The Indefiniteness and Focusing of \textit{Wh}-Words

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This is a slightly modified version of my PhD thesis.
Comments, remarks, and suggestions are very welcome!
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Chapter 1

Introduction

Question words show striking similarities among the languages of the world. First, question words typically form a morphologically distinct class, for example, the class of \textit{wh}-words in English, \textit{w}-words in German, \textit{d}-words in Japanese, and the class of \textit{k}-words in Slavic languages. Second, they are typically morphologically related to indefinites: In a large variety of languages, question words are the morphological base from which indefinites are derived, and in others, question words and indefinites are morphologically identical. Third, question words are typically, if not universally, focused. In language after language studied over the years, researchers have found question words to show the formal markings of focus. But it has also been argued that question words are focused in the semantic-pragmatic sense of the term.

For each of these properties, there are many theoretical approaches aiming at or contributing to their explanation. The \textit{wh}-property plays an important role in the theory of \textit{wh}-movement and hence the various attempts at explaining why \textit{wh}-movement takes place have shed light on the reason why question words bear a \textit{wh}-feature (see, among others, Cheng 1991, Rizzi 1991, Chomsky 1995, Hagstrom 1998, Pesetsky 2000). Similarly, the affinity between question words
and indefinites has been fruitfully investigated, especially by semantic theories deriving the meaning of constituent questions on the basis of the assumption that question words have the same meaning as indefinites (see Hamblin 1973, Karttunen 1977, Reinhart 1994, Kratzer & Shimoyama 2002). As for explaining the focus property of question words, it seems that the least progress has been made. This may well be attributed to the success of the existing syntactic and semantic question theories: The core facts of \( wh \)-movement are accounted for without referring to a (syntactic) focus feature, and the essential answerhood conditions of constituent questions are derived without taking into account the semantic or pragmatic contribution of focus. Conversely, the attempts that have been made to give the focus feature a central role in the theory of questions tend to neglect the other two properties: By declaring (certain movements of \( wh \)-words that were formerly thought to be instances of) \( wh \)-movement as focus movement the role of the \( wh \)-feature is neglected. If, for example, we follow Sabel (2004) in the assumption that \( wh \)-movement in German is in fact focus movement, we fail to explain why focused non-\( wh \) words do not show the same movement patterns as focused \( wh \)-words.\(^1\) On the semantic side, the question theory proposed in Beck (2006) is based on the assumption that the semantic contribution of question words consists in their focus semantic value. However, this theory remains silent about why the focus semantic value of non-\( wh \) words does not contribute in the same way to the meaning of constituent questions. Moreover, Beck’s assumption means abandoning, without an alternative, the most natural explanation of the indefinite-interrogative affinity. This shows the importance of an integrated theory of all three typologically widespread properties of question words.

This thesis provides such an integrated theory. In the course of the following

\(^1\)The same critique applies in part to the proposals made in Stepanov (1998) and Bošković (2002).
chapters, I will show that the focus feature borne by question words plays a syntactic role in connection with their *wh*-morphology and has a semantic effect in connection with their indefinite meaning. More precisely, I will show that this feature is just a plain focus feature in the sense that it also occurs with non-*wh*-words and that these occurrences are generally described as focused constituents. Hence, the only domain-specific assumption that is made throughout this whole thesis concerns the syntactic interplay between the focus feature and the *wh*-feature. The indefinite occurrences of *wh*-words in languages like German and Korean show that the *wh*-feature alone does not mark a *wh*-word as needing to be syntactically licensed. Rather, it seems that it is the co-occurrence of a *wh*-feature with a focus feature that must be syntactically licensed by the interrogative complementizer \( C^{[+Q]} \) (in connection with other functional heads in the left periphery of a clause).

These assumptions are illustrated in (1) with the LF structure of the *wh*-question *Who called?*

\[
(1) \quad [CP \ C^{[+Q]} [FocP\ who^{[+F]} [TP\ t\ who\ called ]]]
\]

In this LF structure, the phrase FocP is a left-peripheral functional projection, which provides a landing site for *wh*-movement, and +F represents the (positively specified) focus feature of the question word *who*. As can be seen, \( C^{[+Q]} \) erases the *wh*-feature but leaves unerased the focus feature of the question word. As for the semantics of this feature, I will show that it denotes a presuppositional exhaustification operator, that is, the operator that is assumed in Szabolcsi (1994) to apply to constituents in the preverbal focus position of Hungarian. Hence, if the LF structure in (1) is compositionally interpreted, it has the denotation structurally represented in (2).

\[
(2) \quad \llbracket C^{[+Q]} \rrbracket^i(\lambda i((\EXH^i(\lambda i.\llbracket who \rrbracket^i)))(\lambda i\lambda x.\text{call}'(i)(x))))
\]
Without going into the specifics of this denotation, let me point out what meaning aspects it will be shown to capture. First and foremost, (2) captures the answerhood conditions of the question ‘Who called?’ and, in addition to this, it encodes the presupposition that someone called. This is summarized in (3).

(3) Who\(^{[+F]}\) called?

*expresses the question: ‘Who called?’*

*presupposes: ‘Someone called.’*

Note that it is commonly assumed that simple *wh*-questions have this additional meaning aspect – an existential presupposition – but that it is left unaccounted for by all pertinent question theories. Thus, the analysis conducted in this thesis shows that the focus feature borne by *wh*-words must be taken into account to arrive at an adequate theory of *wh*-movement and to derive all of the answerhood conditions of constituent questions.

Another example that will be shown to support these conclusions is provided by double questions (and, more generally, by multiple questions). In a number of languages, it can be observed that double questions can be formed along two alternative derivational paths. On the one path, the focus feature of both *wh*-words remains intact, and on the other, one of the focus features is erased in the course of licensing the two question words.\(^2\) This is indicated in (4a) and (b) with the two possible grammatical realizations of the double question *Which boy read which novel?* where the feature assignments are to be understood as an indication of which focus features remain unerased at LF.

\(^2\)Note that the former is a marked option in the sense that structures like (4a) can be felicitously used only in very specific discourse contexts.
(4) a. Which boy read which\(^+[F]\) novel?

*expresses the question:* ‘Which boy read which novel?’

*presupposes:* ‘Every boy read one and only one novel.’

b. Which\(^+[F]\) boy read which\(^+[F]\) novel?

*expresses the question:* ‘Which boy read which novel?’

*presupposes:* ‘One and only one boy read a novel, and

one and only one novel was read by a boy.’

It will be shown that given this distribution of focus features, the questions in (4a) and (b) have the meaning aspects given underneath. That is, (4a) is (indicating) the structure underlying the single-pair reading of the double question under consideration, and (4b) the structure underlying its pair-list reading. Like in the example considered before, it will be shown that the presuppositions leading to these readings result from interpreting the focus features shown in (4a) and (b) in the way indicated in (2).

These results depend, of course, on the underlying semantic question theory. The theory employed to achieve these results is the partition theory of questions (see Groenendijk & Stokhof 1982 for the first exposition of this theory). A semantic question theory must first and foremost enable us to account for the answerhood conditions of questions, that is, for the conditions a question imposes on how it can be answered.\(^3\) Thereby, it must allow us to distinguish between different kinds of answers such as, for example, complete vs. partial answers and direct vs. indirect answers. Another requirement for a theory of questions is that it account for the logical and semantic relations that questions bear to each other. Examples of such relations are the entailment relation\(^4\) and the relation that

\(^3\)However, this does not imply that *direct* questions should be the primary goal of investigation. See Groenendijk & Stokhof 1982, p. 175 for discussion.

\(^4\)For example, the question in (i-a) entails the question in (i-b) (provided that Mary is in the
CHAPTER 1. INTRODUCTION

a direct question bears to its indirect counterparts. The partition theory not only satisfies these requirements, but it does so in a methodologically sound and conceptually elegant way. That is why I have chosen this theory as the framework for my semantic investigation of \textit{wh}-questions.\footnote{I am grateful to Peter Staudacher for introducing me to the partition theory and for pointing out to me its advantages and problems.}

However, in its original form the partition theory of question does not account for the indefinite-interrogative affinity. That is, the meaning of constituent questions is not derived on the basis of the semantic identity of question words and indefinites. Therefore, the first aim of this thesis is to develop a dynamic-semantic version of the partition theory. In this version of the theory, \textit{wh}-words can be analyzed as denoting dynamic existential quantifiers, which accommodates the indefinite-interrogative affinity. This means that, overall, the analysis proposed in this thesis provides an account of all three typologically widespread properties of question words, mentioned at the beginning of this introduction.

This thesis is structured as follows. Chapter 2 introduces the partition theory of questions as it is presented in Groenendijk \& Stokhof (1982). The chapter concludes with a discussion of some (more or less) theory-internal problems of the original version of the partition theory. As will be shown, these problems result from the way question words are conceived, namely as natural-language correlates of the $\lambda$-abstraction sign. In chapter 3, I will point out that in addition to these problems, the partition theory does account for the indefinite-interrogative affinity. This affinity will be illustrated with data from diverse languages in which

\begin{itemize}
\item[(i)] a. Who walks in the garden?
\item b. Does Mary walk in the garden?
\end{itemize}

See Groenendijk \& Stokhof 1984\textit{b} for discussion.
question words and indefinites are one and the same lexical items. Furthermore, I will present the logical foundations of a dynamic-semantic version of the partition theory, which will be shown to solve all the problems discussed in chapter 2 and 3. Chapter 4 complements the investigations of the previous chapter with a dynamic type logic that allows to compositionally derive the partition-theoretic denotation of $wh$-questions on the basis of the assumption that question words denote dynamic existential quantifiers. In the course of demonstrating how this type logic can be employed, I will present some of the syntactic assumptions that will be used throughout the thesis. Chapter 5 discusses a second manifestation of the indefinite-interrogative affinity, namely the widespread phenomenon that there are indefinite pronouns derived from interrogative ones. In the course of this discussion, I will compare the dynamic question semantics presented in chapter 3 and 4 with a alternative-semantic version of the partition theory, proposed in Kratzer & Shimoyama (2002). It will be shown that the dynamic-semantic version of the partition theory has a broader empirical coverage than the alternative-semantic version. Chapter 6 discusses one such empirical domain which requires the greater expressiveness of a dynamic question semantics for modeling the phenomena found, namely the possibility of anaphoric reference to question words. I will show how to account for this phenomenon by natural additions to the assumptions made before. Chapter 7 consists of two parts. In the first part, I will present fractions of the empirical evidence that at whatever language we look, question words show the formal markings of focus. In the second part of chapter 7, I will demonstrate that the focus feature borne by question words has a semantic interpretation and, moreover, that it has the same interpretation as when it occurs on non-$wh$-words. Finally, chapter 8 discusses intervention effects in $wh$-questions. It will be shown that intervention effects are predicted by the dynamic question semantics in conjunction with the semantic contribution of the focus feature argued
for in this thesis.
Chapter 2

The Partition Theory of Questions

The following sections provide an outline of the partition theory as it is presented in Groenendijk & Stokhof (1982) (henceforth G&S82). This is with the exception of the final section, section 2.5, which is devoted to discuss some problems of the partition theory.

2.1 Preliminaries

Like other semantic analyses of interrogatives, G&S82 deals primarily with *wh*-complements, that is, with indirect questions. This is motivated by a methodological consideration. Groenendijk and Stokhof hold that there is a “general lack of intuitions about the kind of semantic object that is to be associated with [direct questions].” In contrast to this, “we do have some intuitions about the semantics of declarative sentences in which [*wh*-complements] occur embedded under such verbs as *know, tell, wonder.*” (G&S82, p. 175) The idea is that the semantics of indirect questions can be analyzed in a way that has proven highly successful in modern linguistics, namely by compositional analysis within a truth-conditional

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1See, for example, Hintikka 1976 and Karttunen 1977.
approach to meaning. But in addition to being of interest in its own right, a semantic analysis of indirect questions can also be expected to enhance the understanding of the semantics of direct questions. Indeed, after having spelled out their analysis G&S are confident to conclude that “little or nothing speaks against simply associating direct questions with the same semantic objects we associated \(wh\)-complements with.” (G&S82, p. 227) This assessment is substantiated in later work which deals in depth with the theory of the question-answer relation (see in particular chapter IV\(^2\) and V of Groenendijk & Stokhof 1984\(^b\)). There, G&S define a number of answerhood notions that crucially refer to the semantic objects mentioned above. In what follows, I therefore assume that G&S82 provides as much a semantic analysis of direct as of indirect questions.

Groenendijk and Stokhof conduct their analysis in the framework of Montague Grammar. In Montague Grammar, each step in the syntactic derivation of an expression is semantically interpreted. This contrasts with models of grammar in which semantic interpretation applies to a syntactic representation at the level of LF, which means that it takes place only at the end of a syntactic cycle interfacing with LF.\(^3\) In its substance, though, the question semantics of G&S is framework independent. To align with the most elaborate syntactic analyses of \(wh\)-questions, I will switch to an LF analysis once I have introduced the dynamic semantic version of G&S’s question semantics.

As logical representation language, Groenendijk and Stokhof use Ty\(_2\), the language of two-sorted type theory. The translation into Ty\(_2\) assumes that natural-language expressions are intensional throughout. That is, all lexical items are associated with constants of intensional type (that is, a type beginning in \(s\)). Moreover, expressions of non-atomic categories are translated into function expressions

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\(^2\) reprinted from Groenendijk & Stokhof 1984\(^a\)

\(^3\) The two approaches obviously converge if each phrase constitutes a cycle of its own. This is, however, not usually assumed.
which require arguments of intensional type. To give an example, the intransitive verb *walk* is translated into the expression *walk’*(\(v_{0,s}\)), in which *walk’* is a constant of type \(\langle s, \langle \langle s, e \rangle, t \rangle \rangle\) and \(v_{0,s}\) is a variable of type \(s\) (an index variable). This means that *walk* denotes (the characteristic function of) a set of individual concepts. However, in the case of *walk* and other improper intensional verbs, this set corresponds naturally to a set of individuals. For ease of exposition, I will therefore simplify the translation into Ty\(_2\) by “extensionalizing” improper intensional expressions. For example, I will translate *walk* into the expression *walk’*(\(v_{0,s}\)), where *walk’* is a constant of type \(\langle s, \langle e, t \rangle \rangle\).\(^4\) Correspondingly, common nouns like *girl* are associated with constants of type \(\langle s, \langle e, t \rangle \rangle\) and transitive verbs like *love* with constants of type \(\langle s, \langle e, \langle e, t \rangle \rangle \rangle\). Furthermore, I will use the letter \(i\) instead of \(a\) to designate the index variable \(v_{0,s}\), which occurs in all translations of lexical items. Finally, note that the following type-identical expressions are differentiated by their category: intransitive verbs are of category \(t/e\), common nouns of category \(t//e\), and 1-place question abstracts of category \(t///e\). Thus, the number of slashes serves only for identification.

\(^4\)I do not use a subscripted asterisk to designate these constants because asterisk-subscripted constants have a different status in that they are not translations of natural-language expressions.

2.2. The meaning of *yes/no*-questions

As explained above, Groenendijk and Stokhof elicit the meaning of interrogative sentences by intuitive judgements about the truth conditions of declarative sentences that embed a *wh*-complement. More specifically, they consider deductive
arguments such as (1).\(^5\)

\((1)\) John knows whether Mary walks

\[\text{Mary walks} \]

\[\text{John knows that Mary walks} \]

The tableau in (1) indicates that the sentences \textit{John knows whether Mary walks} and \textit{Mary walks} jointly entail the sentence \textit{John knows that Mary walks}. A straightforward way to account for this is to assume that the interrogative complement \textit{whether Mary walks} denotes the same proposition as the declarative complement \textit{that Mary walks}. However, this cannot be the whole truth, since the premise \textit{Mary walks} is crucial to the argument. It must therefore be concluded that even if the two complements denote the same proposition, they do this in a different way. This is confirmed by the observation that not only the argument in (1), but also the one in (2)\(^6\) is valid.

\((2)\) John knows whether Mary walks

\[\text{Mary doesn’t walk} \]

\[\text{John knows that Mary doesn’t walk} \]

By the same reasoning as above, the validity of (2) leads to the conclusion that \textit{whether Mary walks} denotes the proposition that Mary doesn’t walk, provided that Mary in fact doesn’t walk. Taken together, (1) and (2) thus show that the denotation of \textit{whether Mary walks} is \textit{index dependent}: “at an index at which it is true that Mary walks it denotes the proposition that Mary walks, and at an index

\(^5\) = (I) in Groenendijk & Stokhof (1982)
\(^6\) = (II) in Groenendijk & Stokhof (1982)
2.2. THE MEANING OF YES/NO-QUESTIONS

at which it is false that Mary walks it denotes the proposition that Mary doesn’t walk” (G&S82, p. 189).

One of the key contributions of G&S82 is the insight that the above description can be put in the following way: “at an index \(i\) whether \(Mary\) \(walks\) denotes that proposition \(p\) such that for every index \(k\), \(p\) holds true at \(k\) iff the truth value of \(Mary\) \(walks\) at \(k\) is the same as at \(i\)” (G&S82, p. 189). If this paraphrase is rendered in \(Ty_2\), the denotation of whether \(Mary\) \(walks\) can thus be represented by the proposition-denoting expression in (3).\(^7\)

\[
\lambda j (\text{walk}'(i)(m) \leftrightarrow \text{walk}'(j)(m))
\]

It is easy to verify that (3) in fact captures the index-dependent character of the corresponding yes/no-question. There are two cases: First, assume it is true that Mary walks at the index assigned to \(i\). That is, assume that \(\text{walk}'(i)(m)\) is true. Then \(\text{walk}'(i)(m) \leftrightarrow \text{walk}'(j)(m)\) is true iff \(\text{walk}'(j)(m)\) is true. Hence, (3) denotes (the characteristic function of) the set of all indices \(k\) such that \(\text{walk}'(j)(m)\) is true when \(k\) is assigned to \(j\). This just means that (3) denotes the proposition that Mary walks. For the second case, assume that \(\text{walk}'(i)(m)\) is false. On this assumption, (3) denotes the set of all indices \(k\) such that \(\text{walk}'(j)(m)\) is false when \(k\) is assigned to \(j\), and this means that (3) denotes the proposition that Mary doesn’t walk.

Observe that the index variable \(i\) is free in (3). If this variable is \(\lambda\)-bound as in (4), the resulting expression denotes a propositional concept, the sense of the yes/no-question under consideration.

\[
\lambda i \lambda j (\text{walk}'(i)(m) \leftrightarrow \text{walk}'(j)(m))
\]

\(^7\)Cf. (4) in Groenendijk & Stokhof (1982).
Applied to an index \( i \), (4) gives the proposition that is the true answer to the question of whether Mary walks at \( i \). This again highlights the difference in meaning between a yes/no-question and a denotationally identical declarative sentence: The sense of a declarative sentence is a propositional concept that for each index gives the same proposition.

### 2.3 The meaning of \textit{wh}-questions

#### 2.3.1 The basic meaning aspects

In the case of \textit{wh}-questions, the method described above leads to the conclusion that these too denote index-dependent propositions. More specifically, the validity of the argument in (5)\(^8\) shows that the \textit{wh}-complement \textit{who walks} denotes a proposition that entails that Bill walks provided that Bill in fact walks.

\begin{align*}
(5) & \quad \text{John knows who walks} \\
& \quad \text{Bill walks} \\
& \quad \text{John knows that Bill walks}
\end{align*}

So for John to know who walks, he must have some knowledge about the actual denotation of \textit{walk}. How exhaustive must this knowledge be? Arguments such as (5) show that John must know of everyone who walks that he or she in fact walks. From the validity of (6)\(^9\), we can conclude that John must not have erroneous beliefs about the extension of \textit{walk}.

\(^8\) = (V) in Groenendijk & Stokhof (1982)  
\(^9\) = (VIII) in Groenendijk & Stokhof (1982)
2.3. THE MEANING OF WH-QUESTIONS

(6) John believes that Bill and Suzy walk
    Only Bill walks
    
    John doesn’t know who walks

By accepting the validity of (5) and (6), the denotation of who walks is granted a stronger degree of exhaustiveness than Hintikka (who would reject both arguments)\(^{10}\) and Karttunen (who rejects the latter)\(^{11}\) incorporate into their question semantics. And G&S defend an even stronger notion of exhaustiveness in that they exclude the possibility of doubt: They argue if there is a person such that John doubts whether this person walks, he would not say of himself that he knew who walks. What all these observations amount to is the following: for John to know who walks, he must have an exhaustive knowledge about the actual denotation of walk and of its complement. This means that even (7)\(^{12}\) (and its inverse) is a valid argument.

(7) John knows who walks
    
    John knows who doesn’t walk

\(^{10}\)Hintikka assumes that wh-questions have an existential-quantifier reading as well as a universal-quantifier reading (see Hintikka 1976, pp. 61f). These two readings of the question in (i) are represented in (i-a) and (b), respectively.

(i) John knows who walks.
   a. \(\exists x(x \text{ walks } \rightarrow \text{John knows that } x \text{ walks})\)
   b. \(\forall x(x \text{ walks } \rightarrow \text{John knows that } x \text{ walks})\)

Obviously, the existential-quantifier reading is not even weakly exhaustive.

\(^{11}\)See Karttunen 1977, p. 22.

\(^{12}\)\(= (X)\) in Groenendijk & Stokhof (1982)
Groenendijk and Stokhof observe that the entailments above can be accounted for by generalizing their account of the semantics of yes/no-questions. As discussed above, the denotation of a yes/no-question whether \( \varphi \) can be obtained from an equivalence that states if the truth value of \( \varphi \) is the same at two indices. According to this, the denotation of a wh-question who \( \alpha \) is obtained from an equation that states if the denotation of \( \alpha \) is the same at two indices. For the wh-question under consideration, this is exemplified by the following paraphrase. “At an index \( i \), who walks denotes that proposition \( p \), which holds true at an index \( k \) iff the denotation of walk at \( k \) is the same as its denotation at \( i \)” (G&S82, p. 179). Correspondingly, the denotation of who walks is represented by the Ty\(_2\) expression in (8).\(^{13}\)

\[
(8) \quad \lambda j(\lambda x.\text{walk}'(i)(x) = \lambda x.\text{walk}'(j)(x))
\]

To get an idea of what proposition is denoted by (8), consider two example cases. First, assume that no one walks at the index assigned to \( i \). That is, assume that walk\(^{'}\)(\( i \)) denotes the empty set. In this case, \( \lambda x.\text{walk}'(i)(x) = \lambda x.\text{walk}'(j)(x) \) iff walk\(^{'}\)(\( j \)) denotes the empty set. Hence, (8) denotes the set of all indices \( k \) such that walk\(^{'}\)(\( j \)) denotes the empty set when \( k \) is assigned to \( j \), which means that (8) denotes the proposition that no one walks. As a second example, assume that walk\(^{'}\)(\( i \)) denotes the set of Bill and Paul. Then (8) denotes the set of all indices \( k \) such that walk\(^{'}\)(\( j \)) denotes the set of Bill and Paul when \( k \) is assigned to \( j \). That is, (8) denotes the proposition that only Bill and Paul walk. This first of all shows that the proposition denoted by (8) is index dependent in the way envisaged, and secondly, that (8) denotes the true and exhaustive answer to the question of who walks at the index assigned to \( i \). Actually, it can be shown that the proposition denoted by (8) is exhaustive to a degree such that all of the arguments in (5) to (7)

\[^{13}\text{Cf. (6) in Groenendijk & Stokhof (1982).}\]
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are valid.\textsuperscript{14}

This is the core of the semantic analysis in G&S82. Let me next discuss two issues that will later prove to be important for the grammatical analysis of wh-questions.

2.3.2 De dicto/de re ambiguity of which-questions

Wh-questions that contain a which-phrase (henceforth which-questions) exhibit a de dicto/de re ambiguity. Evidence for this ambiguity is provided by the following observation by Groenendijk and Stokhof: Whether the argument in (9)\textsuperscript{15} is valid depends on how the conclusion is read. The argument is valid if the conclusion is read de re: If John knows who walks, then it holds – de re – of each spy that John knows whether he walks. If, however, the conclusion is taken de dicto, the argument is not valid: If John knows who walks, he does not necessarily know who is a spy that walks (because he might not know who is a spy).

(9) John knows who walks

\underline{John knows which spy walks}

\textsuperscript{14}For example, it obviously holds that $\lambda x.\text{walk}'(i)(x) = \lambda x.\text{walk}'(j)(x)$ iff $\lambda x.\neg\text{walk}'(i)(x) = \lambda x.\neg\text{walk}'(j)(x)$. Therefore, $\lambda j(\lambda x.\text{walk}'(i)(x) = \lambda x.\text{walk}'(j)(x))$ denotes the same proposition as $\lambda j(\lambda x.\neg\text{walk}'(i)(x) = \lambda x.\neg\text{walk}'(j)(x))$. Thus, the argument in (7) is trivially valid, since it translates as given in (i).

(i) $\text{know}'(i)(j, \lambda j(\lambda x.\text{walk}'(i)(x) = \lambda x.\text{walk}'(j)(x)))$

$\text{know}'(i)(j, \lambda j(\lambda x.\neg\text{walk}'(i)(x) = \lambda x.\neg\text{walk}'(j)(x)))$

For the proof of the arguments in (5) and (6), see Groenendijk & Stokhof 1982, pp. 196f.

\textsuperscript{15}Cf. (XI) in Groenendijk & Stokhof (1982). I am grateful to Manfred Krifka for the more perspicuous example in the text.
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To capture this ambiguity, both of the expressions in (10) and (11) are assumed in G&S82 to be possible translations of *which spy walks*. In (10), both occurrences of the predicate concept spy' apply to the free index variable $i$. Due to this property, (10) represents the *de re* reading of *which spy walks*.\(^\text{16}\)

(10) \[ \lambda j (\lambda x (\text{spy}'(i)(x) \land \text{walk}'(i)(x)) = \lambda x (\text{spy}'(i)(x) \land \text{walk}'(j)(x))) \]

In (11), the two occurrences of spy' apply to different index variables. In each case, spy' applies to the same index variable as the predicate concept walk' with which it forms a predicate. As a result, (11) represents the *de dicto* reading of *which spy walks*.\(^\text{17}\)

\(^{16}\)To verify this, observe that the argument in (9) is valid if it translates as given below.

(i) \[ \text{know}'(i)(j, \lambda j (\lambda x. \text{walk}'(i)(x) = \lambda x. \text{walk}'(j)(x))) \]

\[ \text{know}'(i)(j, \lambda j (\lambda x (\text{spy}'(i)(x) \land \text{walk}'(i)(x)) = \lambda x (\text{spy}'(i)(x) \land \text{walk}'(j)(x))) \]

This can be shown as follows. It is easily seen that the following equivalences and inferences hold.

\[ \lambda x. \text{walk}'(i)(x) = \lambda x. \text{walk}'(j)(x) \]
\[ \iff \]
\[ \forall x (\text{walk}'(i)(x) \iff \text{walk}'(j)(x)) \]
\[ \implies \]
\[ \forall x (\text{spy}'(i)(x) \rightarrow (\text{walk}'(i)(x) \iff \text{walk}'(j)(x))) \]
\[ \iff \]
\[ \lambda x (\text{spy}'(i)(x) \land \text{walk}'(i)(x)) = \lambda x (\text{spy}'(i)(x) \land \text{walk}'(j)(x)) \]

Therefore, for every index $k$ such that \[ [\lambda j (\lambda x. \text{walk}'(i)(x) = \lambda x. \text{walk}'(j)(x))]_{M,g}(k) = 1 \], it also holds that \[ [\lambda j (\lambda x (\text{spy}'(i)(x) \land \text{walk}'(i)(x)) = \lambda x (\text{spy}'(i)(x) \land \text{walk}'(j)(x)))]_{M,g}(k) = 1 \].

Thus, on the assumption that to know a proposition is to know its entailments, (i) is valid.

\(^{17}\)As required, the argument in (9) is not valid if *which spy walks* translates as given in (11). That is, (i-a) does not entail (i-b).
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(11) \[ \lambda j(\lambda x(spy'(i)(x) \land walk'(i)(x))) = \lambda x(spy'(j)(x) \land walk'(j)(x))) \]

It is the de dicto reading which will be of particular interest in the remainder of this chapter, as it will turn out to be the reading with which the adequacy of a categorematic treatment of wh-words can be tested (see section 2.5).

2.3.3 The general form of wh-question translations

So far, we have only considered wh-questions with a single wh-expression. For an example of a multiple question and its translation into Ty₂, take a look at (12).

(12) Which boy loves which girl?
\[ \lambda j(\lambda x\lambda y(boy'(i)(x) \land girl'(i)(y) \land love'(i)(x, y))) = \lambda x\lambda y(boy'(j)(x) \land girl'(j)(y) \land love'(j)(x, y))) \]

In general, a wh-question translates as an expression of the form given in (13). In (13), \( \phi \) and \( \psi \) are formulas and \( x_1, \ldots, x_n \) are pairwise distinct individual variables (where \( n \geq 1 \) is the number of question words of the wh-question translated).

(13) \[ \lambda j(\lambda x_1 \ldots \lambda x_n. \phi = \lambda x_1 \ldots \lambda x_n. \psi) \]

The level of abstraction of this schema is fine-grained enough for much of the discussion to follow (for example, to achieve the proof of proposition 1 in section

(i) a. know'(i)(j, \lambda j(\lambda x. walk'(i)(x) = \lambda x. walk'(j)(x)))

b. know'(i)(j, \lambda j(\lambda x(spy'(i)(x) \land walk'(i)(x)) = \lambda x(spy'(j)(x) \land walk'(j)(x))))

This follows from the fact that the embedded proposition in (i-a) does not entail the embedded proposition in (i-b). To see this, consider a model \( M \) and assignment \( g \) such that for some index \( k \) it holds that \([walk'(i)]_{M,g} = [walk'(j)]_{M,g\{j/k\}}\) and \([spy'(i)]_{M,g} \neq [spy'(j)]_{M,g\{j/k\}}\). With such \( M \) and \( g \), \([\lambda j(\lambda x.walk'(i)(x) = \lambda x.walk'(j)(x))]_{M,g}(k) = 1\), but \([\lambda j(\lambda x(spy'(i)(x) \land walk'(i)(x)) = \lambda x(spy'(j)(x) \land walk'(j)(x)))]_{M,g}(k) = 0\).
However, one can be much more specific about the form of $\phi$ and $\psi$, and about the way they differ. First of all, both $\phi$ and $\psi$ have free variable occurrences of $x_1, \ldots, x_n$. Therefore, $\phi$ and $\psi$ are in an obvious sense saturated $n$-place relations $R(x_1, \ldots, x_n)$ and $R'(x_1, \ldots, x_n)$, respectively. Moreover, $\phi$ and $\psi$ have free occurrences of the index variables $i$ and $j$ and differ from each other only with respect to these occurrences. More specifically, $\phi$ has a free occurrence of $i$ where $\psi$ has a free occurrence of $j$, and vice versa. This means that the denotation of a wh-question can be represented by an expression of the form (14).

\begin{equation}
\lambda j(\lambda x_1 \ldots \lambda x_n(\beta(i)(x_1, \ldots, x_n))) = \lambda x_1 \ldots \lambda x_n(\beta(j)(x_1, \ldots, x_n)))
\end{equation}

The schema in (14) illustrates that the question theory of G&S82 incorporates the so-called categorial approach to the semantics of interrogatives. According to this approach, an $n$-place question denotes an $n$-place relation. Now observe that (14) contains the relation-denoting terms $\lambda x_1 \ldots \lambda x_n.\beta(\{i\mid j\})(x_1, \ldots, x_n)$ as subexpressions.

In the following section, it will be shown that the incorporation of the categorial approach has far-reaching consequences for the grammatical analysis of wh-questions: to preserve the principle of compositionality, an $n$-place question
must be derived from an expression that denotes an $n$-place relation. As will be argued in section 2.5, this causes a number of problems when it comes to assigning grammatical properties to the constituents of a \textit{wh}-question. In a Montague Grammar framework, these problems become particularly evident, possibly more so than in an LF framework. But I think it is safe to say that the same issues arise in one form or another in both frameworks. In this sense, the problems addressed in section 2.5 are theory neutral, as is the solution presented in chapter 3 and 4.

2.4 \textbf{The grammar of \textit{wh}-questions}

2.4.1 \textbf{Two grammar rules specific to \textit{wh}-questions}

According to G&S82, there are two (classes of) grammar rules that are specific to \textit{wh}-questions.\textsuperscript{23} These can be viewed as bearing on the internal and on the external grammar of \textit{wh}-questions, respectively. More specifically, there are (i) rules of \textit{abstract formation}, which regulate the syntactic distribution of \textit{wh}-words and their semantic import, and (ii) a rule of \textit{clause formation}, which derives the proper categorial status of \textit{wh}-questions and their propositional denotation.\textsuperscript{24} The class of abstract formation rules is further subdivided into \textit{wh-preposing} and \textit{wh-substitution} rules, which account for the grammatical properties of \textit{ex-situ} and \textit{in-situ} \textit{wh}-words, respectively. Representatives of these rules are given below and illustrated by exemplary derivations.

\textsuperscript{23}At least, the combination of both is.

\textsuperscript{24}A more specific designation would be “interrogative clause formation.” G&S use the designation “constituent complement formation.”
2.4.2 Simple *wh*-questions

A simple *wh*-question of English is derived in two steps from a sentence containing a syntactic variable. In the first step, a *wh*-preposing rule transforms the sentence into a so-called *abstract*, and in the second, the abstract is transformed into an interrogative clause by a clause formation rule.

If $\varphi$ is a sentence containing a syntactic variable $he_n$, an abstract is formed by placing a *wh*-word in front of $\varphi$ and by deleting or anaphorizing the occurrences of $he_n$ in $\varphi$. On the semantic level, the translation of $\varphi$ is turned into a predicate-denoting expression by $\lambda$-abstracting the variable that is introduced by $he_n$. This is illustrated in (15) for the question *who walks*.

\[
\begin{array}{c}
\text{(15) } who(\text{NOM}) \text{ walks} \\
\lambda x_0. \text{walk}'(i)(x_0) \\
\mid \\
he_0(\text{NOM}) \text{ walks} \\
\text{walk}'(i)(x_0)
\end{array}
\]

The rule in (16) is a simplified version of the *wh*-preposing rule in G&S82 which yields the structure in (15).\(^{25}\) To simplify matters, the syntactic part of this rule is implicitly defined to apply to sentences with only one occurrence of the given syntactic variable.

\[
\begin{align*}
(16) \quad \text{Abstract formation, } & \text{wh-preposing of who (AF1)} \\
a. \text{ If } \varphi \in P_t, \text{ then } F_{AF1,n}(\varphi) \in P_{t//e}. \\
\text{Condition: } \varphi \text{ contains an occurrence of } he_n \text{ which bears case } c. \\
F_{AF1,n}(\varphi) = \text{who}(c) \psi, \text{ where } \psi \text{ comes from } \varphi \text{ by deleting the occurrence of } he_n \text{ in } \varphi.
\end{align*}
\]

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b. If $\varphi \rightsquigarrow \varphi'$, then $F_{AF1,n}(\varphi) \rightsquigarrow \lambda x_n.\varphi'$.

Note that according to this rule the *wh*-pronoun *who* is a syncategorematic expression: it does not belong to a syntactic category and does not receive an independent semantic interpretation. Nevertheless, the nominal properties of this pronoun must be considered to obtain an adequate result from application of the rule: the condition in (16a) requires *who* to bear the same case as *he*$_n$. This discrepancy between the lack of a category and the existence of categorial properties is discussed in greater detail in section 2.5.

The clause formation rule in (17) accounts for the clausal properties of simple *wh*-questions. Syntactically, this rule is a category-changing rule that transforms an abstract into a syntactic object of the clausal category $\mathcal{T}$ (see 17a). On the semantic level, the rule derives a proposition-denoting expression of the form characterized in section 2.3.3 above (see 17b).

(17) Clause formation, $CF$ (to be generalized)

a. If $\chi \in P_{t//e}$, then $F_{CF}(\chi) \in P_{t}$.

b. If $\chi \rightsquigarrow \chi'$, then $F_{CF}(\chi) \rightsquigarrow \lambda j(\chi' = (\lambda i.\chi')(j))$.

Applying this to the example *who walks*, we get the following.

---

27Other nominal properties such as person and number are ignored, although they manifest themselves, for example, in the agreement between a subject *wh*-pronoun and the finite verb.
28$= (S:CCF*)$ on p. 196 of Groenendijk & Stokhof (1982)
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(18) \[\text{who}(\text{NOM}) \text{ walks, } T\]
\[
\lambda j(\lambda x_0.\text{walk}'(i)(x_0)) = \lambda x_0.\text{walk}'(j)(x_0))
\]
\[
\text{who}(\text{NOM}) \text{ walks, } t///e
\]
\[
\lambda x_0.\text{walk}'(i)(x_0)
\]
\[
\text{he}_0(\text{NOM}) \text{ walks, } t
\]
\[
\text{walk}'(i)(x_0)
\]

To prepose a \textit{wh}-pronoun other than \textit{who}, the abstract formation rule in (16) above, \textit{AF1}, needs to be modified only slightly by making it a preposing scheme for \textit{wh}-pronouns in general.\(^{30}\) However, a substantially different abstract formation rule must be defined to derive \textit{wh}-questions with a preposed \textit{which}-phrase. This is due to the fact that \textit{which}-phrases are of unbounded syntactic complexity. Such phrases cannot be handled by a syntactic rule of the form (16a). Rather, what is needed is a 2-ary syntactic rule that takes, in addition to a sentence, a \textit{which}-phrase or a noun phrase from which a \textit{which}-phrase can be formed. Implementing the latter option,\(^{31}\) the \textit{wh}-preposing rule for \textit{which}-phrases takes the form in (19).

Again, this rule is a simplified rendering of the corresponding rule of G&S\(^\text{82}.\)\(^{32}\)

(19) \textit{Abstract formation, \textit{wh}-preposing of a \textit{which}-phrase (AF2)}

\[\text{a. If } \varphi \in P_t \text{ and } \delta \in P_{CN}, \text{ then } F_{AF2,n}(\delta, \varphi) \in P_{t///e}.\]

\[\text{Condition: } \varphi \text{ contains an occurrence of } he_n \text{ which bears case } c.\]

\[F_{AF2,n}(\delta, \varphi) = \text{which}(c) \delta(c) \psi, \text{ where } \psi \text{ comes from } \varphi \text{ by deleting the occurrence of } he_n \text{ in } \varphi.\]

\[\text{b. If } \varphi \rightsquigarrow \varphi' \text{ and } \delta \rightsquigarrow \delta', \text{ then } F_{AF2,n}(\delta, \varphi) \rightsquigarrow \lambda x_n(\delta'(x_n) \land \varphi').\]

\(^{30}\)In G&S\(^\text{82},\) only the \textit{wh}-pronoun \textit{who} is considered.

\(^{31}\)See section 2.5 for an argument that this is the only option in a non-dynamic framework.

\(^{32}\)Cf. (S:\textit{AB2})(T:\textit{AB2}) on p. 198 and p. 211 of Groenendijk & Stokhof (1982).
Again, it can be observed that the nominal properties of the *which*-phrase are referred to,\(^{33}\) although the phrase is not assigned a (nominal) category. The analysis tree in (20) shows the derivation of the *de dicto* reading of *which spy walks*. As depicted, the abstract underlying this question is derived from the common noun *spy* and the sentence *he\(_0\)* walks by an application of \(AF^2\).

\[
\begin{align*}
\text{which spy(NOM)\ walks, } &\lambda j(\lambda x_0(\text{spy}'(i)(x_0) \land \text{walk}'(i)(x_0))) \\
\text{which spy(NOM)\ walks, t/\#/e} &\lambda x_0(\text{spy}'(i)(x_0) \land \text{walk}'(i)(x_0)) \\
\text{AF}^2_0 \quad \text{spy, CN} &\quad \text{he}_0(\text{NOM)\ walks, t} \\
\text{spy}'(i) &\quad \text{walk}'(i)(x_0)
\end{align*}
\]

### 2.4.3 Multiple *wh*-questions

Multiple *wh*-questions are derived in three or more steps from sentences containing two or more (pairwise distinct) syntactic variables. The rules applied in the first and last step of such a derivation are identical to the rules that derive simple *wh*-questions. In the first step, a *wh*-preposing rule introduces the first *wh*-term into the derivation, and in the last, a clause formation rule forms an interrogative clause. In the steps in between, the second to last *wh*-terms are introduced into the

\[^{33}\text{English *which*-phrases do not exhibit case. However, their German counterparts, for instance, are overtly marked for case:}\]

(i) a. welch-er Bär
    which-NOM bear.NOM
b. welch-en Bär-en
    which-ACC bear-ACC
derivation. In a simple *wh*-fronting language like English, these *wh*-terms occur *in situ* and must therefore be substituted for the syntactic variables in the input expression. This is achieved by another kind of abstract formation rule, a so-called *wh*-substitution rule.

*Wh*-substitution rules differ from *wh*-preposing rules with respect to the objects they operate on and the output they deliver. A *wh*-preposing rule invariably operates on a sentence and invariably derives an abstract or, more precisely, a 1-ary abstract (an expression of category \( t///e \) and type \( \langle e, t \rangle \)). In contrast to this, *wh*-substitution rules operate on abstracts of variable arity. That is, they form an \( n+1 \)-ary abstract from an \( n \)-ary abstract, where \( n \) is the number of *wh*-terms that have already been introduced. This means that a *wh*-substitution rule takes the form of a rule *scheme*, which is flexible enough to deal with different categories/types as input and output. This is exemplified by the rule scheme for *who* in (21).\(^{34}\) As can be seen in (21a), the input expression may be of a variable type \( A \) drawn from the set \( AB \), where \( AB = \{ t///e, t///e/e, t///e/e/e, \ldots \} \).

(21) Abstract formation, *wh*-substitution of *who* (AF3)

a. If \( \chi \in P_A, A \in AB \), then \( F_{AF3,n}(\chi) \in P_{A/e} \).

Condition: \( \chi \) contains an occurrence of *he*\(_n\) which bears case \( c \).

\[ F_{AF3,n}(\chi) = \xi, \text{ where } \xi \text{ comes from } \chi \text{ by replacing the occurrence of } \text{he}_n \text{ in } \chi \text{ by } \text{who}(c). \]

b. If \( \chi \rightsquigarrow \chi' \), then \( F_{AF3,n}(\chi) \rightsquigarrow \lambda x_n.\chi' \).

Again, *which*-phrases require a separate rule or rather rule scheme (see 22).\(^{35}\)

(22) Abstract formation, *wh*-substitution of a *which*-phrase (AF4)

\(^{34}\)Cf. (S:AB3) on p. 214 and (T:AB3) on p. 201 of Groenendijk & Stokhof (1982).

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a. If \( \chi \in P_A, A \in AB \) and \( \delta \in P_{CN} \), then \( F_{AF4,n}(\chi, \delta) \in P_{A/e} \).

Condition: \( \chi \) contains an occurrence of \( he_n \) which bears case \( c \).

\( F_{AF4,n}(\chi, \delta) = \xi \), where \( \xi \) comes from \( \chi \) by replacing the occurrence of \( he_n \) in \( \chi \) by \( which(c) \delta(c) \).

b. If \( \chi \leadsto \chi' \) and \( \delta \leadsto \delta' \), then \( F_{AF4,n}(\chi, \delta) \leadsto \lambda x_n[\delta'].\chi' \).

The categorial diversity produced by the \( wh \)-substitution rule schemes requires the adaption of the clause formation rule to the variable inputs. This is achieved by generalizing the rule in (17) to the rule scheme given in (23).\(^{36}\)

(23) \hspace{1cm} \textit{Clause formation, } \textit{CF}

\begin{enumerate}
\item If \( \chi \in P_A, A \in AB \), then \( F_{CF}(\chi) \in P_t \).
\item If \( \chi \leadsto \chi' \), then \( F_{CF}(\chi) \leadsto \lambda j(\chi' = (\lambda i.\chi')(j)) \).
\end{enumerate}

Thus, instead of allowing only expressions of category \( t///e \) as input, clause formation can now proceed from all categories in the set \( AB \) (see above).

The \textit{de dicto} reading (with respect to both \textit{which}-phrases) of a double question like \textit{(guess) which man which girl loves} can then be derived as follows.

(24) \[ \lambda_j(\lambda x_0[\text{girl}'(i)]\lambda x_1(\text{man}'(i)(x_1) \land \text{love}'(i)(x_0, x_1))) = \lambda x_0[\text{girl}'(j)]\lambda x_1(\text{man}'(j)(x_1) \land \text{love}'(j)(x_0, x_1))) \]

Note that by the definition of restricted \( \lambda \)-abstraction, the translation of the root node of (24) denotes the same proposition as the expression in (25).

(25) \[ \lambda_j(\lambda x_0\lambda x_1(\text{girl}'(i)(x_0) \land \text{man}'(i)(x_1) \land \text{love}'(i)(x_0, x_1))) = \lambda x_0\lambda x_1(\text{girl}'(j)(x_0) \land \text{man}'(j)(x_1) \land \text{love}'(j)(x_0, x_1))) \]

Note that (25) is of the form identified in section 2.3.3 as the general form of \( wh \)-question translations.

### 2.5 Problems of the categorial approach

The discussion in this section serves to provide (essentially) theory-internal motivation for implementing the partition theory in the way proposed in chapter 3 and 4.
2.5. PROBLEMS OF THE CATEGORIAL APPROACH

2.5.1 Problems arising from the unbounded categorial diversity

The above sketch must suffice as an outline of how the denotation of wh-questions is compositionally derived in G&S82. In anticipation of the discussion below, I have already mentioned that there is a factor that complicates the grammatical analysis of wh-questions and calls into doubt its descriptive and explanatory adequacy. This factor was identified to be the categorial approach to the semantics of interrogatives, which the question theory of G&S82 incorporates (see section 2.3.3).

Syntactically, the incorporation of the categorial approach is evident in the fact that (multiple) wh-questions are formed from expressions – termed abstracts – that are of unbounded categorial diversity \((t, t/e, t/e/e, t/e/e/e, \ldots)\). We saw that as a consequence of this, the rules generating wh-questions must be conceived as rule schemes, that is, as rules which refer to a category variable (for example, the variable \(A\) in (23)). While this is arguably a way to deal with the problem, the categorial diversity still affects the analysis of certain linguistic phenomena in an unwelcome way. An example that comes to mind is the following. In a large variety of languages, interrogative sentences are formed by means of so-called question markers, which typically occur in clause-peripheral position. An example of such a language is Japanese. In Japanese, there are several clause-final question markers, one of which, the particle \(ka\), obligatorily occurs in embedded questions. This is illustrated with the sentences in (26).\(^{37}\)

\[(26)\]
\[
a. \text{Naoya-wa [Mary-ga nani-o nomiya-de nonda ka] oboeteru.}
\]
\[
\text{Naoya-TOP Mary-NOM what-ACC bar-LOC drank Q remember}
\]
\[
\text{‘Naoya remembers what Mary drank at the bar.’}
\]

\(^{37}\)The examples in (26) are adapted from Ishihara (2003).
   Naoya-TOP who-NOM what-ACC bar-LOC drank Q remember
   ‘Naoya remembers who drank what at the bar.’

It is tempting to relate these occurrences of ka with what is referred to as “clause formation” in the preceding sections – that is, to assume that by adding ka an abstract is transformed into an interrogative clause. However, this means that ka must be a syncategorematic expression since abstracts are of variable category. This in turn rules out the most plausible account of the syntactic distribution of ka, namely that it is the interrogative counterpart to the declarative complementizer to. As shown in (27), to occurs in clause-final position in embedded declaratives.

(27) Naoya-wa [Mary-ga nanika-o nomiya-de nonda to]
   Naoya-TOP Mary-NOM something-ACC bar-LOC drank that
   omotteru.
   think
   ‘Naoya thinks that Mary drank something at the bar.’

By its syntactic distribution, to exemplifies the head-final character of Japanese and thereby points to the following problem. If ka is a syncategorematic expression, it is inaccessible to generalizations referring to categorial properties such as the bar level of a category. So it is just an accident that ka occurs clause-finally like to (and heads of phrases in general in Japanese). This, however, is unsatisfactory. That is, what starts out as a promising analysis of the question marker ka is flawed by the impossibility to assign it a category – and this does not seem to reflect an empirical fact, but rather a theory-internal problem.

---

38For example, the abstracts underlying the embedded questions in (26a) and (b) are of category $t///e$ and $t///e/e$, respectively.
Unsurprisingly, then, this is not the only case where the analysis in G&S82 fares badly due to the diversity of the categories from which \textit{wh}-questions are derived. Another negative consequence is that \textit{wh}-words must be analyzed as syncategorematic expressions as well. To see this, take a look at the partial analysis tree in (28), which shows the final steps in the derivation of the 3-place question \textit{who introduced whom to whom}. To derive this question, three occurrences of \textit{who(m)} must be introduced into the derivation step by step. Since each of these steps increases the arity of the abstract derived, each occurrence must be added to an expression of a different category. Hence, \textit{who(m)} or any other \textit{wh}-word cannot be of a (single) fixed category.

\begin{equation}
\begin{aligned}
\text{who introduced whom to whom, } t \quad & \\
\lambda_f(\lambda x_2 \lambda x_1 \lambda x_0. \text{introduce}'(i)(x_0, x_1, x_2) = \\
& = \lambda x_2 \lambda x_1 \lambda x_0. \text{introduce}'(i)(x_0, x_1, x_2)) \\
\end{aligned}
\end{equation}

\begin{align*}
\text{who introduced whom to whom, } t / / e / / e / / e \\
\lambda x_2 \lambda x_1 \lambda x_0. \text{introduce}'(i)(x_0, x_1, x_2) \\
\end{align*}

\begin{align*}
\text{who introduced whom to him}_2, t / / e / / e / / e \\
\lambda x_1 \lambda x_0. \text{introduce}'(i)(x_0, x_1, x_2) \\
\end{align*}

\begin{align*}
\text{who introduced him}_1 \text{ to him}_2, t / / e / / e / / e \\
\lambda x_0. \text{introduce}'(i)(x_0, x_1, x_2) \\
\end{align*}

\begin{align*}
\text{he}_0 \text{ introduced him}_1 \text{ to him}_2, t \\
\text{introduce}'(i)(x_0, x_1, x_2) \\
\end{align*}

The problem is that a syncategorematic analysis of \textit{wh}-words is descriptively and explanatorily inadequate. \textit{Wh}-words are usually categorized as pronouns, adverbs,
determiners, et cetera – and this is for a good reason: *wh*-words simply share all relevant grammatical properties with the elements of these categories. Therefore, whatever principles account for the, say, case properties of a nominal should do so for *wh*-pronouns and *which*-phrases too; but this is impossible if *wh*-words are syncategorematic expressions. A reflex of this can be found in the abstract formation rules $AF_1$-$AF_4$. As pointed out above, these rules require that *wh*-pronouns and *which*-phrases bear case, but note that this cannot be derived from their – lacking – categorial status. Moreover, it cannot be explained that *wh*-pronouns and *which*-phrases bear the same case as non-*wh* NPs that stand in the same (structural/thematic) relation to the verb.

Another difficulty that results from the syncategorematic treatment of *wh*-words is that different abstract formation rules must be employed to introduce *wh*-pronouns and *which*-phrases into a derivation. As we saw in section 2.4, this is to account for grammatical differences *internal* to these expressions. More precisely, two variants of $AF$ rules must be defined to deal with the fact that *which*-phrases are syntactically complex, whereas *wh*-pronouns are not (compare $AF_2$/$AF_4$ with $AF_1$/$AF_3$). The same problem arises with respect to *wh*-adverbs, which require yet another $AF$ rule.\(^{39}\) As a matter of fact, virtually every grammatical difference between *wh*-constituents must be encoded in a separate $AF$ rule.\(^{40}\) This is unintuitive and makes it difficult to explain the syntactic distribution of *wh*-words.\(^{41}\)

\(^{39}\) *Wh*-adverbs do not bear (structural) case or other nominal features. Beyond that, they are bound to the occurrence of variables of a different type than the type of terms.

\(^{40}\) For example, the possessive *wh*-pronoun in (i) cannot be preposed by $AF_1$ because it pied-pipes the possessed NP.

(i) \([NP \text{ Whose advice }] \text{ should I follow } t_{NP}?\)

\(^{41}\) However, this does not mean that explanatory accounts of the distributional facts are impossi-
2.5. PROBLEMS OF THE CATEGORIAL APPROACH

For these reasons, it is desirable to remove the ingredients of the categorial approach from the question theory of Groenendijk and Stokhof. However, this does not seem to be possible in a non-dynamic semantic framework such as Ty₂.

2.5.2 Why it seems that the categorial approach cannot be dismissed

Groenendijk and Stokhof consider introducing wh-constituents only after an expression of the clausal category ℰ has been formed (G&S82, pp. 204f). This could get rid of the problems discussed in the previous section, such as the syncategorematic status of wh-words. For the question derived in (28) above, the alternative approach amounts to categorizing wh-pronouns as terms and replacing the AF rules by a rule, let us call it CG for categorial, which allows the tree in (29) to be derived (where \( F_{CG,\nu}(who, \ldots) \)' is the translation of the expression derived in each step).

---

ble. In G&S82, certain constraints on wh-movement are expressed by specifying which syntactic variables count as wh-traces, which depends on their syntactic environment. If this notion of wh-trace is referred to in all AF rules, the associated generalizations are indeed captured, cf. Groenendijk & Stokhof (1982), pp. 208ff.
In each step of the derivation above, an occurrence of the *wh*-pronoun *who* is merged with an expression of category $\overline{t}$ to again derive an expression of this category. Therefore, *who* can itself be of a particular category, more specifically, of category $T$.

Now, Groenendijk and Stokhof argue that in the general case, the hypothesized rule $CG$ cannot be interpreted compositionally. Their argument goes as follows.\(^{42}\) On the semantic side, $CG$ would have to transform an expression of the form (30a) into one of the form (30b) (or an equivalent expression).

\[(30) \quad \lambda j(\alpha/i/ = \alpha/j/)
\quad \text{b. } \lambda j(\lambda x(\ldots \alpha \ldots)/i/ = \lambda x(\ldots \alpha \ldots)/j/)
\]

In the case of *wh*-pronouns, this can be done as follows: Translate a *wh*-pronoun as given in (31a) and combine it with (30a) in the way specified in (31b).

\[(31) \quad \lambda P.\forall x(P(i)(x))
\]

\(^{42}\)Cf. Groenendijk & Stokhof 1982, pp. 204f. The expressions in (30)-(34) are adapted from this source.
2.5. PROBLEMS OF THE CATEGORIAL APPROACH

b. \(\lambda j(\beta(\lambda i\lambda x_n(\rho(j))))\), where \(\beta\) translates a \(wh\)-term and \(\rho\) an interrogative and \(x_n\) is the variable quantified over

This yields the expression in (32a), which is denotationally equivalent to (32b). Since (32b) is of the required form, the above procedure realizes the desired transformation.

(32) a. \(\lambda j.\forall x(\lambda x_n(\alpha/i/ = \alpha/j/)(x))\)
   b. \(\lambda j(\lambda x_n.\alpha/i/ = \lambda x_n.\alpha/j/)\)

Which-phrases, however, pose a problem for this procedure, as it cannot derive the \(de \ dicto\) reading that is induced by these phrases. Following the pattern for \(wh\)-pronouns just given, a which-phrase which \(\delta\) translates as a term of the form (33) (where \(\delta'\) is the translation of \(\delta\)).

(33) \(\lambda P.\forall x(\delta'(x) \rightarrow P(i)(x))\)

Combining (33) with (30a) by way of (31b) gives the expression in (34a), where this expression denotes the same proposition as (34b).

(34) a. \(\lambda j.\forall x(\delta'(x) \rightarrow (\lambda x_n(\alpha/i/ = \alpha/j/))(x))\)
   b. \(\lambda j(\lambda x_n(\delta'(x_n) \land \alpha/i/) = \lambda x_n(\delta'(x_n) \land \alpha/j/))\)

Now, note that in (34b) both occurrences of \(\delta'\) contain a free occurrence of the index variable \(i\). Therefore, the proposition denoted by (34a/b) is the \(de \ re\) reading of a which-question. Take, for example, the question which spy walks discussed in section 2.3.2. In (35a), you find the Ty\(_2\) translation of the clause that serves as the starting point of the derivation (whether he\(_0\) walks). The expression in (35b) is the proposed translation for which spy.
(35) a. \( \lambda j. (\text{walk}'(i)(x_0) \leftrightarrow \text{walk}'(j)(x_0)) \)
   
   b. \( \lambda P. \forall x (\text{spy}'(i)(x) \rightarrow P(i)(x)) \)

The result of combining (35a) and (b) is the expression in (36a), which is equivalent to (36b). Now observe that (36b) is identical to the expression that was shown to represent the de re reading of which spy walks (see (10) in section 2.3.2).

(36) a. \( \lambda j. \forall x (\text{spy}'(i)(x) \rightarrow (\lambda x_0 (\text{walk}'(i)(x_0) \leftrightarrow \text{walk}'(j)(x_0))(x))) \)
    
   b. \( \lambda j (\lambda x (\text{spy}'(i)(x) \land \text{walk}'(i)(x)) = \lambda x (\text{spy}'(i)(x) \land \text{walk}'(j)(x))) \)

From this, Groenendijk and Stokhof conjecture that there is no way to derive the de dicto reading of a which-question from (30a) and (33) (G&S82, p. 205). This conjecture is proved in Zimmermann (1985), which shows that the ingredients of the categorial approach cannot be removed from the original version of Groenendijk and Stokhof’s partition theory of questions.

Nevertheless, the following chapter will show that it is possible to treat wh-words categorically and derive the de dicto reading in a compositional way. The key to achieve this is to replace the non-dynamic semantics used in G&S82 by a dynamic semantics. This will allow us to analyze wh-words in the same way as indefinites, that is, in terms of dynamic existential quantification.
Chapter 3

A Dynamic Partition Semantics

3.1 Introduction

At the end of the previous chapter, I discussed a number of problematic grammatical assumptions that we apparently have to accept to compositionally derive the semantic objects identified in G&S82 as \textit{wh}-question denotations. At the outset of this chapter, I want to discuss an empirical phenomenon which presents another problem for the grammatical analysis in G&S82,\(^1\) but which also points to a solution to all problems encountered. The phenomenon is the following: Indefinite and interrogative pronouns are closely related in the majority of the world’s languages.\(^2\) Consider, for instance, the example in (1), which is a string of Lakhota words. This string can either be read as a \textit{yes/no}- or as a \textit{wh}-question (see the paraphrases in (1a) and (b), respectively). On the first reading, the \textit{wh}-pronoun \textit{táku} functions as an indefinite, and on the second as a question word.\(^3\)

\(^{1}\)I am grateful to Peter Staudacher for pointing out this problem to me.
(1) šúka ki tákuyaxtáka he
dog the something/what bit Q

a. ‘Did the dog bite something?’
b. ‘What did the dog bite?’

If explanatory adequacy is to be achieved, a theory of interrogatives must therefore incorporate a compositional analysis of *wh*-questions in which *wh*-terms are treated essentially like indefinites. The question theory presented in G&S82 does not offer such an analysis. Rather, we saw in section 2.5.2 that G&S feel compelled to conclude that *wh*-terms are the natural language counterpart of the λ-abstraction sign of type theory. This means that as long as we cannot establish a link between λ-abstraction and existential quantification, the indefinite-interrogative affinity remains unaccounted for. At the time G&S82 was written, such a link appeared not to exist. But in the following years, a surprising insight emerged from the development of dynamic semantic frameworks for natural language. This insight is described in Groenendijk & Stokhof (1992) as follows.

Treating [*wh*-terms] like indefinites in a dynamic framework would mean translating them in terms of dynamic existential quantification. [...] [I]f existential quantification is dynamic, we can ‘disclose’ the property $\lambda x \phi$ from the existentially quantified formula $\exists x \phi$. This means that in the end it makes no difference whether we deal with *wh*-terms as a form of restricted λ-abstraction, or as dynamic existential quantification. (*Op. cit.*, p. 122)

Despite its promise, the idea expressed in this quote has never been spelled out. This and the following chapter aims to achieve just this.\(^4\) The chapter is or-

\(^4\)The paper from which the above quote is taken came to my knowledge only after I had finished most of the work on this chapter. Therefore, reference to Groenendijk & Stokhof (1992) is not as
3.2. THE INDEFINITE-INTERROGATIVE AFFINITY

In the languages of the world, indefinite and interrogative pronouns are often closely related in form.\(^5\) Among the languages that show this relationship, we can identify two major classes: In the first class, indefinite and interrogative pronouns are identical in form,\(^6\) or rather, they are one and the same item.\(^7\) In the second class, indefinite pronouns are derived from interrogative pronouns.\(^8\) In

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\(^5\)Here and below, I use “pronoun” in the broad sense of Haspelmath (1997), including pro-adverbs and determiners.

\(^6\)To be precise, the formal identity holds except for the F-feature borne by the interrogative occurrences of such pronouns. See below and chapter 7 for discussion.

\(^7\)Another possibility would be that form identical indefinite and interrogative pronouns are different but homonymous lexical items. However, this is highly unlikely, given the pervasiveness of the indefinite-interrogative affinity (for discussion, see Bhat 2000). Therefore, I neglect this possibility.

\(^8\)According to Martin Haspelmath, no languages are attested in which the direction of derivation is reversed: “I am not aware of a clear case in which an indefinite pronoun is formally unmarked with respect to a marked interrogative pronoun” (Haspelmath 1997, p. 25). Furthermore,
this section, I will concentrate on the first class of languages, because I consider
the identity of indefinite and interrogative pronouns as the basic phenomenon.
In chapter 5, I will discuss the second class of languages along with an influen-
tial analysis, Kratzer & Shimoyama (2002), which takes the derivational relation-
ship between various pronoun paradigms as starting point. A thorough compari-
son will show that the approach taken here is similar to Kratzer & Shimoyama’s
analysis in several important respects. This is quite unexpected, since the two
approaches not only take different stances on what constitutes the core of the
indefinite-interrogative affinity, but are in addition based on (seemingly) very dif-
ferent concepts: alternative sets on the one hand (Kratzer & Shimoyama’s ap-
proach) and dynamic existential quantification on the other (the approach pursued
here). However, the comparison will also show that the dynamic-semantic ap-
proach is more powerful, leading to broader empirical coverage.

As a starting point, let us take another look at Lakhota (cf. ex. (1) in the
introduction to this chapter). To reapeat, the string in (2) has two readings, a
yes/no-question and a wh-question reading. On the first reading, the wh-pronoun
táku functions as an indefinite, and on the second as a question word.

(2) šúka ki táku yaxtáka he
dog the something/what bit Q

a. ‘Did the dog bite something?’
b. ‘What did the dog bite?’

There is more to be said about the double function of the wh-pronoun in this
string. According to Van Valin (1993), the two readings of (2) are disambiguated
by the location of the focus: If it falls on the wh-pronoun, (2) is interpreted as a

inddefinite and interrogative pronouns are only rarely derived from a common stem by attaching
3.2. THE INDEFINITE-INTERROGATIVE AFFINITY

constituent question, and if it falls on some other constituent, (2) is interpreted as a yes/no-question (cf. op. cit., p. 98). This can be observed for all pronouns in the following table.

(3) \textit{Lakhota}

<table>
<thead>
<tr>
<th>Interrogative/Indefinite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person</td>
</tr>
<tr>
<td>\textit{tuwa}</td>
</tr>
<tr>
<td>‘who’/‘someone’</td>
</tr>
<tr>
<td>Thing</td>
</tr>
<tr>
<td>\textit{táku}</td>
</tr>
<tr>
<td>‘what’/‘something’</td>
</tr>
<tr>
<td>Place</td>
</tr>
<tr>
<td>\textit{tuktel}</td>
</tr>
<tr>
<td>‘where’/‘somewhere’</td>
</tr>
<tr>
<td>Manner</td>
</tr>
<tr>
<td>\textit{tókhel}</td>
</tr>
<tr>
<td>‘how’/‘somehow’</td>
</tr>
</tbody>
</table>

We thus see that in Lakhota the syntactic occurrences of \textit{wh}-pronouns are marked as indefinite and interrogative occurrences, respectively.

A comparable observation can be made in Korean. According to Choe (1995), the string in (4) allows for a yes/no-question and a \textit{wh}-question reading (see the paraphrases in (4a) and (b), respectively). Correspondingly, the \textit{wh}-pronoun
nwu(kwu) functions either as an indefinite or as a question word.9

(4) nwu(kwu)-ka pakkey w-ass-ni?
someone/who-SUB outside come-PAST-Q

a. ‘Is there someone at the door?’
b. ‘Who is at the door?’

Again, we find a correlation between these two functions and focusing/prominence: Without stress, nwu(kwu) can mean ‘someone’ or ‘somebody’ and with emphatic stress, it only means ‘who’ (cf. op. cit., p. 289).10 Finally, we can observe that nwu(kwu) is not unique in this respect, but rather a member of a

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9In the nominative, nwukwu occurs without the second syllable of its stem nwu-ka ‘who-NOM’, and cannot take the full form *nwukwu-ka. See Bratt 1996, p. 241.

10In addition to this, the two readings of (5) are associated with different sentence-final intonations: rising intonation in the case of (a) and falling intonation in the case of (b). I assume that this is a reflex of the fact that the first reading derives from an underlying yes/no-question and the second from a wh-question.
3.2. THE INDEFINITE-INTERROGATIVE AFFINITY

paradigm (see the table in (5)).

(5) **Korean**

<table>
<thead>
<tr>
<th></th>
<th>Interrogative/Indefinite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person</td>
<td><code>nwu(kwu)</code></td>
</tr>
<tr>
<td></td>
<td>‘who’/‘someone’ or ‘somebody’</td>
</tr>
<tr>
<td>Thing</td>
<td><code>mues</code></td>
</tr>
<tr>
<td></td>
<td>‘what’/‘something’</td>
</tr>
<tr>
<td>Place</td>
<td><code>eti(ey)</code></td>
</tr>
<tr>
<td></td>
<td>‘where’/‘somewhere’</td>
</tr>
<tr>
<td>Time</td>
<td><code>encey</code></td>
</tr>
<tr>
<td></td>
<td>‘when’/‘sometime’</td>
</tr>
<tr>
<td>Manner</td>
<td><code>ettehkey</code></td>
</tr>
<tr>
<td></td>
<td>‘how’/‘in {a certain</td>
</tr>
<tr>
<td>Det. (spec.)</td>
<td><code>etten NP</code></td>
</tr>
<tr>
<td></td>
<td>‘which NP’/‘a certain NP’</td>
</tr>
<tr>
<td>Det. (unspec.)</td>
<td><code>musun NP</code></td>
</tr>
<tr>
<td></td>
<td>‘what NP’/‘some NP’</td>
</tr>
</tbody>
</table>

As a third and final example, let us consider German.\(^{11}\) We find that the string in (6) can be read either as a simple or as a double *wh*-question (see (6a) and (b), respectively). The first reading is forced by leaving the *in-situ* *wh*-pronoun *was* unaccented, and the second by accenting it.\(^{12}\) If accented, the *wh*-pronoun is construed as a question word and otherwise as an indefinite.\(^{13}\)

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\(^{11}\)See Zaefferer 1991 for an overview of the different uses of *wh*-pronouns in German.

\(^{12}\)See chapter 7 for a more detailed description.

\(^{13}\)See chapter 7 for a discussion why *ex-situ* *wh*-words must in general be construed as question words.
Wer hat was gekauft?
who has something/what bought

a. ‘Who bought something?’

b. ‘Who bought what?’

Table (7) gives a list of German wh-pronouns that have the combination of properties described above.

<table>
<thead>
<tr>
<th></th>
<th>Interrogative/Indefinite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person</td>
<td>wer</td>
</tr>
<tr>
<td></td>
<td>‘who’/‘someone’</td>
</tr>
<tr>
<td>Thing</td>
<td>was</td>
</tr>
<tr>
<td></td>
<td>‘what’/‘something’</td>
</tr>
<tr>
<td>Place</td>
<td>wo</td>
</tr>
<tr>
<td></td>
<td>‘where’/‘somewhere’</td>
</tr>
<tr>
<td>Time</td>
<td>wann</td>
</tr>
<tr>
<td></td>
<td>‘when’/‘sometime’</td>
</tr>
<tr>
<td>—</td>
<td>welch-</td>
</tr>
<tr>
<td></td>
<td>‘which one(s)’/‘some’</td>
</tr>
</tbody>
</table>

To summarize, we observe two things in the above languages: First, indefinite and interrogative wh-pronouns are morphologically identical, and second, the interrogative occurrences of these pronouns are focused. On the common assumption that focusing does not change the lexical meaning of a word, we must conclude that wh-pronouns have the same lexical meaning in the interrogative as in the indefinite construal. However, as it stands, the question theory of G&S82

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14 See chapter 7 for a thorough discussion.
3.3. **THE QUANTIFICATIONAL FORCE OF WH-WORDS**

runs counter to this conclusion. The following section will show how this problem along with the problems pointed out in section 2.5 can be solved.

### 3.3 The quantificational force of *wh*-words

To start this section, I want to draw attention to an aspect of the question semantics of G&S that appears to be counter-intuitive in the light of the empirical finding reported above. Above, we learned that *wh*-words typically have existential quantificational force when used non-interrogatively. But, as brought out by the discussion in section 2.5.2, interrogative *wh*-words induce universal quantification. Consider, for example, what G&S presented as a possible term translation for the question word *who*, the expression in (31a) (repeated in (8) for convenience).

\[(8) \quad \lambda P. \forall x(P(i)(x))\]

As you can see, (8) denotes a universal generalized quantifier. At first sight, the empirical findings reported above conflict with this aspect of the question theory of G&S, and importantly, this seems unavoidable: It is part of the question concept of G&S’s that *wh*-words induce universal quantification. This property follows directly from one of the cornerstones of their theory, namely from the strong exhaustiveness of *wh*-question denotations (see section 2.3).

However, saying that *wh*-words induce universal quantification does not necessarily mean that they *carry* universal quantificational force. The reason is that universal and existential quantification are interdefinable – a logical fact which shows its effects in natural-language sentences, as has long been observed. Take,

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15Other question theories explain the identity of indefinite and interrogative pronouns in a principled way. Take, for example, the question semantics of Karttunen (1977), according to which a question word is an indefinite that takes scope over the question operator of a question.
for example, the conditional sentence in (9). To express the unmarked reading of this sentence by a formula of predicate logic, the universal sentence in (9a) seems to be the most adequate translation. Under a compositional analysis, however, the translation of (9) must take the form of an implication in which the indefinite *an outsider* occurs as an existentially quantified term in the antecedent (see 9b).

(9) If an outsider wins, I get rich.
   a. $\forall x((\text{outsider}'(x) \land \text{win}'(x)) \to \text{I_get_rich}')$
   b. $\exists x(\text{outsider}'(x) \land \text{win}'(x)) \to \text{I_get_rich}'$

The point is, of course, that (9a) and (b) are logically equivalent, since $\forall x(\phi \to \psi)$ is equivalent to $\exists x.\phi \to \psi$, if $x$ is not free in $\psi$ (which is the case in the example considered). This equivalence holds even unconditionally if the assumption is made that an existential quantifier in the antecedent of an implication can bind into the consequent. This binding becomes possible under a so-called *dynamic* semantic interpretation of the language of predicate logic, as developed in Staudacher (1987) and Groenendijk & Stokhof (1991). Crucially, it was natural-language expressions such as the donkey sentence in (10) that motivated this concept. This sentence requires (10a) and (b) to be equivalent so that the intuitively most adequate and the compositional translation can be reconciled.

(10) If a donkey sleeps, it snores.
   a. $\forall x((\text{donkey}'(x) \land \text{sleep}'(x)) \to \text{snore}'(x))$
   b. $\exists x(\text{donkey}'(x) \land \text{sleep}'(x)) \to \text{snore}'(x)$

---

16The equivalence of $\forall x(\phi \to \psi)$ and $\exists x.\phi \to \psi$ can be derived as follows:

$$\forall x(\phi \to \psi) \iff \forall x(\neg\phi \lor \psi) \iff \forall x.\neg\phi \lor \psi \iff \neg\exists x.\phi \lor \psi \iff \exists x.\phi \to \psi$$

It is the second equivalence in the above derivation that requires $x$ not to be free in $\psi$. 
As will be shown in detail in section 3.4.1, this can be achieved by interpreting ‘∃’ and ‘→’ dynamically, that is, by assuming that the existential quantifier can bind into the consequent of an implication. This guarantees that the equivalence in (11) holds for all formulas $\phi$ and $\psi$. (Below, the symbol ‘≃’ indicates that the equivalence depends on the dynamic interpretation of ‘∃’ and ‘→’.)

\[(11) \quad \forall x (\phi \rightarrow \psi) \simeq \exists x. \phi \rightarrow \psi\]

In view of these logical relations, it is to be expected that the universal quantificational force of question words is a logical consequence of their existential quantificational nature. This expectation is further substantiated by the following consideration: As pointed out in section 2.3.3, representations of wh-question denotations take the general form (13) (repeated in (12) for convenience).

\[(12) \quad \lambda j (\lambda x_1 \ldots \lambda x_n. \phi = \lambda x_1 \ldots \lambda x_n. \psi)\]

Now observe that the equation contained in (12) can be equivalently represented by the universal closure of the biconditional $\phi \leftrightarrow \psi$:

\[\lambda x_1 \ldots \lambda x_n. \phi = \lambda x_1 \ldots \lambda x_n. \psi\]

\[\Leftrightarrow\]

\[(A) \quad \forall x_1 \ldots \forall x_n (\phi \leftrightarrow \psi)\]

Formula (A) can then be transformed into a conjunction of two universally closed implications:
\[ \forall x_1 \ldots \forall x_n (\phi \leftrightarrow \psi) \]

\[ \iff \]

(B)

\[ \forall x_1 \ldots \forall x_n (\phi \rightarrow \psi) \land \forall x_1 \ldots \forall x_n (\psi \rightarrow \phi) \]

Formula (B) indicates that the conflict pointed out above is completely resolved in a dynamic semantic framework: To simplify matters, let us assume that \( \phi \) and \( \psi \) do not contain existential quantifiers themselves. Then we can take (B) to be a formula of dynamic predicate logic without affecting its truth conditions. The equivalence stated in (11) allows us to rewrite a universally closed implication as an implication with an existentially closed antecedent. Thus, we can deduce formula (C) below.

\[ \forall x_1 \ldots \forall x_n (\phi \rightarrow \psi) \land \forall x_1 \ldots \forall x_n (\psi \rightarrow \phi) \]

\[ \simeq \]

(C)

\[ (\exists x_1 \ldots \exists x_n, \phi \rightarrow \psi) \land (\exists x_1 \ldots \exists x_n, \psi \rightarrow \phi) \]

This finding already shows that arguably the universal import of \( \mathrm{wh} \)-words is induced by dynamic existential quantifiers. To go a step further in the argument, we have to examine the semantics of dynamic predicate logic more closely. However, in order not to lose focus, I defer this to section 3.4.2. For now, let me simply assert that a conjunction of two implications like (C) can be conflated into a biconditional between the two antecedents.\(^{17}\) That is, we obtain the following equivalence.

\(^{17}\)Neither Staudacher (1987) nor Groenendijk & Stokhof (1991) define a dynamic interpretation for ‘\( \leftrightarrow \)’. However, the definition that suggests itself naturally has the property claimed here. See section 3.4.2.4.
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\[(\exists x_1 \ldots \exists x_n . \phi \rightarrow \psi) \land (\exists x_1 \ldots \exists x_n . \psi \rightarrow \phi)\]

\[\simeq\]

\[\exists x_1 \ldots \exists x_n . \phi \leftrightarrow \exists x_1 \ldots \exists x_n . \psi\]

Summing up so far, we have found that on dynamic interpretation, an expression of the form (13) denotes the same proposition as an expression of the form (12).\(^{18}\)

(13) \[\lambda j (\exists x_1 \ldots \exists x_n . \phi \leftrightarrow \exists x_1 \ldots \exists x_n . \psi)\]

Now recall that the formulas \(\phi\) and \(\psi\) above are formally closely related: As pointed out in section 2.3.3, they can be regarded as saturated relations that differ

\(^{18}\)It is not entirely clear to me what Groenendijk and Stokhof allude to in the passage cited in the introduction of this chapter. However, when they speak of the possibility “to disclose the property \(\lambda x . \phi\) from the existentially quantified formula \(\exists x . \phi\)” they seem to refer to the following logical fact: (i-a) denotes the same property as (i-b) if the existential quantifier is interpreted dynamically (cf. Dekker 1993).

(i) a. \(\lambda x'((\exists x . \phi) \land x = x')\)
   b. \(\lambda x . \phi\)

This means that on dynamic interpretation, an expression of the form (ii) denotes the same proposition as an expression of the form (12) (cf. Honcoop 1996, where existential disclosure is used for a different but related purpose).

(ii) \[\lambda j(\lambda x'_1 \ldots \lambda x'_n ((\ldots ((\exists x_1 \ldots \exists x_n . \phi) \land x_n = x'_n) \ldots) \land x_1 = x'_1) = \lambda x'_1 \ldots \lambda x'_n ((\ldots ((\exists x_1 \ldots \exists x_n . \psi) \land x_n = x'_n) \ldots) \land x_1 = x'_1)\]

While this identity could lead to an analysis comparable to the one discussed here, the identity between (12) and (13) seems to be more insightful.
from one another only with respect to the index they depend on. That is, at a more
fine-grained level of detail (13) is of the form (14).

\[ (14) \quad \lambda_j(\exists x_1 \ldots \exists x_n. \beta(i)(x_1, \ldots, x_n) \leftrightarrow \exists x_1 \ldots \exists x_n. \beta(j)(x_1, \ldots, x_n)) \]

By looking at (14), we can observe that a \(wh\)-question denotation can be derived
by applying the operator denoted by (15a) to a proposition denoted by an expres-
sion of the form (15b).

\[ (15) \quad \begin{align*}
& a. \quad \lambda p \lambda j(p(i) \leftrightarrow p(j)) \\
& b. \quad \lambda i. \exists x_1 \ldots \exists x_n. \beta(i)(x_1, \ldots, x_n)
\end{align*} \]

This means that we can solve in one fell swoop all the problems we encountered
in the course of this and the previous chapter. By translatin g \(wh\)-words in terms
of dynamic existential quantification, we can analyze \(wh\)-pronouns and which-
phrases as terms that translate into existential generalized quantifiers. In doing
so, \(wh\)-words are treated categorically, and hence the problems discussed in
section 2.5 are completely resolved. For example, we can replace the plethora of
abstract formation rules needed in the original approach by what amounts to a gen-
eral (\(wh\)-)movement rule. In addition to this, \(wh\)-words are analyzed in such a way
as to account for the indefinite-interrogative affinity: According to the envisaged
analysis, indefinites and question words belong to the same syntactic categories
and have the same lexical semantic content. We therefore expect that there are
languages in which certain words can function both as indefinites and as question
words.

To give an impression of the implications of this analysis, I will now show
how to derive the de dicto reading of (guess) which man which girl loves in a
Montague Grammar framework. The crucial aspects of this derivation are given
in the analysis tree below (cf. tree (24) in section 2.4). Each branching of this
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A tree is annotated with the semantic operation that derives the translation of the branching node from the translations $\alpha'$ and $\beta'$ of the left and right daughter node, respectively. As you can see, only functional application is used to combine $\alpha'$ with $\lambda i.\beta'$, except where a property-denoting expression is formed from $\beta'$. The translations given are (abbreviations of) expressions of a type logic that represent the dynamic meaning of the corresponding natural language expression (see chapter 4 below).

Note that the wh-word occurrences are identified by numeric subscripts. This serves to derive different translations for each occurrence of a wh-word. For the time being, it is only for illustrative purposes that $\textit{which}_1$ is coindexed with the syntactic variable $e_1$. However, it should be clear that under the usual syntactic assumptions, $e_1$ is the coindexed trace of (the phrase pied-piped by) $\textit{which}_1$ (lit-
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erally or in a descriptive sense). In addition, I want to point out that the subject *which*-phrase is merged in the position that is relevant for its thematic interpretation. This is to highlight the possibility to interpret *wh*-phrases *in situ*. In contrast to this, the object *which*-phrase is merged displaced from the position of thematic interpretation, which shows that *wh*-phrases can be interpreted *ex situ*. The exact syntax of *wh*-questions is subject to a (partly) independent investigation and will be discussed in chapter 4 and 7.

In the following section, I will define a two-sorted dynamic predicate logic with λ-abstraction over individual and index variables. This logic, called DPLC, will be employed to prove the identity between (12) and (13) above (or rather a slightly more general proposition).\(^\text{19}\) However, DPLC is not expressive enough to model the compositional derivation of *wh*-question denotations. A type logic that can serve this purpose will be presented in chapter 4.

3.4 A dynamic logic with limited λ-abstraction

To prepare for the reader for the main topic of this section, the following subsection will introduce the basic concept of all dynamic logics, namely the concept of context change.

3.4.1 Dynamic logics

The basic idea of dynamic logics is that certain logical expressions change the evaluation context for the expressions that follow. This raises two questions: What is the evaluation context of a logical expression, and which expressions change it? There is no general answer to these questions, but as regards the dynamic logi-

\(^{19}\)In (12)/(13), the formulas \(\phi\) and \(\psi\) were required not to contain existential quantifiers. This condition can be dropped.
ics developed in Staudacher (1987) and Groenendijk & Stokhof (1991) a specific answer can be derived from the natural-language phenomena they are designed to explain. As mentioned in the preceding section, these phenomena comprise anaphoric relations in donkey sentences and, more generally, cross-sentential anaphoric relations between indefinites and pronouns. The discourse in (16) contains such a relation: the pronoun *it* is anaphorically linked to the indefinite *a dog* across a sentence boundary.

(16) A dog came in. It barked.

It is impossible to formalize this relation by translating (16) into standard predicate logic – at least if the translation is to obey the principle of compositionality. This can be seen as follows: (17) gives the formula that results from translating (16) in a compositional way.

(17) $\exists x (\text{dog}^{'}(x) \land \text{come_in}^{'}(x)) \land \text{bark}^{'}(x)$

In the attempt to model the anaphoric relation, the (quantificational aspect of the) indefinite is represented by the existential quantifier $\exists x$ and the pronoun by the variable $x$. Problematically, however, the existential quantifier does not bind this occurrence of $x$. This follows from two facts: (i) under the principle of compositionality, the syntactic scope of a quantifier is bounded by the sentence in which it occurs, and (ii) in standard predicate logic, existential quantifiers cannot bind variables beyond their syntactic scope. This becomes apparent by considering the truth conditions of (17). According to the standard interpretation of predicate logic, the truth conditions of (17) with respect to a variable assignment $g$ (in a model with domain $\mathcal{D}$) are derived as follows.

$$\llbracket \exists x (\text{dog}^{'}(x) \land \text{come_in}^{'}(x)) \land \text{bark}^{'}(x) \rrbracket_g = 1$$
\[\iffloor \exists x (\text{dog}'(x) \land \text{come_in}'(x)) \rfloor_g = 1 \text{ and } \lceil \text{bark}'(x) \rceil_g = 1\]

There is a \(d \in D : \lceil \text{dog}'(x) \land \text{come_in}'(x) \rceil_{g[x/d]} = 1 \text{, and } \lceil \text{bark}'(x) \rceil_g = 1\)

The last statement above shows that the scope of the existential quantifier, that is, the formula \(\text{dog}'(x) \land \text{come_in}'(x)\) is evaluated with respect to potentially different assignments than the formula \(\text{bark}'(x)\): The latter is evaluated with respect to the original assignment \(g\), and the first with respect to assignments that can differ from \(g\) in the value assigned to \(x\). This means that (17) can be true in a model in which \(\text{bark}'(x)\) is satisfied by an entity that does not satisfy \(\text{dog}'(x) \land \text{come_in}'(x)\). Hence, (17) fails to model the anaphoric relation in (16), and it fails because the satisfying assignments of the existential formula are not preserved for evaluating the subsequent formula.

In the dynamic logics under consideration, the questions raised in the beginning are therefore answered as follows: The evaluation context is a set of variable assignments, and it is changed by existential formulas to preserve their satisfying assignments. The truth conditions of (17) are then as described below.

\[\lceil \exists x (\text{dog}'(x) \land \text{come_in}'(x)) \land \text{bark}'(x) \rceil_g = 1\]

\[\iffloor \exists x (\text{dog}'(x) \land \text{come_in}'(x)) \rfloor_g = 1 \text{ and } \lceil \text{bark}'(x) \rceil_h = 1 \text{ for some } h \in /\phi/_{g}\]

As you can see, the formula \(\text{bark}'(x)\) is evaluated with respect to an assignment \(h\) from a set that depends on a certain meaning aspect of the existential formula \(\phi\). More specifically, \(h\) is an element of the set \(/\phi/_{g}\), the so-called set of result contexts of \(\phi\) with respect to \(g\). This set is given in (18).
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(18) \[ /\phi/_{g} = \{ g[x/d] \mid d \in \mathcal{D} \text{ and } [\text{dog}'(x) \land \text{come_in}'(x)]_{g[x/d]} = 1 \} \]

Generally, the set of result contexts of an existential formula \( \exists v. \psi \) with respect to an assignment \( g \) is the set of all satisfying assignments of \( \psi \) that differ from \( g \) in at most the value assigned to \( v \).\(^{20}\) We then find that the following equivalences hold on a dynamic interpretation of predicate logic.

\[
[\exists x (\text{dog}'(x) \land \text{come_in}'(x)) \land \text{bark}'(x)]_{g} = 1 \\
\overset{\text{dyn.}}{\iff} \\
\text{There is a } d \in \mathcal{D} : [\text{dog}'(x) \land \text{come_in}'(x)]_{g[x/d]} = 1, \text{ and } [\text{bark}'(x)]_{h} = 1 \text{ for some } h \in \{ g[x/d] \mid d \in \mathcal{D} \text{ and } [\text{dog}'(x) \land \text{come_in}'(x)]_{g[x/d]} = 1 \} \\
\iff \\
\text{There is a } d \in \mathcal{D} : [\text{dog}'(x) \land \text{come_in}'(x)]_{g[x/d]} = 1 \text{ and } [\text{bark}'(x)]_{g[x/d]} = 1 \\
\iff \\
[\exists x (\text{dog}'(x) \land \text{come_in}'(x) \land \text{bark}'(x))]_{g} = 1
\]

This means that the last occurrence of \( x \) in (17) is bound by the existential quantifier although it is not in its syntactic scope. Therefore, the anaphoric relation in (16) can be modeled in compliance with the principle of compositionality.

To summarize: In a dynamic logic, the meaning of a formula is more than its truth conditions. Beyond these, a formula has context change potential, as given by its set of result contexts. As will be discussed in the following section, it is the context change potential that exhausts the meaning of a formula, and not its truth conditions. This means that two formulas are logically equivalent iff they have the same context change potential. Now remember that the set of result contexts

\(^{20}\)This formulation presupposes that \( \psi \) does not contain existential quantifiers itself.
of an existential formula contains all satisfying assignments of its scope. This is the reason why stating a logical equivalence between existential formulas lends universal force to the existential quantifiers. This will be shown in more detail below.

3.4.2 The logic DPLC

3.4.2.1 Outlook

In this section, I will show that the following proposition holds if the existential quantifier and the biconditional operator are interpreted dynamically.

**Proposition 1** If $\phi$ and $\psi$ are formulas and $x_1, \ldots, x_n$ are pairwise distinct individual variables, then $\lambda j(\lambda x_1 \ldots \lambda x_n.\phi = \lambda x_1 \ldots \lambda x_n.\psi)$ denotes the same proposition as $\lambda j(\exists x_1 \ldots \exists x_n.\neg\neg\phi \leftrightarrow \exists x_1 \ldots \exists x_n.\neg\neg\psi)$.

To prove proposition 1, I will define a dynamic semantics for a two-sorted predicate logic with $\lambda$-abstraction over individual and index variables. Let us call this logic *DPLC* in allusion to Dynamic Predicate Logic and Lambda Calculus. DPLC is just expressive enough to serve as a representation language for *wh*-question denotations (but not to model their compositional derivation). This allows me to present the core of my analysis without unnecessary complication. As you will see, DPLC is defined in close analogy to PLA (see Staudacher 1987) with some notational borrowings from DPL (see Groenendijk & Stokhof 1991).

3.4.2.2 The syntax of DPLC

First, we have to define the type system of DPLC. As just mentioned, we only allow for $\lambda$-abstraction over individual and index variables, and furthermore $\lambda$-abstraction over index variables. To prove proposition 1, I will define a dynamic semantics for a two-sorted predicate logic with $\lambda$-abstraction over individual and index variables. Let us call this logic *DPLC* in allusion to Dynamic Predicate Logic and Lambda Calculus. DPLC is just expressive enough to serve as a representation language for *wh*-question denotations (but not to model their compositional derivation). This allows me to present the core of my analysis without unnecessary complication. As you will see, DPLC is defined in close analogy to PLA (see Staudacher 1987) with some notational borrowings from DPL (see Groenendijk & Stokhof 1991).

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21See section 3.4.2.5 for an explanation why $\phi$ and $\psi$ occur doubly negated in the existential formulas above.
abstraction may only apply to expressions of relational type (a type ending in $t$).
Hence, the set of DPLC types is as defined below.

**Definition 1 (Primitive Relational Types)** $PRT$, the set of primitive relational
types, is the smallest set such that:

1. $t \in PRT$
2. If $a \in PRT$, then $\langle e, a \rangle \in PRT$ and $\langle s, a \rangle \in PRT$

**Definition 2 (DPLC Types)** $T$, the set of DPLC types, is the set $PRT \cup \{e, s\}$.

The logical vocabulary of DPLC consists of the usual logical symbols. The
non-logical vocabulary contains infinitely many constants and denumerably many
variables of each type in $T$. The syntax of DPLC is then given by the following
recursive definition (where $ME_a$ is the set of meaningful expressions of type $a$).

**Definition 3 (Syntax of DPLC)**

1. Every constant and variable of type $a$ is in $ME_a$.
2. If $\alpha \in ME_{(b,a)}$, $\beta \in ME_b$, then $\alpha(\beta) \in ME_a$.
3. If $\alpha, \beta \in ME_a$, then $\alpha = \beta \in ME_t$.
4. If $\phi, \psi \in ME_t$, then $\neg \phi$, $(\phi \land \psi)$, $(\phi \lor \psi)$, $(\phi \rightarrow \psi)$, $(\phi \leftrightarrow \psi) \in ME_t$.
5. If $\phi \in ME_t$ and $\nu$ is an individual variable, then $\exists \nu \phi$, $\forall \nu \phi \in ME_t$.
6. If $\alpha \in ME_a$ where $a \in PRT$, and $\nu$ is a variable of type $b$ where $b \in \{e, s\}$,
   then $\lambda \nu \alpha \in ME_{(b,a)}$.
7. Nothing is in $ME_a$ for any type $a$ except as required by 1–6.
As usual, a meaningful expression of type \( t \) is called a formula. Furthermore, by a meaningful expression of DPLC we mean any member of \( \bigcup_{a \in T} \text{ME}_a \). Obviously, every meaningful expression of DPLC is also a meaningful expression of Ty_2. Conversely, a Ty_2 expression \( \alpha \) is a meaningful expression of DPLC iff the following conditions hold: (i) \( \alpha \) contains only constants and variables of a type in \( T \), (ii) quantified variables in \( \alpha \) are of type \( e \), and (iii) \( \lambda \)-bound variables in \( \alpha \) are of type \( e \) or \( s \). On these assumptions, all \textit{wh}-question translations discussed in G&S82 are meaningful expressions of DPLC.

### 3.4.2.3 The semantics of DPLC

The semantics of DPLC is defined in such a way that a DPLC expression of type \( a \) denotes the same kind of semantic object as a Ty_2 expression of type \( a \). This means that a DPLC model is a substructure of a Ty_2 model. More precisely, a DPLC model is a triple \( \langle D, S, F \rangle \), where \( D \) and \( S \) are two disjoint, non-empty sets and \( F \) is an interpretation function for the constants of DPLC. The sets \( D \) and \( S \) are used to specify the range of possible denotations: For each type \( a \in T \), the set of possible denotations of type \( a \) \( (D_a) \) is as given by the following recursive definition.

#### Definition 4 (Possible Denotations)

1. \( D_e = D \)
2. \( D_s = S \)
3. \( D_t = \{0, 1\} \)
4. \( D_{\langle a,b \rangle} = D_b^{D_a} \)

The interpretation function \( F \) has as its domain the set of all constants and maps each constant to a member of \( \bigcup_{a \in T} D_a \). Specifically, whenever \( a \) is a type in \( T \) and
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c is a constant of type $a$, then $F(c) \in \mathcal{D}_a$. As usual, variables are interpreted by means of an assignment function, that is, a function having as its domain the set of all variables and mapping each variable of type $a$ to an element of $\mathcal{D}_a$. If $g$ is such a function, then $g[\nu/d]$ is that assignment function such that $g[\nu/d](\nu') = g(\nu')$ for $\nu \neq \nu'$, and $g[\nu/d](\nu) = d$.

Now we are prepared to define the extension of DPLC expressions and the set of result contexts of DPLC formulas: For every meaningful expression $\alpha$, $[\alpha]_{M,g}$ is to be the extension of $\alpha$ with respect to $g$ in $M$. For every formula $\phi$, $/\phi/_{M,g}$ is to be the set of result contexts of $\phi$ with respect to $g$ in $M$. These notions are given by the simultaneous recursive definition below.

**Definition 5 (Semantics of DPLC)**

1. $[c]_{M,g} = F(c)$, for every constant $c$
2. $[\nu]_{M,g} = g(\nu)$, for every variable $\nu$
3. $[\lambda \nu \alpha]_{M,g} =$ that function $f \in \mathcal{D}_{a_b}$ such that for all $d \in \mathcal{D}_b$ it holds that $f(d) = [\alpha]_{M,g[\nu/d]}$, where $a$ is the type of $\alpha$ and $b \in \{e, s\}$ is the type of $\nu$
4. $[\alpha(\beta)]_{M,g} = [\alpha]_{M,g}([\beta]_{M,g})$
5. $[\alpha = \beta]_{M,g} = 1$ iff $[\alpha]_{M,g} = [\beta]_{M,g}$
6. $[\neg \phi]_{M,g} = 1$ iff $[\phi]_{M,g} = 0$
7. $[\phi \land \psi]_{M,g} = 1$ iff there is a $h \in /\phi/_{M,g}$ such that $[\psi]_{M,h} = 1$
8. $[\phi \lor \psi]_{M,g} = 1$ iff $[\phi]_{M,g} = 1$ or $[\psi]_{M,g} = 1$
9. $[\phi \rightarrow \psi]_{M,g} = 1$ iff for all $h \in /\phi/_{M,g}$ it holds that $[\psi]_{M,h} = 1$
10. $[\phi \leftrightarrow \psi]_{M,g} = 1$ iff $/\phi/_{M,g} = /\psi/_{M,g}$
11. \[ \exists \nu \phi \] \text{ in } M, g = 1 \text{ iff there is a } d \in D \text{ such that } [\phi]_{M,g[v/d]} = 1

12. \[ \forall \nu \phi \] \text{ in } M, g = 1 \text{ iff for all } d \in D \text{ it holds that } [\phi]_{M,g[v/d]} = 1

13. For \( \chi \neq (\phi \land \psi) \), \( \chi \neq \exists \nu \phi \), and \( \chi \neq (\lambda \nu_1 \ldots \lambda \nu_n \phi)(\alpha_1) \ldots (\alpha_n) \):

\[
[\chi]_{M,g} = \begin{cases} 
\{ g \} & \text{if } [\chi]_{M,g} = 1 \\
\emptyset & \text{otherwise}
\end{cases}
\]

14. \[ \phi \land \psi \] \text{ in } M, g = \{ h \mid \text{there is a } k \in [\phi]_{M,g} \text{ such that } h \in [\psi]_{M,k} \}

15. \[ \exists \nu \phi \] \text{ in } M, g = \{ h \mid \text{there is a } d \in D \text{ such that } h \in [\phi]_{M,g[v/d]} \}

16. \[ (\lambda \nu_1 \ldots \lambda \nu_n \phi)(\alpha_1) \ldots (\alpha_n) \] \text{ in } M, g = \[ \phi \] \text{ in } M, g[v_1/d_1, \ldots, v_n/d_n], \text{ where } d_1 = \[ \alpha_1 \] \text{ in } M, g, \ldots, d_n = \[ \alpha_n \] \text{ in } M, g

With respect to definition 5, a few remarks are in order. Definition 5 guarantees that the “static expressions” of DPLC have the same extension in DPLC as in Ty\(_2\). Take, for example, the translation of who walks, and consider its Ty\(_2\) extension \( \|\cdot\| \) in a model \( M \) with respect to an \( M \)-assignment \( g \). Compare this to its DPLC extension \([\cdot]\) in a model \( M' \) with respect to an \( M' \)-assignment \( g' \). How can we specify these models and assignments so that they validate the following identity?

\[
\| \lambda j (\lambda x.\text{walk}'(i)(x)) = \lambda x.\text{walk}'(j)(x) \|_{M,g} = \]

\[
[\lambda j (\lambda x.\text{walk}'(i)(x)) = \lambda x.\text{walk}'(j)(x)]_{M',g'}
\]

With static expressions such as the one considered here, the answer is simple: If \( M = \langle D, S, F \rangle \), then \( M' \) can be chosen to be the triple \( \langle D, S, F' \rangle \), where \( F' \) is the restriction of \( F \) to the set of DPLC constants. Correspondingly, \( g' \) can be chosen to be the restriction of \( g \) to the set of DPLC variables. I will not try to define the class of static expressions of DPLC. However, it should be evident that a DPLC expression is static if it does not contain an existential quantifier. Against this background, we can be assured that all wh-question translations discussed
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in G&S82 are static in this sense. Therefore, proposition 1 is not only about the
semantic relation between DPLC expressions, but also about the semantic relation
between certain expressions of Ty$_2$ and certain expressions of DPLC.

In comparison to its ancestors PLA and DPL, DPLC has an important ad-
dition, namely the biconditional operator ‘$\leftrightarrow$’. By clause 10 of definition 5, a
biconditional $\phi \leftrightarrow \psi$ is true iff $\phi$ and $\psi$ bring about the same context change.
This definition is of crucial importance for my analysis, so I want to emphasize
that it is by no means arbitrary. Rather, it is chosen so that ‘$\leftrightarrow$’ is the object-
language counterpart to the metalanguage equivalence notion ‘$\simeq$’ (see definition
10 below). This will be shown in the following section, along with a discussion
of some logical properties of DPLC formulas.$^{22}$ Before that, let me draw your
attention to another meaning aspect of the biconditional operator: By clause 13,
‘$\leftrightarrow$’ is an externally static operator, that is, an operator that does not pass on the
context change brought about by the formulas in its scope. As we use DPLC to
represent the meaning of natural-language expressions, this assumption requires
careful empirical evaluation. This task will be carried out in section 6.1.

3.4.2.4 Some logical properties of DPLC formulas

The notions of truth, validity, and contradictoriness of a DPLC formula $\phi$ can be
defined as in standard predicate logic, namely in terms of the extension of $\phi$:

Definition 6 (Truth) $\phi$ is true with respect to $g$ in $\mathcal{M} \iff \llbracket \phi \rrbracket_{\mathcal{M},g} = 1$.

Definition 7 (Validity)

$\phi$ is valid $\iff \forall M \forall g : \phi$ is true with respect to $g$ in $\mathcal{M}$.

$^{22}$The discussion in section 3.4.2.4 draws heavily from Groenendijk & Stokhof (1991). In par-
ticular, all definitions are adapted from this source.
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Definition 8 (Contradictoriness)

\( \phi \) is a contradiction \( \iff \forall M \forall g : \phi \) is false with respect to \( g \) in \( M \).

However, the notion of logical equivalence cannot be defined in an analogous way. This is so because the meaning of a DPLC formula is not exhausted by its extension. To see this, take a look at an equivalence notion that is defined in terms of the satisfying assignments of a formula, the notion of s-equivalence:

Definition 9 (s-equivalence)

\( \phi \equiv s \psi \iff \forall M : \{ g \mid [\phi]_{M,g} = 1 \} = \{ g \mid [\psi]_{M,g} = 1 \} \).

Why is s-equivalence not a suitable notion of logical equivalence in DPLC? The answer is as follows: Take, for example, the formulas \( \exists x. P(x) \) and \( \exists y. P(y) \). These formulas are s-equivalent, since they have the same truth-conditional content. Nevertheless, they differ in meaning. This can be seen by the fact that they cannot always be substituted for one another: For instance, the conjunction \( \exists x. P(x) \land \neg P(x) \) is a contradiction, whereas \( \exists y. P(y) \land \neg P(x) \) is a contingent formula.\(^{23}\) This shows that the notion of logical equivalence must be defined in terms of the context change potential of the formulas under consideration. This gives rise to the following definition:

Definition 10 (Equivalence) \( \phi \equiv \psi \iff \forall M \forall g : [\phi]_{M,g} = [\psi]_{M,g} \).

Note that according to definition 10, \( \exists x. P(x) \) is not equivalent to \( \exists y. P(y) \):

\[
[\exists x. P(x)]_{M,g} = \{ g[x/d] \mid d \in D \text{ and } g(P)(d) = 1 \}
\]

\[
[\exists y. P(y)]_{M,g} = \{ g[y/d] \mid d \in D \text{ and } g(P)(d) = 1 \}
\]

\(^{23}\)Remember that the former conjunction is equivalent to \( \exists x(P(x) \land \neg P(x)) \), and the latter equivalent to \( \exists y(P(y) \land \neg P(x)) \).
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The above sets are in general different (that is, whenever $g(P) \supset \{g(x)\}$ or $g(P) \supset \{g(y)\}$).

Now it can be seen that the biconditional operator ‘$\leftrightarrow$’ is the object-language correlate of ‘$\simeq$’. That is, we find that the following fact holds.

**Fact 1** $\phi \simeq \psi \iff \phi \leftrightarrow \psi$ is valid.

This shows that the biconditional operator of DPLC rightly deserves its name. Therefore, it has a general bearing that proposition 1 holds for DPLC.

### 3.4.2.5 Proof of proposition 1

I will now present the proof of proposition 1 from the beginning of this section. Roughly speaking, proposition 1 states that a $\lambda$-abstract of the form $\lambda x_1 \ldots \lambda x_n.\phi$ and a formula of the form $\exists x_1 \ldots \exists x_n.\neg\neg\phi$ have comparable semantic values, namely if we consider the extension of the $\lambda$-abstract and the context change potential of the existential formula. The double negation in the latter serves to hide the context change potential that might exist independently of the existential prefix: $\neg\neg\phi$ does not have any context change potential while it has the same truth conditions as $\phi$. By the former property, $\neg\neg\phi$ is a so-called test, a notion we will use in the following. So before we continue, let me give a definition\(^{24}\) and state the relevant fact for the imminent discussion:

**Definition 11 (Test)** $\phi$ is a test $\iff \forall M \forall g \forall h : h \in /\phi/M,g \Rightarrow g = h$.

**Fact 2** For all formulas $\phi$, $\neg\neg\phi$ is a test.

To prove proposition 1, we will need the following two lemmas.

---

Lemma 1 If $\phi$ is a test and $x_1, \ldots, x_n$ and $y$ are individual variables such that $x_1, \ldots, x_n$ are pairwise distinct from $y$, then for all models $\mathcal{M}$ and all $\mathcal{M}$-assignments $g$ and $h$, it holds that $h \in /\exists x_n \ldots \exists x_1.\phi/_{\mathcal{M},g} \implies h(y) = g(y)$.

Proof of lemma 1 Proof by induction over the length $n$ of the $\exists$-prefix of $\phi$.

Induction base ($n = 0$): Let $\mathcal{M}$ be an arbitrary model, and let $g, h$ be arbitrary $\mathcal{M}$-assignments. Now assume that $h \in /\phi/_{\mathcal{M},g}$. If $\phi$ is a test, $/\phi/_{\mathcal{M},g} \subseteq \{g\}$, and hence $h = g$. Since $\mathcal{M}$ and $g, h$ were chosen arbitrarily, we conclude that lemma 1 holds for $n = 0$.

Induction hypothesis: Assume that lemma 1 holds for an arbitrary $n \geq 0$.

Induction step ($n \rightarrow n + 1$): Let $\mathcal{M}$ be an arbitrary model, and let $g, h$ be arbitrary $\mathcal{M}$-assignments. Furthermore, let $\phi$ be a test, and let $x_1, \ldots, x_{n+1}$ and $y$ be individual variables such that $x_1, \ldots, x_{n+1}$ are pairwise distinct from $y$. Assume that $h \in /\exists x_{n+1} \exists x_n \ldots \exists x_1.\phi/_{\mathcal{M},g}$. Then by definition, there is a $d \in \mathcal{D}_e$ such that $h \in /\exists x_n \ldots \exists x_1.\phi/_{\mathcal{M},g[x_{n+1}/d]}$. By induction, it then follows that $h(y) = g[x_{n+1}/d](y)$. Since by assumption $x_{n+1}$ is distinct from $y$, we conclude that $g[x_{n+1}/d](y) = g(y)$, and hence that $h(y) = g(y)$. Since $\mathcal{M}$ and $g, h$ were chosen arbitrarily, it follows that lemma 1 holds for $n + 1$.

Before proving lemma 2, let me remind you of the following fact (see clause 15 of definition 5).

Fact 3 $h \in /\exists x.\phi/_{\mathcal{M},g} \iff$ there is a $d \in \mathcal{D}_e$ such that $h \in /\phi/_{\mathcal{M},g[x/d]}$.

Lemma 2 If $\phi$ and $\psi$ are tests and $x_1, \ldots, x_n$ and $y$ are individual variables such that $x_1, \ldots, x_n$ are pairwise distinct from $y$, then the following equivalence holds
3.4. A DYNAMIC LOGIC WITH LIMITED \( \lambda \)-ABSTRACTION

for all models \( M \) and all \( M \)-assignments \( g \):

\[
/\exists y \exists x_1 \ldots \exists x_n. \phi /_{M,g} = /\exists y \exists x_1 \ldots \exists x_n. \psi /_{M,g}
\]

\[\iff\]

\[
\forall d \in D_e : /\exists x_1 \ldots \exists x_n. \phi /_{M,g[y/d]} = /\exists x_1 \ldots \exists x_n. \psi /_{M,g[y/d]}
\]

**Proof of lemma 2** Let \( M \) be an arbitrary model, and let \( g \) be an arbitrary \( M \)-assignment. Furthermore, let \( \phi \) and \( \psi \) be tests, and let \( x_1, \ldots, x_n \) and \( y \) be individual variables such that \( x_1, \ldots, x_n \) are pairwise distinct from \( y \).

"⇒": Assume that \( /\exists y \exists x_1 \ldots \exists x_n. \phi /_{M,g} = /\exists y \exists x_1 \ldots \exists x_n. \psi /_{M,g} \). Suppose there is a \( d \in D_e \) such that \( /\exists x_1 \ldots \exists x_n. \phi /_{M,g[y/d]} \neq /\exists x_1 \ldots \exists x_n. \psi /_{M,g[y/d]} \). Then, without loss of generality, there is an assignment function \( h \) such that (i) \( h \in /\exists x_1 \ldots \exists x_n. \phi /_{M,g[y/d]} \) and (ii) \( h \notin /\exists x_1 \ldots \exists x_n. \psi /_{M,g[y/d]} \). From (i), it follows that \( h \in /\exists y \exists x_1 \ldots \exists x_n. \phi /_{M,g} \). Now we can derive a contradiction by showing that \( h \notin /\exists y \exists x_1 \ldots \exists x_n. \psi /_{M,g} \): By lemma 1, we conclude from (i) that \( h(y) = d \). Again by lemma 1, we conclude that for any \( d' \in D_e \) such that \( d' \neq d \), it holds that \( h \notin /\exists x_1 \ldots \exists x_n. \psi /_{M,g[y/d']} \). In combination with (ii), this implies that \( h \notin /\exists y \exists x_1 \ldots \exists x_n. \psi /_{M,g} \) so that we have derived a contradiction. Therefore, the supposition cannot be true, and it follows that for all \( d \in D_e \), \( /\exists x_1 \ldots \exists x_n. \phi /_{M,g[y/d]} = /\exists x_1 \ldots \exists x_n. \psi /_{M,g[y/d]} \). One direction of lemma 2 is thereby proved.

"⇐": Assume that \( /\exists x_1 \ldots \exists x_n. \phi /_{M,g[y/d]} = /\exists x_1 \ldots \exists x_n. \psi /_{M,g[y/d]} \) for all \( d \in D_e \). Now consider the following implication, which is a simple corollary of set theory.

\[
\forall d \in D_e : /\exists x_1 \ldots \exists x_n. \phi /_{M,g[y/d]} = /\exists x_1 \ldots \exists x_n. \psi /_{M,g[y/d]}
\]

\[\Rightarrow\]

\[
\bigcup_{d \in D_e} /\exists x_1 \ldots \exists x_n. \phi /_{M,g[y/d]} = \bigcup_{d \in D_e} /\exists x_1 \ldots \exists x_n. \psi /_{M,g[y/d]}
\]
Since for all $\chi$, $\exists y \exists x_1 \ldots \exists x_n. \chi / M, g = \bigcup_{d \in D_c} \exists x_1 \ldots \exists x_n. \chi / M, g[y/d]$, it follows that $\exists y \exists x_1 \ldots \exists x_n. \phi / M, g = \exists y \exists x_1 \ldots \exists x_n. \psi / M, g$. This proves the other direction of lemma 2. Since $M$ and $g$ were chosen arbitrarily, we conclude that lemma 2 is valid.

Now we are prepared to prove proposition 1.

Proof of proposition 1  We have to show that the following equivalence holds for all models $M$ and $M$-assignments $g$:

$$\llbracket \lambda x_1 \ldots \lambda x_n. \phi = \lambda x_1 \ldots \lambda x_n. \psi \rrbracket_{M, g} = 1 \iff \llbracket \exists x_1 \ldots \exists x_n. \lnot \lnot \phi \leftrightarrow \exists x_1 \ldots \exists x_n. \lnot \lnot \psi \rrbracket_{M, g} = 1$$

This will be proved by induction over the length $n$ of the $\lambda$-$\exists$-prefix of $\phi$ and $\psi$.

Induction base ($n = 1$): Let $M$ be an arbitrary model and let $g$ be an arbitrary $M$-assignment. Furthermore, let $\phi$ and $\psi$ be tests. It must be shown that $\llbracket \lambda x. \phi = \lambda x. \psi \rrbracket_{M, g} = 1$ iff $\llbracket \exists x. \lnot \lnot \phi \leftrightarrow \exists x. \lnot \lnot \psi \rrbracket_{M, g} = 1$. For a proof, consider the following equivalences.

$$\llbracket \lambda x. \phi = \lambda x. \psi \rrbracket_{M, g} = 1 \iff_1$$

$$\forall d \in D_c : \llbracket \phi \rrbracket_{M, g[x/d]} = 1 \iff \llbracket \psi \rrbracket_{M, g[x/d]} = 1 \iff_2$$

$$\forall d \in D_c : \llbracket \lnot \lnot \phi \rrbracket_{M, g[x/d]} = 1 \iff \llbracket \lnot \lnot \psi \rrbracket_{M, g[x/d]} = 1$$
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\[ \iff_3 \]
\[
\bigcup_{d \in D_e} \{ g[x/d] \mid \llbracket \neg\neg\phi \rrbracket_{M,g[x/d]} = 1 \} = \bigcup_{d \in D_e} \{ g[x/d] \mid \llbracket \neg\neg\psi \rrbracket_{M,g[x/d]} = 1 \}
\]

\[ \iff_4 \]
\[
/\exists x.\neg\neg\phi /_{M,g} = /\exists x.\neg\neg\psi /_{M,g}
\]

\[ \iff_5 \]
\[
\llbracket \exists x.\neg\neg\phi \leftrightarrow \exists x.\neg\neg\psi \rrbracket_{M,g} = 1
\]

The first two equivalences follow from the definition of $\lambda$-abstraction and negation, respectively. Equivalence (3) is a consequence of the extensionality of sets. Equivalence (4) holds since $\neg\neg\phi$ and $\neg\neg\psi$ are tests: if a formula $\chi$ is a test, 
\[
/\exists x.\chi /_{M,g} = \bigcup_{d \in D_e} \{ g[x/d] \mid \llbracket \chi \rrbracket_{M,g[x/d]} = 1 \}. 
\]

Finally, equivalence (5) follows from the definition of the biconditional. Since $M$ and $g$ were chosen arbitrarily, we conclude that proposition 1 holds for $n = 1$.

**Induction hypothesis:** Assume that proposition 1 holds for an arbitrary $n \geq 1$.

**Induction step ($n \rightarrow n + 1$):** Let $M$ be an arbitrary model and $g$ be an arbitrary $M$-assignment. Furthermore, let $\phi$ and $\psi$ be tests, and let $x_1, \ldots, x_n$ and $y$ be pairwise distinct individual variables. It must be shown that $\llbracket \lambda y \lambda x_1 \ldots \lambda x_n. \phi = \lambda y \lambda x_1 \ldots \lambda x_n. \psi \rrbracket_{M,g} = 1$ iff $\llbracket \exists y \exists x_1 \ldots \exists x_n. \neg\neg\phi \leftrightarrow \exists y \exists x_1 \ldots \exists x_n. \neg\neg\psi \rrbracket_{M,g} = 1$. For a proof, consider the following equivalences.

\[ \llbracket \lambda y \lambda x_1 \ldots \lambda x_n. \phi = \lambda y \lambda x_1 \ldots \lambda x_n. \psi \rrbracket_{M,g} = 1 \]

\[ \iff_1 \]
\[
\forall d \in D_e : \llbracket \lambda x_1 \ldots \lambda x_n. \phi = \lambda x_1 \ldots \lambda x_n. \psi \rrbracket_{M,g[y/d]} = 1
\]
The first equivalence is a consequence of the definition of \(\lambda\)-abstraction. Equivalence (2) follows by iterated application of the induction hypothesis. Equivalence (3) and (5) follow immediately from the definition of the biconditional operator, and equivalence (4) holds by lemma 2. Since \(M\) and \(g\) were chosen arbitrarily, we conclude that proposition 1 holds for \(n + 1\). \(\square\)
Chapter 4

A Dynamic Type Logic

4.1 Introduction

In this section, I will provide the specifics of a dynamic logic that allows us to model the derivation of wh-question denotations. There is already a number of type logics that can serve, or that can be modified to serve this purpose. Therefore, I will simply adopt one of the existing approaches, Muskens (1996), and adjust it to our needs.1 With reference to DRT,2 Muskens shows that dynamic predicate logic can be reduced to classical type theory, that is, he demonstrates that it is possible to represent the dynamics of DRT in terms of ordinary type logic. Against the background of this fact, Muskens convincingly argues that DRT expressions are best treated as abbreviations for type-logical expressions. This way, Montague Semantics and Discourse Representation are combined into a formalism that is both easy to use and mathematically rigorous.

Below, I provide an implementation of this idea which follows Muskens’ proposal in all respects except for the syntax of the dynamic-logic constructs: I will

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1I am grateful to Regine Eckardt for pointing Muskens’ article out to me.
2See Kamp & Reyle 1993.
use the usual formula notation instead of Muskens’ linearized DRT notation. Our implementation is achieved (i) by specifying the type logic that serves as the target language into which the abbreviations are translated and (ii) by specifying how to translate the abbreviations. This information can be found in the following two subsections.

### 4.2 The type logic MTy₃

The reduction of dynamic predicate logic to classical type theory requires specific properties of the targeted type logic. The following stipulations ensure that the type system and the semantic models used for interpretation are suitable for our purposes.

#### 4.2.1 A primitive type for contexts

First, we need a type-logical correlate of what is referred to as context in dynamic predicate logic. Let us therefore assume that our type logic has a primitive type for contexts. Beyond this, we need primitive types for entities and possible-world indices. Thus, we assume three primitive types beyond $t$: the type of entities $e$, the type of indices $s$, and the type of contexts $c$.³ Accordingly, we take $Type$, the set of types of our logic, to be the smallest set $Y$ such that (i) $e, s, c, t \in Y$, (ii) whenever $a, b \in Y$, $\langle a, b \rangle \in Y$.

As usual, the set of types is correlated with a family of sets of possible denotations. To be specific, let $D$, $S$, and $C$ be pairwise disjoint, non-empty sets, which we regard as the set of entities, the set of indices, and the set of contexts,

³In Muskens (1996), contexts are called states and assigned the type $s$. However, this clashes with the usual convention to designate by $s$ the type of indices. Since we need both, indices and contexts, we use $s$ for indices and $c$ for contexts.
respective. Then $\mathcal{D}_a$, the set of possible denotations of type $a$, is defined over $\mathcal{D}$, $\mathcal{S}$, and $\mathcal{C}$ in the following way: $\mathcal{D}_c = \mathcal{D}$, $\mathcal{D}_a = \mathcal{S}$, $\mathcal{D}_e = \mathcal{C}$, $\mathcal{D}_t = \{0, 1\}$, and $\mathcal{D}_{\langle a, b \rangle} = \mathcal{D}_b^{\mathcal{D}_a}$.

As will be explained shortly, contexts come into play in connection with semantic objects called *registers*. Registers are functions from contexts to entities, that is, functions in $\mathcal{D}_{\langle c, e \rangle}$. To characterize the purpose of these functions, let me simply point out that register constants will later be called *discourse referents*.

The following table gives an overview of the symbols that will be used to designate contexts and registers in the subsequent discussion.

<table>
<thead>
<tr>
<th>contexts</th>
<th>registers</th>
</tr>
</thead>
<tbody>
<tr>
<td>type</td>
<td>$c$</td>
</tr>
<tr>
<td>variables</td>
<td>$k, k', k_1, k_2, \ldots$</td>
</tr>
<tr>
<td>constants</td>
<td>$-$</td>
</tr>
<tr>
<td>metavariables for semantic objects</td>
<td>$\kappa, \kappa'$</td>
</tr>
<tr>
<td>metavariables for terms</td>
<td>$k, k'$</td>
</tr>
</tbody>
</table>

Henceforth, we speak of the value of a register $\rho$ in a context $\kappa$ to refer to the entity $\rho(\kappa)$. Furthermore, we speak of updating a register $\rho$ to a value $d$ when we

---

4In Muskens (1996), registers are atomic objects denoted by terms of another primitive type, $\pi$. Terms of type $\pi$ are related to terms of type $\langle c, e \rangle$ by means of a fixed non-logical constant $v$ of type $\langle \pi, \langle c, e \rangle \rangle$. Thereby, $v(u)(k)$ is taken to be the value of register $u$ in context $k$. I deviate from these assumptions to spare the additional type $\pi$. This does not complicate Muskens’ approach, rather the contrary.
mean selecting a context \( \kappa \) such that \( \rho(\kappa) = d \).

### 4.2.2 Imposing a structure on the semantic models

For registers to serve their intended purpose, we need to impose a certain structure on the semantic models we use for interpretation. To this end, we have to refer to a specific subset of the set of registers \( D_{(c,e)} \), namely to those registers denoted by a constant. Let us call these registers named registers, and let \( \text{NMD} \) be a predicate of type \( \langle (c, e), t \rangle \) that singles them out.\(^5\) We want to ensure that each named register can be updated to any possible value without affecting the value of any other named register. To be able to formulate this in a concise way, let us define an abbreviation.\(^6\) For all terms \( k \) and \( k' \) of type \( c \) and all terms \( \delta_1, \ldots, \delta_n \) of type \( (c, e) \), we write

\[
 k[\delta_1, \ldots, \delta_n]k' \quad \text{for} \quad \forall \nu((\text{NMD}(\nu) \land \delta_1 \neq \nu \land \ldots \land \delta_n \neq \nu) \rightarrow \nu(k) = \nu(k'))
\]

According to this definition, a formula \( k[\delta]k' \) expresses that the contexts denoted by \( k \) and \( k' \) differ at most in the value of the register denoted by \( \delta \) whereby only named registers are considered. (For reasons of brevity, I will henceforth no longer mention the restriction to named registers when referring to the above relation between contexts.) Now we can impose the following axiom on our semantic models to enable the abovementioned register updates.\(^7\)

---

\(^5\)This means that for all \( M \) and all \( g \), the denotation of \( \text{NMD} \) must be as follows: \( \forall \rho \in D_{(c,e)} : [\text{NMD}]_{M,g}(\rho) = 1 \iff \rho \in \text{ran}(F) \), where \( F \) is the interpretation function of \( M \). The set of named registers corresponds to the range of the function denoted by \( \nu \) in Muskens’ original system. See fn. 4.


\(^7\)Cf. AX1 on p. 156 in Muskens (1996). Note that due to the differences mentioned in fn. 4, we cannot simply adopt AX1. A further difference arises from the fact that Muskens distinguishes between two kinds of registers: for indefinites and for proper names. We will not use the latter kind of register, and hence disregard this distinction.
4.2. THE TYPE LOGIC MTY

Axiom 1 \( \forall k \forall \nu \forall x (NMD(\nu) \rightarrow \exists k'(k[\nu]k' \land \nu(k') = x)) \)

Axiom 1 demands that for each context, each named register, and each entity, there is a second context that is just like the first one, except that the value of the given register is the given entity. To see the effect of axiom 1 on the structure of the affected domains, let us consider a model satisfying this axiom: Assume for simplicity that there are only three named registers, \( \rho_1, \rho_2, \) and \( \rho_3. \)

Then axiom 1 guarantees that for each triple \( \langle d_1, d_2, d_3 \rangle \) of elements of \( D_e, \) there is a context \( \kappa \) such that \( \langle \rho_1(\kappa), \rho_2(\kappa), \rho_3(\kappa) \rangle = \langle d_1, d_2, d_3 \rangle. \) This is illustrated in table 1 below for \( D_e = \{ \circ, \bullet \}. \) In table 1, the element in the \( n \)th row and \( m \)th column is the value of \( \rho_m \) in \( \kappa_n \) (that is, \( \rho_m(\kappa_n)\)).

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Table 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \kappa_1 )</td>
<td>( \rho_1 )</td>
</tr>
<tr>
<td>( \kappa_1 )</td>
<td>( \circ )</td>
</tr>
<tr>
<td>( \kappa_2 )</td>
<td>( \circ )</td>
</tr>
<tr>
<td>( \kappa_3 )</td>
<td>( \circ )</td>
</tr>
<tr>
<td>( \kappa_4 )</td>
<td>( \circ )</td>
</tr>
<tr>
<td>( \kappa_5 )</td>
<td>( \bullet )</td>
</tr>
<tr>
<td>( \kappa_6 )</td>
<td>( \bullet )</td>
</tr>
<tr>
<td>( \kappa_7 )</td>
<td>( \bullet )</td>
</tr>
<tr>
<td>( \kappa_8 )</td>
<td>( \bullet )</td>
</tr>
</tbody>
</table>

Now compare table 1 with table 2. The rows of table 2 are the graphs of all assignment functions on the restricted domain \( \{ x_1, x_2, x_3 \} \) (where \( x_1, x_2, \) and \( x_3 \) are variables of type \( e \)). That is, the element in the \( n \)th row and \( m \)th column of table 2 is the value of \( g_n \) applied to \( x_m. \) The correspondence between table 1 and table 2 shows that contexts can be considered as model-theoretic counterparts of

\[^8\text{Note, however, that this assumption is incompatible with axiom 2 introduced below.}\]
assignment functions (if we disregard the reversal of the functor-argument relation with respect to registers and variables, respectively).

A second axiom demands that all constants of type \( \langle c, e \rangle \) denote different registers. Let us call register-denoting constants discourse referents. Then the following axiom guarantees that an update on a discourse referent does not affect any other discourse referent.\(^9\)

**Axiom 2** \( u_n \neq u_m \) for each two different discourse referents \( u_n \) and \( u_m \).

We will refer to the type logic specified above as \( \text{MTy}_3 \) (Muskens’ Ty\(_3\)). This is in allusion to the fact that we are dealing with a three-sorted type logic and that we only consider models that satisfy Muskens’ axioms 1 and 2.

### 4.3 Translating dynamic predicate logic into \( \text{MTy}_3 \)

#### 4.3.1 The available expressive means

To demonstrate what has been achieved so far, I will now show how to represent in \( \text{MTy}_3 \) the context change potential of the existential formula \( \exists x. \text{walk}'(x) \).

Assume that \( u \) is a discourse referent (a constant of type \( \langle c, e \rangle \)) and that \( k \) is a context variable. Then the \( \lambda \)-abstract in (1) is a meaningful expression of \( \text{MTy}_3 \).

\[
\lambda k. \text{walk}'(u(k))
\]

On the assumption that \( u \) denotes the register \( \rho \), (1) denotes (the characteristic function of) the set of all contexts \( \kappa \) such that \( \rho(\kappa) \) is an individual that walks. Furthermore, axiom 1 guarantees that for each individual \( d \), there is a context \( \kappa \) such that \( \rho(\kappa) = d \) (remember that \( \rho \) is a named register, \( \rho \) being the denotation

---

\(^9\)Cf. AX3 on p. 156 in Muskens (1996). Note, however, that AX3 should read "\( \psi(u_n) \neq \psi(u_m) \) for each two different unspecific referents \( u_n \) and \( u_m \)."
of $u$). Consequently, it holds that for each individual $d$ such that $d$ walks, there is a context $\kappa$ in the extension of (1) such that $\rho(\kappa) = d$. This means that the extension of (1) corresponds to the set $S$ of satisfying assignments of the open formula $\text{walk}'(x)$: $S$ is the set of all assignment functions $g$ such that $g(x)$ is an individual that walks; and for each individual $d$ such that $d$ walks, $S$ contains a $g$ such that $g(x) = d$.

The correspondence pointed out above shows that context variables can be considered as object-language correlates of assignment functions and can hence be used to represent the context change potential of formulas of dynamic predicate logic. In section 3.4.2, we identified the context change potential of the DPLC formula $\exists x.\text{walk}'(x)$ with its set of result contexts relative to an assignment $g$, the set $\exists x.\text{walk}'(x)/g$ (for simplicity, I omit reference to the model). By definition 5, an assignment $g'$ is an element of $\exists x.\text{walk}'(x)/g$ iff (i) $g$ and $g'$ differ at most in the value assigned to $x$ and (ii) $g'(x)$ is an individual that walks. Furthermore, it is easy to see that for each assignment function $g$ and each individual $d$ such that $d$ walks, there is an assignment function $g' \in \exists x.\text{walk}'(x)/g$ such that $g'(x) = d$.

Consider now the MTy$_3$ term in (2), which will be shown to represent the context change potential characterized above.

$$\lambda k \lambda k'(k[u]k' \land \text{walk}'(u(k'))$$

The relation denoted by (2) holds between a pair of contexts $\kappa$ and $\kappa'$ iff the following two conditions are met (where again we assume that $u$ denotes $\rho$): (i) $\kappa$ and $\kappa'$ differ at most in the value of $\rho$ and (ii) $\rho(\kappa')$ is an individual that walks. Furthermore, we can derive from axiom 1 that for each context $\kappa$ and each individual $d$ such that $d$ walks, there is a context $\kappa'$ such that $\langle \kappa, \kappa' \rangle$ is in the extension of (2) and $\rho(\kappa') = d$.

This shows that (2) represents the context change potential of the existential
4.3.2 The abbreviations

To highlight the relationship pointed out above, let us refer to the term in (2) and, generally, to terms of type $\langle c, \langle c, t \rangle \rangle$ as dynamic formulas. I will now define some abbreviations that allow us to designate dynamic formulas in a manner that shows their relation to corresponding formulas of dynamic predicate logic.\(^\text{10}\)

First, we need a simple way of designating dynamic formulas that correspond to atomic formulas of dynamic predicate logic. Therefore, let us agree on the following: If $R$ is a constant of type $\langle s, e^n t \rangle$ (where $e^0 t = t$ and $e^{k+1} t = \langle e, e^k t \rangle$), $i$ is a term of type $s$, and $\delta_1, \ldots, \delta_n$ are terms of type $\langle c, e \rangle$, we write

\begin{align*}
\text{Abbr. 1} & \quad R(i)(\delta_1, \ldots, \delta_n) \quad \text{for} \quad \lambda k \lambda k' (k = k' \land R(i)(\delta_1(k), \ldots, \delta_n(k))).
\end{align*}

This abbreviation convention is illustrated in (3) (where $u$ is a discourse referent and $\nu$ and $\nu'$ are register variables).

(3) a. $\text{walk}'(i)(u)$ is short for $\lambda k \lambda k' (k = k' \land \text{walk}'(i)(u(k)))$

b. $\text{love}'(i)(\nu, \nu')$ is short for $\lambda k \lambda k' (k = k' \land \text{love}'(i)(\nu(k), \nu'(k)))$

To designate dynamic formulas that correspond to complex formulas of dynamic predicate logic, we agree on the following: If $\Phi$ and $\Psi$ are dynamic formulas and $u$ is a discourse referent,\(^\text{11}\) we write

\[^{10}\text{Cf. Muskens 1996, p. 157. Muskens uses linearized DRS boxes to abbreviate dynamic formulas. This way, no confusion can arise by mistaking the abbreviations for ordinary formulas. On the other hand, it is (at least for me) somewhat difficult to grasp the meaning of these expressions. The format I propose allows to read the abbreviations as if they were formulas of dynamic predicate logic.}\]

\[^{11}\text{At first sight, an expression of the form $\exists u \Phi$ appears to express something nonsensical, namely quantification over a register constant. However, notice that the quantification is over}\]
4.3. TRANSLATING DYNAMIC PREDICATE LOGIC INTO MTY$_3$

Abbr. 2

$\neg \Phi$ for $\lambda k \lambda k' (k' = k \land \neg \exists k_2. \Phi(k)(k_2))$

$(\Phi \lor \Psi)$ for $\lambda k \lambda k' (k' = k \land \exists k_2 (\Phi(k)(k_2) \lor \Psi(k)(k_2)))$

$(\Phi \rightarrow \Psi)$ for $\lambda k \lambda k' (k' = k \land \forall k_2 (\Phi(k)(k_2) \rightarrow \exists k_3. \Psi(k_2)(k_3)))$

$(\Phi \leftrightarrow \Psi)$ for $\lambda k \lambda k' (k' = k \land \forall k_2 (\Phi(k)(k_2) \leftrightarrow \Psi(k)(k_2)))$

$\forall u \Phi$ for $\lambda k \lambda k' (k' = k \land \forall k_2 (k[u]k_2 \rightarrow \exists k_3. \Phi(k_2)(k_3)))$

Abbr. 3

$\exists u \Phi$ for $\lambda k \lambda k'. \exists k_2 (k[u] k_2 \land \Phi(k)(k'))$

$(\Phi \land \Psi)$ for $\lambda k \lambda k'. \exists k_2 (\Phi(k)(k_2) \land \Psi(k_2)(k'))$

The above list is organized in such a way that Abbr. 2 subsumes the externally static operators, and Abbr. 3 the externally dynamic ones. Note that the above conventions are direct translations of how the semantic value of the corresponding DPL formulas is defined. Therefore, we can be sure that, for instance, the dynamic formula abbreviated by $(\Phi \land \Psi)$ is in fact the dynamic conjunction of $\Phi$ and $\Psi$.

If no confusion can arise, we will speak of the abbreviations conforming to Abbr. 1–3 as of actual expressions of our logic.

---

context variables in the underlying MTY$_3$ expression. Therefore, $\exists u \Phi$ is best pronounced as “there is an update of the register denoted by $u$ that satisfies $\Phi$.” The same comments apply to the abbreviation $\forall u \Phi$, which is best pronounced as “every update of the register denoted by $u$ satisfies $\Phi$.”

$^{12}$Again, we assume that the biconditional operator is externally static. See section 6.1 for a problematization of this assumption.

$^{13}$See definition 2 in Groenendijk & Stokhof (1991). This holds with the exception of the biconditional operator, which, as already mentioned, is not defined in Groenendijk & Stokhof (1991).
4.3.3 An example discourse

To get an impression of how to work with these abbreviations, take a look at the discourse in (4a), which we represent as given in (4b).\(^\text{14}\)

\begin{enumerate}
\item[a.] A man walks (in the park). He whistles.
\item[b.] \(\exists u(\text{man}'(i)(u) \land \text{walk}'(i)(u)) \land \text{whistle}'(i)(u)\)
\end{enumerate}

Firstly, the derivation in (5) shows how to resolve the abbreviation \(\text{man}'(i)(u) \land \text{walk}'(i)(u)\).

\begin{enumerate}
\item[(5)] \(\text{man}'(i)(u) \land \text{walk}'(i)(u)\) is short for
\[
\lambda k \lambda k'. \exists k_2 (\text{man}'(k)(k_2) \land \text{walk}'(k_2)(k'))
\]
\[
= \lambda k \lambda k'. \exists k_2 ((k = k_2 \land \text{man}'(i)(u(k_2))) \land (k_2 = k' \land \text{walk}'(i)(u(k_2))))
\]
\[
= \lambda k \lambda k'(k = k' \land \text{man}'(i)(u(k)) \land \text{walk}'(i)(u(k)))
\]
\end{enumerate}

Now we can easily expand the first conjunct of (4b), namely as as given below.

\begin{enumerate}
\item[(6)] \(\exists u(\text{man}'(i)(u) \land \text{walk}'(i)(u))\) is short for
\[
\lambda k \lambda k'. \exists k_2 (k[u]k_2 \land (k_2 = k' \land \text{man}'(i)(u(k_2))) \land \text{walk}'(i)(u(k_2))))
\]
\[
= \lambda k \lambda k'(k[u]k' \land \text{man}'(i)(u(k')) \land \text{walk}'(i)(u(k')))
\]
\end{enumerate}

With the above, we can finally specify the MTy\(_3\) term abbreviated by the whole of (4b). This is shown in (7).

\begin{enumerate}
\item[(7)] \(\exists u(\text{man}'(i)(u) \land \text{walk}'(i)(u)) \land \text{whistle}'(i)(u)\) is short for
\[
\lambda k \lambda k'. \exists k_2 ((k[u]k_2 \land \text{man}'(i)(u(k_2))) \land \text{walk}'(i)(u(k_2)) \land
\]
\[
(k_2 = k' \land \text{whistle}'(i)(u(k_2))))
\]
\end{enumerate}

\(^{14}\)Here and in the following, we save some brackets when no confusion arises.
4.4. SOME LOGICAL PROPERTIES OF DYNAMIC FORMULAS

\[ = \lambda k \lambda k'(k[u]k' \land \text{man}'(i)(u(k')) \land \text{walk}'(i)(u(k')) \land \text{whistle}'(i)(u(k'))) \]

By looking at the second \(\lambda\)-term in (7), we can then easily see that (4b) abbreviates a term that is denotationally equivalent to the term in (8).

\[ (8) \quad \exists u(\text{man}'(i)(u) \land \text{walk}'(i)(u) \land \text{whistle}'(i)(u)) \]

This shows that we can treat expressions like (4b) and (8) as formulas of a (two-sorted) dynamic predicate logic. To complete this analogy, I will now define some logical notions for dynamic formulas.

4.4 Some logical properties of dynamic formulas

Dynamic formula denote functions from contexts to (characteristic functions of) sets of contexts. In other words, dynamic formulas denote their context change potential. This contrasts with the way the context change potential of a DPLC formula is given, namely by a semantic object that is defined alongside its denotation. Correspondingly, the logical notions defined below take a different form from the corresponding notions of DPLC. So, for instance, the notion of truth of a dynamic formula \(\Phi\) must be defined relative to a context \(\kappa\):\(^{15}\)

**Definition 12 (Truth)**

\[ \Phi \text{ is true with respect to } g \text{ and } \kappa \text{ in } M \iff \exists \kappa' : [\Phi]_{M,g}(\kappa)(\kappa') = 1. \]

The notion of validity must then be defined as truth with respect to all models, assignments, and contexts:

**Definition 13 (Validity)**

\[ \Phi \text{ is valid} \iff \forall M \forall g \forall \kappa : \Phi \text{ is true with respect to } g \text{ and } \kappa \text{ in } M. \]

Since dynamic formulas denote their context change potential, the notion of logical equivalence can be defined by sole reference to their extension:\(^{16}\)

**Definition 14 (Equivalence)** \(\Phi \simeq \Psi \iff \forall M \forall g : [\Phi]_{M,g} = [\Psi]_{M,g}.\)

Then we again find that ‘\(\leftrightarrow\)’ is the object-language correlate of ‘\(\simeq\)’:

**Fact 4** \(\Phi \simeq \Psi \iff \Phi \leftrightarrow \Psi\) is valid.

To be able to talk about the truth conditions of dynamic formulas, we define the following notion. For every dynamic formula \(\Phi\), \([\Phi]_{\text{stat}}\) is to be the static extension of \(\Phi\) with respect to \(g\) in \(M\) (see below for a definition of \([\Phi]_{\text{stat}}\)).

**Definition 15 (Static extension)**

\[
[\Phi]_{\text{stat}}_{M,g} = \begin{cases} 
1 & \text{if } \forall \kappa \exists \kappa' : [\Phi]_{M,g}(\kappa)(\kappa') = 1 \\
0 & \text{otherwise}
\end{cases}
\]

### 4.5 How to derive \(wh\)-question denotations

#### 4.5.1 Some lexical specifications

With the tools introduced above, we are now able to compositionally derive \(wh\)-question denotations. By following Muskens in defining our dynamic-logic constructs, we avoided leaving the realm of ordinary type logic. Therefore, we now have at our disposal the full power of \(\lambda\)-abstraction. Below, you find a list of lexical items and how they are translated into MTy\(_3\) using the abbreviations introduced above. Below, we abbreviate \(\langle c, \langle c, t \rangle \rangle\) as \(L\) and \(\langle c, e \rangle\) as \(E\). That is, we say that dynamic formulas are of type \(L\) and that discourse referents and register terms are of type \(E\).

\(^{16}\)Cf. the discussion in section 3.4.2.4.
4.5. **HOW TO DERIVE WH-QUESTION DENOTATIONS**

given below are isomorphic to their (non-dynamic) $Ty_2$ counterparts.

**MTy$_3$ translations of some lexical items**

<table>
<thead>
<tr>
<th>LI</th>
<th>Translation</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Q$</td>
<td>$\lambda p \lambda j (p(i) \leftrightarrow p(j))$</td>
<td>$\langle \langle s, \langle \rangle \rangle, \langle s, \langle \rangle \rangle \rangle$</td>
</tr>
<tr>
<td>$who_n$</td>
<td>$\lambda P. \exists u_n. P(i)(u_n)$</td>
<td>$\langle \langle s, \langle \rangle \rangle, \langle \rangle \rangle$</td>
</tr>
<tr>
<td>$walk$</td>
<td>$\lambda \nu. walk'(i)(\nu)$</td>
<td>$\langle \langle \rangle, \langle \rangle \rangle$</td>
</tr>
</tbody>
</table>

### 4.5.2 A simple example

Assume that the *wh*-question *Who walks?* has the syntactic structure sketched in (9) and that a constituent $[\alpha \beta]$ translates into $\alpha'(\lambda i. \beta')$, where $\alpha$ and $\beta$ translate into $\alpha'$ and $\beta'$, respectively. Then we derive the translation of (9) as shown in (9a) and (b).\(^\text{17}\)

\(9\) \[Q [who walks]]

a. $[who walks] \rightsquigarrow (\lambda P. \exists u. P(i)(u))(\lambda i. \lambda \nu. walk'(i)(\nu))$

\[= \exists u. \text{walk}'(i)(u)\]

\[= \lambda k \lambda k'. (k[u]k' \land \text{walk}'(i)(u(k')))]\]

\(^\text{17}\)As there is only one *wh*-word, I omit the subscript and translate *who* into $\lambda P. \exists u. P(i)(u)$. 
b. \([ Q \text{ [who walks]} ] \sim \lambda p \lambda j (p(i) \leftrightarrow p(j)) (\lambda i. \exists u. \text{walk}'(i)(u))

\begin{align*}
&= \lambda j (\exists u. \text{walk}'(i)(u) \leftrightarrow \exists u. \text{walk}'(j)(u)) \\
&= \lambda j \lambda k \lambda k' (k = k' \land \\
&\quad \forall k_2 ((k[u]k_2 \land \text{walk}'(i)(u(k_2))) \leftrightarrow \\
&\quad (k[u]k_2 \land \text{walk}'(j)(u(k_2))))
\end{align*}

What remains to be shown is that this does in fact represent the meaning of \textit{who} walks. To show this, let us annotate the translation derived in (9b) in the following way:

\[
\lambda j \lambda k \lambda k' (k = k' \land \\
\forall k_2 ((k[u]k_2 \land \text{walk}'(i)(u(k_2))) \leftrightarrow \\
(k[u]k_2 \land \text{walk}'(j)(u(k_2)))))
\]

Then we first observe that \( \varphi \) can be rewritten equivalently as the equation in (10).

(10) \quad \lambda k_2 (k[u]k_2 \land \text{walk}'(i)(u(k_2))) = \lambda k_2 (k[u]k_2 \land \text{walk}'(j)(u(k_2)))

Then we know by axiom 1 that for each context, each named register, and each entity, there is a second context that is just like the first one, except that the value of the given register is the given entity. This means that the following equivalence holds for all \( \text{MTy}_3 \) models \( \mathcal{M} \), \( \mathcal{M} \)-assignments \( g \), and contexts \( \kappa \in \mathcal{D}_c \):

\[
\kappa \in [\lambda k_2 (k[u]k_2 \land \text{walk}'(i)(u(k_2)))]_{\mathcal{M}, g} \\
\Leftrightarrow \\
\exists d \in \mathcal{D}_e : [u]_{\mathcal{M}, g}(\kappa) = d \land d \in [\lambda x. \text{walk}'(i)(x)]_{\mathcal{M}, g}
\]

The same holds for the righthand side of the equation in (10). Hence, (10) is equivalent to (11).
4.5. HOW TO DERIVE WH-QUESTION DENOTATIONS

(11) \( \lambda x. \text{walk}'(i)(x) = \lambda x. \text{walk}'(j)(x) \)

Consequently, the static extension of \( \Phi \) is identical to the extension of (11):

\[
\forall M \forall g : \llbracket \Phi \rrbracket_{stat}^M,g = \llbracket \lambda x. \text{walk}'(i)(x) = \lambda x. \text{walk}'(j)(x) \rrbracket_{M,g}
\]

This shows that the translation derived in (9b) represents the answerhood conditions of the \( wh \)-question under consideration.

4.5.3 Some auxiliary notions

To emphasize that there is a tight semantic relation between \( \lambda j(\exists u. \text{walk}'(i)(u) \leftrightarrow \exists u. \text{walk}'(j)(u)) \) and \( \lambda j(\lambda x. \text{walk}'(i)(x) = \lambda x. \text{walk}'(j)(x)) \), we would like to state the result of the preceding section in the following way: The static extension of the former term is identical to the extension of latter. To do this in a meaningful way, we extend the notion of static extension as follows: If \( \Phi \) is a dynamic formula and \( \nu_1, \ldots, \nu_n \) are variables of type \( a_1, \ldots, a_n \), respectively, the static extension of \( \lambda \nu_1 \ldots \lambda \nu_n \Phi \) with respect to \( g \) in \( M \) is given by the following recursive definition.

**Definition 16 (Static extension, extended)**

1. \( \llbracket \Phi \rrbracket_{stat}^{stat} \) is as given by definition 15.

2. \( \llbracket \lambda \nu_k \ldots \lambda \nu_n \Phi \rrbracket_{stat}^{stat} \) is that function \( f \) with domain \( D_{a_k} \) such that for all \( d \in D_{a_k} \) it holds that \( f(d) = \llbracket \lambda \nu_{k+1} \ldots \lambda \nu_n \Phi \rrbracket_{stat}^{stat} \),

Obviously, the static extension of a term of type \( \langle s, \mathcal{L} \rangle \) is a proposition. Correspondingly, we call the (non-static) extension of a term of type \( \langle s, \mathcal{L} \rangle \) a dynamic proposition. By translating questions into expressions of type \( \langle s, \mathcal{L} \rangle \), we thus assume that they denote dynamic propositions. Correspondingly, we call the intension of a question a dynamic propositional concept (a semantic object of type \( \langle s, \langle s, \mathcal{L} \rangle \rangle \)).
4.5.4 On the analysis tree on p. 59

On p. 59, we have already taken a look at the analysis tree of the (embedded) *wh*-question in (12).

(12) (I wonder) which girl which man loves.

The lexical items used in this analysis tree are summarized in the following table. The translation of $Q$ has already been specified in the preceding section and is reappearing for convenience. Furthermore, note that the lexical item $e_n$ below is the equivalent to a syntactic variable in Montague Grammar.

<table>
<thead>
<tr>
<th>LI</th>
<th>Translation</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Q$</td>
<td>$\lambda p \lambda f(p(i) \leftrightarrow p(j))$</td>
<td>$\langle \langle s, \downarrow \rangle, \langle s, \downarrow \rangle \rangle$</td>
</tr>
<tr>
<td>$\text{which}_n$</td>
<td>$\lambda P \lambda P'.\exists u_n(P(i)(u_n) \land P'(i)(u_n))$</td>
<td>$\langle \langle s, \langle e, \downarrow \rangle \rangle, \langle \langle s, \langle e, \downarrow \rangle \rangle, \downarrow \rangle \rangle$</td>
</tr>
<tr>
<td>$e_n$</td>
<td>$\lambda P.P(i)(\nu_n)$</td>
<td>$\langle \langle s, \langle e, \downarrow \rangle \rangle, \downarrow \rangle$</td>
</tr>
<tr>
<td>man</td>
<td>$\lambda \nu.\text{man}'(i)(\nu)$</td>
<td>$\langle e, \downarrow \rangle$</td>
</tr>
<tr>
<td>girl</td>
<td>$\lambda \nu.\text{girl}'(i)(\nu)$</td>
<td>$\langle e, \downarrow \rangle$</td>
</tr>
<tr>
<td>love</td>
<td>$\lambda Q\lambda \nu.Q(i)(\lambda i \lambda \nu'.\text{love}'(i)(\nu, \nu'))$</td>
<td>$\langle \langle s, \langle \langle s, \langle e, \downarrow \rangle \rangle, \downarrow \rangle \rangle, \langle e, \downarrow \rangle \rangle$</td>
</tr>
</tbody>
</table>

On the basis of these lexical items, the analysis tree of the *wh*-question in (12) is derived as described in the paragraph preceding the tree on p. 59.

4.5.5 An example in an LF interpretive framework

As mentioned in section 2.1, I will switch to an LF interpretive framework in the later parts of my thesis. To demonstrate how the dynamic semantics presented...
above is used in such a framework, let us consider the \textit{wh}-question in (13).

(13) (I wonder) which girl he loves.

I assume that (13) has the LF structure in (14) (where the indices of \textit{he}$_1$ and \textit{which}$_2$ are chosen arbitrarily but different from one another).

(14)

For the moment, I will not discuss the specific assumptions made in (14) but only list them below.

- \textit{Ex-situ wh}-phrases such as [\textit{DP which}$_2$ \textit{girl}] above occupy the specifier position of a functional projection selected by C. In simple \textit{wh}-questions, this projection is assumed to be FocP (cf. Rizzi 1997).

- The index of a \textit{wh}-moved item adjoins to the sister of the derived position of the moved phrase (see Heim & Kratzer 1998). For an item with index $n$, the adjoined node is labeled $\lambda n$. In (14), the moved item is the \textit{wh}-determiner \textit{which}$_1$ and its index adjoins to Foc', which is the sister of the pied-piped \textit{which}-phrase [\textit{DP which}$_2$ \textit{girl}].
A moved phrase leaves a trace that is coindexed with the moved item. In (14), the wh-phrase \([_{DP} which_{2} girl]\) leaves the trace \(t_{2}\) in its base position.

In LF interpretive frameworks it is unusual to speak about the translation of syntactic objects into terms of a logical formalism which denote certain semantic objects. Rather, the terms of the logical formalism are conceived as the semantic objects themselves, or put differently, the syntactic objects are assumed to denote the semantic objects. For this reason, I will henceforth often use specifications like (15) to give the meaning of an expression.

\[
(15) \quad [girl]^{i} = \lambda \nu.\underline{girl}'(i)(\nu)
\]

The equation in (15) states that at index \(i\), the noun \(girl\) denotes the semantic object specified on the right hand side of the equation.

Following this convention, the denotations of the atomic constituents of (14) are given in the following table.

**The denotation of the atomic constituents of (15)**

\[
\begin{align*}
[C^{i+Q}]^{i} &= \lambda p \lambda j (p(i) \leftrightarrow p(j)) \\
[which_{n}]^{i} &= \lambda P \lambda P'. \exists u_{n} (P(i)(u_{n}) \land P'(i)(u_{n})) \\
[girl]^{i} &= \lambda \nu.\underline{girl}'(i)(\nu) \\
[he_{n}]^{i} &= \lambda P. P(i)(u_{n}) \\
[t_{n}]^{i} &= \lambda P. P(i)(\nu_{n}) \\
[love]^{i} &= \lambda Q \lambda \nu. Q(i)(\lambda i \lambda \nu'. \underline{love}'(i)(\nu, \nu'))
\end{align*}
\]

*NB: The specification of he\(_{n}\) will be revised in section 6.3.3.*

Furthermore, the denotation of phrasal constituents is derived as follows.
The denotation of phrasal constituents

\[
\llbracket \lambda n \alpha \rrbracket^i = \lambda \nu_n \llbracket \alpha \rrbracket^i \\
\llbracket \alpha \beta \rrbracket^i = \llbracket \alpha \rrbracket^i(\lambda i. \llbracket \beta \rrbracket^i) \quad \text{or} \\
\llbracket \alpha \beta \rrbracket^i = \llbracket \beta \rrbracket^i(\lambda i. \llbracket \alpha \rrbracket^i) \quad \text{(whichever is defined)}
\]

To keep matters simple, the semantic contribution of the Foc head is ignored in the following analysis. The same holds for the T head. That is, we will derive the denotation of the simplified LF structure in (16).

On the basis of the specifications given above, the denotation of (16) is derived as shown below.

---

\(^{17}\)For a detailed analysis, see chapter 7, especially section 7.4.
\[
\text{[VP]}^{i,\nu_2} = [\text{love}](\lambda i. [\text{FocP}]^i)
\]
\[
= \lambda Q \lambda \nu. Q(i)(\lambda i \lambda \nu'. \text{love}'(i)(\nu, \nu'))(\lambda i. \lambda P(i)(\nu_2))
\]
\[
= \lambda \nu. \text{love}'(i)(\nu, \nu_2)
\]
\[
\text{[TP]}^{i,\nu_2} = [\text{he}_1](\lambda i. [\text{VP}]^i)
\]
\[
= \lambda P. P(i)(\lambda i. \text{love}'(i)(\nu, \nu_2))
\]
\[
= \text{love}'(i)(u_1, \nu_2)
\]
\[
[\lambda 2 \text{TP}]^{i,\nu_2} = \lambda \nu_2. \text{love}'(i)(u_1, \nu_2)
\]
\[
[\text{DP}]^i = [\text{which}_2](\lambda i. [\text{girl}]^i)
\]
\[
= \lambda P. \lambda P'. \exists u_2(P(i)(u_2) \land P'(i)(u_2))(\lambda i. \lambda \nu. \text{girl}'(i)(\nu))
\]
\[
= \lambda P. \exists u_2(\text{girl}'(i)(u_2) \land P(i)(u_2))
\]
\[
[\text{FocP}]^i = [\text{DP}]^i(\lambda i. [\lambda 2 \text{TP}]^{i,\nu_2})
\]
\[
= \lambda P. \exists u_2(\text{girl}'(i)(u_2) \land P(i)(u_2))(\lambda i \lambda \nu_2. \text{love}'(i)(u_1, \nu_2))
\]
\[
= \exists u_2(\text{girl}'(i)(u_2) \land \text{love}'(i)(u_1, u_2))
\]
\[
[\text{CP}]^i = [\text{C}^{i+0}]^i(\lambda i. [\text{FocP}]^i)
\]
\[
= \lambda p \lambda j(p(i) \leftrightarrow p(j))(\lambda i. \exists u_2(\text{girl}'(i)(u_2) \land \text{love}'(i)(u_1, u_2)))
\]
\[
= \lambda j(\exists u_2. \text{love}'(i)(u_1, u_2) \leftrightarrow \exists u_2. \text{love}'(j)(u_1, u_2))
\]
What I have presented so far is the core of a dynamic question semantics. Yet, this core system has one critical flaw: Non-\textit{wh} indefinites are predicted to give rise to a question-word interpretation just like \textit{wh}-words. This problem will be fixed in chapter 7 and 8 (see especially section 7.3.3 and 8.3), in the course of explaining the role of the F-feature borne by \textit{wh}-words.
Chapter 5

Another Look at the
Indefinite-Interrogative Affinity

5.1 Introduction

In the beginning of chapter 3, I pointed out that the indefinite-interrogative affinity has two manifestations: In one class of languages, indefinite pronouns are identical to interrogative pronouns, and in another class, they are derived from interrogative pronouns. The dynamic question semantics presented in the previous chapters takes the identity case at face value: Interrogative pronouns are taken to be indefinites in that they are analyzed as dynamic existential quantifiers just like indefinites. In this chapter, I will examine how this assumption fares with regard to the second class of languages. At first glance, these languages seem not to pose a problem for the quantificational analysis proposed: We can simply assume that indefinite pronouns are derived from interrogative ones by an affix that is semantically empty (while having a specific grammatical function). However, if we widen the focus beyond interrogative-derived indefinites, we encounter derivational relationships that cast doubt on the assumption that interrogative pronouns
have existential quantificational force. More specifically, there are interrogative-derived pronouns that have universal force, and this is taken by some researchers as an indication that interrogative pronouns do not have quantificational force of their own at all. To dispel these doubts, I will show that the dynamic-semantic approach is flexible enough to account for the problematic derivational relationships. This will allow us to conclude that the dynamic question semantics developed in this thesis provides a semantically uniform account of both manifestations of the indefinite-interrogative affinity. Furthermore, I will show that dynamic-semantic approach is more powerful than the alternative-semantic approach proposed in Kratzer & Shimoyama (2002) in that the latter cannot account for the fact that question words can be anaphorically referred to.

The first section of this chapter illustrates one instance of the derivational relationship between interrogative and indefinite pronouns with the relevant morphosyntactic paradigm of Japanese. In section 5.3, I will discuss the morphosyntactic relationships that are seen as problematic for quantificational accounts of the semantics of interrogative pronouns. Section 5.4 presents a non-quantificational approach to explaining these data, Kratzer & Shimoyama (2002), before I will show in section 5.5 that they do not pose a challenge to the dynamic-semantic approach. Finally, section 5.6 shows that the alternative-semantic approach of Kratzer & Shimoyama (2002) is not suited to model cross-sentential anaphoric relations.

5.2 Interrogative-derived indefinites

5.2.1 Interrogative-derived indefinites in Japanese

According to Haspelmath (1997), indefinite pronouns are quite generally derived forms. Furthermore, these forms are typically derived from interrogative pro-
nouns.¹ In the following discussion, I will concentrate on the relevant facts of a single language, Japanese, and only touch on a few other languages.

Indefinite pronouns of Japanese are complex forms that are derived by adding the suffix -ka to an interrogative pronoun stem. To see evidence for this derivational relationship, consider the sentences in (1).²

(1) a. Naoya-ga nani-o nomiya-de nonda no?
   Naoya-NOM what-ACC bar-LOC drank Q
   ‘What did Naoya drink at the bar?’

b. Naoya-ga nanika-o nomiya-de nonda no?
   Naoya-NOM something-ACC bar-LOC drank Q
   ‘Did Naoya drink something at the bar?’

c. Naoya-ga nanika-o nomiya-de nonda.
   Naoya-NOM something-ACC bar-LOC drank
   ‘Naoya drank something at the bar.’

The sentence in (1a) is a simple wh-question, formed with the interrogative pronoun nani ‘what’. In the minimally different (1b), nani is replaced by the derived form nanika. Observe that the sentence so formed is a yes/no-question with nanika meaning ‘something’. Example (1c) presents nanika in the corresponding declarative sentence. Again, observe that nanika is adequately paraphrased by ‘something’.

Below, you find another example of an interrogative pronoun and its derived indefinite form, dare ‘who’ and dareka ‘someone’ in (2a) and (b), respectively.³

¹Another typical base of derived indefinites are generic nouns such as, for example, ‘person’ and ‘thing’. See Haspelmath 1997, p. 26.
²(1a) and (c) are taken from Ishihara 2004.
³I am very grateful Kazuko Yatsushiro for helping me with the Japanese data.
(2) a. Dare-ga John-o hometa no?
   who-NOM John-ACC praised Q
   ‘Who praised John?’

b. Dareka-ga John-o hometa.
   someone-NOM John-ACC praised
   ‘Someone praised John.’
Overall, it can be observed that the affixation of interrogative pronouns with -\textit{ka} is a regular morphosyntactic process. The table in (3) shows a large part of the resulting paradigm of interrogative-derived indefinites of Japanese together with their base forms.\footnote{Cf. Yatsushiro 2001 and Shimoyama 2006.}

(3) \textit{Japanese}

<table>
<thead>
<tr>
<th></th>
<th>Interrogative</th>
<th>Indefinite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person</td>
<td>\textit{dare}</td>
<td>\textit{dareka}</td>
</tr>
<tr>
<td></td>
<td>‘who’</td>
<td>‘someone’</td>
</tr>
<tr>
<td>Thing</td>
<td>\textit{nani}</td>
<td>\textit{nanika}</td>
</tr>
<tr>
<td></td>
<td>‘what’</td>
<td>‘something’</td>
</tr>
<tr>
<td>Place</td>
<td>\textit{doko}</td>
<td>\textit{dokoka}</td>
</tr>
<tr>
<td></td>
<td>‘where’</td>
<td>‘somewhere’</td>
</tr>
<tr>
<td>Time</td>
<td>\textit{itu}</td>
<td>\textit{ituka}</td>
</tr>
<tr>
<td></td>
<td>‘when’</td>
<td>‘sometime’</td>
</tr>
<tr>
<td>Partitive</td>
<td>\textit{dore}</td>
<td>\textit{doreka}</td>
</tr>
<tr>
<td></td>
<td>‘which one’</td>
<td>‘one of them’</td>
</tr>
<tr>
<td>Reason</td>
<td>\textit{naze}</td>
<td>\textit{nazeka}</td>
</tr>
<tr>
<td></td>
<td>‘why’</td>
<td>‘for some reason’</td>
</tr>
</tbody>
</table>

Comparable paradigms can be found in a large variety of languages, among them Bulgarian, Greek, and Latvian (see Hapemlth 1997 and Bhat 2000).
5.2.2 Interrogative-derived indefinites in languages of the German/Korean class

Before going on to discuss some more interesting properties of Japanese interrogative pronouns, let me point out that interrogative-derived indefinites can also be found in the other class of languages mentioned at the outset of this chapter. That is, we find such indefinites in languages in which wh-pronouns can be construed as either interrogative or indefinite pronouns (see the discussion in section 3.2). A case in point is German. So let us take another look at example (6) of chapter 3 (repeated in (4) for convenience) and contrast it with (5).

(4) Wer hat was gekauft?
   who has what bought
   a. ‘Who bought something?’
   b. ‘Who bought what?’

In (5), you see that the wh-pronoun was ‘what’/‘something’ can be prefixed with the affix irgend-. The paraphrase in (5a) indicates that the resulting pronoun is an indefinite, more precisely, an indefinite by which the speaker of (5) expresses indifference about the sort of items bought. The impossibility of paraphrase (5b) shows that the derived indefinite can no longer function as a question word.

(5) Wer hat irgend-was gekauft?
   who has irgend-what bought
   a. ‘Who bought something, no matter what?’
   b. *‘Who bought what?’

See Kratzer & Shimoyama 2002 for a discussion of this meaning aspect and an analysis of related interpretive effects.
The example in (6) is provided to show that *irgend*- indefinites are not restricted to negative polarity contexts.

(6) Hans hat irgend-was gekauft.
    Hans has *irgend*-what bought
    ‘Hans bought something.’
    (The speaker does not know or care what.)

Furthermore, let me mention that *irgend*- can attach to all the *wh*-pronouns listed in table (7) of chapter 3 (and to some others that do not allow for an indefinite construal such as, for example, *wie* ‘how’).\(^6\)

Turning to another language discussed in section 3.2, we observe that Korean shows essentially the same facts as German.\(^7\) To see this, compare the examples in (4)–(6) with (7a)–(c), and note that the affixation of -*inka* in Korean has the same grammatical effect as the affixation of *irgend*- in German (disregarding the epistemic meaning aspect of the latter affix).

(7) a. Nwu(kwu)-ka wass-ni?’
    who-NOM came-Q
    (i) ‘Did someone come?’
    (ii) ‘Who came?’

\(^6\)Moreover, non-*wh* indefinites too can be prefixed by *irgend*-:

(i) a. Jemand hat angerufen.
    Someone has called
    ‘Someone called.’

b. Irgend-jemand hat angerufen.
    *irgend*-someone has called
    ‘Someone called.’ (The speaker does not know or care who.)

\(^7\)The data in (i) are taken from Shin (2005).
b. Nwukwu-(i)nka-ka wass-ni?’
   who-inka-NOM came-Q
   (i) ‘Did someone come?’
   (ii) *‘Who came?’

c. Nwukwu-(i)nka-ka wass-ta.
   who-inka-NOM came-DECL
   ‘Someone came.’

This means that the dividing line between languages of the Japanese class and languages of the German/Korean class is not defined by the existence of interrogative-derived indefinites. Rather, these languages differ in the availability of a (non-interrogative) indefinite construal for bare interrogative pronouns. To see that such a construal is not available in Japanese, consider the data in (8): The question in (8a) cannot be paraphrased as given in (a-i),\(^8\) and the corresponding declarative construction is unacceptable (see 8b).

(8) a. Dare-ga John-o hometa no?
   who-NOM John-ACC praised Q
   (i) *‘Did someone praise John?’
   (ii) ‘Who praised John?’

b. *Dare-ga John-o hometa.
   who-NOM John-ACC praised

\(^8\)Recall that the question particle no can be used to mark yes/no-questions. See (1b) and (i) below.

(i) Dareka-ga John-o hometa no?
   someone-NOM John-ACC praised Q
   ‘Did someone praise John?’
However, this does not mean that Japanese completely lacks an indefinite construal for bare interrogative pronouns. But as we will see in the following section, Japanese interrogative pronouns must always cooccur with certain overt particles (none of which occurs in 8b).

### 5.3 Interrogative-derived universal quantifiers

In the pertinent literature, Japanese interrogative pronouns are often referred to as *indeterminate pronouns*, a term originating from Kuroda (1965). The introduction of this term was motivated by the observation that Japanese interrogative pronouns are not restricted to interrogative interpretations. Today, we know that this is more the rule than the exception among the languages of the world, but at the time of his writing, Kuroda saw the need to make this indeterminateness terminologically explicit.

For an example of the phenomenon under consideration, take a look at the declarative sentence in (9),\(^9\) in which nani (the question word of (1a)) receives what appears to be a universal interpretation.

\[
(9) \quad [[[\text{Taro-ga nani-o katta-kara}] \text{ okotta}] \text{ hito-mo heya-o deteitta}.]
\]

\[
\text{Taro-NOM what-ACC bought-because got.angry person-mo room-ACC left}
\]

‘For every thing \(x\), the people who got angry because Taro had bought \(x\) left the room.’

Note that this interpretation requires the (affixal) particle -mo to take scope over nani. We especially find that the minimally different construction in (10), lacking

the particle *mo, is ungrammatical.\textsuperscript{10}

(10) *[[Taro-ga nani-o katta-kara] okotta] hito]-ga
    Taro-NOM what-ACC bought-because got.angry person-NOM
    heya-o deteitta.
    room-ACC left

Data such as (9) clearly show that Japanese interrogative pronouns allow for a non-interrogative interpretation – a universal one if we take the paraphrase in (9) at face value. However, we have seen in chapter 3 that it is very plausibly an indication of the indefinite nature of an item if it shows this kind of quantificational variability. Therefore, we are not surprised to find scholars of Japanese paraphrasing the universal occurrences of interrogative pronouns with indefinite pronouns. To see an example of this, consider the data in (11), taken from Shimoyama (2006).\textsuperscript{11}

(11) [[Dono gakusei-ga teisyutusita] syukudai]-mo
    which student-NOM submitted homework assignment-mo
    yuu-datta.
    A-was
    ‘Every homework assignment that a student had handed in got an A.’

In (11), the phrase *dono gakusei* ‘which student’ is paraphrased as ‘a student’

\textsuperscript{10}Note that in (9), the nominative marker *-ga* cannot co-occur with *-mo* on *hito* ‘person’ but must otherwise be present.

\textsuperscript{11}See (26a) on p. 154 of the article cited. Note, however, that Shimoyama does not literally analyze […*syukudai*-mo as ‘every homework assignment …’. See section 5.4 for a discussion of the underlying approach.
5.3. INTERROGATIVE-DERIVED UNIVERSAL QUANTIFIERS

and not as ‘every student’. Given this paraphrase, the sentence in (11) bears a striking resemblance to a well-known class of donkey sentences, the so-called quantificational donkey sentences. The sentence in (12) is the paradigmatic example of this class of constructions.

(12) Every farmer who owns a donkey beats it.

a. $\forall x (\text{farmer}'(x) \land \exists y (\text{donkey}'(y) \land \text{own}'(x,y)) \rightarrow \text{beat}'(x,y))$

b. $\forall x \forall y (\text{farmer}'(x) \land \text{donkey}'(y) \land \text{own}'(x,y) \rightarrow \text{beat}'(x,y))$

The logical paraphrase in (12a) is a compositionally adequate rendering of the meaning of (12). We especially note that the indefinite phrase a donkey is translated in terms of an existential quantifier in the restriction of the universal quantifier denoted by every. In dynamic predicate logic, (12a) is equivalent to the formula in (12b), as should be clear from the discussion in chapter 3. In (12b), the narrow-scope existential quantifier is replaced by a wide-scope universal quantifier. This equivalence once again provides the logical justification for the assumption that indefinites denote existential quantifiers even if in some environments they exhibit universal quantificational force. In the case of the English paraphrase of the sentence in (11), the same argument can even be made without referring to dynamic predicate logic, since the indeterminate phrase in the relative clause does not anaphorically bind a pronoun in the matrix clause. That is, the compositionally adequate rendering of this paraphrase, shown in (13a), is equivalent to (13b) in standard predicate logic.\textsuperscript{14}

\textsuperscript{12}In the latter case, the paraphrase of (12) would read as follows: ‘For every student $x$, the homework assignment(s) that $x$ had handed in got an A.’

\textsuperscript{13}See Nishigauchi 1990, chapter IV and Takahashi 2002, pp. 578ff for a discussion of this parallelism.

\textsuperscript{14}I do not want to claim that (13b) is a most adequate logical paraphrase of the sentence in
CHAPTER 5. THE INDEFINITE-INTERROGATIVE AFFINITY II

(13) Every homework assignment that a student had handed in got an A.
   a. $\forall x (HA(x) \land \exists y (\text{student}'(y) \land \text{handed_in}(y, x)) \rightarrow \text{got_an_A}(x))$
   b. $\forall x \forall y (HA(x) \land \text{student}'(y) \land \text{handed_in}(y, x) \rightarrow \text{got_an_A}(x))$

Thus, it seems that indeterminate pronouns of Japanese can simply be taken as indefinite pronouns – indefinite pronouns that for some morphosyntactic reason must occur in the scope of an overt particle like no, ka, or mo.

However, the data considered above can also be given a different spin. Beginning with Nishigauchi (1990), it is often held that the (quantificational) force of an indeterminate pronoun is not determined by the pronoun itself but by the closest operator in the scope of which it appears.\textsuperscript{15} To appreciate the plausibility of this view, take a look at the paradigm in (14).\textsuperscript{16}

(14) a. [[Dare-o hihansita] hito]-ga John-o hometa no?
   who-ACC criticized person-NOM John-ACC praised Q
   ‘For which human $x$ does it hold that a person who had criticized $x$ praised John?’

b. [[Dare-o hihansita] hito]-ka-ga John-o hometa.
   who-ACC criticized person-ka-NOM John-ACC praised
   ‘For some human $x$, a person who had criticized $x$ praised John.’

\textsuperscript{11}, but only point out that it is in accord with a well-known logical fact to analyze Japanese indeterminate pronouns in terms of (dynamic) existential quantification.

\textsuperscript{15}Again, this view has a well-known precursor in the semantic analysis of indefinites, namely Heim 1982.

\textsuperscript{16}The data in (14a,b) are from Yatsushiro (2001) (see example 3a,b). In the article cited, these sentences are paraphrased somewhat differently: (14b) is paraphrased as ‘Someone or other who had criticized someone praised John’ and (14c) as ‘Whoever criticized someone praised John.’ I have chosen arguably less adequate paraphrases to highlight the point being made with these examples.
c. [[Dare-o hihansita hito]-mo John-o hometa.
   who-ACC criticized person-mo John-ACC praised
   ‘For every human \( x \), the people who had criticized \( x \) praised John.’

The paradigm in (14) shows that the indeterminate pronoun dare can co-occur with an interrogative, an existential, or a universal particle, and these particles contribute a specific (quantificational) force to dare:17 In (14a), dare is in the immediate scope of the question particle no, and by this particle it receives interrogative force (in the sense that it must be interpreted as a question word). In (14b), dare is in the immediate scope of the particle -ka, and this particle provides it with existential quantificational force.18 Finally, (14c) shows that the particle -mo lends universal quantificational force to the indeterminate pronouns in its immediate scope.

To see that the quantificational force is in fact contributed by the particle and not by the co-occurring indeterminate pronoun, consider the example in (15).19

(15) [[Daremo-o hihansita hito]-ga John-o hometa.
   everyone-ACC criticized person-NOM John-ACC praised
   ‘A person who criticized everyone praised John.’

The sentence in (15) differs from (14c) in the position of the universal particle -mo. As can be seen from the paraphrases of the two sentences, the position of -mo determines the quantificational scope.

---

17In addition, there are particles that lead to interpretations comparable to NPI any and free choice any (see Shimoyama 2006, p. 143). We will not be concerned with these particles and interpretations.

18For some speakers of Japanese, -ka must occur adjacent to an indeterminate pronoun or, in the case of the determiner dono, adjacent to its complement. However, Yatsushiro (2001) and Takahashi (2002) discuss less restrictive varieties, to which I am referring here.

19See example (2b) in Yatsushiro (2001).
Furthermore, the sentence in (16) shows that the universal particle -mo is an unselective operator in the sense that it affects all of the indeterminate pronouns in its immediate scope.\(^{20}\)

A-was Q want to know
a. ‘Yoko wonders whether for every topic \(x\), every year \(y\), the paper that Taro wrote on \(x\) in \(y\) got an A.’
b. *‘Yoko wonders whether for which year \(y\), for every topic \(x\), the paper that Taro wrote on \(x\) in \(y\) got an A.’
c. *‘Yoko wonders whether for which topic \(x\), for every year \(y\), the paper that Taro wrote on \(x\) in \(y\) got an A.’

The impossibility of the mixed readings (16b) and (c) strongly suggests that the universal particle -mo is an unselective binder.

\(^{20}\)Cf. example (12) in Shimoyama (2006), pp. 146f. Note that (16) has a second reading, which is paraphrased in (i).

\[(i)\] (?)‘Yoko wonders whether for which topic \(x\) and for which year \(y\), the paper that Taro wrote on \(x\) in \(y\) also got an A.’

The possibility of this reading does not fit the view that the universal particle -mo is an unselective binder. For the time being, I follow Shimoyama (2006) in the assumption that this reading is due to a different, non-quantificational, particle -mo\(_2\), with the meaning ‘also’.
The table in (17) illustrates that the quantificational variability noted above can be observed for a variety of indeterminate pronouns.\textsuperscript{21}

\begin{table}[h]
\centering
\begin{tabular}{|l|l|l|l|}
\hline
 & Interrogative & Indefinite & Universal \\
\hline
Person & dare…no & dare-ka & dare…-mo  \\
& ‘who’ & ‘someone’ & ‘everyone’ \\
\hline
Thing & nani…no & nani-ka & nani…-mo  \\
& ‘what’ & ‘something’ & ‘everything’ \\
\hline
Place & doko…no & doko-ka & doko…-mo  \\
& ‘where’ & ‘somewhere’ & ‘everywhere’ \\
\hline
Time & itu…no & itu-ka & itu…-mo  \\
& ‘when’ & ‘sometime’ & ‘everytime’ \\
\hline
Det. & dono N…no & dono N-ka & dono N…-mo  \\
& ‘which N’ & ‘some N’ & ‘every N’ \\
\hline
Partitive & dore…no & dore-ka & dore…-mo  \\
& ‘which one’ & ‘one of them’ & ‘everything’ \\
\hline
\end{tabular}
\end{table}

In the following two sections, I will discuss two approaches to the quantificational variability of indeterminate pronouns. The first, Kratzer & Shimoyama (2002), is based on the assumption that indeterminate pronouns do not have quantificational force of their own. However, I will show with the second approach, presented in section 5.5, that the quantificational variability of indeterminate pronouns follows naturally from a quantificational analysis.

\textsuperscript{21}The dots in the first and third column of (17) are meant to indicate that no and -mo need not occur adjacent to a co-occurring indeterminate pronoun. In contrast to this, -ka has this restriction, at least for some speakers of Japanese. See footnote 18.
Kratzer & Shimoyama (2002) present a non-quantificational analysis of Japanese indeterminate pronouns that builds on the idea that indeterminate pronouns denote alternative sets of entities. To give an example, they assume that *dare* ‘who’ denotes the set of all humans. This is represented in (18), where for each expression (or rather, tree node) $\alpha$, $\|\alpha\|^{w,g}$ is the Kratzer & Shimoyama denotation of $\alpha$ at index $w$ with respect to the variable assignment $g$.

\begin{equation}
\|dare\|^{w,g} = \{x \mid \text{human}(x)(w)\}
\end{equation}

All other lexical items are assumed to denote the singleton set of their ordinary denotation. Accordingly, the verb *nemutta* ‘slept’ has the denotation specified in (19).

\begin{equation}
\|nemutta\|^{w,g} = \{\lambda x.\lambda w'.\text{slept}(x)(w')\}
\end{equation}

To compose two such denotations, the mode of composition must be pointwise functional application or *Hamblin functional application*, as this rule is termed in Kratzer & Shimoyama (2002). This composition rule is defined in (20).

\begin{equation}
\text{If } \alpha \text{ is a branching node with daughters } \beta \text{ and } \gamma, \\
\text{and } \|\beta\|^{w,g} \subseteq D_\sigma \text{ and } \|\gamma\|^{w,g} \subseteq D_{(\sigma,\tau)}, \\
\text{then } \|\alpha\|^{w,g} = \{a \in D_\tau \mid \exists b \exists c (b \in \|\beta\|^{w,g} \land c \in \|\gamma\|^{w,g} \land a = c(b))\}.
\end{equation}

According to these assumptions, the phrase *dare nemutta* denotes a set of propositions $p$ such that $p = f(x)$ for some function $f$ in the denotation of *nemutta* and some entity $x$ in the denotation of *dare*. Since *nemutta* denotes a singleton set, the resulting set of propositions can be written as shown in (21).
5.4. THE ACCOUNT OF KRATZER & SHIMOYAMA (2002)

(21) \( \| \text{dare nemutta} \|^{w,g} = \{ \lambda w'. \text{slept}(x)(w') \mid \text{human}(x)(w) \} \)

In interrogative sentences, the set of propositions denoted by a phrase like dare nemutta is converted into a singleton set of a partition-theoretic question denotation.\(^{22}\) The conversion is achieved by the question marker no defined in (22) (where \( \alpha \) is a node such that \( \| \alpha \|^{w,g} \subseteq D_{(s,t)} \)).\(^{23, 24}\)

(22) \( \| \alpha \text{ no} \|^{w,g} = \{ \lambda w'. \forall p (p \in \| \alpha \|^{w,g} \rightarrow (p(w) = 1 \leftrightarrow p(w') = 1)) \} \)

To illustrate this, let us consider the wh-question in (23).

(23) Dare nemutta no?

who slept Q

‘Who slept?’

According to the above assumptions, (23) has the following denotation.

\[
\| [\text{dare nemutta no}]^{w,g} = \\
= \{ \lambda w'. \forall p (p \in \{ \lambda w'. \text{slept}(x)(w') \mid \text{human}(x)(w) \} \rightarrow (p(w) = 1 \leftrightarrow p(w') = 1)) \}
\]

It should be obvious that the proposition in the singleton set derived above is the

\(^{22}\)That is, the intension of such a denotation defines a partition of the set of indices. This will become evident immediately.

\(^{23}\)With this definition, I am deviating somewhat from the article under discussion, however insubstantially: In Kratzer & Shimoyama (2002), the denotation given in (22) is not directly assigned to the question marker no but to an abstract question morpheme Q.

\(^{24}\)In Kratzer & Shimoyama (2002), it is pointed out that “there should be a choice for the world index with respect to which \( \alpha \) is evaluated” (op. cit., fn. 2, p. 7). The reason is that it must be possible to choose an index for the restriction of a which-phrase to derive the de dicto/de re ambiguity discussed in section 2.3.2. Without the possibility to chose an index, only the de re reading can be derived. However, note that in the case of pronouns like dare, it is doubtful that they give rise to a de dicto/de re ambiguity. Therefore, the restriction assumed in (18) should arguably be omitted.
partition-theoretic denotation of the \textit{de re} reading of the question \textit{which human sleeps}. This means that the alternative-semantic approach accounts for the fact that indeterminate pronouns receive a question-word interpretation if they appear in the immediate scope of the particle \textit{no}.

Now consider in (24a) and (b) the interpretation that is assigned in Kratzer & Shimoyama (2002) to the existential particle -\textit{ka} and the universal particle -\textit{mo}, respectively.\footnote{Again, Kratzer & Shimoyama (2002) do not assign these specifications directly to -\textit{ka} and -\textit{mo} but to abstract particles.} In Next, $\alpha$ is a node such that $\|\alpha\|^w,g \subseteq D_e$.

\begin{align*}
\text{(24) a. } & \|\alpha -\text{ka}\|^w,g = \{\lambda P\lambda w'.\exists a(\|\alpha\|^w,g \wedge P(a)(w') = 1)\} \\
\text{b. } & \|\alpha -\text{mo}\|^w,g = \{\lambda P\lambda w'.\forall a(\|\alpha\|^w,g \rightarrow P(a)(w') = 1)\}
\end{align*}

According to these definitions, -\textit{ka} and -\textit{mo} turn an alternative set of entities into a singleton set of a generalized quantifier that has the alternative set as its restriction. This is illustrated below with example of \textit{dare-ka} ‘who-\textit{ka}/someone’.

\[\|\text{dare-ka}\|^w,g = \{\lambda P\lambda w'.\exists a(\{x \mid \text{human}(x)(w)\} \wedge P(a)(w') = 1)\}\]

Consequently, the sentence \textit{Dare-ka nemutta} ‘Someone slept’ has the following denotation.

\[\|\text{dare-ka nemutta}\|^w,g = \{\lambda w'.\exists a(\{x \mid \text{human}(x)(w)\} \wedge \text{slept}(a)(w') = 1)\}\]

Obviously, the single element of the above set is the proposition that someone slept.\footnote{Again, we have to abstract from the easily correctable problem that the index of the restriction is fixed to $w$.} This shows that the alternative-semantic approach can account for fact that -\textit{ka} contributes existential quantificational force to the indeterminate pronouns in its immediate scope.
To illustrate the corresponding result for the universal particle -mo, consider the slightly more complicated example in (25).  

\[(25) \quad [[\text{Dono gakusei-no] okaasan}] -mo odotta.\]

which student-GEN mother -mo danced
‘Every mother of some student or other danced.’

In (25), -mo is not immediately suffixed to the indeterminate word dono ‘which’ or its complement noun. Rather, dono is the determiner of a DP that is the genitive argument of a (relational) noun, and -mo attaches to the corresponding complex DP. The denotation of dono gakusei ‘which student’ and okasaan ‘mother’ is shown in (26a) and (b), respectively. As you can see, I assume for simplicity that the meaning of okasaan already includes definiteness. This allows us to ignore the semantics of genitive particle -no in the following derivation.

\[(26)\]

| a. ||\(\|\text{dono gakusei}\|_{w,g} = \{ y \mid \text{student}(y)(w) \} \) |
| b. ||\(\|\text{okasaan}\|_{w,g} = \{ \lambda y.\cdot x.\text{mother}(x,y)(w) \} \) |

Thus, the complex DP to which -mo is suffixed denotes the set of all individuals y such that y is the mother of some student or other in w. This can be seen below.

\(\|[[\text{dono gakusei]-no okasaan}] -mo\|_{w,g} = \{ \cdot x.\text{mother}(x,y)(w) \mid \text{student}(y)(w) \} \)

Hence, the subject phrase of (25) has the following denotation when interpreted according to the specification in (24b).

\(\|[[\text{dono gakusei]-no okasaan}] -mo\|_{w,g} = \)

\(= \{ \lambda P \lambda w'.\forall a (a \in \{ \cdot x.\text{mother}(x,y)(w) \mid \text{student}(y)(w) \} \rightarrow P(a)(w') = 1) \} \)

\(^{27}\)See example (16) in Shimoyama (2006).

\(^{28}\)Cf. example (17a) in Shimoyama (2006).
This means that overall, (25) has the denotation given below.

\[ \text{∥} \text{[no okasaan]-mo odotta} \text{∥}_{w,g} = \]
\[ = \{ \lambda w'. \forall a (a \in \{ l.x. \text{mother}(x,y)(w) \mid \text{student}(y)(w) \} \rightarrow \text{danced}(a)(w') = 1) \} \]

Again, it is easy to see that the proposition in the above singleton set correctly represents the meaning of (25). Thus, we can conclude that the alternative-semantic approach accounts for the fact that -mo lends universal quantificational force to the indefinite pronouns in its scope.

Finally, let me mention that in addition to the noun particles -ka and -mo, Kratzer & Shimoyama (2002) define sentential particles that yield the same as meaning contribution as -ka and -mo but on the propositional level.\textsuperscript{29} The corresponding definitions are given in (27) (where \( \alpha \) is a node such that \( \| \alpha \|_{w,g} \subseteq D_{(s,t)} \)).

\[(27) \quad \text{a. } \| \exists \alpha \|_{w,g} = \{ \lambda w'. \exists p (p \in \| \alpha \|_{w,g} \land p(w') = 1) \} \]
\[(27) \quad \text{b. } \| \forall \alpha \|_{w,g} = \{ \lambda w'. \forall p (p \in \| \alpha \|_{w,g} \rightarrow p(w') = 1) \} \]

In the following section, I will show that all of this can also be achieved in the dynamic-semantic framework presented in chapter 4.

### 5.5 Quantificational accounts

The discussion at the beginning of section 5.3 already indicated that the quantificational variability of so-called indeterminate pronouns of Japanese is not at odds with their quantificational nature but rather a consequence thereof. This is

\textsuperscript{29}In Japanese, there is no (direct) evidence for the existence of these particles. That is, all of the data discussed in the pertinent literature suggest that -ka and -mo are DP particles. However, adverbial quantifiers such as sometimes and always can arguably be analyzed in the way shown in (27). But see Hinterwimmer 2005 for arguments to the opposite.
5.5. QUANTIFICATIONAL ACCOUNTS

what I will show in this section by presenting two different accounts of this phenomenon, which both are based on the assumption that indeterminate pronouns denote (dynamic) existential quantifiers. Thereby, I will concentrate on explaining the semantics of the universal particle -mo, since the interrogative and indefinite interpretation of indeterminate pronouns is already accounted for by the general approach presented in chapter 3 and 4.\(^{30}\)

5.5.1 Existential disclosure

Before detailing a more specific account, let me point out that dynamic predicate logics provide the means to account for any and every imaginable compositional/derivational relationship between an existentially quantified expression and a quantificational expression of a different sort: It is one of the distinctive properties of these logics that existentially quantified variables can be disclosed and hence requantified (see Dekker 1993). To show this for our logic MTy, let us agree on the following abbreviation which serves to state that the values of (the registers denoted by) two terms of type \(e\) are identical: If \(\delta\) and \(\delta'\) are terms of type \(e\), we write

\[
\text{Ident}(\delta, \delta') \quad \text{for} \quad \lambda k \lambda k' (k = k' \land \delta(k) = \delta'(k)).
\]

With the aid of this abbreviation, we can define a disclosure operator as shown in (28) (where \(\Phi\) is a dynamic formula).

\[
\text{Discl}_n(\Phi) = \lambda \nu (\Phi \land \text{Ident}(u_n, \nu))
\]

\(^{30}\)What remains to be explained is the morphosyntactic role of the existential particle -ka. For the time being, I assume provisionally that -ka absorbs the wh-feature of the indeterminate pronouns it is suffixed to.
Below, it is illustrated how this operator can be used to disclose an existential formula \( \exists u_n (\text{student}^\prime(i)(u_n) \land \text{sleep}^\prime(i)(u_n)) \) and requantify the result to arrive at the universal formula \( \forall u_m (\text{student}^\prime(i)(u_m) \land \text{sleep}^\prime(i)(u_m)) \).

\[
\forall u_m (\text{Discl}_n(\exists u_n (\text{student}^\prime(i)(u_n) \land \text{sleep}^\prime(i)(u_n))))(u_m) = \\
= \forall u_m \left( (\lambda \nu (\exists u_n (\text{student}^\prime(i)(u_n) \land \text{sleep}^\prime(i)(u_n)) \land \text{Ident}(u_n, \nu))) (u_m) \right) \\
= \forall u_m (\exists u_n (\text{student}^\prime(i)(u_n) \land \text{sleep}^\prime(i)(u_n)) \land \text{Ident}(u_n, u_m)) \\
= \forall u_m \exists u_n (\text{student}^\prime(i)(u_n) \land \text{sleep}^\prime(i)(u_n) \land \text{Ident}(u_n, u_m)) \\
= \forall u_m (\text{student}^\prime(i)(u_m) \land \text{sleep}^\prime(i)(u_m))
\]

This shows that dynamic logics provide the means to account for the quantificational variability of indeterminate pronouns that go far beyond the logical relationship that exists between existential and universal quantification.\(^{31}\)

However, there is reason to believe that existential disclosure is not involved in the phenomenon under discussion. The reason is that existential disclosure is a selective operation in the sense that the disclosure operator must be specified with the index of the discourse referent that is to be disclosed. However, we saw in section 5.3 that the universal operator \(-mo\) is an unselective operator. The crucial example, example (16) in section 5.3, is repeated in (29).

A-was Q want to know

a. ‘Yoko wonders whether for every topic \( x \), every year \( y \), the paper that Taro wrote on \( x \) in \( y \) got an A.’

\(^{31}\)Note that the alternative-semantic account of Kratzer & Shimoyama (2002) has, in this respect, the same expressiveness: The set of alternatives introduced by an indeterminate pronoun can function as the restriction of any generalized quantifier.
b. *‘Yoko wonders whether for which year $y$, for every topic $x$, the paper that Taro wrote on $x$ in $y$ got an A.’

c. *‘Yoko wonders whether for which topic $x$, for every year $y$, the paper that Taro wrote on $x$ in $y$ got an A.’

The impossibility of the mixed readings (29b) and (c) shows that the disclosure operator is likely not involved in the coming about of reading (29a).

5.5.2 The dynamic-semantic analogue of the account of Kratzer & Shimoyama (2000)

In this section, I will reproduce in MTy3 the idea of the approach of Kratzer & Shimoyama (2002). According to this approach, indeterminate pronouns introduce denotation alternatives into a semantic computation, and certain operators quantify over these alternatives. The dynamic-semantic correlate to denotation alternatives are the result contexts of an existential formula. Quantification over such result contexts is achieved by certain sentential connectives, for example, by the dynamic biconditional operator ‘↔’. This operator requires that every result context of the formula to its left is also a result context of the formula to its right and vice versa. Consequently, this operator is suited to bring about the question-word interpretation of $wh$-words, as was shown in chapter 3 and 4. Now if we compare the alternative-semantic meaning of the question operator $no$ in (22) with the alternative-semantic meaning of the particle -$mo$ in (24b) and translate the difference into dynamic semantics, we arrive at the following conclusion: The semantics of the particle -$mo$ involves the dynamic (uni)conditional operator ‘⊃’. This operator is given by the following abbreviation: If $\Phi$ and $\Psi$ are dy-

\[\Phi \supset \Psi\]

\[^{32}\text{The use of the superset symbol for this operator is somewhat unintuitive because }\Phi \supset \Psi \text{ is true in a context if the set of result contexts of } \Phi \text{ is a subset of the set of result contexts of } \Psi.\]
namic formulas, we write

\[(\Phi \supset \Psi) \quad \text{for} \quad \lambda k \lambda k' (k = k' \land \forall k_2 (\Phi(k)(k_2) \rightarrow \Psi(k)(k_2)))\]

Since this operator is a sentential connective, but \textit{-mo} operates on DP denotations, we have to transform a generalized quantifier into an appropriate propositional object. This is achieved by defining a dynamic property \(P^{id}\), which, for all arguments, identifies the input with the output context. This property is given by the abbreviation in (30).

\[(30) \quad P^{id} \quad \text{is short for} \quad \lambda i \lambda \nu \lambda k \lambda k' \cdot k = k'\]

To illustrate what is achieved by this property consider the MTy\(_3\) denotation of \textit{dare}, which is shown in (31). Note that for reasons of comparability, (31) is formed after the example of (18), that is, with a restriction.

\[(31) \quad \llbracket \textit{dare} \rrbracket^i = \lambda P. \exists u (\text{human}(i)(u) \land P(i)(u))\]

If (31) is applied to \(P^{id}\), the result is as given in (32).

\[(32) \quad \llbracket \textit{dare} \rrbracket^i(P^{id}) = \exists u. \text{human}(i)(u)\]

This means that the semantic contribution of \textit{-mo} can be specified as shown in (33), where the double negation serves to neutralize the context change potential of the material in the nuclear scope.

\[(33) \quad \llbracket \textit{-mo} \rrbracket^i = \lambda Q \lambda P(Q(i)(P^{id}) \supset Q(i)(\lambda i \lambda \nu. \neg \neg P(i)(\nu)))\]

Nevertheless, the use of the superset symbol is justified for mnemotechnical reasons.
The following derivation shows the result of applying the operator defined in (33) to the denotation of *dare*.

\[
[dare-mo]^i = \\
= [-mo]^i(\lambda i. [dare]^i) \\
= [\lambda Q\lambda P(Q(i)(P^{id}) \supset Q(i)(\lambda i\lambda \nu. \neg\neg P(i)(\nu)))] \\
= \lambda P(\exists u(\text{human}(i)(u) \land P(i)(u)) \supset \exists u(\text{human}(i)(u) \land \neg\neg P(i)(u))) \\
= \lambda P(\exists u. \text{human}(i)(u) \supset \exists u(\text{human}(i)(u) \land \neg\neg P(i)(u)))
\]

Accordingly, the sentence *Dare-mo nemutta* ‘Everybody slept’ has the denotation derived below.

\[
[dare-mo \text{ nemutta}]^i = \\
= [[dare-mo]^i(\lambda i. [\text{nemutta}]^i) \\
= [\lambda P(\exists u. \text{human}(i)(u) \supset \exists u(\text{human}(i)(u) \land \neg\neg P(i)(u)))](\lambda i\lambda \nu. \text{slept}^i(i)(\nu)) \\
= \exists u. \text{human}(i)(u) \supset \exists u(\text{human}(i)(u) \land \neg\neg \text{slept}^i(i)(u)) \\
= \exists u. \text{human}(i)(u) \supset \exists u(\text{human}(i)(u) \land \text{slept}^i(i)(u))
\]

I will now show that the dynamic formula derived above is true (in every context) if and only if everybody slept at the index assigned to \(i\). Assume that \(u\) denotes the register \(\rho\). Furthermore, assume that \(j\) is a human in \(i\) that did not sleep at \(i\). Then for each input context \(\kappa\) there is a context \(\kappa'\) such that \(\kappa'\) is a result context of \(\exists u. \text{human}(i)(u)\) and \(\rho(\kappa') = j\), since by assumption \(j\) is a human at \(i\). However, for no input context does it hold that such a context \(\kappa'\) is a result context of \(\exists u(\text{human}(i)(u) \land \text{slept}^i(i)(u))\), since by assumption \(j\) did not sleep at
Hence, the formula derived above is false in every context. Now assume that this formula is false in every context. This is the case only if for every context \( \kappa \) there is a context \( \kappa' \) that is the result context of \( \exists u. \text{human}(i)(u) \) but not of \( \exists u(\text{human}(i)(u) \land \text{slept}(i)(u)) \). However, this means that \( u(\kappa') \) is a human at \( i \), but a human that did not sleep at \( i \). This shows that with the specification in (33), we account for the fact that the particle -mo lends universal quantificational force to the indeterminate pronouns in its immediate scope.

This is also true for those constructions in which -mo is not immediately suffixed to an indeterminate pronoun but to a more inclusive DP. This will be demonstrated for the example in (25) (repeated below for convenience).

\[
(34) \quad [[\text{Dono gakusei-no] okaasan}] \text{-mo odotta.}
\]

which student-\( \text{gen} \) mother -mo danced

‘Every mother of some student or other danced.’

I assume, as is natural, that the subject phrase of (34) has the structure in (35) (where the indices on the determiners are chosen arbitrarily but different from one another).

\[
(35) \quad [\text{the}_1 [\text{mother } [(\text{of}) \text{which}_2 \text{student }]]]-\text{mo}
\]

The denotation of the singular definite determiner the can be specified as shown in (36). Note that with this definition, we account for the fact that definite DPs can be anaphorically referred to (in the case of (35) with the pronoun she\(_1\)).

\[
(36) \quad [\text{the}_n]' = \lambda P \lambda P'. \exists u_n (\text{the}(u_n, P) \land P'(i)(u_n))
\]

Thereby, \( \text{the}(u_n, P) \) is given by the following abbreviation: If \( u \) is a discourse referent and \( P \) is dynamic property (that is, a term of type \( \langle s, \langle e, t \rangle \rangle \)), we write
the \((u, P)\) for \(\lambda k \lambda k'(u(k') = \nu P(i)(\nu)(k)(k') \land x = \nu(k'))\)

To see what is achieved by these definitions, consider the following derivation.

\[
\begin{align*}
[[\text{the}_1 \text{ mother } [\text{of} \text{ which}_2 \text{ student }]]^i & = \\
= [[\text{the}_1]^i(\lambda i.[[\text{mother } [\text{of} \text{ which}_2 \text{ student }]]^i) = \\
= [[\text{the}_1]^i(\lambda i \lambda \nu.\exists u_2(\text{student}'(i)(u_2) \land \text{mother}'(i)(\nu, u_2))) = \\
= [\lambda P \lambda P'.\exists u_1(\text{the}(u_1, P) \land P'(i)(u_1))] \\
(\lambda i \lambda \nu.\exists u_2(\text{student}'(i)(u_2) \land \text{mother}'(i)(\nu, u_2))) = \\
= \lambda P'.\exists u_1(\text{the}(u_1, \lambda i \lambda \nu.\exists u_2(\text{student}'(i)(u_2) \land \text{mother}'(i)(\nu, u_2)))\land \\
\land P'(i)(u_1)) = \\
= \lambda P' \lambda k \lambda k'.\exists k_2([u_1]k_2)\land \\
\land \exists k_3(u_1(k_3) = \nu \exists \nu k_4([u_2]k_4 \land k_4 = k_3\land \\
\land \text{student}'(i)(u_2(k_4))\land \\
\land \text{mother}'(i)(\nu(k_4), u_2(k_4))\land \\
\land x = \nu(k_4))\land \\
\land P'(i)(u_1)(k_3)(k'))
\end{align*}
\]

Note that above, the existential quantification of \(k_3\) outscopes the \(\iota\)-operator. This guarantees that the \(\iota\)-term gives the mother of single students because \(k_3\) restricts the existential quantification of \(k_4\) in the scope of the \(\iota\)-operator. Thus, the value of \(u_1\) varies with different contexts over different individuals, where each individual is the mother of a student (both at index \(i\)). This is exactly the desired result.
This should already suffice to make clear that we derive the correct meaning for the sentence in (34). However to be perfectly explicit about this, find below the denotation of the subject phrase of (34).

\[
[[[dono gakusei]-no okasaan]-mo]\] = \\
\lambda P(\exists u_1 (\text{the}(u_1, \lambda i \lambda \nu. \exists u_2 (\text{student}'(i)(u_2) \land \text{mother}'(i)(\nu, u_2)))) \supset \\
\supset \exists u_1 (\text{the}(u_1, \lambda i \lambda \nu. \exists u_2 (\text{student}'(i)(u_2) \land \text{mother}'(i)(\nu, u_2))) \land \\
\land \neg \neg P(i)(u_1)))
\]

Accordingly, (34) has the following denotation.

\[
[[[dono gakusei]-no okasaan]-mo odotta]\] = \\
\exists u_1 (\text{the}(u_1, \lambda i \lambda \nu. \exists u_2 (\text{student}'(i)(u_2) \land \text{mother}'(i)(\nu, u_2))) \supset \\
\supset \exists u_1 (\text{the}(u_1, \lambda i \lambda \nu. \exists u_2 (\text{student}'(i)(u_2) \land \text{mother}'(i)(\nu, u_2))) \land \\
\land \text{dance}'(i)(u_1))
\]

This dynamic formula can easily be shown to be false (in every context) if and only if there is a student at index \(i\) such that his or her mother did not dance at \(i\).

Finally, let me show that basically the same effect can be achieved by means of a sentential operator. This will be shown by developing a specific hypothesis about the adverbial quantifier \textit{always}, which I assume to move at LF to a position in which it takes scope over its local proposition. Then the denotation of \textit{always} can be specified as shown in (37).

\[
(37) \quad [[\textit{always}]] = \lambda p (\text{\underline{Anywhere}}(p) \supset p(i))
\]

Thereby, \textit{\underline{Anywhere}}(p) (“anywhere” in the sense of at any index) is the following abbreviation: If \(p\) is dynamic proposition (that is, a term of type \(s, t\)), we write
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**Anywhere**\((p)\) for \(\lambda k\lambda k'. \exists j. p(j)(k)(k')\)

The effect of these specifications is illustrated with the sentence *A student is always intelligent*. The denotation of this sentence is derived as follows.\(^\text{33}\)

\[
\begin{align*}
[\text{always [a student is always intelligent]]}^i &= \\
= [\text{always}]^i (\lambda i. \exists u (\text{student}'(i)(u) \land \text{intelligent}'(i)(u))) \\
= \text{Anywhere} (\lambda i. \exists u (\text{student}'(i)(u) \land \text{intelligent}'(i)(u))) \supset \\
&\supset \exists u (\text{student}'(i)(u) \land \text{intelligent}'(i)(u)) \\
= [\lambda k\lambda k'. \exists j (k[u]k' \land \text{student}'(j)(u(k')) \land \text{intelligent}'(j)(u(k'))) \supset \\
&\supset [\lambda k\lambda k'(k[u]k' \land \text{student}'(i)(u(k')) \land \text{intelligent}'(i)(u(k'))])
\end{align*}
\]

Without further assumptions, the dynamic conditional derived above does not correctly represent the meaning of the sentence under consideration. It only does so if we presuppose that the set of students is identical at all indices. Given this, the value of \(u\) in \(\text{Anywhere} (\lambda i. \exists u (\text{student}'(i)(u) \land \text{intelligent}'(i)(u)))\) ranges over this set of students. Let us assume that this presupposition is grammaticalized, namely by the semantics of what is plausibly a topic feature, Top. The semantics of this feature is given in (38).

\[(38) \quad [\text{Top}]^i = \lambda P \lambda i \lambda u (P(i)(u) \land \text{Constant}(P))\]

The abbreviation \(\text{Constant}(P)\) in (38) expresses that the extension of the dynamic property \(P\) is constant over all indices. This abbreviation is defined as follows: If \(P\) is dynamic property, we write

\[\text{Thereby, I assume that an erased VP adverb denotes the identity function on the set of VP denotations.}\]
CHAPTER 5. THE INDEFINITE-INTERROGATIVE AFFINITY II

**Constant**\(_(P)\) for \(\lambda k \lambda k'(k = k' \land \forall i \forall j (P(i) = P(j)))\)

An NP bearing the (positively specified) Top feature receives the following interpretation.

(39) \([\textbf{NP}\{\textit{+Top}\}]^i = [\textbf{Top}]^i(\lambda i. [\textbf{NP}]^i)\)

Then the sentences in (40a) and (b) give rise to the interpretations paraphrased underneath.

(40) a. A student\{\textit{+Top}\} is always intelligent.
    ‘Every student is intelligent.’

   b. A student is always intelligent\{\textit{+Top}\}.
    ‘Every intelligent individual is a student.’

This seems to be the correct result (cf. von Fintel 1994).

5.6 Alternative semantics is weaker than dynamic semantics

In this section, I want to point out that the semantic framework used in Kratzer & Shimoyama (2002) cannot be used to model cross-sentential anaphoric relations. This is of importance because we find that wh-terms can serve as antecedents for anaphoric pronouns, as the example in (41) illustrates.

(41) Who\(_s\) won the women’s high jump? What height did she, sjump?
In chapter 6, I will show that the dynamic question semantics proposed in chapter 4 can account for anaphoric relations such as the one in (41) (with a slight modification of the question operator, that is). This means that this semantics semantics is more expressive than the question semantics proposed in Kratzer & Shimoyama (2002), and that this additional expressiveness is actually required.

Why do we even speculate that alternative semantics could be suitable to account for cross-sentential anaphora? The answer is that the individual variable that is introduced by an indefinite phrase is not existentially bound in the denotation of this phrase. Hence, it might be possible not to existentially close these variables before the discourse level (see Heim 1982 for such an approach to discourse anaphora). Let us see by way of an example whether this works out. In (42), it can be seen that the individual variable \(x\) in the denotation of the indefinite phrase \(a\) man is not existentially bound.

\[(42) \quad \|a\ man\|_{w,g} = \{ x \mid \text{man}(x)(w) \}\]

On first sight, it appears that this property persists if (42) is composed with the denotation of a verbal predicate like \(\text{sleeps}\) (see 43).

\[(43) \quad \|\text{sleeps}\|_{w,g} = \{ \lambda x\lambda w'.\text{sleep}(x)(w') \}\]

The result of composing (42) and (43) by pointwise functional application is shown in (44).

\[(44) \quad \|a\ man\ \text{sleeps}\|_{w,g} = \{ \lambda w'.\text{sleep}(x)(w') \mid \text{man}(x)(w) \}\]

The notation used in (44) suggests the individual variable \(x\) is still not existentially bound. However, this is only apparently so, as can be easily seen by considering the characteristic functions of the above sets. These functions are given in (45a-c).
where they are treated for simplicity as notational variants of the corresponding sets.

(45) a. \(\|a\ man\|^{w,g} = \lambda x.\text{man}(x)(w)\)

b. \(\|\text{sleeps}\|^{w,g} = \lambda P.P = \lambda x\lambda w'.\text{sleep}(x)(w')\)

c. \(\|a\ man\ \text{sleeps}\|^{w,g} = \lambda p.\exists x(\text{man}(x)(w) \land p = \lambda w'.\text{sleep}(x)(w'))\)

In (45c), it is made obvious that all occurrences of \(x\) are existentially bound.

Suppose that we still tried to define a dynamic predicate logic on the basis of (characteristic functions of) sets of propositions. What could the dynamic conjunction of two such sets be? The best we can come up with is the definition in (46).

(46) If \(\Phi, \Psi \subseteq D_{(s,t)}\),

then \(\Phi \land \Psi = \lambda r.\exists p\exists q(\Phi(p) \land \Psi(q) \land r = \lambda w'(p(w') \land q(w'))).\)

However, this does not give us a dynamic conjunction operator, as is shown by the following derivation.

\(\|a\ man\ \text{sleeps}\|^{w,g} \land \|\text{he\ snores}\|^{w,g} =\)

\(\lambda p.\exists x(\text{man}(x)(w) \land p = \lambda w'.\text{sleep}(x)(w')) \land \lambda p.p = \lambda w'.\text{snore}(x)(w')\)

\(= \lambda r.\exists p\exists q(\exists x(\text{man}(x)(w) \land p = \lambda w'.\text{sleep}(x)(w'))\land\)

\(\land q = \lambda w'.\text{snore}(x)(w') \land r = \lambda w'(p(w') \land q(w'))))\)

\(= \lambda r.\exists p(\exists x(\text{man}(x)(w) \land p = \lambda w'.\text{sleep}(x)(w'))\land\)

\(\land r = \lambda w'(p(w') \land \text{snore}(x)(w'))))\)

\(\neq \lambda r.\exists x(\text{man}(x)(w) \land r = \lambda w'(\text{sleep}(x)(w') \land \text{snore}(x)(w'))))\)

Hence, we can conclude that alternative semantics is not expressive enough to define a dynamic predicate logic.
Chapter 6

Predictions of the Analysis:
Anaphoric Reference to Wh-Terms

In this chapter, I will provide independent empirical evidence for the dynamic question semantics presented above and propose an analysis in the suggested dynamic framework.

6.1 Wh-terms as anaphoric antecedents: Data

6.1.1 Discourse anaphora

The most direct evidence supporting the assumption that the meaning of question words involves dynamic existential quantification comes from the fact that wh-terms can serve as antecedents for anaphoric pronouns.1,2 Take, for example, the following discourse, which consists of two wh-questions of a single speaker.

---

1See Van Rooy 1998 for this observation and an analysis, which, however, does not account for the indefinite-interrogative affinity.
2I am grateful to Chris Potts for discussing this topic with me and offering valuable suggestions.
(1) Who won this year’s Masters? What was his score?

To exhaustively answer this sequence of questions, the hearer must name the winner of this year’s Masters and specify the score he had. These answerhood conditions show that there is an anaphoric relation between the question word who of the first question and the pronoun his occurring in the second question.

The discourse in (2) provides another example of such an anaphoric relation. However, this time the anaphoric pronoun occurs in a declarative sentence instead of in a question. This yields an additional restriction on the question constituent which writer: The query expressed by (2) corresponds to the query expressed by the question Which Irish writer won the Nobel Prize in Literature in 1969?³

(2) [Which writer] won the Nobel Prize in Literature in 1969?
   To give you a hint: He was Irish.

The discourse in (3) shows that the anaphorically related expressions can occur in utterances of different speakers.

(3) A: I heard John is no longer a bachelor. Who did he marry?
    B: I don’t think you know her. She is from his hometown.

Furthermore, we can observe such anaphoric relations with indirect questions:⁴

³Strictly speaking, this holds only if we take into account the existential presupposition of this question. See the discussion below.

⁴The sentence in (4) is not perfectly natural, but I think this is not due to (sentence or discourse) grammar. Rather, what is odd about this sentence seems to be the mix between vagueness and specificity in what is being expressed. There are more natural examples to illustrate the point made with (4), for example, the sentence in (i) below.

(i) John didn’t say who got the job, but only that he is well-known for his work on
(4) John knows who\textsubscript{i} won the women’s high jump and that she\textsubscript{i} is British.

Thus, it seems that question words introduce anaphoric possibilities just like indefinites.

### 6.1.2 Donkey anaphora

#### 6.1.2.1 The crucial data

To confirm the conclusion reached above, I will now show that question words can serve as antecedents of donkey pronouns. For recapitulation, let us look again at the properties of the donkey sentence presented in example (10) of section 3.3 (repeated in (5) below).

(5) If [a donkey]\textsubscript{i} sleeps, it\textsubscript{i} snores.

a. \( \forall x ((\text{donkey}'(x) \land \text{sleep}'(x)) \rightarrow \text{snore}'(x)) \)

b. \( \exists x (\text{donkey}'(x) \land \text{sleep}'(x)) \rightarrow \text{snore}'(x) \)

The pronoun \textit{it} in the consequent of the conditional is referentially dependent on the indefinite \textit{a donkey} in the antecedent. We assume that this dependency comes about by the dynamic binding properties of the indefinite, due to which it can bind the pronoun even though it is not in its syntactic scope (see 5b for a structural representation). Furthermore, we observe that the conditional operator lends universal quantificational force to the indefinite. As a consequence of these two factors, the pronoun is effectively bound by an operator with universal force (see 5a).

---

crustacean phylogeny.

For reasons of simplicity, I will confine the discussion to the less elaborate example in the main text.
In chapter 3 and 4, I emphasized that the biconditional operator involved in question formation lends universal quantificational force to the question words in its scope. Therefore, we expect that an anaphoric pronoun acts as a donkey pronoun when it is dynamically bound by a question word in the scope of the biconditional operator. This expectation is confirmed by the German data in (6).

(6) Wer belegte [welchen Kurs], und schloss ihn, erfolgreich ab?

who took which course and finished him successfully up

literally: ‘Who took [which course], and finished it, successfully?’

As indicated by the subscripted letter, the question in (6) allows for a reading in which the pronoun *ihn* ‘him’ is referentially dependent on the *wh*-phrase *welchen Kurs* ‘which course’. To show that the question in (6) indeed exhibits an instance of donkey anaphora, we have to establish that the following two properties apply: (i) The referential dependency comes about by dynamic binding and (ii) the personal pronoun is effectively bound by an operator with universal force.

Let us turn to the second property first. What must be established is that (6) allows for a *pair-list* interpretation under the bound-pronoun reading. The possibility of this interpretation is shown by the fact that the pair-list answer in (7) is felicitous in response to (6).

(7) **MARIA** belegte [den SYNTAX-Kurs], und schloss ihn, erfolgreich ab,

**PAULA** belegte [den LOGIK-Kurs], und schloss ihn, erfolgreich ab, . . .

‘**MARIA** took [the SYNTAX course], and finished it, successfully.’

**PAULA** took [the LOGIC course], and finished it, successfully, . . .

The subscripts in (7) indicate that the pronoun *ihn* is referentially dependent on the respective answer term: *den Syntax Kurs, den Logik Kurs*, and so on. Hence, we can conclude that property (ii) holds.
To establish property (i), I will argue that (6) has the LF structure in (8).\(^5\) Two of the assumptions made in (8) will be left unjustified for the moment. The first assumption is that *wh*-movement is to the specifier of a functional head \(F\) in an articulated left periphery and the second that the *ex-situ wh*-phrase *wer* moves across-the-board from a coordinated structure of two FinPs (for this category, see Rizzi 1997).

\[ (8) \]

The most relevant aspect of (8) for the present discussion is the position of the *in-situ wh*-phrase *welchen Kurs*. As you can see, this phrase is assumed not to undergo covert phrasal *wh*-movement (see Pesetsky 2000, Beck 2006 and the dis-

\(^5\)Actually, the V2 movement of the finite verbs in (6) is reconstructed at LF (see (14) below). This is left unrepresent in (8) to motivate the assumption concerning the category of the coordinated phrases.
discussion below). This means that this phrase does not c-command the pronoun \textit{ihn} at LF or at any other stage in the derivation. Hence, there cannot be a static binding relation between these two elements. This means that the referential dependency of the personal pronoun on the \textit{wh}-phrase must be effected by dynamic binding.

Crucial evidence for the LF position of the \textit{in-situ wh}-phrase in (6) is provided by the data in (9).

\begin{align*}
(9) & \quad \text{Wer belegte nicht welchen Kurs?} \\
& \quad \text{who took not which course} \\
& \quad \textit{intended: ‘Who didn’t take which course?’}
\end{align*}

The deviance of the construction in (9) exemplifies a class of phenomena that are known as \textit{intervention effects} in \textit{wh}-questions (see Beck 1996, Beck 2006, and the discussion in chapter 8). In Beck (1996) and many subsequent analyses, intervention effects were taken to show that \textit{in-situ wh}-phrases undergo covert phrasal movement. More specifically, the analysis proposed by Beck (1996) accounts for the deviance of (9) by a condition on LF traces not to occur in an intervention configuration. Thereby, LF traces are traces present at LF but not at S-structure and an intervention configuration is created by a negation or quantifier c-commanding a \textit{wh}-word in the c-command domain of the licensing complementizer of the \textit{wh}-word. However, with the minimalist elimination of S-structure such a condition could no longer be maintained because along with S-structure, the principled definition of what is an LF trace was eliminated. Therefore, later analyses sought to explain intervention effects on the basis of the opposite assumption, that intervention effects are due to \textit{in-situ wh}-phrases not undergoing covert phrasal movement out of an intervention configuration. In Pesetsky (2000), this assumption is spelled out in purely syntactic terms, namely by the assumption that \textit{wh}-phrases fail to be
syntactically licensed in an intervention configuration if this licensing must be achieved by a non-phrasal movement operation. Furthermore, there are semantic explanations of intervention effects in wh-questions which are operative only if in-situ wh-phrases remain in an intervention configuration. For instance, Beck (2006) devises a theory for the in-situ interpretation of in-situ wh-phrases which is designed to filter out intervention configurations. Likewise, the dynamic question semantics proposed in this thesis predicts intervention effects to arise in languages in which in-situ wh-phrases are interpreted in situ. I therefore take (9) to show that in German, in-situ wh-phrases remain in situ at LF. We thus have shown that the personal pronoun ihn in (6) is dynamically bound by the in-situ wh-phrase welchen Kurs. This allows us to conclude that (6) indeed exhibits an example of donkey anaphora.

The above discussion raises the question of what status constructions like (6) have in languages in which in-situ wh-phrases do undergo covert phrasal movement. The perfect acceptability of (10) shows that English is a language of this kind (cf. Pesetsky 2000).

(10) Who didn’t take which course?

So let us consider the English constructions in (11).

(11) a. ??Who took [which course], and finished it, successfully?
   b. ??Who supports [which team], and attends each of its, matches?

---

6See section 8.3.1 for a critique of such an account.
7This will be discussed in great detail in chapter 8.
As indicated, the constructions in (11) are deviant. To see that this is actually expected, let us consider the LF structure of (11a), which is shown in (12).\(^8\)

\[(12)\]

The are two possible reasons that the LF structure in (12) is ungrammatical: (i) The movement of the wh-phrase \[DP \text{which}_2 \text{course}\] violates the coordinate structure constraint. (ii) This movement triggers a weak crossover effect because the pronoun \textit{it}_2 is bound as a result of this movement. Hence, unless (i) and (ii) somehow conspire to lead to a grammatical result,\(^9\) the deviance of (11a) is due to the covert phrasal movement of the \textit{in-situ} wh-phrase in this construction.

\(^8\)In (12), I assume TP coordination instead of the coordination of FinPs as in (8). This is mainly to keep the structure as simple as possible, but could be a real difference between English and German.

\(^9\)One could speculate that the pronoun \textit{it}_2 counts as a trace at LF so that the movement of \[DP \text{which}_2 \text{course}\] would be legitimate as an ATB movement.
6.1. WH-TERMS AS ANAPHORIC ANTECEDENTS: DATA

This reinforces our prior conclusion with regard to (6): The referential dependency of the pronoun *ihn* on the *wh*-phrase *welchen Kurs* is caused by dynamic binding.

6.1.2.2 Deriving the donkey reading attested for German *wh*-questions

In the following, it is shown that we are already in the position to derive the donkey reading of the *wh*-question in (6) (repeated in slightly modified form in 13).

\[
(13) \quad \text{Wer belegte [welchen-ACC Kurs], und schloss ihn, erfolgreich ab?}
\]

who took which-ACC course and locked he.ACC successfully up
literally: ‘Who took [which course], and finished it, successfully?’

I will give the semantic interpretation for a simplified version of the LF structure in (8), namely for the structure in (14). That is, like in the example discussed in section 4.5.5 the semantic contribution of clausal functional heads other than *C* is ignored. Consequently, the coordinated phrases are analysed as (headless) TPs in (14).

\[
(14) \quad [\text{CP} C^{(+Q)}]_{\text{FocP}} \text{wer}_{1} [\lambda 1 [[\text{TP}_{1} t_{1} \text{welchen}_{2} \text{Kurs belegte} ]}
\]

\[
[\text{und} [\text{TP}_{1} t_{1} \text{ihn}_{2} \text{abschloss }]]\]
\]

The only lexical item in (14) that has not been discussed yet is the conjunction *und* ‘and’. The lexical specification of this item can be found at the end of the following table. The other atomic constituents of the LF structure in (14) are translated in the same way as their English counterparts (see section 4.5). For convenience, the translations of these items are also given below.
MTy₃ translations of the atomic constituents of (14)

<table>
<thead>
<tr>
<th>LI</th>
<th>Translation</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>C[+Q]</td>
<td>( \lambda p \lambda j (p(i) \leftrightarrow p(j)) )</td>
<td>( \langle s, \langle s, \langle e, l \rangle, \langle e, l \rangle, \langle e, l \rangle \rangle )</td>
</tr>
<tr>
<td>werₙ</td>
<td>( \lambda P. \exists u_n. P(i)(u_n) )</td>
<td>( \langle s, \langle e, l \rangle, \langle e, l \rangle )</td>
</tr>
<tr>
<td>welchₙ</td>
<td>( \lambda P \lambda P'. \exists u_n. P(i)(u_n) \wedge P'(i)(u_n) )</td>
<td>( \langle s, \langle s, \langle e, l \rangle, \langle e, l \rangle, \langle e, l \rangle \rangle )</td>
</tr>
<tr>
<td>tₙ</td>
<td>( \lambda P. P(i)(\nu_n) )</td>
<td>( \langle s, \langle e, l \rangle, \langle e, l \rangle )</td>
</tr>
<tr>
<td>erₙ</td>
<td>( \lambda P. P(i)(u_n) )</td>
<td>( \langle s, \langle e, l \rangle, \langle e, l \rangle )</td>
</tr>
<tr>
<td>Kurs</td>
<td>( \lambda \nu. \text{course}'(i)(\nu) )</td>
<td>( \langle e, l \rangle )</td>
</tr>
<tr>
<td>belegen</td>
<td>( \lambda Q \lambda \nu. Q(i)(\lambda i \lambda \nu'. \text{take}'(i)(\nu, \nu') )</td>
<td>( \langle s, \langle s, \langle e, l \rangle, \langle e, l \rangle \rangle )</td>
</tr>
<tr>
<td>abschließen</td>
<td>( \lambda Q \lambda \nu. Q(i)(\lambda i \lambda \nu'. \text{finish}'(i)(\nu, \nu') )</td>
<td>( \langle s, \langle s, \langle e, l \rangle, \langle e, l \rangle \rangle )</td>
</tr>
<tr>
<td>und</td>
<td>( \lambda p \lambda p'(i(p(i) \wedge p'(i)) )</td>
<td>( \langle s, \langle s, \langle e, l \rangle \rangle )</td>
</tr>
</tbody>
</table>

NB: The specification of erₙ will be revised in section 6.3.3.

The denotation of the coordinated TPs is derived as sketch in (15).

(15) a. \(\text{TP}^\dagger \sim \exists u_2 (\text{course}'(i)(u_2) \wedge \text{take}'(i)(\nu_1, u_2))\)

b. \(\text{TP}^\dagger \sim \text{finish}'(i)(\nu_1, u_2)\)

c. \([\text{TP}^\dagger \text{ und } \text{TP}^\dagger] \sim \)

\( \sim \exists u_2 (\text{course}'(i)(u_2) \wedge \text{take}'(i)(\nu_1, u_2)) \wedge \text{finish}'(i)(\nu_1, u_2)\)
With respect to the formula derived in (15c), we can note that the existential quantifier \( \exists u_2 \) dynamically binds the last occurrence of the discourse referent \( u_2 \). Hence, the formula derived in (15c) is logically equivalent to a formula in which \( \exists u_2 \) takes syntactic scope over this occurrence of \( u_2 \). That is, we find that the following equivalence holds (where ‘\( \simeq \)’ is the dynamic equivalence notion defined in section 4.4).

\[
\exists u_2 (\text{course}'(i)(u_2) \land \text{take}'(i)(\nu_1, u_2) \land \text{finish}'(i)(\nu_1, u_2)) \simeq \\
\exists u_2 (\text{course}'(i)(u_2) \land \text{take}'(i)(\nu_1, u_2) \land \text{finish}'(i)(\nu_1, u_2))
\]

This means that we can proceed the derivation as shown in (16).

(16) a. \([\lambda 1 [\text{TP}^\downarrow \text{ und TP}^\uparrow]] \simeq \\
\simeq \lambda \nu_1. \exists u_2 (\text{course}'(i)(u_2) \land \text{take}'(i)(\nu_1, u_2) \land \text{finish}'(i)(\nu_1, u_2)) \]

b. \( \text{FocP} \simeq \exists u_1 \exists u_2 (\text{course}'(i)(u_2) \land \text{take}'(i)(u_1, u_2) \land \text{finish}'(i)(u_1, u_2)) \)

By applying the denotation of \( C^{+Q} \) to the intension of FocP, we finally derive that (14) denotes the proposition in (17).

(17) \( \lambda j (\exists u_1 \exists u_2 (\text{course}'(i)(u_2) \land \text{take}'(i)(u_1, u_2) \land \text{finish}'(i)(u_1, u_2)) \leftarrow \\
\leftarrow \exists u_1 \exists u_2 (\text{course}'(j)(u_2) \land \text{take}'(j)(u_1, u_2) \land \text{finish}'(j)(u_1, u_2))) \)

As argued at length in chapter 3, the biconditional operator lends universal quantificational force to the existential quantifiers in its scope. This means that we have successfully derived the donkey reading of the \( WH \)-question in (13).
6.1.2.3 Donkey anaphora is restricted to the scope of the question operator

In this section, I will show that donkey readings resulting from the dynamic binding of an anaphoric pronoun by a *wh*-word are restricted to the scope of the question operator (that is, of the denotation of $\text{C}^{[-]}$). For an example, consider the conditional sentence in (18). What we observe is that (18) does not have the reading given in (18-a), but only the one in (18-b).

(18) If Mary finds out who$_i$ cheated, he$_i$ will be disqualified.

  a. *‘For each $x$, if Mary finds out that $x$ cheated, $x$ will be disqualified.’
  b. ‘Someone cheated and if Mary finds out who did, he will be disqualified.’

In section 6.1.2, it was pointed out that English contrasts with German with regard to the availability of donkey readings in *wh*-questions. However, the German sentence corresponding to (18) does not allow for a donkey reading either. This is shown in (19).

(19) Wenn Maria herausfindet, wer$_i$ geschummelt hat, wird er$_i$

If Maria finds out who cheated has is he disqualified.

  a. *‘For each $x$, if Maria finds out that $x$ cheated, $x$ will be disqualified.’
  b. ‘Someone cheated and if Maria finds out who did, he will be disqualified.’

Therefore, we will concentrate on English in the following discussion.
6.1. WH-TERMS AS ANAPHORIC ANTECEDENTS: DATA

The data in (18) and (19) show that the dynamic meaning of the question operator interferes with the dynamic binding potential of the wh-words in its scope.\(^\text{10}\) For this reason, we have to be more careful about what binding potential wh-words actually have. This question will be approached by considering several constructions and discourses in order to check for the availability of a donkey reading.

To begin with, observe that (20) can be paraphrased as given in (20a). For the sake of argument, let us furthermore assume that (20) is ambiguous between (20a) and the weakly exhaustive reading given in (20b).

(20) Mary knows who cheated.
   a. ‘Mary knows for each \(x\) whether \(x\) cheated.’
   b. ‘Mary knows for each \(x\), if \(x\) cheated, that \(x\) cheated.’

We might therefore be led to expect that (21) has the reading paraphrased in (21a-i) or (a-ii). However, this sentence only allows for the reading given in (21b), which describes a highly unlikely state of affairs.\(^\text{11}\)

(21) #Mary knows who \(i\) was at the party and that he \(i\) danced a lot.
   a. (i) *‘Mary knows for each \(x\) whether \(x\) was at the party and that \(x\)
        danced a lot.’
   (ii) *‘Mary knows for each \(x\), if \(x\) was at the party, that \(x\) was at the

\(^{10}\) Furthermore, we can observe that does not interfere with the binding potential of indefinites in its scope. That is, the conditional clause in (i) allows for a donkey reading with respect to both indefinites, especially, with respect to the indefinite a donkey.

(i) If [a farmer], cares about what feed [a donkey \(j\)], likes best, he, loves it \(j\).

\(^{11}\) One could argue whether a party with a single guest actually is a party. If not, (21) should be marked as unacceptable.
party and that $x$ danced a lot.’

b. ‘There is a single person who was at the party and Mary knows who
and that he danced a lot.’

This corresponds to the fact that by asking the questions in (22), the speaker insinuates that only a single person was at the party:

(22) Who$_i$ was at the party? #Did he$_i$ dance a lot?

*‘Tell me for each $x$ whether $x$ was at the party and whether $x$ danced a lot.’

These observations suggest that a singular personal pronoun can only be used to refer to a question word if the corresponding question allows for a unique answer. This is confirmed by the inacceptability of the anaphoric reference in the German discourse in (23). By the occurrence of the particle alles ‘all’, the first question in (23) excludes a unique answer.$^{12}$ Hence, the singular pronoun in the second question cannot be used to refer to the question word of the first question.

(23) Wer$_i$ war alles auf der Party? *Hat er$_i$ viel getanzt?

who was all at the party has he a lot danced

literally: ‘Who$_i$ all was at the party? Did he$_i$ dance a lot?’

Summing up so far, the acceptability and felicity of the examples considered above and in section 6.1.1 depend on the answerhood conditions of the question $Q$ containing the anaphoric antecedent wh$_i$: If $Q$ allows for a unique answer, a singular personal pronoun can be used to refer anaphorically to wh$_i$ and its use is felicitous to the degree that $Q$ naturally allows for a unique answer. Consequently, questions

$^{12}$See Reis 1992 for discussion. I am grateful to Malte Zimmermann for bringing this fact to my attention.
that require a unique answer give rise to the most felicitous uses. If, on the other hand, \( Q \) excludes a unique answer, a singular pronoun cannot be used to refer to \( wh_i \). To see this most clearly, compare the answerhood conditions of the first question of (2), (22), and (23).

### 6.2 Making \( wh \)-terms anaphorically accessible

#### 6.2.1 Two options to achieve accessibility

According to the analysis presented in chapter 3, question words are inaccessible for anaphoric reference. The reason for this is that question words are in the scope of a biconditional operator, which we assumed to be externally static. Therefore, we have to modify our analysis to make accessible the context change brought about by question words. This can be achieved in two ways: by modifying the dynamic logic that underlies the semantic analysis or by modifying the semantic analysis itself. These two options are discussed in the following two subsections, and the second will be chosen for the analysis of the anaphora data.

#### 6.2.2 Option 1: An externally dynamic biconditional operator

So far, we have proceeded under the assumption that the biconditional operator does not pass on the context change brought about by the formulas in its scope. The above data, however, strongly suggest otherwise: If the meaning of a question word involves dynamic existential quantification, the anaphoric relations considered above are naturally assumed to emerge from dynamic binding; but then it seems that the biconditional operator must be externally dynamic. So let us tentatively assume that the biconditional operator passes on the context change brought about by the formulas in its scope. What does this mean exactly? By definition,
the biconditional of two dynamic formulas $\Phi$ and $\Psi$ is true iff $\Phi$ and $\Psi$ bring about the same context change. Hence, it is natural to assume that a true biconditional brings about this very context change. To implement this, let us amend Abbr. 3 (see section 4.3.2 above) as follows: If $\Phi$ and $\Psi$ are dynamic formulas, we write

$$\text{Abbr. 3a} \quad (\Phi \xrightarrow{\text{dyn}} \Psi) \quad \text{for} \quad \lambda k \lambda k'(\lambda k(k)(k') \land \forall k_2(\Phi(k)(k_2) \leftrightarrow \Psi(k)(k_2))) \lor \lor (k = k' \land \forall k_2(\neg \Phi(k)(k_2) \land \neg \Psi(k)(k_2))).$$

NB: This abbreviation will not be used later on.

Note that the second disjunct in the above specification deals with the special case that $\Phi$ and $\Psi$ both denote the empty relation. In this case, $\Phi \xrightarrow{\text{dyn}} \Psi$ is defined to denote the identity relation (and not the empty relation). However, when we consider MTy$_3$ translations of wh-questions, we can ignore this special case. This is because wh-questions have an existential presupposition, which is meant to say that, for instance, the wh-question in (24) presupposes that someone actually proved the Poincaré Conjecture.

(24) Who proved the Poincaré Conjecture?

\[ \downarrow \text{Someone proved the Poincaré Conjecture.} \]

To account for this meaning aspect, let us assume that the question in (24) expresses a restriction on the class of models with respect to which its denotation is to be evaluated. That is, let us assume that the denotation of the question in (24) is evaluated with respect to the class $[\mathcal{M}]$ of all models $\mathcal{M}$ such that

$$[\exists x.\text{prove}'(i)(x, \text{the}_\text{PC})]_{\mathcal{M},g} = 1 \quad \text{for all assignments} \ g.$$ 

To see that this allows us to ignore the special case mentioned above, consider the MTy$_3$ translation of the

---

13This is to maintain that $\Phi \xrightarrow{\text{dyn}} \Psi$ is true with respect to an assignment $g$ and a context $\kappa$ in a model $\mathcal{M}$ iff there is a context $\kappa'$ such that $[\Phi \xrightarrow{\text{dyn}} \Psi]_{\mathcal{M},g}(\kappa)(\kappa') = 1$.

14See section 7.4.2.1 for a discussion of this meaning aspect of wh-questions.
question in (24), given in (25). Note that in (25) we tentatively use the externally
dynamic biconditional operator instead of the externally static one.

\[
\lambda j (\exists u. \text{prove}'(i)(u, \text{the}_PC) \xrightarrow{\text{dyn}} \exists u. \text{prove}'(j)(u, \text{the}_PC))
\]

What we observe is that $\Phi$ and $\Psi$ represent the existential presupposition of (24).
Put differently, we find that $\Phi$ and $\Psi$ are valid with respect to $[\mathcal{M}]$. This means that for no model in $[\mathcal{M}]$, $\Phi$ and $\Psi$ denote the empty relation and hence that the following equivalence holds (where $\simeq_{[\mathcal{M}]}$ is the equivalence relation `$\simeq$' restricted to the models in $[\mathcal{M}]$).

\[
\Phi \xrightarrow{\text{dyn}} \Psi \\
\simeq_{[\mathcal{M}]}
\lambda k \lambda k'(\Phi(k)(k') \land \forall k_2 (\Phi(k)(k_2) \leftrightarrow \Psi(k)(k_2)))
\]

By inspecting the $\lambda$-term above, we then make another interesting observation.
To state this observation, let us, for the moment, use the notation `$\xrightarrow{\text{stat}}$' to refer to the externally static biconditional operator (the operator defined in Abbr. 3).
What we observe is the equivalence below.

\[
\lambda k \lambda k'(\Phi(k)(k') \land \forall k_2 (\Phi(k)(k_2) \leftrightarrow \Psi(k)(k_2)))
\]

\[
\simeq
(\Phi \xrightarrow{\text{stat}} \Psi) \land \Phi
\]

This means the following for the semantic analysis of $wh$-questions: We can either assume that the biconditional operator is externally dynamic; or we continue to assume that the biconditional operator is externally static and translate $wh$-questions
into expressions of the form $\lambda j((\Phi \leftrightarrow \Psi) \land \Phi)$. I know of no empirical evidence that would favor one approach over the other. However, it seems desirable to keep the logic that underlies our semantic analysis as simple as possible. For this reason, we reject the assumption that the biconditional operator is externally dynamic and go with the other approach.\(^{15}\)

### 6.2.3 Option 2: More complex semantic representations

Continuing the above discussion, we now pursue the hypothesis that the meaning of a \textit{wh}-question is to be represented by an expression of the form $\lambda j((\Phi \leftrightarrow \Psi) \land \Phi)$. For conceptual reasons, however, we should stick to the assumption that the \textit{denotation} of a \textit{wh}-question is properly represented by an expression of the form $\lambda j(\Phi \leftrightarrow \Psi)$. This would imply that the additional conjunct reflects a meaning aspect that does not belong to the proper semantics of a \textit{wh}-question. Nevertheless, for the time being we assume otherwise, that is, that \textit{wh}-questions are headed by the question marker/interrogative complementizer specified below.

**MTy\textsubscript{3} translation of the dynamic question operator**

\begin{align*}
\text{LI} & \quad \text{Translation} & \quad \text{Type} \\
Q^{\text{dyn}} & \sim \lambda p \lambda j((p(i) \leftrightarrow p(j)) \land p(i)) & \langle\langle s, t \rangle, \langle s, t \rangle \rangle
\end{align*}

Note that in a certain sense, translations derived by means of $Q^{\text{dyn}}$ represent the existential presupposition of the translated \textit{wh}-questions. To see this, consider in (26) the term representing the intension of (\textit{guess}) \textit{who won} under the structural hypothesis $[Q^{\text{dyn}} \ [\text{\textit{guess}] \ [\text{\textit{who \ won}]})$.

\begin{align*}
\lambda i \lambda j((\exists u_1. \text{\textit{win'}}(i)(u_1) \leftrightarrow \exists u_1. \text{\textit{win'}}(j)(u_1)) \land \exists u_1. \text{\textit{win'}}(i)(u_1))
\end{align*}

\(^{15}\)I am grateful to Stefan Hinterwimmer for discussing this issue with me.
What we observe is that (26) specifies an equivalence relation on the set of indices iff $\exists u_1. \text{win}'(i)(u_1)$ is true for all assignments to $i$. This can be seen by looking at the reflexivity property: Let $Q$ be the static extension of (26) and assume that $i$ is assigned the index $i$. Then, $Q(i)(i) = 1$ iff $\exists u_1. \text{win}'(i)(u_1)$ is true. This means that (26) represents a proper question intension only in models that satisfy the existential presupposition of the question under consideration.\(^\text{16}\)

### 6.3 Analysis

#### 6.3.1 The basic anaphora facts

There are two lexical items whose denotation we must specify before we can proceed. The first is the personal pronoun (s)he, which we translate into the GQ-lift of a discourse referent (see below).\(^\text{17}\) The second item is the clause coordinator and, which we assume to denote an operator that forms the conjunction of two dynamic propositional concepts. However, for reasons of exposition we present and as homophonous between two lexical items, and $P$ and and $Q$. The first of these items serves to conjoin dynamic propositions, whereas the second serves to conjoin dynamic propositional concepts (see below). Furthermore, we assume that both of these items come in overt as well as covert form (without distinguishing these forms typographically).

\(^{16}\)This reinforces the claim made above that the second conjunct in a representation of the form $\lambda j ((\Phi \leftrightarrow \Psi) \land \Phi)$ should not be considered as belonging to the denotation of a wh-question. Rather, it should be considered to arise from the presupposition of a wh-question.

**MTy₃ translations of some lexical items**

<table>
<thead>
<tr>
<th>LI</th>
<th>Translation</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>(s)heₙ</td>
<td>$\lambda P. P(i)(u_n)$</td>
<td>$\langle {s, {e, t}}, {e} \rangle$</td>
</tr>
<tr>
<td>and $P$</td>
<td>$\lambda p \lambda p' \lambda j (p'(j) \land p(j))$</td>
<td>$\langle {s, {e}, \langle s, {e}, {s, {e}} \rangle \rangle \rangle$</td>
</tr>
<tr>
<td>and $Q$</td>
<td>$\lambda q \lambda q' \lambda i \lambda j (q'(i)(j) \land q(i)(j))$</td>
<td>$\langle {s, {s, {e}}, \langle s, {s, {e}}, {s, {s, {e}}} \rangle \rangle \rangle$</td>
</tr>
</tbody>
</table>

NB: The specification of heₙ will be revised in section 6.3.3.

Now we are prepared to explain the anaphora data presented above.

First, I will show that we can account for the interpretation of the primary examples in section 6.1 on the assumption that the question containing the anaphoric antecedent has a unique answer. Let us begin with the example in (4) (repeated in (27) with some annotations). Note that in (27) the question word who of the embedded question CPᵩ is coindexed with the pronoun he in the coordinated embedded declarative CPᵩ. This is to model the anaphoric relation between these items. The tree in (27a) shows in a more transparent way the relevant compositional structure and (27b) gives the translations of CPᵩ, CPᵩ, and [CPᵩ and $P$ CPᵩ].

(27) John knows [[CPᵩ who₁ won (the women’s high jump)]

and $P$ [CPᵩ that she₁ is British]].
6.3. ANALYSIS

a. John knows CP† and \( \lambda p \lambda p' \lambda j (p'(j) \land p(j)) \)

b. \( \text{CP}^\dagger \sim \lambda j ((\exists u_1. \text{win}'(i)(u_1) \leftrightarrow \exists u_1. \text{win}'(j)(u_1)) \land \exists u_1. \text{win}'(i)(u_1)) \)

\( \text{CP}^\ddagger \sim \lambda i. \text{british}'(i)(u_1) \)

\( [\text{CP}^\dagger \text{ and } p \text{ CP}^\ddagger] \sim \lambda j(((\exists u_1. \text{win}'(i)(u_1) \leftrightarrow \exists u_1. \text{win}'(j)(u_1)) \land \exists u_1. \text{win}'(i)(u_1) \land \text{british}'(j)(u_1)) \)

In the translation of [CP† and \( \text{CP}^\dagger \)], the last occurrence of \( u_1 \) is dynamically bound by the existential quantifier immediately preceding it. Let us look more closely at the denotation of this translation and expand the abbreviations it contains. What we arrive at is the following term, which I will call \( \pi \).

\[
\lambda j \lambda k \lambda k' (\forall k_2 ((k[u_1]k_2 \land \text{win}'(i)(u_1(k_2))) \leftrightarrow (k[u_1]k_2 \land \text{win}'(j)(u_1(k_2)))) \land \\
\land (k[u_1]k' \land \text{win}'(i)(u_1(k'))) \land \text{british}'(j)(u_1(k'))) 
\]

I will now decompose \( \pi \) into several components to explicate its denotation. First, consider the dynamic formula in (28), and assume that \( u_1 \) denotes the register \( \rho \) and that \( i \) and \( j \) are assigned the indices \( i \) and \( j \), respectively.
By definition, (28) is true with respect to a context $\kappa$ iff there is a context $\kappa'$ such that $\kappa$ and $\kappa'$ differ at most in the value of $\rho$, and the value of $\rho$ in $\kappa'$ is an individual that won at $i$ and is British at $j$. Assume now that Ruth is the one who won at $i$. Then axiom 1 guarantees that for each context $\kappa$, there is a context $\kappa'$ such that $\kappa$ and $\kappa'$ differ at most in the value of $\rho$, and the value of $\rho$ in $\kappa'$ is Ruth. Since by assumption Ruth is the individual that won at $i$, (28) is true with respect to a context $\kappa$ iff Ruth is British at $j$. Hence, the static extension of (29) is the proposition that Ruth is British.

Now consider the conjunct missing from (29) to form $\pi$, that is, the formula in (30).

As we saw in section 4.5, axiom 1 guarantees that (30) is equivalent to the equation $\lambda x.\text{win}'(i)(x) = \lambda x.\text{win}'(j)(x)$. If we assume as before that Ruth is the individual that won at $i$, then (30) is true iff Ruth is the individual that won at $j$. So overall, the static extension of $\pi$ is the proposition that Ruth is the individual that won and is British. Clearly, this is the knowledge that we ascribe to John by asserting (27) at $i$. This means that we correctly predict that a singular pronoun can be felicitously used to refer to a question word if the corresponding question has a unique answer.

This result extends to anaphoric relations in direct discourse. Consider, for example, the discourse in (31), which repeats (2) with some annotations. The tree in (31a) specifies what I assume to be the semantically relevant structure of this
6.3. ANALYSIS

discourse, and (31b) gives the resulting translation.

(31) [CP\textsuperscript{\dagger} Which\textsubscript{1} writer won (the Nobel Prize in Literature in 1969)]?
(To give you a hint):[CP\textsuperscript{\dagger} He\textsubscript{1} was Irish].

a. 

\[
\begin{align*}
\text{CP}\textsuperscript{\dagger} & \quad \text{and} \quad Q \\
& \quad \lambda q \lambda q' \lambda i \lambda j (q'(i)(j) \land q(i)(j)) \\
\text{Which}\textsubscript{1} writer won? \\
\text{CP}\textsuperscript{\dagger} & \quad \text{and} \quad Q \\
& \quad \lambda i \lambda j \Phi \\
& \quad \lambda i \lambda j \lambda i \lambda j (i) \land q(i)(j) \\
\text{CP}\textsuperscript{\dagger} & \quad \text{and} \quad Q \\
\text{CP}\textsuperscript{\dagger} & \quad \text{and} \quad Q
\end{align*}
\]

b. \(\text{CP}\textsuperscript{\dagger} \leadsto \lambda i \lambda j \Phi\), where \(\Phi = (\exists u_1 (\text{writer}'(i)(u_1) \land \text{win}'(i)(u_1)) \leftrightarrow \exists u_1 (\text{writer}'(j)(u_1) \land \text{win}'(j)(u_1)) \land \exists u_1 (\text{writer}'(i)(u_1) \land \text{win}'(i)(u_1)))\)

\(\text{CP}\textsuperscript{\dagger} \leadsto \lambda i \lambda i \text{irish}'(i)(u_1)\)

\([\text{CP}\textsuperscript{\dagger} \text{and} Q \text{CP}\textsuperscript{\dagger}] \leadsto \lambda i \lambda j (\Phi \land \text{irish}'(j)(u_1))\)

We know from the discussion of the previous example that in the above translation of \([\text{CP}\textsuperscript{\dagger} \text{and} Q \text{CP}\textsuperscript{\dagger}]\), an update on \(u_1\) in the first conjunct \(\Phi\) is carried over to the second conjunct \text{irish}'(j)(u_1). Therefore, if Samuel is the writer that won at \(i\) and if we apply the static extension of \(\lambda i \lambda j (\Phi \land \text{irish}'(j)(u_1))\) to \(i\), we get the proposition that Samuel is the writer that won and is Irish. So if we assume that at each index, there is exactly one writer that won, the static extension of
\( \lambda i \lambda j (\Phi \land \text{irish}'(j)(u_1)) \) is a propositional concept \( Q \) that can be characterized as follows: For each index \( i \), \( Q(i) \) is the proposition that \( u_1 \) is the writer that won and is Irish, where \( u_1 \) is the writer that won at \( i \). This is the correct result.

For a final example, consider the discourse in (1), repeated in (32). The representations in (32a) and (b) give the structure and translation of this discourse, where \( \text{score}'(i) \) denotes a function from entities to (the characteristic function of) singleton sets of entities (which are numeric values).

\[
(32) \quad [\text{CP}^\dagger \text{Who}_1 \text{ won (this year's Masters)}]?
\quad \text{and} \_ Q \quad [\text{CP}^\ddagger \text{What was his}_1 \text{ score}]? 
\]

a. 

\[
\begin{align*}
\text{CP}^\dagger & \quad \text{and} \_ Q \\
\text{Who}_1 \text{ won?} & \quad \lambda q \lambda q' \lambda i \lambda j (q'(i)(j) \land q(i)(j)) \\
\text{CP}^\ddagger & \quad \text{What}_2 \text{ was his}_1 \text{ score?}
\end{align*}
\]

b. \( \text{CP}^\dagger \sim \lambda i \lambda j . \Phi \), where \( \Phi = (\exists u_1 . \text{win}'(i)(u_1) \leftrightarrow \exists u_1 . \text{win}'(j)(u_1)) \land \exists u_1 . \text{win}'(i)(u_1) \)

\( \text{CP}^\ddagger \sim \lambda i \lambda j . \Psi \), where \( \Psi = (\exists u_2 . \text{score}'(i)(u_1)(u_2) \leftrightarrow \exists u_2 . \text{score}'(j)(u_1)(u_2)) \land \exists u_2 . \text{score}'(i)(u_1)(u_2) \)

\[ [\text{CP}^\dagger \text{and} \_ Q \text{ CP}^\ddagger] \sim \lambda i \lambda j (\Phi \land \Psi) \]

In the above translation of \([\text{CP}^\dagger \text{and} \_ Q \text{ CP}^\ddagger]\), an update on \( u_1 \) in \( \Phi \) is carried over
to $\Psi$. Hence, if we assume that at each index, there is exactly one individual that won, we find the following: The static extension of the translation of $[\text{CP}_i^{\dagger} \text{and}_Q \text{CP}_j^{\dagger}]$ is an equivalence relation which holds between two indices $i$ and $j$ iff the same individual won at $i$ and $j$ and had the same score at $i$ and $j$. This means that we derive the correct translation for the discourse in (32).

### 6.3.2 No unwanted donkey readings are derived

What is shown here is that we correctly predict that the sentence in (21) (repeated in 33) does not have the “donkey readings” paraphrased in (33a) and (b).

(33) #Mary knows who$_i$ was at the party and that he$_i$ danced a lot.

a. *‘Mary knows for each $x$ whether $x$ was at the party and that $x$ danced a lot.’

b. *‘Mary knows for each $x$, if $x$ was at the party, that $x$ was at the party and that $x$ danced a lot.’

To repeat, it is because of two observations that we are concerned with the question of why this is: First, the biconditional operator, which is involved in question formation, lends universal force to the question words in its scope, and second, question words are dynamic binders. Therefore, we have to explain why (33) does not have an interpretation akin to a donkey reading. Fortunately, the explanation is simple and straightforward: In a donkey sentence, the anaphoric pronoun is in the scope of the (conditional) operator that lends universal force to the indefinite. Therefore, with respect to the translation of the donkey sentence in (5), the following identity holds:
\[ \lambda i(\exists u. (\text{donkey}'(i)(u) \land \text{sleep}'(i)(u)) \rightarrow \text{snore}'(i)(u)) \]

\[ = \]

\[ \lambda i. \forall u. ((\text{donkey}'(i)(u) \land \text{sleep}'(i)(u)) \rightarrow \text{snore}'(i)(u)) \]

In contrast to this, the anaphoric pronoun in (33) is not in the scope of the (biconditional) operator that lends universal force to the question word. To see this more clearly, let us consider the complement clause of (33), shown in (34).

(34) \[ [\text{CP}_1 \ 	ext{who}_1 \text{ was at the party}] \text{ and } [\text{CP}_2 \ 	ext{that he}_1 \text{ danced a lot}] \]

The MTy\(_3\) translation of this clause is given in (A), where for simplicity we translate the predicates of \(\text{CP}_1\) and \(\text{CP}_2\) into \(\lambda \nu. \text{party}'(i)(\nu)\) and \(\lambda \nu. \text{dance}'(i)(\nu)\), respectively. We can derive that (A) is denotationally equivalent to (B), but there is no way to proceed from (B) to (C).

\[ (A) \quad \lambda j(((\exists u. \text{party}'(i)(u) \leftrightarrow \exists u. \text{party}'(j)(u)) \land \exists u. \text{party}'(i)(u)) \land \text{dance}'(j)(u)) \]

\[ = \]

\[ (B) \quad \lambda j(\exists u. \text{party}'(i)(u) \land \forall u((\text{party}'(i)(u) \leftrightarrow \text{party}'(j)(u)) \land \text{dance}'(j)(u)) \]

\[ \neq \]

\[ (C) \quad \lambda j(\exists u. \text{party}'(i)(u) \land \forall u((\text{party}'(i)(u) \leftrightarrow \text{party}'(j)(u)) \land \text{dance}'(j)(u))) \]
Moreover, we arrive at the same result if we assume, for the sake of the argument, that the extension of CP\textsuperscript{†} is only weakly exhaustive:

\[
\lambda j(\exists u. \text{party}'(i)(u) \land \forall u (\text{party}'(i)(u) \rightarrow \text{party}'(j)(u) \land \text{dance}'(j)(u))) \\
\neq \\
\lambda j(\exists u. \text{party}'(i)(u) \land \forall u (\text{party}'(i)(u) \rightarrow (\text{party}'(j)(u) \land \text{dance}'(j)(u))))
\]

This explains why (33) does not have the readings in (33a) and (b). Furthermore, the preceding discussion shows that the translation derived for (33) correctly represents the meaning of this sentence given that only one individual was at the party. What remains to be shown is why (33) insinuates that only one individual was at the party. In the following subsection, I will sketch how to account for this fact.

### 6.3.3 Singular and plural antecedents

#### 6.3.3.1 The crucial contrasts

Intuitively, the sentence in (33) insinuates that only one individual was at the party because a singular anaphoric pronoun requires a singular antecedent. This is confirmed by the fact that a plural anaphoric pronoun gives rise to the inverse effect. So, for instance, the following discourse insinuates that several people were awarded the Fields Medal in 2006.\textsuperscript{18}

\textsuperscript{18}The first question of (35) can be used as a request to name the persons who were awarded the Fields Medal individually or as a group (and also if some were awarded the medal individually and some as a group). It seems that in any case, the question word can be anaphorically referenced by \textit{them}.
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(35) Who was awarded the Fields Medal in 2006? Did each of them accept it?

Correspondingly, it is perfectly acceptable to use a plural anaphoric pronoun to refer to the *wh*-word of a question that excludes a unique answer. To see this, compare (36) with (23).

(36) Wer war alles auf der Party? Haben sie viel getanzt?

who was all at the party have they a lot danced

literally: ‘Who all was at the party? Did they dance a lot?’

Conversely, a plural pronoun cannot be used to refer to the *wh*-word of a question that requires a unique answer:

(37) [Which mathematician] was awarded the Fields Medal in 2006? *Did each of them accept it?

6.3.3.2 Link’s lattice-theoretic approach to plural semantics

To account for these facts, we have to model the singular/plural distinction in our logic. For this purpose, I adopt the lattice-theoretical analysis of plurals proposed in Link (1983). According to this analysis, plural expressions denote objects of the same type as the corresponding singular expressions. However, objects of equal type are partially ordered with respect to each other, namely by the so-called individual part relation. Furthermore, objects of equal type can be joined to an object of the same type, the *sum* of the joined objects (which in turn are individual parts of their sum). In this sense, we assume that a plural expression denotes a sum of objects whereas a singular expression denotes an atomic object (an object

\[ \text{Note that we cannot yet account for the so-called uniqueness presupposition induced by a singular *which*-phrase in a simple *wh*-question.} \]
that has no individual parts other than itself).

This means that we have to impose a Boolean structure on the sets of possible denotations of all expressions that can be plural. For the purposes of this section, it suffices to only consider the set $\mathcal{D}_e$ of entities. Let us therefore assume that $\mathcal{D}_e$ is the domain of a complete atomic Boolean algebra, with join operation ‘$\sqcup$’ and the intrinsic ordering relation ‘$\leq$’. Furthermore, let us assume that ‘$\leq$’ is expressed in the object language by the operator ‘$\Pi$’ (of type $\langle e, \langle e, t \rangle \rangle$). Thus, a formula $a\Pi b$ is to be read as “$a$ is an individual part of $b$.”

### 6.3.3.3 Applying Link’s semantics

It is natural to assume that a singular anaphoric pronoun requires a singular antecedent, that is, an antecedent denoting an atomic object. Likewise, a plural anaphoric pronoun can be assumed to require an antecedent denoting a non-atomic object. Thus, we need to express in MTy$_3$ that a register has an atomic value. To achieve this, let us agree on the following abbreviation: $\text{Abbr. 4 At}(\delta)$ for

$$\lambda k \lambda k'(k = k' \land \partial \forall x(x \Pi \delta(k) \rightarrow x = \delta(k))).$$

Above, I use Beaver’s partial operator ‘$\partial$’ to guarantee that the atomicity of (the value of) $\delta$ is presupposed. The definition of the partial operator is given in (38) (cf. Beaver 2001).

\begin{equation}
\text{(38)} \quad \text{For all formulas } \varphi, \partial \varphi \text{ is true if } \varphi \text{ is true, and undefined otherwise}
\end{equation}

---


$^{22}$Otherwise, the negated sentence It is not the case that he$_1$ sleeps would be true in all contexts in which the discourse referent $u_1$ is linked to a non-atomic individual.
Correspondingly, the following abbreviation is used to express that a register has a non-atomic (that is, a plural) value: If \( \delta \) is a term of type \( e \), we write

\[
\text{Abbr. 4 } \text{Pl}(\delta) \text{ for } \lambda k \lambda k' (k = k' \land \exists x (x \Pi \delta(k) \land x \neq \delta(k))).
\]

This allows to give the following lexical specification of the singular pronoun \((s)he\) on the one hand and the plural pronoun \(they\) on the other.

\textbf{MTy}_3 \text{ translation of the singular and plural 3rd person pronoun}

<table>
<thead>
<tr>
<th>LI</th>
<th>Translation</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>((s)he_n)</td>
<td>(\lambda P(\text{At}(u_n) \land P(i)(u_n)))</td>
<td>(\langle \langle s, \langle e, t \rangle \rangle, t \rangle)</td>
</tr>
<tr>
<td>(they_n)</td>
<td>(\lambda P(\text{Pl}(u_n) \land P(i)(u_n)))</td>
<td>(\langle \langle s, \langle e, t \rangle \rangle, t \rangle)</td>
</tr>
</tbody>
</table>

Against this background, the data discussed in the course of this chapter suggest that a question word is a (potential) singular antecedent iff the corresponding question allows for a unique answer, and a plural antecedent otherwise. The problem to be tackled then is to derive this correlation in a principled way. An important factor in explaining this correlation seems to be the availability of a plural interpretation for a given question word. Consider the data in (39).

(39) a. I wonder who is talking to one another (in the room next door).

b. *I wonder which person is talking to one another (in the room next door).

As indicated, there is a marked contrast between the sentence in (39a) and the construction in (39b). Whereas (39a) is judged as acceptable by at least some speakers of English,\(^{23}\) (39b) is completely unacceptable for all speakers.

\(^{23}\)Speakers of American English tend to judge (39a) as unacceptable. This suggests that for these speakers, reciprocals must have an antecedent that is morphosyntactically (as well as semantically) plural.
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The same contrast can be observed in German (see 40).

(40) a. Ich frage mich, wer nebenan miteinander spricht.
   I ask myself who next door with one another talks
   ‘I wonder who is talking to each other next door.’

   b. *Ich frage mich, welche Person nebenan miteinander spricht.
   I ask myself which person next door with one another talks

The contrast in (39) and (40) shows that wh-pronouns allow for a plural interpretation even though they are morphosyntactically singular. In contrast to this, singular which-phrases are not only morphosyntactically but also semantically singular.\(^{24}\) Now, it suggests itself that this semantic difference is also responsible for the contrast in (41), the starting point of our above discussion.

(41) a. Who, was at the party? Did they, dance a lot?

   b. [Which person], was at the party? *Did they, dance a lot?

Hence, we must lexically specify that the singular wh-determiner which quantifies over atomic entities only, whereas wh-pronouns quantify over atomic or non-atomic entities. This means that the denotation which must be specified as shown below (and the lexical specification of who can be left unchanged).

\(^{24}\)A singular which-phrase that is restricted by a group denoting noun is of course semantically plural. This is shown in (i).

(i) a. I wonder which pair is talking to one another (in the room next door).

   b. Ich frage mich, welches Paar nebenan miteinander spricht.
      I ask myself which pair next door with one another talks
      ‘I wonder which pair is talking to each other next door.’

To account for this, we have to assume that these nons denote predicates of group objects which are atomic with respect to the individual-part relation.
MTy\textsubscript{3} translation of the singular \textit{wh}-determiner \textit{which}
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(⟨e t⟩, we write

\(\star P\) for \(\lambda \nu \lambda k \lambda k'(k = k' \land P(\nu(k)))\).

To see what is achieved by this abbreviation consider a static predicate \(P\) and its dynamic-semantic correlate \(P\), that is, the semantic object \(\lambda \nu \lambda k \lambda k'(k = k' \land P(\nu(k)))\). With respect to \(P\) and \(\mathcal{P}\), it can be easily shown that the following identity holds for all models \(\mathcal{M}\) and assignments \(g\) such that \(g(k) = g(k')\).

\[(\star P)_{\mathcal{M},g} = \llbracket (\lambda x. \exists \nu (x = \nu(k) \land P(\nu(k)))\rrbracket_{\mathcal{M},g}\]

With the above, it is easy to see that \(\star P\) is the dynamic-semantic correlate of \(\star P\). So, to give an example, we find that the identity in (44) holds.

\[(\lambda \nu. \text{sleep}'(i)(\nu)) = \lambda \nu \lambda k \lambda k'(k = k' \land \text{sleep}'(i)(\nu(k)))\]

Next, we have to define what it means to be the maximal element of the plural predicate of a dynamic predicate. Obviously, this notion is presuppositional with respect to the existence and uniqueness of a maximal element. Hence, the definition of the maximality notion involves a \(\sigma\)-operator of appropriate type. Such an operator is given by the following abbreviation: If \(\delta\) is a term of type \(\mathcal{E}\), \(\nu\) is a variable of type \(\mathcal{E}\), and \(\Phi\) is a dynamic formula we write

\[\delta = \sigma \nu \Phi\] for \(\lambda k \lambda k'(\delta(k) = \lambda x. \exists \nu'(x = \nu'(k) \land \llbracket (\lambda \nu \Phi)\rrbracket(\nu'(k)) \land \forall \nu_2 [\llbracket (\lambda \nu \Phi)\rrbracket(\nu_2)(k) \rightarrow (\nu_2(k) \Pi x)])\)

Even though the right-hand side of the above definition looks pretty complicated, it can be equivalently rewritten in a much simpler form. To see this, consider the dynamic formula \(u = \sigma \nu. \text{sleep}'(i)(\nu)\), which is the abbreviation of the MTy\(_3\) term
given below.

\[ \lambda k \lambda k'(u(k) = \iota x. \exists \nu'(x = \nu'(k) \land [[\lambda \nu. \text{sleep}'(i)(\nu)]](\nu')(k)(k') \land \\
\land \forall \nu_2([[\lambda \nu. \text{sleep}'(i)(\nu)]](\nu_2)(k)(k') \rightarrow \nu_2(k) \Pi x))) \]

By the identity noted in (44), it is easily seen that the following equivalence holds.

\[ x = \nu'(k) \land [[\lambda \nu. \text{sleep}'(i)(\nu)]](\nu')(k)(k') \]

\[ \Leftrightarrow \]

\[ k = k' \land \text{sleep}'(i)(x) \]

Correspondingly, it can be shown that the following two formulas are equivalent.

\[ \forall \nu_2([[\lambda \nu. \text{sleep}'(i)(\nu)]](\nu_2)(k)(k') \rightarrow \nu_2(k) \Pi x) \]

\[ \Leftrightarrow \]

\[ k = k' \land \forall y(\text{sleep}'(i)(y) \rightarrow y \Pi x) \]

Thus, overall we find that the following identity holds.

\[ u = \sigma \nu. \text{sleep}'(i)(\nu) \]

\[ = \]

\[ \lambda k \lambda k'(k = k' \land u(k) = \iota x(\text{sleep}'(i)(x) \land \forall y(\text{sleep}'(i)(y) \rightarrow y \Pi x))) \]

The last term transparently shows that the dynamic formula \( u = \sigma \nu. \text{sleep}'(i)(\nu) \) expresses that the discourse referent \( u \) is linked to the maximal sum individual formed from individuals that sleep at the index assigned to \( i \).

Now the meaning of exhaustivized variants of the \( wh \)-pronoun \( who \) and the singular \( wh \)-determiner \( which \) can be specified as shown below.
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MTy₃ translations of exhaustivized variants of who and which

LI Translation

\[ \text{who}^\text{EXH}_n \quad \sim \quad \lambda P. \exists u_n (u_n = \sigma \nu. P(i(\nu))) \]

\[ \text{which}^\text{EXH}_n \quad \sim \quad \lambda P \lambda P'. \exists u_n (\text{At}(u_n) \land u_n = \sigma \nu. (P(i(\nu) \land P'(i(\nu)))) \]

NB: These specifications will not be used in the following chapters.

Note that these specifications will be replaced in chapter 7 by a compositional account which derives the above denotations from the non-exhaustive meaning of these wh-words and the meaning of the F(ocus)-feature that question words bear in (simple) wh-questions (see especially section 7.4.2.1 and 7.4.2.2).

What remains to be shown is that the above definitions guarantee that a question word is a singular antecedent iff the corresponding question has a unique answer, and a plural antecedent otherwise. To see this is indeed the case, consider the translation of the who-question in (45) (where the verbal predicate is translated as \(\lambda \nu. \text{party}'(i(\nu))\)).

\[ (45) \quad \text{Who was at the party?} \]

\[ \lambda j ( (\exists u (u = \sigma \nu. \text{party}'(i(\nu))) \leftrightarrow \exists u (u = \sigma \nu. \text{party}'(j(\nu)))) \land \]

\[ \land \exists u (u = \sigma \nu. \text{party}'(i(\nu))) \]

What we observe is that the discourse referent \(u\) is linked to the maximal sum individual consisting of the persons who were at the party at the index assigned to \(i\). Such a discourse referent can be referenced by a plural anaphoric pronoun.

Now consider the denotation of the which-question in (46).

\[ (46) \quad \text{Which person was at the party?} \]
\[ \lambda j (\exists u (\text{At}(u) \land u = \sigma \nu (\text{person}'(i)(\nu) \land \text{party}'(i)(\nu))) \leftrightarrow \exists u (\text{At}(u) \land u = \sigma \nu (\text{person}'(j)(\nu) \land \text{party}'(j)(\nu))) \land \exists u (\text{At}(u) \land u = \sigma \nu (\text{person}'(i)(\nu) \land \text{party}'(i)(\nu)))) \]

Again, the discourse referent \( u \) is linked to the maximal sum individual consisting of the persons who were at the party at the index assigned to \( i \). However, this time this object is required to be an atomic object. Hence, \( u \) can only be referenced by a singular anaphoric pronoun.

This shows that the dynamic question semantics proposed in chapter 3 allows us to account for the anaphoric binding potential of \( wh \)-words. The proposed analysis is conducted within the usual bounds of a dynamic semantic framework. This means that the anaphoric binding potential of \( wh \)-words has been traced back to their indefinite nature.
Chapter 7

The Focusing of Wh-Words

7.1 Introduction

Focus, just like any linguistic sign, comprises aspects of meaning and form. That is to say that a focused constituent has semantic-pragmatic properties that an otherwise equal but non-focused constituent does not have and these properties co-occur with distinctive (morpho)syntactic and/or phonological properties of the focused constituent. To refer to the formal properties alone, it is common to characterize a focused constituent as being *F-marked*, a terminology that will be used henceforth.

In section 7.2, I will draw attention to the fact that in a large variety of languages, (interrogative) *wh*-words are obligatorily F-marked. Furthermore, I will show that this is the case independently of significant typological differences such as the F-marking strategy employed in a language.\(^1\) The discussion in section 7.2 concentrates on simple *wh*-questions, and actually it must be so restricted to arrive at the above-mentioned conclusion that *wh*-words are obligatorily F-marked. The

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\(^1\)When speaking of an F-marking strategy, I am referring to a surface-oriented classification of the formal properties of focused constituents such as their syntactic distribution.
reason is that in a number of languages, multiple questions show a striking relaxation of this requirement. This phenomenon will be discussed in section 7.3.2 in terms of the question as to whether the focusing of wh-words serves to satisfy certain interpretive conditions such as discourse-pragmatic requirements inherent to the use of wh-questions. I will argue that this question has to be answered in the negative. Finally, section 7.4 shows that despite this fact, the F-marking of wh-words has specific interpretive effects resulting from the interplay between a focus-semantic operator and the dynamic question semantics presented in the previous chapters.

Before proceeding, two remarks are in order. As discussed in chapter 3, there are occurrences of wh-words that do not give rise to a question-word but to an indefinite interpretation. Significantly, indefinite wh-words are not focused, neither in the formal nor in the semantic-pragmatic sense of the term. Thus, the current chapter deals only with interrogative wh-words, or question words for short. Furthermore, when considering the formal marking of focus, one often finds that wh-words are not F-marked themselves but rather as part of a corresponding wh-phrase. Therefore, I will often speak of the F-marking of wh-phrases. However, I assume that the F-marking of a more inclusive syntactic object is only due to morphosyntactic constraints on the F-marking of syntactic heads.

7.2 Question words are obligatorily F-marked

7.2.1 Overview

The starting point of my investigation of focus in wh-questions is the observation that in a large variety of languages, question words are obligatorily F-marked. This observation can be drawn from the linguistic literature, which

\[^2^\text{See also section 7.2.6 and 7.3.3 below.}\]
not only provides for a large amount of relevant data and insightful analyses, but also for the recognition of the fact that this phenomenon is very widespread or even universal (see, for example, É. Kiss 1995, p. 23). To get an impression of the universality of the phenomenon, find below a fragmentary list of languages in which *wh*-phrases are F-marked according to the bracketed references. In the Austronesian languages *Malagasy* (Sabel 2004), *Selayarese* (Finer 1997), and *Tagalog* (Aldridge 2004), in the Bantu languages *Aghem* (Watters 1979, Horvath 1986), *Kikuyu* (Bergvall 1983, Bergvall 1987, Schwarz 2003), *Kimatuumbi* (Odden 1984), *Kitharaka* (Muriungi 2003), *Nguni* (Sabel & Zeller to appear), *Northern Sotho* (Zerbian 2006a, Zerbian 2006b), and *Sesotho* (Demuth 1987), in the Chadic languages *Guruntum* (Hartmann & Zimmermann 2006), *Hausa* (Tuller 1986, Hartmann & Zimmermann 2007), *Bade, Kanakuru, Ngizim, Podoko, and Tangale* (Tuller 1992), in the Kwa languages *Akan* (Drubig 2000) and *Foodoo* (Fiedler 2007), in the Romance languages *Italian* (Calabrese 1984) and *Romanian* (Göbel 1998), in the Siouan languages *Lakhota* (Siouan; Van Valin 1993) and *Omaha* (Siouan; É. Kiss 1995), in the Slavic languages *Bulgarian* (Izvorski 1993, Bošković 1998), *Serbo-Croatian* (Bošković 2000, Stjepanović 2003), and *Russian* (Stepanov 1998), and also in *Basque* (Isolate; Manandise 1988, Ortiz de Urbina 1999), *Greek* (Greek; Tsimipli 1995), *Gurune* (Gur; Dakubu 2001, Haida 2003a), *Haida* (Na-Dene; É. Kiss 1995), *Hungarian* (Finno-Ugric; Horvath 1986, É. Kiss 1991, É. Kiss 1998), *Iraqi Arabic* (Semitic; Sabel 2004), *Japanese* (Japanese; Ishihara 2003), *Korean* (Isolate; Choe 1995), *Malayalam* (Dravidian; Jayaseelan 1995, Jayaseelan 2001), *Mam* (Mayan; England 1983), and *Quechua* (Quechuan; É. Kiss 1995). Beyond the languages listed above, I will show that interrogative *wh*-words are also F-marked in *German* (see section
7.2.6).³

Inspecting the languages in this list reveals that wh-words are F-marked independently of the F-marking strategy employed in a language. This will be illustrated in the following subsections with four languages, which were chosen because they exemplify different such strategies in a very perspicuous way. I distinguish between two positional strategies and two in-situ strategies of F-marking. The positional strategies are focus movement and clefting and will be illustrated with data from Hungarian and Northern Sotho, respectively. The two in-situ strategies differ in the grammatical means used to F-mark a constituent in its in-situ position. On the one hand, F-marking is achieved by a morphosyntactic marker (exemplified by Gurune), and on the other by phonological prominence (exemplified by Japanese). Furthermore, I will argue, using the example of German, that wh-words are F-marked even if they have undergone wh-movement.

7.2.2 F-marking of wh-phrases in Hungarian

The first language considered to see evidence for the obligatory F-marking of wh-phrases is Hungarian. Hungarian employs a positional F-marking strategy. This is meant to say that constituents are F-marked by their position within the clause.⁴ More precisely, a constituent must appear in immediate preverbal position if it is to be interpreted as the (sole) narrow focus of a sentence (see É. Kiss 1991). To see this, consider the paradigm in (1).⁵

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³This observation is far from new. However, I will defend a more general claim than is usually done.
⁴In Hungarian, constituents can also be F-marked in situ (for discussion, see É. Kiss 1998). However, the wh-phrase of a simple constituent question must be F-marked positionally. See below.
⁵Cf. example (9a,b) and (11) in É. Kiss (1991), pp. 115f.
7.2. **QUESTION WORDS ARE OBLIGATORILY F-MARKED**

(1) a. János haza kisérte Marit.
    John.NOM home escorted Mary.ACC
    (i) ‘John escorted Mary home.’
    (ii) ‘It was home that John escorted Mary.’

b. János kisérte haza Marit.
    (i) *‘John escorted Mary home.’
    (ii) ‘It was John who escorted Mary home.’

c. Marit kisérte János haza.
    (i) *‘John escorted Mary home.’
    (ii) ‘It was Mary who John escorted home.’

In all of the sentences in (1), the immediately preverbal constituent can be interpreted as being narrowly focused (see paraphrase (ii) of each sentence). Furthermore, with the exception of (1a) the immediately preverbal constituent must be so interpreted, as is shown by the inadequacy of paraphrase (b-i) and (c-i).

For the time being, I will not go into the details of how to analyze the syntactic structures giving rise to the narrow-focus readings observed in the above paradigm. Let me just note that I adopt the standard assumption that in Hungarian, positional F-marking is achieved by focus movement to the specifier of a left-peripheral functional head, which is accompanied by verb movement to this head (see Brody 1990).

Now let us see which position a *wh*-phrase occupies in a Hungarian *wh*-question. According to É. Kiss (1998), “a *wh*-phrase (other than *miért* ‘why’) is always in the preverbal [. . . ] focus position in Hungarian [. . . ].” *(op. cit.,* p. 249)* This is exemplified by the paradigm in (2).\(^6\)

\(^6\)Cf. (57) in É. Kiss (2002), p. 98. I am very grateful to Beáta Gyuris for providing judgements and discussing the Hungarian data with me.
(2) a. A huzat [melyik szoba ablakait] törte be?
    the draft which room’s windows.acc broke in
    ‘The windows of which room did the draft break?’
b. [Melyik szoba ablakait] törte be a huzat?
c. *A huzat [melyik szoba ablakait] be törte?
d. *[Melyik szoba ablakait] be törte a huzat?
e. *[Melyik szoba ablakait] a huzat be törte?
f. *[Melyik szoba ablakait] a huzat törte be?

The unacceptability of (2c-f) shows that *wh*-phrases must be F-marked in Hungarian (at least, as far as simple *wh*-questions and *wh*-phrases other than other than *miért* are concerned).7

To confirm this conclusion, note that there is only one preverbal focus position in Hungarian. This is meant to say that a phrase preceding a preverbal focus phrase (e.g. János in 3a,b) cannot be interpreted as being narrowly focused (see 3a). Rather, such a phrase must be interpreted as the topic of the clause (see 3b).8

(3) János John.
    Marit Mary.acci escorted home
    kisérte escorted
    haza. home

a. *‘It was Mary that JohnFoc escorted home.’
b. ‘As for John, it was Mary who he escorted home.’

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7See section 7.3.2 for a discussion of the F-marking patterns in multiple questions. The question of why *miért* behaves differently than all other *wh*-phrases must be left unanswered.
8Cf. example (2a) in Suranyi (2002), p. 3, and example (10) in É. Kiss (1991), p. 116. Note that in paraphrase (3a), the clefting of *Mary* and the subscript on *John* indicate the same type of focusing. That is, this paraphrase is not meant to express an interpretive asymmetry between the two focused constituents.
Consequently, we expect that a phrase preceding a *wh*-phrase cannot be focal, but must be topical. This expectation is confirmed by the data in (4).\(^9\)

\[(4) \quad \text{János kit kisért haza?} \]

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\(\text{John.NOM who.ACC escorted home} \)

a. ‘*Who did John\(\text{Foc}\) escort home?’

b. ‘As for John, who did he escort home?’

Furthermore, note that the reversal of the *wh*-phrase and the focused non-*wh* phrase results in deviance too (see 5).\(^10\)

\[(5) \quad \ast \text{Mit Marinak adott János?} \]

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\(\text{what.ACC Mary.DAT gave John.NOM} \)

\(\text{intended: ‘What did John give to Mary}\(\text{Foc}\)?’} \)

This confirms our former conclusion that *wh*-phrases are obligatorily F-marked in simple *wh*-questions of Hungarian.

### 7.2.3 F-marking of *wh*-phrases in Northern Sotho

Northern Sotho is like Hungarian in that focused constituents can be positionally F-marked. But by contrast to Hungarian, this is not achieved by focus movement but by means of a cleft construction.\(^11\) This is exemplified in (6a) with an object-focus sentence,\(^12\) and in (6b), with a subject-focus sentence.\(^13\)

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\(^11\)This means that for the purposes of this exposition, I assume that there is no direct syntactic dependency between a clefted constituent and the gap in the cleft clause. However, I will not provide an explicit analysis of cleft sentences, but leave it at a description.

\(^12\)Cf. example (5b) in Zerbian (2006\(a\)), p. 213.

\(^13\)Cf. example (11b) in Zerbian (2006\(a\)), p. 71.
(6) a. Ké mo-kgalabje wo re mmon-e-go.
   \textit{COP CL1-old man DEM.CL1 we OC1.see-pst-rel}
   ‘It is the old man that we saw.’

b. Ké mo-kgalabje á nyaka-ng ngaka.
   \textit{COP CL1-old man CL1 look.for-rel CL9.doctor}
   ‘It is the old man who is looking for the doctor.’

To see that the sentences in (6) are cleft constructions, observe that \textit{ké} is the usual copula in Northern Sotho and that the lexical verbs appear with relative inflection, that is, with the inflectional form that is obligatory in relative clauses.

Alternatively to the positional F-marking shown in (6a), object phrases (or, more generally, non-subject phrases) can be F-marked \textit{in-situ}. That is, a canonical SVO sentence such as (7) not only allows for a wide-focus interpretation (see 7a) but also gives rise to an object-focus reading (see 7b-i).\(^{14}\) However, crucially, a subject-focus reading is not available for such a sentence (see 7b-ii).\(^{15}\)

(7) Mo-kgalabje ó nyaka ngaka.
   \textit{CL1-old man CL1 look.for CL9.doctor}
   a. ‘The old man is looking for the doctor.’

b. (i) ‘The old man is looking for [the doctor]\textsubscript{Foc}.’

(ii) *‘[The old man]\textsubscript{Foc} is looking for the doctor.’

Crucially, this contrast shows up again when we turn to \textit{wh}-questions. On the one hand, we find that object \textit{wh}-phrases can stay \textit{in situ} (see 8a) or be clefted (see 8b).\(^{16}\)

(8) ‘Who is the old man looking for?’

\(^{14}\) Cf. example (2a) in Zerbian (2006a), p. 67.

\(^{15}\) Cf. example (13a-c) in Zerbian (2006a), p. 181.

\(^{16}\) Cf. example (9a) and (16a) in Zerbian (2006b) on p. 267 and p. 272, respectively.
7.2. QUESTION WORDS ARE OBLIGATORILY F-MARKED

a. Mo-kgalabje ó nyaka mang?
   CL1-old man CL1 look.for who

b. Ké mang o mo-kgalabje a mo nyaka-ng?
   COP who CL1 CL1-old.man CL1 CL1OM look.for-REL

On the other hand, subject wh-phrases must be clefted (see the unacceptability of 9a).\(^\text{17}\)

(9) ‘Who is looking for the doctor?’

a. *Mang ó nyaka ngaka?
   who CL1 look.for CL9.doctor

b. Ké mang a nyaka-ng ngaka?
   COP who CL1 look.for-REL CL9.doctor

This shows that wh-phrases are obligatorily F-marked in simple wh-questions of Northern Sotho.\(^\text{18}\) If they were not, (9a) would be grammatical.

7.2.4 F-marking of wh-phrases in Gurune

The next language we consider to show the F-marking requirement for wh-phrases is Gurune.\(^\text{19}\) Gurune has (overt) focus movement, but it also allows for constituents to be F-marked in situ. In the case of non-subject phrases, in-situ F-marking is achieved by a special morphosyntactic marker, as will be shown immediately. To detect these F-marking regularities, we consider phrases that function

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\(^{17}\)Cf. example (13a) and (14) in Zerbian (2006\(b\)), pp. 270f.

\(^{18}\)Note that again, multiple questions show a relaxation of the requirement for wh-phrases to be F-marked. See section 7.3.2.

\(^{19}\)A lot of thanks go to my informant Alex Baba, who is a Gurune speaker from Bolgatanga, to Katí van Nice for her advice on doing informant work, and to Astrid Kiesewetter for her research on relative clauses in Gurune.
as associates of the focus-sensitive operator *ma?*a ‘only’. This operator must be adjoined to its associate, which in addition must be F-marked. In (10a-c), *ma?*a is adjoined to the object phrase, the proper name *Atia*. We then observe that the associate-cum-operator can either appear in situ (see 10a) or clause initially (see 10b). In the former case, the F-marked constituent must be preceded by the particle *la*, and in the latter, the particle *ti* (or its allomorph *ta*) must occur in the second position of the clause. Furthermore, we observe that ungrammaticality arises if the focus status of the associate is not formally marked (see 10c).

(10) ‘Adongo saw only Atia*Foc* yesterday.’
   a. AdNɔ zañ nyɛ ī la Atia ma?a
      Adongo yesterday see *la* Atia only
   b. Atia ma?a tĩ AdNɔ zañ nyɛ
      Atia only *ti* Adongo yesterday see
   c. *AdNɔ zañ nyɛ Atia ma?a
      Adongo yesterday see Atia only

Correspondingly, we find that object *wh*-phrases must appear either in situ preceded by *la* (see 11a-i) or clause initially succeeded by *ti* (see 11a-ii), and the *wh*-phrase cannot be left non-F-marked (see 11a-ii).

(11) a. ‘Who did Adongo see yesterday?’
   (i) AdNɔ zañ nyɛ ī ant
      Adongo yesterday see *la* who
   (ii) ant tĩ AdNɔ zañ nyɛ
      who *ti* Adongo yesterday see
   (iii) *AdNɔ zañ nyɛ ant
      Adongo yesterday see who
7.2. QUESTION WORDS ARE OBLIGATORILY F-MARKED

b. ‘Adongo saw AtiaFoc yesterday.’
   (i) AdNø zaā nyř la Atia
       Adongo yesterday see la Atia
   (ii) Atia ta AdNø zaā nyř
       Atia ta Adongo yesterday see
   (iii) *AdNø zaā nyř Atia
       Adongo yesterday see Atia

The same holds for the answer constituent in a congruent answer, as can be seen in (11b).20 This confirms that la marks an in-situ focus and that ti in second position indicates the fronting of a focused phrase.

In the case of subject phrases, a somewhat different picture arises. Focused (local) subjects occur clause initially (like non-focused subjects) and are optionally followed by the marker n in second position. This is shown in (12) with the aid of the focus operator maʔa, which associates with the subject phrase Atia.

(12) Atia maʔa (n) zaā nyř Adongo
       Atia only n yesterday see Adongo
       ‘Only AtiaFoc saw Adongo yesterday.’

Now observe that wh-subjects and their answer terms are found in the same syntactic environments as the focus associate in (12). This is shown in (13a) and (b), respectively.

(13) a. an (n) zaā nyř Adongo
       who n yesterday see Adongo
       ‘Who saw Adongo yesterday?’

20Note that (11a-i) and (a-ii) can equally felicitously be answered by (11b-i) and (b-ii). This suggests that the two options to express focus are equivalent in their interpretive consequences.
b. Atia (n) zaã nyr Adongo
   Atia n yesterday see Adongo
   ‘Atia_{Foc} saw Adongo yesterday.’

This shows that \(wh\)-phrases have the same syntactic distribution as focused non-\(wh\) phrases. Hence, we can conclude that \(wh\)-phrases are obligatorily F-marked in Gurune.

### 7.2.5 F-marking of \(wh\)-phrases in Japanese

According to Ishihara (2002), Japanese sentences exhibit a special pitch contour to F-mark narrowly focused constituents. In the article cited, this is shown by a detailed phonetic analysis, the results of which I can only reproduce verbally. Consider the minimal pair in (14), where (14a) is a wide-focus sentence, whereas (14b) is to express the narrow-focus interpretation of the dative phrase aniyome ‘sister in law’.\(^{21}\)

(14) a. Aoyama-ga aniyome -ni erimaki-o anda.
   Aoyama-NOM sister in law -DAT sacrf-ACC knitted
   ‘Aoyama knitted a scarf for her sister in law.’

b. Aoyama-ga ANIYOME-ni erimaki-o anda.
   ‘Aoyama knitted a scarf for [her sister in law]_{Foc}.’

The results of Ishihara’s phonetic analysis are as follows: The pitch track of (14a) shows a clear F\(_0\) peak on each of the three argument phrases. This contrasts with what is found for the sentence in (14b). Narrow focus on the dative phrase must be intonationally marked by a raised F\(_0\) peak on this phrase (hence the use of small capitals in 14b) and a reduction of the F\(_0\) peak on the following accusative phrase.

\(^{21}\)See example (1a) and (b) in Ishihara (2002).
erimaki ‘scarf’.

Now, according to Ishihara (2002), Japanese wh-questions are always accompanied by focus intonation. That is, the $F_0$ peak of a wh-phrase is raised and the $F_0$ peaks of the constituents following the wh-phrase are lowered. For an example, consider the minimal pair in (15).23 The sentence in (15a) is a yes/no-question in which the indefinite pronoun nanika ‘something’ functions as direct object.24 The minimally different sentence in (15b) is a simple wh-question formed with the wh-pronoun nani ‘what’ in direct object function.

(15) a. Naoya-ga nanika-o nomiya-de nomida no?
    Naoya-NOM something-ACC bar-LOC drank Q
    ‘Did Naoya drink something at the bar?’

b. Naoya-ga NANI-o nomiya-de nomida no?
    Naoya-NOM what-ACC bar-LOC drank Q
    ‘What did Naoya drink at the bar?’

A comparison of the pitch tracks of (15a) and (b) shows that the $F_0$ peak on the wh-pronoun nani is clearly raised and that the peak on the following locative phrase is strongly reduced. This means that the wh-pronoun in (15b) is prosodically F-marked.

Note in passing that the Japanese data considered above have a bearing on how to interpret the fact that in languages like German and Korean, some wh-word occurrences allow for an indefinite as well as interrogative construal, where the latter requires the wh-word to bear an F-feature.25 In this connection, the Japanese data show that the F-marking of interrogative pronouns cannot simply be taken as

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23See example (3a) and (b) in Ishihara (2002).
24For related discussion, see chapter 5.
25See the discussion in section 3.2 and section 7.2.6 below.
a means to disambiguate the interrogative occurrences of a wh-pronoun from its indefinite occurrences: There is no such ambiguity in Japanese, but interrogative pronouns must still be focused.

### 7.2.6 F-marking of wh-phrases in German

This section serves to show that interrogative wh-words are F-marked even if they have undergone wh-movement. For this purpose, I will first discuss multiple questions of German to provide evidence that in-situ question words must be prosodically F-marked.\(^{26}\) In section 7.2.6.2, I will then argue that despite appearances, ex-situ question words are F-marked too.

#### 7.2.6.1 F-marking of in-situ wh-pronouns

Consider the multiple wh-questions in (16) and (17). Each of the questions in (16) forms a minimal pair with a string-identical question in (17), the minimal contrast being whether the respective in-situ wh-pronoun is accented or not. More precisely, the questions in (16) and (17) are presented to differ minimally in the position of main sentence stress (as marked by small capitals).

(16) a. Wer mag WAS?
   who likes what
   (i) ‘Who likes what?’
   (ii) *‘Who likes something?’

b. Wer sieht WEN?
   who sees who
   (i) ‘Who sees who?’
   (ii) *‘Who sees someone?’

---

\(^{26}\)See also section 3.2.
7.2. **QUESTION WORDS ARE OBLIGATORILY F-MARKED**

(c. Wer bekommt WELCHE?

who becomes which.\{SG:FEM | PL\}

(i) ‘Who gets which one(s)’

(ii) *‘Who gets some?’

In (16a), main sentence stress falls on the *in-situ* wh-pronoun *was*. Given this stress placement, *was* must be interpreted as a question word (the cognate of English ‘what’).\(^{27}\) This is shown by the fact that (16a) only allows for a multiple-question interpretation (see the adequacy of paraphrase (a-i) and the inadequacy of (a-ii). The corresponding facts hold for \*wen ‘who,**ACC**’ and \*welche ‘which ones’ in (17b) and (c), respectively.

The interpretations observed in (16) contrast with what can be observed for the minimally different sentences in (17).

(17) a. Wer MAG was?

(i) *‘Who likes what?’

\(^{27}\)It can be easily demonstrated that the interrogative interpretation is not just the preferred reading, but the only grammatical one: An accented *in-situ* wh-pronoun cannot function as an indefinite, not even if it occurs in a declarative sentence and the context strongly suggests that the accent is to mark a contrastive interpretation (see i-a).

(i) {Ich habe nicht behauptet, dass ich ETWAS gesehen habe, sondern . . . }

‘I didn’t claim that I saw something, but . . .’

a. *‘. . . dass ich WEN gesehen habe.

that I who seen have

b. . . dass ich JEMANDEN gesehen habe.

that I someone seen have

‘. . . that I saw someone.’

Unlike wh-pronouns, the non-wh-pronouns *etwas* ‘something’ and *jemand(en)* ‘someone,**ACC**’ can be used to express the intended contrast (see (i-b)).
(ii) ‘Who likes something?’

b. Wer SIEHT wen?
   (i) *‘Who sees who?’
   (ii) ‘Who sees someone?’

c. Wer BEKOMMT welche?
   (i) *‘Who gets which one(s)?’
   (ii) ‘Who gets some?’

In (17a-c), the verb bears main sentence stress. Given this stress placement, the questions in (17) must be interpreted as simple \textit{wh}-questions. Thereby, the \textit{in-situ} \textit{wh}-pronouns function as non-specific indefinites (for example, \textit{was} in (18a) as the cognate of English ‘something’).

Following Selkirk (1996), I assume that what is perceived as main sentence stress is the rightmost pitch accent of a sentence.\footnote{All-given sentences are an exception to this generalization, since these do not contain a pitch accent. Cf. Selkirk 1996, p. 563.} Hence, the facts observed in (16) and (17) show that \textit{in-situ} \textit{wh}-pronouns are construed as question words if they are accented. Conversely, unaccented \textit{wh}-pronouns function as indefinites.\footnote{This correlation raises the question whether interrogative \textit{wh}-pronouns are F-marked because \textit{wh}-pronouns also have an indefinite use in German. The answer to this question (at least synchronically) is “no”. This can be seen by considering \textit{in-situ} \textit{wh}-pronouns in English. As is well known, these cannot function as indefinites (see i).}

(i) *I saw what.

However, according to Chomsky (1995), \textit{in-situ} \textit{wh}-pronouns must still be F-marked. With respect to the paradigm in (ii), Chomsky notes:

\begin{quote}
In the acceptable cases, the \textit{wh}-phrase in situ has focal stress and could be taking clausal scope for this reason alone; the preferred cases degrade when that property is removed. (Op. cit., p. 387, n. 69; emphasis added)
\end{quote}
Since in German focus is marked by phonological prominence, the pattern described above shows that in-situ question words must be F-marked.

### 7.2.6.2 F-marking of ex-situ wh-pronouns

It has often been noted that in contrast to the intonation-dependent variation observable with respect to in-situ wh-pronouns, ex-situ wh-pronouns must be interpreted as question words irrespective of their intonation. In the context of the current discussion, I use the term ex-situ wh-pronoun to refer to wh-pronouns occupying the initial position of a V2 clause (the vorfeld for short). Later on, this term will again be used in the stricter conventional sense, namely to refer to wh-pronouns that have undergone overt wh-movement.

The phenomenon under discussion is illustrated with the two sentences in (18), which differ minimally as to whether the wh-pronoun is accented (a) or not (b). Again, this is achieved by placement of main sentence stress (marked by small capitals).

(18) a. WER lacht laut
   who laughs loudly
   (i) ‘Who is laughing loudly?’
   (ii) ‘Someone is laughing loudly.’

b. wer LACHT laut
   (i) ‘Who is laughing loudly?’

(ii) a. who saw what
b. whom did you persuade to do what
c. *what did who see
d. *what did you persuade who to do

Note, however, that I do not subscribe to Chomsky’s speculation that focal stress is the sole factor involved in the scope taking of in-situ wh-phrases.
Interestingly, both sentences in (18) can only be interpreted as *wh*-question. That is, the *wh*-pronoun in (18b) cannot function as an indefinite even though it does not bear a pitch accent.

There are two possible conclusions to be drawn from this observation. The first would be that *ex-situ* *wh*-pronouns need not be F-marked for an interrogative construal (cf. Zubizarreta 1998) and the second, that *ex-situ* *wh*-pronouns are F-marked even though they do not bear a pitch accent. The idea of the second approach is that *ex-situ* *wh*-pronouns are in a configuration in which they are phonologically prominent (and hence F-marked) even without an accent. This would follow from a relativized notion of phonological prominence such as the one given in (19).

\[(19) \quad \text{Basic F-Rule}\]

\[
\text{A syntactic head is F-marked iff it is the most prominent element in its}\]

---

The *wh*-questions in (18a) and (b) differ with regard to the discourse conditions they impose. The sentence in (18a), in contrast to (18b), requires the verb *lachen* ‘to laugh’ to be given. However, this is of no relevance to the discussion at hand.

In this connection, it should be pointed out that indefinite pronouns are not generally excluded from the *vorfeld*, as is shown by the sentence in (i).

\[(i) \quad \text{jemand} \quad \text{LACHT} \quad \text{laut}\]

\[
\text{someone laughs} \quad \text{loudly}\]

‘Someone is laughing loudly.’

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I am very grateful to Roger Schwarzschild for pointing out to me the second possibility (referring to considerations in works by Elisabeth Selkirk).

A generalization like (19) has a special status in the framework of Selkirk (1996), namely that of the basic rule governing the distribution of F-features (the Basic Focus Rule). Unlike this, generalization (19) is used descriptively only.
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I will not attempt to define what a phonological domain in the sense of (19) is. Let me simply stipulate that phrases in the vorfeld are mapped onto such a domain. From this, it follows that a single ex-situ wh-pronoun is invariably F-marked. The reason is that such a pronoun is the phonologically most prominent element alone by the fact that it is the only element in its domain.

This approach can be easily put to the test, for example, by modifying a wh-pronoun by a PP or a relative clause.\(^{34}\) Such modified wh-pronouns are given in (20).

\[(20)\]
\begin{align*}
\text{a.} & \quad \text{was aus Gold} \\
& \quad \text{what out of gold} \\
\text{b.} & \quad \text{wer aus München} \\
& \quad \text{who from Munich} \\
\text{c.} & \quad \text{welche die schon rot sind} \\
& \quad \text{which ones that already red are}
\end{align*}

If the vorfeld is occupied by a phrase of the form exemplified in (20a-c), the wh-pronoun is not the only element in its phonological domain. Therefore, accent placement is decisive for which element is the most prominent one. This means that accent placement is predicted to disambiguate again between the indefinite and the interrogative reading of a wh-pronoun.\(^{35}\) The data in (21) show that this prediction is in fact borne out.

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\(^{34}\)I am grateful to Gisbert Fanselow for pointing out to me the PP modifiers, which provide for particularly simple minimal pairs.

\(^{35}\)This observation can be traced back to Reis (1991), who considered pied-piping examples like (i).
(21) a. \[was \ aus \ \text{GOLD}] \ mag \ er
    what out of gold \ likes he
    (i) *‘What does he like that is made out of gold?’
    (ii) ‘He likes something out of gold.’

b. \[WAS \ aus Gold\] \ mag \ er
    (i) ‘What does he like that is made out of gold?’
    (ii) *‘He likes something out of gold.’

Let me first discuss the sentence in (21a). The intonation of the phrase occupying the vorfeld is so specified that the wh-pronoun was is left unaccented. Given this intonation, was can only function as an indefinite pronoun. This is shown by the fact that (21a) cannot be interpreted as paraphrased in (a-i), but only as paraphrased by (a-ii). Note that this contrasts sharply with what we observed with respect to (18b). Turning to (21b), the wh-pronoun was is specified to bear a pitch accent and we observe that it must be interpreted as a question word. That is, (21b) only allows the interpretation given in (b-i) and not the one in (b-ii).36

The examples in (22) and (23) show that this phenomenon occurs in a very regular way.

(i) a. \[was \ zu \text{TUN}] \ hast \ deiner Frau versprochen
    what to do \ have you your \ wife promised
    1) *‘What did you promise your wife to do?’
    2) ‘You promised your wife to do something.’

b. \[WAS zu tun\] \ hast deiner Frau versprochen
    1) ‘What did you promise your wife to do?’
    2) *‘You promised your wife to do something.’

36Furthermore, the wh-pronoun in (21b) does not allow for a specific interpretation. That is, the paraphrase ‘There is a certain thing out of gold that he likes’ is also inadequate for (21b).
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(22) a. [wen aus Hamburg] hat er eingeladen
   who from Hamburg has he invited
   (i) *‘Who from Hamburg did he invite?’
   (ii) ‘He invited someone from Hamburg.’

b. [WEN aus Hamburg] hat er eingeladen
   (i) ‘Who from Hamburg did he invite?’
   (ii) *‘He invited someone from Hamburg.’

(23) a. [welche die schon ROT sind] will er kaufen
   which ones that already red are wants he buy
   (i) *‘Which ones that are already red does he want to buy?’
   (ii) ‘He wants to buy some that are already red.’

b. [WELCHE die schon rot sind] will er kaufen
   (i) ‘Which ones that are already red does he want to buy?’
   (ii) *‘He wants to buy some that are already red.’

The above data strongly suggests that ex-situ wh-pronouns must be F-marked if they are to receive an interrogative interpretation, but that F-marking is not always achieved by accenting. Rather, there are configurations that lend phonological prominence to a single element in this configuration, even if it does not bear a pitch accent. Other such prominence configurations are the left edge of DP, as the following considerations suggest.

Wh-determiners and -specifiers of (syntactically complex) DPs cannot function as indefinites. For example, the wh-determiner welche ‘which.{SG.FEM | PL}’ is construed as a question word whether it is accenteded (see 24a) or not (see 24b).

(24) a. Wer hat [WELCHE Romane] gelesen?
   who has which.PL novels read
   (i) ‘Who has read which novel?’
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(ii) *‘Who has read some novels?’

b. Wer hat [welche ROMANE] gelesen?

(i) ‘Who has read which novel?’

(ii) *‘Who has read some novels?’

Note that (24b) contrasts sharply with what can be observed for the pronominal use of welche (see 25).

(25) Wer hat welche GELESEN?

a. *‘Who has read which one(s)?’

b. ‘Who has read some?’

Correspondingly, welch-phrases cannot occur in declarative sentences, as is illustrated in (26).\(^\text{37}\)

(26) *Ich habe welche Romane gelesen.

I have which novels read

*intended: ‘I have read some novels.’

For this reason, I assume that the left edge of DP (that is, D and its specifier(s)) forms a phonological domain in the sense of (19). To check the validity of this

\(^{37}\)The same holds for the DP specifiers wessen ‘whose’ and wieviele ‘how many’, as can be seen in (i).

(i) a. *Ich habe wessen Romane gelesen.

I have whose novels read

*intended: ‘I have read someone’s novels.’

b. *Ich habe wieviele Romane gelesen.

I have how many novels read

*intended: ‘I have read a number of novels.’
assumption, the left edge of a *welch*-Phrase must be occupied by additional overt material. There is reason to assume that *was für* ‘what for’ in a phrase such as *was für ein Mann* ‘what man’ occupies the specifier position of the indefinite DP *ein Mann* ‘a man’ (see 27).

(27) \[ [\text{DP} [ \text{was für} ] [\text{D}^0 \text{ein}] [\text{NP Mann}]] \]  

The reason is that it is the indefinite determiner that inflects for case in these DPs (see 28a-c). This would be unexpected if *ein Mann* was the complement of the preposition *für*, which is an accusative case assigner.

(28) a. was für ein Mann hat dich gesehen?
    \> what for a.\text{NOM} man has you seen
    \> ‘What man saw you?’  

b. was für einen Mann hast du gesehen?
    \> what for a.\text{ACC} man have you seen
    \> ‘What man did you see?’  

c. was für einem Mann hast du geholfen?
    \> what for a.\text{DAT} man have you helped
    \> ‘What man did you help?’

Now, consider the sentence in (29).

(29) Was für welche Probleme hast du?
    \> what for which.\text{PL} problems have you
    \> ‘What problems do you have?’

However, the *wh*-determiner *welch*- in (29) is clearly an indefinite determiner and

\[ ^{38} \text{Lots of examples akin to (29) can be found by a google search, most of which I find perfectly acceptable.} \]
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not an interrogative one. This can be shown as follows. There is a sharp acceptability contrast between (29) and the construction in (30).

(30) *Was für welches Problem hast du?
    what for which.sg.neut problem have you
    intended: ‘What problem do you have?’

The wh-determiner welches in (30) is the singular (neuter) form of the wh-determiner welch-. Now observe that the contrast between (29) and (30) is mirrored by the pair of sentences in (31). The acceptability of (31a-B) and unacceptability of (31b-B) shows that the indefinite wh-pronoun welch- can only relate to plural antecedents.

    ‘I have problems.’

    B: Ich habe auch welche.
    I have too which
    ‘I have some too.’

b. A: Ich habe ein Problem.
    ‘I have a problem.’

    B: *Ich habe auch welches.
    I have too which
    intended: ‘I have one too.’

In contrast to this, the interrogative (that is, F-marked) wh-determiner welch- selects singular as well as plural complements (see 32).

(32) a. Welche Probleme hast du?
    which problems have you
    ‘Which problems do you have?’
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b. Welches Problem hast du?
which problem have you
‘Which problem do you have?’

Hence, the contrast between (29) and (30) strongly suggests that these constructions involve the indefinite wh-determiner welch-.\(^{39}\) Consequently, the wh-determiner welche must not be accented in this construction (see 33).

(33) a. [WAS für welche Probleme] hast du?
   b. *[Was für WELCHE Probleme] hast du?

To conclude, we find strong evidence that ex-situ wh-word words must be F-marked if they are to be construed as question words. In some configurations, this is not achieved by a pitch accent, but by configurational prominence. Another such prominence configuration is the left edge of DP, which means that wh-determiners and wh-specifiers are always F-marked (with the systematic exception discussed above).

7.2.7 Intermediate conclusion

The above data show that as long as we only consider simple wh-questions, interrogative wh-words are obligatorily F-marked. To proceed from this intermediate conclusion, let us assume that there is a common denominator to all the different F-marking strategies considered in the preceding subsections: The formal expression of focus is mediated by a morphosyntactic feature +F (for short,

\(^{39}\)There are speakers of German who find constructions such as (29) awkward (possibly due to the near redundancy of the wh-determiner welche in this construction). However, even these speakers experience a clear acceptability contrast between (29) and (30). This shows that even speakers who find (29) awkward form a judgement about the indefinite (that is, non-F-marked) wh-determiner welch-.
the F-feature). This is meant to say that an F-marked constituent – be it F-marked by syntactic, morphological, or phonological means – bears an F-feature. More specifically, I make the following assumptions:

- Focus movement is triggered by an F-feature.
- Clefted constituents bear an F-feature.
- Focus morphology is the spell-out of an F-feature.
- Prosodic prominence is the spell-out of an F-feature.

On these assumptions, we can reformulate our intermediate conclusion in the following way.

(34)  
\textit{F-marking requirement (to be specified)}

Interrogative \textit{wh}-words must bear an F-feature

In the following section, I will discuss the question of why the F-marking requirement holds (to the extent that it does).

7.3 Why are interrogative \textit{wh}-words F-marked?

7.3.1 Introduction

It is natural to assume that the semantic-pragmatic effects subsumed under the notion of focus result from the interpretation of the F-feature by the conceptual-intentional system. If we now ask why the F-marking requirement in (34) holds, there are two plausible answers. This requirement could be due to semantic-pragmatic conditions or due to syntactic conditions. In the following subsections, I will discuss these two options and argue that the second answer is the correct one.
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7.3.2 The F-marking requirement is not due to semantic-pragmatic conditions

7.3.2.1 The F-marking requirement and Givenness

It is sometimes speculated that the F-marking requirement specified in (34) is due to the Givenness status of question words, which is meant to say that question words are inherently novel. However, when taking into account the indefinite-interrogative affinity, it is easily seen that this is not a viable assumption. As discussed in section 7.2.6 above, we find that in German, the F-marking requirement is complemented by the following correlation: A *wh*-pronoun functions as a non-specific indefinite if it is not F-marked. The crucial observation in this connection now is that non-*wh* indefinite pronouns are not F-marked either (in the relevant wide-focus contexts). This can be shown as follows. According to Schwarzschild (1999) and Büring (2003), a direct-object expression such as *einen Herrn Müller* ‘a Mr. Miller’ can be the exponent of a VP focus because it must itself be F-marked (see 35a). In contrast to this, an anaphoric pronoun such as *ihn* ‘him’ need not be F-marked and, as a consequence of this, it cannot be the exponent of a VP focus (see 35b).

(35) {Was hat Peters Mutter gemacht?}
‘What did Peter’s mother do?’

a. (i) *Sie hat [VP [einen Herrn Müller]F angerufen]F*
   she has a Mr. Müller called
   ‘She called a Mr. MILLER.’

b. (i) *Sie hat [VP IHNF angerufen]F*
   she has him called
   ‘She called HIM.’
(ii) Sie hat \([_{\text{VP}}\text{ihn ANGERUFEN}_F]_F\)

That is wide-focus contexts like the one specified in (35) provide evidence for whether a pronoun needs to be F-marked by itself. On the basis of the evidence in (36), it must then be concluded that indefinite pronouns need not be F-marked, since they cannot be the exponent of a VP focus (see 36a).

(36) \{Was hat Peters Mutter gemacht?\}
‘What did Peter’s mother do?’

a. *Sie hat \([_{\text{VP}}\text{JEMANDEN}_F\text{angerufen}_F]_F\)
   she has someone called
   ‘She called SOMEONE.’

b. Sie hat \([_{\text{VP}}\text{jemanden ANGERUFEN}_F]_F\)

According to the theory of Schwarzschild (1999), non-F-marked constituents must be given. If the Givenness account was relevant for indefinite pronouns, the data in (36) would imply that indefinite pronouns are given in wide-focus contexts. This seems to be wrong on an intuitive as well as on a theoretical level. Intuitively, unspecific indefinites qualify as inherently novel words, as can be seen from the fact that the standard use of indefinites is to introduce new discourse referents.  

The same conclusion must be drawn on the basis of Schwarzschild’s definition of GIVEn: If, for example, the pronoun someone translates as the set of person properties (see 37a-i), the corresponding \(\exists\)-type shifted GQ must be tautological for someone to count as GIVEn in wide focus contexts (see 37a-ii). If it translates as a choice function applied to the set of persons (see 37b-i), the context must provide for an antecedent referring to the person chosen (see 37b-ii). Both is

40That indefinites pose a challenge to Schwarzschild’s claim that “one doesn’t find words that are inherently novel” (Schwarzschild 1999, p. 142) was pointed out to me by Werner Frey. I am very grateful to Werner for discussing these matters with me.
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plainly not the case.\textsuperscript{41}

\begin{enumerate}
\item[(37)] a. (i) \([\textasciitilde\text{someone}] = \lambda P. \exists x (\text{person}(x) \land P(x))\)
\item[(ii)] \(\models \exists P \exists x (\text{person}(x) \land P(x))\)
\item[b. (i)] \([\text{someone}] = f(\text{person})\), whereby \(f\) is a choice function
\item[(ii)] There is a salient antecedent \(A\) such that \(A\) and \(f(\text{person})\) corefer
\end{enumerate}

Hence, we have to conclude that indefinite pronouns – including indefinite \textit{wh}-pronouns – are not F-marked in wide-focus contexts although they do not count as given. This shows that the contrast between F-marked und non-F-marked \textit{wh}-pronouns is orthogonal to the given/new contrast. Put differently, the reason why interrogative \textit{wh}-pronouns must be F-marked cannot consist in their Givenness status.

7.3.2.2 The F-marking requirement and expressive needs

In section 7.2.2, we considered data that show that in Hungarian, there is only one preverbal focus position. The data supporting this conclusion are repeated in (38).

\textsuperscript{41}As for (37a), it could be argued that there is a person in each discourse situation, namely the speaker. To carry this thought a bit further, (37a-ii) indeed holds with respect to models that take the discourse situation into account. However, this would also imply that nouns denoting the set of persons would count as given in all-new contexts. However, the data in (i) show that this is clearly not the case.

\begin{enumerate}
\item[(i)] \{Was hast du gemacht?\}
\end{enumerate}

\begin{enumerate}
\item[(a)] Ich habe \([\text{VP eine PERSON}]_F \text{gemalt}_F\)
\item[(b)] *Ich habe \([\text{VP eine Person GEMALT}]_F\)
\end{enumerate}
(38) a. János Marit kisérte haza.
   John.NOM Mary.ACC escorted home
   (i) *‘It was Mary that John\textsubscript{Foc} escorted home.’
   (ii) ‘As for John, it was Mary who he escorted home.’

b. János kit kísért haza?
   John.NOM who.ACC escorted home
   (i) *‘Who did John\textsubscript{Foc} escort home?’
   (ii) ‘As for John, who did he escort home?’

In the above sentences, the phrase János, preceding the immediately preverbal phrase, cannot receive a focal interpretation. This provided an argument for the conclusion that \(wh\)-phrases must be F-marked in Hungarian: \(Wh\)-phrases cannot precede a preverbal phrase either, as is shown by the unacceptability of (5) (repeated in 39).

(39) *Mit Marinak adott János?
    what.ACC Mary.DAT gave John.NOM
    intended: ‘What did John give to Mary\textsubscript{Foc}?’

However, this holds only for simple \(wh\)-questions. In multiple \(wh\)-questions, all \(wh\)-phrases can occur preverbally. This is shown by the grammaticality of the double questions in (40). Note that there is an interpretive difference between these questions, which I will come back to below.\footnote{Cf. É. Kiss (1998), p. 263, n10.}

(40) ‘Who brought what for Mary?’
   a. Ki mit hozott Marinak?
      who what.ACC brought Mary.DAT
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b. Mit ki hozott Marinak?
   what.ACC who brought Mary.DAT

The above data clearly show that the F-marking requirement in (34) does not hold for all *wh*-words of a multiple question.

Interestingly, this relaxation of the F-marking requirement in multiple questions is not a peculiarity of Hungarian. This phenomenon can also be found in Northern Sotho. Remember that in Northern Sotho, phrases cannot be F-marked in the canonical subject position. For this reason, *wh*-subjects must be clefted to satisfy the F-marking requirement (see the unacceptability of (41a), repeated from section 7.2.3).

(41) ‘Who is looking for the doctor?’
   a. *Mang ó nyaka ngaka?
      who CL1 look.for CL9.doctor
   b. Ké mang a nyaka-ng ngaka?
      COP who CL1 look.for-REL CL9.doctor

But, again, this does not hold for *wh*-subjects of multiple questions. This is exemplified by the grammaticality of the double question in (42), which shows a non-clefted *wh*-subject.\(^{43}\)

(42) Mang ó dira eng?
   who CL1 do what
   ‘Who is doing what?’

How can we account for the relaxation of the F-marking requirement in multiple questions? To approach a possible (but ultimately incorrect) answer to this

\(^{43}\)See example (17a) in Zerbian (2006b).
question, let me first note that the two Hungarian questions in (40), which were both paraphrased as ‘Who brought what for Mary?’, actually give rise to somewhat different answerhood conditions. According to É. Kiss (1998), these questions express different requests, namely the ones given by the paraphrases in (43a) and (b).

(43) a. Ki mit hozott Marinak?
   who what.ACC brought Mary.DAT
   ‘Tell me about each person what he brought for Mary!’

   b. Mit ki hozott Marinak?
   ‘Tell me about each object who brought it for Mary!’

Both question in (43) express a request to list pairs of persons and things such that the person brought the thing for Mary. However, (43a) is a request to list these pairs by the persons in the discourse domain, whereas (43b) is a request to list them by the things in the discourse domain. In an obvious sense, we can therefore speak of the initial wh-word in (43a,b) as providing the sorting key of the corresponding question. Hence, it seems that the sorting key is provided by the wh-word that is not F-marked. This is confirmed by the following observation.

According to É. Kiss (1998), the double question in (44) is distinguished by the fact that both wh-words it contains are F-marked (the post-verbal one being F-marked in situ).


45Note that this difference corresponds to (43a) and (b) having different presuppositions: The question in (43a) presupposes that each person in the discourse domain has brought something for Mary. In contrast to this, (43b) presupposes that each thing in the discourse domain was brought by someone to Mary. These presuppositions will be discussed in more detail in section 7.4.2.3.
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(44) Ki láttott kit?
    who saw whom
    ‘Who saw somebody, and who was the person he saw?’

Interestingly, (44) only allows for a single-pair interpretation (see the paraphrase in 44b). This can be interpreted to mean that specifying a sorting key in a double question is necessary for a pair-list reading to arise. Let us therefore assume that the F-marking requirement in (34) is overruled by an interpretive condition that yields the exception described in (45).

(45) *Exception to the F-marking requirement (to be abandoned)*

A *wh*-word can be left non-F-marked if it is to provide the sorting key of a multiple question

However, the problem is that this exception does not arise in all languages. To see an example of such a language, let us consider Kitharaka (Bantu).\(^{46}\) First of all, note that Kitharaka exhibits the same subject/object asymmetry as Northern Sotho with respect to possibility to F-mark phrases *in situ*: On the one hand, the object phrase of a canonical SVO sentence can be interpreted as being narrowly focused (see 46b).

    Kinyua SP wash T FV clothes
    a. ‘Kinyua washed clothes.’
    b. ‘Kinyua washed clothes\(_{Foc} \) .’

On the other hand, the (unmodified) subject phrase of an SVO sentence cannot be interpreted in such a manner (see 47b).

\(^{46}\)See Muriungi 2003.
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(47) Muriungi a- kis- ir- e Karimi.
Muriungi SP kiss T FV Karimi
a. ‘Muriungi kissed Karimi.’

b. *‘Muriungi\textsubscript{Foc} kissed Karimi.’

This again means that subject phrases must be overtly F-marked to receive a narrow-focus interpretation. In Kitharaka, overt F-marking is brought about by focus movement, which is accompanied by a procliticizing focus marker (i- in the case of a following consonant and n- otherwise). This can be seen in (48a) for an object phrase and in (48b) for a subject phrase.

(48) a. I- nguo Kinyua a- bur- ir- e.
   \textsubscript{F} clothes Kinyua SP wash T FV
   ‘Kinyua washed clothes\textsubscript{Foc}.’

b. I- Muriungi a- kis- ir- e Karimi.
   \textsubscript{F} Muriungi SP kiss T FV Karimi
   ‘Muriungi\textsubscript{Foc} kissed Karimi.’

Now observe that when we consider \textit{wh}-questions, this subject/object asymmetry shows the expected reflex: \textit{wh}-objects can occur \textit{in situ} (see 49a) or be focus moved (see 49b).

(49) ‘Who did John beat?’

a. John a- ring- ir- e uu?
   John SP beat T FV who

b. N- uu John a- ring- ir- e?
   \textsubscript{F} who John SP beat T FV
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*Wh*-subjects, in contrast, cannot occur in situ (see the unacceptability of 50a), but must undergo focus movement (as shown by the occurrence of the proclitic focus marker *n*- in 50b).

(50) ‘Who kissed Karimi?’
   a. *Uu a-kis-ir-e Karimi?
      who SP kiss T FV Karimi
   b. N-uu a-kis-ir-e Karimi?
      F who SP kiss T FV Karimi

In this respect, Kitharaka is thus just like Northern Sotho. However, other than in Northern Sotho, the *wh*-subject of a multiple question must be F-marked in Kitharaka. This is again shown by the fact that the *wh*-subject of a multiple question cannot occur in situ, as the following data exemplify.47

(51) ‘Who washed what?’
   a. *Uu a-bur-ir-emi?
      who SP wash T FV what
   b. N-uu a-bur-ir-emi?
      F who SP wash T FV what

Observe that the *wh*-subject in (51a) is not F-marked and that this leads to unacceptability. This shows that the F-marking requirement is not relaxed in multiple questions of Kitharaka.48

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47 I owe a lot of thanks to Peter Kinyua Muriungi for providing these data and for discussing them with me.
48 Arguably, the same holds for Italian. According to Calabrese 1984, Italian “does not permit questioning of more than one constituent per sentence: namely questions such as [the ones in (i)] are not possible in Italian:” (See op. cit., p. 67.)
This difference cannot plausibly be due to different conversational needs of speakers of Hungarian and Northern Sotho on the one hand and speakers of Kitharaka on the other. Rather, this variation hints at an underlying syntactic difference between these languages. In Hungarian and Northern Sotho, there is a syntactic condition for \(wh\)-words to be F-marked in simple \(wh\)-questions, but (for reasons to be explained) this requirement does not hold for all \(wh\)-words in multiple questions. In Kitharaka, the F-marking requirement holds for all \(wh\)-words, those in simple and multiple \(wh\)-questions. Consequently, speakers of Hungarian and Northern Sotho can make use of the interpretive effects that emerge from the available expressive options. For example, speakers of Hungarian can use the double questions in (43) and (44) to express different (but semantically related) requests. There is no comparable expressive option for speakers of Kitharaka.

In the following subsection, I will discuss what syntactic condition is responsible for the F-marking requirement specified in (34).

(i)  

(a) *Chi ha scritto che cosa?  

who has written what  

intended: ‘Who has written what?’

(b) *Chi è partito quando?  

who is left when  

intended: ‘Who left when?’

(c) *Quale ragazza ha dato un bacio a quale ragazzo?  

which girl has given a kiss to which boy  

intended: ‘Which girl gave a kiss to which boy?’

On the assumption that Italian permits only one F-marked phrase per clause, the ungrammaticality of the constructions in (i) shows that in Italian, all \(wh\)-words of a multiple \(wh\)-question must be F-marked. Cf. Calabrese 1984, Calabrese 1992.
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7.3.3 The syntactic nature of the F-marking requirement

It is commonly assumed that (interrogative) wh-phrases must be syntactically licensed by the interrogative complementizer $C^{[+Q]}$. Arguably, the syntactic licensing of a wh-phrase is induced by some sort of agreement with $C^{[+Q]}$. According to Chomsky (1998), this agreement is established by the so-called Agree operation, an assumption I will adopt in what follows.

From the perspective of the question semantics presented in the previous chapters, there is strong evidence that the syntactic licensing of wh-words by $C^{[+Q]}$ is necessary for their being interpreted as question words. Until now, we simply ignored a problem of (the most basic version of) the dynamic question semantics, namely the prediction that the question operator denoted by $C^{[+Q]}$ turns all indefinites in its scope into question words. That this prediction is most obviously wrong is shown by the data in (52).

(52) Who bought something?
   a. ‘Who bought something?’
   b. *‘Who bought what?’

The inadequacy of paraphrase (52b) shows that the non-wh indefinite something cannot be interpreted as a question word.\footnote{The redundancy of paraphrase (52a) is to highlight that non-wh indefinites do not even qualify as question words.}

Less obvious, and actually quite unexpected, is the fact that the question oper-

\footnote{But see Reinhart 1994, Reinhart 1995, Reinhart 1998 for the view that \textit{in-situ} wh-phrases need not be syntactically licensed. However, Reinhart does not discuss in depth how to rule out the indefinite reading of \textit{in-situ} wh-phrases, which is predicted by the choice-function semantics employed in these works. Therefore, it remains to be shown whether Reinhart’s approach is feasible.}
ator does not even turn all wh-words in its scope into question words. In chapter 3, we considered languages in which wh-pronouns can function both as question words and as indefinite pronouns. This double functionality persists in the scope of a question operator, as was already shown with the examples presented in section 3.2 (repeated below for convenience).

(53) a. šúka ki táku yaxtáka he
   dog the something/what bit Q
   (i) ‘Did the dog bite something?’
   (ii) ‘What did the dog bite?’

b. nwu(kw)-ka pakkey w-ass-ni?
   someone/who-SUB outside come-PAST-Q
   (i) ‘Is there someone at the door?’
   (ii) ‘Who is at the door?’

c. Wer hat was gekauft?
   who has something/what bought
   (i) ‘Who bought something?’
   (ii) ‘Who bought what?’

As shown by the adequacy of the first paraphrases in (53a-c), the (in-situ) wh-words allow for a non-interrogative interpretation, even though they are in the scope of the question operator. Thus, the above paradigm raises two (interdependent) questions: (i) What differentiates the first and the second reading of (53a-c) in terms of the underlying LF structure? (ii) What precisely is the semantic difference between these readings? In the following I will concentrate on answering the first question, whereas the second question will not be tackled until section 8.3.

The question of what syntactic difference there is between the indefinite and the interrogative occurrences of a wh-pronoun has already been addressed above:

51 See also section 7.2.6 above.
The interrogative occurrences bear a special syntactic relation to the interrogative complementizer. That is, interrogative *wh*-words enter into an Agree relation with \( C^{[+Q]} \). According to Chomsky (1998), they must do so because of a morphological feature, the \( wh \)-feature, which must be erased in the course of a syntactic derivation by the Agree operation. However, this immediately raises the question of why only interrogative \( wh \)-words must do so. In den Dikken (2002), the problem surrounding this question is phrased as follows: “[R]egardless of whether [a \( wh \)-pronoun] is semantically interpreted as a question word or as an indefinite pronoun, its morphological composition is invariant” (Op. cit., p. 2). This means that whatever morphological feature requires an interrogative \( wh \)-pronoun to enter into an Agree relation with \( C^{[+Q]} \) should also require an indefinite \( wh \)-pronoun to do so. Hence, we have to conclude that the \( wh \)-feature is not sufficient to mark a \( wh \)-word as needing to be licensed by \( C^{[+Q]} \). Put in the terms of Chomsky (1998), the \( wh \)-feature does not suffice to render \( wh \)-words active for the Agree relation with \( C^{[+Q]} \). But what does, then?

To approach this question, let us remember what differentiates the indefinite and interrogative occurrences of a \( wh \)-word. As already noted in section 3.2 and 7.2.6, the difference is that interrogative \( wh \)-words are F-marked, whereas indefinite \( wh \)-words are not. This strongly suggests that the F-feature is necessary for rendering a \( wh \)-word active for the Agree relation with \( C^{[+Q]} \). Let us therefore assume that it is the feature combination \( [+wh, +F] \) that renders a \( wh \)-word active. This amounts to say that the feature combination \( [+wh, +F] \) is uninterpretable, whereas the \( wh \)- and the F-feature alone are interpretable.\(^{52}\)

Due to their feature setup, F-marked \( wh \)-words must enter into an Agree rela-

\(^{52}\)This raises the question what interpretation the \( wh \)-feature has. To answer this question, we have to investigate (subtle) interpretive differences between \( wh \)-indefinites and non-\( wh \) indefinites. This must be left for future research.
tion with $C^{[+Q]}$ to erase (at least one of the features leading to) the uninterpretable feature combination, whereas non-F-marked wh-words need not (and hence cannot) do so. For the moment, I will not go into the specifics of these assumptions. However, let me tentatively assume that as a result of such an Agree relation, the wh-feature of an agreeing wh-word is erased, whereas the F-feature remains in the syntactic computation and must be interpreted at LF.

### 7.4 Question words are focused

#### 7.4.0.1 Initial evidence

Due to the strictness of the F-marking requirement in simple wh-questions, it is hard to single out the semantic-pragmatic effect of the F-feature among the answerhood conditions of these questions. However, we saw above that there are several options in Hungarian to F-mark the wh-words in a multiple question and that different such F-marking patterns go along with different answerhood conditions. The crucial data is repeated below for convenience.\(^{53}\)

\[(54)\]  

a. Ki mit\(^{[+F]}\) hozott Marinak?  
   who what.ACC brought Mary.DAT  
   ‘Tell me about each person what he brought for Mary!’

b. Mit ki\(^{[+F]}\) hozott Marinak?  
   ‘Tell me about each object who brought it for Mary!’

c. Ki\(^{[+F]}\) látott kit\(^{[+F]}\)?  
   who saw whom  
   ‘Who saw somebody, and who was the person he saw?’

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In (54a,b), only the immediately preverbal *wh*-word bears an F-feature, whereas the respective other one does not. It seems that as a consequence, the non-F-marked *wh*-word functions as the sorting key of the pair-list question expressed in each respective case. Furthermore, both *wh*-words in (54c) bear an F-feature and the answerhood conditions are those of a single-pair question.

Hence, it seems that F-features on *wh*-words contribute to the answerhood conditions of the *wh*-questions in which they appear. In the following sections, I will argue that the F-feature on a *wh*-word receives basically the same semantic interpretation that Kenesei (1986) and Szabolcsi (1994) proposed for preverbal focus phrases in Hungarian, an interpretation involving exhaustification and presuppositionality. But before going into the specifics of this proposal, I will review an intuitive argument for the semantic-pragmatic import of the F-feature on *wh*-words.

7.4.1 An intuitive argument

According to Culicover & Rochemont (1983), “[interrogative] *wh*-words function naturally as focus constituents of constructions in which they appear” (*op. cit.*, p. 140), a claim that has been made in one form or another by various linguists.\(^{54}\) In Erteschik-Shir (1986), the intuition that question words are focal is ascribed to the following line of thought.\(^{55}\)

1. A sentence must have at least one focus.

2. Simple *wh*-questions have an existential presupposition. For example, the question in (55a) presupposes the proposition given in (55b).

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\(^{54}\)See, for example, Calabrese 1984, Rochemont 1986, Lambrecht & Michaelis 1998, and Zubizarreta 1998.

\(^{55}\)Note, however, that Erteschik-Shir (1986) argues for an opposing view.
(55) a. Who gave the book to Mary?
   b. Someone gave the book to Mary.

3. The only constituent of (55a) that is not part of (55b) is the \textit{wh}-word.

4. Hence, the \textit{wh}-word must be the focus of (55a).

Presented in this way, the above reasoning may appear somewhat naive. However, I will show that the underlying intuition can very well be theoretically founded (see Haida 2003b for a first approach). This is done at the beginning of the following section. Overall, this section shows how to derive various answerhood conditions of simple and multiple \textit{wh}-questions which do not follow from question semantics proper (neither in the Groenendijk & Stokhof nor in the Hamblin/Karttunen framework). These answerhood conditions will be shown to result from the interplay between the dynamic question semantics proposed in chapter 4 and the semantics of the F-feature, which will be presented below.

### 7.4.2 Presuppositions of simple and multiple \textit{wh}-questions

#### 7.4.2.1 Existential presupposition

As already mentioned in the previous section, simple \textit{wh}-questions have an existential presupposition. At least, this is an assumption in many pertinent publications such as Keenan (1971), Katz (1972), Givón (1973), Karttunen (1977), Malone (1978), Hintikka (1978), Hagstrom (1998), and Lin (1998). Thus, these authors hold that, for instance, the question in (56a) has the presupposition in (56b).

(56) a. Who called?
   b. \( \neg \exists \text{ someone called} \)
However, this assumption is sometimes challenged by pointing out that (57-A) is a coherent reply to the question in (57-Q).

(57) Q: Who called?
   A: No one called.

Of course, the coherence of this reply does not show that it is a (semantic) answer to the question posed. It is well known that negations can be used to protest against a presupposition. Hence, (57-A) could be a protest against the existential presupposition of (57-Q). In my view, the incoherence of the discourse in (58) provides more conclusive evidence for judging the correctness of the assumption under discussion.

(58) Q: Who called?
   A: #Someone called.

If (58-A) did not presuppose that someone called, the reply in (58-Q) would be an informative answer, since it rules out the possibility that in fact no one called. However, (58-A) seems to be odd precisely because it is a completely uninformative reply. Therefore, I assume that simple \textit{wh}-questions have indeed an existential presupposition.

The challenge then is to derive this presupposition in a systematic way. In the previous section, I pointed out that some researchers assume that the existential presupposition is due to the focusing of the \textit{wh}-word. Expressed in structural terms, this assumption can be made precise in the following way. In the sections above, it was argued that the \textit{wh}-word of a simple \textit{wh}-question must bear an F-
feature. Thus, it is reasonable to assume that (58-Q) has the LF structure in (59).

\[(59) \quad [_{CP} C[^{[+Q]}] [_{FocP} who_{1}[^{[+F]}] [\lambda 1 [_{TP} t_{who_{1}} called ]]]]]

If (59) is interpreted in the way proposed in chapter 4, that is, without taking into account the semantic contribution of the F-feature (and/or of the Foc head), we arrive at answerhood conditions that do not capture the existential presupposition of the question under consideration. Let us therefore assume that the F-feature does receive a semantic interpretation.\(^{57}\) That is, let us assume that (59) is interpreted as shown in (60).

\[(60) \quad Q^i(\lambda i(\llbracket F \rrbracket^i(\lambda i.\llbracket who_{1} \rrbracket^i)(\lambda i\lambda \nu.\text{call}^i(i)(\nu))))

But what is the semantics of the F-feature? According Szabolcsi (1994), a phrase in the preverbal focus position of Hungarian receives an interpretation involving exhaustification and presuppositionality. More precisely, Szabolcsi assumes that the (entity) denotation of the preverbal focus phrase is identified with the maximal sum individual satisfying the predicate denoted by the sister of the focus-moved phrase.\(^{58}\) Remember that in simple \textit{wh}-questions of Hungarian, \textit{wh}-phrases must

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\(^{56}\)The Foc head is not represented in (59) (and in the LF-structures to follow) because it will not receive a semantic interpretation.

\(^{57}\)Alternatively, we could assume that what is interpreted is not the F-feature but the Foc head that hosts the \textit{wh}-word in its specifier. For reasons of transparency, I will pursue the assumption made in the main text.

\(^{58}\)In Szabolcsi (1994), this is achieved by the operator shown in (i) (where ‘\(\Pi\)’ denotes the individual part relation).

\[(i) \quad \text{EXH}_{8} = \lambda z \lambda P. z = _{i x}(P(x) \land _{\forall y}(P(y) \rightarrow y \Pi x))

\]

Compare (i) to the definition of \(\delta = \sigma \nu. P(\nu)\) below.
occur in just this preverbal focus position. Therefore, let us assume that the F-
feature denotes a presuppositional exhaustification operator. However, we have
to slightly modify the proposal of Szabolcsi (1994) because we do not deal with
dentity-denoting phrases but with phrases denoting existential generalized quanti-
fiers. For this reason, the denotation of the F-feature must be defined as shown
in (61) (where $Q$ and $P$ are variables of type $\langle s, \langle s, \langle e, t \rangle \rangle, t \rangle$ and $\langle s, \langle e, t \rangle \rangle$, respectively).

(61) $\llbracket F \rrbracket^i = \lambda Q \lambda P. Q(i)(\lambda i \lambda \nu'(\nu' = \sigma \nu. P(i)(\nu)))$

Thereby, the dynamic formula $\nu' = \sigma \nu. P(i)(\nu)$ is an instance of the abbreviation
defined in section 6.3.3.3 and for convenience repeated here: If $\delta$ is a term of type
$e$, $\nu$ is a variable of type $e$, and $\Phi$ is a dynamic formula we write

$\delta = \sigma \nu. \Phi$ for $\lambda k. \lambda k'(\delta(k) = \iota x. \exists \nu'(x = \nu'(k) \land [^* (\lambda \nu. \Phi)](\nu')(k') \land$

$\wedge \forall \nu_2 ([^* (\lambda \nu. \Phi)](\nu_2)(k'(k) \rightarrow \nu_2(k) \Pi x)))$

As you can see, a dynamic formula of the form $\delta = \sigma \nu. P(\nu)$ expresses that
register $\delta$ has as its value the maximal element of the plural predicate of $P$.\(^{59}\)
That is, $\delta = \sigma \nu. P(\nu)$ expresses exhaustification and presuppositionality in just
the same way as the exhaustification operator of Szabolcsi (1994).

This means that $who_{1}^{[+F]}$ denotes the exhaustivized existential generalized quantifier that is given by the following derivation.

$\llbracket F \rrbracket^i(\lambda i. [\llbracket who_{1} \rrbracket]^i) = [\lambda Q \lambda P. Q(i)(\lambda i \lambda \nu'(\nu' = \sigma \nu. P(i)(\nu)))](\lambda i \lambda \nu P. \exists u_1. P(u_1))$

$= \lambda P. \exists u_1 (u_1 = \sigma \nu. P(i)(\nu))$

Note that the denotation of $who_{1}^{[+F]}$ derived above is identical to the denotation
of $who_{1}^{EXH}$, which we stipulated in section 6.3.3.3 to account for the anaphoric

\(^{59}\)See section 6.3.3.3 for the definition of the plural predicate $^*P$ of a dynamic predicate $P$.\)
potential of \textit{wh}-pronouns. This means that we have compositionally derived the anaphoric potential of \textit{wh}-pronouns from their standard lexical semantics and the semantics of the F-feature.

With this at hand, the denotation of FocP of the LF structure in (59) is derived as given below.

\[
[FocP]^i = ([F]^i(\lambda i. [who_i]^i))(\lambda i\nu. \text{call}'(i)(\nu)) = [\lambda P. \exists u_i(u_i = \sigma\nu. P(i)(\nu))(\lambda i\nu. \text{call}'(i)(\nu)) = \exists u_i(u_i = \sigma\nu. \text{call}'(i)(\nu))
\]

Let us consider now what the presuppositionality of \(u_i = \sigma\nu. \text{call}'(i)(\nu)\) implies for the denotation of FocP derived above. Remember that we have shown in section 6.3.3.3 that the abbreviation \(u_i = \sigma\nu. \text{call}'(i)(\nu)\) can be expanded to the following MTy\textsubscript{3} term.

\[
\lambda k\lambda k'(k = k' \land u_i(k) = ix(\text{call}'(i)(x) \land \forall y(\text{call}'(i)(y) \rightarrow y \Pi x)))
\]

Now assume that no one called at the index assigned to the index variable \(i\). Then, \text{call}'(i) denotes the (characteristic function of the) empty set. Hence, the \(i\)-term \(ix(\text{call}'(i)(x) \land \ldots)\) is undefined. Consequently, the equation \(u_i(k) = ix(\text{call}'(i)(x) \land \ldots)\) is undefined for all valuations of \(u_i\) and all values assigned to \(k\). Hence, the dynamic formula \(\exists u_i(u_i = \sigma\nu. \text{call}'(i)(\nu))\) – the denotation of FocP – is undefined if no one called at the index assigned to \(i\). Furthermore, it can be easily seen that this carries over to the overall denotation of (59). Thus, we have derived the existential presupposition of the \textit{wh}-question in (56a). This shows that the existential presupposition of simple \textit{wh}-questions is in fact due to the focusing of the \textit{wh}-word.

In the following section, I will show that by the same assumptions, we also derive the presuppositions of simple \textit{wh}-questions which are formed with a singular \textit{which}-phrase.
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7.4.2.2 Existential and uniqueness presupposition

When considering simple \textit{wh}-questions which are formed with a singular \textit{which}-phrase (henceforth \textit{singular-which questions}), we find that these do not only have an existential but also a uniqueness presupposition. This is an assumption shared by Hirschbühler (1978), Higginbotham & May (1981), Comorovski (1996), Dayal (1996), Dayal (2002), and Hagstrom (1998) among others. Thus, these authors hold that, for instance, the question in (62a) presupposes what is given in (62b), namely the existence and uniqueness of a novel such that it holds that John has read it.

(62) a. Which novel has John read?
   b. $\neg$ John has read one and only one novel

Evidence for assuming these presuppositions can be drawn from the question-reply pairs in (63).

(63) Q: Which novel has John read?
   A$_1$: John has read Thomas Mann’s \textit{Buddenbrooks}.
   A$_2$: #John has read Mann’s \textit{Buddenbrooks} and Hesse’s \textit{Steppenwolf}.
   A$_3$: #John has read a novel.

The felicitous answer in (63-A$_1$) is in accord with the existential and uniqueness presupposition of (63-Q). In contrast to this, the reply in (63-A$_2$) does not satisfy the uniqueness presupposition and is hence infelicitous. The reply in (63-A$_3$) is infelicitous because it is uninformative – it merely asserts what is already presupposed by the existential presupposition of (63-Q).

In the following, I will show that the presuppositions of singular-\textit{which} questions also result from the interplay between question semantics proper and the
semantics of the F-feature. Especially, I will show that the uniqueness presupposition is a direct consequence of the semantic singularity of singular *which*-phrases (as opposed to the semantic plurality of *wh*-pronouns).

To see this, let us determine what answerhood conditions we arrive at if we interpret the F-feature on the *wh*-determiner of a singular *which*-question in the way proposed above. For this purpose, consider the question in (64a), for which I assume the LF-structure in (64b).

(64) a. Which student called?
   
b. \[ \text{\textup{CP}} \text{\textup{C}}^{[+Q]} \left[ \text{\textup{FocP}} \left[ \text{\textup{DP}} \text{\textup{which}}_{\text{\textup{F}}} \right] \lambda_1 \left[ \text{\textup{TP}} \left[ \text{\textup{DP}} \text{\textup{student}} \right] \right. \left. \text{\textup{called}} \right] \right] \]

For deriving the LF structure in (64b), I assume the copy theory of movement and a delete operation which applies at LF to redundant parts of the copies of a movement chain (see Chomsky 1993, Sauerland 1996). In (64b), the delete operation applies to the restrictor NP in the higher copy of the moved *which*-phrase and to the *wh*-determiner in the lower copy. This can be seen as a reflex of the fact that it is features of the *wh*-determiner that are necessarily involved in the movement.

60 For simple *wh*-question such as (64a), we could maintain the assumption that *wh*-movement leaves behind a trace. That is, we could assume that (64a) has the LF structure shown in (i).

(i) \[ \text{\textup{CP}} \text{\textup{C}}^{[+Q]} \left[ \text{\textup{FocP}} \left[ \text{\textup{DP}} \text{\textup{which}}_{\text{\textup{F}}} \text{\textup{student}} \right] \lambda_1 \left[ \text{\textup{TP}} \text{\textup{called}} \right] \right] \]

To achieve the same results as on the approach followed in the main text, this assumption requires the F-feature to have the denotation specified in (ii) (where \( \text{\textup{id}} \) is the abbreviation given in (65a)).

(ii) \[ [F]^i = \lambda Q \lambda P \lambda P', \text{\textup{Q}}(i)(\lambda i \lambda \nu \cdot \text{\textup{id}})(\lambda i \lambda \nu'(\nu' = \sigma \nu(P(i)(\nu) \land P'(i)(\nu)))\]

However, when we turn to multiple questions, it becomes evident that the copy theory of movement is to be preferred over the trace theory. See section 7.4.2.4 below.
of the *which*-phrase, whereas the NP is only pied-piped material. As for the semantics of the delete operation, I assume that it gives an “empty” semantic object, that is, a semantic object that allows the semantic composition to proceed without adding any content above what is necessary to specify an object of the appropriate semantic type. In the case of an NP, I assume that deletion gives the predicate that is true for all arguments (see 65a).61 Furthermore, I assume that the deletion of a determiner denotes a generalized quantifier (that is, a semantic object of type \(\langle \langle s, \langle e, t \rangle \rangle, \langle \langle s, \langle e, t \rangle \rangle, t \rangle \rangle\)) that gives the conjunction of its two arguments, where both apply to the same free variable (see 65b).

(65) a. \([\text{NP}]^i = \lambda \nu. \text{id},\) where \(\text{id}\) is short for \(\lambda k \lambda k'. k = k'\)

b. \([\text{Det}_n]^i = \lambda P \lambda P'(i) (P(i)(\nu_n) \land P'(i)(\nu_n))\)

Note that in (65b), the index of the deleted determiner is not also deleted but retained as index of the variable that the (dynamic) predicates \(P(i)\) and \(P'(i)\) apply to. This is to guarantee the correct semantic association between the higher and the lower copy of a moved *which*-phrase.

In (64b), the F-feature is assumed to be a feature of the *wh*-determiner and not of the *which*-phrase as a whole. This means that the operator denoted by the F-feature does not apply to a semantic object of type \(\langle \langle s, \langle e, \underline{L} \rangle \rangle, \underline{L} \rangle\) like in the case of F-marked *wh*-pronouns, but to the denotation of a *wh*-determiner, that is, to a semantic object of type \(\langle \langle s, \langle e, \underline{L} \rangle \rangle, \langle \langle s, \langle e, \underline{L} \rangle \rangle, \underline{L} \rangle \rangle\). This can be seen in

61 Of course, this is to be understood in the sense of the underlying dynamic logic \(\text{MTy}_3\). As can be seen in (65a), the predicate characterized in the main text is a function of type \(\langle e, \underline{L} \rangle\), namely the constant function to the total relation on the set of contexts.
(66), where the semantic composition of the denotation of (64b) is shown.

\[
[C^{[\mathbb{Q}]}]^i(\lambda i([F]^i(\lambda i.[\text{which}]_1)^i)(\lambda i.[\text{student}]^i)) \\
(\lambda i\lambda i_1([\text{which}^iF_1]^i(\lambda i.[\text{student}]^i)(\lambda i.[\text{call}]^i))))
\]

To accommodate for this argument type, we have to specify an alternative denotation for the F-feature, namely the one given in (67) (where \( \mathbb{Q} \) is a variable of type \( \langle \langle s, \langle e, t \rangle \rangle, \langle s, \langle e, t \rangle \rangle, t \rangle \rangle \) and \( P, P' \) are variables of type \( \langle s, \langle e, t \rangle \rangle \)).

\[
[F]^i = \lambda \mathbb{Q} \lambda P \lambda P'. \mathbb{Q}(i)(P)(\lambda i\lambda i_1(\nu' = \sigma \nu. P'(i)(\nu)))
\]

Note that by the specification given above, exhaustification applies only to the nuclear scope of the F-marked wh-determiner. However, by the assumptions concerning the LF structure of the questions under consideration, the restrictor NP of a wh-moved which-phrases ends up being interpreted in the lower copy of the movement chain. Hence, exhaustification applies also with respect to the denotation of the restrictor NP. This will be discussed in greater detail at the end of this section.

As for the denotation of the singular wh-determiner which, I adopt the assumption motivated in section 6.3.3.3 that this determiner encodes its semantic singularity. More precisely, I assume that (the singular form of) which is lexically specified as shown in (68).

\[
[\text{which}_n]^i = \lambda P \lambda P'. \exists u_n (At(u_n) \land P(i)(u_n) \land P'(i)(u_n))
\]

\[63\]We could do without an alternative denotation for the F-feature if we assumed that it is a feature of the which-phrase as a whole. However, morphosyntactic evidence speaks against this assumption. Therefore, I will not pursue this possibility further.

\[63\]In section 6.3.3.3, we also considered a lexical specification of \( \text{which}_n \) encoding what turns out to be the semantic contribution of the F-feature. Therefore, this specification becomes obsolete with the analysis provided in this section.
On these assumptions, the F-marked *wh*-determiner \( \text{which}_1^{[+F]} \) denotes the semantic object derived below.

\[
\begin{align*}
\llbracket \text{which}_1^{[+F]} \rrbracket^i &= [F]^i(\lambda_i.\llbracket \text{which}_1 \rrbracket^i) \\
&= \lambda Q \lambda P \lambda P'.Q(i)(P)(\lambda_i \lambda \nu'(\nu' = \sigma \nu'.P'(i)(\nu)))(\lambda_i.\llbracket \text{which}_1 \rrbracket^i) \\
&= \lambda P \lambda P'.\exists u_1(\text{At}(u_1) \land P(i)(u_1) \land u_1 = \sigma \nu.P'(i)(\nu))
\end{align*}
\]

Hence, the higher copy of the *which*-phrase in (64b) has the following denotation.

\[
\begin{align*}
\llbracket \text{which}_1^{[+F]} \text{ student} \rrbracket^i &= \\
&= \llbracket [F]^i(\lambda_i.\llbracket \text{which}_1 \rrbracket^i) \rrbracket(\lambda_i.\llbracket \text{student} \rrbracket^i) \\
&= \lambda P \lambda P'.\exists u_1(\text{At}(u_1) \land \text{id} \land u_1 = \sigma \nu.P'(i)(\nu)) \\
&= \lambda P'.\exists u_1(\text{At}(u_1) \land u_1 = \sigma \nu.P'(i)(\nu))
\end{align*}
\]

Furthermore, the denotation of \( \text{TP} \) of (64b) can be specified as given below.

\[
\begin{align*}
\llbracket \text{TP} \rrbracket^{i,\nu_1} &= \llbracket \text{which}_1^{[+F]} \text{ student} \rrbracket^i(\lambda_i.\llbracket \text{call} \rrbracket^i) \\
&= \lambda P \lambda P'(P(i)(\nu_1) \land P'(\nu_1))(\lambda_i \lambda \nu.\text{student}'(i)(\nu)(\lambda_i \lambda \nu.\text{call}'(i)(\nu))) \\
&= \text{student}'(i)(\nu_1) \land \text{call}'(i)(\nu_1)
\end{align*}
\]

Now we are in the position to give the denotation of FocP of the LF structure in (64b). This is done by means of the following derivation.

\[
\begin{align*}
\llbracket \text{FocP} \rrbracket^i &= \\
&= \llbracket \text{which}_1^{[+F]} \text{ student} \rrbracket^i(\lambda_i \lambda \nu_1.\llbracket \text{TP} \rrbracket^{i,\nu_1}) \\
&= \lambda P'.\exists u_1(\text{At}(u_1) \land u_1 = \sigma \nu.P'(i)(\nu))(\lambda_i \lambda \nu_1.\text{student}'(i)(\nu_1) \land \text{call}'(i)(\nu_1))) \\
&= \exists u_1(\text{At}(u_1) \land u_1 = \sigma \nu.\text{student}'(i)(\nu) \land \text{call}'(i)(\nu)))
\end{align*}
\]
I will now show that the denotation of FocP derived above is only defined if there is one and only one student who called at (the index assigned) to \( i \). First, note that the dynamic formula 

\[
\sigma \nu (\text{student}'(i)(\nu) \land \text{call}'(i)(\nu))
\]

can be expanded to the term 

\[
\lambda k \lambda k'(k = k' \land u_1(k) = T),
\]

where \( T \) is the \( \iota \)-term shown below.

\[
\iota x (\text{student}'(i)(x) \land \text{call}'(i)(x) \land \forall y ((\text{student}'(i)(y) \land \text{call}'(i)(y)) \rightarrow y \Pi x))
\]

Now assume that there is no student who called at \( i \). Then \( T \) is undefined. Thus, the denotation of FocP is undefined if there is no student that called at to \( i \).

Then assume that there is more than one student who called at \( i \). More precisely, assume w.l.o.g. that there are exactly two such students, \( j \) and \( b \) Then \( T \) denotes the individual sum of \( j \) and \( b \) (that is, the plural individual \( j \oplus b \)).

Now remember that the dynamic formula \( A\iota(u_1) \) encodes the presupposition that the value of \( u_1 \) is atomic (see the definition in section 6.3.3.3). This means that for each valuation of \( u_1 \) and each value assigned to \( k \) and \( k' \), the formula 

\[
A\iota(k)(k') \land u_1(k) = T
\]

is either false or undefined. Thus, the denotation of FocP is undefined if there is more than one student who called at \( i \).

Furthermore, it can be easily seen that both results carry over to the overall denotation of (64b), which means that we have derived the existential and uniqueness presupposition of the singular which-question in (64a). Thus, these presuppositions have been traced back to the semantic contribution of the F-feature of the singular wh-determiner which.

As a final consideration, let us take another look at the denotation of the F-marked wh-determiner which\([+F] \), which is repeated in (69a) for convenience. We assumed that the question Which student called? has the LF structure shown in somewhat simplified form in (69b). On the assumptions concerning the interpretation of the delete operation, we derive that FocP has the denotation in shown in (69c).
7.4. QUESTION WORDS ARE FOCUSED

(69) a. \[
[\text{which}_n|^{\text{F}}]|^i = \lambda P \lambda P'. \exists u_n (\text{At}(u_n) \land P(i)(u_n) \land u_n = \sigma \nu. P'(i)(\nu))
\]

b. \[
[\text{CP C}^{(+Q)} [\text{FocP [which}_1|^{+F}\text{ student }][\lambda 1 [[\text{which}_1\text{ student }\text{ called }]]]]
\]

c. \[
[\text{which}_1|^{+F}]^i(\lambda i \lambda \nu \text{id})(\lambda i \lambda \nu_1 (\text{student'}(i)(\nu_1) \land \text{call'}(\nu_1)))
\]

Now consider the stipulation we made in section 6.3.3.3 to account for the anaphoric potential of singular which-phrases. In that section, we had to assume that the denotation of the singular wh-determiner which is lexically specified as shown in (70a). At that point of the discussion, the LF structure of Which student called? was assumed to be as shown in (70b). Consequently, we derived the denotation of FocP as sketched in (70c).

(70) a. \[
[\text{which}_n^{\text{EXH}}]|^i = \lambda P \lambda P'. \exists u_n (\text{At}(u_n) \land u_n = \sigma \nu. P(i)(\nu) \land P'(i)(\nu))
\]

b. \[
[\text{CP C}^{(+Q)} [\text{FocP [which}_1\text{ student }][\lambda 1 [t_1 \text{ called }]]]
\]

c. \[
[\text{which}_1^{\text{EXH}}]^i(\lambda i \lambda \nu \text{student'}(i)(\nu))(\lambda i \lambda \nu_1, \text{call'}(i)(\nu_1))
\]

It can be easily seen that (69c) and (70c) specify the same semantic object. This means that we have derived on principled grounds the anaphoric potential of singular which-phrases, just like before the anaphoric potential of wh-pronouns.

In the next section, I will show that, perhaps somewhat unexpectedly, the semantic contribution of the F-feature also gives rise to the so-called pair-list interpretation of double questions (or, more generally, the list interpretation of multiple questions).
7.4.2.3 The list interpretation of multiple questions

In section 7.3.2.2 and 7.4.0.1, we discussed multiple questions of Hungarian. This discussion suggested that different F-marking patterns in multiple questions lead to different answerhood conditions. As regards the pair-list interpretation of double questions, the relevant data is repeated once more in (71).

\[(71)\]

(a) \[Ki \text{ mit}^{[+F]} \text{ hozott } Marinak?\]
\[\text{who what.ACC brought Mary.DAT}\]
\[‘Tell me about each person what he brought for Mary!’\]

(b) \[Mit \text{ ki}^{[+F]} \text{ hozott } Marinak?\]
\[‘Tell me about each object who brought it for Mary!’\]

It is reasonable to assume that the answerhood conditions of the questions in (71a) and (b), given by the explicit performative paraphrase below each question, are a combination of their semantics and their presuppositions. Following, as before, the question-semantic approach of Groenendijk & Stokhof, the questions in (71a) and (b) define the same partition of the logical space, namely the one in which all cells are propositions specifying for each and every pair \(\langle x, y \rangle\) whether \(x\) brought \(y\) for Mary or not. Then, in order to give the above answerhood conditions, the questions in (71a) and (b) must have the presuppositions shown in (72a-ii) and (b-ii), respectively.

\[(72)\]

(a) (i) \[Ki \text{ mit}^{[+F]} \text{ hozott } Marinak?\]
\[\text{who what.ACC brought Mary.DAT}\]
\[‘Tell me about each person what he brought for Mary!’\]

(ii) \[\neg \] for everyone, there is something that he brought for Mary

(b) (i) \[Mit \text{ ki}^{[+F]} \text{ hozott } Marinak?\]
\[‘Tell me about each object who brought it for Mary!’\]

(ii) \[\neg \] for everything, there is someone who brought it for Mary

\[\text{Cf. É. Kiss (1998), p. 263, n10.}\]

\[\text{This furthermore assumes that questions are standardly interpreted as requests for complete answers.}\]
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Such a pair-list presupposition is assumed in É. Kiss (1993), Comorovski (1996), Dayal (1996), Dayal (2002), Hagstrom (1998), and Krifka (2001a), among others.66 We can decompose the pair-list presupposition into two (related) components, an exhaustiveness presupposition (for every. . .) and an existential presupposition (there is some. . .). Thereby, the latter relates to the F-marked wh-word and the former to the non-F-marked wh-word. It seems that, again, the existential presupposition is due to the focusing of a wh-word. But where does the exhaustiveness presupposition come from? What I will show in the following is that this presupposition results as a side effect of the existence presupposition triggered by the F-marked wh-word. Put differently, I will show that the presuppositions given in (72a-ii) and (b-ii) immediately derive from interpreting the LF structures in (73a) and (b), respectively, in the by now familiar way.67

(73) a. 
\[
[CP C^{+Q} \text{TopP } ki_1 [\lambda 1 [\text{FocP } mitz_2^{+[F]} \lambda 2 [\text{TP } t_{ki_1} hozott t_{mitz_2} \text{Marinak }]]]]]
\]

b. 
\[
[CP C^{+Q} \text{TopP } mitz_2 [\lambda 2 [\text{FocP } ki_1^{+[F]} [\lambda 1 [\text{TP } t_{ki_1} hozott t_{mitz_2} \text{Marinak }]]]]]
\]

In (73a,b), the clause-initial wh-phrase is assumed to occupy the specifier position of TopP. This assumption is compatible to the fact that in Hungarian, a phrase preceding the immediately preverbal phrase cannot receive a focal interpretation. However, the following analysis will ignore the interpretive import of the head of TopP (which is therefore not represented above). That is, the non-F-marked wh-phrase in (73a,b) will not be assigned a topical interpretation, but merely a non-

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66See also Higginbotham & May 1981 and Hornstein 1995 for the assumption of an even stronger (but empirically inadequate) presupposition, namely that there is a bijective function between the restrictor domains of the two wh-phrases of a double question, the graph of which is being asked for.

67In the pertinent literature, it is usually assumed that in focus constructions such as the ones in (71), the verb overtly moves to adjoin to the head of the Foc phrase. However, this movement is reconstructed at LF.
focal interpretation. By the assumption made above, the LF structures in (73a,b) have the denotations shown in (74a) and (b), respectively (where the denotation of \( ki \) and \( mit \) is assumed to be identical to their English cognates).

\[
\begin{align*}
(74) \quad a. \quad & Q^i(\lambda i([ki]_i^i)(\lambda i\lambda \nu_1([F]_i^{i'}(\lambda i.[mit_2]_i^i))((\lambda i\lambda \nu_2.\text{\underline{bring}}(i)(\nu_1, \nu_2, m)))))) \\
& = [\lambda P.\exists u_2(u_2 = \sigma \nu.\text{\underline{bring}}(i)(\nu_1, \nu_2, m))] = [\lambda P.\exists u_2(u_2 = \sigma \nu.\text{\underline{bring}}(i)(\nu_1, \nu_2, m))] = [\lambda P.\exists u_2(u_2 = \sigma \nu.\text{\underline{bring}}(i)(\nu_1, \nu_2, m))]
\end{align*}
\]

From now on, we will concentrate on the denotation of the LF structure in (73a), knowing that we would make the corresponding observations when considering the denotation of (73b). First, let us take a closer look at the denotation of FocP of the LF structure in (73a). The denotation of this FocP can be specified as shown below.

\[
[FocP]^{i,\nu_1} = [\lambda P.\exists u_2(u_2 = \sigma \nu.\text{\underline{bring}}(i)(\nu_1, \nu_2, m))]
\]

Let us assume that in a context \( \kappa \), the value of the register assigned to \( \nu_1 \) is John. Then, as discussed in section 7.4.2.1, \([FocP]^{i,\nu_1}(\kappa)\) is defined only if John brought something for Mary at the index assigned to \( i \). That is, the F-marked \( wh \)-word triggers an existential presupposition, again, due to the semantics of its F-feature.

In the following two paragraphs, we will examine what interpretive effects this presupposition yields at the TopP and CP level of the LF structure in (73a). The denotation of TopP is specified in the following derivation.

\[
[TopP]^i = [ki_1]^i(\lambda i\lambda \nu_1.[FocP]^{i,\nu_1})
\]

\[
= [\lambda P.\exists u_1.P(i)(u_1)](\lambda i\lambda \nu_1.\exists u_2(u_2 = \sigma \nu.\text{\underline{bring}}(i)(\nu_1, \nu, m))) = [\lambda P.\exists u_1.P(i)(u_1)](\lambda i\lambda \nu_1.\exists u_2(u_2 = \sigma \nu.\text{\underline{bring}}(i)(\nu_1, \nu, m)))
\]
Let us assume that the discourse referent \( u_1 \) denotes the register \( \rho \). Then we observe the following with respect to the denotation of TopP derived above: For every context \( \kappa \), \([\text{TopP}]^i(\kappa)\) is defined only if there is a context \( \kappa' \) such that \( \kappa \) and \( \kappa' \) differ at most with respect to the value of \( \rho \) and \( \rho(\kappa') \) brought something for Mary at the index assigned to \( i \). By axiom 1,\(^{68}\) it follows that \([\text{TopP}]^i\) is defined only if someone brought something for Mary at the index assigned to \( i \). That is, the existential presupposition of FocP interacts with the denotation of the non-F-marked \( \textit{wh} \)-word to give rise to what appears to be an existential presupposition with respect to both \( \textit{wh} \)-words. However, it is important to distinguish the true presupposition, the existential presupposition triggered by the F-marked \( \textit{wh} \)-word, from the derived presupposition, which is not a presupposition by itself but rather the truth-conditional content of the non-F-marked \( \textit{wh} \)-word, interacting with the embedded true presupposition.

This distinction is crucial for understanding that the denotation of the interrogative complementizer turns the derived presupposition into what above is called exhaustiveness presupposition (which, again, is not a presupposition by itself but a derived effect of the true presupposition). To see this, consider the denotation of (73a), which is specified in the derivation below.

\[
[\text{CP}]^i = Q^i(\lambda i. [\text{TopP}]^i)
\]

\[
= \lambda p. \lambda j (p(i) \leftrightarrow p(j)) (\lambda i. \exists u_1 \exists u_2 (u_2 = \sigma \nu. \underline{\text{bring}}(i)(u_1, \nu, m)))
\]

\[
= \lambda j (\exists u_1 \exists u_2 (u_2 = \sigma \nu. \underline{\text{bring}}(i)(u_1, \nu, m)) \leftrightarrow \exists u_1 \exists u_2 (u_2 = \sigma \nu. \underline{\text{bring}}(j)(u_1, \nu, m)))
\]

In chapter 3, we discussed that two formulas of dynamic predicate logic are equivalent iff they have the same context change potential. Furthermore, it was pointed out that the biconditional operator ‘\( \leftrightarrow \)’ is the object-language correlate of this

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\(^{68}\)See section 4.2.2.
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meta-language equivalence relation. As a consequence of this, we found that ‘↔’ lends universal force to the existential quantifiers in its scope. This raises the expectation that the biconditional operator is also responsible for the exhaustiveness presupposition of multiple questions. So let us see what effect the biconditional operator denoted by the interrogative complementizer has on the existential presupposition triggered by the F-marked wh-word in the scope of the non-F-marked wh-word. What we find is the following: For every index \( j \) and every context \( \kappa, \kappa' \), \([\text{CP}]^i(j)(\kappa')(\kappa)\) is true iff \( \kappa = \kappa' \) and it holds that for every context \( \kappa_2 \), \([\exists u_1 \exists u_2(u_2 = \sigma \nu. \text{bring}'(i)(u_1, \nu, m))]^i(\kappa)(\kappa_2)\) is equivalent to \([\exists u_1 \exists u_2(u_2 = \sigma \nu. \text{bring}'(j)(u_1, \nu, m))]^i(\kappa)(\kappa_2)\). For this to be the case, it must hold in particular that the former denotation is defined for every result context \( \kappa_2 \). Thus, \([\exists u_2(u_2 = \sigma \nu. \text{bring}'(i)(u_1, \nu, m))]^i\) must be defined for every possible value of (the register denoted by) \( u_1 \). Now remember that by axiom 1, the possible values of \( u_1 \) range over the whole domain of entities. Hence, we can conclude that \([\exists u_1 \exists u_2(u_2 = \sigma \nu. \text{bring}'(i)(u_1, \nu, m))]^i\) is defined only if for everyone, there is something that he brought for Mary at index \( i \), and this result carries over to \([\text{CP}]^i\). This means that we have derived the pair-list presupposition of the double question in (71a).

In the same way, we also derive the pair-list presupposition of (71b) if, as we assume, this question has the LF structure in (73b). Furthermore, the analysis of the current section combines well with the analysis of section 7.4.2.2. This can be seen when we consider the double question in (75a), which has the presupposition in (75b) (see, for example, Dayal 2002).

(75) a. Who read which novel?

b. ⊢ everyone read one and only one novel
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From the analysis of the Hungarian data in (71), we are lead to conclude that the *wh*-pronoun in (75a) does not bear an F-feature but that only the *wh*-determiner of the *in-situ which*-phrase does. Therefore, I assume that (75a) has the Spell-Out structure shown in (76).

(76) \[ [\text{CP } C^{[+Q]} [\alpha \text{ who}_1 [\text{FocP } \lambda \text{read } [\text{DP which}_2^{[+F]} \text{ novel }]]]]] \]

In (76), the *wh*-pronoun underwent movement to the specifier position of a projection \( \alpha \) above FocP. For the moment, I remain agnostic about the categorial status of \( \alpha \) and about how the movement of the *wh*-pronoun is triggered. At LF, the *in-situ which*-phrase must have undergone movement, since otherwise exhaustification would not apply with respect to its NP restriction. Therefore, I assume that the *which*-phrase undergoes covert *wh*-movement to the specifier position of FocP. More precisely, I assume that (75a) has the LF structure shown in (77).\(^{69}\)

(77) \[ [\text{CP } C^{[+Q]} [\alpha \text{ who}_1 [\lambda \text{FocP } \lambda \text{read } [\text{DP which}_2^{[+F]} \text{ novel }]]]]] \]

\(^{69}\)As for the deletion of *wh*-pronoun, I assume, analogously to the categories considered before, that a deleted DP denotes a semantic object which allows the semantic composition to proceed, but which is otherwise empty (see i-a). However, note that again the index of the deleted item is retained. Furthermore, remember that a(n extensional) transitive verb such as *read* has the denotation given in (i-b).

(i) a. \[ [\text{DP}_n]^i = \lambda P. P(\nu_n) \]

b. \[ [\text{read}]^i = \lambda Q. \lambda \nu. Q(i)(\lambda i \lambda \nu'. \text{read}(i)(\nu, \nu')) \]
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On the assumptions made so far, (76) denotes the question extension given in (78).

\[(78) \quad Q_i(\lambda i(\llbracket \text{who} \rrbracket_1)^i(\lambda i\lambda \nu_1([\llbracket F \rrbracket]^i(\lambda i.[\text{which}_2]^i))(\lambda i.[\text{novel}']^i)(\lambda i\lambda \nu_2(\text{novel}'(i)(\nu_1) \wedge \text{read}'(i)(\nu_1, \nu_2))))))\]

This question extension can specified as shown in (79).

\[(79) \quad Q_i(\lambda i.\exists u_1 \exists u_2(\text{At}(u_2) \wedge u_2 = \sigma \nu.(\text{novel}'(i)(\nu) \wedge \text{read}'(i)(u_1, \nu))))\]

From the discussion in section 7.4.2.2, it should be clear that the dynamic formula \(\exists u_2(\text{At}(u_2) \wedge u_2 = \sigma \nu.(\text{novel}'(i)(\nu) \wedge \text{read}'(i)(u_1, \nu)))\) encodes an existential and uniqueness presupposition with respect to novels read by the individual that is the value of \(u_1\). Furthermore, the analysis in the current section has shown that the question operator and the non-F-marked wh-word interact with the presupposition in their scope to give the effect of an exhaustiveness presupposition with respect to the individuals that read a novel. That is, we can conclude that (79) encodes the presupposition shown in (75b).

As a final remark, I want to point out that the semantic singularity of the singular wh-determiner which does not come to the fore if it does not bear an F-feature. Empirically, this can be seen from the fact that the question in (80a) has the presupposition in (80b) (see again Dayal 2002, among others).

\[(80) \quad \text{a. Which boy read which novel?} \quad \text{b. \neg \forall \text{every boy read one and only one novel}}\]

Apart from the additional restriction, the presupposition of (80a) is identical to the presupposition of (75a). This shows that the difference between the singular wh-determiner which and the wh-pronoun who with respect to their semantic singularity does (in general) not appear if they occur as the ex-situ wh-phrase of a
7.4. QUESTION WORDS ARE FOCUSED

This is predicted by the approach discussed here if we assume that the question in (80a) has the LF structure in (81b), which is derived from the Spell-Out structure in (81a).

(81) a. \[
\begin{array}{l}
\text{CP} \quad \text{C} \quad [\text{\underline{+Q}}] \quad [\text{\underline{\text{DP which}}}_1 \text{boy}]\\
\hspace{2em} \text{[FocP Foc} \ [\text{TP \underline{DP which}}_1 \text{boy} \text{read} \ [\text{DP which}}_2^{+F} \text{novel }])])]]]
\end{array}
\]

\[
\begin{array}{l}
b. \quad \text{CP} \quad \text{C} \quad [\text{\underline{+Q}}] \quad [\text{\underline{\text{DP which}}}_1 \text{boy}] \quad [\lambda \text{FocP} \ [\text{\underline{DP which}}_2^{+F} \text{novel }]]
\hspace{2em} \text{[\lambda \text{TP \underline{DP which}}_1 \text{boy} \text{read} \ [\text{DP which}}_2^{+F} \text{novel }])])]]]
\end{array}
\]

Note that in (81b), the delete operation is assumed to apply to the whole lower copy of the first-moved which-phrase. As will become evident immediately, this assumption is necessitated by the semantic properties of the question in (80a). Thus, the LF structure in (81b) strongly suggests that the movement of the first-moved wh-phrase of a multiple question is of a different kind than the movement of the wh-phrases moved afterwards and the movement of the only wh-phrase of a simple wh-question. This coincides well with the former assumptions concerning the role of the F-feature in wh-movement. However, it still needs to be explained what triggers the movement of the first-moved wh-phrase of a multiple question. But let us here concentrate on the semantic interpretation that the LF structure in (81b) receives. The denotation of (81b) is given in (82).

\[
\begin{array}{l}
Q^i(\lambda i, \exists u_1(\text{At}(u_1) \land \text{boy}^i(u_1) \land \exists u_2(\text{At}(u_2) \land \\
\hspace{2em} \land u_2 = \sigma \nu(\text{novel}^i(\nu) \land \text{read}^i(\nu)(u_1, \nu)))))
\end{array}
\]

As one can easily verify, the requirement for the value of \( u_1 \) to be atomic remains vacuous because this value is not required to be the maximal sum individual of some predicate. Hence, (82) encodes the presupposition shown in (80b).

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70 See section 7.4.2.4 below for a context which brings this difference to the fore.
The following section will discuss the single-pair interpretation of double questions (or, more generally, the single-tuple interpretation of multiple questions). Thereby, we will see that the semantic singularity of the singular *wh*-determiner *which* can be brought to the fore even if it occurs as the determiner of the first-moved *wh*-phrase of a multiple question.

### 7.4.2.4 The single-tuple interpretation of multiple questions

It seems that the list interpretation is the most prominent reading of multiple questions. It is sometimes even claimed that in languages such as English, multiple questions have no other reading or, more specifically, that they do not allow for a single-tuple interpretation (see, for example, Bošković 1998). However, as pointed out Dayal (2002), there are contexts that bring the single-tuple interpretation of multiple questions to the fore.\(^{71}\) Consider, for an example, the context given in (83) by the sentence in curly brackets. In the immediate context of this sentence, the double question in (83-Q) must be pronounced in a specific way. As indicated by small capitals, the two *wh*-determiners must bear an accent, whereas all other constituents are left unaccented. In an obvious sense, this intonation shows that (83-Q) relates to the given context and will be used in the following to guarantee this context relatedness.

(83) {This boy read this novel.}

Q: WHICH boy read WHICH novel?

A\(_1\): John read Thomas Mann’s *Buddenbrooks*.

A\(_2\): #John and *Bill* read Mann’s *Buddenbrooks*.

A\(_3\): #John read Mann’s *Buddenbrooks* and Hesse’s *Steppenwolf*.

\(^{71}\)Note that the questions discussed in the following are multiple-question examples of what is called *REF-question* in Wachowicz (1974).
In the context of the sentence in curly brackets, the double question in (83-Q) allows only for a single-pair answer. That is, the reply in (83-A₁) forms a coherent discourse with this question, whereas (83-A₂) and (A₃) are incoherent replies. This suggests that in the context given in curly brackets, (84a) has the single-pair presupposition given in (84b).²²

(84) {This boy read this novel.}

a. WHICH boy read WHICH novel?
b. ⊣ there is one and only one boy who read a novel and there is one and only one novel that was read by a boy

Now, it could be argued that the incoherence of (83-A₂) and (A₃) is not due to a presupposition of the question in (83-Q) but due to the context sentence itself. However, the following considerations show that (83-Q)/(84a) must be assumed to have the presupposition given in (84b) (in the context under discussion, that is). Consider the context sentence given in (85), which differs from the previous one in that its subject phrase is in the plural. Observe that the subject which-phrase of a double question that relates to this context sentence must also be in the plural. This is shown by the inadequacy of (85-Q₁) as opposed to the adequacy of (Q₂).

(85) {These boys read this novel.}

Q₁: #WHICH boy read WHICH novel?
Q₂: WHICH boys read WHICH novel?

²²The presupposition in (84b) can be put differently as in (i).

(i) ⊣ there is one and only one pair \((x, y)\) such that \(x\) is a boy, \(y\) is a novel, and \(x\) read \(y\)
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If (85-Q₁) did not presuppose that there is one and only one boy-novel pair such that the boy read the novel, this fact could not be explained. Especially, the pair-list presupposition *every boy read one and only one novel* is perfectly compatible with the context sentence of (85).

Furthermore, it should be pointed out that the inadequacy of (85-Q₁) in the given context is due to the *semantic* singularity of the subject *which*-phrase. This can be seen from the fact that a *wh*-pronoun can be used in a corresponding context to relate to a plural subject. This is shown by the adequacy of the discourse in (86).

(86)  {They read this novel.}

Q:  WHO read WHICH novel?
A:  John and Mary read Thomas Mann’s *Buddenbrooks*.

---

73Note that it is possible (and even required) to deaccent a singular noun in the context of an occurrence of its plural form:

(i)  {Two boys read Thomas Mann’s *Buddenbrooks*…}
    a.  … and ONE boy Hermann Hesse’s *Steppenwolf*.
    b.  #… and ONE BOY Hermann Hesse’s *Steppenwolf*.

74The same contrast is found between *in-situ which*-phrases and *wh*-pronouns:

(i)  {This boy read these novels.}
Q₁:  #WHICH boy read WHICH novel?
Q₂:  WHICH boy read WHICH novels?

(ii)  {This boy read them.}
Q:  WHICH boy read WHAT?
As will be explicated below, the question in (86-Q) also presupposes that there is one and only one novel $y$ such that some $X$ read $y$, but due to the semantic plurality of the subject $wh$-pronoun, $X$ is the individual sum of (potentially) more than one individual. Correspondingly, we also find that (86-A) is a perfectly adequate answer to (86-Q).

Now remember that we saw in the previous section that the semantic singularity of the singular $wh$-determiner which does not show an interpretive effect if it does not bear an F-feature. Hence, the above observations show that both which-phrases of the double question in (84a) bear an F-feature.\(^{75}\) Therefore, I assume that (84a) has the Spell-Out structure shown in (87).\(^{76}\)

$$\text{(87)} \quad \left[\text{CP} \ C^{(+Q)} \ [\text{FocP} \ [\text{DP} \ \text{which}_1^{[+F]} \ \text{boy} ] \ [\text{TP} \ \text{which}_1^{[+F]} \ \text{boy}] \ \text{read} \ [\text{DP} \ \text{which}_2^{[+F]} \ \text{novel} ]]\right]$$

Note that in (87), both $wh$-words bear an F-feature and that the subject which-phrase underwent $wh$-movement to the specifier of FocP. I assume that at LF, the object which-phrase is adjoined to the subject which-phrase in its derived position. More precisely, I assume that the LF structure of (84a) is as shown in (88).\(^{77}\)

$$\text{(88)} \quad \left[\text{CP} \ C^{(+Q)} \ [\text{FocP} \ [\text{DP}_{1,2} \ [\text{DP}_1 \ \text{which}_1^{[+F]} \ \text{boy}] \ [\text{DP}_2 \ \text{which}_2^{[+F]} \ \text{novel} ]]] \ [\lambda_1 \ \lambda_2 \ [\text{TP} \ [\text{DP}_1 \ \text{which}_1^{[+F]} \ \text{boy}] \ \text{read} \ [\text{DP}_1 \ \text{which}_2^{[+F]} \ \text{novel} ]]]\right]$$

\(^{75}\)This conclusion is corroborated by their bearing an accent. However, note that we have seen above that, conversely, the lack of an accent on a $wh$-word does not necessarily show that it does not bear an F-feature. See section 7.2.6.2 for discussion.

\(^{76}\)Note that the PF deletion indicated in (87) differs from the corresponding deletion at LF. See the LF structure below.

\(^{77}\)The indices on the DP-labels are only notational and serve to clarify the structure of the complex DP.
CHAPTER 7. THE FOCUSING OF WH-WORDS

Note that I assume that the indices of both determiners dominated by DP\(_{1,2}\) adjoin to the sister constituent of this phrase. This, in turn means, that the sister of DP\(_{1,2}\) denotes a relation. Consequently, the denotation of DP\(_{1,2}\) must be generalized quantifier of type \(\langle\langle s, \langle e, \langle e, t\rangle\rangle\rangle, t\rangle\), which furthermore must incorporate the denotation of DP\(_1\) and DP\(_2\). This is achieved by the interpretation rule in (89), where for all dynamic formulas \(\Phi\) and register variables \(\nu\), \(\exists\nu\Phi\) is short for \(\lambda k\lambda k'.\exists\nu\Phi(k)(k').\)

\[
(89) \quad [[\text{DP}_{m,n} \text{DP}_m \text{DP}_n]]^i = \lambda R([\text{DP}_m]^i(\lambda i\lambda \nu.\exists\nu'.R(i)(\nu, \nu')) \land [\text{DP}_n]^i(\lambda i\lambda \nu'.\exists\nu.\lambda R(i)(\nu, \nu'))) 
\]

To see what is achieved by this rule, consider in (90a,b) the denotation of the higher copies of the two \textit{which}-phrases in (88).

\begin{align*}
(90) \text{a. } & [[\text{DP}_1]]^i = [[\text{which}_1]^{[\text{+F}]} \text{boy}]^i = \lambda P'.\exists u_1(\text{At}(u_1) \land u_1 = \sigma \nu.P'(i)(\nu)) \\
\text{b. } & [[\text{DP}_2]]^i = [[\text{which}_2]^{[\text{+F}]} \text{novel}]^i = \lambda P'.\exists u_2(\text{At}(u_2) \land u_2 = \sigma \nu.P'(i)(\nu))
\end{align*}

Hence, by the interpretation rule in (89), the complex DP formed by adjoining DP\(_2\) to DP\(_1\) has the denotation derived below.

\[
[[[\text{DP}_{1,2} \text{DP}_1 \text{DP}_2]]]^i = \lambda R([\lambda P'.\exists u_1(\text{At}(u_1) \land u_1 = \sigma \nu.\exists\nu'.R(i)(\nu, \nu'))) \land [\lambda P'.\exists u_2(\text{At}(u_2) \land u_2 = \sigma \nu.\exists\nu.R(i)(\nu, \nu'))]) \land \exists u_2(\text{At}(u_2) \land u_2 = \sigma \nu'.\exists\nu.R(i)(\nu, \nu'))
\]

\[\text{78The interpretation rule in (89) makes only sense for exhaustivized generalized quantifiers. This means that we either have to restrict the interpretation rule in (89) to this class of DP denotations or the DP-adjunction performed in (88) must be restricted to the specifier of FocP.}\]
7.4. QUESTION WORDS ARE FOCUSED

It should be clear from the discussions in the previous sections that the semantic object derived above encodes an existence and uniqueness presupposition with respect to both arguments of the dynamic relation-in-intension it operates on. However, to be absolutely certain about this, let us proceed to determine the denotation of FocP of the LF structure in (88). The denotation of the sister constituent of DP$_{1,2}$ is given by the following derivation.

$$[[\lambda [1 \lambda T P]]^i] = \lambda \nu_1 \lambda \nu_2. [[[TP]]^i]$$

$$= \lambda \nu_1 \lambda \nu_2(\text{boy}'(i)(\nu_1) \land \text{novel}'(i)(\nu_2) \land \text{read}'(i)(\nu_1, \nu_2))$$

$$=: R^i$$

Then the denotation of FocP of (88) is derived as follows.

$$[[\text{FocP}]]^i = [[[[\text{DP}_{1,2} \text{ DP}_1 \text{ DP}_2]]^i](\lambda i. R^i)$$

$$= \lambda R(\exists u_1(\text{At}(u_1) \land u_1 = \sigma \nu. \exists \nu'. R(i)(\nu, \nu')) \land$$

$$\land \exists u_2(\text{At}(u_2) \land u_2 = \sigma \nu'. \exists \nu. R(i)(\nu, \nu'))) (\lambda i. R^i)$$

$$= \exists u_1(\text{At}(u_1) \land u_1 = \sigma \nu. \exists \nu'. R^i(\nu, \nu')) \land$$

$$\land \exists u_2(\text{At}(u_2) \land u_2 = \sigma \nu'. \exists \nu. R^i(\nu, \nu'))$$

Now assume that there is no boy who read a book at the index assigned to $i$. Then, $u_1 = \sigma \nu. \exists \nu'. R^i(\nu, \nu')$ is undefined for all valuations of $u_1$. Consequently, the first conjunct of the dynamic formula derived above is undefined. We arrive at the same conclusion if we assume that there is more than one boy who read a novel at the index assigned to $i$. On this assumption, $\text{At}(u_1) \land u_1 = \sigma \nu. \exists \nu'. R^i(\nu, \nu')$ is either false or undefined for any valuation of $u_1$. Correspondingly, we find that the second conjunct is defined only if there is one and only one novel that was read by a boy at the index assigned to $i$. This means that the denotation of FocP encodes the single-pair presupposition given in (84b). Since this result carries over to the
overall denotation of (88), we have derived the single-pair presupposition of the double question in (84a).

In the following, I will show that we also derive the correct presupposition for the question in (86) (repeated in 91a), namely the presupposition shown in (91b).

(91) {She/they read this novel.}
    a. WHO read WHICH novel?
    b. ⊣ there is one and only one novel that was read

As will be shown immediately, this presupposition is derived if we assume that (91a) has the LF structure in (92).

(92) $\left[\text{CP C}^{+[\text{Q}]} \left[\text{FocP} \left[\text{DP}_{1,2} \left[\text{DP}_1 \text{who}_1^{[+\text{F}]} \text{[DP}_2 \text{which}_2^{[+\text{F}] \text{novel}]}\right]\right] \right] \right]$
    $\left[\lambda_1 \left[\lambda_2 \left[\text{TP} \left[\text{DP}_1 \text{who}_1^{[+\text{F}]} \text{read} \left[\text{DP}_2 \text{which}_2^{[+\text{F}] \text{novel}]}\right]\right]\right]\right]\right]$]$

Below, you find the denotation of FocP of this LF structure.

$$[\text{FocP}]^i = \exists u_1 (u_1 = \sigma \nu. \exists \nu'(\text{novel}'(i)(\nu') \land \text{read}'(i)(\nu, \nu'))) \land$$
$$\land \exists u_2 (\text{At}(u_2) \land u_2 = \sigma \nu. \exists \nu(\text{novel}'(i)(\nu') \land \text{read}'(i)(\nu, \nu'))$$

Obviously, the denotation of FocP does not encode a uniqueness presupposition with respect to the individuals that read a novel but only with respect to the novels read.

This concludes our discussion of the interpretive effects of the F-feature on wh-words.
Chapter 8

Predictions of the Analysis: Intervention Effects

8.1 Introduction

This chapter deals with a class of phenomena that are known as intervention effects in *wh*-questions.¹ These effects are exemplified by the unacceptability (or marginality) of the constructions in (1).²

(1) a. *Minsu-man nuku-lûl po-ass-ni? (Korean)
   Minsu-only who-ACC see-PAST-Q
   intended: ‘Who did only Minsu see?’

b. *mâymiikhray chôop ?áan nagsii lêmnyay (Thai)
   nobody like read book which
   intended: ‘Which books does nobody like to read?’

c. ??Wer hat niemandem was gezeigt? (German)
   who has nobody what showed

¹See Beck 1996 for a first comprehensive study of this phenomenon.
²See examples (1a) and (21) in Beck (to appear) and (11a) in Beck (1996).
intended: ‘Who showed what to nobody?’

In Beck (2006), intervention effects in wh-questions are characterized as summarized below.

(I) Certain elements, so-called interveners, may not occur between a wh-phrase and its licensing complementizer.

(II) The class of interveners contains (counterparts of) the following elements:

(a) focusing elements such as only, even, and also

(b) the sentence negation not and quantificational elements such as (almost) every, no, most, few (and other nominal quantifiers), always, often, never (and other adverbial quantifiers)

The problematic configuration described in (I) is schematically represented in (2), where $C^{[+Q]}$ is the licensing complementizer of the wh-phrase.

(2) $*[ C^{[+Q]} \ldots [ intervener \ldots wh-phrase \ldots ] \ldots ]$

Syntactically, the licensing of the wh-phrase by $C^{[+Q]}$ is achieved by establishing an agreement relation\(^3\) between these elements (see Chomsky 1998, Pesetsky 2000 and the discussion in section 8.3). Semantically, the licensing is often related to the requirement for all wh-phrases – ex-situ and in-situ ones – to take scope at (or rather immediately above) the question operator denoted by $C^{[+Q]}$. However, in accord with the dynamic question semantics proposed in chapter 3 (and also with the analyses of Kratzer & Shimoyama 2002, Beck 2006) I assume that the semantic licensing consists in the evaluation of the meaning contribution of the wh-phrase by the question operator.

\(^3\)For the moment, this is to be understood in a broad sense. For example, the relation established by an operation like feature movement is also an agreement relation in the broad sense.
Since there seem to be two licensing requirements, there are two possible explanations for the emergence of intervention effects in *wh*-questions: a syntactic one – the intervener prevents the agreement relation to be established (see Pesetsky 2000, Kratzer & Shimoyama 2002, Kratzer 2006), and a semantic one – the intervener prevents the meaning contribution of the *wh*-phrase to be evaluated (see Butler 2000, Beck 2006 and the discussion below). The syntactic account will be briefly discussed in section 8.3.1, but the main body of the remainder of this chapter is devoted to the options for explaining intervention effects in semantic terms (or from a combination of syntactic and semantic factors). In section 8.2, I will discuss the basics of an account that suggests itself as an explanation for intervention effects in the framework of the dynamic semantics used in this thesis. However, it will be shown that although the basic account predicts in which configurations intervention effects arise, it does not explain why the intervention configuration shown in (2) leads to deviance. Therefore, section 8.3 and 8.4 explore the possibilities to strengthen the basic account to derive the deviance of (2). The final solution arrived at in section 8.4 will consist in the demonstration that all what is needed to achieve this result is to take into account the semantic contribution of the F-feature borne by *wh*-words.

---

4The question semantics proposed in Kratzer & Shimoyama 2002 is also suited for providing a semantic explanation. Furthermore, there are mixed syntactic/semantic accounts. For example, the analysis proposed in Beck (1996) is based on the assumption that the syntactic configuration created by the LF movement of a *wh*-phrase across an intervener is ungrammatical. The LF movement is thereby motivated by the semantic requirement for *wh*-phrases to take scope above the question operator.
8.2 The basics of a dynamic semantic account

8.2.1 Honcoop’s observation

Among the different approaches taken to explain the emergence of intervention effects, there is one that is of special relevance to my proposal, namely the dynamic-semantic analysis proposed in Honcoop (1996), Honcoop (1998). Honcoop’s analysis starts out from the observation that the expressions inducing intervention effects “all create so-called inaccessible domains for binding, i.e. an indefinite DP that occurs inside the syntactic scope of these expressions cannot bind a pronoun that occurs outside of their syntactic scope.” (Honcoop 1996, p. 93) Concentrating for the moment on the expressions listed in (1b-ii), this observation is easy to verify. Consider, for example, the sentences in (3), which are to be interpreted with the scope of their operators given in brackets.

(3) a. John didn’t buy a car.  

Honcoop does not consider intervention effects emerging from the configuration characterized in (2) but intervention effects in so-called split constructions. This class of effects is exemplified by the German construction in (i-b) (cf. Beck 1996, Honcoop 1996, Honcoop 1998).

(i) a. Was hat Maria [DP \( t_w \) für Leute] eingeladen?
   what has Maria for people invited
   ‘What people did Maria invite?’

b. ??Was hat niemand [DP \( t_w \) für Leute] eingeladen?
   what has nobody for people invited
   intended: ‘What people did nobody Maria invite?’

However, the dynamic question semantics proposed in this thesis allows us to use Honcoop’s insight for explaining the emergence of an intervention effect in (2).

---

5 Honcoop does not consider intervention effects emerging from the configuration characterized in (2) but intervention effects in so-called split constructions. This class of effects is exemplified by the German construction in (i-b) (cf. Beck 1996, Honcoop 1996, Honcoop 1998).

6 See section 8.3.5.2 for a discussion of the other interveners.

7 Cf. (13) and (16) in Honcoop (1996).
b. Every student bought a car. (every student > a car)
c. No student bought a car. (no student > a car)
d. Most students bought a car. (most students > a car)
e. John never bought a car. (never > a car)

The crucial question with regard to the sentences in (3) is whether the indefinite a car is accessible for being referenced by an anaphoric pronoun. As shown in (4), this is not the case in any of the sentences given in (3).

(4) a. John didn’t buy a car. *It was too expensive.
b. Every student bought a car. *It was too expensive.
c. No student bought a car. *It was too expensive.
d. Most students bought a car. *It was too expensive.
e. John never bought a car. *It was too expensive.

According to the dynamic semantic account of cross-sentential anaphora, inaccessible domains are created by operators/connectives that do not pass on the context change brought about by the formulas in their scope. Such operators are called static (as opposed to dynamic). On the basis of evidence such as that in (4), it must be concluded that negation, disjunction, implication, and the universal quantifier are static.⁸ In contrast to this, we can conclude that conjunction and the existential quantifier are dynamic operators.⁹ This can be drawn from the fact that an indefinite remains accessible within a coordinate structure [XP [and YP]] and in the scope of another indefinite. This is shown by the anaphora data in (5).

---

⁸If disjunction, implication, and the universal quantifier are defined by means of negation, the static nature of these operators is a consequence of the static nature of negation. See Staudacher 1987 and Groenendijk & Stokhof 1991.

(5) a. A man bought a car. It was very expensive.
   b. John borrowed money and bought a car. It was very expensive.

Therefore, we expect no intervention effects to be induced by indefinites and the conjunction and. This expectation is confirmed by the acceptability of the German sentences in (6).10

(6) a. Wann muss ein Brautpaar welche Formulare ausfüllen?
   when must a couple which forms fill in
   ‘When does a couple have to fill in which forms?’
   b. Wer hat was verkauft und was verschenkt?
   who has what sold and what given away?
   literally: ‘Who sold what and gave away what?’

Below, the logical difference between static and dynamic operators is illustrated with the effect they each have on the context change potential of the dynamic formula in (7).

(7) $\exists u. \text{walk}'(i)(u)$

According to Abbr. 1 and 3 defined in section 4.3.2, (7) abbreviates the MTy term in the first line of (8), which can be simplified to the term given in the second line. As discussed in chapter 4, these terms provide a specification of the context change potential of (7).

(8) $\lambda k \lambda k' \exists k_2(k[u]k_2 \land (k_2 = k' \land \text{walk}'(i)(u(k_2))))$
$= \lambda k \lambda k'(k[u]k' \land \text{walk}'(i)(u(k')))$

---

10For the sentence in (6a), see example (73a) in Beck (1996).
The (curried) relation denoted by the terms in (8) holds between all (input contexts) \( \kappa \) and (output contexts) \( \kappa' \) such that (i) \( \kappa \) and \( \kappa' \) differ in at most the value of the register (denoted by) \( u \) and (ii) the value of \( u \) in \( \kappa' \) is an entity that walks (at the index assigned to \( i \)). This means that the dynamic formula in (7) expresses a certain potential to change the interpretation context for subsequent formulas: Each output context \( \kappa' \) is such that the value of \( u \) in \( \kappa' \) is an individual that walks.

Now it is easily checked that this context change potential is overridden by a static operator. More precisely, dynamic formulas derived from (7) by means of negation, disjunction, etc. do not preserve the context change potential expressed by the terms in (8). This is exemplified with the negation of (7), which is shown in (9).

\[
\neg \exists u. \text{walk}'(i)(u)
\]

According to Abbr. 2 defined in section 4.3.2, (9) is the abbreviation for the MTy₃ term in (10).

\[
\lambda \kappa \lambda \kappa' (k = k' \land \neg \exists k_2 (k'[u]k_2 \land \text{walk}'(i)(u(k_2))))
\]

Obviously, the term in (10) denotes a subrelation of the identity relation, namely the relation that holds between any context \( \kappa \) and itself that is not in the domain of the relation denoted by the terms in (8). This means that the dynamic formula in (9) does not change the interpretation context for subsequent formulas. Especially, it holds that in each output context \( \kappa' \), the value of \( u \) in \( \kappa' \) is identical to the value of \( u \) in the input context.

The same can be observed for the dynamic formula in (11), which is a universal formula derived from (7).\(^{11}\)

\(^{11}\)Note that for the purposes of our discussion, it does not matter that the universal quantifier in (11) quantifies vacuously.
(11) \[ \forall u' \exists u. \text{walk}'(i)(u) \]

Again by a stipulation of Abbr. 2, we can expand (11) to the MTy\(_3\) term in (12).

(12) \[ \lambda k \lambda k'(k = k' \land \forall k_2(k[u']k_2 \rightarrow \exists k_3(k_2[u]k_3 \land \text{walk}'(i)(u(k_3)))) \]

Like in the case considered before, we observe that the static operator \(\forall\) overrides the context change potential of (7). That is, (11) denotes a subrelation of the identity relation.

Now it is shown that in contrast to this, the context change potential of (7) is preserved across the scope of a dynamic operator. Consider the dynamic formula in (13), an existential formula derived from (7).\(^\text{12}\)

(13) \[ \exists u' \exists u. \text{walk}'(i)(u) \]

By Abbr. 3, we can expand (13) to (14).

(14) \[ \lambda k \lambda k' \exists k_2(k[u']k_2 \land k_2[u]k' \land \text{walk}'(i)(u(k'))) \]

Obviously, the term in (14) preserves the context change potential expressed by (7) with respect to the value of \(u\): Each output context \(\kappa'\) of (14) is such that the value of \(u\) in \(\kappa'\) is an individual that walks.

### 8.2.2 Wh-intervention effects in the proposed framework

Against the background of the discussion above, intervention effects in \(wh\)-questions indicate that the relation between a \(wh\)-phrase and its licensing complementizer is anaphora like, namely in the sense that the context change brought about by the former feeds the interpretation of the latter. Now note that this is exactly

\(^{12}\text{Again, it does not matter that } \exists u' \text{ quantifies vacuously.}\)
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how this relation is analyzed by the dynamic question semantics advocated here. According to this semantics, it is due to two factors that a *wh*-term functions as a question constituent: (i) the context change potential of the *wh*-term and (ii) the evaluation of this potential by the interrogative complementizer. Therefore, the dynamic approach predicts that a *wh*-term cannot function as a question constituent in an intervention configuration.

To show this more explicitly, let us consider the Thai construction in (1b) (repeated in 15).

(15) *mâymiikhray chôop ?án nagsii lêmnay
teacher like read book which
*intended: ‘Which books does nobody like to read?’

Simplifying somewhat, let us assume that (15) has the LF-structure sketched in (16).\(^{13}\)

(16) \[ \text{CP} C^{[+Q]} [\text{TP} \text{nobody}_1 [\text{VP} \text{read} [\text{DP} \text{which}_2 \text{book} ]]]] \]

As discussed in section 4.5.5, this LF structure denotes the semantic object specified in (17).

\(^{13}\)For the moment, I am not concerned with locating the exact position of an object *wh*-phrase at LF. To derive the intervention effect, a *wh*-phrase must be c-commanded by an intervener at LF. The representation in (i) is an arguably more adequate but essentially equivalent rendering of the LF structure in (16).

(i) \[ \text{CP} C^{[+Q]} [\text{TP} \text{nobody} \text{T} [\text{vP} \text{which book} ] [\text{v'} \text{nobody} [\text{v'} \text{v} [\text{VP} \text{read} [\text{DP} ]]]]]] \]

Furthermore, I ignore the F-feature borne by the *wh*-determiner *lêmnay ‘which’. But see section 8.4 for a demonstration of the fact that the semantics of this feature is one crucial factor in the emergence of intervention effects in *wh*-questions.
The denotations of the lexical items in (17) are shown in the following table. (In the most part, this table is repeating the definitions contained in section 4.5.5).

**The denotations of the atomic constituents of (17)**

\[
\begin{align*}
\mathcal{C}^{\text{\text{+Q}}}_i & = \lambda i \lambda j (p(i) \leftrightarrow p(j)) \\
\text{nobody}_i & = \lambda P. \neg \exists u_n (\text{person}'(i)(u_n) \land P(i)(u_n)) \\
\text{which}_i & = \lambda P \lambda P'. \exists u_n (P(i)(u_n) \land P'(i)(u_n)) \\
\text{book}_i & = \lambda \nu. \text{book}'(i)(\nu) \\
\text{read}_i & = \lambda Q \lambda \nu. Q(i)(\lambda i \lambda \nu'. \text{read}'(i)(\nu, \nu'))
\end{align*}
\]

Consequently, (16) denotes the semantic object given by the expression in (18).

\[
Q^i(\lambda i. \neg \exists u_1 (\text{person}'(i)(u_1) \land \exists u_2 (\text{book}'(i)(u_2) \land \text{read}'(i)(u_1, u_2)))
\]

According to the abbreviations defined in section 4.3.2, the expression in (18) abbreviates the following term.

\[
Q^i(\lambda i \lambda k \lambda k' (k = k' \land \neg \exists k_2 \exists k_3 (k[u_1]k_3 \land \text{person}'(i)(u_1(k_3)) \land k_3[u_2]k_2 \land \text{book}'(i)(u_2(k_2)) \land \text{read}'(i)(u_1(k_2), u_2(k_2))))
\]

With respect to (19), we observe that \(Q^i\) operates on a dynamic proposition which does not express a context change potential with respect to any discourse referent. The first conjunct \(k = k'\) in (19), which is introduced by the negation, expresses just this. This means that the term in (18)/(19) does not represent the extension of a \textit{wh}-question but the extension of a \textit{yes/no}-question, namely of the \textit{yes/no}-question in (20).
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(20) Does nobody read any book?

Put differently, the negation prevents the context change brought about with respect to $u_2$ to be evaluated by the question operator $Q^i$. This shows that the dynamic approach correctly predicts that (15) cannot receive a wh-question interpretation. However, without further assumptions the dynamic approach fails to account for the unacceptability of this construction.

A comparable observation can be made with respect to the German example in (1c). This example is repeated in (21), but with one added detail. The construction in (1c) has an acceptable reading, namely the reading in which the in-situ wh-pronoun was is interpreted as an indefinite.\(^{14}\) In (21), the in-situ wh-pronoun is specified to bear an accent, which excludes the indefinite interpretation (see 21a). Therefore, (21) only allows for the multiple question interpretation, which, however, is only marginally acceptable due to the intervention effect (see 21b).

(21) ??Wer hat niemandem was gezeigt?

who has nobody what showed

a. *‘Who showed nobody anything?’

b. ??‘Who showed what to nobody?’

Let us assume that the construction in (21) has the LF structure simplistically sketched in (22a) and hence the denotation specified in (22b).

(22) a. $\left[ C^{[+Q]} \left[ \text{who}_1 \left[ \text{nobody}_2 \left[ \text{what}_3 \text{show} \right] \right] \right] \right]$

b. $\left[ C^{[+Q]} \right]^i(\lambda i. \left[ \text{who}_1 \right]^i (\lambda i. \left[ \text{nobody}_2 \right]^i (\lambda i. \left[ \text{show} \right]^i (\lambda i. \left[ \text{what}_3 \right]^i))))$

By the now usual assumptions, we thus derive that (22a) denotes the semantic object given by the expression in (23).

\(^{14}\)See section 3.2 and 7.2.6.
Like in the previous example, the negation prevents the context change with respect to \( u_3 \) to be “visible” to the question operator. The only visible context change is the one with respect to \( u_1 \). This can be seen by considering the term in (24).

(24) \[
Q^i(\lambda i. \lambda k \lambda k'(k[u_1]k' \land \neg \exists k_2 \exists k_3(k'[u_2]k_3 \land \text{person}'(i)(u_2(k_3)) \land \\
& \land (k_3[u_2]k_2 \land \text{show}'(i)(u_1(k_2), u_2(k_2), u_3(k_2))))))
\]

Hence, the semantic object given by (23)/(24) represents the extension of the simple \( wh \)-question given in (25)

(25) Who showed nobody anything?

This shows that the dynamic approach correctly predicts reading (21b) to be unavailable for (21).\(^{15}\) However, the dynamic approach also predicts reading (21a) to be available.\(^{16}\)

How can this result be interpreted? On the one hand, the predicted effect (unavailability of an interrogative interpretation for \( wh \)-terms in an intervention configuration) clearly differs from the intervention effect (unavailability of any interpretation, especially, of the indefinite interpretation for these terms). On the other hand, the distribution of the predicted effect seems to be identical to the intervention effect. Therefore, it would be a strange coincidence if intervention effects resulted from an independent factor. Therefore, our goal must be to rule out

---

\(^{15}\)See section 8.4 for a discussion of the (marginal) acceptability of a single-pair interpretation for (21).

\(^{16}\)The same predictions follow from the question semantics proposed in Kratzer & Shimoyama (2002). The latter prediction seems to be the reason for Kratzer & Shimoyama (2002) to opt for a purely syntactic account of intervention effects. See Kratzer 2006 for an elaborate account along the lines of Pesetsky (2000). I am grateful to Doris Penka for discussing this with me.
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the indefinite interpretation while maintaining the insight provided by the dynamic
approach.

In the following two sections, I will present two alternative approaches of how
this can be achieved. The first approach is based on the assumption that the inter-
rogative complementizer shares a numerical index with each question word that it
licenses. This assumption can be independently motivated, but it is highly stipu-
lative in that there are no morphological correlates to numerical indices in natural
languages. Even though the stipulative account is still quite an achievement, I
will show in section 8.4 that for the purpose of accounting for intervention ef-
fects, we can do away with numerical indices if we take into account the semantic
contribution of the F-feature borne by $wh$-words.

8.3 A syntactic-semantic account

8.3.1 Against a purely syntactic account

As mentioned in the introduction to this chapter, it is commonly assumed that
interrogative $wh$-phrases must be syntactically licensed by the interrogative com-
plementizer $C^{[+Q]}$. According to recent syntactic theories, the licensing of an
in-situ $wh$-phrase is induced by some sort of agreement between the $wh$-phrase
and $C^{[+Q]}$ (see Chomsky 1998, Pesetsky 2000). This agreement is established by
a sub-operation of the (phrasal) movement operation, the operation Move-F (see
Chomsky 1995) or Agree (see Chomsky 1998, Chomsky 1999). For the purposes
of the current discussion, we can treat Move-F and Agree as the same operation,
Move-F/Agree.

Departing from these assumptions and concepts, there are approaches trying
to explain intervention effects by a condition on Move-F/Agree (see, for exam-
ple, Pesetsky 2000, Kratzer 2006). However, these approaches are at odds with
the consequences of that property that makes the assumption of an operation like Move-F/Agree worthwhile to entertain, namely that it is a sub-operation of the phrasal movement operation (see Chomsky 1995, Chomsky 1998 for clear indications that Move-F/Agree is just that). Otherwise, it would be nothing more than a descriptive device. Now the problem is the following: If Move-F/Agree is a sub-operation of the phrasal movement operation and is blocked in intervention configurations, phrasal movement is predicted to be also blocked in intervention configurations. However, as is well known, *wh*-phrases can undergo phrasal *wh*-movement across an intervener (at least referential *wh*-phrases can; see Cinque 1990, Rizzi 1990 for discussion). This is shown most clearly by the contrast in (26).\(^{17}\)

(26) a. *Which book didn’t which student read?\(^{17}\)

*intended:* ‘Which book did which student not read?’

b. Which book didn’t John read *which book*?

The unacceptability of (26a) shows that sentential negation is an intervener in English (like in all other languages). Nevertheless, phrasal *wh*-movement can apply across sentential negation, as is shown by the perfect acceptability of (26b).\(^{18}\) This shows that Agree/Move-F is not blocked in intervention configurations.

Moreover, as already mentioned above, it would be a strange coincidence if

\(^{17}\)See example (98d) in Pesetsky (2000), p. 60. Note that in English, interventions effects can often be circumvented by covert phrasal movement. However, such movement is excluded for the subject *which*-phrase in (26a). See Pesetsky 2000, pp. 60ff for discussion. Furthermore, note that the inversion of two *which*-phrases in a double question does not give rise to a superiority effect:

(i) Which book did which student read?


\(^{18}\)As shown in (i), a comparable contrast exists in German (cf. Beck 1996, Beck 2006).
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Agree/Move-F failed to establish the necessary syntactic licensing relation between a *wh*-phrase and $C^{[+Q]}$ in exactly those configurations that prevent the context change potential of the *wh*-phrase to be evaluated by the question operator. Therefore, I assume that *wh*-phrases are syntactically licensed in intervention configurations.

8.3.2 The syntactic licensing of in-situ *wh*-phrases

Despite the conclusion reached in the previous section, we can make an argument that the syntactic licensing of *wh*-phrases plays a crucial role for the emergence of intervention effects. In this section, I will show that intervention effects can be seen to follow from the requirement that the context change potential of syntactically licensed *wh*-phrases be visible to the question operator (in a sense made precise below). To formulate this requirement, we have to answer a question we left open in section 7.3.3, namely the question of what semantic difference there is between the two readings of a string such as (27) (repeated from above).

(27) Wer hat was gekauft? (German)
who has something/what bought

(i) a. ??Wer hat niemandem was gezeigt?
who has nobody what showed
intended: ‘Who showed what to nobody?’

b. Was hat Hans niemandem was gezeigt?
what has Hans nobody what showed
‘What did Hans show to nobody?’

However, it is not clear whether this contrast allows for the same conclusion as the English contrast in (i). The reason is that it could be argued that in the derivation of (i-b), the *wh*-phrase is scrambled above the intervener before *wh*-movement applies. For arguments against such a derivation, see Müller & Sternefeld 1993.
a. ‘Who bought something?’

b. ‘Who bought what?’

To answer this question, let us review how we answered the corresponding syntactic question, namely the question of what LF structures the two readings of (27) reflect. In the course of answering this question, we observed that the interrogative occurrence of *was* bears an accent, whereas the indefinite occurrence does not:

(28) a. Wer hat was gekäuf?
   (i) ‘Who bought something?’
   (ii) *‘Who bought what?’

b. Wer hat wás gekauft?
   (i) *‘Who bought something?’
   (ii) ‘Who bought what?’

From this, we concluded that a *wh*-word functions as a question word if and only if it bears an F-feature. So, in a first approximation, (28a) and (b) were assumed to have the LF structure shown in (29a) and (b), respectively.

(29) The LF structure of (28a) and (b) (to be revised)

   a. $[\text{C}^{[+\text{Q}]} \ [\text{wer}_1^{[+\text{wh},+\text{F}]} \ [[\text{was}_2^{[+\text{wh},-\text{F}]} \ \text{gekauft }] \ \text{hat }]]]

   b. $[\text{C}^{[+\text{Q}]} \ [\text{wer}_1^{[+\text{wh},+\text{F}]} \ [[\text{was}_2^{[+\text{wh},+\text{F}]} \ \text{gekauft }] \ \text{hat }]]]

Then we argued that the feature combination $[+\text{wh},+\text{F}]$ is uninterpretable and that an item bearing these features must enter into an Agree relation with $\text{C}^{[+\text{Q}]}$. Furthermore, we assumed that as a result of establishing this relation one of the offending features is eliminated. In regard to the question of which of the two

---

19 For reasons of brevity, phrasal category labels are omitted in the following discussion.
features is eliminated, the discussion in section 7.4.2 showed that the answer is different for simple and multiple \textit{wh}-questions (and for different readings of multiple questions). However, the specifics of this are not important at this point of the discussion, so let us simply consider in (30) the result of the Agree operations performed in (29a) and (b).

(30) The LF structure of (28a) and (b) (to be revised)
   a. \[ C^{[+Q]} \{ \text{wer}_1^{[+wh,+F]} \{ [\text{was}_2^{[+wh,-F]} \text{gekauft } \text{hat}] ] \} \]
   b. \[ C^{[+Q]} \{ \text{wer}_1^{[+wh]} \{ [\text{was}_2^{[+wh,+F]} \text{gekauft } \text{hat}] ] \} \]

In (30a), Agree between \( C^{[+Q]} \) and \text{wer}_1 eliminates the \textit{wh}-feature of the \textit{wh}-word. Furthermore, note that \textit{was}_2 need not, and hence cannot, enter into an Agree relation with \( C^{[+Q]} \) since it does not bear the uninterpretable feature combination. In (30b), Agree between \( C^{[+Q]} \) and \text{wer}_1 eliminates the F-feature and Agree between \( C^{[+Q]} \) and \textit{was}_2 the \textit{wh}-feature of the respective \textit{wh}-word.

Now assume that \( C^{[+Q]} \) receives the index of all \textit{wh}-words it agrees with. This means that we finally arrive at the assumption that (28a) and (b) have the LF structures shown in (31).

(31) The LF structure of (28a) and (b)
   a. \[ C^{[+Q]} \{ \text{wer}_1^{[+wh,+F]} \{ [\text{was}_2^{[+wh,-F]} \text{gekauft } \text{hat}] ] \} \]
   b. \[ C^{[+Q]} \{ \text{wer}_1^{[+wh]} \{ [\text{was}_2^{[+wh,+F]} \text{gekauft } \text{hat}] ] \} \]

Since in the following we will not be concerned with interpreting the \textit{wh}- and F-features of the \textit{wh}-words in (31a) and (b), we can simplify these LF-structures as shown in (32).

(32) The LF structure of (28a) and (b) (simplified versions)
In the following section, I will show what interpretation the indices on $C^{[+Q]}$ receive and how they can be used to account for intervention effects in *wh*-questions.

### 8.3.3 The semantic interpretation of *in-situ* *wh*-phrases

It is natural to assume that the LF structures in (32b) and (32a) denote the semantic objects given by (33a) and (b), respectively. Thereby, $Q_{\{u_{j1},...,u_{jn}\}}^i$ is the denotation of $C^{[+Q]}_{\{j_1,...,j_n\}}$, which is yet to be defined.

\[
\begin{align*}
\text{(33)} & \quad a. \quad Q_{\{u_1\}}^i(\lambda i. \exists u_1 \exists u_2 \left[ \text{buy}^i(i)(u_1, u_2) \right]) \\
& \quad b. \quad Q_{\{u_1,u_2\}}^i(\lambda i. \exists u_1 \exists u_2 \left[ \text{buy}^i(i)(u_1, u_2) \right])
\end{align*}
\]

Before defining the question operator $Q_{\{u_{j1},...,u_{jn}\}}^i$, let me state what interpretive aspects a semantic object of the form $Q_{\{u_{j1},...,u_{jn}\}}^i(\lambda i. \Phi^i)$ is required to have:

1. The semantic difference between (28b) and (a) shows that the question operator $Q_{\{u_{j1},...,u_{jn}\}}^i$ evaluates *only* the context change potential of $\Phi^i$ with respect to the discourse referents $u_{j1}, \ldots, u_{jn}$.

2. Intervention effects in *wh*-questions show that $Q_{\{u_{j1},...,u_{jn}\}}^i$ requires that $\Phi^i$ have a context change potential with respect to *all* discourse referents $u_{j1}, \ldots, u_{jn}$.

The first aspect is implemented by defining a biconditional operator that is relativized to a given set of discourse referents. This is achieved by the following abbreviation. If $\Phi$ and $\Psi$ are dynamic formulas and $\delta_1, \ldots, \delta_n$ are discourse referents, we write
Abbr. 2a \( (\Phi \xrightarrow{\{\delta_1, \ldots, \delta_n\}} \Psi) \) for
\[
\lambda k \lambda k' (k = k' \land \forall k_2 (k[\delta_1, \ldots, \delta_n] k_2 \rightarrow (\Phi(k)(k_2) \leftrightarrow \Psi(k)(k_2)))).
\]
The second interpretive aspect is implemented with the aid of an abbreviation \([\delta/\Phi]\) which expresses that the dynamic formula \(\Phi\) has a context change potential with respect to the discourse referent \(\delta\). The abbreviation to this effect is defined as follows. For all dynamic formulas \(\Phi\) and discourse referents \(\delta\), we write
\[
[\delta/\Phi] \text{ for } \lambda k \lambda k' (k = k' \land \exists k_2 \exists k_3 (\Phi(k_2)(k_3) \land \delta(k_2) \neq \delta(k_3))).
\]
Now we are in the position to define the denotation of \(C^{(+Q)}_{\{j_1, \ldots, j_n\}}\), namely as given below.

**The denotation of \(C^{(+Q)}_{\{j_1, \ldots, j_n\}}\)**

\[
\llbracket C^{(+Q)}_{\{j_1, \ldots, j_n\}} \rrbracket^i = \lambda p \lambda j ((p(i) \xrightarrow{\{u_{j_1}, \ldots, u_{j_n}\}} p(j)) \land [u_{j_1}/p(i)] \land \ldots \land [u_{j_n}/p(i)])
\]

For convenience, \(\llbracket C^{(+Q)}_{\{j_1, \ldots, j_n\}} \rrbracket^i\) is sometimes written as \(Q^i_{\{u_{j_1}, \ldots, u_{j_n}\}}\) (as already done above).

In the following subsection, I will show that these assumptions account for intervention effects in \(wh\)-questions.

### 8.3.4 How intervention effects are accounted for

To see what is achieved by the assumptions made above, consider once again the question in (21) (repeated below in slightly different form).

(34) ??Wer\(^{(+wh,+F)}\) hat niemandem was\(^{(+wh,+F)}\) gezeigt?
\[\text{who has nobody what showed intended: `Who showed what to nobody?’}\]
In accord with the assumption that $C^{+Q}$ is coindexed with all $wh$-words that it enters into an Agree relation with, (34) must be assumed to have the LF structure in (35).

\[(35) \quad [C^{+Q}_{\{1,3\}} [who_1 [nobody_2 [what_3 show]]]]\]

By the assumptions concerning the denotation of $C^{+Q}_{\{1,3\}}$, this LF structure denotes the semantic object given by the term in (36).

\[(36) \quad Q^i_{\{u_1, u_3\}}(\lambda i. \exists u_1 \neg \exists u_2(\text{person'}(i)(u_2) \land \exists u_3. \text{show'}(i)(u_1, u_2, u_3)))\]

By the definition of $Q^i_{\{u_1, u_3\}}$, this term corresponds to the following expression.

\[\begin{align*}
\lambda j((\exists u_1 \neg \exists u_2(\text{person'}(i)(u_2) \land \exists u_3. \text{show'}(i)(u_1, u_2, u_3)) & \{u_1, u_3\} \\
\leftarrow & \exists u_1 \neg \exists u_2(\text{person'}(j)(u_2) \land \exists u_3. \text{show'}(j)(u_1, u_2, u_3))) \land \\
\leftarrow & \exists u_1 \neg \exists u_2(\text{person'}(i)(u_2) \land \exists u_3. \text{show'}(i)(u_1, u_2, u_3)) \land \\
\land & [u_1/\exists u_1 \neg \exists u_2(\text{person'}(i)(u_2) \land \exists u_3. \text{show'}(i)(u_1, u_2, u_3))] \land \\
\land & [u_3/\exists u_1 \neg \exists u_2(\text{person'}(i)(u_2) \land \exists u_3. \text{show'}(i)(u_1, u_2, u_3))] \\
\end{align*}\]

Let us consider the conjunct in the last line of (37). If we expand the abbreviations used to write down this conjunct, we arrive at the MT$_3$ term in (38) (cf. the term in (24) above).

\[\begin{align*}
\lambda k \lambda k'(k = k' & \land \exists k_3 \exists k_3(u_3(k_2) \neq u_3(k_3)) \land \\
\land & (k_2[u_1]k_3 \land \exists k_4 \exists k_5(k_3[u_2]k_5 \land \text{person'}(i)(u_2(k_5))) \land \\
\land & (k_5[u_3]k_4 \land \text{show'}(i)(u_4(k_4), u_2(k_4), u_3(k_4))))))
\end{align*}\]

Now it can be seen that (38) is contradictory, namely in the requirement that $k_2$ and $k_3$ differ with respect to $u_3$ (expressed by the conjunct $u_3(k_2) \neq u_3(k_3)$ at the end of the first line) in conjunction with the requirement that $k_2$ and $k_3$ differ at
most with respect to $u_1$ (expressed by the conjunct $k_2[u_1]k_3$ at the beginning of the second line). Consequently, (37) is a proposition over the empty relation between contexts. This means that the intension of (34) does not define a (non-trivial) partition of the logical space. This explains the deviance of (34).

### 8.3.5 A comparison with Beck (2006)

This section serves to discuss the similarities and differences between the analysis presented in this section and the focus-semantic account of intervention effects proposed in Beck (2006). In a certain sense, both accounts assume that the question operator is a selective binder of question words, whereas interveners are unselective binders that prevent these selective relations to be established.\(^{20}\) That is, the two accounts agree that intervention configurations have the structure in (39).

\[
(*) \quad [\text{Q}_{\{i,j\}} [\text{intervener} [\ldots wh_i \ldots wh_j \ldots]]]
\]

The indices in (39) represent the selective relations between the question operator Q and the coindexed question words. As for the exact semantic nature of these relations, the two accounts agree in assuming that question words introduce alternatives into the semantic computation which are evaluated by the question operator. However, they make different assumptions about what these alternatives are and where they come from.

In Beck’s focus-semantic account, the alternatives come from the focusing of question words. By virtue of this property, question words introduce focus alternatives into the semantic computation, that is, sets of ordinary semantic values.\(^{21}\)

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\(^{20}\text{Cf. Beck to appear, pp. 31ff.}\)

\(^{21}\text{In this respect, Beck (2006) is closely related to Kratzer & Shimoyama (2002). However, on the latter account alternative sets are introduced by virtue of the indefiniteness of question words. See footnote 22 below.}\)
In the dynamic semantic account, the source of the alternatives lies in the indefiniteness of question words.\(^{22}\) By virtue of their indefiniteness, question words introduce a discourse referent, which can assume alternative values. Interestingly, and quite intriguingly too, both of these assumptions are very well motivated. In chapter 7, it was shown that question words are inherently focused, and in chapter 3, that they are typically closely related to indefinites. Moreover, both of these properties are independently assumed to be the source of semantic alternatives.\(^{23}\)

Therefore, the different assumptions about the source of the semantic alternatives cannot be used to evaluate the adequacy of the two accounts. However, the evaluation can be based on a related difference, namely on the answers the two accounts give to the question of what semantic property makes an operator to an intervener. In the focus-semantic account, interveners are focus-sensitive operators, whereas in the dynamic-semantic account, interveners are operators creating inaccessible domains for anaphoric binding. The empirical adequacy of these assumptions will be investigated in the following two subsections.

### 8.3.5.1 Problematic interveners for the focus-semantic account

The interveners listed in (II-a) (see p. 236) are by definition focus-sensitive operators in the sense that they are most typical representatives of this class of operators. Hence, these interveners provide the prime justification for the focus-semantic account proposed in Beck (2006). In contrast to this, the quantificational interveners listed in (II-b) are usually not classified as focus-sensitive operators since they do not necessarily give rise to focus-affected readings. Therefore, they are *prima facie* problematic for Beck’s account of intervention effects. However, Beck can

\(^{22}\)This is also the assumption of Kratzer & Shimoyama (2002). However, these authors analyse the indefiniteness, or in their view, the indeterminateness of *wh*-words differently than is done here. See chapter 5 for a thorough comparison.

\(^{23}\)For the assumption of focus alternatives, see the tradition starting with Rooth 1992.
refer to evidence that appears to show that quantifiers in fact can associate with focus. In (40), you find examples that show the association of the quantificational adverb *always* with different focused constituents.\(^{24}\)

(40) a. Mary always takes John to the MOVIES.
≈ If Mary takes John anywhere, she takes him to the movies.

b. Mary always takes JOHN to the movies.
≈ If Mary takes anyone to the movies, she takes John to the movies.

Following Rooth (1992), Beck assumes that focus-sensitive operators associates with focus only indirectly, namely by means of a focus anaphor that they share with Rooth’s ‘∼’ operator (which is a “true” focus-associating operator). This is illustrated in (41) for the sentences in (40).\(^{25}\)

(41) a. \[ \text{always}_C [\sim C [\text{Mary takes John to } [\text{the movies}]_{F_1} ] ] ] \]

b. \[ \text{always}_C [\sim C [\text{Mary takes } [\text{John}]_{F_1} \text{ to the movies } ] ] ] \]

Thereby, the index \(C\) represents a variable that *always* shares with the ‘∼’ operator, and which provides the domain of the adverbial quantifier.

As already mentioned, operators like *always* do not necessarily give rise to focus-affected readings. This is shown by the example in (42).\(^{26}\)

(42) Mary always managed to complete [her exams]_F.

To accommodate this fact, *always* is assumed to be a variable focus-sensitive operator in the sense that its domain variable need not be coindexed with the focus

\(^{24}\)See example (68) in Beck (*to appear*), p. 24. Beck ascribes this kind of examples to Mats Rooth.

\(^{25}\)Cf. example (78) in Beck (*to appear*), p. 25.

\(^{26}\)See example (76) in Beck (2006), which Beck ascribes to to Beaver and Clark.
anaphor of the ‘∼’ operator. According to this assumption, (43) is a legit representation of (42).

\[(43) \quad \text{[always}_{C_1} [\sim C_2 [\text{Mary managed to complete [her exams]}_{F_1} ]]\]

This means that the elements listed in (II-b) can be assumed to necessarily co-occur with a ‘∼’ operator without being necessarily linked to this operator. This would explain their intervener status in wh-questions while accounting for their variability with respect to focus association.

However, quantifiers such as always and every are then predicted not only to be interveners in wh-questions but also in constructions like the German sentence in (44).

\[(44) \quad \text{Ich will nur, dass jedes Kind}_{i} [\text{ein Bild von seinem}_{i} \text{ Haustier}]_{F} \text{ malt (und nicht auch, dass jedes Kind seine Eltern malt).}
\]

‘I only want that every child, paints [a picture of its pet]_{F}
(\text{and not also that every child paints its parents}).’

The possibility of a nur ‘only’ to associate with the focused constituent across jeder ‘every’ strongly suggests that this quantifier does not necessarily co-occur with a ‘∼’ operator. This means that the quantificational interveners in (II-b) are in fact problematic for Beck’s focus-semantic account.

More generally, Beck notes that her theory predicts intervention effects in multiple focus constructions of the form in (45).  

\[(45) \quad [\sim_i D \ldots [\sim_j C [\ldots F_j, \ldots F_i, \ldots]] \ldots ]\]

\[^{27}\text{See example (M-Focus) in Beck (to appear), p.32. Note that the indices in (45) only serve to indicate the intended focus associations.}\]
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However, her empirical analysis leads to the conclusion that although focus association across intervening operators is not freely possible, “it must be acknowledged that the effect is limited in ways that (available variants of) the [focus-semantic account] do not lead us to expect.” (Beck to appear, pp. 36f).

8.3.5.2 Problematic interveners for the dynamic-semantic account

The interveners listed in (II-b) are most typical representatives of expressions creating inaccessible domains for anaphoric binding. On the first sight, these operators are thus unproblematic for the dynamic-semantic account of intervention effects. However, according to Kim (2002), the core set of interveners are the focus operators listed in (II-a). This is to say that a language shows intervention effects with the interveners in (II-a) if it shows intervention effects at all. In contrast to this, there is some cross-linguistic variation with respect to the occurrence of intervention effects with the interveners in (II-b). For example, the cognate of the quantificational adverb often does not produce an intervention effect in Korean (see 46b) but focus operators do, as we have already seen in (1a) (repeated in 46a).


b. Minsu-nûn chachu nuku-lûl p’ati-e teliko ka -ss-ni? Minsu-TOP often who-ACC party-DIR take -PAST-Q ‘Who did Minsu often take to the party?’

---

28See Beck to appear, p. 10. I am very grateful to Sigrid Beck for discussing these issues with me.

To account for the acceptability of (46b), it is plausible to assume that Korean is like English in that *in-situ* wh-phrases undergo covert phrasal wh-movement (cf. Pesetsky 2000). More specifically, I assume that (46b) has the LF structure shown in (47).

\[
\text{(47) } [\text{CP [\text{FocP who [Foc′ [TP Minsu-TOP [T [\text{VP often}
\text{[TP t_{who, to the party take} ] T ]] Foc ]]} C^{[+Q]}]]}}
\]

In line with the assumptions made in chapter 4, wh-movement targets the specifier position of a Foc head in the left periphery. As shown in (47), this position c-commands the position occupied by the quantificational adverb *often*. Consequently, an intervention effect is avoided.

Why, then, does an intervention effect occur in (46a)? A natural answer is: because the intervener itself undergoes covert phrasal movement to a position c-commanding the target position of wh-movement. Assume for concreteness that *Minsu-man ‘Minsu-only’* undergoes covert Focus movement and that this movement targets the Foc head too. If the two movements targeting the Foc head are subject to the Minimal Link Condition,\(^{31}\) we must assume that (46a) has the LF structure shown in (48).

\[
\text{(48) } [\text{CP [\text{FocP Minsu-only [Foc′ who [Foc′ [TP t_{Minsu-only}
\text{[T [\text{VP t_{who see} ] T ]] Foc ]]} C^{[+Q]}]]}}
\]

The LF structure obviously includes an intervention configuration, which provides the basis for explaining the contrast in (46).

\(^{30}\)In (47), I do not assume that the topic-marked subject phrase moves to the specifier position of a left-peripheral Topic projection. However, the argument remains valid if we assume such a movement operation to apply.

\(^{31}\)See Chomsky 1995.
Nevertheless, the operators in (II-a) pose a problem for the dynamic-semantic account of intervention effects – at least for the version proposed in this section. The dynamic-semantic account predicts that only those elements are interveners that create inaccessible domains for anaphoric binding. Now the problem is that focus-sensitive operators do not create inaccessible domains, as is shown by the possibility of the anaphoric relations in (49).

(49) a. Only John bought a car. It was very expensive.
   b. Even John bought a car. It was very cheap.

This means that the dynamic-semantic approach proposed in this section does not account for the fact that the operators in (II-a) are interveners. However, I will show in section 8.4.2.1 that the purely semantic version of this approach does. This second version will be presented in the following section.

8.4 A purely semantic account

8.4.1 The crucial observation

In section 8.2.2, it was shown that (without further assumptions such as the ones discussed in the previous section) the dynamic question semantics proposed in this thesis predicts that wh-words receive an indefinite interpretation if they occur

\[\text{\footnotesize 32On the other hand, the donkey sentences in (i) are quite marginal.}\]

(i) a. ??If only John buys a car, it is a very expensive car.
   b. ??If even John buys a car, it is a very cheap car.

Still, the data in (49) must be regarded as problematic for the dynamic-semantic account of intervention effects.
in an intervention configuration. For example, the Hindi construction in (50a) is incorrectly predicted to express the question paraphrased in (50b).

(50) ??koi nahiN kyaa pRhaa? (Hindi)
unany not what read.PERF.M

a. ‘What did no one read?’ (= the “intended” meaning of 50)
b. ‘Did no one read anything?’ (= the meaning predicted so far)

However, so far we did not take into account one crucial aspect of wh-questions that we discussed at length in chapter 7: the fact that (with certain exceptions not immediately relevant here) interrogative wh-words bear an F-feature and that this feature receives a semantic interpretation. As discussed in section 7.4.2.1, the F-feature on a wh-word denotes an exhaustification operator that is presuppositional with respect to the existence (and uniqueness) of a maximal sum individual resulting from exhaustification. Now let us consider what this implies for the construction in (50). That is, let us assume that the wh-pronoun in (50) bears an F-feature and that this feature is interpreted as usual. We then arrive at the conclusion that (50) has the presupposition in (51).

(51) There is something that someone read.

Now assume that the question in (50) indeed expresses the yes/no-question in (50b). Then it holds that the construction in (50) presupposes what is an exhaustive answer to the question it expresses. This means that (50) cannot be used to request for information since it presupposes that the question expressed is already settled. This, I assume, explains the deviance of this construction.

33But see d’Avis 2001, d’Avis 2002, Zanuttini & Portner 2003 for the assumption that self-answering questions have an exclamative use. However, it is this assumption that is in need of
In the following, I will show that the analysis sketched above can be explic-
cated without further assumptions. That is, I will show that the deviance of (50)
follows immediately from what has already been established in chapter 4 and 7.
To recapitulate the crucial result of chapter 7, let us consider the question in (52),
which forms a minimal contrast pair with (50).

(52) kyaa koi nahiin tkyaa paRhaa?
    what anyone not read.PERF.M
    ‘What did no one read?’

In (52), the wh-word kyaa ‘what’ is scrambled over the intervener nahiin ‘not’
so that it is no longer in an intervention configuration. If, as we assume, this still
holds at LF, (52) has the LF structure shown in simplified form in (53).34

\[
(53) \begin{array}{c}
\text{[CP C}^{[+Q]} \text{[XP what}_{2}^{[+F]} \text{[} \lambda 2 \text{[TP no one}_{1} \text{[VP read}]]]]] \\
\end{array}
\]

By the assumptions made in chapter 7, the LF structure in (53) denotes the seman-
tic object given in (54).

The indefinite article presupposes that its restriction set contains more than one element, but this
is excluded by the semantics of the superlative. This explains the deviance of (i).

(i) *I will meet a richest man in the world.

I remain agnostic about the exact category of XP in (53) since this does not play a role for
the discussion at hand. We could assume that in Hindi, scrambling is adjunction to TP or that
F-marked constituents undergo optional focus movement. Accordingly, XP in (53) is either TP or
FocP.
(54) \[ Q^i(λi.∃u_2(u_2 = σν.¬∃u_1 \text{read}'(i)(u_1, ν))) \]

As shown in section 7.4.2.1, the dynamic formula \( u_2 = σν.¬∃u_1 \text{read}'(i)(u_1, ν) \) is defined only if there is something that no one read at the index assigned to \( i \).

Since this carries over to the overall denotation of (53), we find that (52) has the presupposition in (55).

(55) There is something that no one read.

This presupposition is unproblematic because (55) is only a partial answer to the question expressed by (52).

But now, consider again the deviant construction in (50). The LF structure of this construction is shown in simplified form in (56).

(56) \[ \left[ \text{CP C}^{i+Q} \right] \left[ \text{TP no one}_1 \left[ \text{VP what}_2^{[+]F} \text{read } \right] \right] \]

By the very same assumption as before, (58) denotes the question extension given in (57).

(57) \[ Q^i(λi.¬∃u_1 ∃u_2(u_2 = σν.\underbrace{\text{read}'(i)(u_1, ν) \Phi^i}_i)) \]

With respect to the semantic object in (57), we observe the following: The dynamic formula \( \Phi^i \) is defined only if there is something that (the individual that is the value of the register denoted by) \( u_1 \) read at \( i \). Next, observe that \( ∃u_2 \Phi^i \) is true (in any given context)\(^{35} \) if it is defined: If there is something that \( u_1 \) read at \( i \), the register denoted by \( u_2 \) can be assigned a value that is the maximal sum of entities read by \( u_1 \) at \( i \). Consequently, \( ∃u_1 ∃u_2 \Phi^i \) is also true if it is defined (and this is the case only if there is something that someone read at \( i \)). This again means that

\(^{35}\) See the notion of truth of a dynamic formula defined in 4.4.
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\[ \neg \exists u_1 \exists u_2 \Phi^i \] is false in any given context if it is defined. Furthermore, we observe that \( \neg \exists u_1 \exists u_2 \Phi^i \) does not have context change potential since negation is a static operator. This can be seen most clearly when considering the MTy_3 term in (58), which is equivalent to the term abbreviated by \( \neg \exists u_1 \exists u_2 \Phi^i \).

\[ (58) \quad \lambda k \lambda k'(k = k' \land \neg \exists k_2 \exists k_3 (k[u_1]k_2 \land k_2[u_2]k_3 \land u_2(k_3)) = \]
\[ = \ i x (\text{\*read}'(i)(u_1(k_3), x) \land \forall y(\text{\*read}'(i)(u_1(k_3), y) \rightarrow y \Pi x))) \]

Obviously, (58) denotes a subrelation of the identity relation on the set of contexts, and this means that \( \neg \exists u_1 \exists u_2 \Phi^i \) does not have context change potential. Now let us confirm with the aid of the term in (58) that we indeed have drawn the correct conclusion with respect to the truth or rather falsity of \( \neg \exists u_1 \exists u_2 \Phi^i \). By axiom 1,\(^{36}\) (58) can be equivalently rewritten as (59) (where \( z \) and \( z' \) are variables of type \( e \)).

\[ (59) \quad \lambda k \lambda k'(k = k' \land \neg \exists z \exists z'(z' = i x (\text{\*read}'(i)(z, x) \land \]
\[ \land \forall y(\text{\*read}'(i)(z, y) \rightarrow y \Pi x))) \]

Now it can be easily seen that the condition that there be no entities \( z \) and \( z' \) with the specified properties cannot be met if the presupposition expressed by the \( \iota \)-term is satisfied. Thus, \( \neg \exists u_1 \exists u_2 \Phi^i \) denotes the empty relation. Furthermore, note that this holds for all assignments to the index variable \( i \). This means that in all contexts, the intension of (57) defines the trivial partition of the set of indices on which (57) is defined. That is, (57) does not express a question in the semantic sense of the term (although it is a question in the syntactic sense). This explains the deviance of (50).

To conclude this section, let me point out that the same analysis as above can be given for quantificational interveners other than negative QPs. To see this,
consider the (hypothetical) LF structure in (60), which is an instance of an intervention configuration created by the universal QP everyone.

(60) \[ CP^{[\text{+Q}]}_{\text{TP}} \text{ everyone}_1 [VP \text{ what}_2^{[\text{+F}]} \text{ read }]] \]

The LF structure in (60) denotes the question extension in (61).

(61) \[ Q^i(\lambda i. \forall u_1 \exists u_2 (u_2 = \sigma \nu (\text{read}'(i)(u_1, \nu)))) \]

The dynamic formula \( \Phi^i \) in (61) abbreviates an MTy\(_3\) term that is equivalent to the term abbreviated by the expression in (62).

(62) \[ \lambda k \lambda k'(k = k' \land \forall k_2[k | u_1]k_2 \rightarrow \exists k_3[k_2[u_2]k_3 \land u_2(k_3) = \right) = \lambda x(\text{read}'(i)(u_1(k_3), x) \land \forall y(\text{read}'(i)(u_1(k_3), y) \rightarrow y \Pi x)) \]

The term in (62) obviously denotes a subrelation of the identity relation on the set of contexts, namely the identity relation itself. This can be seen most easily by considering the MTy\(_3\) term in (63), which is equivalent to (62) (again by axiom 1).

(63) \[ \lambda k \lambda k'(k = k' \land \forall z \exists z'(z' = \right) = \lambda x(\text{read}'(i)(z, x) \land \forall y(\text{read}'(i)(z, y) \rightarrow y \Pi x)) \]

Obviously, the condition that for each entity \( z \), there be an entity \( z' \) with specified properties is always met if the presupposition expressed by the \( \iota \)-term is satisfied. Thus, \( \Phi^i \) denotes the identity relation on the set of contexts, and this holds for all assignments to the index variable \( i \). Hence, we find that the intension of (61) defines in all contexts the trivial partition of the set of indices on which (61) is defined. This explains the deviance of constructions of the form (60).
8.4.2 Multiple wh-questions

In this section, I will demonstrate that the result achieved above carries over to more complex instances of intervention configurations. Consider, for example, the multiple wh-construction in (64), in which one of the question words is in an intervention configuration.

(64) ??Wer hat nicht was gelesen?  
who has not what read

a. *‘Who didn’t read what?’  (= the “intended” meaning of 64)

b. ‘Who didn’t read anything?’  (= the meaning predicted so far)

As pointed out in section 8.2.2, (64) is predicted to express the simple wh-question paraphrased in (64b) if (64) is analyzed along the lines of the dynamic question semantics proposed in chapter 4. However, this does not yet take into account the presupposition that is triggered by the F-feature of the in-situ wh-pronoun was ‘what’ in the above intervention configuration. Remember that we saw in section 7.4.2.3 that (outside of special contexts) multiple question have a list presupposition that is triggered by an F-marked wh-word in the scope of a non-F-marked wh-word. For instance, the double question in (65) has the pair-list presupposition given underneath, and this presupposition is due to the semantic contribution of the F-feature borne by the in-situ wh-pronoun.37

(65) Who read what[^F]?

37Following Pesetsky (2000), I assumed in section 7.4.2.3 that in English, in-situ wh-phrases undergo covert phrasal movement and specifically that this movement targets the specifier of FocP. On these assumptions, (65) has the LF structure in (i).

(i) [CP C[^Q] [FocP who1 [λ1 [FocP what[^F] [λ2 [TP who1 read what[^F]]]]]]]]
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\[ \neg \text{\每个人都读了某事} \]

This presupposition constitutes only a partial answer to the multiple question expressed by (65). However, if we now look back at the wh-construction in (64) and assume that this construction indeed expresses the simple wh-question paraphrased by (64b), we observe that the pair-list presupposition \textit{everyone read something} is an exhaustive answer to (64b). This means that analogous to the cases discussed in the previous section, there is reason to assume that the wh-construction in (64b) is deviant because it is a self-answering question.

Let me now show that the observation made above can be made precise by considering what semantic object we arrive at if we assume that the wh-construction in (64b) has the LF structure shown in simplified form in (66).

(66) \[
\text{[CP C}\text{[Q]}\text{[TopP \ensuremath{\text{wer}}_1 [\lambda 1 [\text{[TP } \ensuremath{\text{nicht}} \text{[VP \ensuremath{\text{was}}_2^[F] \text{liest}]})]]])}]
\]

The most relevant aspect of the LF structure in (66) is the position of the \textit{in-situ} wh-pronoun \textit{was} ‘what’. As you can see, I assume that this pronoun remains in the intervention configuration created by \textit{nicht} ‘not’. Thereby, I follow Pesetsky (2000) in the assumption that there is a parametric difference between English and German due to which \textit{in-situ} wh-phrases undergo covert phrasal movement to the left periphery in English but not in German. Furthermore, note that the \textit{in-situ} wh-pronoun bears an F-feature, whereas the \textit{ex-situ} wh-pronoun does not. On the

\[ \text{38A more elaborate LF structure for (64b) is given in (i).} \]

(i) \[
\text{[CP C}\text{[Q]}\text{[TopP \ensuremath{\text{wer}}_1 [\lambda 1 [\text{[FocP Foc} [\text{[TP } \ensuremath{\text{nicht}} \text{[VP \ensuremath{\text{was}}_2^[F] \text{gelesen}]}) [\text{hat}]})])}]
\]

\[ \text{39In Pesetsky (2000), this assumption is (among others) motivated by the fact that intervention effects occur in German but not in English (aside from inverted multiple questions). However, Pesetsky offers a syntactic account of intervention effects. See the discussion in section 8.3.1.} \]
usual assumptions, (66) denotes the question extension shown in (67).

\[ (67) \quad Q^i(\lambda i. \exists u_1 \neg \exists u_2 (u_2 = \sigma \nu. \text{read}'(i)(u_1, \nu))) \]

To see that the intension of (67) defines in all contexts the trivial partition of the set of indices, consider the dynamic formula \( \Phi^i \) above. It can be shown along the same lines as in the previous section that for all valuations of \( u_1 \), \( \Phi^i \) denotes the empty relation if it is defined. Now consider the dynamic formula \( \exists u_1 \Phi^i \).

By definition, \( \exists u_1 \Phi^i \) abbreviates the MTy_3 term \( \lambda k. \lambda k'. \exists k_2 (k[u_1]k_2 \land \Phi^i(k_2)(k')) \).

Hence, since \( \Phi^i \) denotes the empty relation on the set of contexts, it follows that \( \exists u_1 \Phi^i \) also denotes the empty relation on the set of contexts. Since this holds for all assignments to \( i \), we find that the intension of (67) defines in all contexts the trivial partition of the set of indices on which (67) is defined. This again means that the \( wh \)-construction in (64) does not define a proper semantic question, which accounts for the deviance of this construction.

To round this section off, I will show that the analysis discussed here works also for universal QPs in multiple questions. To demonstrate the intervener status of universal QPs, let us consider the multiple question in (68).

\[ (68) \quad \text{Wem hat jeder wäs gezeigt?} \]  
\[ \text{(German)} \]

whom has everyone what showed

a. *‘Who did everyone show what?’ \( (C^{[Q]}_j > \text{jeder} > \text{was}) \)

b. ‘Tell me for everyone who he showed what!’ \( \text{(jeder} > C^{[Q]}_j > \text{was}) \)

The question in (68) does not allow for the reading in (68a) but only for the reading in (68b). The available reading arguably results from the universal QP \textit{jeder} ‘everyone’ taking wide scope over the question operator (see Krifka 2001b for discussion). Then the unavailability of reading (68a) indicates that \textit{jeder} creates
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An intervention configuration for the in-situ wh-word was ‘what’ if it does not take wide scope. This means that it must be shown that the LF structure in (69) does not give rise to a proper semantic question.

(69) \[ CP \ C_{\text{[+]Q}} \ [\text{TopP} \ wem_2 \ [\lambda 2 \ \text{TP} \ \text{jeder}_1 \ \text{was}_2 \ \text{was}_3^{[+F]} \ \text{zeigt}]] \]

To see that this is indeed the case, consider in (70) the denotation of the LF structure in (69).

(70) \[ Q^i(\lambda i. \exists u_2 \ \forall u_1 \ \exists u_3 (u_3 = \sigma \nu, \text{show}^i(u_1, u_2, \nu))) \]

In the previous section, it was shown that universal formulas of the form of \( \Phi^i \) in (70) denote the identity relation on the set of contexts. More precisely, it can be shown that for all valuations of \( u_2 \), the dynamic formula \( \Phi^i \) denotes the identity relation if it is defined. Consequently, the dynamic formula \( \exists u_2 \Phi^i \) also denotes the identity relation if it is defined. Thus, we find that the intension of (70) defines in all contexts the trivial partition of the set of indices.

8.4.2.1 The deviance induced by focus operators

In section 8.3.5.2, we observed that focus operators such as only and even do not create inaccessible domains for anaphoric binding. Consequently, the first version of the dynamic-semantic approach to intervention effects failed to account for the deviance of constructions like (71) (repeated from above).

(71) *Minsu-man nuku-lûl po-ass-ni? (Korean)

Minsu-only who-ACC see-PAST-Q
intended: ‘Who did only Minsu see?’
In this section, I will show that this problem is resolved once we take into account the presupposition that is triggered by the F-feature of the *wh*-word *nuku* ‘who’.

To see how this presupposition interacts with the meaning of *-man* ‘only’, let us first consider meaning of the sentence in (72). What we find is that the indefinite phrase *a car* contributes both to the asserted meaning of this sentence and to its presupposition. This can be concluded from the standard presupposition tests, which give the following results: The sentence in (72) asserts (⊢) and presupposes (⊣) the propositions given underneath.\(^{40}\)

(72) Only John saw a girl.

\[
\begin{align*}
\downarrow & \text{No person other than John saw a girl.} \\
\neg & \text{John saw a girl.}
\end{align*}
\]

Now let us specify on the basis of these observations the denotation of the sentence in (72). To do this, we need to introduce some abbreviations. To specify the presupposition of (72), the following abbreviation proves handy: If Φ is a dynamic formula, we write

\[\partial \Phi \text{ for } \lambda k \lambda k'. \partial \Phi(k)(k').\]

Furthermore, to give the denotation of proper names we henceforth use the following abbreviation: For all constants c of type e, we write

\[c \text{ for } \lambda k. c.\]

\(^{40}\)To see this, consider, for example, the result of the question test in (i).

(i) Q: Did only John see a girl?  
A: No, other people saw a girl too.  
A’: #No, he didn’t see a girl.
Then the denotation of (72) can be specified as shown in (73).\(^{41}\)

\[
\lambda_i(\forall u([a \text{ girl}]^i(\lambda i \lambda \nu'. \text{see}'(i)(u, \nu'))) \rightarrow \text{Ident}(u, \underline{\text{john}})) \land \\
\land \partial [a \text{ girl}]^i(\lambda i \lambda \nu'. \text{see}'(i)(\underline{\text{john}}, \nu'))) 
\]

Observe that by the semantic contribution of \textit{only}, the proposition in (73) expresses that everybody who met a girl is identical to John (if its presupposition is satisfied).

If we assume, as is natural, that -\textit{man} has the same semantics as \textit{only}, the construction in (71) as the denotation in (74).

\[
Q^i(\lambda i(\forall u([\text{who}^+\text{F}]^i(\lambda i \lambda \nu'. \text{see}'(i)(u, \nu'))) \rightarrow \text{Ident}(u, \underline{\text{minsu}})) \land \\
\land \partial [\text{who}^+\text{F}]^i(\lambda i \lambda \nu'. \text{see}'(i)(\underline{\text{minsu}}, \nu'))) 
\]

By resolving $[\text{who}^+\text{F}]^i$, (74) can be further specified as shown in (75).

\[
Q^i(\lambda i(\forall u(\exists u'(u' = \sigma \nu'. \text{see}'(i)(u, \nu'))) \rightarrow \text{Ident}(u, \underline{\text{minsu}})) \land \\
\land \partial \exists u'(u' = \sigma \nu'. \text{see}'(i)(\underline{\text{minsu}}, \nu'))) 
\]

In the following, it will be shown that the intension of (75) defines a trivial partition of the set of indices on which it is defined. Assume that there is an individual other than Minsu. Then the universal formula in the first line of (75) is false in every context if it is defined: As discussed in the previous sections, the existential formula $\exists u'(u' = \sigma \nu'. \text{see}'(i)(u, \nu'))$ is true in every context and for every

\(^{41}\)Remember that $\text{Ident}(\delta, \delta')$ identifies the values of two terms $\delta$ and $\delta'$ of type $\varepsilon$. That is, this expression is short for $\lambda k \lambda k'(k = k' \land \delta(k) = \delta'(k))$. See section 5.5.1 for the declaration of this abbreviation.
valuation of $u$ if it is defined. However, there is a context in which the formula \textbf{Ident}($u, \text{minsu}$) is false, since by assumption there is an individual other than Minsu. Now assume that Minsu is the only individual. Then the universal formula in the first line of (75) is trivially true in all contexts. Furthermore, the formula in the second line of (75) is true in all contexts if it is defined. This means that the overall formula in (75) defines either the empty relation on the set of contexts or the identity relation. Since this holds for all assignments to $i$, we can conclude that (75) does not define a proper semantic question. Thus, we account for the fact that deviance arises if a \textit{wh}-word appears in the scope of \textit{only}.

The same conclusion can be drawn for the focus operator \textit{even}, as will be shown with the following (slightly more involved) argument. First, consider the assertion ($\vdash$) and presupposition ($\dashv$) of the sentence in (76) (for the presupposition triggered by \textit{even}, see Kay 1990).

\begin{equation}
(76) \quad \text{Even John bought a car.}
\end{equation}

$\vdash$ John bought a car.

$\dashv$ Every person other than John was more likely to buy a car.

Let us assume that there is a relation \textbf{MoreLikely} that is true for a pair of dynamic propositions $\lambda i.\Phi$ and $\lambda i.\Psi$ if $\lambda i.Phi$ is more likely than $\lambda i.\Psi$. This relation is used in the following abbreviation. For all dynamic formulas $\Phi$ and $\Psi$, we write

\textbf{MoreLikely}($\lambda i.\Phi, \lambda i.\Psi$) for $\lambda k\lambda k'(k = k' \land \text{MoreLikely}($\lambda i.\Phi, \lambda i.\Psi$))

Then the denotation of the sentence in (76) can be specified as shown in (77).
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(77)  \[ \lambda_i([a\ car]^i(\lambda i\lambda\nu'.buy'(i)(\underline{john},\nu'))) \land \\
\land \partial\forall u(-Ident(u,\underline{john}) \rightarrow \\
\rightarrow MoreLikely(\lambda_i.[[a\ car]^i(\lambda i\lambda\nu'.buy'(i)(u,\nu'))), \\
\lambda_i.[[a\ car]^i(\lambda i\lambda\nu'.buy'(i)(\underline{john},\nu'))])) \]

Now let us think about what must be the case for a dynamic proposition \( \lambda_i.\Phi \) to be more likely than another dynamic proposition \( \lambda_i.\Psi \). Plausibly, a minimal requirement should be that \( \lambda_i.\Phi \) is true at more indices and in more contexts than \( \lambda_i.\Psi \). Then consider the (hypothetical) LF structure in (78).

(78)  \([\text{CP}^{[+Q]} [\text{even John bought what}^{[+F]}]]\]

On the assumptions as those for the previous example, the LF structure in (78) denotes the question extension given in (79).

(79)  \([\text{Q}^{i}(\lambda_i(\exists u(\underline{u} = \sigma\nu'.buy'(i)(\underline{john},\nu'))) \land \\
\land \partial\forall u(-Ident(u,\underline{john}) \rightarrow \\
\rightarrow MoreLikely(\lambda_i.\exists u'(u' = \sigma\nu'.buy'(i)(u,\nu'))), \\
\lambda_i.\exists u'(u' = \sigma\nu'.buy'(i)(\underline{john},\nu'))))))\]

To see that the intension of (79) defines the trivial partition of the set of indices on which it is defined, note that the existential formula in the first line of (79) is defined only for those indices at which John actually bought something. Therefore, let us consider only those models for which this formula is defined at all indices. What we then observe is that the dynamic proposition in the third line of (79) cannot be more likely that the dynamic proposition in the forth line because the latter
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is true at all indices and in all contexts. Thus, we can conclude that the semantic
object given above does not define a proper semantic question. This explains the
deviance of constructions of the from (78).

8.4.2.2 The single-tuple interpretation of intervention constructions

In section 7.4.2.4, we discussed the single-tuple interpretation of multiple ques-
tions. In German, this reading arises in the the same contexts that are used in
Dayal (2002) to evoke this reading in English. This is illustrated in (80) with the
single-pair reading of a double question.

(80) {Sie haben das gelesen.} (German)
{‘They read that.}

Q: Wer hat was gelesen?
Who read what?
A: Hans und Maria haben Thomas Manns Buddenbrooks gelesen.
‘Hans and Maria read Thomas Mann’s Buddenbrooks.’

The single-tuple interpretation was shown to result from an LF structure in which
all wh-words undergo movement to the specifier of FocP, which requires them
to all bear an F-feature. Accordingly, the double question in (80-Q) has the LF-
structure shown in (81).42

42Note that I still assume that in German, the F-feature on a wh-word does not in general force
phrasal movement to FocP.
Consequently, we predict that an intervention construction such as the one in (82) has an acceptable reading.

(82) (*Wer hat oft was gelesen?
wer has often what read
intended: ‘Who often read what?’

This can be seen by considering the syntactic structure in (83), which is predicted to be a possible LF-structure of (82).

(83) \[
\begin{array}{l}
\text{[CP} \ C^[+Q]} \\
\text{\quad [FocP [DP}_{1,2} \ \text{wer}_1^{[+F]} \ \text{was}_2^{[+F]}]} \\
\text{\quad \quad [\lambda_1 [\lambda_2 [TP \ \text{oft}_1 [VP \ \text{was}_2 \ \lambda_1 \lambda_2 \ \text{gelesen}] \ \text{hat}]}}
\end{array}
\]

In Last, the in-situ wh-word *was* is no longer in an intervention configuration and hence (82) is predicted to have a possible reading, namely, the single-pair reading that the denotation of (83) gives rise to. There is ample evidence that this prediction is in fact correct. First of all, it is pointed out in Beck (1996) that at least some speakers find intervention constructions such as (83) quite acceptable, but only under the single-pair reading (see Beck 1996).43 Moreover, we find that an intervention construction is rendered fully acceptable by contexts that evoke its single-tuple reading. This is demonstrated with the discourse in (84).44

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43See Pesetsky 2000 for the same observation in English.

44The question in (84-Q) is chosen differently from (82) because it is not possible to construct a sentence in which a weak object pronoun like an unstressed demonstrative pronoun *das* ‘that’ is c-commanded by a VP adverb such as oft ‘often’:

(i) *Sie haben oft das gelesen.
They have often that read.
intended: ‘They often read that.’
(84) {Diesen Leuten darf keiner diese Geschichten erzählen.} 
these people may no one these stories tell 
{‘No one may tell these stories to these people.’}

Q: Wem darf keiner welche Geschichten erzählen? 
whom may no one which stories tell 
‘To whom may no one tell which stories?’

A: Keiner darf unseren Nachbarn die Geschichten über Hans erzählen. 
‘No one may tell our neighbours the stories about Hans.’

This concludes our discussion of intervention effects in *wh*-questions.

The reason is that weak pronouns are forced to undergo movement to the left edge of the German *mittelfeld*:

(ii) Sie haben das oft *t* das gelesen. 
They have that often read. 
‘They often read that.’

Note, however, that (84-Q) gives rise to an intervention effect if it is judged outside of a context such as the one in (84).
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