

## Clarification and generalized quantifiers\*

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### Abstract

We attempt to show that a classical concern of formal semantics, quantification, interacts in an interesting way with dialogue strategies when viewed from the perspective of our approach to semantics using Type Theory with Records (TTR). TTR analyzes semantic content in terms of structured semantic objects containing subcomponents and we argue that these components influence what a dialogue participant can take up in response to a reprise of part of a previous utterance of a quantified sentence. The discussion builds on previous work by Purver and Ginzburg who introduce the Reprise Content Hypothesis and use it to argue for a particular analysis of quantification. In previous work we contrasted their approach with a more classical generalized quantifier analysis. In the present paper we synthesize the two approaches and suggest that this gives us the best account of the reprise phenomena associated with quantification.

**Keywords:** Clarification, Quantification, Reprise Content Hypothesis, Type Theory

### 1. Introduction

An important concern of classical formal semantics (Montague, 1974; Dowty et al., 1981) is the analysis of quantified sentences such as (1).

- (1) a. *every* child loves *a* toy
- b. *no* child likes brussel sprouts
- c. *the* father gave *the* child *a* drink

The italicized determiners in (1) can be analyzed in terms of the existential and universal quantifiers of classical logic. Barwise and Cooper (1981); Keenan and Stavi (1986) introduced into linguistics the semantic treatment of *generalized* quantifiers, that is, a broader set of quantifiers which include those which cannot be treated in terms of the existential and universal quantifiers. Examples of such quantifiers are italicized in (2).

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- (2) a. *most* children eat baked beans  
 b. *few* children are enthusiastic about vegetables  
 c. *many* children have *lots of* friends

Peters and Westerståhl (2006) provide an in depth study of generalized quantifiers, covering a large part of the literature on them. The leading idea of the semantic analysis of generalized quantifiers is that they express relations between sets. For example, (2a) expresses that the intersection of the set of children and the set of those who eat baked beans is a set which contains “most” children. What constitutes most can vary from context to context. The minimum requirement seems to be that the intersection contain more than half of the children. (2b) says that the intersection of the set of children and the set of those who are enthusiastic about vegetables is a set containing “few” members where again what counts as few is determined by context (including the nature of the predicates compared). Similar remarks can be made about *many*. An advantage of this proposal for the non-classical quantifiers which are not definable in terms of the existential and universal quantifiers is that the same view in terms of comparison of sets can be taken of the classical quantifiers as well. Thus the indefinite article corresponding to an existential quantifier can be analyzed as requiring that the intersection between the two sets is non-empty. Its negation *no* can be regarded as requiring that the intersection *is* empty. The universal quantifier (represented by *every*) requires that all the members of the first set are in the intersection (that is, the first set is a subset of the second set).

The generalized quantifier view of the comparison of sets seems intuitively psychologically appealing when we are considering complete sentences. However, a question arises as to what the utterance of a quantified noun-phrase on its own should represent. This becomes relevant when we consider clarification requests in dialogue which consist of a single noun-phrase. The classical proposal for this in the semantics literature is that noun-phrases represent families of sets, that is the set of sets which enter into the appropriate relation with the set represented by the common noun-phrase. A variant of this proposal (originating with Montague) is that noun-phrases represent functions from properties (that is, in Montague’s terms functions from possible worlds to sets) to truth-values: the characteristic function of a set of properties. Such proposals make the compositional semantics of sentences containing quantified noun-phrases work out, but seem less attractive as candidates for the content of lone noun-phrases. A dialogue participant who utters a reprise clarification request *many children?* seems to be raising issues about children, or the number of children in a certain context, and not about a set of sets or a function from properties to truth-values. A standard reply that classical semanticists might give to this kind of objection is that the meanings we assign to constituents are not meant to represent what people are talking about directly but are rather a mathematical model which enables us to obtain compositionally meanings which model the kind of truth conditions and entailments which speakers associate with utterances. While this may be a reasonable answer in the context of a semantics oriented towards the analysis of complete sentences, it still leaves open the question of what a speaker who utters a sentence fragment during the course of a dialogue (e.g. a lone noun-phrase as a clarification request) is actually talking about.

Purver and Ginzburg have addressed this problem in a series of works (Purver and Ginzburg, 2004; Ginzburg and Purver, 2008; Ginzburg, 2012). They propose an alternative semantics for noun-phrases which exploits the notion of *witness set* from Barwise and Cooper (1981). Intuitively a witness set is a set which will make a quantifier into something true. For example, a witness set for *many children* is a set which contains many children: the set of people who smoke may not

be such a set whereas the set of people who sleep at least eight hours a night may be such a set. This would mean that the sentence *many children smoke* would be false whereas the sentence *many children sleep at least eight hours a night* would be true. On this kind of analysis the content of a lone noun-phrase *many children* would be based on the notion of witness set. This seems more intuitive when we ask what the utterer of a lone noun-phrase is actually talking about. The answer is “a set containing many children”. In the clarification request perhaps the speaker is asking for a characterization of some set or sets which contain many children. We will explore the details of Purver and Ginzburg’s proposal below.

In connection with this analysis Purver and Ginzburg introduce a principle of interpretation for reprise utterances, that is utterances which repeat part of the preceding utterance. They propose the Reprise Content Hypothesis (RCH) and use it to support their proposal for the analysis of quantified noun-phrases.

RCH comes in two versions and is stated in Ginzburg (2012) as

**RCH (weak)** A fragment reprise question queries a part of the standard semantic content of the fragment being reprised.

**RCH (strong)** A fragment reprise question queries exactly the standard semantic content of the fragment being reprised.

They argue for the strong variant and then use this to draw consequences for the semantic content of quantified noun phrases in general, claiming that this provides a strengthening of the constraints placed on semantic interpretation by compositionality.

This represents an important step in connecting the traditional concerns of formal semantics with the more recent concerns concerning clarification which have arisen in dialogue semantics. This paper is an attempt to show that the connection might be even tighter than Purver and Ginzburg originally suggested. In Cooper (2010) we argued that a more classical generalized quantifier analysis, recast in terms of type theory with records, accounts in an explanatory way for certain aspects of the reprise clarification data that Purver and Ginzburg cite. In this paper we will repeat those arguments and in addition argue for an account that unifies the analysis of Purver and Ginzburg and Cooper (2010).

We will first consider (in Section 2) the anatomy of generalized quantifiers, presenting first a TTR version of a classical generalized quantifier analysis and the latest version of the Purver and Ginzburg proposal presented by Ginzburg (2012) which we will revise slightly in order to account for monotone decreasing and non-monotone quantifiers. We will show how the two approaches can be unified into a single analysis. We will then look at some theoretical possibilities for how generalized quantifiers might be clarified (Section 3). We will review the data concerning the clarification of quantifiers that Purver and Ginzburg presented (Section 4) concentrating mainly on the kinds of clarifications they involve. (Purver and Ginzburg concentrated on the types of clarification requests.) We will conclude that the data are consistent with the hypotheses introduced in the previous section. Finally (in Section 5), we will draw some conclusions about the nature of RCH.

## 2. The anatomy of generalized quantifiers

The anatomy of quantified propositions can be characterized using TTR (Cooper, 2005, 2012) and the analysis of non-dynamic generalized quantifiers presented in Cooper (2004) as the type in (3).

$$(3) \quad \left[ \begin{array}{ll} \text{restr} & : Ppty \\ \text{scope} & : Ppty \\ c_q & : q(\text{restr}, \text{scope}) \end{array} \right]$$

(3) is a *record type*. It has three fields:

- The first field corresponds to the *restriction* or first argument of the quantifier, represented by the common noun phrase following the determiner in a noun phrase. In a record which is of the type (3) there must be a field with the same label, ‘restr’ containing an object of the type *Ppty*, that is a property. We will spell out what we mean by property below.
- The second field represents the *scope* or second argument of the quantifier, corresponding to the verb phrase in a sentence when the quantifier is in subject position. This is also required to be a property.
- The third field represents a constraint requiring that a certain quantifier relation  $q$  hold between the two properties. For example, if  $q$  is the existential quantifier relation (corresponding to the English determiner *a* or singular count *some*) then the relation will hold just in case there is an object which has both the restriction and the scope property.  $q(\text{restr}, \text{scope})$  also represents a type. We can think of it as the type of witnesses for the quantifier relation holding between the two properties. So in the case of the existential a witness would be something which has both properties ‘restr’ and ‘scope’. If there is no such object then this type will be empty.<sup>1</sup>

We use the idea from intuitionistic type theory (Martin-Löf, 1984) that the intuitive notion of proposition is represented by a type (known under the slogan “propositions as types”).<sup>2</sup> The idea is that the proposition is “true” if there is something of the type and “false” if the type is empty.

A particular example of a quantified proposition will be a refinement of the type in (3). If we represent the property of being a thief informally as ‘*thief*’, the property corresponding to *broke in here last night* as ‘*bihln*’ and the existential quantifier relation as  $\exists$ , then the type representing the “proposition” corresponding to *a thief broke in here last night* would be (4).

$$(4) \quad \left[ \begin{array}{ll} \text{restr}=\text{'thief'} & : Ppty \\ \text{scope}=\text{'bihln'} & : Ppty \\ c_{\exists} & : \exists(\text{restr}, \text{scope}) \end{array} \right]$$

where the values in the ‘restr’ and ‘scope’ fields are restricted to be ‘*thief*’ and ‘*bihln*’ respectively.<sup>3</sup>

1. Thinking of  $q(\text{restr}, \text{scope})$  as a type of witness objects goes against claims that I have made orally and in work in progress that types constructed with predicates (so-called “ptypes”) should be thought of as types of situations. I believe that the discussion in this paper could be recast in terms where quantificational types like  $q(\text{restr}, \text{scope})$  are construed as situation types, but will leave this for future research.

2. This idea is also known as the Curry-Howard isomorphism.

3. Technically, the type *Ppty* has been restricted to be the singleton type which contains exactly the property ‘*thief*’ in the restriction field and the property ‘*bihln*’ in the scope field. The notation used in these fields,  $[\ell=a:T]$ , is used as a convenient way of representing  $[\ell:T_a]$ , where if  $T$  is a type and  $a$  is an object of any type, then  $T_a$  is a type such that  $b : T_a$  iff  $b : T$  and  $b = a$ . (Note that this is a revision of the notion of singleton type that we have used previously in, for example, Cooper, 2012.)

We make this precise by using the relations between sets from classical generalized quantifier theory as presented, for example, in Barwise and Cooper (1981). We take *Ppty* to be an abbreviation for a function type, as given in (5).

- (5) *Ppty* abbreviates the type  $([x:Ind] \rightarrow RecType)$

that is, the type of functions from records with a field labelled ‘x’ for an individual to record types (corresponding to the intuitive notion of proposition). In order to relate properties to sets we first introduce a notation for the set of objects of a type.

- (6) The *extension* of type  $T$ ,  $[T]$ , is the set  $\{a \mid a : T\}$ .

If  $P$  is a property, that is  $P:Ppty$ , we will talk of the set of objects which *have*  $P$ . We will call this the property extension, or *P-extension*, of  $P$ . The definition of this uses the notion of the extension of a type.

- (7) The *P-extension* of property  $P$ ,  $[\downarrow P]$ , is the set  $\{a \mid \exists r[r : [x:Ind] \wedge r.x = a \wedge [P(r)] \neq \emptyset]\}$ .

That is, the P-extension of  $P$  is the set of objects  $a$  which occur in the x-field of some record  $r$ <sup>4</sup> such that the extension of the type  $P(r)$  is non-empty.

Suppose that  $q$  is a generalized quantifier relation between properties. We will use  $q^*$  to represent the corresponding relation between sets from classical generalized quantifier theory. We require (8).

- (8) The type  $q(P_1, P_2)$  is non-empty iff the relation  $q^*$  holds between  $[\downarrow P_1]$  and  $[\downarrow P_2]$ .

For example, if  $q$  is the existential quantifier relation, this will require that  $q(P_1, P_2)$  is a non-empty type just in case the P-extensions of the two properties have a non-empty overlap,  $[\downarrow P_1] \cap [\downarrow P_2] \neq \emptyset$ .

We need to go further and say what the objects of type  $q(P_1, P_2)$  are. (9) is an option that will work for all *conservative* quantifier relations. To say that a quantifier relation  $q$  is conservative means that  $q^*$  will hold between two P-extensions  $[\downarrow P_1]$  and  $[\downarrow P_2]$  just in case it holds between  $[\downarrow P_1]$  and the intersection of  $[\downarrow P_1]$  and  $[\downarrow P_2]$ . We will assume with Peters and Westerstahl (2006) that all natural language quantifier relations are conservative.<sup>5</sup> Now we can make a precise proposal for what the objects of the type with the quantifier relation will be:

- (9)  $a : q(P_1, P_2)$  iff  $q^*$  holds between  $[\downarrow P_1]$  and  $[\downarrow P_2]$  and  $a = [\downarrow P_1] \cap [\downarrow P_2]$

(9) says that an object  $a$  will be of the type  $q(P_1, P_2)$  just in case the classical quantifier relation  $q^*$  holds between the P-extensions of the two properties and in addition  $a$  is the intersection of those P-extensions. This definition builds on the notion of *witness set* from Barwise and Cooper (1981). It claims that for any  $P_1$  and  $P_2$  the objects of the type  $q(P_1, P_2)$  are witness sets for the quantifier.

Now let us return to the record type (4). The type theory will require that an object will be of this type if it is a record containing at least three fields with the labels in the type (labels may only

4. The notation  $r.x$  refers to the object in the x-field of  $r$ .

5. This means that *only* is not considered to represent a quantifier relation.

occur once in a record or record type) and values in those fields of the types required by the record type. Thus if there is no witness for the quantifier constraint type ‘ $c\exists$ ’ then there will not be anything of the record type (4) either.

What makes this crucially a generalized quantifier approach to quantified propositions is the use of the quantifier relation which holds between two properties. There is another aspect to Montague’s treatment of noun-phrases which is sometimes referred to as a generalized quantifier approach (by Purver and Ginzburg, among others). This is the psychologically troubling aspect of the treatment of generalized quantifiers discussed on p. 2f. This involves  $\lambda$ -abstraction over properties in the compositional treatment of noun phrase interpretations according to Montague’s style (Montague, 1974, Chapter 8: ‘The Proper Treatment of Quantification in Ordinary English’). So, for example, the content of the noun phrase *a thief* will be a function from properties to record types where the scope field has been abstracted over:

$$(10) \quad \lambda P:Ppty \left( \begin{array}{ll} \text{restr}=\text{'thief'} & : Ppty \\ \text{scope}=P & : Ppty \\ c\exists & : \exists(\text{restr},\text{scope}) \end{array} \right)$$

The use of the  $\lambda$ -calculus in (10) can be regarded as a kind of glue to get the compositional semantics to work out. (This is the kind of view of the  $\lambda$ -calculus as a glue language which is presented by Blackburn and Bos, 2005.) If you have another way to engineer the compositional semantics then you could abandon the  $\lambda$ -abstraction used in (10) but still use the generalized quantifier notion of relations between sets.

Now let us consider (11).

$$(11) \quad \left[ \begin{array}{l} \text{q-params:} \left[ \begin{array}{l} x:\{Ind\} \\ r:\text{most}(x,\text{student}) \end{array} \right] \\ \text{cont:left(q-params.x)} \end{array} \right]$$

This is a representation for *most students left* proposed by Ginzburg (2012) in his TTR recasting of the Purver and Ginzburg approach to quantification. It requires that there be a set ‘x’ which is what Barwise and Cooper (1981) would call a witness set for the quantifier ‘most(student)’, that is, some set containing most students. In addition it requires that the predicate ‘left’ holds (collectively) for that set (which we may interpret as the predicate ‘left’ holding individually of each member of the witness set).<sup>6</sup> This analysis is, then, also a generalized quantifier analysis. It differs from the previous one in that it emphasizes the witness set and uses a different relation between sets for the quantifier relation, namely a relation between a witness set and the set corresponding to what we called the restriction previously. The witness quantifier relation is ‘most’ in (11). This analysis works well for monotone increasing quantifiers.<sup>7</sup> However, as Purver and Ginzburg (2004) point out, it is more problematic with monotone decreasing quantifiers<sup>8</sup> since there you have to check the

6. Note that the notion of witness set for a quantifier introduced by Barwise and Cooper is related though slightly different from the notion of witness set for a quantified sentence which we discussed above. The witness sets for a quantifier are potentially witnesses for the whole quantified sentence. A witness set for the sentence will be a witness set for the quantifier, but a witness set for the quantifier will not necessarily be a witness set for the sentence.

7. A monotone increasing quantifier relation  $q$  is one such that  $q(P_1, P_2)$  implies  $q(P_1, P_3)$  if  $[\downarrow P_2]$  is a subset of  $[\downarrow P_3]$ .

8. A monotone decreasing quantifier relation  $q$  is one such that  $q(P_1, P_2)$  implies  $q(P_1, P_3)$  if  $[\downarrow P_3]$  is a subset of  $[\downarrow P_2]$ .

witness set against the restriction and the scope in a different way. In that paper they go through a number of different options for solving the problem, finally coming to a preference for treating monotone decreasing quantifiers as the negation of monotone increasing quantifiers, partly because it facilitates a treatment of complement anaphora. That suggests to me that the representation for *few students left* corresponding to the analysis in (11) should be something like (12).

$$(12) \quad \left[ c : \neg \left( \begin{array}{l} \text{q-params:} \left[ \begin{array}{l} x : \{Ind\} \\ r : \text{many}(x, \text{student}) \end{array} \right] \\ \text{cont: left}(q\text{-params}.x) \end{array} \right) \right] \right]$$

that is, something that requires that there is no set  $x$  containing many students such that  $x$  (collectively) left. Now the only way I can think of to engineer the compositional semantics to achieve (12) is to have something along the lines of (13) corresponding to the noun phrase.

$$(13) \quad \lambda P : Ppty \left( \begin{array}{l} \left[ c : \neg \left( \begin{array}{l} \text{q-params:} \left[ \begin{array}{l} x : \{Ind\} \\ r : \text{many}(x, \text{student}) \end{array} \right] \\ \text{cont: } P(q\text{-params}.x) \end{array} \right) \right] \end{array} \right) \right)$$

but this involves exactly the Montagueesque  $\lambda$ -paraphernalia that Purver and Ginzburg wish to avoid. However, as before, if you have an alternative way of engineering the compositional glue then you can apply it here as well while still maintaining the anatomy of quantification based on the witness quantifier relation. A curiosity here, though, is that the negation and the  $\lambda$ -abstraction would have to include the q-params field in their scope rather than being within the content field. This would be the only way in which the negation could get wider scope than *many*. But q-params according to Ginzburg (2012) is at the top level of the sign, on the same level as phonology. It seems like it would be preferable to have an analysis where the negation is contained within the content-field.

Perhaps more difficult is the fact that the Purver-Ginzburg analysis also has difficulties with non-monotone quantifiers such as *an even number of students* where it is not so clear that the negation strategy is available.

This separation of the glue function of the  $\lambda$ -calculus and the analysis of quantified utterances in terms of generalized quantifier relations between sets leads me to suppose that Purver and Ginzburg's objection is not so much to generalized quantifiers as such as to the use of Montague's  $\lambda$ -calculus based approach to compositional semantics. For these reasons I think the following variant of Purver and Ginzburg's analysis, which fixes the monotonicity problem, might be considered as a friendly amendment which is consonant with their aims of emphasizing the role of witness sets. For quantifier predicates  $q$  we introduce a new predicate  $q^\dagger$  which takes a single property argument.  $q^\dagger(P)$  is the type of witness sets for the quantifier in the sense of Barwise and Cooper (1981). The objects belonging to  $q^\dagger(P)$  are characterized in (14).

$$(14) \quad a : q^\dagger(P) \text{ iff } a \subseteq [\downarrow P] \text{ and } q^* \text{ holds between } [\downarrow P] \text{ and } a.$$

Our proposed revision to the Purver and Ginzburg analysis is given in (15).

$$(15) \quad \begin{array}{ll} \text{q-params} & : \left[ \begin{array}{l} w : q^\dagger(P_1) \\ c_q = \text{q-params}.w : q(P_1, P_2) \end{array} \right] \\ \text{cont} & : \end{array}$$

According to this *most students left* will correspond to (16) (using ‘student’ and ‘left’ as informal representations of the appropriate properties).

$$(16) \left[ \begin{array}{ll} \text{q-params} & : \left[ \text{w:most}^\dagger(\text{student}) \right] \\ \text{cont} & : \left[ \text{c}_q = \text{q-params.w:most}(\text{student}, \text{left}) \right] \end{array} \right]$$

It is easy to see that the quantifier anatomies presented in (3) and (15) are not really alternatives that conflict with each other. A first attempt to combine them is the more detailed anatomy given in (17).

$$(17) \left[ \begin{array}{ll} \text{q-params:} & \left[ \text{w:}q^\dagger(\text{cont.restr}) \right] \\ \text{cont} & : \left[ \begin{array}{ll} \text{restr} & :P_{pty} \\ \text{scope} & :P_{pty} \\ \text{c}_q = \text{q-params.w:}q(\text{cont.restr}, \text{cont.scope}) \end{array} \right] \end{array} \right]$$

The advantage of (17) over (3) is that it makes explicit a role for a witness set which is determined only by the quantifier relation and a single property. This becomes important for the interpretation of noun-phrases where the second property is not determined. Our preference is to represent the unsaturated nature of an NP using Montague’s  $\lambda$ -technology. If there is another way to treat compositionality it could presumably be used with the analysis in (17).

However, (17) is not quite correct in that it claims that the content of the utterance is a record providing two properties and a witness set for the quantifier relation holding between them. This would not sufficiently distinguish intuitively different contents. Consider (18).

- (18) a. two students left  
b. few students left

Both (18a) and (18b) could be true in a domain where there are fifty students and exactly two of them left, say Margaret and Billy. The set {Margaret, Billy} is an appropriate witness set for both (18a) and (18b) being the intersection of the set of students and the set of leavers and being a set which contains two students as well as being a set which contains few students. Thus the records corresponding to cont in (17) would be the same (even though the types we are assigning to them are distinct), although intuitively the two sentences have different content, though they can be used to describe the same situation. The content should be the record *type* rather than the record. In general if we have been tempted to have a field as in (19)

$$(19) \left[ \ell : T \right]$$

and discover that the object in the  $\ell$ -field of a record of this type should be  $T$  itself rather than an object of type  $T$ , we should change (19) to (20).

$$(20) \left[ \ell = T : Type \right]$$

Following this strategy on (17) would yield (21), which, however, introduces another problem.

$$(21) \left[ \begin{array}{ll} \text{q-params:} & \left[ \text{w:}q^\dagger(\text{cont.restr}) \right] \\ \text{cont=} & \left[ \begin{array}{ll} \text{restr} & :P_{pty} \\ \text{scope} & :P_{pty} \\ \text{c}_q = \text{q-params.w:}q(\text{cont.restr}, \text{cont.scope}) \end{array} \right] \end{array} \right] : RecType$$



(21) is not a well-formed type since the path ‘cont.restr’ which is used in the ‘q-params’-field and the embedded type is no longer defined. Our move to a manifest field requiring the type itself as value makes the labels unavailable within the larger type. However, it is possible to use paths from the larger type to define the type in the manifest field. A solution to this is to place the restriction field in the ‘q-params’-field and adjust path-names accordingly, as in (22).

$$(22) \left[ \begin{array}{l} \text{q-params:} \left[ \begin{array}{l} \text{restr:} P_{\text{pty}} \\ \text{w} : q^\dagger(\text{q-params.restr}) \end{array} \right] \\ \text{cont=} \left[ \begin{array}{l} \text{scope} : P_{\text{pty}} \\ \text{c}_q = \text{q-params.w:} q(\text{q-params.restr}, \text{scope}) \end{array} \right] : RecType \end{array} \right]$$

This example shows the disadvantage of the inexact abbreviatory notation for dependent fields that we are using. Within the ‘c<sub>q</sub>-field’ in the embedded type the labels ‘q-params.w’ and ‘q-params.restr’ refer to the larger embedding type whereas ‘scope’ refers to the embedded type but there is nothing to signal this in the notation. In the more explicit (but less readable) representation explained in Cooper (2012) (22) would be (23).

$$(23) \left[ \begin{array}{l} \text{q-params:} \left[ \begin{array}{l} \text{restr:} P_{\text{pty}} \\ \text{w} : q^\dagger(\text{q-params.restr}) \end{array} \right] \\ \text{cont:} \langle \lambda v_1: \{ Ind \} \\ \quad (\lambda v_2: P_{\text{pty}} \\ \quad \quad (RecType \left[ \begin{array}{l} \text{scope:} P_{\text{pty}} \\ \text{c}_q : \langle \lambda v_3: P_{\text{pty}} (q(v_2, v_3)_{v_1}), \\ \quad \quad \quad \langle \text{scope} \rangle \rangle \end{array} \right] \rangle), \\ \quad \quad \langle \text{q-params.w, q-params.restr} \rangle \rangle \end{array} \right]$$

While (23) is the correct full representation and should remain as the official notation it is not exactly perspicuous. A compromise perhaps is to use ‘↑’ before a path-name to indicate that it “takes its scope” in the next higher embedding record type, as in (24).

$$(24) \left[ \begin{array}{l} \text{q-params:} \left[ \begin{array}{l} \text{restr:} P_{\text{pty}} \\ \text{w} : q^\dagger(\text{q-params.restr}) \end{array} \right] \\ \text{cont=} \left[ \begin{array}{l} \text{scope} : P_{\text{pty}} \\ \text{c}_q = \uparrow \text{q-params.w:} q(\uparrow \text{q-params.restr}, \text{scope}) \end{array} \right] : RecType \end{array} \right]$$

Our proposal for the analysis of the noun-phrase *most students* is thus (25) (using ‘student’ as an abbreviation for the property of being a student and *Quant* as the type ( $P_{\text{pty}} \rightarrow RecType$ ), the type of quantifiers, corresponding to NPs).

$$(25) \left[ \begin{array}{l} \text{q-params:} \left[ \begin{array}{l} \text{restr} = \text{student:} P_{\text{pty}} \\ \text{w} : \text{most}^\dagger(\text{q-params.restr}) \end{array} \right] \\ \text{cont=} \\ \quad \lambda P: P_{\text{pty}} \\ \quad \left( \left[ \begin{array}{l} \text{scope} = P : P_{\text{pty}} \\ \text{c}_{\text{most}} = \uparrow \text{q-params.w:} \text{most}(\uparrow \text{q-params.restr}, \text{scope}) \end{array} \right] \right) : Quant \end{array} \right]$$

Our intention in having ‘q-params’ external to the content is that it should represent a kind of referential reading (Donnellan, 1966), perhaps related to what Barwise and Perry (1983) would call a value-loaded reading, where the witness set and the restriction property is fixed by context.<sup>9</sup> The idea would be then that in compositional interpretation the information in the ‘q-params’-field should percolate up to the top. In order to achieve this the ‘q-params’-field associated with a constituent such as a verb-phrase or a sentence should be of the type which is the result of merging the types required for ‘q-params’-fields of its daughters. This means that the labels ‘restr’ and ‘w’ need to be changed to provide unique identifiers in order not to clash with ‘q-params’ information coming from other noun-phrases. For now we will assume that each noun-phrase comes along with a unique identifier  $i$  which can be subscripted to the labels. Thus (25) will become (26).

$$(26) \left[ \begin{array}{l} \text{q-params:} \left[ \begin{array}{ll} \text{restr}_i = \text{student:} P_{pty} & \\ w_i & : \text{most}^\dagger(\text{q-params.restr}_i) \end{array} \right] \\ \text{cont=} \\ \lambda P: P_{pty} \\ \left( \begin{array}{ll} \text{scope} = P & : P_{pty} \\ c_{\text{most}} = \uparrow \text{q-params.w}_i : \text{most}(\uparrow \text{q-params.restr}_i, & \\ \text{scope}) & \end{array} \right) : Quant \end{array} \right]$$

This view of q-params will require that (26) is not the only reading associated with *most students*. Consider examples where it is very hard or impossible to obtain referential (or even *de re*) readings for embedded noun-phrases.

- (27) a. Sam doesn’t claim that most students are enthusiastic  
 b. Everybody claimed that most students are enthusiastic

Just as it seems very hard to give *most students* wide scope in (27) in order to obtain a *de re* reading (“most students are such that Sam doesn’t claim that they are enthusiastic”, “most students are such that everybody claimed that they are enthusiastic”), it seems hard to have a wide scope existential quantification over a witness set for the quantifier (“there is a set containing most students such that Sam doesn’t claim that they constitute a proof that most students are enthusiastic”, “there is a set containing most students such that everybody claimed that they are enthusiastic”). Compare this with the corresponding affirmative sentence in (28).

- (28) Sam claims that most students are enthusiastic

Here there does seem to be an intuitive *de re* reading: “most students are such that Sam claims that they are enthusiastic”. This is a reading where Sam need not be willing to affirm that most students are enthusiastic. She can make individual claims about a number of students, that they are enthusiastic, without having made a claim that most students are enthusiastic. Similarly, though

9. This is different to what is proposed in Ginzburg (2012) where the ‘q-params’-field is external to the content at the noun-phrase level but becomes part of the content by compositional processes at the sentence level, thus obtaining a non-referential reading. Techniques for wide-scope interpretation (such as storage) would be needed in order to get the referential reading of the noun-phrase in the sentence. Note also that we are generalizing the notion of referential reading to apply to more than just definite descriptions. A thorough discussion of referential readings involving witness sets in this way is beyond the scope of this paper.

we are less used to talking about it, there seems to be a reading: “there is a set containing most students such that Sam claims that they constitute a proof that most students are enthusiastic. This is a reading where there is some particular set containing most students about which Sam makes a particular claim, namely that it is a witness set for *most students are enthusiastic*. On such a reading it is possible to continue the sentence with (29)

(29) ...namely all the first years registered for the course

This is not a possible continuation for (27a).

A proposal for the non-referential (attributive or “value-free”) reading is (30).

$$(30) \left[ \begin{array}{l} \text{q-params:} \textit{Rec} \\ \text{cont=} \\ \lambda P:\textit{Ppty} \\ \left( \begin{array}{l} \text{restr}_i = \text{student}:\textit{Ppty} \\ w_i:\text{most}^\dagger(\text{restr}_i) \\ \text{scope} = P:\textit{Ppty} \\ c_{\text{most}} = w_i:\text{most}(\text{restr}_i, \text{scope}) \end{array} \right) \end{array} \right] : \textit{Quant}$$

where *Rec* is the type of records with no constraints on their fields.<sup>10</sup> Both (26) and (30) are meant to be part of larger sign types of the kind proposed by Ginzburg (2012), for example, as sketched in (31).

10. This type can also be represented as ‘[ ]’.

(31) a. *referential reading*

$$\left[ \begin{array}{l} \text{phon: "most students"} \\ \text{cat=np: Cat} \\ \dots \\ \text{q-params: } \left[ \begin{array}{l} \text{restr}_i = \text{student: Ppty} \\ \text{w}_i : \text{most}^\dagger(\text{q-params.restr}_i) \end{array} \right] \\ \text{cont=} \\ \lambda P: P\text{pty} \\ \left( \left[ \begin{array}{l} \text{scope} = P: P\text{pty} \\ \text{c}_{\text{most}} = \uparrow \text{q-params.w}_i : \text{most}(\uparrow \text{q-params.restr}_i, \text{scope}) \end{array} \right] \right) : \text{Quant} \end{array} \right]$$

b. *non-referential reading*

$$\left[ \begin{array}{l} \text{phon: "most students"} \\ \text{cat=np: Cat} \\ \dots \\ \text{q-params: Rec} \\ \text{cont=} \\ \lambda P: P\text{pty} \\ \left( \left[ \begin{array}{l} \text{restr}_i = \text{student: Ppty} \\ \text{w}_i : \text{most}^\dagger(\text{restr}_i) \\ \text{scope} = P: P\text{pty} \\ \text{c}_{\text{most}} = \text{w}_i : \text{most}(\text{restr}_i, \text{scope}) \end{array} \right] \right) : \text{Quant} \end{array} \right]$$

The details of the rest of the sign type (indicated by ‘...’ in (31)) are not important for the current discussion, except that we assume that there will either be a constituents-field as discussed in Ginzburg (2012) or a more traditional daughters-field as in classical HPSG as discussed in a TTR setting in Cooper (2008).

### 3. Potential clarifications

We introduce a hypothesis concerning potential responses to clarification requests:

(32) *Clarification request response hypothesis*

- a. A response to a clarification request must address a path in the type corresponding to content of the clarification request
- b. There is a strong tendency for a response to a clarification request to be a major constituent such as a noun-phrase or sentence.

Our main hypothesis is that what can be addressed by a clarification in response to a clarification request are paths within the type corresponding to the content of the clarification request. From a theoretical point of view this is natural since paths in a sign can be regarded as parameters of an utterance whose values can be questioned.

(33) shows the paths represented in (31).

- (33) a. *referential reading*
- phon
  - cat
  - ...
  - q-params
  - q-params.restr<sub>i</sub>
  - q-params.w<sub>i</sub>
  - cont
- b. *non-referential reading*
- phon
  - cat
  - ...
  - q-params
  - cont

The ‘...’ correspond to what we have not made precise in (31). In this will be included paths to the constituents of the noun-phrase (for example, if we adopt the daughters proposal of Cooper 2008 corresponding to the daughters feature in standard HPSG, see, for example, Ginzburg and Sag 2000). According to our hypothesis these paths represent what can be addressed by an answer to a clarification question.<sup>11</sup> Note that we make different predictions for the referential and non-referential readings. Namely, that on the referential reading the restriction and witness are available whereas they are not on the non-referential reading. It is a significant advantage of this analysis that we can distinguish referential and non-referential readings of a lone noun-phrase and that it is not, for example, dependent on the scope that it takes within a complete sentence.

The scope of the quantifier (corresponding to the verb-phrase if the noun-phrase were to be placed in the subject position of a sentence) cannot be addressed as it does not lie on a path within the type. The witness role can be addressed on a referential reading but not a non-referential one. The restriction, if it corresponds to a constituent, can be addressed on either reading, whereas the restriction in a noun-phrase without a constituent corresponding to the restriction (e.g. *everybody*) can only be addressed on the referential reading (via the q-params:w<sub>i</sub>-path). This makes some precise and intuitive theoretical predictions, although it can be difficult to tease apart the readings on the basis of actual data which greatly underdetermine the interpretation. One problem, of course, is that the notion of referentiality of quantified noun-phrases is notoriously slippery. Added to this is the fact that in a dialogue game-board analysis there is no requirement that both dialogue participants have the same interpretation or, if we take underspecification into account, even have decided individually on a particular interpretation. Viewing interpretation from the perspective of uncertainty for dialogue participants can actually help us understand why referentiality can seem so problematic when viewed in terms of classical non-dialogical semantics. Consider (34).

11. It seems to us unintuitive that the q-params path would be addressed, that is the collection of all the q-params as opposed to the individual q-params represented by the paths q-params.restr<sub>i</sub> and q-params.w<sub>i</sub> which are provided in the referential reading but not in the non-referential reading. This, together with the unique subscripting needed on the labels within q-params, suggests to us that the q-params field is ultimately not quite what is needed for this analysis. But as of yet we do not have an alternative analysis to offer.

- (34) A: A thief broke in here last night  
 B: A thief?  
 A: a. my ex-husband, actually (*witness*)  
     b. burglar wearing a mask (*restriction*)  
     c. got in through the bedroom window (*scope*)  
     d. two thieves, actually (*content*)

There is nothing in *A*'s first utterance which indicates to *B* whether *a thief* is to be referentially interpreted or not. There may of course be other circumstances which indicate this which are not recorded here. *A* may be pointing at a particular person or a photograph. There may have been previous dialogue which made it perfectly clear that *A* knows who it was who broke in. But if this is the beginning of the dialogue and there is no pointing or a sufficiently rich context, then *B* cannot know whether *A*'s use of *a thief* is referential or not, that is, *B* cannot know whether *A* has an independent way of identifying the thief, as given by the instantiated q-params. *B*'s clarification request can be seen as a step towards obtaining information that will indicate whether there is support for a referential reading or not. Certain answers to the clarification request will require a referential reading. At the point at which *B* utters the clarification request *B* does not know whether *A*'s utterance of *a thief* was intended referentially or not. Similarly, *A* cannot know whether *B*'s clarification request was intended referentially or not, although given that *B* is asking the question it seems reasonable to assume that *B* does not have an independent way of identifying the thief.<sup>12</sup> However, what *A* is clarifying is her original use of the noun-phrase and she is therefore at liberty to take this on either a referential or a non-referential reading.

(34a) addresses the issue of an appropriate witness for the noun-phrase that *B* presents in the clarification request. As such it requires a referential reading of the noun-phrase. At this point in the dialogue *B* knows that *A* has an independent way of identifying the thief. This does not mean that the original intended interpretations of the clarification request or the initial utterance by *A* were referential – only that it is possible to construe them as referential, that is, that there is support for the claim that *A* has an independent way of identifying the individual in question. Compare (34a) with (35) where a referential reading is unavailable for the initial utterance.

- (35) A: Sam doesn't think that a thief broke in here last night  
 B: A thief?  
 A: my ex-husband, actually

(35) is hard to interpret as a coherent dialogue. *A*'s second utterance can at best be interpreted as ignoring *B*'s clarification request and suggesting her own theory of who she thinks or knows broke in. The negation makes all the difference here. Compare it with (36).

- (36) A: Sam thinks that a thief broke in here last night  
 B: A thief?  
 A: my ex-husband, actually

Here *A*'s response to *B*'s clarification request can be interpreted as a clarification of the belief which *A* is attributing to Sam. It is at this point in the dialogue that we realize that *a thief* in *A*'s

12. Except for the perhaps unusual context where *B* knows perfectly well who it is but is questioning the use of the description *thief* for this person.

first utterance must be interpreted referentially (even though it may be *de dicto*, apparently giving us the conclusion that in *A*'s view Sam believes that *A*'s ex-husband is a thief).

(34b) involves a clarification of a content corresponding to a syntactic constituent (*thief*) and therefore, according to our hypothesis, does not affect referentiality. However, the second part of our hypothesis (32b) comes into play. The common noun phrase presented is not a major constituent and this seems to make it difficult to interpret as a response.<sup>13</sup> The difficulty becomes even clearer when we embed it beneath a negated attitude verb as in (37).

- (37) A: Sam doesn't think that a thief broke in here last night  
 B: A thief?  
 A: burglar wearing a mask

It is hard, though perhaps not impossible, to interpret *A*'s second turn as denying that Sam has a *de dicto* belief "A burglar wearing a mask broke in here last night". The reading we are after seems much facilitated by (38) where the negation and the whole noun-phrase is repeated.

- (38) A: Sam doesn't think that a thief broke in here last night  
 B: A thief?  
 A: not a burglar wearing a mask, at any rate

Such readings seem easier to obtain in the non-negated case in (39).

- (39) A: Sam thinks that a thief broke in here last night  
 B: A thief?  
 A: burglar wearing a mask

(34c) seems quite difficult to interpret as a response to the clarification question.<sup>14</sup> While the scope of the quantifier in *A*'s first utterance corresponds to a constituent verb-phrase *broke in here last night* it does not correspond to a constituent of the clarification request and neither is there a path in the sign-type of the clarification request which corresponds to the scope. This is not to say that dialogues of this form may not occur, but if they do, the turn following the clarification would not be interpreted as a response to the clarification request, rather as a continuation which ignores the clarification request.

(34d) addresses the entire content of the noun-phrase, available on a path in the sign-type and also a constituent in the sense that it corresponds to the complete clarification request. However, it updates only the quantifier relation and determiner constituent in that it just repeats the restriction. *two* without *thieves* is also possible but this should probably be interpreted as providing a complete

13. As one of the reviewers points out, this condition does not play a role if the clarification question itself is not a major constituent, for example just the common noun *thief*. This might suggest a tendency for the category of the clarification to match the category of the clarification question.

14. One of the reviewers pointed out that the clarification question might be interpreted as a request for a repeat or clarification of what followed the words *a thief*. In this case (34c) is an appropriate response. Such a clarification request is addressing the phonology (indicating that the speaker didn't hear the rest of the utterance). It's not clear to me whether there is a special intonation associated with such questions or whether dialogue participants rely on gestural cues to indicate this kind of question. Languages seem to differ in the degree to which such questions are available. My intuition is that such questions are more frequent in Swedish than in English, for example. This could be checked in dialogue corpora by investigating the answers given to noun-phrase reprise questions.

noun-phrase (quantifier) rather than a determiner (quantifier relation) in line with (32b). If the determiner is not one that is capable of being a complete noun-phrase the response becomes much less acceptable. Thus the examples in (40) sound downright ungrammatical as responses to the clarification request.

- (40) a. the, actually  
b. every, actually

These would have been fine if the clarification request had been *Did you say “a thief”?* with emphasis on *a*, where it is explicit that the phonology is being addressed.

We can compare the examples of responses to reprise clarification requests to examples of non-reprise clarification requests relating to a quantifier as given in (41).

- (41) A: Somebody broke in here last night  
B: a. (not) your ex-husband? (*witness*)  
b. burglar wearing a mask? (*restriction*)  
c. got in through the bedroom window? (*scope*)  
d. just one person? (*content*)

Much the same remarks hold for these clarification requests as for the responses to the reprise clarification requests. The witness clarification request seems to force a referential reading, not on *A*'s original utterance but at the point at which the clarification request is uttered. *A* can go on to deny that a referential reading was intended by saying something like (42).

- (42) All I know is that there was a noise in the kitchen

The restriction clarification request sounds kind of elliptical and a repetition of the determiner *a* would probably be preferable in accordance with (32b) adjusted to apply to such clarification requests. It is also the case that there is no common noun constituent which this clarification request can address. It again seems to force a referential reading (since that is the only way that the restriction can be made available) and *A* is at liberty to deny that such a reading is intended as in the witness case. But if *A* answers *yes* to this question then there is a commitment to a referential reading on the part of both participants at this point even if the intended original utterance by *A* was a non-referential reading. Our hypothesis would predict that the scope clarification request is more available since, in contrast to a response to the noun-phrase clarification request of the previous examples, the scope is available as a constituent. My intuition is that it is more available although the VP-constituent does not appear to count as a major constituent and there appears to be a preference for a complete sentence as in (43) to express this (and a corresponding question as to whether it should count as a clarification request at all).

- (43) Did they get in through the bedroom window?

Finally the clarification request addressing the content focusses on the quantifier relation and can be expressed as *just one?*. As before it seems that this is to be seen as a complete noun-phrase rather than just a determiner.



This suggests that the hypothesis (32) could be generalized to include this kind of clarification. In addition there seem to be other data that behave in a similar way. (44) presents examples of apposition, parentheticals or repairs.<sup>15</sup> How we classify them seems to depend on the semantic relation between the original noun-phrase and its appositive.

- (44) a. A thief, my ex-husband, actually, broke in here last night (*witness*, appositive)  
 b. A thief, ??(a) burglar wearing a mask, broke in here last night (*restriction*, appositive/parenthetical)  
 c. ?\*A thief, got in through the bedroom window, broke in here last night (*scope*)  
 d. ?A thief, he got in through the bedroom window, broke in here last night (*scope*, parenthetical)  
 e. A thief, two thieves, actually, broke in here last night (*content*, repair)

The judgements discussed above are rather subtle and there are a number of predictions that are difficult to test against real data. However, if we compare these examples with (45) and (46), where the potential clarifications and clarification questions are not directly addressing an available path associated with the previous turn, there is a robust intuition that you have to work a lot harder or be embedded in a rich context to interpret them as coherent.

- (45) A: A thief broke in here last night  
 B: A thief?  
 A: a. maroon  
 b. maroon sweater  
 c. police  
 d. scar over the left eye
- (46) A: Somebody broke in here last night  
 B: a. maroon?  
 b. maroon sweater?  
 c. police?  
 d. scar over the left eye?

It is hard to give examples of impossible dialogues since there is no notion of grammaticality as there is with single sentences. What we can examine is the most likely interpretation given what we gather about the context from what we know about the dialogue. For example, let us consider how we might interpret (46). (46a) seems hard to interpret at all unless, for example *maroon* is being used (innovatively) as a way of characterizing skin-colour, in which case it would be a clarification relating to the restriction, though, of course, non-preferred since it does not represent a complete noun-phrase. A natural way of interpreting (46b) would be as elliptical for *wearing a maroon sweater* which would in effect coerce it to be a clarification of the restriction, again non-preferred. Depending on the political situation in the country the dialogue is about, (46c) might be interpreted

15. Apposition was suggested by one of the reviewers of this paper.

as a restriction clarification, i.e. *Was it the police who broke in?*, or as a very elliptical way of asking whether *A* called the police. This latter interpretation could be facilitated, for example, if *A* and *B* routinely talked about break-ins and had a checklist of questions which they normally asked, among them whether the police was called. In this case, of course, (46c) would not be a clarification of the quantifier. Finally, (46d) is most naturally interpreted as elliptical for *with a scar over the left eye*, making it as a clarification of the restriction.

Similar remarks can be made about the appositive/parenthetical/repair cases in (47).

- (47) a. A thief, maroon, broke in here last night  
 b. A thief, maroon sweater, broke in here last night  
 c. A thief, police, broke in here last night  
 d. A thief, scar over the left eye, broke in here last night

Except for (47d) all these examples sound pretty incoherent unless embedded in a rich context of the kind we discussed for the clarification examples. This seems consistent with a view of parentheticals as a discourse level phenomenon rather than a syntactic phenomenon.

A central question is to what extent similar facts can be observed about generalized quantifiers in general and whether different classes of quantifiers behave differently with respect to the availability of clarification interpretations. Consider

- (48) A: most thieves are opportunists  
[http://www.accessmylibrary.com/coms2/summary\\_0286-33299010\\_ITM](http://www.accessmylibrary.com/coms2/summary_0286-33299010_ITM), accessed 18th January, 2010  
 B: most thieves?  
 A: a. successful ones (*witness/restriction*)  
 b. bide their time (*scope*)  
 c. 80%, actually (*content, with focus on the quantifier relation*)

Here the witness and restriction clarifications appear to collapse since a witness set for the quantifier has to be a subset of thieves (i.e. the restriction) which contains most thieves. However, (48a) does appear to be ambiguous between an interpretation corresponding to “successful thieves are opportunists” (a witness reading) and “most successful thieves are opportunists” (a restriction reading). Thus while the form of the clarification is the same its interpretation is ambiguous between a witness clarification and a restriction clarification. However, there would seem to be a preference for the restriction clarification interpretation to be represented by the complete noun-phrase *most successful ones* since for the restriction clarification reading *successful ones* would have to be parsed as a common noun phrase. For the witness reading *successful ones* would be parsed as a complete noun-phrase.

As with the previous examples we have discussed the scope response (48b) appears to be inappropriate as a response to the clarification request whereas addressing the whole content with focus on the quantifier relation is fine.

#### 4. Towards an empirical investigation

We have not attempted to make an empirical investigation of the phenomena we have discussed in this paper. Rather we have tried to clarify some of the formal semantic issues and sharpen intuitions relating to the examples. The judgements are subtle and part of the point is that fine-grained semantic distinctions are left underdetermined in dialogue data. Because of this, one may wonder whether there is any hope of doing empirical work in this area at all. It is not straightforward to find relevant examples in corpora and one has to rely on making subtle distinctions in interpretation which are not really possible to annotate. Experimental methods, where you have more control over the data produced, may prove more tractable but again there is the problem that even the interpretation of data obtained in an experimental situation may be underdetermined. This notwithstanding, I will try to argue in this section that the prospects are not entirely bleak and will support this view by looking at the data that Purver and Ginzburg have already collected.

Let us try to summarize what we have from the previous discussion that could be investigated in a dialogue corpus. For a noun-phrase clarification request there are three kinds of clarification available:

- witness
- restriction, i.e. a common noun-phrase (dispreferred)
- content (a complete noun-phrase possibly with restriction or quantifier relation focus)

A restriction clarification in the form of a common noun phrase is dispreferred apparently because of a preference for clarifications to be “major” constituents. Instead there is a tendency for the clarification to be a noun-phrase which addresses the complete content but may focus on either the restriction (common noun phrase, if there is one) or the quantifier relation (determiner, if there is one).

The Purver-Ginzburg data divides into witness clarifications, one dubious case of a possible restriction clarification and content clarifications possibly focussed either on the restriction or the quantifier relation. The majority of the cases they cite are content clarifications focussed on the restriction. There are no examples of clarifications other than of these three types in their data. We give details of the relevant examples below.

##### 4.1 Witness clarifications

- (49) 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.

BNC file KPY, sentences 1005–1008 Purver and Ginzburg (2004)

- (50) Terry: Richard hit the ball on the car.  
           ...  
       Nick: What ball?  
       Terry: **James [last name]’s football.**

BNC file KR2, sentences 862, 865–866 Purver and Ginzburg (2004)

Intuitively both of these examples appear to be witness clarifications, although one might argue that this status is unclear. (50) might be arguably a content clarification focussed both on the restriction (*ball*→*football*) and the quantifier relation if we analyze *James [last name]’s* as a determiner representing a quantifier relation.

## 4.2 Restriction clarifications

There is one example in their data which could be an instance of restriction clarification.

- (51) George: You want to tell them, bring the tourist around show them the  
                  spot  
       Sam: The spot?  
       George: **where you spilled your blood**

BNC file KDU, sentences 728–730 Purver and Ginzburg (2004)

Here we have interpreted the clarification as additional material which is to be added as a modifier to the restriction, that is *the spot where you spilled your blood*. However, another interpretation is available where *where you spilled your blood* is a noun-phrase in its own right or perhaps an embedded question as in *show them where you spilled your blood*. This would then make the example a case of content clarification (or perhaps even witness clarification). As this is the only potential example of a restriction clarification and our hypothesis is that restriction clarifications are dispreferred perhaps these interpretations are more likely.

## 4.3 Content clarifications with restriction focus

The most common kind of clarification in the data are ones where the entire noun phrase is repeated with the additional modifier inserted, as in the following examples:

- (52) Terry: Richard hit the ball on the car.  
       Nick: What car?  
       Terry: **The car that was going past.**

BNC file KR2, sentences 862–864 Purver and Ginzburg (2004)

- (53) 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.

BNC file K7D, sentences 307–313 Purver and Ginzburg (2004)

- (54) 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.

BNC file KPB, sentences 417–421 Purver and Ginzburg (2004)

- (55) 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.

BNC file KDE, sentences 2214–2217 Purver and Ginzburg (2004)

(56) is different in that it is the dialogue participant who contributes the original clarification request who provides alternative restrictions. Note that in this case the restrictions do not correspond to a syntactic constituent in the original utterance (*nothing*).

- (56) 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** *<unclear>*?

BNC file H4T, sentences 43–48 Purver and Ginzburg (2004)

In (57) we have a case where a modifier in the original utterance is replaced by a new modifier in the clarification, thus changing what was said non-monotonically, not merely further specifying what was said.

- (57) Elaine: what frightened you?  
 Unknown: The bird in my bed.  
 Elaine: The what?  
 Audrey: The birdie?  
 Unknown: **The bird in the window.**

BNC file KBC, sentences 1193–1197 Purver and Ginzburg (2004)

The whole of the restriction can be replaced in this way.

- (58) 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

BNC file KE3, sentences 4678–4681 Purver and Ginzburg (2004)

Even though a different noun is chosen to express the restriction it can nevertheless be a refinement of the original utterance. In (59) the natural interpretation is the director is a woman.

- (59) 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.**

BNC file KCV, sentences 3012–3016 Purver and Ginzburg (2004)

(60) seems to be a case where the speaker is searching for the right noun to express the restriction.

- (60) 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.**

BNC file KNV, sentences 188–191 Purver and Ginzburg (2004)

#### 4.4 Content clarifications with quantifier relation focus

In the data that Purver and Ginzburg present there appear to be two clear examples of content clarifications with quantifier relation focus.

- (61) 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.**  
 Anon 2: How many people worked there?

BNC file K6U, sentences 1493–1499 (Purver and Ginzburg (2004) cite it without the last turn)

We included the final turn to strengthen the interpretation that it is the quantifier relation which is being clarified. It seems hardly likely that the restriction *rooms* is in need of clarification.

- (62) Marsha: yeah that's it, this, she's got three rottweilers now and  
 Sarah: **three?**  
 Marsha: **yeah**, one died so only got three now ⟨laugh⟩

BNC file KP2, sentences 295–297 Purver and Ginzburg (2004)

#### 4.5 Other content clarifications

(63) is a little difficult to classify.

- (63) 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⟩

BNC file KSV, sentences 257–261 Purver and Ginzburg (2004)

It might be interpreted as if it involves a discussion of whether the restriction *day* is to mean week-days or all days of the week and whether it is to include holidays. An alternative analysis might classify it as a clarification with quantifier relation focus, that is, a discussion as to whether it really is *every* day that is meant.

### 5. Conclusion

We have examined the nature of generalized quantifiers in the light of clarifications given as answers to clarifications which consists of a single noun-phrase. Whereas Purver and Ginzburg focus on the nature of the clarification request, we focus on the nature of the clarification and thereby indirectly illuminate the content that should be associated with the clarification request.

We agree with Purver and Ginzburg that the notion of witness should play a central role in explaining these interactions but have argued that their witness-based analysis of generalized quantifiers should be combined with a more classical approach and that this makes certain predictions about what can be addressed by the clarification. A review of the data that Purver and Ginzburg

present seems to be consistent with our combined analysis concerning the availability of witness, restriction and whole content readings associated with the clarification.

Issues of referentiality are less clear, partly because the phenomenon is inherently underdetermined from the dialogue and the dialogue participants may have different views on the referentiality of a particular noun-phrase utterance – and indeed a dialogue participant may leave the referentiality of a noun-phrase underspecified. A clear prediction is that a witness clarification offers the possibility of interpreting a noun-phrase referentially. This appears to follow trivially from the nature of witnesses. Perhaps there is not much more that can be said in terms of specific examples.

What does this say about Purver and Ginzburg's Reprise Content Hypothesis? The analysis we have given is consistent with RCH in that it seems to allow a fragment reprise question to query exactly the standard semantic content of the fragment being reprised. For the most part it appears to be this content which is being addressed in the clarification which responds to the fragment reprise question although there may be focus on either the restriction or the quantifier relation. The clarification may also provide a witness for this content. The fact that the clarification addresses parameters identified by paths in the clarification request does not of itself affect the RCH (which is concerned only with reprises). Thus the RCH remains intact but what we consider to be the content of a noun-phrase reprise is richer than the content proposed by Purver and Ginzburg in that it combines both the witness-based analysis and the more classical analysis based on the quantifier relation. One may consider the clarifications (that is, the responses to the clarification requests) as responding to certain aspects of the noun-phrase content (witness, restriction, quantifier relation). Thus while the strong version of the RCH holds intact for the reprise clarification request, the response to this request may address part of the meaning of the reprise.

One of the advantages of using TTR is that you get structured semantic contents. Instead of the unstructured sets and functions of classical model theoretic semantics, you get articulated record types with labels pointing to various components. What the clarifications discussed in this paper seem to show is that speakers pick up on these meaning components even when they are not represented by separate syntactic constituents. It seems to me that this is an important part of a semantic theory of dialogue which should allow us to make detailed predictions about the nature of cohesion in dialogue.

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