King's Research Portal

DOI:

[10.1093/jos/21.3.283](https://doi.org/10.1093/jos/21.3.283)

Document Version

Peer reviewed version

[Link to publication record in King's Research Portal](#)

Citation for published version (APA):

Purver, M., & Ginzburg, J. (2004). Clarifying Noun Phrase Semantics. *Journal of Semantics*, 21(3), 283 - 339.
<https://doi.org/10.1093/jos/21.3.283>

Citing this paper

Please note that where the full-text provided on King's Research Portal is the Author Accepted Manuscript or Post-Print version this may differ from the final Published version. If citing, it is advised that you check and use the publisher's definitive version for pagination, volume/issue, and date of publication details. And where the final published version is provided on the Research Portal, if citing you are again advised to check the publisher's website for any subsequent corrections.

General rights

Copyright and moral rights for the publications made accessible in the Research Portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognize and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the Research Portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the Research Portal

Take down policy

If you believe that this document breaches copyright please contact librarypure@kcl.ac.uk providing details, and we will remove access to the work immediately and investigate your claim.

Clarifying Noun Phrase Semantics

Matthew Purver, Jonathan Ginzburg

August 22, 2003

Abstract

Reprise questions are a common dialogue device allowing a conversational participant to request clarification of the meaning intended by a speaker when uttering a word or phrase. As such they can act as semantic probes, providing us with information about what meaning can be associated with word and phrase types. This paper discusses the evidence provided by reprise questions concerning the meaning of common nouns, quantified noun phrases and determiners. We argue that this evidence runs contrary to the traditional semantic representation of such noun phrases as sets of sets, and instead leads us to a treatment as sets of individuals. We outline a resulting analysis within the HPSG framework, and discuss its extension to such phenomena as quantifier scope, anaphora and monotone decreasing quantifiers.

1 Introduction

1.1 Overview

Reprise questions are a common dialogue device allowing a conversational participant (CP) to request clarification of some property of an utterance (or part thereof). In this paper we are concerned specifically with those reprise questions which concern the meaning intended by a speaker when uttering a word or phrase (see below). By virtue of this, they can provide us with information about what meaning can be associated with word and phrase types, and therefore provide useful extra evidence for the field of semantics – a domain overfull with theories underdetermined by evidence. This paper discusses the evidence provided by reprise questions concerning the semantics of common nouns (CNs), determiners and quantified noun phrases (QNP), and outlines some general implications for NP semantics, together with some implications for semantic representation in HPSG and other related underspecified representations.

Our central claim is that reprise questions show that QNPs denote (situation-dependent) individuals – or sets of individuals – rather than sets of sets, or properties of properties. We develop a witness-set-based analysis which treats all QNPs in a coherent manner, and allows an analysis of reprise questions via grounding. We also show how anaphora and quantifier scope can be accounted for within this analysis, via a view of NPs as functional, and show how non-monotone-increasing NPs can be represented.

1.2 Content of Reprise Questions

Ginzburg and Cooper (2001, forthcoming) (hereafter G&C) provide an analysis of proper name (PN) reprise questions which treats them as questions concerning the semantic content of the PN (which is taken to be a referential index, the intended referent of the name). In this way, a reprise such as that in example (1) can be taken to be paraphrasable as shown:

- (1)

A:	Did Bo leave?
B:	BO?
~	<i>“Is it BO_i that you are asking whether i left?”</i>
~	<i>“Who do you mean by ‘Bo’?”</i>

The two readings shown here are distinct, but both concern the content of the PN *Bo*. An overview of this analysis is given in section 2.1 below.

G&C’s analysis applies only to PNs. However, it is clear that other nominal fragments¹ can be reprised, and our intention in this paper is to examine such reprises and, where possible, propose a suitable extended analysis.

It is also clear that not all nominal fragment reprises involve querying a simple referential index. On the other hand, it seems uncontentious to propose that such questions² must query at least *some part of*

¹And, indeed, fragments of other categories, but we leave these for future work.

²Or rather, *content readings* of such questions – see section 2.1.4.

the semantic content of the fragment being reprised, and we take this as our basic hypothesis. A stronger, but intuitively attractive, proposal might be that such questions query *exactly* the semantic content of the fragment – we will examine the possibility of both these hypotheses throughout.

We state the two versions of the hypothesis here for reference:

1.2.1 Reprise Content Hypothesis (weak version)

A nominal fragment reprise question queries a part of the standard semantic content of the fragment being reprised.

1.2.2 Reprise Content Hypothesis (strong version)

A nominal fragment reprise question queries exactly the standard semantic content of the fragment being reprised.

1.3 Corpus Evidence

We have used the British National Corpus (BNC) (see Burnard, 2000) to investigate actual occurrences of reprise questions in dialogue. Questions were found using SCoRE (see Purver, 2001), by searching for common reprise patterns (e.g. words repeated from the immediately preceding turn). This method means that some examples may have been missed, but provides us with a lower bound: at least those questions that were found must be accounted for by a semantic theory.

The intended meaning of reprise questions is often ambiguous. Throughout this paper we give possible and impossible paraphrases – we have of course had to construct these ourselves, but have made every effort to infer them not only from the questions themselves but from the dialogue context, particularly the responses of other CPs. Possible paraphrases are therefore those which we believe to be consistent both with the question and the context, and impossible ones those which would be inconsistent with either. This method may seem *ad hoc*, but is based upon the method used in (Purver et al., 2001, 2003a) to classify reprise question types: this was shown to have good statistical reliability when the judgements of two independent markers were compared.

The resulting quantity of data is not enough to allow for serious statistical analysis to good degrees of confidence, but does provide us with a significant number of examples that must be accounted for. However, while this is the case for CNs, verbs, and definite and indefinite NPs, few examples could be found of reprises of other QNPs, or of determiners. In the corresponding sections we therefore have to rely more on our intuition and invented examples, but we have pointed out below where this is the case.

1.4 HPSG Notation

Our analysis is couched in HPSG (Pollard and Sag, 1994), and in particular the version described in (Ginzburg and Sag, 2000). Like G&C, we believe that our analysis is applicable to other frameworks, but HPSG provides us with certain features that are advantageous for the analysis of reprise questions (in particular, direct access to phonological, syntactic, semantic and contextual information).³ In an attempt both to save space and to make our examples more readable for those not familiar with HPSG attribute-value matrix (AVM) notation, we will use some abbreviations throughout. These are shown in table 1.

In the next section we give some background on firstly, G&C's analysis of reprise questions, and secondly, traditional views of QNP semantics. The subsequent sections 3 and 4 discuss the content of reprise questions for CNs and QNPs together with a corresponding semantic analysis, and some further issues arising from this are discussed in section 5.

³For an alternative formulation of some of G&C's account within Martin Lf Type Theory, see Cooper and Ginzburg (2002).

AVM	Abbreviation
$\left[\begin{array}{l} \textit{parameter} \\ \text{INDEX } x \\ \text{RESTR } \left\{ \left[\begin{array}{l} \text{INSTANCE } x \\ \text{PROPERTY } P \end{array} \right] \right\} \end{array} \right]$	$x : \textit{property}(x, P)$
$\left[\begin{array}{l} \textit{proposition} \\ \text{SOA} \mid \text{NUCLEUS} \left[\begin{array}{l} \textit{verb_rel} \\ \text{ROLE_1 } x \\ \text{ROLE_2 } y \end{array} \right] \end{array} \right]$	$\textit{verb}(x, y)$
$\left[\begin{array}{l} \textit{question} \\ \text{PARAMS } \{ \} \\ \text{PROP } \textit{verb}(x, y) \end{array} \right]$	$?.\textit{verb}(x, y)$
$\left[\begin{array}{l} \textit{question} \\ \text{PARAMS } \left\{ x : \textit{property}(x, P) \right\} \\ \text{PROP } \textit{verb}(x, y) \end{array} \right]$	$?x.\textit{verb}(x, y)$ or $?x : \textit{property}(x, P).\textit{verb}(x, y)$

Table 1: HPSG AVM Abbreviations

2 Background

2.1 Reprise Questions

G&C, following on from Ginzburg and Sag (2000), provide an analysis of clarification questions together with a method of resolution of associated elliptical forms. This analysis is couched within a HPSG grammar and a Question-Under-Discussion (QUD) approach to dialogue context.

2.1.1 Contextual Parameters and Grounding

G&C posit a modified semantic representation within HPSG which allows an analysis of how clarification questions arise. Standard versions of HPSG directly encode idealized content (that which a speaker would be expected to associate with a sign) within the value for the `CONTENT` feature. Instead, G&C propose a representation which expresses contextual dependence: contextually dependent parameters are abstracted to a set which is the value of a new `C-PARAMS` feature. This allows the sign to be viewed as a λ -abstract, or a *meaning* in the Montagovian sense (a function from context to content). This is shown in AVM [1] for A's original utterance in example (1):

$$[1] \left[\begin{array}{l} \text{C-PARAMS } \left\{ x : \textit{named}(x, Bo), a : \textit{speaker}(a), b : \textit{addressee}(b) \right\} \\ \text{CONTENT } \left[\textit{ask}(a, b, ?.\textit{leave}(x)) \right] \end{array} \right]$$

Note also that the semantic representation includes the conversational move type *ask*, following Ginzburg et al. (2003) – this will be important in order to give the correct interpretation for *clausal* questions (see be-

low). An equivalent λ -abstract expression (ignoring the parameters associated with speaker and addressee, as we will do from now on for readability's sake) would be:

$$\lambda\{x : \text{named}(x, \text{Bo})\}.ask(a, b, ?.leave(x))$$

The grounding process for an addressee can then be thought of as a process of establishing the referents of these parameters in context, in order to obtain the fully specified intended content. It is failure to do this that results in the formation of a clarification question with the purpose of querying the sub-utterance from which the relevant parameter emanates.

2.1.2 Clausal Readings

In the case when a hearer finds a value for a contextual parameter that is problematic in some way, the question that arises is a *clausal* question, a *polar* (yes/no) question corresponding to the first of the paraphrases given in example (1) above, or to that given in example (2):

- (2)

A:	Did Bo leave?
B:	Bo? / Bo Smith?
A:	That's right.
B:	Yes, half an hour ago.

 $\leadsto$ “Is it **Bo_x** / **Bo Smith_x** that you are asking whether *x* left?”

The mechanism which licenses this reading (and by which interpretation proceeds) is a coercion operation, which takes the utterance being clarified as its input and produces a partially updated context where the maximal QUD is the question formed by abstracting the problematic parameter from the intended content (in this case $\lambda\{x : \text{named}(x, \text{Bo})\}.ask(a, b, ?.leave(x))$, paraphrasable as “For which *Bo_x* are you asking whether *x* left?”).

This context then allows an elliptical bare fragment question “*Bo?*” to be resolved as having the content $?.ask(a, b, ?.leave(x))$ (paraphrasable as in example (2) above). Similarly a reprise sluice (a bare *wh*-phrase) “*Who?*” would simply be resolved as having the new QUD as its content.

2.1.3 Constituent Readings

In the case where the hearer can find no value for a parameter in context, the question that arises is a *constituent* question, a *wh*-question corresponding to the second paraphrase in example (1) or to that given here as example (3):

- (3)

A:	Did Bo leave?
B:	BO?
A:	Bo Smith.
B:	Yes, half an hour ago.

 $\leadsto$ “What is the intended content of your utterance ‘Bo’?”

For this reading, a different coercion operation is defined, which results in an updated context where the maximal QUD is precisely this question about the intended content of a sub-utterance, $?.spkr_meaning_rel('Bo', x)$. In this case the elliptical question “*Bo?*” (delivered with suitable intonation) can be resolved as having this question as its content.

While the clausal and constituent readings can be seen to be distinct, they both involve *querying the semantic content* of the relevant sub-utterance, following an inability to find a suitable referent for that content in the hearer's context. It is this property that allows us to use them to investigate what semantic content can be attributed to various word and phrase types.

2.1.4 Lexical Readings

As pointed out by G&C, and in more detail by Purver et al. (2001), reprise questions may have other possible readings apart from the two described above. In particular, a *lexical* reading concerning phonology

or orthography of the words used by the speaker seems to be easily available (for example, in situations with high background noise levels).

- (4)⁴ Matthew: It wasn't all that bad. At least the pool was clean.
 Lara: **Mr Pool?**
 Matthew: The pool.
 Lara: Oh <laugh>.
 ~→ "Did you say 'Mr Pool'?"

While seemingly common, we are not concerned with such readings in this paper as, lacking any reference to word or phrase meaning, they do not shed any light on semantics. When we refer to reprise questions hereafter, this should be taken as referring to content readings only.

2.1.5 Experimental Evidence

We note that there is experimental evidence which appears to correspond with this view of clarification, and with our reprise content hypothesis as stated in section 1.2 above. We might expect that the content readings we are interested in would only be possible with those words whose semantic content involves some sort of reference (whether to an individual, as with PNs, or to a property or predicate, as we shall propose for CNs below), thus enabling the abstraction of a contextual parameter. Function words (e.g. prepositions), on the other hand, would be unlikely to lead to reprise questions with content readings.

In an experimental study which involved the introduction of simulated reprise questions into text-based dialogue (see Healey et al., 2003; Purver et al., 2003b), results showed that reprises of function words were indeed very difficult to interpret as having a content reading – all were interpreted as *lexical*, *gap* or non-clarificational questions, or were simply ignored.

2.2 QNP Semantics

The semantic representation of QNPs has of course been a subject of lively debate for some time, and we cannot hope to do justice to the field here; instead we point out the main differences in currently popular views in the areas on which we hope that the study of reprise questions can shed some light.

2.2.1 The Quantificational View

One view, dating back at least to Russell (1905), holds that QNPs contribute quantificational terms to the semantic representation of a sentence. This is exemplified by Montague (1974)'s PTQ, in which sentences containing QNPs are given representations as follows:

$$\text{"every } A \text{ Bs"} \mapsto \forall x(A(x) \rightarrow B(x))$$

On this view, QNPs therefore denote functions from properties of individuals ($e \rightarrow t$) to truth values (t) (in other words, they are properties of properties ($(e \rightarrow t) \rightarrow t$)): The content of a QNP is defined by the properties that hold of some referent contained in it (in the case of "every dog", all those properties which are true or untrue of every dog).

$$\text{"every } A" \mapsto \lambda P.\forall x(A(x) \rightarrow P(x))$$

Those who adhere strictly to this view take it also to hold for definite descriptions: definites are not considered to be directly referential in the same sense as PNs, but are seen as defined by existential quantification with a uniqueness constraint.

$$\text{"the } A" \mapsto \lambda P.\exists x(A(x) \wedge \forall y(A(y) \rightarrow y = x) \wedge P(x))$$

⁴BNC file KPP, sentences 321–325

2.2.2 The Referential View

An alternative view originating with Strawson (1950) and Donnellan (1966) is that some NPs, in particular definites, can be directly referential. Donnellan pointed out that while the Russellian approach covered *attributive* uses well (those described by Russell as “known by description”), they did not appear to cover *referential* uses. Others (e.g. Fodor and Sag, 1982) have also pointed out that indefinites can be used *specifically* (the speaker has a specific individual in mind, although the hearer is not expected to be able to identify it) and *definitely* (expected to be identified by the hearer)⁵, and that these uses also do not appear to fit with a purely quantificational analysis.

On the quantificational view, this apparently referential nature is argued to follow from pragmatic principles rather than any true semantic reference. This argument originates with Kripke (1977), and a concise statement is given by Ludlow and Neale (1991) and Ludlow and Segal (forthcoming). Essentially it runs as follows (omitting some steps for brevity’s sake here):

1. S has expressed a quantified proposition $\tau x.F(x) \wedge P(x)$.
2. S could not be doing this unless she thought that $P(b)$ where b is some referent.
3. S knows and I know that $b = \tau x.F(x)$
4. Therefore S has implicated that $P(b)$.

Other approaches such as the dynamic theories of Heim (1982), Kamp and Reyle (1993) and possibly Groenendijk and Stokhof (1991) might be said to fall somewhere in between the two camps, with definites having some kind of reference (although this may be to a contextual discourse referent rather than a real-world object).

In most views, however, NPs with other quantifiers (*every*, *most* etc.) are seen as quantificational.

2.2.3 Generalized Quantifiers and Witness Sets

The theory of Generalized Quantifiers (GQs) (see Barwise and Cooper, 1981)⁶ (hereafter B&C) has been applied to the quantificational view, both to extend the Russellian approach to other natural language quantifiers, and to allow semantics of the QNP constituent to be represented more transparently in the sentence representation:

$$\begin{aligned} \text{“every } A \text{”} &\mapsto \text{every}(A) \\ \text{“every } A \text{ Bs”} &\mapsto \text{every}(A)(B) \end{aligned}$$

where

$$\begin{aligned} \llbracket \text{every}(A) \rrbracket &= \{X \mid A \subseteq X\} \\ \llbracket \text{every}(A)(B) \rrbracket &= B \in \llbracket \text{every}(A) \rrbracket = B \in \{X \mid A \subseteq X\} = A \subseteq B \end{aligned}$$

Essentially the quantificational view of QNPs still holds: QNPs are GQs, and as such denote a family of sets (a set of sets, here the set of those sets which contain A), rather than being directly referential.

To explain how a hearer can process a GQ without having to determine the identity of this full set of sets, B&C introduce the notion of a *witness set*. For a GQ $D(A)$, this is defined as being any set w which is both a subset of A and a member of $D(A)$. For an indefinite *a dog*, w can be any nonempty set of dogs; for a definite *the dog*, w must be the set containing exactly the contextually unique dog; for the universal *every dog*, w must be equal to the set of all dogs. For monotone increasing (MON $\uparrow$) quantifiers, the following equivalence holds:

$$\exists w[w \subseteq X] \leftrightarrow X \in D(A)$$

In other words, showing that a predicate X holds of a witness set is equivalent to showing that the corresponding GQ holds of the predicate. We will use this notion heavily below.

In the next section we begin by examining CN reprise questions, and show that G&C’s analysis can be extended to account for their apparent meaning in a manner consistent with the traditional view of CN

⁵A good summary of these terms, with examples, is available in (Ludlow and Neale, 1991).

⁶But see also e.g. (Keenan and Stavi, 1986; Keenan and Westerståhl, 1997; van der Does and van Eijck, 1996).

semantics. In section 4 we then discuss QNP reprise questions, and show that their meaning can be more naturally accounted for by the referential view of QNP semantics. Section 5 then discusses some issues raised by the view put forward in section 4.

3 Common Nouns

In this section we examine CN reprise questions, and show that their meaning appears to be entirely consistent both with the standard semantic view of CNs as denoting properties of individuals, and with our hypothesis that reprise questions concern the semantic content of the fragment being reprised. We then outline a corresponding HPSG analysis.

3.1 Nouns as Properties

The semantic content of CNs is traditionally viewed as being a property (of individuals). Montague (1974) expressed this as a λ -abstract, a function from individuals to truth values, e.g.:

$$\lambda x.book(x)$$

and this view is essentially shared by most strands of formal semantics. Variations (especially in representation) certainly exist: in situation semantics (Barwise and Perry, 1983) this might be expressed as a λ -abstracted infon (see Cooper, 1995), in DRT (Kamp and Reyle, 1993) as a predicative DRS (see Asher, 1993), but these approaches share the basic view that CNs are properties of individuals.

Note that we are setting mass nouns and bare plurals aside for the present. These might be expected to refer instead to *kinds* (see e.g. Carlson, 1977; Chierchia, 1998), or in the case of plurals, behave as indefinites (Kamp and Reyle, 1993). We examine both below in sections 3.4 and 3.5.

In this case we would expect CN reprise questions to be able to query the property expressed by the noun, and this property only, when a CP cannot identify this property in context. The clausal and constituent readings may both still be available, but the noun property or predicate should always be the element under question:

Clausal reading: “*Is it the property P about which you are asking/asserting ... P ... ?*”

Constituent reading: “*What is the property P which you intend to be conveyed by the word N ?*”

In contrast, it should not be possible for CN-only reprises to be interpreted as questions about e.g. individual referents.

3.2 Corpus Evidence

Happily this appears to be the case: all corpus examples of CN reprises found (not including bare mass nouns and plurals which are discussed in sections 3.4 and 3.5) confirmed this expectation, as shown in table 2. Examples are given here together with what appear to be possible and impossible paraphrases:

(5) ⁷	Monica:	You pikey! Typical!
	Andy:	Pikey?
	Nick:	Pikey!
	Andy:	What’s pikey? What does pikey mean?
	Monica:	I dunno. Crusty.
	~>	“Are you saying I am a pikey ?”
	~>	“What property do you mean by the word ‘pikey’?”
	~>	#“Which pikey are you saying I am?”

⁷BNC file KPR, sentences 218–225

	Pattern	Referent Reading (cla+con)	Predicate Reading (cla+con)
CN Examples	"... <i>N</i> ..." / " <i>N</i> ?"	-	58
		-	100%
		-	(42+16)

Table 2: Literal Reprises – CNs

The same appears to be true when the CN reprised forms part of an indefinite NP:

- (6)⁸ Emma: Got a comb anywhere?
 Helena: **Comb?**
 Emma: Even if it's one of those <pause> tremmy [*sic*] pretend combs you get with a Barbie doll, oh this'll do! <pause> Don't know what it is, but it'll do!
- ~> "Is it a **comb** that you are asking if I've got?"
 ~> # "Which comb are you are asking if I've got?"

And indeed even when the CN is part of a seemingly referential definite NP:

- (7)⁹ Carol: We'll get the turkey out of the oven.
 Emma: **Turkey?**
 Carol: Well it's <pause> it's <pause> er <pause> what's his name?
 Bernard Matthews' turkey roast.
 Emma: Oh it's looks horrible!
- ~> "Are you saying the thing we'll get out is a **turkey**?"
 ~> "What concept/property do you mean by 'turkey'?"
 ~> # "Which turkey are you saying we'll get out?"
 ~> # "Is it this/that turkey you're saying we'll get out?"

Note that paraphrases which concern an intended referent of the NP containing the CN (e.g. the "*Which X ...*" paraphrases) do not appear to be available, even when the NP might appear to be referential (see example (7)).

3.3 Analysis

As expected, we therefore suppose that the semantic representation of a CN must consist at least partially (and, if we are to hold to our strong hypothesis, solely) of a property of individuals.

An analysis entirely parallel to that of section 2.1 is possible if properties of individuals (which we shall refer to here as *predicates*) are regarded as possible cognitive / contextual referents. The predicate content of a noun can then have an associated C-PARAM which is to be grounded by the CP (by finding the intended (predicate) referent given its name) and then made the subject of a clarification question in case this grounding process fails.¹⁰ Noun content is therefore made contextually dependent (rather than *a priori* given), as we require for a treatment of clarification.¹¹

We therefore propose a representation of CNs in which the CONTENT (and the sole member of C-

⁸BNC file KCE, sentences 1513–1516

⁹BNC file KBJ, sentences 131–135

¹⁰It may fail for various reasons: with lexically ambiguous words, more than one property with this name will exist; with unknown words, no known property may be found in context; in other cases the CP may find the apparently intended predicate surprising or impossible.

¹¹This fact also perhaps offers a way to account for the psycholinguistically observable fact that CPs can have different understandings of the predicate being conveyed, and can indeed establish their own agreed meanings (see e.g. Pickering and Garrod, 2003).

PARAMS) is a parameter whose INDEX is a named property of individuals:

$$[2] \left[\begin{array}{ll} \text{PHON} & \langle \text{dog} \rangle \\ \text{CONTENT} & \boxed{1} [P : \text{name}(P, \text{dog})] \\ \text{C-PARAMS} & \{ \boxed{1} \} \end{array} \right]$$

This may seem uncontentious, but note that it does not correspond to the standard CN semantics used in HPSG, where CONTENT is a parameter whose INDEX is an individual (to be inherited as the referent of a NP mother). Including this parameter in C-PARAMS, as shown in AVM [3], would not give the correct reading for a clarification question, as this individual would become the referent to be grounded and thus the subject of the question (which we have seen is impossible).

$$[3] \left[\begin{array}{ll} \text{CONTENT} & \boxed{1} [x : \text{dog}(x)] \\ \text{C-PARAMS} & \{ \boxed{1} \} \end{array} \right]$$

We could hold to the standard HPSG semantics while avoiding this problem, by abstracttting only the predicate to C-PARAMS rather than the whole CONTENT, following (Purver, 2002):

$$[4] \left[\begin{array}{ll} \text{CONTENT} & [x : P(x)] \\ \text{C-PARAMS} & \{ [P : \text{name}(P, \text{dog})] \} \end{array} \right]$$

This version, however, no longer holds to the strong hypothesis (CONTENT is no longer a member of C-PARAMS, and a resulting clarification question will not query the entire semantic content).

Similar problems apply to approaches such as MRS (Copestake et al., 1999) which assume that all content is amalgamated across syntactic daughters. Here the content of a CN consists of an *elementary predication*, a piece of propositional information, which again concerns the individual referent which will be quantified over by the mother NP:

$$[5] \left[\begin{array}{ll} \text{CONTENT} & \left[\begin{array}{ll} \text{HOOK | INDEX} & x \\ \text{RELS} & \{ [h1 : \text{dog}(x)] \} \end{array} \right] \end{array} \right]$$

Again, making the entire content contextually available would seem to give the wrong readings for reprise questions.

3.4 Bare Singulars

As mentioned above, bare singular mass nouns might be expected to refer to kinds or concepts, but again not to individual referents. And again, this did appear to be the case. All reprises of bare singular CNs (i.e. singular CNs where the CN in the original utterance being clarified had no determiner) seemed to fit with this (see table 3).

(8) ¹²	Richard:	because Donna is high in admir- admiration in fact I
	Anon 4:	Admiration?
	Richard:	I admire
	Anon 4:	I think it's called infatuation
	~	~
	~	“Is it the property/concept admiration you’re saying Donna is high in?”
	~	“What property/concept/kind do you mean by ‘admiration’?”

¹²BNC file KSV, sentences 5869–5874

	Pattern	Referent Reading (cla+con)	Relation Reading (cla+con)	Predicate/Kind Reading (cla+con)
Bare Singular	"... <i>N</i> ..." / " <i>N</i> ?"	- - -	- - -	41 100% (37+4)
Bare Plural	"... <i>Ns</i> ..." / " <i>Ns</i> ?"	2 3% (0+2)	1 7% (1+0)	26 90% (20+6)

Table 3: Literal Reprises – Bare CNs

- (9)¹³ Iris: Oh you should see <pause> see it! <pause> It has only been <pause> burning coal in it!
 Gordon: **Coal?**
 Iris: And it's all burnt, it's burnt all the skirting board and er
 Gordon: Good God!
- ~> "Is it the concept/kind/substance **coal** you're saying was burning?"
 ~> "What concept/kind/substance do you mean by 'coal'?"
 ~> # "Which individual bits of coal are you saying were burning?"

Note that we have not attempted to distinguish between concepts, kinds and the properties or predicates discussed above, as this level of distinction does not seem possible from our imputed paraphrases – what is clear is that these sort of paraphrases always seem acceptable.

The analysis of mass nouns can therefore take exactly the same form as that for other CNs given above, with the semantic content being a property or kind which must be identified in context:

$$[6] \left[\begin{array}{l} \text{PHON} \quad \langle \text{admiration} \rangle \\ \text{CONTENT} \quad \boxed{1} [P : \text{name}(P, \text{admiration})] \\ \text{C-PARAMS} \quad \{ \boxed{1} \} \end{array} \right]$$

3.5 Bare Plurals

With bare plurals, the situation was more complex. Most examples found did seem to follow the same lines, with a property or kind reading being preferred, and often being the only possible reading (see example (10)).

- (10)¹⁴ John: Now I would like you to tell me about numbers.
 Simon: **Numbers?**
 John: Mhm. What are they?
 Simon: **Numbers** <laugh> erm <pause>
 John: What do we use them for?
- ~> "Is it the property **numbers** you're saying I should tell you about things with?"
 ~> "Is it the concept/kind **numbers** you're saying I should tell you about?"
 ~> # "Which numbers are you saying I should tell you about?"

However, some examples afforded a possible individual referent reading (see example (11)), and one

¹³BNC file KCF, sentences 1573–1577

¹⁴BNC file FMF, sentences 591–596

example was best read as querying the plurality relation itself (example (12)).

- (11)¹⁵
Dorothy:	Anyway, you were telling me about <pause> meals.
Andrew:	Meals?
Dorothy:	Mm.
Andrew:	What <unclear>?
Dorothy:	At Pontepool.
~>	<i>“Which meals are you saying I was telling you about?”</i>
~>	<i>“Which property/concept do you mean by ‘meals’?”</i>
~>	<i>“Is it the property meals you’re saying I was telling you about things with?”</i>
-
- (12)¹⁶
William:	You two
Unknown:	<unclear>
William:	hours ago
Clare:	<laugh> <pause> Hours?
William:	Well an hour
Unknown:	<unclear>
Kim:	it wasn’t hours
~>	<i>“Is it really more than one hour ago you’re telling me it was?”</i>

As we will see in section 4.2 below, these are exactly the readings that seem to be available for indefinite NPs (a predicate reading, a logical determiner relation reading, and a (rarer) individual referent reading). This therefore suggests that bare plurals could be represented as indefinites (and we leave the details of this representation to section 4.2). However, as some examples seemed to *only* allow a property/kind reading (e.g. example (10) above), it may be that (as assumed by Kamp and Reyle (1993)) they should be seen as ambiguous between indefinites and kinds.

3.6 Summary

In this section we have presented evidence that shows that CN reprise questions concern a predicate. We have interpreted this as consistent with the common view that CNs denote properties of individuals, and as supporting our hypothesis that reprise questions concern the semantic content of the fragment being reprised.

We have shown how an analysis can be constructed within HPSG which allows this semantic content to be made contextually available for grounding and clarification, according to (the strong version of) our reprise content hypothesis. We have also shown that standard HPSG analyses are not entirely consistent with the view of CNs as denoting predicates, and therefore would allow only the weaker version of the hypothesis to hold.

Examination of bare singular and plural CNs shows that mass nouns can be represented in a similar way (as denoting properties or kinds), but that some bare plurals must be represented differently, as individual referent reprise questions are possible.

In the next section we examine reprises of QNPs.

4 Noun Phrases

If we hold to the quantificational view of NP semantics, we should find that reprise questions concern a family of properties/sets (those properties which hold of the referent of the QNP). A referential view might instead lead us to expect that reprises of referential definites & specific indefinites should concern the individual referents directly.

¹⁵BNC file KBW, sentences 1247–1251

¹⁶BNC file KBN, sentences 1367–1371

4.1 Definite NPs

Taking a referential semantic viewpoint, we might therefore expect reprises of definite NPs to be paraphrasable as follows:

Clausal reading: “*Is it the individual X about which you are asking/asserting ... X ... ?*”

Constituent reading: “*Which individual X do you intend to be referred to by the phrase NP?*”

From a quantificational viewpoint, a paraphrase concerning a set of properties or sets might perhaps be expected:

Clausal reading: “*Is it the set of properties that hold of X about which you are asking/asserting ... X ... ?*”

Constituent reading: “*Which set of properties do you intend to be conveyed by the phrase NP?*”

Our corpus investigation included many types of definite NP: PNs, pronouns and demonstratives as well as definite descriptions. PNs have already been discussed in section 2.1 above – we examine the others here. An overview of results is shown in table 4.

4.1.1 Demonstratives and Pronouns

Perhaps unsurprisingly (many of those who hold to the quantificational view believe demonstratives to be directly referential), our corpus investigation shows that demonstratives license the referential readings, not only when echoed verbatim as in example (13) (we shall call this kind of verbatim repeat a *direct echo*), but also when reprised with a co-referring PN as in example (14), or with a reprise sluice as in example (15). Both clausal and constituent versions seem available.

- (13)¹⁷ John: Which way’s North, do you know?
 Sara: That way.
 John: **That way?** Okay.
 ~> “Are you telling me **that way there** is North?”
 ~> “By ‘that way’ do you mean that way there?”

- (14)¹⁸ Christopher: What was that lady <pause> <unclear>?
 Dorothy: **Julie?**
 Christopher: Mm.
 Dorothy: She’s been with you, hasn’t she?
 ~> “By ‘that lady’ do you mean Julie?”

- (15)¹⁹ Anon 1: Oh God I hate these lot, they’re so boring.
 Cassie: **What lot?**
 Anon 1: Them!
 Cassie: **Who? What them lot?**
 ~> “What lot are you telling me you hate?”
 ~> “What lot do you mean by ‘these lot’?”

The same also appears to hold for pronouns, although we discuss these in more detail in section 5.4

¹⁷BNC file JP4, sentences 755–758

¹⁸BNC file KBW, sentences 883–886

¹⁹BNC file KP4, sentences 1546–1550

Reprises using PNs As with demonstratives, definite descriptions can be reprised with another NP that conveys the same desired referent:

- (19)²³ | Unknown: And er they X-rayed me, and took a urine sample, took a blood sample. Er, the doctor
 | Unknown: **Chorlton?**
 | Unknown: Chorlton, mhm, he examined me, erm, he, he said now they were on about a slide
 | <unclear> on my heart. Mhm, he couldn't find it.
 | ~> "By 'the doctor' do you mean Chorlton?"

This is interesting: not only does it give further weight to the idea that these reprises are genuinely referential (PNs are generally held to be referential even by those who hold to the quantificational view of definite NPs), it also suggests that the referent can be an entity in the world (rather than some kind of discourse object).

Sluices And again, reprise sluices are available which seem to concern a referent:

- (20)²⁴ | Terry: Richard hit the ball on the car.
 | Nick: **What car?**
 | Terry: The car that was going past.
 | Nick: **What ball?**
 | Terry: James [last name]'s football.
 | ~> "Which car are you saying Richard hit the ball on?"
 | ~> "Which car do you mean by 'the car'?"
 | ~> "Which ball are you saying Richard hit on the car?"
 | ~> "Which ball do you mean by 'the ball'?"

Reference vs. Pragmatics Two points are perhaps worth reinforcing: firstly, definite descriptions, pronouns, demonstratives and proper names all seem to make the same kind of referential reprise questions available; secondly, it seems very hard to interpret any of these examples as querying a family of sets rather than an individual referent.

It also seems difficult to reconcile these examples with the Kripkean view of reference via pragmatics, as outlined in section 2.2. Firstly, examples like example (19), in which a referential question is asked (and answered) before the sentence containing the original NP has been finished, do not obviously permit an explanation which requires understanding of the proposition expressed as an early step.²⁵

Secondly, in general, reprise questions do not appear to be able to query pragmatically inferred content. For instance, A's statement in the invented example (21), taken to be uttered outside a West End theatre currently showing a best-selling musical, could perhaps be inferred to be implicating other messages:

- (21) | A: I have a ticket for tonight's performance.
 | ~> "I am offering to sell a ticket for tonight's performance."
 | ~> "Would you like to buy a ticket for tonight's performance?"

But a reprise of the sentence does not seem to be able to be understood as querying these implicatures, but only the *directly conveyed semantic content* (see Ginzburg et al., 2003, 2001, for a more detailed

²³BNC file KPY, sentences 1005–1008

²⁴BNC file KR2, sentences 862–866

²⁵Minimally, it would require a radically incremental view of semantic processing.

exposition):

- (22) A: I have a ticket for tonight's performance.
 B: **You have a ticket for tonight's performance?**
 ~> "Are you telling me you have **a ticket**?"
 ~> "What do you mean by 'you have a ticket'?"
 ~> # "Are you offering to sell me a ticket?"
 ~> # "Are you asking if I want to buy a ticket?"

We therefore suppose that the content of definite NPs must at least contain, and perhaps consist entirely of (as sketched out roughly in AVM [7] – we will fill in the details in section 4.4), the intended referent (which in the case of plurals, we assume will be a set). An analysis of these referent reprise questions would then be available along identical lines to that for PNs given in section 2.1 – an identifiable referent for the contextual parameter must be found in context as part of the grounding process.

$$[7] \left[\begin{array}{ll} \text{PHON} & \langle \text{the, dog} \rangle \\ \text{CONTENT} & \boxed{1} [x : \text{the_dog}(x)] \\ \text{C-PARAMS} & \{ \boxed{1} \} \end{array} \right]$$

4.1.3 Definite Descriptions – Functional Readings

Most of the rest of the examples of direct echoes of definite descriptions did not seem to be querying an individual referent, but rather seemed to be querying a function or its domain. As might be expected, these examples were mostly *attributive* uses, which have long been held up as examples against the referential nature of definite descriptions, but other types that we would expect to behave in this way include *de dicto* uses, *narrow scope* uses, Poesio (1994)'s *weak* definites, and *generic* uses, none of which obviously convey direct reference.

Following Barwise and Perry (1983) we take the function expressed by attributive uses to be one from situations to individuals. Example (23) shows a question which seems to query the identity of the function, while example (24) seems to have a domain reading available (amongst other possibilities):

- (23)²⁶ Anon 1: In those days how many people were actually involved on the estate?
 Tommy: Well there was a lot of people involved on the estate because they had to repair paths. They had to keep the river streams all flowing and if there was any deluge of rain and stones they would have to keep all the pools in good order and they would
 Anon 1: **The pools?**
 Tommy: Yes the pools. That's the salmon pools
 Anon 1: Mm.
 ~> "What are you intending 'the pools' to pick out in the situation you are describing?"
 ~> # "Which actual entities are you referring to by 'the pools'?"

- (24)²⁷ Eddie: I'm used to sa–, I'm used to being told that at school. I want you <pause> to write the names of these notes up here.
 Anon 1: **The names?**
 Eddie: The names of them.
 Anon 1: Right.
 ~> "What situation/notes are you intending me to interpret 'the names' relative to?"
 ~> ? "What are you intending 'the names' to refer to in that situation?"
 ~> # "Which actual names are you referring to by 'the names'?"

²⁶BNC file K7D, sentences 307–313

²⁷BNC file KPB, sentences 417–421

Again, a reading concerning properties of properties or sets of sets does not seem plausible. We therefore suppose that such uses can be captured by an analysis as sketched in AVM [8], this being the functional equivalent of the version in AVM [7] above, with its constituent function and domain becoming the members of C-PARAMS:

$$[8] \left[\begin{array}{l} \text{functional_definite_np} \\ \text{PHON} \quad \langle \text{the, dog} \rangle \\ \text{CONTENT} \quad \lambda [f(s) : s \in D \wedge s \models \text{the_dog}(f(s))] \\ \text{C-PARAMS} \quad \{ [f], [D] \} \end{array} \right]$$

of which, following Poesio (1994), we will abbreviate the CONTENT as follows hereafter:

$$[x : \text{the_dog}_s(x)]$$

Grounding therefore requires both the function f and the domain D of the situational argument s to be found in context. Failure to do so would therefore license clarification questions which can be read as concerning either function or domain, or both. Note that the job of identifying the domain corresponds to Poesio (1993)'s view of definite interpretation as anchoring a parameter corresponding to the resource situation, but that on our view this is not *all* that is required.

We do not insist that the domain of the function is one of situations: indeed, for narrow-scope definites it seems simpler to take the domain as being a set of individuals contributed by a wider-scoping NP (and we set this out in section 5.3). However, the treatment of the semantic content as functional, with the resulting contribution to C-PARAMS, remains.

Strong/Weak Hypothesis This representation does not fit exactly with the strong version of our reprise content hypothesis as it is currently phrased. While both constituent elements of the content (function and domain) are reprisable, a single question might of course query only one of them, thus holding only to the weak version of the hypothesis. However, querying the entire content directly would seem wrong here, as it would necessarily reduce the functional representation to the non-functional version.

Ambiguity Introduction of this alternative analysis means, of course, that we are currently assuming some ambiguity in the representation of definites: but note that this is not an ambiguity of semantic type (the CONTENT is still of type e). This ambiguity could be removed by taking *all* definite descriptions to be functional, with referential definites those where the situational argument s is the current utterance situation s_0 (thus resembling von Heusinger (2002)'s analysis of specific indefinites as those functional on the speaker).²⁸ In such cases, grounding of the function f in the known current situation s_0 is equivalent to identifying the referent $x = f(s_0)$. As this appears to be a worst-case analysis (over half of our corpus examples appeared to be directly referential), we do not take this step here, but merely note it as an option.

It seems likely that such a step would not be required for PNs and demonstratives in any case, which do not appear to have functional versions (not being able to take narrow scope)²⁹, so these would keep the previous simple referential analysis.

4.1.4 Definite Descriptions – Sub-Constituent Readings

The few remaining examples of definite NP reprises found seemed to be easier to interpret as having a predicate reading, identical to that which would be obtained by reprising the CN alone. No intonational

²⁸Of course, removing this ambiguity here would lead to more work later. When resolving scope, we will have more arguments which need their reference established – see section 5.3.

²⁹Although possible counterexamples have been proposed for demonstratives – see (Roberts, 2002).

information is available in the BNC, but these readings appear to be those that are made more prominent by stressing the CN (see example (25)).

- (25)³⁰
Anon 1:	They'd carry the sack on their back?
George:	On the back, the bushel, yes
Anon 1:	The bushel?
George:	<unclear>
Anon 1:	<unclear>
George:	The corn.
- ~~~~~
 ~~~~~  
 ~~~~~
- “What are you referring to by ‘the bushel’?”
 “What property do you mean by ‘bushel’?”
 “Is it the thing with the property *bushel* that you’re saying ...”

This does not seem to be restricted to definites: in fact, the same readings seemed to be possible for all other NPs we examined (as we will see below). We therefore suppose that this reading is in fact a reprise of the CN rather than the NP as a whole. Examination of sluices reinforces this: where reprise sluices were found with this reading, only the CN was substituted by a wh-word, rather than the whole NP:

- (26)³¹
Elaine:	what frightened you?
Unknown:	The bird in my bed.
Elaine:	The what?
Audrey:	The birdie?
Unknown:	The bird in the window.
- ~~~~~
 ~~~~~
- “What property_x is it you’re saying the thing with *x* frightened you?”

Similarly, although none were found in the BNC, it seems plausible that a reading corresponding to the logical relation expressed by the determiner is possible (again, the reader may find this easier to capture by imagining intonational stress on the determiner).

In other words, the readings available for reprises of sub-constituents of the NP are still available when reprising the NP, especially when the relevant sub-constituent is stressed. This leads us to re-formulate our reprise content hypothesis to allow for “inherited” daughter questions:

4.1.5 Reprise Content Hypothesis (revised weak version)

A nominal fragment reprise question queries part of the standard semantic content of the fragment being reprised or one of its syntactic daughters.

4.1.6 Reprise Content Hypothesis (revised strong version)

A nominal fragment reprise question queries exactly the standard semantic content of the fragment being reprised or one of its syntactic daughters.

This has implications for C-PARAMS inheritance which must be reflected in the grammar, and also requires a theory of sub-constituent focussing to explain how the readings arise (see section 4.5).

4.2 Indefinite NPs

So we have seen that the evidence provided by reprises of definite NPs leads us towards a view of them as referential (although possibly functional) rather than quantificational. In this section, we turn to *indefinites*.

Again, a referential viewpoint might lead us to expect that reprises of indefinites should involve a referent (perhaps not a specific real-world object but a discourse referent (Kamp and Reyle, 1993), belief

³⁰BNC file H5H, sentences 254–257

³¹BNC file KBC, sentences 1193–1197

object (Zimmerman, 1999) or intentional object (Dekker, 2002)), and that this referent would therefore be queried by a reprise question.

4.2.1 Sub-Constituent Readings

However, if they do exist, such readings seem to be uncommon. All direct echo examples we found were most felicitous when read as sub-constituent readings, as described in section 4.1.4 above. For plain singular indefinites, all examples seemed identical to the CN predicate reading (whether clausal or constituent). Note that the constituent reading, paraphrased in the examples below as “*What property do you mean by ‘N’?*”, might also be paraphrased “*What is a N?*” – but that this should not be confused with a *referential* constituent reading “*Which N do you mean by ‘a N’?*”.

- (27)³²
Mum:	What it ever since last August. I’ve been treating it as a wart.
Vicky:	A wart?
Mum:	A corn and I’ve been putting corn plasters on it
~>	“ <i>Is it the property wart_i that you’re saying you’ve been treating it as something with <i>i</i>?</i> ”
~>	“ <i>What property do you mean by ‘wart’?</i> ”
~>	#“ <i>Which wart are you saying you’ve been treating it as?</i> ”
-
- (28)³³
Unknown:	What are you making?
Anon 1:	Erm, it’s a do– it’s a log.
Unknown:	A log?
Anon 1:	Yeah a book, log book.
~>	“ <i>Is it the property log that you’re saying it’s something with?</i> ”
~>	“ <i>What property do you mean by ‘log’?</i> ”
~>	#“ <i>Which log are you saying it is?</i> ”

For plural indefinites the same holds, although a reading querying the determiner rather than the predicate is also available (as we suggested might be possible for definites in section 4.1.4 above):

- (29)³⁴
Anon 2:	Was it nice there?
Anon 1:	Oh yes, lovely.
Anon 2:	Mm.
Anon 1:	It had twenty rooms in it.
Anon 2:	Twenty rooms?
Anon 1:	Yes.
~>	“ <i>Is it twenty_N that you’re saying it had <i>N</i> rooms?</i> ”
~>	“ <i>Is it rooms that you’re saying it had twenty of?</i> ”
~>	#“ <i>Which twenty rooms are you saying are it had?</i> ”

The fact that these readings are so predominant might suggest that the content of an indefinite NP should in fact be identified with that of a sub-constituent. But this seems problematic: firstly, which sub-constituent would we choose? As seen above (e.g. in example (29)), both determiner and CN content seem to be available. Secondly, it would mean that indefinites could not have semantic type *e*, thus giving an analysis with different semantic types for definites and indefinites. There are other problems too, not least for an account of anaphora (see section 5.4 below for more details). In any case, the argument for making this step does not seem strong: after all, the same sub-constituent questions are available for definite NPs (see section 4.1.4 above).

³²BNC file KE3, sentences 4678–4681

³³BNC file KNV, sentences 188–191

³⁴BNC file K6U, sentences 1493–1498

Sluices This is perhaps reinforced by the fact that reprise sluices which query the CN predicate seem to be equally common for definites and indefinites. As shown in table 5, the same number of “*A what?*” reprises (see example (30) below) were found as “*The what?*” reprises (see example (26) above). This is hardly strong evidence, but might help us to believe that subconstituent questions are no *more* made available by indefinites than definites, as we might expect them to be if the content of indefinites really was the same as that of one of their subconstituents.

- (30)³⁵ Stuart: I know it’s good in it? <unclear> but erm, <unclear> bought her, I’ve bought her a Ghost video.
 Mark: **A what?**
 Stuart: A Ghost video.
 Mark: Oh yeah.
- ~ “What property *P* is it you’re saying you’ve bought her something with *P*?”
 ~ “What property do you mean by ‘Ghost video’?”
 ~ #“Which Ghost video are you saying you’ve bought her?”

	Pattern	Number in BNC
Definite	“... <i>the N</i> ...” / “ <i>The what?</i> ”	10
Indefinite	“... <i>a(n) N</i> ...” / “ <i>A(n) what?</i> ”	10

Table 5: Predicate Sluices

4.2.2 Possible Referential Readings

In addition, while no clear examples were found in our corpus study, we feel that there *is* a possibility of referential questions with specific indefinites where the hearer realises that the speaker has a particular referent in mind, and intends the hearer to be able to identify it (what Ludlow and Segal (forthcoming) call *definite* indefinites). Some BNC examples, while most felicitous when read as CN predicate queries, do seem to offer a possible referential paraphrase:

- (31)³⁶ Stefan: Everything work which is contemporary it is decided
 Katherine: Is one man?
 Stefan: No it is a woman
 Katherine: **A woman?**
 Stefan: A director who’ll decide.
 Katherine: She’s good?
 Stefan: Hm hm very good.
- ~ “Is it a **woman** you are saying it is?”
 ~ ?“Which woman are you saying it is?”

Sluices If this is the case, we should expect referential reprise sluices “*What/Which N?*” (as opposed to the CN predicate sluice “*A what?*” described in section 4.2.1 above) to be available, if rare. And “*which N?*” examples certainly exist for indefinites, and are indeed rare (about 6 times less common after *a N* than after *the N* – see table 6).

However, we must be careful when examining these examples, as it is important to distinguish between *reprise* sluices – questions concerning the directly conveyed content of the utterance, asked by the hearer during the comprehension (grounding) process, and typically delivered with a rising reprise intonation – and the more familiar *direct* sluices – questions asking for more specific information than that directly

³⁵BNC file KDA, sentences 672–675

³⁶BNC file KCV, sentences 3012–3018

	Pattern	Number in BNC
Definite	"... <i>the N</i> ..." / "What/Which <i>N</i> ?"	25
Indefinite	"... <i>a(n) N</i> ..." / "What/Which <i>N</i> ?"	4

Table 6: Referential Sluices

conveyed, which are not asked during the comprehension process but can be asked even after complete acceptance of an assertion, and which do not appear with the same rising reprise intonation.

Of course, especially given the lack of intonational information in the BNC, it is very difficult to determine the reprise/direct nature of a sluice beyond any doubt – we can merely attempt to fit plausible paraphrases to the dialogue context. In most cases (see example (32)), both interpretations seemed plausible, although the direct version arguably more likely. But one example in particular (example (33)) seemed to support a reprise reading more readily: the speaker appears to be using an indefinite in order to identify a person without mentioning him by name, while the interviewer wants to be sure he has understood the intended reference correctly.

- (32)³⁷
- Nicola: We're just going to Beckenham because we have to go to a shop there.
 Oliver: **What shop?**
 Nicola: A clothes shop. <pause> and we need to go to the bank too.
- ~> reprise: "What shop are you telling me we have to go to?"
 ~> reprise: "What shop do you mean by 'a shop'?"
 ~> direct: "What shop do we have to go to?"
- (33)³⁸
- Ray: And of course, when this all happened, and I'm listening to what people are saying tonight, it's it's sort of making me feel a bit sick what they're saying.
 Nicky Campbell: Why is that?
 Ray: One supports that I lay in the street looking and waiting for a a man they mention tonight and that man is a well known killer of British soldiers. And I'm now asked
 Nicky Campbell: **Which man?**
 Ray: I'm now asked to respect him. And I'm sorry, I cannot respect a man
 Nicky Campbell: **The man who's name has been mentioned tonight?**
 Ray: Tonight. I cannot say that anybody can respect a man in this country and to run for their country as a well known I R A supporter. And he's up there on one of your pictures.
 Nicky Campbell: Mhm.
- ~> reprise: "Which man do you mean by 'a man they mention tonight'?"
 ~> reprise: "Which man are you telling me you lay waiting for?"
 ~> direct: "Which man did you lie waiting for?"

We take this as at least tentative support for a view that indefinites (a) can be seen as referential, and (b) that this referential term can be contributed to C-PARAMS, thus being available for reprise questions. We therefore propose that an analysis of indefinites should allow for such readings to be constructed: that as for definites, their content should consist (at least in part) of an individual (or set of individuals) of type *e*. In ordinary uses this content must be existentially quantified at sentence/clause level (more details of this are given in section 5.3). Definite uses are distinguished simply by making the content a member of C-PARAMS.

³⁷BNC file KDE, sentences 2214–2217

³⁸BNC file HV2, sentences 225–236

[9]	<i>indefinite_np</i>	
	PHON	$\langle \text{a, dog} \rangle$
	CONTENT	$\boxed{1} [x : \text{dog}(x)]$
	STORE	$\left\{ \boxed{1} [x] \right\}$
	C-PARAMS	$\boxed{2} \cup \boxed{3}$
	DTRS	$\left\langle \left[\text{C-PARAMS } \boxed{2} \right], \left[\text{C-PARAMS } \boxed{3} \right] \right\rangle$
	<i>ref_indefinite_np</i>	
	PHON	$\langle \text{a, dog} \rangle$
	CONTENT	$\boxed{1} [x : \text{dog}(x)]$
	STORE	$\{ \}$
	C-PARAMS	$\left\{ \boxed{1} \right\} \cup \boxed{2} \cup \boxed{3}$
	DTRS	$\left\langle \left[\text{C-PARAMS } \boxed{2} \right], \left[\text{C-PARAMS } \boxed{3} \right] \right\rangle$

This view of indefinites as individuals which are existentially quantified (rather than as generalized quantifiers) is not dissimilar to the *choice function* approach of Reinhart (1997); Szabolcsi (1997), or the *epsilon term* approach of van Rooy (2000); von Heusinger (2000); Kempson et al. (2001) – where indefinites denote individuals chosen by some existentially quantified choice function. While these approaches seem perfectly consistent with our observations, we prefer for simplicity’s sake to quantify over the individuals directly, although we will use functional versions to express relative scope in section 5.3 below.

This account also allows us to give an analysis of sluicing which expresses the distinction between direct and reprise sluices: direct sluices are those which concern an existentially quantified referent contributed by a previous grounded utterance (essentially the analysis of (Ginzburg and Sag, 2000)); while reprise sluices are those which concern the identity of a member of C-PARAMS during grounding, following G&C.

4.3 Other Quantified NPs

We have so far only considered definite and indefinite NPs. What of QNPs which contain other quantifiers?

There are really very few examples of reprises of such QNPs in the BNC³⁹, so it is premature to claim strong results; but what indications we could get, together with our intuition, point towards an identical analysis to that proposed above for indefinites. Most examples seem most felicitous when interpreted as concerning sub-constituents (either the CN predicate or the logical relation expressed by the quantifier), but seem to have a possible referential interpretation too:

(34) ⁴⁰	Richard:	No I’ll commute every day
	Anon 6:	Every day?
	Richard:	as if, er Saturday and Sunday
	Anon 6:	And all holidays?
	Richard:	Yeah <pause>
	~	“Is it days _N that you are saying you’ll commute every N?”
	~	“Is it every day that you are saying you’ll commute?”
	~	“Which days do you really mean by ‘every day’?”
	~	
	~	

With universals as in example (34) above, we should perhaps not be surprised by referential readings: it has been suggested that universals should be considered as definites (see e.g. Prince, 1992; Abbott, 2001).

³⁹This is not surprising, as these NPs are relatively rare in the BNC to begin with. They are an order of magnitude less common than “*the/a N*”: there are more than 50 times more sentences containing “*the N*” as there are containing “*every N*”, and “*most N*”, “*many N*” and “*few N*” are even rarer. As we found less than 100 reprises of “*the N*”, we would only expect a few “*every N*” reprises, and none for the other quantifiers, and this is what we find.

⁴⁰BNC file KSV, sentences 257–261

They are less clearly available with other quantifiers:

- (35)⁴¹ | Anon 1: Er are you on any sort of medication at all Suzanne? Nothing?
 | Suzanne: No. Nothing at all.
 | Anon 1: **Nothing?** No er things from the chemists and cough mixtures or anything <un-clear>?
 | ~~~~~
 | ~~~~~ *“Is it **no** things that you are saying you’re on?”*
 | ~~~~~ *?“Which things do you really mean by ‘nothing’?”*

As before, imagined examples seem to be possible where referential uses can be made more clear by use of co-referring PNs in the reprise:

- (36) | A: I want everyone in here to come with me.
 | B: **Everyone?** / **Me, Carl and Donna?**
 | ~~~~~
 | ~~~~~ *“Who do you mean by ‘everyone’?”*
 | ~~~~~ *“By ‘everyone’ do you mean B, C and D?”*
- (37) | A: Most people came to the party.
 | B: **Most people?**
 | A: Well, me, Brenda and Carmen.
 | ~~~~~
 | ~~~~~ *“Who do you mean by ‘most people’?”*

Given this possibility, we propose to analyse these QNPs as existentially quantified sets of individuals, which are not contributed to C-PARAMS under normal circumstances. Referential uses are obtained simply by adding the content to C-PARAMS. In the next section, we outline this approach in more detail.

4.4 Semantic Analysis

If we are to hold to our reprise content hypothesis, the availability of referent readings for QNP reprise questions means that the semantics of QNPs must (at least partially) consist of a referent individual or set. It seems clear that this referent is the witness set of the corresponding GQ (where this set may be functionally dependent on a situation or another set).

Two approaches present themselves. Firstly, we can hold to a standard view of QNPs as denoting GQs, and assume that the witness set forms the parameter to be grounded in context. This will, of course, only hold to the weaker version of our hypothesis. Secondly, as we have been sketching out so far, we can hold to the stronger version by considering QNPs to denote witness sets directly.

⁴¹BNC file H4T, sentences 43–48

4.4.1 QNPs as GQs

The first approach is shown in AVM [10] (for a definite version – the equivalent indefinite version would of course not add the witness set to C-PARAMS).

$$[10] \left[\begin{array}{l} \text{referential\_np} \\ \text{PHON} \quad \langle \text{the, dog} \rangle \\ \text{CONTENT} \quad \boxed{1} \left[\begin{array}{l} \text{generalized\_quantifier} \\ Q(P) \end{array} \right] \\ \text{C-PARAMS} \quad \left\{ w : \text{witness}(w, \boxed{1}) \right\} \cup \boxed{4} \cup \boxed{5} \\ \text{DTRS} \quad \left\langle \begin{array}{l} \text{det} \\ \text{CONTENT} \quad \boxed{2} \left[Q : Q = \text{the} \right] \\ \text{C-PARAMS} \quad \boxed{4} \left\{ \boxed{2} \right\} \end{array} \right\rangle, \left[\begin{array}{l} \text{nominal} \\ \text{CONTENT} \quad \boxed{3} \left[P : \text{name}(P, \text{dog}) \right] \\ \text{C-PARAMS} \quad \boxed{5} \left\{ \boxed{3} \right\} \end{array} \right] \right\rangle \end{array} \right]$$

Here P is the predicate denoted by the CN *dog*, and w the witness set containing the unique referent dog. The relation $\text{witness}(w, Q(P))$ is of course defined as:

$$\text{witness}(w, Q(P)) \leftrightarrow w \subseteq P \wedge w \in Q(P)$$

or for minimal witness sets:

$$\text{witness}(w, Q(P)) \leftrightarrow w \subseteq P \wedge w \in Q(P) \wedge \neg \exists w' [w' \subset w \wedge w' \in Q(P)]$$

This would account for the availability of referential reprise questions: failure to find a suitable witness set in context will result in a clarification question concerning its identity. This solution, however, only holds to the weak version of our reprise content hypothesis, as the reprise question would no longer concern the entire content of the NP, but only a part. As such, it does not offer a clear explanation of why reprise questions can only query this part, rather than the whole GQ content.

4.4.2 QNPs as Witness Sets

Accordingly we take the second approach: to treat QNPs as denoting their witness sets directly. This leads us to a simple representation, using B&C's equivalence stated in section 2.2.3 above, that a verbal predicate holds of a QNP iff the witness set belongs to the set expressed by that predicate.⁴²

$$[11] \left[\begin{array}{l} \text{referential\_np} \\ \text{PHON} \quad \langle \text{the, dog} \rangle \\ \text{CONTENT} \quad \boxed{1} \left[w : w = Q''(P) \right] \\ \text{C-PARAMS} \quad \left\{ \boxed{1} \right\} \cup \boxed{4} \cup \boxed{5} \\ \text{DTRS} \quad \left\langle \begin{array}{l} \text{det} \\ \text{CONTENT} \quad \boxed{2} \left[Q'' : Q'' = \text{the}'' \right] \\ \text{C-PARAMS} \quad \boxed{4} \left\{ \boxed{2} \right\} \end{array} \right\rangle, \left[\begin{array}{l} \text{nominal} \\ \text{CONTENT} \quad \boxed{3} \left[P : \text{name}(P, \text{dog}) \right] \\ \text{C-PARAMS} \quad \boxed{5} \left\{ \boxed{3} \right\} \end{array} \right] \right\rangle \end{array} \right]$$

Here we define the function the'' which picks out our witness set via the following equivalences:

$$w = Q''(P) \leftrightarrow Q'(w, P) \leftrightarrow \text{witness}(w, Q(P))$$

Essentially this gives us a semantic representation of a sentence “*the dog snores*” which can be written as follows:

⁴²This could alternatively be thought of as implicitly universally quantifying over the members of the witness set.

$$the'(w, D) \wedge dog(D) \wedge snore(w)$$

which is similar to the representation of (Hobbs, 1983, 1996)⁴³, or alternatively:

$$w = the''(D) \wedge dog(D) \wedge snore(w)$$

In both cases, the sentence is true iff $w \subseteq snore$.

This solution has the same power to account for clarifications as the previous one (the witness set forms the contextual parameter to be grounded), but also holds to the strong version of our reprise content hypothesis, and therefore straightforwardly explains why reprise questions can only concern this set (or a sub-constituent). However, this version holds only for $MON\uparrow$ quantifiers: some possible solutions for other quantifiers are discussed in section 5.5 below.

4.5 HPSG Analysis

Neither of these approaches seem to sit particularly well with the head-driven nature of HPSG: **CONTENT** and **C-PARAMS** are now not being directly inherited from or amalgamated across syntactic daughters.

CONTENT Specification As pointed out in section 3.3 above, holding to the strong version of our reprise content hypothesis must mean that NPs do not inherit their content from their head daughter CNs (as in the unification-based semantics of (Sag and Wasow, 1999; Ginzburg and Sag, 2000)), or simply amalgamate across daughters (as in MRS (Copestake et al., 1999)): the referential reprises available for NPs are simply not available when reprising the daughters. To specify the content correctly, we must therefore posit a type *qnp* for all QNPs which specifies how the semantic representation is built:

$$[12] \left[\begin{array}{c} qnp \\ \text{CONTENT} \left[\begin{array}{c} \text{INDEX } w \\ \text{RESTR } \left\{ \begin{array}{c} \text{witness\_set\_rel} \\ \text{INSTANCE } w \\ \text{PROPERTY } P \\ \text{RELN } Q \end{array} \right\} \end{array} \right] \\ \text{DTRS} \left\langle \left[\begin{array}{c} \text{det} \\ \text{CONTENT} \mid \text{INDEX } Q \end{array} \right], \left[\begin{array}{c} \text{nominal} \\ \text{CONTENT} \mid \text{INDEX } P \end{array} \right] \right\rangle \end{array} \right]$$

(or in abbreviated form):

$$[13] \left[\begin{array}{c} qnp \\ \text{CONTENT} \left[w : w = Q(P) \right] \\ \text{DTRS} \left\langle \left[\begin{array}{c} \text{det} \\ \text{CONTENT } Q \end{array} \right], \left[\begin{array}{c} \text{nominal} \\ \text{CONTENT } P \end{array} \right] \right\rangle \end{array} \right]$$

Note that the constraint expressed above is still monotonic (no semantic information is dropped in construction of the mother) and compositional (the semantics of the mother is obtained purely by functional application of daughters).

C-PARAMS Amalgamation As mentioned in section 4.1.4 above, the availability of sub-constituent readings shows that the **C-PARAMS** value for a phrase must include the amalgamated values of its daughters. However, the fact that reprises of head daughters (e.g. CNs) cannot be interpreted as querying the content

⁴³Although Hobbs uses the notion of a *typical element* of a set and uses this as the argument of a verb (coercing the predicate into a typical/non-typical version as necessary). We do not take this step.

of their *sisters* means that this amalgamation cannot be via lexical heads (as in the general Non-LOCAL Amalgamation Constraint assumed to govern C-PARAMS by G&C), but must be explicitly specified for the mother. We could therefore express this as a default constraint on the type *phrase* similar to G&C's CONSTITITS Amalgamation Constraint, shown in AVM [14] below.

$$[14] \left[\begin{array}{l} \text{phrase} \\ \text{C-PARAMS} \quad \boxed{1} \cup \dots \cup \boxed{n} \\ \text{DTRS} \quad \left\langle \left[\text{C-PARAMS} \quad \boxed{1} \right], \dots, \left[\text{C-PARAMS} \quad \boxed{n} \right] \right\rangle \end{array} \right]$$

However, definite NPs must override this default, as they introduce a new contextual parameter as well as amalgamating those of its daughters. Indefinites hold to it, but we must ensure that their content is instead existentially quantified. We can combine these facts into a general *definiteness principle*.

Definiteness Principle In our HPSG terms, indefinites must contribute their content to the STORE feature (see section 5.3 for more details), while definites contribute it to C-PARAMS (and this is what distinguishes definite from indefinite uses). We can therefore state a general principle: the content of a NP must be a member of either C-PARAMS or STORE. We can replace AVM [14] with a more general Definiteness Principle, which we take as applying to both words and phrases. For words, it is simply expressed:

$$[15] \left[\begin{array}{l} \text{word} \\ \text{CONTENT} \quad \boxed{1} \\ \text{STORE} \quad \boxed{2} \\ \text{C-PARAMS} \quad \left\{ \boxed{1} \right\} - \boxed{2} \end{array} \right]$$

For phrases, it also specifies STORE and C-PARAMS amalgamation from daughters:

$$[16] \left[\begin{array}{l} \text{phrase} \\ \text{CONTENT} \quad \boxed{1} \\ \text{STORE} \quad \boxed{2} \cup \boxed{3} \\ \text{C-PARAMS} \quad \left(\left\{ \boxed{1} \right\} - \boxed{2} \right) \cup \boxed{4} \cup \dots \cup \boxed{n} \\ \text{HEAD-DTR} \quad \left[\text{STORE} \quad \boxed{3} \right] \\ \text{DTRS} \quad \left\langle \left[\text{C-PARAMS} \quad \boxed{4} \right], \dots, \left[\text{C-PARAMS} \quad \boxed{n} \right] \right\rangle \end{array} \right]$$

Definites (and referential words such as CNs, which on our account are referential to a predicate) can therefore be specified as having empty STORE values, thus forcing their content to be a member of C-PARAMS. Indefinites can be specified as contributing to STORE, and thus can make no contribution to C-PARAMS.

Sub-Constituent Focussing This amalgamation of C-PARAMS from daughters goes some way towards accounting for the sub-constituent readings that always seem available (especially when a constituent is intonationally stressed), but we also require an explanation of how the sub-constituent becomes focussed in order to assign the relevant content to the reprise question.

We assume Engdahl and Vallduví (1996)'s analysis of information structure in HPSG, with a feature INFO-STRUCT divided into FOCUS and GROUND⁴⁴, with the contents of each linked (in English at least) to intonation. Reprise questions are now taken to be querying the FOCUSSED component (and checking that

⁴⁴There is some redundancy here between GROUND and MAX-QU, as both are expressing contextually given elements. A full account would link the two (see Engdahl et al., 1999)

the GROUND components are indeed given in context by the utterance being clarified)⁴⁵.

Note that a complete analysis of this phenomenon may require an account of focus spreading from CN to NP: it seems plausible to us that a reprise even with the CN intonationally focussed may be interpreted as querying the NP referent. This should be possible, again using Engdahl and Vallduví (1996)'s analysis, but we note that the usual assumption that focus spreads from the *most oblique* daughter to the mother would not appear to hold in this case (intuitively at least – as far as we know accounts of focus spreading have never considered phenomena at this low a level, within NPs).

4.6 Summary

In this section we have shown that reprises of definite NPs apparently query a referent rather than a generalized quantifier or property-of-properties, and surmised that this may also be true for referential uses of other QNPs.

We have shown how these referents can be represented as witness sets, and that our reprise content hypothesis can be held to in its strong version if a semantic representation of QNPs as denoting witness sets is used. This leads to a relatively simple flat representation, with similarities to that of Hobbs (1983) or the choice function/epsilon term approach.

Having outlined our treatment of QNPs, in the next section we take a quick look at some further implications of this treatment (for the semantics of determiners and for a treatment of anaphora), and show how it can be extended to cope with issues we have so far only mentioned as problematic: quantifier scope and non-MON $\uparrow$ quantifiers.

5 Further Issues

5.1 Determiners

Where does this leave us with regard to determiners? A view of NPs as denoting witness sets and of CNs as denoting predicates (properties of individuals) seems to leave us with a view of determiners as denoting functions from the CN predicates to the NP sets (i.e. functions of type $(e \rightarrow t) \rightarrow e$). In a model-theoretic sense, they would therefore denote relations between two sets (the equality relation for *every*, a relation that picks out an epsilon term for *a/some*, a relation that picks out a set of a particular cardinality for *two/three*).

The alternative view of NPs as denoting GQs, on the other hand, would force us to view determiners as denoting functions from CN predicates to GQs (sets of sets) – essentially the Montagovian view of determiners as functions of type $(e \rightarrow t) \rightarrow ((e \rightarrow t) \rightarrow t)$.

Do either of these fit with what determiner reprise questions seem to mean?

⁴⁵We suspect that the GROUND components are present either to help disambiguate the exact source constituent being clarified, or just to make the reprise more syntactically palatable.

5.1.1 Evidence

Determiner-only reprises seem to be rare: the only suitable examples found through corpus investigation involved numerals (see example (38)).⁴⁶

- (38)⁴⁷ Marsha: yeah that's it, this, she's got three rottweiler's now and
 Sarah: **three?**
 Marsha: yeah, one died so only got three now <laugh>
 ~~~~~  
 ~~~~~ "Is it **three**<sub>N</sub> you are saying she's got *N* rottweilers?"

For these examples, the query appears to concern the cardinality of the set under discussion, which fits quite nicely with the idea of determiners as denoting set relations.

For other determiners, we have to rely on our intuition, and on those QNP reprise examples mentioned in section 4 above in which the determiner appears to be stressed, e.g. example (34), repeated here as example (39):

- (39)<sup>48</sup> Richard: No I'll commute every day  
 Anon 6: **Every day?**  
 Richard: as if, er Saturday and Sunday  
 Anon 6: And all holidays?  
 Richard: Yeah <pause>  
 ~~~~~  
 ~~~~~ "Is it **every**_N that you are saying you'll commute on *N* days?"

Again, these readings do seem to fit quite nicely with the idea of determiners as denoting set relations, and perhaps less so with that of relations between sets and sets of sets.

Another possible reading seems to be one asking about the situation in which the quantifier relation is being used. This could be accounted for in terms of situated relations (functional on situations), analogous to the functional sets discussed briefly in section 4.1.3 and in more detail in section 5.3 below.

However, the sparsity of the evidence and the difficulty of pinning down a definitive paraphrase mean we hesitate to make any strong claims here: but we do claim that determiner reprises provide no counter-evidence to the analysis of section 4.

5.2 WH-Phrases

We have not so far mentioned WH-phrases. How should their semantic content be represented so as to be consistent with what their reprises seem to mean?

Very few examples of reprises of "what/which *N*" phrases (i.e. those including a CN) were found, so we have also looked at reprises of plain WH-words, as shown in the examples below. Examination of these reprises suggests that the query can concern a property but not a referent. In "what/which *N*" examples (see example (40)) we see the familiar sub-constituent readings (querying the CN predicate or the determiner relation); bare WH examples (example (41)) seem to query a predicate expressed as part of the lexical

⁴⁶The only non-numerical determiner-only reprise questions we have found are queries regarding surface form (rather than semantic content), of the type classified by Purver et al. (2001) as the *gap* reading: the element being clarified is not the determiner but rather whatever word(s) came immediately after it.

⁴⁷BNC file KP2, sentences 295–297

⁴⁸BNC file KSV, sentences 257–261

semantics of the WH-word itself. Referent readings seem impossible in all cases.

- (40)⁴⁹
Unknown:	How many procedures have we actually audited so far Richard?
Richard:	How many procedures?
Unknown:	Yeah.
~	<i>“Is it procedures_N you are asking about how many Ns?”</i>
~	<i>“Is it a number of procedures you are asking about?”</i>
~	<i>#“Which procedures are you asking how many of them there are?”</i>
-
- (41)⁵⁰
Charlotte:	Why does the dustman have to take it away?
Larna:	No not the dustman, the postman
Charlotte:	Why does the postman have to take all the letters away?
Larna:	Why? Well he takes them to the post office
Charlotte:	Yeah
Larna:	then the post office sorts them out
~	<i>“Is it a reason you are asking for?”</i>
~	<i>#“Which reason are you asking for?”</i>

The simplest and most consistent analysis therefore seems to be that WH-phrases resemble indefinites, in that they represent terms (or sets of terms) which are *not* added to C-PARAMS (hence no referent reprise reading). However, these terms are not existentially quantified within the sentence but queried: on a view of questions as λ -abstracts, they are part of the abstracted set. In our HPSG analysis, this is achieved by adding them to STORE rather than C-PARAMS (like indefinites), but giving them a distinct type which must be discharged into the PARAMS feature rather than QUANTS.

5.3 Quantifier Scope

We have so far mentioned quantifier scope only briefly. Two questions present themselves: firstly, how do we account for relative scope in a simple witness-set-based representation; and secondly, how does scope fit with reprise questions and C-PARAMS?

5.3.1 Quantifier Storage and Retrieval

As we are representing indefinites as existentially quantified sets, we need a mechanism for introducing this quantification into the semantic content of the sentence at the appropriate level. For this we use the familiar storage method of (Cooper, 1983), using the feature STORE to which existentially quantified elements are added by lexical/phrasal constituents and from which they are retrieved to form part of the sentence semantics.

We keep the lexically-based retrieval mechanism of (Ginzburg and Sag, 2000), whereby inherited STORE values are (by default) allowed to be discharged into the QUANTS feature. Note that as only existential quantification is being used, the order of quantifiers is not important – we can therefore represent QUANTS as a *set* rather than a *list*, thus no longer requiring the *order* operator of Ginzburg and Sag (2000). Our version of the STORE Amalgamation Constraint therefore appears as in AVM [18]:

$$[18] \left[\begin{array}{l} \text{word} \\ \text{CONTENT} \quad \left[\text{QUANTS} \quad [2] \right] \\ \text{STORE} \quad \{ [1] \cup \dots \cup [n] \} - [2] \\ \text{ARG-ST} \quad \left\langle \left[\text{STORE} \quad [1] \right], \dots, \left[\text{STORE} \quad [n] \right] \right\rangle \end{array} \right]$$

⁴⁹BNC file KM4, sentences 920 – 922

⁵⁰BNC file KD1, sentences 434 – 440

In addition, because there is now only one kind of quantification, we can treat both STORE and QUANTS as sets of *parameters* rather than *quantifiers*: as well as marginally simplifying STORE/QUANTS themselves, this turns out to be useful for our treatment of anaphora (see section 5.4 below).

The members of the QUANTS set are taken to be *simultaneously* quantified over, following Cooper (1993)'s definition of simultaneous quantification for his situation-theoretic reconstruction of DRT (Kamp and Reyle, 1993). A quantified *soa* is viewed as an abstract, with the QUANTS set abstracted from the body. Truth conditions are then dependent on the existence of some appropriate assignment for that abstract – one which assigns values to the members of the abstracted set such that the *soa* is supported by the relevant situation.

5.3.2 Representation of Scope

By using the functional representation outlined in section 4.1.3, we can express relative scope by regarding narrow-scoping NPs as functional on other referential sets: the alternative readings of “*every dog_d likes a cat_c*” are produced by the alternative views of *a cat* being a simple existentially quantified individual *c*, or one that is functionally dependent on the set of dogs *f(d)* via an existentially quantified function *f* (so giving an analysis similar to the choice function analysis of e.g. Farkas (1997); von Heusinger (2002)).

This requires a mechanism for identification of the functional *arguments* with the relevant wide-scoping sets/individuals in the sentence: where these wide-scope individuals are definites (members of C-PARAMS), this is achieved by making the narrow-scope argument a member of C-PARAMS and identifying the two during grounding; where the wide-scope individuals are indefinites (members of STORE), it occurs through the anaphoric binding mechanism which we describe in section 5.4.2 below. The narrow-scope *function* remains a member of C-PARAMS or STORE depending on (in)definiteness, just as described in section 4.

Note that we have postulated functional NPs with two types of argument – those functional on situations (as for attributive definites) and those functional on other NPs (as for our narrow-scope version here). A simpler view whereby functional NPs always take situations as arguments might be possible: in the case of narrow-scoping elements, the argument would be a situation linked to another NP, directly analogous to Cooper (1995)'s *individual* situation (a situation for each member of the witness set, which supports the proposition expressed by the sentence for that member). The cost of this view would be that sets of individual situations must be provided in C-PARAMS/STORE, either by NPs themselves or by verbal predicates. As we currently have no evidence for this, we leave it aside for now as a possible alternative.

5.3.3 Reprises and Scope

Finding corpus examples of multiple-quantifier sentences in dialogue with determinable scope ordering and followed by reprise questions is a seemingly Sisyphean task which we have frankly not even attempted. It seems clear to us, though, that directly referential reprises can only make any sense when reprising a QNP with widest scope, while reprises of narrow-scoping elements will be read as functional in the same way as those described in section 4.1.3 - attempting to identify the function or its domain. We should therefore find invented examples such as example (42) acceptable (it seems so to us):

(42)	A: Every professor relies on their teaching assistant. B: Their teaching assistant? ↪ “What situation are you intending me to interpret ‘their teaching assistant’ in?” ↪ “What are you intending ‘their teaching assistant’ to refer to for each professor?” ↪ #“Which actual person are you referring to by ‘their teaching assistant’?”

5.4 Anaphora

5.4.1 Intersentential Anaphora

An account of anaphora seems to follow simply, whereby anaphoric terms such as pronouns are treated like definites – they have referential C-PARAMS whose reference must be established during the grounding process. The constraints on this identification may be slightly different to those for definites: rather than

having to identify a referent in the general context, truly anaphoric uses must have to refer to entities already established in the discourse. Deictic uses can be accounted for by assuming that salient referents are introduced into the discourse (or the general context) by external cognitive means.

Details will depend on the model of context being used, which we do not intend to delve into here⁵¹. We just note that the treatment of NPs as denoting witness sets allows these sets to provide potential antecedents for anaphors in future utterances. Where these antecedent sets are associated with definites, it is clear that they are already in the context: for indefinites, a protocol will be required to account for their addition thereto.⁵²

One puzzle, however, is the quantifier *every*. In contrast to quantifiers such as *all*, *most*, which licence only plural anaphora (which we assume to refer to the witness set denoted by the QNP and therefore introduced to the discourse), *every* also licenses singular anaphora. If we assume that an *every*-QNP denotes a set, it is not clear how a singular individual is provided for reference. If instead we view a singular pronoun as functional on a set, it is not clear why this is not possible for other plural quantifiers.

5.4.2 Intrasentential Anaphora

Accounting for intrasentential anaphora requires a further step. If pronouns (and anaphoric definites) are taken as referring to existentially quantified elements within the same sentence, they can no longer have a contextual parameter associated with them: they do not refer to an element in the context external to the utterance.

We therefore propose that elements of C-PARAMS can be removed if they can be identified with an element of QUANTS – i.e. a binding mechanism similar to Poesio (1994)’s *parameter anchoring* and van der Sandt (1992)’s *presupposition binding* (hence the advantage of our implementation of STORE/QUANTS as parameters rather than quantifiers). This mechanism is implemented via a new feature B(OUND)-PARAMS: referential parameters can be members of either C-PARAMS or B-PARAMS, but membership of B-PARAMS is limited to those parameters which can be identified with existentially quantified parameters (i.e. members of STORE/QUANTS). This leads us to the final version of our definiteness principle:

$$[19] \left[\begin{array}{l} \text{word} \\ \text{CONTENT} \quad [1] \\ \text{STORE} \quad [2] \\ \text{C-PARAMS} \quad [3] \\ \text{B-PARAMS} \quad \{ [1] \} - [2] - [3] \end{array} \right]$$

while the restriction on B-PARAMS membership is expressed through the final version of our lexical quantifier storage mechanism:

$$[20] \left[\begin{array}{l} \text{word} \\ \text{CONTENT} \quad \left[\text{QUANTS} \quad [Q] \right] \\ \text{STORE} \quad [S] = \{ [1_a] \cup \dots \cup [n_a] \} - [Q] \\ \text{B-PARAMS} \quad \{ [1_b] \cup \dots \cup [n_b] \} - \text{subset}([Q] \cup [S]) \\ \text{ARG-ST} \quad \left\langle \left[\begin{array}{l} \text{STORE} \quad [1_a] \\ \text{B-PARAMS} \quad [1_b] \end{array} \right], \dots, \left[\begin{array}{l} \text{STORE} \quad [n_a] \\ \text{B-PARAMS} \quad [n_b] \end{array} \right] \right\rangle \end{array} \right]$$

We ensure that all members of B-PARAMS are thus discharged by specifying top-level sentences (in our grammar, signs of type *root-cl*) as having empty B-PARAMS. Note that this mechanism can also apply to the arguments of narrow-scope functional NPs, thus allowing them to be functional from wider-scoping existentially quantified sets. This includes situational arguments, allowing the argument of an attributive definite to be taken as the situation introduced in the utterance (the described situation).

⁵¹For one thing, a full account will presumably also require some notion of salience or discourse structure.

⁵²This cannot be as simple as adding an utterance’s existentially quantified sets to a discourse record on acceptance: Ginzburg (2001) gives examples of anaphora to entities from unaccepted assertions and even from ungrounded utterances. One way to take these into account might be to allow for the possibility of pronouns which are functional on (sub-)utterances themselves (or, as Ginzburg suggests, utterance situations).

5.5 Monotone Decreasing Quantifiers

As we mentioned in section 4.4.2 above, B&C point out that it is not sufficient with monotone decreasing (MON $\downarrow$) cases to show that a predicate holds of a witness set: instead we must show that the witness set contains *all* members of the restriction set of which the predicate holds.

$$\exists w[(X \cap A) \subseteq w] \leftrightarrow X \in D(A)$$

This means that our representation of QNPs as denoting witness sets fails to encapsulate the meaning of MON $\downarrow$ quantifiers (or non-monotone quantifiers such as *exactly two*). The sentence “*Few men work*” does not only convey the fact that the property of working holds of some set S containing few men, but also that the property does not hold of any men who are not in S.

$$few(S, \{x | man(x)\}) \wedge work(S)$$

$$few(S, \{x | man(x)\}) \wedge work(S) \wedge \neg \exists S'[(S' \subseteq \{x | man(x)\}) \wedge (S \subset S') \wedge work(S')]$$

One solution might be to appeal to pragmatics: Hobbs (1996) solves the problem by use of a pragmatic constraint which strengthens the sentence meaning accordingly: *few men work* is taken just as the assertion that there is a set containing few men, all of whom work, but this is strengthened by an abductive process to the assertion that this set is the maximal set of working men.

Another would of course be to regard the content of QNPs as GQs rather than witness sets, but of course this means only the weak hypothesis can hold (see above).

Another possibility is the view of MON $\downarrow$ quantifiers as the negation of their MON $\uparrow$ counterparts (*few men work* is truth-conditionally equivalent to *most men don't work*). This has been much explored in the DPL tradition of GQs (see e.g. van den Berg, 1996).

Complement Set Anaphora One of the advantages of such an approach is that it allows for an explanation of the phenomenon of *complement set anaphora* noticed by Moxey and Sanford (1987, 1993). Kibble (1997a,b) sees sentences with such quantifiers as ambiguous between internal and external negation (*most men don't work* vs. *it's not true that most men work*), giving rise to the possibility of complement set (the men who don't work) and reference set (the men who do) anaphora respectively.

An interesting question is therefore whether reprise questions of MON $\downarrow$ QNPs can query the reference or complement set. The pragmatic approach would suggest only the reference set is possible, the negation approach the reverse. Sadly, examples of MON $\downarrow$ QNP reprises are rare. Most of those we have found seem to be best paraphrased as sub-constituent readings, querying either the CN predicate or the logical quantifier relation:

(43) ⁵³	Lorna:	Oh shit! I've gotta ring mum. Tell mum no meat.
	Kathleen:	No meat?
	Lorna:	I'm not allowed to get meat and stuff.
	Kathleen:	Why?
	Lorna:	Cos we're vegetarians!
	$\leadsto$	“Is it really <i>meat</i> _P you're saying to tell mum no P?”
	$\leadsto$	“Is it really <i>no</i> _N you're saying to tell mum N meat?”

But some do seem to allow for reference set reference, and possibly for complement set reference as

⁵³BNC file KCW, sentences 2204–2210

well, although this seems less clear:

- (44)⁵⁴ Anon 1: Did any of them the lads that you the men that you went away with. Did they come back?
 Richard: Not all.
 Anon 1: **Not all of them?**
 Richard: Oh no.
 Anon 1: Were any of them.
 ~→ “Who are you telling me did come back?”
 ~→ ?“Who are you telling me didn’t come back?”

Kibble gives the following example of complement set anaphora:

- (45) BBC News: Not all of the journalists agreed, among them the BBC’s John Simpson.

where *them* is construed to refer to the group of journalists who did *not* agree. An imagined reprise version seems easier to construe as querying the complement set:

- (46) A: Not all of the journalists agreed.
 B: **Not all of them?**
 A: John Simpson was pretty combative. Marr and Paxman didn’t like it much either.
 ~→ “Who do you mean **didn’t** agree?”

If so, a more consistent approach would be to view $\text{MON}\downarrow$ QNPs as denoting *pairs* of reference and complement sets $[R, C]$. The reference set R is, as with $\text{MON}\uparrow$ QNPs, a witness set; the complement set C is $(A - R)$ (for a quantifier living on A). Such a pair might be paraphrased as “ R as opposed to C ”, and can be interpreted as follows:

$$\text{snore}([R, C]) \leftrightarrow (R \subseteq \text{snore}) \wedge (C \cap \text{snore} = \emptyset)$$

Most such QNPs will presumably be non-referential and thus will not contribute to C-PARAMS: what is contributed in any referential cases depends on whether we believe in complement set reprises – if so, the pair $[R, C]$ will be made a member of C-PARAMS; if not, just R , as in AVM [21].

$$[21] \left[\begin{array}{l} \text{PHON} \\ \text{CONTENT} \\ \text{C-PARAMS} \\ \text{DTRS} \end{array} \right] \left[\begin{array}{l} \langle \text{few, dogs} \rangle \\ \left[\begin{array}{l} \text{REF} \quad [1] [r : r = Q(P)] \\ \text{COMP} \quad [c : c = (P - r)] \end{array} \right] \\ \{ [1] \} \cup [4] \cup [5] \\ \left\langle \left[\begin{array}{l} \text{det} \\ \text{CONTENT} \quad [2] [Q : Q = \text{few}'] \\ \text{C-PARAMS} \quad [4] \{ [2] \} \end{array} \right], \left[\begin{array}{l} \text{nominal} \\ \text{CONTENT} \quad [3] [P : \text{name}(P, \text{dog})] \\ \text{C-PARAMS} \quad [5] \{ [3] \} \end{array} \right] \right\rangle \end{array} \right]$$

The existence of both members of the pair now helps us explain how they are possible anaphoric referents: and so why (only) $\text{MON}\downarrow$ QNPs license complement-set reference. As it stands, this says nothing about the relative preference for reference set anaphora observed by Nouwen (2003), or the possibility that not all $\text{MON}\downarrow$ quantifiers license complement set anaphora that he also raises, although his approach using inference of non-emptiness seems perfectly applicable to ours. Further investigation of $\text{MON}\downarrow$ reprises, particularly if more data can be obtained, may help us in this direction.

⁵⁴BNC file HEU, sentences 360–365

6 Conclusions

In this paper we have introduced the use of reprise questions as probes in order to investigate the semantic content of words and phrases, and examined the evidence provided by the apparent meaning of these questions as regards the semantic content of nouns, noun phrases and (briefly) determiners. This evidence has led us to the following conclusions:

- The commonly held view of CNs as properties (of individuals) seems to correspond well with their reprises.
- The view of NPs as denoting sets of sets, or properties of properties, seem very difficult to reconcile with reprise questions.
- Reprises of NPs all seem to be able to query focussed sub-constituents.
- Reprises of definite NPs suggest that most uses of these NPs are referential to a (possibly functional) individual or set.
- Reprises of indefinite NPs and other QNPs suggest that such referential uses, while rare, are possible.

These conclusions have led us to a representation of NPs as denoting witness sets, and a definite/indefinite distinction expressed by abstraction (or lack thereof) of referential parameters to a contextually dependent set. We have shown how this can take into account relative quantifier scope via a functional view, intrasentential anaphora via a parameter binding mechanism, and non-monotone-increasing quantifiers via a representation as pairs of sets.

We have outlined a corresponding treatment in HPSG (including a revised quantifier storage mechanism), and noted along the way that this causes us to revise some of the standard assumptions made in HPSG about inheritance of content from daughter to mother, and non-local amalgamation by heads rather than syntactic mothers.

Acknowledgements

The authors are supported by the UK Engineering and Physical Sciences Research Council under grant GR/R04942/01. They would also like to thank Bill Ladusaw, Gerald Penn, John Beavers and Christian Ebert for useful discussion and comments.

Contact Details

Name	Matthew Purver	Email	matthew.purver@kcl.ac.uk
Postal Address	Department of Computer Science, King's College London, Strand, London WC2R 2LS, UK	Phone	+44-20-7848-2476
		Fax	+44-20-7848-2851

References

- B. Abbott. Definiteness and indefiniteness. In L. Horn and G. Ward, editors, *Handbook of Pragmatics*. Blackwell, 2001. To appear.
- N. Asher. *Reference to Abstract Objects in Discourse*. Kluwer Academic Publishers, 1993.
- J. Barwise and R. Cooper. Generalized quantifiers and natural language. *Linguistics and Philosophy*, 4:159–219, 1981.
- J. Barwise and J. Perry. *Situations and Attitudes*. MIT Press, 1983.
- L. Burnard. *Reference Guide for the British National Corpus (World Edition)*. Oxford University Computing Services, 2000. URL <ftp://sable.ox.ac.uk/pub/ota/BNC/>.
- G. Carlson. *Reference to Kinds in English*. PhD thesis, University of Massachusetts at Amherst, 1977.
- G. Chierchia. Reference to kinds across languages. *Natural Language Semantics*, 6(4):339–405, 1998.
- R. Cooper. Quantification and syntactic theory. *Synthese Language Library*, 1983.

- R. Cooper. Towards a general semantic framework. In R. Cooper, editor, *Integrating Semantic Theories*. ILLC/Department of Philosophy, University of Amsterdam, 1993.
- R. Cooper. The role of situations in generalized quantifiers. In S. Lappin, editor, *The Handbook of Contemporary Semantic Theory*. Blackwell, 1995.
- R. Cooper and J. Ginzburg. Using dependent record types in clarification ellipsis. In J. Bos and C. Matheson, editors, *Proceedings of the Sixth Workshop on Formal Semantics and Pragmatics of Dialogue (EDILOG 2002)*, 2002.
- A. Copestake, D. Flickinger, I. A. Sag, and C. Pollard. Minimal recursion semantics: An introduction. Draft, 1999. URL <http://www-csli.stanford.edu/aac/papers/newmrs.ps>.
- P. Dekker. A pragmatic view upon indefinites. In *Proceedings of the ESSLI-01 Workshop on Choice Functions and Natural Language Semantics*. Working Papers of the Department of Linguistics in Konstanz, 2002.
- K. Donnellan. Reference and definite descriptions. *Philosophical Review*, 77:281–304, 1966.
- E. Engdahl, S. Larsson, and S. Ericsson. Focus-ground articulation and parallelism in a dynamic model of dialogue. In *Task Oriented Instructional Dialogue (TRINDI): Deliverable 4.1*. University of Gothenburg, 1999.
- E. Engdahl and E. Vallduví. Information packaging in HPSG. In C. Grover and E. Vallduví, editors, *Studies in HPSG*, pages 1–31. University of Edinburgh, 1996.
- D. Farkas. Dependent indefinites. In F. Corblin, D. Godard, and J.-M. Maradin, editors, *Empirical Issues in Formal Syntax and Semantics*, pages 243–267. Peter Lang, 1997.
- J. Fodor and I. A. Sag. Referential and quantificational indefinites. *Linguistics and Philosophy*, 5:355–398, 1982.
- J. Ginzburg. Fragmenting meaning: Clarification ellipsis and nominal anaphora. In H. Bunt, editor, *Computing Meaning 2: Current Issues in Computational Semantics*. Kluwer Academic Publishers, 2001.
- J. Ginzburg and R. Cooper. Resolving ellipsis in clarification. In *Proceedings of the 39th Meeting of the ACL*, pages 236–243, 2001.
- J. Ginzburg and R. Cooper. Clarification, ellipsis, and the nature of contextual updates. *Linguistics and Philosophy*, forthcoming.
- J. Ginzburg and I. A. Sag. *Interrogative Investigations: the Form, Meaning and Use of English Interrogatives*. CSLI Publications, 2000.
- J. Ginzburg, I. A. Sag, and M. Purver. Integrating conversational move types in the grammar of conversation. In *Proceedings of the Fifth Workshop on Formal Semantics and Pragmatics of Dialogue (BI-DIALOG)*, pages 45–56, 2001.
- J. Ginzburg, I. A. Sag, and M. Purver. Integrating conversational move types in the grammar of conversation. In P. Kühnlein, H. Rieser, and H. Zeevat, editors, *Perspectives on Dialogue in the New Millennium*. John Benjamins, 2003.
- J. Groenendijk and M. Stokhof. Dynamic predicate logic. *Linguistics and Philosophy*, 14(1):39–100, 1991.
- P. G. T. Healey, M. Purver, J. King, J. Ginzburg, and G. J. Mills. Experimenting with clarification in dialogue. In *Proceedings of the 25th Annual Meeting of the Cognitive Science Society*, 2003.
- I. Heim. *The Semantics of Definite and Indefinite Noun Phrases*. PhD thesis, University of Massachusetts at Amherst, 1982.
- J. Hobbs. An improper treatment of quantification in ordinary English. In *Proceedings of the 21st Annual Meeting*, pages 57–63. Association for Computational Linguistics, 1983.
- J. Hobbs. Monotone decreasing quantifiers. In K. van Deemter and S. Peters, editors, *Semantic Ambiguity and Underspecification*, pages 55–76. CSLI Publications, 1996.
- H. Kamp and U. Reyle. *From Discourse To Logic*. Kluwer Academic Publishers, 1993.
- E. Keenan and J. Stavi. A semantic characterization of natural language determiners. *Linguistics and Philosophy*, 9: 253–326, 1986.
- E. Keenan and D. Westerståhl. Generalized quantifiers in linguistics and logic. In J. van Benthem and A. ter Meulen, editors, *Handbook of Logic and Language*, pages 837–893. Elsevier, 1997.
- R. Kempson, W. Meyer-Viol, and D. Gabbay. *Dynamic Syntax: The Flow of Language Understanding*. Blackwell, 2001.
- R. Kibble. Complement anaphora and dynamic binding. In A. Lawson, editor, *Proceedings of the seventh annual conference on Semantics and Linguistic Theory (SALT VII)*. Cornell University, 1997a.
- R. Kibble. Complement anaphora and monotonicity. In G. Morrill, G.-J. Kruijff, and R. Oehrle, editors, *Proceedings of the Formal Grammar conference*, pages 125–136, 1997b.
- S. Kripke. Speaker's reference and semantic reference. In *Perspectives in the Philosophy of Language*, number 2 in Midwest Studies in Philosophy, pages 6–27. University of Minnesota Press, 1977.
- P. Ludlow and S. Neale. Indefinite descriptions: In defense of Russell. *Linguistics and Philosophy*, 14:171–202, 1991.
- P. Ludlow and G. Segal. On a unitary semantical analysis for definite and indefinite descriptions. In A. Bezuidenhout and M. Reimer, editors, *Descriptions and Beyond: An Interdisciplinary Collection of Essays on Definite and Indefinite Descriptions*. Oxford University Press, forthcoming.

- R. Montague. The proper treatment of quantification in ordinary English. In R. Thomason, editor, *Formal Philosophy: Selected Papers of Richard Montague*, pages 247–270. Yale University Press, 1974.
- L. Moxey and A. Sanford. Quantifiers and focus. *Journal of Semantics*, 5:189–206, 1987.
- L. Moxey and A. Sanford. *Communicating Quantities: a Psychological Perspective*. Lawrence Erlbaum Associates, 1993.
- R. Nouwen. Complement anaphora and interpretation. *Journal of Semantics*, 20(1):73–113, 2003.
- M. Pickering and S. Garrod. Toward a mechanistic psychology of dialogue. *Behavioral and Brain Sciences*, forthcoming, 2003.
- M. Poesio. A situation-theoretic formalization of definite description interpretation in plan elaboration dialogues. In P. Aczel, D. Israel, Y. Katagiri, and S. Peters, editors, *Situation Theory and its Applications*, volume 3, pages 339–374. CSLI Publications, 1993.
- M. Poesio. Weak definites. In *Proceedings of the Fourth Conference on Semantics and Linguistic Theory (SALT-4)*, 1994.
- C. Pollard and I. A. Sag. *Head Driven Phrase Structure Grammar*. University of Chicago Press and CSLI, Chicago, 1994.
- E. Prince. The ZPG letter: Subjects, definiteness and information status. In W. Mann and S. Thompson, editors, *Discourse Description: Diverse Linguistic Analyses of a Fund-Raising Text*, pages 295–326. John Benjamins, 1992.
- M. Purver. SCoRE: A tool for searching the BNC. Technical Report TR-01-07, Department of Computer Science, King's College London, October 2001. URL <ftp://ftp.dcs.kcl.ac.uk/pub/tech-reports/tr01-07.ps.gz>.
- M. Purver. Processing unknown words in a dialogue system. In *Proceedings of the 3rd ACL SIGdial Workshop on Discourse and Dialogue*, pages 174–183, 2002.
- M. Purver, J. Ginzburg, and P. Healey. On the means for clarification in dialogue. In *Proceedings of the 2nd ACL SIGdial Workshop on Discourse and Dialogue*, pages 116–125, 2001.
- M. Purver, J. Ginzburg, and P. Healey. On the means for clarification in dialogue. In R. Smith and J. van Kuppevelt, editors, *Current and New Directions in Discourse & Dialogue*. Kluwer Academic Publishers, 2003a.
- M. Purver, P. G. T. Healey, J. King, J. Ginzburg, and G. J. Mills. Answering clarification questions. In *Proceedings of the 4th SIGdial Workshop on Discourse and Dialogue*, 2003b.
- T. Reinhart. Quantifier scope: How labour is divided between QR and choice functions. *Linguistics and Philosophy*, 20:335–397, 1997.
- C. Roberts. Demonstratives as definites. In K. van Deemter and R. Kibble, editors, *Information Sharing: Reference and Presupposition in Language Generation and Interpretation*, pages 89–136. CSLI Publications, 2002.
- B. Russell. On denoting. *Mind*, 14:479–493, 1905.
- I. Sag and T. Wasow. *Syntactic Theory: A Formal Introduction*. CSLI Publications, 1999.
- P. Strawson. On referring. *Mind*, 59:320–344, 1950.
- A. Szabolcsi. Strategies for scope taking. In A. Szabolcsi, editor, *Ways of Scope Taking*, pages 109–155. Kluwer Academic Publishers, 1997.
- M. van den Berg. Dynamic generalised quantifiers. In J. van der Does and J. van Eijck, editors, *Quantifiers, Logic and Language*, Studies in Linguistics and Philosophy, pages 63–94. CSLI Publications, 1996.
- J. van der Does and J. van Eijck. Basic quantifier theory. In J. van der Does and J. van Eijck, editors, *Quantifiers, Logic and Language*, pages 1–45. CSLI Publications, 1996.
- R. van der Sandt. Presupposition projection as anaphora resolution. *Journal of Semantics*, 9:333–377, 1992.
- R. van Rooy. The specificity of indefinites. In *Proceedings of the 1998 Budapest Workshop on Indefinites*, 2000.
- K. von Heusinger. The reference of indefinites. In K. von Heusinger and U. Egli, editors, *Reference and Anaphoric Relations*, pages 247–265. Kluwer Academic Publishers, 2000.
- K. von Heusinger. Specificity and definiteness in sentence and discourse structure. *Journal of Semantics*, 19(3): 245–274, 2002.
- T. E. Zimmerman. Remarks on the epistemic rôle of discourse referents. In L. Moss, J. Ginzburg, and M. de Rijke, editors, *Logic, Language and Computation: Volume 2*, number 96 in CSLI Lecture Notes, pages 346–368. CSLI Publications, 1999.