indeed connected to hyperintensionality, we would expect that, in cases where there is no reason to doubt that the attitude subjects are aware of the relevant entailment relations, monotonicity inferences should be unobjectionable. For *believe* and its German counterpart *glauben*, this seems to be correct – for instance, (A.2) is intuitively judged valid, probably because we find it hard to imagine

an attitude subject that is unaware of such a simple entailment. On the other hand, the inferences in (A.3) and (A.4) are clearly invalid even if we assume Peter is competent enough to notice the entailment. So once we exclude situations in which hyperintensionality becomes relevant, proposition-embedding predicates show clear variation in their monotonicity properties and linguistic theory has to account for this variation.

(A.2) (A.2-a) $\Rightarrow$ (A.2-b)

- a. *Der Peter glaubt, dass es stark regnet.*
the Peter believes that it strongly rains
'Peter believes that it is raining heavily.'
- b. *Der Peter glaubt, dass es regnet.*
the Peter believes that it rains
'Peter believes that it is raining.'

(A.3) (A.3-a) $\nRightarrow$ (A.3-b)

- a. *Der Peter bestreitet, dass es stark regnet.*
the Peter denies that it strongly rains
'Peter denies that it is raining heavily.'
- b. *Der Peter bestreitet, dass es regnet.*
the Peter denies that it rains
'Peter denies that it is raining.'

(A.4) (A.4-a) $\nRightarrow$ (A.4-b)

- a. *Der Peter hat jetzt erst bemerkt, dass es stark regnet.*
the Peter has now PRT noticed that it strongly rains
'Peter didn't notice until now that it is raining heavily.'
- b. *Der Peter hat jetzt erst bemerkt, dass es regnet.*
the Peter has now PRT noticed that it rains
'Peter didn't notice until now that it is raining.'

If this is correct, the judgments about 'entailment' reported in Sections 3.1.1 to 3.1.3 are presumably actually about a weaker notion of entailment that is relativized to worlds in which the attitude subjects have the required logical competence. Arguably, there are other domains of grammar in which this more liberal notion, rather than unrelativized logical entailment, is relevant. One of them is the licensing of polarity items. A common generalization in this area of semantics is that NPIs like *auch nur irgendjemand* 'anyone at all' in (A.5) have to appear in an environment that generally supports downward-monotonic inferences. It has since been shown, however, that NPIs are acceptable in various non-monotonic environments that are not covered by this generalization. This has led to a class of analyses that assume weaker licensing conditions based on a weaker notion of entailment, such as von Stechow's (1999) notion of Strawson downward-monotonicity, defined in footnote 7 above. Given this background, the behavior of NPIs in the scope of attitude verbs suggests that yet another weakening of the relevant notion of entailment is called for: For instance, *bestreiten* 'deny' licenses NPIs (A.5-b), while *glauben* 'believe' does not, and NPIs in the complement of *glauben* can be licensed by a negative quantifier in the matrix clause (A.5-c). This is exactly the behavior we would expect if *glauben* counted as upward-monotonic and *bestreiten* as (Strawson) downward-monotonic. If we allow for the

possibility that a monotonicity inference can fail because the subject fails to notice the relevant entailment relation, however, both contexts should be non-monotonic.

- (A.5)
- a. *#Der Peter glaubt, dass auch nur irgendjemand gekommen ist.*
the Peter believes that also just anyone come.PTCP is
#‘Peter believes that anyone came.’
 - b. *Der Peter bestreitet, dass auch nur irgendjemand gekommen ist.*
the Peter denies that also just anyone come.PTCP is
‘Peter denies that anyone came.’
 - c. *Niemand glaubt, dass auch nur irgendjemand gekommen ist.*
nobody believes that also just anyone come.PTCP is
‘Nobody believes that anyone came.’

Such examples show independently that, while truth-conditional semantics needs to be sensitive to hyperintensional aspects of the semantics of attitude predicates, there is a grammatically relevant notion of monotonicity that is *not* sensitive to them. Further, the judgments in (3.43)-(3.46) suggest that by default, it is this notion, rather than unrelativized logical entailment, that underlies our intuitive judgments of semantic acceptability. If this general perspective is correct, we cannot avoid the monotonicity puzzle by pointing out that opaque predicates occasionally show non-monotonic behavior: Once we restrict our claims to scenarios in which the attitude subjects have the required logical competence to accept the relevant entailments among the embedded clauses, we expect to no longer see any effects of non-monotonicity. For instance, on this view, (A.6-b) is still predicted to be true in scenario (A.6-a), since in judging acceptability, we normally don’t consider scenarios in which Peter and Maria are unaware of simple facts about entailment.

- (A.6)
- a. SCENARIO: Maria believes that Germany will win the next World Cup and has no beliefs about tomorrow’s weather. Peter believes that it will rain tomorrow and has no beliefs about the World Cup.
 - b. *Der Peter glaubt etwas, das auch die Maria glaubt.*
the Peter believes something that also the Maria believes
‘Peter believes something that Maria also believes.’

In sum, while there is a sense in which opaque predicates are generally non-monotonic, this is not what normally underlies our judgments about the inferences supported by specific opaque predicates. The apparent non-monotonicity only shows up in scenarios that contradict our default assumption that the attitude subjects are aware of the relevant entailments between the meanings of complement clauses. This means that as long as the context allows us to attribute basic logical competence to the attitude subjects, the monotonicity puzzle persists. As an idealization, I will therefore stick to a possible-worlds semantics for opaque predicates which validates the monotonicity inferences observed in Section 3.1. An extension of the empirical and theoretical claims in this thesis to a framework that allows us to model different degrees of logical competence on the attitude subject’s part is left to future work.

A.2 Beck & Sharvit’s (2002) definition of subquestion decompositions

Beck & Sharvit (2002) develop a notion of ‘divisions’ of a question into parts that differs from my notion of a canonical subquestion decomposition in several respects. Here is a paraphrase of one subcase of their definition (Beck & Sharvit 2002:129, (82)), slightly adapted to match my terminology:¹

- (A.7) A set $\mathcal{D} \subseteq D_{\langle s, \langle \langle s, t \rangle, t \rangle \rangle}$ of questions is a division of a question Q into subquestions in a world w iff
- a. every $Q' \in \mathcal{D}$ is a subquestion of Q
 - b. and the weakly exhaustive answers to the subquestions in $\mathcal{D}$ in w jointly entail the strongly exhaustive answer to Q in w
 - c. and there is no proper subset $\mathcal{D}' \subseteq \mathcal{D}$ such that the weakly exhaustive answers to the subquestions in $\mathcal{D}'$ in w jointly entail the strongly exhaustive answer to Q in w .

An obvious difference between (A.7) and my definition in (4.12) is that Beck & Sharvit (2002) do not restrict their decompositions to canonical subquestions. But there are three other respects in which the two definitions differ.

Difference 1: Strong exhaustivity Instead of entailments between strongly exhaustive answers, Beck & Sharvit’s (2002) definition makes reference to weakly exhaustive answers. Roughly, the weakly exhaustive answer to a question Q in a world w is the conjunction of all the elements of Q ’s Hamblin set that are true in w . Further, unlike (4.12), Beck & Sharvit’s definition does not require that the exhaustive answers to the subquestions have to jointly entail an exhaustive answer to our original question Q in every world: The entailment only has to hold between those exhaustive answers that are true in the evaluation world. This definition is adopted in order to account for QVE sentences that allow for a weakly exhaustive reading of the embedded question, i.e. that can be paraphrased in terms of a relation between an attitude subject and the weakly exhaustive answer to the embedded question in the evaluation world. Since my discussion in Chapter 4 is restricted to the non-question-embedding predicate *glauben* ‘believe’ and to proposition-embedding readings of *wissen* ‘know’, I removed this world-dependence from the definition in order to be able to derive more straightforward predictions. Whether higher-order DPs are ever sensitive to a world-dependent notion of subquestion is a matter for future work.

Difference 2: Definition of ‘subquestion’ The second difference is more important for the topic at hand. Beck & Sharvit employ a notion of ‘subquestion’ that is much weaker than subsumption:

- (A.8) Q' is a subquestion of Q iff there is a $p \in \text{SEA}(Q')$ and a $q \in \text{PA}(Q)$ such that $p \subseteq q$.

¹The actual definition has a second subcase in which (A.7-b) only requires the answers to the subquestions to entail a *weakly* exhaustive answer to Q in w . This is motivated by the behavior of certain question-embedding predicates which, when they occur in QVE sentences, seem to have a reading that ‘ignores’ Hamblin answers that are false in the evaluation world.

(A.8) says that *some* strongly exhaustive answer to the subquestion has to determine a partial answer to the larger question. This notion of subquestion is very liberal – for instance, given a fixed domain of individuals, it predicts that $\llbracket \textit{who owns a red car} \rrbracket$ and $\llbracket \textit{who owns a car} \rrbracket$ are subquestions of each other: The proposition $\llbracket \textit{Anna and nobody else owns a red car} \rrbracket$ is a strongly exhaustive answer to $\llbracket \textit{who owns a red car} \rrbracket$ and entails that Anna owns a car, which is a partial answer to $\llbracket \textit{who owns a car} \rrbracket$. So $\llbracket \textit{who owns a red car} \rrbracket$ counts as a subquestion of $\llbracket \textit{who owns a car} \rrbracket$. But at the same time, the proposition $\llbracket \textit{nobody owns a car} \rrbracket$ exhaustively answers $\llbracket \textit{who owns a car} \rrbracket$ and clearly entails that nobody owns a red car, which is a partial answer to $\llbracket \textit{who owns a red car} \rrbracket$. So the converse holds as well and $\llbracket \textit{who owns a car} \rrbracket$ and $\llbracket \textit{who owns a red car} \rrbracket$ are predicted to be subquestions of each other.

While there might be grammatical phenomena that rely on this notion of subquestion, it is arguably too weak to capture the semantics of quantifiers restricted by a question. For instance, the QVE sentence (A.9-b) seems plainly false in scenario (A.9-a) even though putative subquestions like $\llbracket \textit{who owns a red car} \rrbracket$ are highly salient in this scenario. This suggests that questions of the form $\llbracket \textit{who owns a red car} \rrbracket$, $\llbracket \textit{who owns a blue car} \rrbracket$ etc. do not form a subquestion decomposition of $\llbracket \textit{who owns a car} \rrbracket$ for the purposes of interpreting QVE structures. More importantly for our present purposes, this subquestion decomposition is not available for the interpretation of higher-order DPs either: The higher-order identity statement in (A.9-c) is true in the given scenario, even though Brit knows more about the colors of the cars than Anna.

- (A.9) a. SCENARIO: Anna and Brit want to organize a car parade in their village. For this purpose, they want to find out who the car owners in the village are and what colors their cars are. With the help of the police, they were able to compile an exhaustive list of all car owners. But the police has no data about the colors of the cars. Brit has now found out the colors of some of the cars, but she has not told Anna yet and Anna does not know anything about the colors of the cars.
- b. *Anna und Brit wissen nur teilweise, wer hier ein Auto besitzt.*
 Anna and Brit know only partly who here a car owns
 ‘Anna and Brit know only in part who owns a car here.’ false
- c. *Zur Frage, wer hier ein Auto besitzt, wissen Anna und Brit dasselbe.*
 to.the question who here a car owns know Anna and Brit the.same
 ‘As for the question who owns a car here, Anna and Brit know the same thing(s).’
 true

Definition (4.12), on the other hand, accounts for the judgments in (A.9) since neither of the questions $\llbracket \textit{who owns a car} \rrbracket$ and $\llbracket \textit{who owns a red car} \rrbracket$ subsumes the other.

Difference 3: Minimality condition The third difference between the two definitions has to do with the way they deal with redundancy. Both definitions exclude decompositions that contain questions Q and Q' such that Q' is a subquestion of Q . But while my definition (4.12) does not involve any further constraints on ‘redundant’ subquestions, Beck & Sharvit’s (2002) definition (A.7) imposes a stronger condition: Condition (A.7-c) states that the decomposition S may not have any proper subset S' that satisfies the two other conditions of the definition, (A.7-a) and (A.7-b). Adding this condition to my definition would mean that, for instance, (A.10-a) would not be a canonical subquestion decomposition of $\{\mathbf{a}, \mathbf{b}, \mathbf{c}\}$, since it has proper

subsets that are canonical subquestion decompositions, like (A.10-b) or (A.10-c).

- (A.10)a. $\{\text{SQ}(\{\mathbf{a}, \mathbf{b}\}), \text{SQ}(\{\mathbf{b}, \mathbf{c}\}), \text{SQ}(\{\mathbf{a}, \mathbf{c}\})\}$
 b. $\{\text{SQ}(\{\mathbf{a}, \mathbf{b}\}), \text{SQ}(\{\mathbf{b}, \mathbf{c}\})\}$
 c. $\{\text{SQ}(\{\mathbf{a}, \mathbf{b}\}), \text{SQ}(\{\mathbf{a}, \mathbf{c}\})\}$

The advantage of not including a subset-minimality condition is that, in many cases, the definition of $\text{ADAPT}_C(\mathcal{D}, S, \mathcal{D}')$ yields a unique adapted subquestion decomposition. If the adapted decomposition has to be subset-minimal, as required in (A.7), the result is often not unique – for instance, adapting $\{\text{SQ}(\{\mathbf{a}\}), \text{SQ}(\{\mathbf{b}\}), \text{SQ}(\{\mathbf{c}\})\}$ to the set $\{\mathbf{a} \vee \mathbf{b}, \mathbf{b} \vee \mathbf{c}, \mathbf{a} \vee \mathbf{c}\}$ could yield either of the two decompositions in (A.10-b,c).

A.3 Subquestion decompositions and plurals in questions (Beck & Sharvit 2002)

In this appendix, I provide an additional, indirect argument for the use of subquestion decompositions in the semantics of higher-order DPs. It is based on Beck & Sharvit’s (2002) claim that subquestion decompositions are needed to give a compositional analysis of QVE structures. Beck & Sharvit further observe that the subquestions that matter for the analysis of QVE cannot always be derived from Hamblin sets as they are usually conceived. The reason is that QVE sentences seem to be sensitive to the part-whole structures introduced by non-*wh* plural expressions like *the students* (cf. also Lahiri 2002 for this observation), but on most existing theories of question semantics (including Hamblin 1973), non-*wh* plurals do not have any special status. Beck & Sharvit (2002) therefore propose a more liberal notion of ‘parts’ of a question which allows non-*wh* plural expressions to contribute to the part-whole structure of a question in the same way as plural *wh*-expressions. Their formal analysis is arguably too permissive since the possible subquestion decompositions are no longer constrained by the grammatical structure of the question at all. Nonetheless, the type of data they discuss provides a new way of diagnosing whether a semantic phenomenon is sensitive to the part-whole structures of questions. Using examples that resemble theirs, I will argue that these part-whole structures influence the interpretation of higher-order DPs as well.

Beck & Sharvit (2002) are concerned with the problem of giving a compositional analysis of QVE sentences that extends to the full range of predicates that allow for QVE. The earlier literature (see Lahiri 2002) connects QVE readings to the ability of a question-embedding predicate to also embed propositions. But Beck & Sharvit (2002) challenge this putative correlation and claim that interrogatives with QVE readings can sometimes also appear in positions that disallow propositional complements, such as the subject position of (present-tense) *depend* (A.11-a).² For instance, (A.11-a) does not have a natural paraphrase with a propositional complement, but can be paraphrased as in (A.11-b), which crucially still involves an interrogative complement.

- (A.11)a. *Who will be admitted depends for the most part exclusively on this committee.*

²It should be pointed out that Nathan (2006:ch. 5) challenges this view and provides a detailed defense of the correlation between QVE and the ability of verbs to embed propositional complements.

- b. ‘For most people, it depends exclusively on this committee whether they will be admitted.’

Beck & Sharvit argue that, in order to derive the prominent reading of (A.11-a) compositionally, the modifier *for the most part* should be interpreted as quantifying over ‘parts’ of the question denotation that are themselves questions, rather than propositions.³ Their paraphrase, given in (A.11-b), suggests that the quantificational domain of the adverbial is a set of subquestions of the question $\llbracket \textit{who will be admitted} \rrbracket$, as sketched in (A.12-b). For the purposes of examples like (A.11-a), we can take these subquestions to be polar questions corresponding to Hamblin answers, as in (A.12-a).

- (A.12)a. For any semantic question $Q \in D_{\langle\langle s,t \rangle, t \rangle}$: $\text{PARTS}(Q) = \{\text{SQ}(\{p\}) \mid p \in Q\}$
 $\text{PARTS}(\llbracket \textit{who will be admitted} \rrbracket) = \{\llbracket A \textit{ will be admitted} \rrbracket, \llbracket A \textit{ will not be admitted} \rrbracket, \llbracket B \textit{ will be admitted} \rrbracket, \llbracket B \textit{ will not be admitted} \rrbracket, \dots$
 b. $\lambda w. \llbracket \textit{most} \rrbracket(w)(\text{PARTS}(\llbracket \textit{who will be admitted} \rrbracket(w)))$
 $(\lambda Q_{\langle\langle s,t \rangle, t \rangle}. \llbracket \textit{depends exclusively on this committee} \rrbracket(w)(Q))$

But importantly, Beck & Sharvit (2002) argue that this is still not the complete picture: There are some QVE examples that seem to involve quantification over more fine-grained subquestions that do not correspond to Hamblin answers. In particular, this is the case if the embedded question contains non-interrogative plural expressions, as in (A.13):

- (A.13) *Luise knows for the most part which books these professors recommended.*
 (Beck & Sharvit 2002:125, (67))

An analysis along the lines of (A.12) would predict that (A.13) has only one QVE reading, on which Luise has to know the answers to most of the subquestions in (A.14-a). The exact meanings of the questions in (A.14-a) depend on one’s semantics of definite plurals, but if nothing special is said about the role of plurals in interrogative semantics, they presumably ask whether all of the professors recommended book A, whether all of the professors recommended book B and so on.⁴ Now Beck & Sharvit (2002) point out, following the earlier literature, that there is at least one additional construal of (A.13). On this construal, (A.13) says that, for most of the professors, Luise has to know which books they recommended – in other words, she has to be able to answer most of the subquestions in (A.14-b). This construal is not straightforwardly derivable on the basis of the Hamblin set, since implementations of alternative semantics for questions usually do not assign a special status to non-interrogative plural DPs. While Beck & Sharvit (2002) do not explicitly discuss other potential construals of (A.13), their analysis actually predicts that there should be many more ways of dividing the embedded question in (A.13) into subquestions. Two particularly salient ones are given in (A.14-c,d). While further research is needed to determine

³A reading of (A.11-a) on which *for the most part* modifies the degree of dependence on the committee can be ruled out since it would clash with the meaning of *exclusively*.

⁴For some reason, the paraphrase of this subquestion decomposition given in Beck & Sharvit (2002:125, (70)) involves existential quantification over the professors: One example of a question in this decomposition, according to them, would be $\llbracket \textit{whether one of these professors recommended book A} \rrbracket$. It is unclear to me how they derive these existential readings of the plural definites since they are not what mainstream analyses of plurals (even in cumulative sentences) predict.

which of these additional construals are empirically justified⁵, the main point for now is that plurals inside an interrogative seem to be able to impose their ‘part structure’ on the denotation of the interrogative: The question denotation seems to have parts that correspond to parts of the embedded plural, although the semantic mechanism that derives such denotations is not well understood yet.

- (A.14)a. $\llbracket \text{whether these professors recommended book } A \rrbracket$,
 $\llbracket \text{whether these professors recommended book } B \rrbracket$, ...
 b. $\llbracket \text{which books professor 1 recommended} \rrbracket$, $\llbracket \text{which books professor 2 recommended} \rrbracket$,
 $\llbracket \text{which books professor 3 recommended} \rrbracket$, ...
 c. $\llbracket \text{which of these professors recommended book } A \rrbracket$,
 $\llbracket \text{which of these professors recommended book } B \rrbracket$, ...
 d. $\llbracket \text{whether professor 1 recommended book } A \rrbracket$,
 $\llbracket \text{whether professor 2 recommended book } B \rrbracket$, ...

Cumulative sentences provide an additional argument for the claim that question denotations involve a ‘part structure’ that is more fine-grained than the Hamblin set. Beck & Sharvit (2002:44ff.) show that, when a question-embedding predicate combines with a plural subject as in (A.15), there is a reading involving a cumulative relation between the atomic individuals constituting the plural subject and certain subquestions of the embedded question. For instance, (A.15) may be true if the students told the speaker different propositions that each answer a subquestion and that jointly entail an answer to the embedded question.

- (A.15) *These students told me which books those professors recommended.*
 (Beck & Sharvit 2002:152, (164-a))

While Beck & Sharvit (2002) clearly intend the cumulative reading to be sensitive to ‘parts’ of the question that correspond to atomic parts associated with the plural *those professors*, they do not elaborate on the exact truth conditions of (A.15). At least for the German counterpart of this example, (A.16-a), it seems to me that the scenarios in (A.16-b) and (A.16-c) can both make it true on the relevant reading. Scenario (A.16-b) corresponds to a subquestion decomposition of the kind sketched in (A.14-b), while (A.16-c) requires subquestions that ask whether a specific professor recommended a specific book, which suggests that the subquestion decomposition in (A.14-d) is available as well.

- (A.16)a. *Diese Studenten haben mir gesagt, welche Bücher diese Professorinnen*
 these students have me.DAT said which books these professors.FEM
empfohlen haben.
 recommended have
 ‘These students told me which books these professors recommended.’
 b. SCENARIO: There are two relevant professors, Sarah and Anna. One student, Hans, told the speaker which books Sarah recommended and another student, Peter, told the speaker which books Anna recommended.
 c. SCENARIO: There are two relevant professors, Sarah and Anna. One student, Hans, told the speaker that Sarah recommended book A and Anna recommended book C. Another student, Peter, said that Sarah also recommended book B and Anna also

⁵For instance, Lahiri (2002) argues, in a different framework, that we should not allow for a part structure like (i-d) since, when combined with a proportional quantifier like *for the most part*, it gives rise to a ‘proportion problem’ of the type found in dynamic semantics.

recommended book D. Sarah and Anna did not recommend any other books.

In the scenarios in (A.16-b,c), neither of the two students told the speaker a complete answer to the embedded question. However, the question can be decomposed into subquestions such that, between them, the two students answered all subquestions in the decomposition.⁶ Since these subquestions are, on standard assumptions, not derivable from Hamblin answers in the way indicated in (A.12-a) above, such examples motivate a semantics for questions that does not identify their denotations with Hamblin sets – or, put differently, a way of computing Hamblin sets that allows plurals, as well as *wh*-expressions, to ‘generate’ non-trivial alternatives.

How do these observations relate to higher-order DPs? The main empirical observation to be made here is that the sets of propositions higher-order DPs quantify over, just like the subquestion decompositions that matter for QVE, are not always definable on the basis of the Hamblin set. Further, the conditions under which the quantificational domain has additional structure that goes beyond the Hamblin set are similar for higher-order DPs and QVE. As an illustration, consider (A.17-b), which seems true in the scenario given in (A.17-a).

- (A.17)a. SCENARIO: Hans and Peter find it frustrating that their three professors, Maria, Sarah and Anna, usually recommend completely different books. This time, they did not pay much attention when the recommended reading was discussed in class. Hans thinks Maria recommended book 1 and Sarah recommended book 2, and Peter also thinks Sarah recommended book 2, but neither of them can remember which other books Maria and Sarah recommended or whether Anna recommended any books.
- b. *Zur Frage, welche Bücher die drei Professorinnen empfohlen haben,*
to the question which books the three professors recommended have
glaubt der Peter etwas, das der Hans auch glaubt.
believes the Peter something REL the Hans also believes
‘As for the question which books the three professors recommended, Hans believes
something Peter also believes.’ **true in (A.17-a)**

Without additional assumptions about the role of plurals in interrogative semantics, the Hamblin set of the embedded question in (A.17-b) will be restricted to propositions like $\llbracket$ *the three professors recommended book 1* $\rrbracket$, $\llbracket$ *the three professors recommended book 2* $\rrbracket$ and so on. In scenario (A.17-a), neither Hans nor Peter believes any proposition of this kind. Further, since neither of them even has an opinion as to whether there were any books that all three professors recommended, they do not believe any disjunctions or conjunctions of these Hamblin answers either. This means that the notion of canonical subquestion decompositions from Section 4.2.1, which is defined on the basis of the Hamblin set, cannot distinguish between scenarios like (A.17-a) and scenarios in which Hans and Peter are completely uninformed about the domain-restricting question.

The judgment in (A.17) suggests that propositions like $\llbracket$ *Sarah recommended book 2* $\rrbracket$ should count as partial answers to the question $\llbracket$ *which books the three professors recommended* $\rrbracket$. If so,

⁶As discussed by Beck & Sharvit (2002), many examples of QVE and of cumulative readings of questions have a reading that does not require a strongly exhaustive answer to the embedded question. For instance, it seems that (A.16-a) can also be true if the students, between them, mentioned all books recommended by the professors, but it does not follow from their statements that these were all the books recommended by the professors and hence they did not give a strongly exhaustive answer. Since the exact truth conditions of weaker exhaustive readings of questions are still not well understood (see e.g. Cremers & Chemla 2016), I will ignore this aspect of the problem in my discussion of subquestion decompositions.

the projection mechanism that determines the Hamblin set should be redefined in such a way that the parts introduced by the denotations of definite plurals can give rise to distinct elements of the set. For instance, the embedded question in (A.17) could have the Hamblin set in (A.18), and a polar question containing a plural definite could have a non-trivial Hamblin set along the lines of (A.19). If partial answers are defined on the basis of these modified Hamblin sets, we correctly predict that $\llbracket \textit{Sarah recommended book 2} \rrbracket$ may count as a partial answer for question (A.18) (if the question is evaluated at an index where Sarah is a professor) and $\llbracket \textit{Anna will come} \rrbracket$ may count as a partial answer for (A.18).

(A.18) Given scenario (A.17-a):

$$\begin{aligned} & \llbracket \textit{which books the three professors recommended} \rrbracket(w) \\ &= \{ \lambda w'. \textbf{recommend}(w')(\textbf{book}_1)(\textbf{anna}), \lambda w'. \textbf{recommend}(w')(\textbf{book}_1)(\textbf{maria}), \\ & \lambda w'. \textbf{recommend}(w')(\textbf{book}_1)(\textbf{sarah}), \lambda w'. \textbf{recommend}(w')(\textbf{book}_2)(\textbf{anna}), \\ & \lambda w'. \textbf{recommend}(w')(\textbf{book}_2)(\textbf{maria}), \lambda w'. \textbf{recommend}(w')(\textbf{book}_2)(\textbf{sarah}), \dots \} \end{aligned}$$

(A.19) Given a scenario where $\llbracket \textit{the linguists} \rrbracket = \textbf{anna} \oplus \textbf{brit} \oplus \textbf{carl}$:

$$\llbracket \textit{whether the linguists will come} \rrbracket(w) = \{ \lambda w'. \textbf{come}(w')(\textbf{anna}), \lambda w'. \textbf{come}(w')(\textbf{brit}), \lambda w'. \textbf{come}(w')(\textbf{carl}) \}$$

In this thesis, I did not give a formal semantics that derives the Hamblin sets in (A.19), since doing so would require a broader discussion of semantic plurality in questions, which would take us too far afield here. One of the issues that one would need to resolve in order to develop such a formal system is how plural *wh*-phrases and non-*wh* plural definites differ in their contributions to semantic composition. In other words, how does (A.20-a) differ from (A.20-b)?

(A.20)a. *Luise weiß zum Großteil, welche Bücher die drei Professorinnen*

Luise knows to.the large.part which books the three professors.FEM

empfohlen haben.

recommended have

‘For the most part, Luise knows which books the three professors recommended.’

b. *Luise weiß zum Großteil, welche Bücher welche von den drei Professorinnen*

Luise knows to.the large.part which books which of the three professors.FEM

empfohlen haben.

recommended have

‘For the most part, Luise knows which of the three professors recommended which books.’

Another issue is how the semantic contributions of singular and plural *wh*-phrases should be distinguished. For instance, (A.21) implies that each of the professors recommended only one book, and a QVE interpretation of *zum Großteil* ‘for the most part’, which is harder to get here than in (A.20-a), can only mean that for most of the ten professors, Luise knows which unique book they recommended.

(A.21) *Luise weiß (?zum Großteil), welches Buch diese zehn Professorinnen empfohlen*

Luise knows to.the large.part which book these ten professors recommended

haben.

have

‘For the most part, Luise knows which of these ten professors recommended which book.’

As a final descriptive observation about subquestion decompositions, I would like to point out

that the interpretation of questions can apparently be sensitive to semantic part-whole structures which, strictly speaking, are unrelated to plurality. An example of this is given in (A.22).

- (A.22)a. SCENARIO: Meteorologists Anna and Bea are asked to predict tomorrow's weather in Austria. Anna thinks that there will not be any rain in Tyrol, Salzburg and Upper Austria, but is not sure about the other regions. Bea thinks there will not be any rain in Salzburg, Upper Austria and Lower Austria, but she is not sure about the other regions.
- b. *Zur Frage, ob es in Österreich regnen wird, glaubt die Anna*
 to.the question whether EXPL in Austria rain will believes the Anna
etwas, das die Bea auch glaubt.
 something REL the Bea also believes
 'As for the question whether it will rain in Austria, Anna believes something Bea also believes.' **true**

(A.22-b) seems to be true in the given scenario because Anna and Bea agree on the proposition that there will be no rain in Upper Austria and Salzburg. Given the discussion in Section 3.2 above, this proposition should therefore count as a partial answer to the question whether it will rain in Austria. Needless to say, the traditional way of deriving Hamblin sets cannot account for this, since it simply gives us the Hamblin set $\{\llbracket it\text{ will rain in Austria} \rrbracket, \llbracket it\text{ will not rain in Austria} \rrbracket\}$, and neither Anna nor Bea is committed to either of the two answers in this set. But even a framework of the kind sketched in the preceding paragraphs, where each atomic part associated with a semantically plural expression 'generates' a separate Hamblin answer, does not generate the right subquestion decomposition for (A.22) since the embedded question in (A.22) does not contain any plural expressions.

What this suggests is that the denotations of questions are sensitive to the presence of subexpressions whose denotations have a 'part-whole structure' in a very general sense, not just to the presence of plurals. In the context of (A.22-a), there are subquestions corresponding to salient parts of Austria, such as $\llbracket whether\text{ it will rain in Salzburg} \rrbracket$, and partial answers to these subquestions matter for the interpretation of the higher-order DP even if they would not count as partial answers relative to the traditional Hamblin set.⁷ If so, the central claim of this section – that there is an analogy between the part-whole structures of questions in QVE sentences and the part-whole structures of questions that restrict higher-order DPs – predicts that sentences like (A.23) should have QVE readings.

- (A.23) *Die Anna weiß zum Großteil, ob es in Österreich regnen wird.*
 the Anna knows to.the large.part whether EXPL in Austria rain will
 'For the most part, Anna knows whether it will rain in Austria.'

That is, (A.23) should have a reading on which it means that for most salient parts x of Austria, Anna knows whether it will rain in x . My judgment is that this is indeed possible, but the matter still awaits further empirical investigation.

⁷The data discussed in Beck & Sharvit (2002) do not make this clear because the examples they use to motivate their notion of parts of questions all involve expressions that can be analyzed as denoting pluralities with atomic parts: plural DPs, predicate conjunctions (see Schmitt 2017 for arguments that these are plural expressions) and singular universal quantifiers (which show one of the hallmarks of semantic plurality, cumulative readings, as discussed by Schein 1993, Kratzer 2003, Champollion 2010, Haslinger & Schmitt 2018 a.o.).

Bibliography

- Aloni, Maria. 2001. *Quantification under Conceptual Covers*: Universiteit van Amsterdam dissertation.
- Asher, Nicholas. 1993. *Reference to abstract objects in discourse* (Studies in Linguistics and Philosophy 50). Dordrecht: Kluwer.
- Bäuerle, Rainer & M. J. Cresswell. 2003. Propositional Attitudes. In D. M. Gabbay & F. Guenther (eds.), *Handbook of Philosophical Logic*, vol. 10, 121–141. Dordrecht: Springer 2nd edn.
- Bäuerle, Rainer & Thomas Ede Zimmermann. 1991. Fragesätze. In [von Stechow & Wunderlich \(1991\)](#) 333–348.
- Beck, Sigrid. 2000. The semantics of *different*: Comparison operator and relational adjective. *Linguistics and Philosophy* 23. 101–139.
- Beck, Sigrid & Yael Sharvit. 2002. Pluralities of Questions. *Journal of Semantics* 19. 105–157.
- Bogal-Allbritten, Elizabeth & Keir Moulton. 2018. Nominalized clauses and reference to propositional content. In Robert Truswell, Chris Cummins, Caroline Heycock, Brian Rabern & Hannah Rohde (eds.), *Proceedings of Sinn und Bedeutung 21*, 215–232.
- Büring, Daniel. 1997. The great scope inversion conspiracy. *Linguistics and Philosophy* 20(2). 175–194.
- Büring, Daniel. 2003. On D-Trees, Beans, and B-Accents. *Linguistics and Philosophy* 26(5). 511–545.
- Champollion, Lucas. 2010. Cumulative readings of *every* do not provide evidence for events and thematic roles. In Maria Aloni, Harald Bastiaanse, Tikitou de Jager & Katrin Schulz (eds.), *Logic, Language and Meaning*, 213–222. Heidelberg: Springer.
- Chierchia, Gennaro & Raymond Turner. 1988. Semantics and Property Theory. *Linguistics and Philosophy* 11. 261–302.
- Chomsky, Noam. 1981. *Lectures on Government and Binding. The Pisa Lectures*. Dordrecht: Foris.
- Condoravdi, Cleo, Dick Crouch & Martin van den Berg. 2001a. Counting Concepts. In *Proceedings of the Thirteenth Amsterdam Colloquium*, 67–72. Amsterdam.

- Condoravdi, Cleo, Dick Crouch, Martin van den Berg, John Everett, Valeria Paiva, Reinhard Stolle & Danny Bobrow. 2001b. Preventing Existence. In *FOIS '01*, ACM.
- Counihan, Marian. 2008. *Looking for logic in all the wrong places: An investigation of language, literacy and logic in reasoning*: University of Amsterdam dissertation.
- Cremers, Alexandre & Emmanuel Chemla. 2016. A Psycholinguistic Study of the Exhaustive Readings of Embedded Questions. *Journal of Semantics* 33(1). 49–85.
- Deal, Amy Rose. 2008. Property-type objects and modal embedding. In Atle Grønn (ed.), *Proceedings of Sinn und Bedeutung 12*, Oslo: ILOS.
- Elliott, Patrick D. 2017. Explaining DPs vs. CPs without syntax. In *Proceedings of CLS 52*, 171–185. Chicago Linguistic Society.
- von Fintel, Kai. 1994. *Restrictions on quantifier domains*: University of Massachusetts dissertation.
- von Fintel, Kai. 1999. NPI Licensing, Strawson Entailment, and Context Dependency. *Journal of Semantics* 16. 97–148.
- Geach, Peter. 1972a. Class and concept. In *Logic Matters*, 226–235. Oxford: Basil Blackwell.
- Geach, Peter. 1972b. A medieval discussion of intentionality. In *Logic Matters*, 129–138. Oxford: Basil Blackwell.
- van Geenhoven, Veerle & Louise McNally. 2005. On the property analysis of opaque complements. *Lingua* 115. 885–914.
- Grimshaw, Jane. 1979. Complement Selection and the Lexicon. *Linguistic Inquiry* 10(2). 279–326.
- Groenendijk, Jeroen & Martin Stokhof. 1984. *Studies on the semantics of questions and the pragmatics of answers*: Universiteit van Amsterdam dissertation.
- Guerzoni, Elena & Yael Sharvit. 2007. A question of strength: on NPIs in interrogative clauses. *Linguistics and Philosophy* 30. 361–391.
- Hamblin, C. L. 1973. Questions in Montague English. *Foundations of Language* 10(1). 41–53.
- Haslinger, Nina. 2018. Quantificational arguments of opaque verbs in German: Disentangling monotonicity and context dependency. Handout for a talk given at Goethe-Universität Frankfurt.
- Haslinger, Nina & Viola Schmitt. 2018. Scope-related cumulativity asymmetries and cumulative composition. In Sireemas Maspong, Brynhildur Stefánsdóttir, Katherine Blake & Forrest Davis (eds.), *Proceedings of SALT 28*, 197–216.

- Heim, Irene. 1982. *The semantics of definite and indefinite noun phrases*: University of Massachusetts dissertation.
- Heim, Irene. 1984. A Note on Negative Polarity and Downward Entailingness. In Charles Jones & Peter Sells (eds.), *Proceedings of NELS 14*, 98–107. Amherst: University of Massachusetts.
- Heim, Irene. 1991. Artikel und Definitheit. In von Stechow & Wunderlich (1991) 487–535.
- Heim, Irene & Angelika Kratzer. 1998. *Semantics in Generative Grammar*. Blackwell.
- Hintikka, Jaakko. 1969. Semantics for Propositional Attitudes. In *Models for Modalities. Selected Essays*, 87–111. Dordrecht: Reidel.
- Karttunen, Lauri. 1977. Syntax and semantics of questions. *Linguistics and Philosophy* 1(1). 3–44.
- Kastner, Itamar. 2015. Factivity mirrors interpretation: The selectional requirements of presuppositional verbs. *Lingua* 164. 156–188.
- Kaufmann, Magdalena & Thomas Ede Zimmermann. 2009. Intensionale Relativsätze. Unpublished seminar handout, Goethe-Universität Frankfurt.
- Kratzer, Angelika. 1978. *Semantik der Rede. Kontexttheorie – Modalwörter – Konditionalsätze* (Monographien Linguistik und Kommunikationswissenschaft 38). Königstein: Scriptor.
- Kratzer, Angelika. 2003. The event argument and the semantics of verbs. Ms., University of Massachusetts at Amherst. <https://semanticsarchive.net/Archive/GU1NWM4Z/>.
- Kratzer, Angelika. 2006. Decomposing attitude verbs. Handout for a talk given at the Hebrew University of Jerusalem. <https://semanticsarchive.net/Archive/DcwY2JkM/>.
- Kratzer, Angelika. 2012. *Modals and Conditionals* (Oxford Studies in Theoretical Linguistics 36). Oxford: Oxford University Press.
- Lahiri, Utpal. 2002. *Questions and answers in embedded contexts* (Oxford Studies in Theoretical Linguistics 2). Oxford: Oxford University Press.
- Landman, Meredith. 2006. *Variables in Natural Language*. Amherst: University of Massachusetts dissertation.
- Mayr, Clemens. 2013. Downward monotonicity in questions. In Emmanuel Chemla, Vincent Homer & Gregoire Winterstein (eds.), *Proceedings of Sinn und Bedeutung 17*, 345–362. Paris: École normale supérieure.
- Meier, Cécile. 2009. A comparative analysis for resemblance. In L. Kálmán (ed.), *Proceedings of the 10th Symposion on Logic and Language*, <http://www.nytud.hu/lola10/proceedings/meier.pdf>.

- Moltmann, Friederike. 1997. Intensional verbs and quantifiers. *Natural Language Semantics* 5. 1–52.
- Moltmann, Friederike. 2008. Intensional verbs and their intentional objects. *Natural Language Semantics* 16. 239–270.
- Moltmann, Friederike. 2013. *Abstract Objects and the Semantics of Natural Language*. Oxford: Oxford University Press.
- Montague, Richard. 1974. The Proper Treatment of Quantification in Ordinary English. In Richmond H. Thomason (ed.), *Formal Philosophy. Selected Papers of Richard Montague*, 247–270. New Haven/London: Yale University Press.
- Moulton, Keir. 2009. *Natural Selection and the Syntax of Clausal Complementation*. Amherst: University of Massachusetts dissertation.
- Nathan, Lance. 2006. *On the interpretation of concealed questions*: MIT dissertation.
- Partee, Barbara. 1987. Noun Phrase Interpretation and Type Shifting Principles. In Jeroen Groenendijk, Dick de Jongh & Martin Stokhof (eds.), *Studies in discourse representation theory and the theory of generalized quantifiers*, 115–141. Dordrecht: Foris.
- Partee, Barbara & Mats Rooth. 1983. Generalized Conjunction and Type Ambiguity. Manuscript, University of Massachusetts Amherst.
- Partee, Barbara Hall. 1979. Semantics – Mathematics or Psychology? In Rainer Bäuerle, Urs Egli & Arnim von Stechow (eds.), *Semantics from Different Points of View*, 1–14. Berlin/Heidelberg/New York: Springer.
- Penka, Doris. 2011. *Negative Indefinites* (Oxford Studies in Theoretical Linguistics 32). Oxford/New York: Oxford University Press.
- Pesetsky, David Michael. 1983. *Paths and categories*: MIT dissertation.
- Pietroski, Paul M. 2000. On Explaining That. *The Journal of Philosophy* 97(12). 655–662.
- Rooth, Mats. 1992. A Theory of Focus Interpretation. *Natural Language Semantics* 1. 75–116.
- Rothstein, Susan. 2017. *Semantics for Counting and Measuring*. Cambridge University Press.
- Sauerland, Uli. 2004. The Interpretation of Traces. *Natural Language Semantics* 12. 63–127.
- Sauerland, Uli. 2008. Implicated presuppositions. In Anita Steube (ed.), *The discourse potential of underspecified structures*, 581–600. de Gruyter.
- Schein, Barry. 1993. *Plurals and events*. Cambridge, Massachusetts: MIT Press.
- Schmitt, Viola. 2017. Cross-categorial plurality and plural composition. Manuscript, University of Vienna.

- Schwager, Magdalena. 2007. Bodyguards under Cover: the Status of Individual Concepts. In *Proceedings of SALT 17*, 246–263.
- Schwarz, Florian. 2015. Intensional transitive verbs: I owe you a horse. To appear in *Companion to Semantics*, eds. Lisa Matthewson, Cecile Meier, Hotze Rullmann und Thomas Ede Zimmermann.
- Schwarzschild, Roger. 1996. *Pluralities* (Studies in Linguistics and Philosophy 61). Dordrecht: Kluwer.
- von Stechow, Arnim. 1980. Modification of Noun Phrases. A Challenge for Compositional Semantics. *Theoretical Linguistics* 7. 57–110.
- von Stechow, Arnim & Dieter Wunderlich (eds.). 1991. *Semantik. Ein internationales Handbuch der zeitgenössischen Forschung* (Handbücher zur Sprach- und Kommunikationswissenschaft 6). Berlin/New York: de Gruyter.
- Stenning, Keith & Michiel van Lambalgen. 2008. *Human Reasoning and Cognitive Science*. Cambridge, Massachusetts: MIT Press.
- Westerståhl, Dag. 1985. Determiners and Context Sets. In Johan van Benthem & Alice ter Meulen (eds.), *Generalized Quantifiers in Natural Language*, 45–71. Dordrecht: Foris.
- Wetzel, Linda. 2006. Types and Tokens. In Edward N. Zalta (ed.), *Stanford Encyclopedia of Philosophy*, Metaphysics Research Lab, Stanford University. <https://stanford.library.sydney.edu.au/entries/types-tokens/>.
- Wagiel, Marcin. 2018. *Subatomic Quantification*. Brno: Masaryk University dissertation.
- Zimmermann, Thomas Ede. 1993. On the proper treatment of opacity in certain verbs. *Natural Language Semantics* 1. 149–179.
- Zimmermann, Thomas Ede. 2006. Monotonicity in opaque verbs. *Linguistics and Philosophy* 29. 715–761.
- Zimmermann, Thomas Ede. 2017. Quantification over alternative intensions. *Semantics and Pragmatics* 10(8). 1–24.

Abstract

This thesis explores two aspects of the semantics of German sentences like (i), in which opaque predicates combine with DP arguments. Three classes of opaque predicates are considered: proposition-embedding predicates (i-a), question-embedding predicates (i-b) and intensional transitive verbs, which have been argued to take property arguments (i-c).

- (i) a. *Der Peter glaubt **etwas**, das auch die Maria glaubt.*
‘Peter believes something Maria also believes.’
- b. *Dem Peter sind **zwei Sachen** unklar.*
‘Two things are unclear to Peter.’
- c. *Peter und Maria suchen **dasselbe**.*
‘Peter and Maria are looking for the same thing(s).’

The first part of the thesis deals with the question whether data like (i) motivate a more liberal view of the correspondence between syntactic categories and semantic types than usually assumed. I argue that the syntactic category DP does not correspond to a uniform set of semantic types: A small subclass of DPs, which I call ‘higher-order DPs’, have basic meanings that allow them to quantify over objects of any semantic category selected by a lexical predicate, including complex, derived categories such as properties or question meanings. In contrast, ‘ordinary DPs’ like *jemand* ‘someone’ or *zwei Bücher* ‘two books’ have a basic meaning involving quantification over individuals; any other readings of such DPs can be attributed to type-shifting.

In the second part of the thesis, I discuss a semantic puzzle due to [Zimmermann \(2006\)](#) that involves sentences like (i-a): If *glauben* ‘believe’ has an upward-monotonic semantics along the lines of [Hintikka \(1969\)](#), and if the object DP in (i-a) quantifies over arbitrary propositions, (i-a) should have extremely weak, possibly trivial truth conditions, since we can always find a proposition that is weak enough to follow both from Peter’s belief state and from Maria’s belief state. I show that this problem is more general than previously noted, as it affects all three of the verb classes shown in (i) and persists even if the quantifier is contextually restricted. For this reason, I propose a new analysis of higher-order DPs ranging over propositions, which relies on a domain-restriction mechanism that is more powerful than usually assumed. The domain of higher-order DPs is restricted by a contextually provided question. The restrictor and the nuclear scope of the higher-order determiner, together with the discourse context, determine a decomposition of this question into subquestions. The DP then quantifies over the set of all propositions that are partial answers to a question in the decomposition. Propositions that are too weak to count as answers to a subquestion in the decomposition are excluded from the domain. Unlike the proposal in [Zimmermann \(2006\)](#), this analysis accounts for the unexpectedly strong truth conditions of sentences like (i-a) by means of a non-standard semantics for the DP, without any changes to the semantics of the predicate, and is therefore compatible with established analyses of opaque predicates.

Deutschsprachige Zusammenfassung

Diese Arbeit befasst sich mit zwei Aspekten der Semantik deutscher Sätze wie (i), in denen opake Prädikate eine DP als Argument nehmen. Konkret werden drei Arten von opaken Prädikaten betrachtet: Prädikate, die Propositionen einbetten (i-a), Prädikate, die Fragen einbetten (i-b) und intensionale transitive Verben, deren semantische Argumente unter anderem als Eigenschaften analysiert worden sind (i-c).

- (i) a. *Der Peter glaubt **etwas**, das auch die Maria glaubt.*
- b. *Dem Peter sind **zwei Sachen** unklar.*
- c. *Peter und Maria suchen **dasselbe**.*

Der erste Teil der Arbeit behandelt die Frage, ob Beispiele wie (i) dafür sprechen, dass das Verhältnis zwischen syntaktischen Kategorien und semantischen Typen weniger strikt ist, als üblicherweise angenommen wird. Ich argumentiere dafür, dass die syntaktische Kategorie DP keiner einheitlichen Klasse semantischer Typen entspricht: Eine kleine Klasse von DP_n, die ich als **höherstufige DP_n** bezeichne, können in ihrer Grundbedeutung über Objekte aller semantischen Kategorien quantifizieren, die von lexikalischen Prädikaten selegiert werden, einschließlich komplexer, abgeleiteter Kategorien wie Eigenschaften oder Fragebedeutungen. Im Gegensatz dazu lässt die Grundbedeutung **gewöhnlicher DP_n** wie *jemand* oder *zwei Bücher* nur Quantifikation über Individuen zu; andere Lesarten solcher DP_n sind auf Typverschiebungen zurückzuführen.

Der zweite Teil befasst sich mit einem bei [Zimmermann \(2006\)](#) diskutierten Problem, das die Interpretation von Sätzen wie (i-a) betrifft: Wenn man *glauben* eine aufwärtsmonotone Semantik in Anlehnung an [Hintikka \(1969\)](#) zuschreibt und das DP-Objekt als Quantor über beliebige Propositionen interpretiert, sollte (i-a) sehr schwache, möglicherweise sogar triviale Wahrheitsbedingungen haben, da sich immer eine Proposition finden lässt, die schwach genug ist, um sowohl aus Peters Glaubenszustand als auch aus Marias Glaubenszustand zu folgen. Es wird gezeigt, dass dieses Problem allgemeiner ist als bisher gedacht, da es alle drei Verbklassen in (i) betrifft und auch bestehen bleibt, wenn der Quantifikationsbereich kontextuell eingeschränkt ist. Die Analyse, die ich vorschlage, basiert daher auf einem Mechanismus zur Einschränkung des Quantifikationsbereichs, der stärker ist, als üblicherweise angenommen wird. Der Bereich einer höherstufigen DP hängt von einer kontextuell gegebenen Frage ab. Der Restriktor und der nukleare Skopus des höherstufigen Determinierers bestimmen gemeinsam mit dem Diskurskontext eine Aufteilung dieser Frage in eine Menge von Teilfragen. Die DP quantifiziert über alle Propositionen, die partielle Antworten auf eine dieser Teilfragen sind. Propositionen, die zu schwach sind, um eine Teilfrage zu beantworten, werden aus dem Quantifikationsbereich ausgeschlossen. Diese Analyse hat die Eigenschaft, dass sich die unerwartet starken Wahrheitsbedingungen von Sätzen wie (i-a) aus einer unüblichen Semantik für die DP und nicht aus der Verbbedeutung ergeben, und ist daher im Gegensatz zu dem von [Zimmermann \(2006\)](#) vertretenen Ansatz mit den üblichen Analysen opaker Verben kompatibel.