Syntactically complex demonstratives and sortal inherency

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Abstract. Two problems related to the analysis of noun phrases in which demonstratives occur are discussed: (1) it is shown that there exists an infinite number of syntactically complex demonstrative noun phrases and thus an infinite number of noun phrases which are neither purely referential not purely quantificational, (2) some problems concerning the semantic role of the common noun to which demonstrative apply can be treated within the generalised quantifier theory. This can be done using the distinction between sortally inherent and sortally not inherent quantifiers.

Keywords: complex demonstratives, generalised quantifiers.

1   Introduction

Usually when philosophers talk about "complex demonstratives" they talk about noun phrases of the form *this/that CN*, where *CN* stands for a common noun, possibly complex (Borg, 2000; Dever, 2001; King, 2001). There has been much debate recently on the semantic and pragmatic status of such constructions and their relation to other noun phrases in NLs. Some theorists (Braun,1994) claim that such expressions are directly referential in the sense of Kaplan. This means that strictly speaking they are not quantificational and are similar to other referential noun phrases. Other researchers take an opposite view: complex demonstratives are essentially quantificational and thus belong to the larger class of quantificational noun phrases (King, 2001). Arguments of King are criticised in (Altshuler, 2007). There are also views which although compatible with the demonstrative and quantificational positions, present complex demonstratives in a different light. Thus Roberts (2002) claims that they are just definites.

Of course the discussion of demonstratives is unavoidably related to other problems in natural language semantics. One of the problems in the focus of the discussion concerning complex demonstratives is the semantic status of the common noun *CN*. In particular most researchers are concerned with the question of whether the sentence of the form *This CN VP*, completed by speaker demonstration, expresses a proposition if the object demonstrated does not have the property expressed by *CN*. Furthermore, is this situation similar to the more general situation of non-expressibility of proposition due to presupposition failure?

I will leave aside many of the problems which the above debate brings up. The purpose of this article is twofold. First, I want to point out that from the empirical point of view the way philosophers talk about complex demonstratives is very restricted. I will show that natural languages use the usual means they have at their disposal to form syntactically complex expressions in forming syntactically complex demonstratives. It follows from this observation that the class of complex demonstratives that one has to consider is much larger than the class considered by philosophers.

Secondly, I want to apply some results from the generalised quantifier theory to deal with the problem of the semantic status of the common noun in the subject NP in which a demonstrative occurs. In particular I will use the distinction between sortally inherent and not sortally inherent

quantifiers to deal with this problem (cf. Keenan, 2000). The proposed analysis will apply to the whole class of syntactically complex demonstratives.

In the next section I show why and how the class of complex demonstratives should be extended. Then, after presenting in the next section some formal tools from generalised quantifiers theory I apply some results from this theory to the discussion of the semantic status of the common noun.

2   Syntactically complex demonstratives

The way philosophers talk about complex demonstratives is very restrictive. One of the obvious properties of natural languages is the possibility their syntax offers to form more and more complex expressions from simpler ones and in a systematic way. One of the simplest means to do this is to make use of Boolean connectors. It has been shown already some time ago (Keenan and Faltz, 1985) that major grammatical categories are syntactically Boolean in the sense that it is possible to produce an infinity of members of a given category just by using Boolean connectors applied to members of the same category. Boolean machinery is not the only way to obtain similar results. Another way to do this is by modification, that is by successive application of one or many modifiers to a specific argument. Thus we can apply a simple adverb to a verb phrase, possibly complex (e.g., resulting already from a Boolean operation) to obtain by modification a more complex verb phrase. Similarly we can first apply a Boolean binary connective to obtain a complex adverb (which is a verb phrase modifier) and then apply this complex verbal modifier to a verb phrase.

It can be easily shown that the two ways to compose syntactically complex expressions of a given category apply also to demonstratives. To illustrate this I will use basically the demonstrative *this* ignoring for the moment the philosophers distinction between simple and complex demonstratives.

One observes first that there are simple Boolean compounds of this demonstrative. Thus we have *this and this, this or this, this but not this*. We also have *not this* alone even if this phrase may sound not very grammatical. This "light ungrammaticality" is similar to the one we have with many functional expressions (in particular determiners) which not always can be easily negated on the surface. Semantically, as we will see, there does not seem to be any particular problem with such negated demonstratives.

We also notice that such Boolean compounds of "pure demonstratives" can Booleanly combine with non demonstrative NPs to hold syntactically complex (demonstrative) NPs . Thus we have *Leo and this*, (as in *I hate Leo and this*), *Lea but not this, some logicians but not this, most philosophers but not this one, this but not this neither most dogs, this but no artichoke, between six and ten Latin letters but not this*, etc.

Finally one observes that the prototypical demonstrative *this* can be modified in various ways. This is shown by the following examples: *only this, not only this, even this, also this, at least this, at most this, let alone this, in particular this*, etc. Of course such modified demonstratives can Booleanly combine with other demonstratives or with non demonstrative NPs. Thus we have *not only not this let alone this, some students and in particular this one, this and also this but not this, this and even this*, etc.

The final empirical observation concerning complex demonstratives is related to various complex determiners in which demonstratives can occur as essential parts making them thus demonstrative as well . Let me first quickly describe some complex determiners in a general way, without insisting on the presence of demonstratives in them.

There exist in English various complex determiners which can be called exclusion and inclusion determiners. They have the following form: *Det... conn NP*, where *conn* is a specific connector. In the case of the exclusion determiners, the connector is *except*. There can be, however many

other connectors of this type (Zuber, 1998). For instance the following connectors can be used to form complex determiners: *including, in addition to, besides, apart from*, etc. Here are some examples of complex NPs in which complex determiners with such other connectors are used: *some students, including Leo; most teachers, including Leo and Lea; all philosophers, in addition to Fido; between five and ten dogs, in addition to four cats; five other logicians besides Leo*, etc. We observe now that the NP above, the second argument of the connector *conn* can be replaced by a demonstrative *this (one)*. This leads to the construction of the following syntactically complex demonstratives determiners; *Every... except this (one), most ..., including this, five... in addition to this*, etc. moreover, the NP above can also be replaced by a "booleanly" complex demonstrative leading to the complex demonstrative determiners like *Most .... , including Leo and this(one), every..., except Leo and this(one)*, etc.

Notice that inclusion and exclusion determiners are more than just Boolean complexes. For instance *every student except this one* is not a Boolean combination of *every student* and *this student*. Similarly *five students, including Leo* is not a conjunction of *five students* with *Leo (the student)* (Zuber, 1998).

As the above examples show demonstrative determiners can occur as parts of other determiners giving thus rise to a non-trivially infinite class of complex demonstrative determiners and thus of complex demonstrative NPs. It follows from this in particular that, contrary to what some philosophers have been claiming, there are many NPs which are quantificational and referential at the same time. This means that no claim about demonstratives can be taken seriously if it does not treat jointly syntactically complex demonstratives and (nominal) determiners. I want to show that the semantics of determiners in general as constructed in generalised quantifier theory in conjunction with the Boolean semantics offers better solutions to various problems concerning demonstratives.

3   Formal preliminaries

Unary determiners, members of DET_1, are expressions of category NP/CN that is they are functional expressions which take one common noun as argument and give a NP as result. The resulting NPs being of the form *Det CN* will be called DPs, or *determiner phrases*. We will limit our discussion NPs which occur in subject position of sentences. Syntactically they are functional expressions of category S/VP (functional expressions which take verb phrases as arguments and form with them sentences). We can thus say that we will consider sentences of the form *Det CN VP*.

Semantically sentences of the above form be interpreted by (logical) sentences $D(S)(P)$, where D is the denotation of *Det*, S is the denotation of the *CN* and P is the denotation of the *VP*. If we interpret verb phrases extensionally as denoting sets then NPs and thus determiners denote functions taking sets onto truth-values. This means that NPs denote sets of sets. Since such functions take as possible argument one set they are sometimes called (generalised) quantifiers of type $\langle 1 \rangle$. This is true even of denotations of proper nouns.

The determiner *Det* denotes the function D which takes two sets, S and P as arguments and gives a truth value as result. In that sense determiners denote quantifiers of type $\langle 1, 1 \rangle$. Since a determiner takes a common noun to give an NP we can also consider, equivalently, that a determiner denotes a function which takes sets as arguments and gives sets of sets as results.

Type $\langle 1, 1 \rangle$ quantifiers form a Boolean algebra (Keenan and Stavi, 1986). What is interesting, however, is the fact that in general they form proper sub-algebras of the algebra formed from the set of all relevant functions. In other words various types of quantifiers can obey some common general constraints which are of a non logical nature and which make them thus different from logically possible quantifiers. Let us look at some of such properties and make at the same time a classification of unary determiners.

An important class of unary determiners is the class of those determiners which denote the conservative functions $CONS$. By definition $F \in CONS$ iff for any set X, Y, Z if $X \cap Y = X \cap Z$ then $F(X)(Y) = F(X)(Z)$. Equivalently F is conservative iff for any set X, Y we have $F(X)(Y) = F(X)(X \cap Y)$. Conservative functions form a Boolean algebra with Boolean operations defined pointwise. A great majority of unary determiners are conservative in the sense that they always denote conservative functions.

The algebra of $CONS$ has two important sub-algebras: the algebra INT of intersective functions and the algebra $CO - INT$ of co-intersective functions (Keenan, 1993). By definition $F \in INT$ iff for any set X, Y, W, Z if $X \cap Y = W \cap Z$ then $F(X)(Y) = F(W)(Z)$. Similarly $F \in CO - INT$ iff for any set X, Y, W, Z if $X - Y = W - Z$ then $F(X)(Y) = F(W)(Z)$. Intersectivity and co-intersectivity are strict sub-properties of conservativity. Roughly speaking if the denotation D of a determiner is a conservative function then to decide whether $D(A)(B)$ is true one has to look only at the intersection of A with B or the intersection of A with B' (and, in contradistinction with other logically possible quantifiers it is not necessary to look at the complement of A). When D is intersective we have to look at the intersection of A with B in order to evaluate the truth of $D(A)(B)$. Similarly if D is co-intersective we need to look at the intersection of A with B'.

One observes that intersective functions are symmetric, that is if F is intersective then $F(X)(Y) = F(Y)(X)$ for any $X, Y \subset E$. Co-intersective functions are not symmetric but they are contrapositional (Zuber 2005): if F is co-intersective then $F(X)(Y) = F(Y')(X')$ (where X' is the Boolean complement of X).

Algebras INT and $CO - INT$ have interest in their own. It can be shown that any conservative determiner is a Boolean combination of elements of INT and elements of $CO - INT$ (Keenan 1993). One can also show that the algebras INT and $CO - INT$ are isomorphic to the algebra D_{NP} (that is the algebra of type $\langle 1 \rangle$ quantifiers). The isomorphism associates with the intersective (or co-intersective) type $\langle 1, 1 \rangle$ quantifier F the type $\langle 1 \rangle$ quantifier Q in such a way that $Q = F(E)$, where E is the unit (one) element of the denotational algebra D_{CN}, and can be expressed as "being an object". So in particular the quantifier $SOME$ is associated to $SOMETHING$ and $EVERY$ is associated to $EVERYTHING$.

Functions in INT and in $CO - INT$ are important because of the following property important for our analysis to come: they are the only conservative quantifiers *sortally reducible*. To understand what this means consider first the following sentences:

(1a) Some philosophers are logicians.
(1b) Some individuals are such that they are philosophers and logicians
(2a) Every philosopher except Leo is a logician.
(2b) Every individual except Leo is such that if it is a philosopher then it is a logician

Sentences in (1a) and (1b) are logically equivalent. One can also check that this is true of (2a) and (2b). These equivalences say that for some quantifiers of type $\langle 1, 1 \rangle$ (in this case for $SOME$ and for $EVERY...exceptLeo$) one can eliminate the restriction on the domain of quantification imposed by the first argument and compensate it by making the second argument Booleanly more complex. Quantifiers for which such elimination is possible are sortally reducible. On the other hand quantifiers for which such elimination is not possible (like $MOST$ for instance) are inherently sortal.

More precisely: A type $\langle 1, 1 \rangle$ quantifier F is sortally reducible iff there is a binary Boolean function h (taking sets as arguments) such that $F(X)(Y) = F(E)(h(X, Y))$. Otherwise F is called *inherently sortal*. The important result we will need which concerns sortally reducible quantifiers is the following (Keenan 1993): A conservative F is sortally reducible iff F is inter-

sective or F is co-intersective. In general quantifiers in natural languages are not sortally reducible (Keenan, 2000).

Crucially for our purposes sortal reducibility entails a more general property essential for our analysis. Indeed it is easy to show that if D is intersective then $D(S)(P)$ is equivalent to $D(S_1)(S \cap P)$ for any S_1 such that $S \subseteq S_1$. Similarly if D is co-intersective then $D(S)(P)$ is equivalent to $D(S_1)(S' \cup P)$ for any S_1 such that $S \subseteq S_1$. So the crucial property roughly says that in sentences with sortally reducible quantifiers we can always lessen (and moreover fully eliminate) the restriction on the domain of quantification (imposed by the first, nominal, argument). We will call this property $FIDQ$, or the property of freely increasable domain of quantification (cf. Zuber, 2005).

We will apply this property to an analysis of complex demonstrative determiners of various kinds indicated in the introduction. Such an application presupposes that we have a way of telling which determiners are sortally reducible and which are not. Of course we can always make "logical calculations" to classify them. We can also observe that for determiners of the form *Det...conn NP* sortal reducibility depends on the sortal reducibility of *det*: in general if *det* is sortally reducible so is the determiner *det...conn NP*. This claim although in need of being justified for various connectors which may occur in complex demonstratives, will not play an essential role in what follows.

4   Sortal inherency and demonstratives

In order to answer various questions concerning the semantics of complex demonstratives and the role of the common noun to which demonstrative apply we need to systematise the empirical observations made in the section 2. We have seen that "simple" demonstrative *this* is categorially ambiguous. First, it can be categorised as an NP and in this case it corresponds to the NP *this object/existent* and can be used as the subject NP on its own with no restriction. Possibly, in such cases speaker's demonstration replaces the universal property $OBJECT$.

Second, *this* can also be categorised as a (unary) determiner, in which case it applies to a common noun to form a noun phrase. There is a general agreement that in this case it denotes a conservative function (cf. Keenan and Stavi, 1986). More can be said, however. We observe that *this* as determiner denotes an intersective function, as can be checked either directly using the definition of intersective functions or some of their properties (like symmetry for instance). For instance we note that (3a) is logically equivalent to (3b) and to (3c), if the the speaker point the same object in all cases:

(3a) This philosopher is bald.
(3b) This (human) being is (a) bald (and a) philosopher.
(3c) This bald person is a philosopher

In addition we notice that since the algebra of intersective functions is isomorphic to the algebra of type $\langle 1 \rangle$ quantifiers, *this* considered as a determiner is mapped to *this object*, which may explain that there is lexically one *this* even if it is categorially ambiguous.

Concerning syntactically complex noun phrase demonstratives we will consider only those which are obtained from syntactically complex demonstrative determiners. Recall that a syntactically complex determiner is a determiner of the form *Det...conn this(one)*, where *Det* is a unary determiner and *conn* is one of the connectives we discussed in section 2. It follows from this restriction that we will not consider such complex noun phrase demonstratives as *Leo and this student* or *this teacher and this student*. Obviously the latter example may present additional problems given the fact that they involve two different common nouns. In opposition to this the complex noun phrase demonstratives we consider have only one common noun as argument. Thus

we observe that the *Det* and *this* in examples we consider must apply to the same common noun. This is because examples like *Most teachers, including this student* or *Every student, except this teacher* are "internally inconsistent" (unless the person pointed at is a student and a teacher at the same time).

Let us start our analysis of the semantic contribution of the common noun argument by looking at syntactically simple noun phrase demonstratives. So suppose that I point intentionally at something that I believe to be a young wild cat and I utter (4a). Ignoring various scopal possibilities of *intelligent* and ambiguity of *young* we can consider, given the property of freely increasable domain of quantification indicated above, that (4a) is logically equivalent to (4b), (4c), (4d) and (4e);

(4a) This young wild cat is intelligent.
(4b) This wild cat is young and intelligent.
(4c) This cat is young, wild and intelligent.
(4d) This animal is a young and intelligent wild cat.
(4e) This (object) is a young and intelligent wild cat.

Furthermore, we observe that (4a), and as a matter of fact all sentences in (4), entail (5), which we consider for purposes of illustration, as grammatical:

(5) This is intelligent

This series of equivalences allows me to be mistaken as to the property by which I (partially) describe the object pointed at when using the specific noun phrase demonstrative. Thus it can happen that I am pointing at something which is a wild cat but not a young wild cat. Similarly I can be pointing at something which in fact is a cat but neither wild nor young. Finally it is possible that I am pointing at something which is not a cat but obviously is "something", that is an object. In fact the basic supposition is that I am pointing "at least" at an object or a being. If this being is intelligent then I can still express a true proposition, namely the one in (5), even if I am partially mistaken with the descriptions I attribute to the demonstrated being by using a particular demonstrative NP in subject position.. In other words the truth of the proposition expressed by my utterance of (4a) does not depend solely on properties used in the subject NP. Properties expressed by the predicate should also be taken into account.

Important point is now that the situation needs not be the same when I use a syntactically complex NP demonstrative in subject position. We know that such a demonstrative can be formed either from a sortally reducible determiner (that is a determiner denoting a sortally reducible quantifier) or from a determiner which is not sortally reducible. The first case occurs for instance with the syntactically complex demonstrative NP *Some young wild cats, including this one* which is formed from the sortally reducible determiner *Some..., including this (one)*. This means that sentence (6a) is equivalent to (6b):

(6a) Some wild young cats, including this one, are intelligent
(6b) Some beings, including this one, are wild, young and intelligent cats

This equivalence allows us to proceed in this case in the way similar to the one illustrated above with examples in (4) (with additional necessity of taking into account the semantics proper to the "non-demonstrative" part of the complex determiner).

The second case, that is the case of sortally irreducible quantifiers. For instance the determiner *most* and consequently the complex demonstrative determiner like *most..., including this(one)* is

sortally irreducible. This means that we cannot in this case extend freely its domain of quan-tification (the denotation of the first argument, the common noun) as in the case of intersective or co-intersective quantifiers. Thus we cannot in general find a property P such that (7a) is equivalent to (7b):

(7a) Most wild young cats, including this one, are intelligent.
(7b) Most beings, including this one, are intelligent and P.

Consequently my mistakes in the description of demonstrated objects are different when I use (syntactically complex) demonstratives denoting sortally reducible quantifiers than when I use demonstratives denoting sortally irreducible quantifiers(in subject position) . In the first case my mistake is "partial" and can be corrected by the use of a specific predicte. Although this observation concerns some aspects of language use it is a consequence of a purely logical result from the GQ theory.

5   Concluding remarks

The are various problems related to the semantics of demonstratives and their use that I did not touch upon in this paper. As far as I can see my proposal concerning the possible role of the subject common noun argument does not preclude more fine grained analysis. For instance I suppose that the meaning of the demonstrative *this* is such that sentences in (8) can be considered as logically equivalent:

(8a) This teacher is bald.
(8b) This bald person is a teacher

The problem here is not only that the notion of logical equivalence in the context of demonstratives may be dubious but also that the above sentences may differ in presuppositions, as it has often been claimed. My proposal is not incompatible with such an analysis since we can suppose that presuppositions contribute also to the semantics and their presence necessitates a stronger notion of semantic equivalence.

I wanted to justify the following claim: demonstratives, even though usually analysed at the purely pragmatic level, cannot be analysed in isolation, without taking into account many other linguistic phenomena. I show in particular that there is an infinite number of syntactically complex demonstrative determiners and noun phrases which clearly are quantificational and referential "at the same time" contradicting thus various claims that noun phrases are either (purely) referential or (purely) quantificational (cf. Larson and Segal, 1995)[1].

Notice that there are also syntactically complex interrogative demonstratives. They can occur in so-called *inclusive questions* (Zuber, 2000):

(9a) Which student, in addition to this one, is bald?
(9b) Apart from Leo and this student which other student will dance?

Such examples show that the question of the semantic status of demonstratives should be asked not only in the context of proposition expressing expressions.

Finally, I have tried to show that some simple tools from the formal semantics, in particular from generalised quantifier theory, may be useful in the analysis of demonstratives as well. If my proposal is sound then the distinction between semantics and pragmatics needs additional explanation.

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[1] In fact such a dichotomy has been criticised on other grounds as well, cf. Carlson and Pelletier, 2002

References

Altshuler, D. 2007. WCO, ACD and what they reveal about complex demonstratives. *Natural Language Semantics* 15, pp. 265-277

Borg, E. 2000. Complex Demonstratives, *Philosophical Studies* 97, pp.229-249

Braun, D. 1994. Structured characters and complex demonstratives. *Philosophical Studies* 74, pp. 193-219

Carlson, G. and Pelletier, J.F. 2002. The Average American has 2.3 Children, *Journal of Semantics* 19, pp.73-104

Dever, J. 2001. Complex Demonstratives, *Linguistics and Philosophy* 23:3, pp. 271-330

Glanzberg, M. and Siegel, S. 2006. Presupposition and Policing in Complex Demonstratives. *Nous* 40:1, pp.1-42

Keenan, E. L. 1993. Natural Language, Sortal Reducibility and Generalised Quantifiers, *Journal of Symbolic logic* 58:1, pp. 314-325.

Keenan, E. L 2000. Quantification in English is Inherently Sortal, *The History of Philosophy and Logic* 20, pp. 251-265

Keenan, E. L. and Faltz, L. M. 1985. *Boolean Semantics for Natural Language*, D. Reidel Publishing Company, Dordrecht.

Keenan, E. L. and Stavi, J. 1986. A semantic characterisation of natural language determiners, *Linguistics and Philosophy* 9, pp.253-326

King, J. 2001. *Complex Demonstratives: a quantificational approach*, MIT Press

Larson, R. and G. Segal 1995. *Knowledge of Meaning: An Introduction to Semantic Theory* , Cambridge, MA, MIT Press

Roberts, C. 2002. Demonstratives as Definites, *in* K. van Deemter and R. Kibble *eds. Information Sharing: Reference and Presupposition in Language Generation and Interpretation* CSLI Lectures Notes, pp. 89-136

Zuber, R. 1998. On the Semantics of Exclusion and Inclusion Phrases, *in* Lawson, A. (ed.) *SALT8*, Cornell University Press, pp. 267-283

Zuber, R. 2000. On Inclusive Questions, *in* Billerey *et al.* (eds.) *WCCFL 19 Proceedings*, Cascadilla Press, pp.617-630

Zuber, R. 2005. More Algebras for Determiners, P. Blache and E. Stabler (eds.) *Logical Aspects of Computational Linguistics 5*, vol. 3492 of LNAI, Springer Verlag, pp.363-378