DEPENDENT INDEFINITES

Donka F. Farkas, UCSC

Abstract

The paper first lays out a non-configurational approach to scope ambiguities in which scope dependencies are treated as dependencies between evaluation indices of variables. The notions of dependent and domain variables are defined naturally in this framework. These concepts are then used to account for the distribution and interpretation of determiner reduplication in Hungarian, a phenomenon that has not received much attention so far.[1]

1. Introduction

This paper contributes to the study of the semantics of indefinites in natural language by introducing on the scene a new type of indefinite, called *dependent.* We meet it in Hungarian, where one may reduplicate certain determiners, as illustrated in [1]-[3].[2]

[1] Minden gyerek olvasott egy-egy / hét-hét könyvet.
every child read a-a / seven-seven book-ACC
'Every child read a/seven book(s).'

[2] Minden gyerek más-más könyvet olvasott.
every child different-different book-ACC read
'Every child read a different book.'

[3] Minden gyerek külön-külön szobában aludt.
every child separate-separate room slept
'Every child slept in a separate room.'

In what follows I will be concerned with the distribution and interpretation of reduplicated indefinites and cardinals illustrated in [1]. The phenomenon of D(eterminer) Reduplication, was first noticed in Moravcsik (1976), a survey of reduplication phenomena across languages. More recently, Gil (1995) mentions reduplication of cardinals in Hungarian as an example of noun phrases that must be interpreted in the 'share' of a distributive predication, but no detailed investigation of this phenomenon has been undertaken so far. Such an exercise is theoretically instructive because it turns out to be relevant to the following two issues: (i) the necessity of having models for natural language semantics that accommodate both worlds and situations, and (ii) the question of what drives noun

[1]Material contained in this paper was presented at the Conference on Predication and Specification, Santa Cruz, November 1994, a colloquium at UCSD, the Colloque de Syntaxe et Semantique, Paris, October, 1995, and the 5th Logic, Language and Computation Workshop, Stanford, May 1996. I wish to thank the participants at these talks, and especially Anna Szabolcsi, for useful comments and thought-provoking questions.

[2]Noun phrases containing the modfier *külön* 'separate' and *más* 'different' must be placed in focus position, i.e., immediately to the left of the verb, whether reduplication occurs or not.

phrase interpretation in general, and in particular, what determines the scopal behavior of various types of noun phrases. With respect to the first issue, recall that in classical model-theoretic semantics only worlds where resorted to, while classical situation semantics used only situations. The study of D-reduplication in Hungarian provides evidence for adopting models that use both types of theoretical constructs. With respect to the second issue, the data and the account presented here lend support to an approach to scope that is not structure driven in the sense that syntactic considerations (at either the surface or at more abstract levels) are seen as underdetermining the scopal interpretation of noun phrases. This is in sharp contrast with Q(uantifier) R(aising) accounts of scope, either in their classical form (whose source is May (1977)), or in their more recent versions, such as Heim (1982) and Beghelli and Stowell (to appear). Finally, the discussion provides an affirmative answer to the question of whether the indefinite article *egy* has to be distinguished from the homophonous cardinal numeral meaning 'one'.

The rest of the paper is organized as follows: Section 2 reviews basic theoretical assumptions with special attention to quantification and scope.[3] Section 3 outlines a semantically based noun phrase typology, and Section 4 returns to D-reduplication in Hungarian and proposes an account that makes use of the notions introduced in the previous two sections. Section 5 concludes by linking D-reduplication with reduplication elsewhere in the grammar of Hungarian.

2. Framework

2.1. General assumptions

I assume that semantic interpretation involves two related levels of representation, syntactic structure and logical form (lf). In the case of sentences, the former is assumed to be the surface structure representation of the sentence. The latter is the representation of its semantic structure, and is constructed on the basis of the former. Lf expressions (lfs) determine the satisfaction conditions of the linguistic expression they are associated with relative to a model M, a context c, and an assignment function *f*. In what follows, issues concerning the role of the context in interpretation will be ignored.

The model M consists of a triplet, <W, U, V>, where W is a set of worlds, U is a set of (sorted) individuals, and V is a valuation function assigning intentions to constants. Following Kratzer (1989) I take it that situations are parts of worlds. Every $w \in$ W determines its own extensional model M_w, such that M_w = <S_w, U_w, V_w>, where S_w are the situations in w, U_w are the individuals in w, and V_w is a valuation function assigning denotations to constants relative to the situations in S_w.

Lfs are structured sets of conditions on the model, which jointly determine the satisfaction conditions of the expressions they are associated with. Satisfaction conditions of complex expressions are arrived at compositionally from the satisfaction conditions of their parts and their mode of combination. The information represented at this level

[3] A more detailed discussion of these issues is to be found in Farkas (1996) and Farkas (to appear). A condensed version of the D-reduplication facts and their account is presented in Farkas (1996), Section 3.

is essentially the same as that contained in the boxes of D(iscourse) R(epresentation) T(heory) but since structural considerations at this level play a relatively minor role, the approach is closer in spirit to Dynamic Predicate Logic (see Groenendjik and Stokhof (1991)).

The components of lfs that play a role below are the following: (i) predicative expressions made up of n-ary predicates followed by n argument slots, (ii) sorted variables (aka discourse referents) which are connected to these argument slots, and (iii) quantifiers. I will not deal here with the connection between argument slots and discourse referents, but simply use the same variable name for the discourse referent and the argument slot it is associated with.

Following McCawley (1980), I assume that predicative expressions have two distinct functions: they can be used either as main predications, as in standard logical languages, or as restrictive expressions. In the latter case they delimit the domain from which a variable may receive values, as in logical languages that use restricted quantification. Restrictive predicative expressions will be separated from the variable they restrict by a colon. The D(escriptive) C(ontent) of noun phrases contributes restrictive expressions; the main predicates of sentences contribute main predications. To illustrate, the lf of the sentence in [4a] is given in [4b],

[4] a. A man left.

b. *(x: man(x)) leave(x)*

where x is an individual variable restricted by the predicative expression *man(x)* to range over individuals who are men, and *leave(x)* is the main predication.

Following the insight of work in DRT and File Change Semantics, originating in Kamp (1981) and Heim (1982) respectively, lfs are allowed to contain free variables (the variable x in [4b], for instance). The quantificational force of such variables is the result of the way satisfaction conditions of lfs are defined. Most generally, the satisfaction conditions for an lf e are as in [5]:

[5] An expression e is satisfied in w wrt M and c iff there is an assignment function f such that e is satisfied relative to f in w and c, abbreviated as $(e)_{f,w,c}$.

The particular conditions e imposes depend on the form and content of e.

Assume now that [4b] is interpreted with respect to some world w in W and some context c. Its satisfaction conditions are as in [6]:

[6] [4b] is satisfied in w wrt M and c iff there is a function f such that $(x:\ man(x)\ leave(x))_{f,w,c}$. This condition is met iff (i) $f(x,w) \in V(man,w)$, and (ii) $f(x,w) \in V(leave,w)$.

Subcondition (i) is contributed by the restrictive expression in [4b], while subcondition (ii) is contributed by the main predication.

I also assume that expressions at lf contain evaluation indices à la Kaplan, which specify the coordinates with respect to which the expression in question is to be evaluated. Among these coordinates we will be concerned with modal and functional ones, which specify the world and the assignment function relative to which the expression is evaluated. In what follows we restrict our attention to evaluation indices on variables. They come into play only in Section 2.3, and will be ignored until then.

2.2 Quantification

The main advantage of assuming a level of lf for present purposes is that it allows a uniform characterization of the various types of quantificational structures in natural language. At lf, quantificational expressions share the tripartite structure in [7]:

[7] Quantifier Restrictor N(uclear) S(cope)

The Restrictor defines a set of cases, assumed to be non-empty, that form the domain of quantification. The NS is a predication on this set. In Aristotelean terms then, the Restrictor is the logical subject of the predication expressed in the NS. The predication relation between the Restrictor and the NS may be either distributive or collective. In the former case it predicates of the whole set defined by the Restrictor; in the latter it distributes over the elements of this set. Most generally, the satisfaction conditions of quantificational expressions are as in [8],

[8] A quantificational expression e is satisfied in w wrt M and c iff there is an f such that $(e)_{f,w,c}$. This condition is met iff Q-many ways of satisfying e_R relative to *f,w,c* are ways of satisfying e_{NS} relative to *f,w,c.*

where e_R and e_{NS} are the lfs in the Restrictor and the NS respectively. The 'ways of satisfying' e_R determine the cases that form the domain of quantification. These cases may be worlds, situations or individuals. Quantification over worlds is illustrated in [9] by a modal sentence and an afactual conditional; quantification over situations is illustrated in [10] by a sentence involving adverbs of quantification and by a factual conditional, and quantification over individuals is illustrated in [11] by a sentence involving D-quantification.

[9] a. Martin may have arrived home by now.

b. If Martin had been home he would have answered the phone.

[10] a. Often/always/sometimes, when Martin is hungry he is irritable.

b. If Marin is hungry he is irritable.

[11] Every student passed.

We will briefly review each type of quantification below.

Quantification over individuals

This type of quantification is triggered by quantificational determiners. The quantifier at lf is subscripted by the variable introduced by the quantificational noun phrase that contains the determiner in question. The general form of such expressions is as in [12].

[12] $Qx\,[\ldots\ x\ \ldots]_R\,[\ldots]_{NS}$

A way of satisfying the Restrictor in this case amounts to choosing an evaluation function that assigns to x a value that meets its restrictive expression, contributed by the DC of the quantificational noun phrase. Thus, to see whether some f satisfies e_R one has to consider alternative ways of assigning values to x, i.e., one has to consider assignment functions f' that assign to x values that meet the DC condition contributed by the quantificational noun phrase. One then has to see whether Q-many of these functions have extentions that satisfy the NS. Applying [8] to [12] we get the satisfaction conditions in [13]:

[13] Let e be an expression of the form in [12]. e is satisfied in w wrt M, c, iff there is an f such that $(e)_{f,w,c}$. This condition is met iff there are Q-many functions f' which extend f wrt x such that $(e_{NS})_{f',w,c}$, such that each f' has a (possibly trivial) extension f'' such that $(e_{NS})_{f'',w,c}$.

Assignment functions are assumed to assign values to all variables. The notion of a function f' extending another function f with respect to a set of variables X is defined in [14].

[14] *Extention of a function*
A function f' extends a function f wrt a set of variables X iff f' agrees with f on all assignments except for the variables in X. If X is empty, f' is a trivial extention of f. The function f is called the *domain function* for f', and X is the *extension set* of f'.

The expression $f'(f/x)$ will be used to indicate that f' extends f, and x is in the extension set of f'.

According to [13] then, an expression of the form in [12] is satisfied wrt w,c iff there is a function f such that Q-many extensions f' of f that satisfy the expression in the Restrictor wrt w,c, have extensions f'' that satisfy the expression in the NS wrt w,c. The expression in the Restrictor has to be satisfied relative to a set of functions F' which extend f; the expression in the NS has to be satisfied relative to a set of functions F'', each of which extend a function in F'. Let us call the function (or set thereof) that has to satisfy an expression e, the *base function* of e. The base function of the expression in [12] is the initial function f; the base function for the expression in the Restrictor of [12] is the set of functions F', and the base function for the expression in the NS is the set of functions F''. The functions in F'' are *dependent on* the functions in F' because they are defined by associating to every f' in F' a function f''.

Let us exemplify with [11], whose lf is given in [15], and whose satisfaction conditions are given in [16].

[15] $\forall_x$ [*x: student(x)*]$_R$ [*pass(x)*]$_{NS}$

[16] Let *e* be the expression in [15]. *e* is satisfied in *w* wrt *M* and *c* iff there is an *f* such that *(e)*$_{f,w,c}$. This condition in satisfied iff there is some function *f* with the following property: every *f'(f/x)* such that *f'(x,w)* $\in$ *V(student,w)* has the property of having a trivial extension *f"* such that *f"(x,w)* $\in$ *V(pass,w)*.

These conditions amount to requiring that every individual in the relevant set of students be in the set of individuals who passed. The complex condition in [16] is a special case of [13], which in turn is a special case of [8], which instantiates the general schema in [5].

With respect to distributivity, I follow Kamp and Reyle (1993) in assuming that the distributive reading of an example like [17] involves a distributive universal quantificational structure whose Restrictor is contributed by the plural or coordinate noun phrase.

[17] The children/Bill and Mary carried the suitcase upstairs.

Following Roberts (1991), I assume that distributivity is a mode of predication, and that in the case of [17], the subject noun phrase introduces an i-sum referent whose i-parts form the domain over which the distributive predication ranges. Whether a predication is understood collectively or distributively may depend on properties of the logical subject (determiners *every* and *each* require distributive predication), or on properties of the predicate (*gather* can only be understood collectively).

Quantification over worlds

In the case of quantification over worlds the domain of quantification is a subset *W'* of W. In the case of modalized sentences, *W'* is what Kratzer (1980) calls the modal base. Whether the quantifier is existential or universal depends on the choice of modal. Such sentences are true iff the NS (the lf of the proposition in the scope of the modal) is satisfied in one or all *w'* $\in$ *W'*.

With afactual conditionals, *W'* is established on the basis of the antecedent, which contributes the expression in the Restrictor. The consequent contributes the expression in the NS, and the default quantifier is universal. The lf of such sentences is of the form in [18], where lf_a and lf_q are the lfs of the antecedent and the consequent respectively.

[18] Q$_{w'}$ [lf_a]$_R$ [lf_q]$_{NS}$

A way of satisfying the expression in the Restrictor in [18] amounts to choosing a world *w'* close to *w* such that lf_a is satisfied at *w'*. Given [8] then, the satisfaction conditions of such expressions are as in [19]:

[19] Let *e* be an expression of the form in [18]. *e* is satisfied in *w* wrt M, c, iff there is an *f* such that *(e)*$_{f,w,c}$. This condition is met iff Q-many worlds *w'* close to *w* such that *(*lf_a*)*$_{f,w',c}$ are such that *(*lf_q*)*$_{f,w',c}$.

The claim one makes by asserting an afactual conditional is that every appropriate world relative to which the antecedent is satisfied is a world relative to which the consequent is satisfied as well. (I ignore here the question of 'closeness'.) Crucially, the main predications of both the antecedent and the consequent are evaluated with respect to the worlds *w',* rather than the initial world *w*. Let us call the world (or set of worlds) relative to which an expression *e* has to be satisfied *the base world* for *e*. In the case of afactual conditionals the base world for the entire expression is the initial world *w;* the base worlds for both the antecedent and the consequent are the worlds in *W'.*

Quantification over situations

Quantification over situations is treated analogously with quantification over worlds, except that expressions are evaluated relative to an extensional model M_w, where S_w, the situations in *w*, play the role played by W in intensional models. Sentences involving adverbs of quantification are similar to modalized sentences in that they involve quantification over a contextually established subset of S_w. Factual conditionals are treated on a par with afactual ones, except that now the antecedent determines a set of situations, and the consequent has to be true in situations that extend them. The lf of a factual conditional is of the form in [20a], and its satisfaction conditions are as in [20b]. A way of satisfying the Restrictor in this case amounts to choosing a situation in which the antecedent is satisfied.

[20] a. $\forall_{s'}$ $[lf_a]_{s'}$ $[lf_q]_{s"}$

b. The expression in [20a] is satisfied in *w* wrt *M* and *c* iff there is a function *f* with the following property: for every $s' \in S_w$ such that $(lf_a)_{f,s',c}$, there is a situation $s" \in S_w$ such that *s'* is part of *s"* and $(lf_q)_{f,s",c}$.

The situations *s"* depend on the situations *s'* the same way in which the functions *f"* depended on the functions *f'* in the case of quantification over individuals.

The three types of quantification discussed above fall into two natural calsses, *extensional* and *intensional* depending on whether one stays within the limits of a single world or not. Extensional quantification in its turn is of two types, *individual* or *situational*, depending on whether the domain of quantification is made up of individuals or situations. In the case of intensional quantification, the quantifier binds a world-level variable. In the case of extensional quantification, the quantifier binds an individual-level or a situation-level variable.

2.3 Scope

In this subsection I turn briefly to that aspect of scope which is directly relevant to D-reduplication in Hungarian, namely the question of the scope of a variable relative to a quantifier. A variable is said to have *narrow scope* relative to a quantifier iff it co-varies with the variable bound by the quantifier. Otheriwse it will be said to have *wide scope* relative to that quantifier.

Let us exemplify with a variable introduced in the NS of an expression involving

quantification over individuals, as in [21].

[21] Every child read *a book by Astrid Lindgren.*

The subject noun phrase here contains the quantificational determiner *every* which contributes a universal quantifier that necessarily binds the variable introduced by this noun phrase. The DC of this noun phrase provides the restrictive expression on this variable, and must occur in the Restrictor. The rest of the sentence makes up the NS. The indefinite noun phrase *a book by Astrid Lindgren* may be understood either as having narrow scope relative to the variable bound by the quantifier, in which case books co-vary with children, and the indefinite may refer to several books, or it may be understood as having wide scope relative to the quantifier, in which case the indefinite refers to a single book.

In the terms of the previous subsection, the variable contributed by the subject must be in the extension set of *F'*, the base functions of the Restrictor. The variable contributed by the indefinite is in the extension set of *F"*, the base functions of the NS, under the narrow scope reading, while in the wide scope reading it is evaluated by the base function *f*, and is not in the extension set of either *F'* or *F"*. If a variable x is in the extension set of a set of functions ϕ, x will be said to be evaluated by the functions in ϕ.

I adopt here the direct representation of this distinction argued for in Farkas (1996) and Farkas (to appear). According to it, variables, like other elements of lfs, have a set of evaluation coordinates including a functional index, and a modal or situational index. The functional index specifies which function (or set of functions) assigns values to the variable; the modal or situational index specifies which world(s) or situation(s) the function has to be evaluated at. For the case at hand, the variable contributed by the indefinite will be assigned the functional index *f* in the wide scope case, and the index *F"* in the narrow scope case. The latter indexing indicates that the variable is in the extension set of the functions in *F"*. The representations of the two readings are given in [22]:

[22] a. *Narrow scope:*
$\forall_x$ [$x_{F'}$: *child(x)*]$_{F'}$ [$y_{F"}$: *book-by-A.L.(y) read(x,y)*]$_{F"}$

b. *Wide scope:*
$\forall_x$ [$x_{F'}$: *child(x)*]$_{F'}$ [y_f: *book-by-A.L.(y) read(x, y)*]$_{F"}$

(Modal indices are supposed to be set to the initial world w and are ignored here.) There are several properties of these lfs that follow from the fact that they represent quantification over individuals (which in turn follows from the use of the determiner *every* in [21]). Thus, it follows from [13] that the base function of the Restrictor is the set of functions *F'*, and that the base function of the NS is the set *F"*. This is indicated by the subscripts *F'* and *F"* on the Restrictor and NS respectively. Furthermore, the relation of these two sets to one another and to the initial function *f* is also given by [13]: the functions $f' \in F'$ extend *f* and the functions $f" \in F"$ extend those in *F'*, and depend on

these functions. The fact that x is in the extension set of F' (indicated by the indexing of x by F') follows from the fact that x is contributed by the quantificational noun phrase that also contributes the quantifier. The two readings differ only in that in the former the variable contributed by the indefinite is in the extension set of F'', while in the latter it is not. Given the indexings in [22] and the general form of the satisfaction conditions of expressions quantifying over individuals in [13], the satisfaction conditions of the two lfs in [22] are as in [23]:

[23] a. *Narrow scope*
The expression in [22a] is satisfied in w wrt M and c iff there is a function f with the following property: for every function $f'(f/x)$ such that $f'(x, w) \in V(child, w)$, there is an extension $f''(f'/y)$ such that $f''(y, w) \in V(book\text{-}by\text{-}A.L., w)$ and $\langle f'(x, w), f''(y, w)\rangle \in V(read, w)$.

b. *Wide scope*
The expression in [22b] is satisfied in w wrt M and c iff there is a function f with the following property: for every function $f'(f/x)$ such that $f'(x, w) \in V(child, w)$, there is a trivial extension f'' such that $f(y, w) \in V(book\text{-}by\text{-}A.L., w)$ and
$\langle f'(x, w), f(y, w)\rangle \in V(read, w)$.

Note that $f''(y) = f(y)$ in [22b], and $f''(x) = f'(x)$ in both [22a] and [22b], and therefore in [23] only the functions that fix the values of the relevant variables are used. Now because y is in the extension set of F'' in [22a], it co-varies with x. In such cases y will be said to *depend on* x and x will be said to be the *domain variable* of y. In [22b] y does not co-vary with, and therefore does not depend on x.

When an indefinite has narrow scope relative to the quantifier in examples involving modal or situational quantification, the variable contributed by the indefinite co-varies with the world or situation level variable bound by the quantifier. This means that the function interpreting the variable is to be evluated at each world/situation in the domain of quantification. When the indefinite has wide scope relative to a quantifier, there is no such co-variation; the variable is interpreted relative to the initial world or situation. Thus, when the indefinite in [24] has narrow scope with respect to the quantifier the identity of the movie may vary from world to world, while when the indefinite has wide scope no such co-variation is possible, and the indefinite refers to a single movie:

[24] If a Czech movie from the sixties had been available I would have been pleased.

In situational quantification, narrow scope indefinites co-vary with situations, while wide scope indefinites do not. Thus, the indefinite in [25] co-varies with situations of Johnny being sick in the narrow scope reading, while in the wide scope reading it does not, and Johnny is understood to reread the same book.

[25] Often/Always when he is sick, Johnny reads a Dorothy Sayers mystery.
If/when Johnny is sick he reads a Dorothy Sayers mystery.

Let us assume that the indefinite contributes a variable *y* in both [24] and [25], and that these sentences are evaluated relative to a world *w* and a function *f*. In the narrow scope reading of [24] *y* is indexed by *w'*, the variable bound by the quantifier, and therefore one has to consider the value *f* assigns *y* at each of these worlds. Under this reading [24] is satisfied iff there is an *f* such that for every appropriately chosen world *w'* such that *f(y, w')* is a Czech movie from the sixties and is available at *w'*, I am pleased at *w'*. Under the wide scope reading of the indefinite in [24], *y* is indexed by *w*, and therefore one has to consider the value *f* assigns *y* at *w*. Under this reading [24] is satisfied iff there is an *f* such that for every appropriately chosen world *w'* such that *f(y, w)* is a Czech movie from the sixties and is available in *w'*, I am pleased in *w'*. Under the narrow scope reading then *y* is dependent on *w'*, while under the wide scope reading it is not. In the case of [25], the indefinite may be indexed by *s"*, which gives us the narrow scope reading or it may not, which gives us the wide scope reading. In the former case the indefinite is dependent on *s'*, the variable bound by the quantifier, while in the latter it is not.

In this approach to scope then, scopal ambiguities are the result of different indexings on variables, rather than the result of differences in structural configuration. What the possible indices of a variable are is determined partly by morphological considerations, and partly by the requirement that the index of an expression be *accessible* to that expression. The relation of index accessiblity is defined in [26]:

[26] *Accessibility relation*
The base coordinates of an expression e are accessible to any supart of e.

An immediate consequence of this relation is that indefinites will be able to have wide scope relative to a quantifier no matter how deeply embedded they are without having to be moved over unbounded domains. Also, in the case of quantification over individuals, indefinites in the Restrictor may be 'bound' by the quantifier (i.e., may be indexed by *F'*), but indefinites in the NS may not, since *F'* is not accessible to variables in the NS.

Crucially for our present purposes the approach presented here distinguishes between variables at several levels. First, there is the sortal distinction between *extensional* and *intensional* variables, the latter ranging over worlds, the former further subdividing between *individual* and *situational* variables, depending on whether they range over individuals or situations within a world. Second, variables may be *dependent* or not, and the former are dependent on a *domain* variable, where dependency is understood as in [27].

[27] A variable v_2 is dependent on a variable v_1 iff the values assigned to v_2 co-vary with those assigned to v_1.

In such cases v_2 is a dependent variable, and v_1 is its domain variable. Dependency in the approach outlined above is a direct consequence of the index a variable bears, and

thus is not reducible to structural factors. Thus, in [22a], y is dependent on x because it is indexed by F", and the functions in this set depend on the functions F' that index x. Note also that in order for a variable to be dependent on another both variables must refer non-rigidly, i.e., they must be assigned several potentially different values.

Now if the above observations are on the right track the distinctions drawn here should be relevant to the interpretation of natural language expressions. The next two sections will show that this expectation is fulfilled.

3. Types of noun phrases

Noun phrases can be subcategorized relative to a variety of parameters. In this section I am concerned in particular with distinctions concerning the type of contribution noun phrases make to semantic structure, and more specifically, with semantic restrictions that result in restricted surface distribution or restrictions in scopal interaction.

With respect to semantic contribution, the most fundamental distinction is that between noun phrases that contribute a variable and those that do not. The former contribute a variable that becomes associated with an argument position, as in all the examples discussed so far. The latter fall into two classes: predicative noun phrases, exemplified in [28], and noun phrases that function as Predicate Operators, exemplified in [29].[4]

[28] Sam is *a doctor.*

[29] Sam wrote *letters* in the afternoon.

Predicate Operators contribute only a DC condition that restricts a particular argument slot of the main predication they are associated with. In the case of [29], this is the direct object, or second argument of *write.* At lf then, the DC condition contributed by this noun phrase occurs as part of the predicate. The main predication of [29] at lf is of the form in [30], where *letter(y)* modifies the predicate by restricting its second argument to entities that are letters:

[30] *(write(x, y) letter(y))*

Since these noun phrases do not contribute a variable that may have its own evaluation coordinates, they may not scope independently of the predicate, and take 'narrowest scope' in examples like [31].

[31] Every child wrote letters in the afternoon.

The existential force of Predicate Operators is the result of the existential force associated with arguments of a predicate. Since asserting [29] amounts to asserting that a letter-writing event occurred, asserting [29] entails that there must have been some letters that were being written.

[4] I follow here the terminology and basic insight of Szabolcsi (to appear). For proposals compatible though different in details, see McNally (1995) and van Geehoven (1995).

Existential bare plurals in English are interpreted as Predicate Operators, and so are bare accusatives in Hungarian. In both languages then, the absence of an article is connected to the Predicate Operator function. In Hungarian, Predicate Operators are distinguished by surface position as well: they must occur in a special, immediately preverbal position normally reserved for preverbal particles. (For details, see Szabolcsi (to appear).) The fundamental property of these noun phrases is their semantic role as predicate modifiers; their scopal properties, as well as restrictions concerning their surface occurence in Hungarian are consequences of this property.

Noun phrases that introduce variables may fall into several categories depending on the type of constraints they impose on the interpretation of the variable or the DC condition that restricts it, and these constraints may in turn constrain the distribution and interpretation of the noun phrases in question. For an example of a morphologically based constraint on the DC condition, consider subjunctive restrictive relatives in Romance, exemplified by the French sentence in [32]:

[32] Je cherche quelqu'un qui sache le Roumain.
I look-for someone who knows.SUBJ the Romanian
'I am looking for someone who knows Romanian.

Farkas (1985) argues that subjunctive relatives are possible only when the relative is interpreted in an intensional context, i.e., only when the condition expressed by it holds of the variable introduced by the noun phrase in a set of non-realistic worlds. As a result, noun phrases containing such relatives may only occur in contexts that allow such interpretations, and will always be interpreted as having narrow scope with respect to the operators that introduce such contexts. In [32] for instance, the constraint on the interpretation of the subjunctive relative is responsible for the fact that the direct object noun phrase must be interpreted as having narrow scope relative to the predicate *chercher* 'look for'. Various kinds of negative polarity items impose constraints on the semantic context in which they may occur which results in similar constraints on their scopal interpretation (see Zwarts (1996), Giannakidou (in prep.)).

If the assumptions in Section 2 are on the right track, the distinctions set up at the end of that section should also play a role in noun phrase typology. In particular, one expects noun phrase types to differ depending on the type of constraints they impose on the functions that assign values to the variables they contribute. These expectations are met.

Proper names and deictics such as *I*, *you*, *today* for instance, have to be interpreted by functions that are constant relative to the model or the context, and therefore they are rigid and immune to scopal variation and co-variation: they may not act as either domain or dependent variables. By contrast, as mentioned above, noun phrases that have a quantificational determiner contribute a variable that must be 'bound by the quantifier', i.e., the variable must be interpreted by the set of functions that form the base function of the Restrictor, and must be in the extension set of these functions. As a result, such

variables may be domain variables. These noun phrases therefore have necessarily non-rigid reference. Particular determiners may impose further restrictions on the evaluation of the variable or the noun phrase as a whole. Thus, *every* and *each* require their noun phrase to contribute the key of a distributive predication. One could argue, following suggestions made in Vendler (1967), that *every* contributes a universal quantifier and the requirement that the predication be distributive, while *each* simply marks its noun phrase as the key of a distributive predication. The universal flavor of noun phrases whose determiner is *each* is the result of the treatment of distributivity as involving universal quantification over the elements of the key. This suggestion explains the well-known paradigm in [33], under the assumption that only determiners contributing a universal quantifier may be modified by *almost*:

[33] a. Almost every student left the room.

b. Almost all the cake has been eaten.

c. *Almost each student left the room.

Ordinary (in)definites, i.e., DPs whose D is an (in)definite article, are special in that they impose no constraints whatsoever on their evaluation function, which explains why they are not restricted with respect to scopal interpretation.[5] In the next section we return to D-reduplication in Hungarian, and show that the account of the distribution and interpretation of these noun phrases relies on the distinctions set up in Section 2.

4. Dependent indefinites in Hungarian

We now examine D-reduplication in Hungarian in some detail with the aim of accounting for the distribution and interpretation of these noun phrases. The first relevant generalization is that they must have non-rigid reference. Thus, the examples in [1], repeated here as [34], are scopally unambiguous: the indefinite must be within the scope of the universal (i.e., books must co-vary with children):

[34] Minden gyerek olvasott egy-egy / hét-hét könyvet.
every child read a-a / seven-seven book-ACC
'Every child read a/seven book(s).'

The non-reduplicated variants of [34], given in [35] are scopally ambiguous: the indefinite may or may not be within the scope of the universal.

[35] Minden gyerek olvasott egy / hét könyvet.
every child read a / seven book-ACC
'Every child read a/seven book(s).'

Recall that in the analysis of distributivity adopted here, both noun phrases that contribute the key in a distributive predication, and those that are dependent on them in such

[5] Following Heim (1982), I assume that the main distinguishing factor between definites and indefinites concerns the familiarity of the variable contributed by the noun phrase. The familiarity requirement on definite noun phrases is responsible for their preference for wide scope readings.

a predication are non-rigid in reference. The former are non-rigid because the variable they contribute is bound by the universal quantifier associated with distributivity; the latter are non-rigid because the variable they contribute co-varies with the variable bound by the quantifier. If non-rigidity were the only relevant restriction on D-reduplication, both noun phrases contributing the key and noun phrases that are dependent on them should allow D-reduplication. The data in [36] and [37] show that only the latter part of the prediction is correct.

[36] A gyerekek hoztak egy-egy könyvet.
the children brought a-a book.ACC
'The children brought a book each.'

[37] * Hét-hét gyerek szalad.
seven-seven child runs
'Seven children are running.'

Note that both the direct object in [36] and the subject in [37] refer non-rigidly under the distributive reading of these sentences, and yet D-reduplication is allowed only in the former case. Example [38] below shows that non-reduplicated cardinals may introduce the key in a distributive predication.

[38] Hét gyerek szalad.
seven child runs
'Seven children are running.'

The crucial difference between [34] and [36] on the one hand, and [37] on the other is that the indefinite in the former two examples is dependent, while in the latter it is not. The condition in [39] accounts for all the data presented so far:

[39] *Dependent Variable Condition*
Reduplicated indefinites must introduce dependent variables.

The restriction to noun phrases that introduce dependent variables accounts for the possibility of D-reduplication in [34], as well as [36], and exludes it in [37]. In what follows, noun phrases that introduce dependent variables will be called dependent. D-reduplication then is restricted to dependent noun phrases.

Given the definition of dependent variables in [27] above, the question that arises now is whether there are constraints on what the domain variable may be. We now turn to data that show that the answer is affirmative, and therefore that the condition in [39] is not restrictive enough.

Consider the examples in [40] and [41].

[40] * Ha a tanár megbetegedne, helyettesítené egy-egy szülő.
if the professor sick.COND.III. replace.COND.III a-a parent
'If the teacher were sick a parent would replace him.'

[41] * Mari kell találkozzon egy-egy párizsi tanárral.
Mari must meet a-a Parisian professor-with
'Mari must meet a professor from Paris.'

The versions of these sentences without D-reduplication are grammatical and scopally ambiguous: the indefinite may be understood either as having wide scope relative to the conditional or modal operator, in which case it is independent, or it may have narrow scope, in which case it is dependent on the intensional variable *w'* bound by the quantifier. Under this latter interpretation [39] predicts D-reduplication to be possible and yet we see in [40] and [41] that it is not.

Given our discussion of various types of quantification and sorts of variables, the feature that distinguishes between [40] and [41] on one hand, and [34] and [36] on the other, is that the variable introduced by the indefinite is dependent on an extensional variable in the latter examples, and on an intensional variable in the former. The extensional dependency condition in [42] accounts for all the data presented so far.

[42] *Extensional Dependency Condition*
D-reduplication may occur only in noun phrases that contribute a variable dependent on an extensional domain variable.

This condition predicts D-reduplication to be possible in factual conditionals, as well as in sentences involving adverbial quantification, since in these cases the domain variable is situation-level, and therefore extensional. The examples in [43] and [44] show that this prediction is correct.

[43] (Időnként) egy-egy diák megbukik.
occasionally a-a student fails
'Occasionally a student fails.'

[44] Ha egy-egy tanár megbetegedik helyettesíti egy szülő.
if a-a teacher gets sick replaces-him a parent
'If a teacher gets sick, a parent replaces him.'

The restriction against intensional domain variables predicts that D-reduplication will not occur in noun phrases that contribute variables dependent on generic domain variables, given that genericity has been argued to involve a modal dimension. (For a recent discussion of this issue, see Condoravdi (1994).) The ungrammaticality of [45] shows that this prediction is correct.

[45] * Ha egy-egy gyerek beteg, lázas.
if a-a child sick feverish
'If a child is sick she has a fever.'

The restriction in [42] also predicts, correctly, that D-reduplication will not be possible in indefinites that have narrow scope relative to negation.

[46] * Mari nem olvasott egy-egy regényt.
Mari not read a-a novel
'Mari didn't read a novel.'

Before going on to further distinctions that need to be made we will examine some obvious alternatives to [42] and show why they are not adequate. Instead of the requirement of dependency one might hypothesize that the relevant parameter is whether the variable is introduced in the Restrictor or the NS. One might hypothesize then that D-reduplication is allowed in the NS but not the Restrictor. That this hypothesis is not correct is shown by the fact that D-reduplication may occur in examples such as [43] and [44] above, as well as [47] and [48] below:

[47] Ahányszor egy-egy híres személy meglátogatta a várost
Whenever a-a famous person visited the town
'Whenever a famous person visited the town
elvitték a kastélyba.
they-took-him the castle-to
they took him to the castle.'

[48] Olykor, mikor egy-egy olyan könyvet olvasok, ami a szívemhez szól
occasionally when a-a such boo I-read which the hear-my-to speaks
'Occasionally, when I read a book that speaks to my heart
jól érzem magam.
well feel-I myself
I feel well.'

Instead of the condition on the extensionality of the domain variable one could hypothesize that D-reduplication is sensitive to the extensionality of the context in which the noun phrase occurs, and therefore that D-reduplication will not occur in noun phrases that are within the semantic scope of an intensional operator. Note however, that the possibility of D-reduplication in [49] is predicted by the constraint in [42] but not by the hypothesis just given.

[49] Mindenki kell találkozzon egy-egy párizsi tanárral.
Everybody must meet a-a Parisian professor-with
'Everybody must meet a professor from Paris.'

This example has a reading in which the D-reduplicated indefinite is within the semantic scope of the intensional quantifier contributed by *kell* 'must' but is dependent on the extensional variable contributed by the universal *mindenki* 'everybody'. The constraint in [42] predicts D-reduplication to be possible here, while a ban on occurring within an intensional context would incorrectly rule it out.

Note that the account of when D-reduplication is allowed, i.e., the Extensional Dependency Condition in [42], makes crucial reference to concepts introduced in Section 2, specifically the notions of dependent and domain variables, and the distinction between

extensional and intensional variables. Recall that we were led to defining dependent and domain variables by our approach to scope and quantification. In this approach dependency (co-variation) is a property of variables determined by the nature of their evaluation coordinates. In structural theories of scope, on the other hand, dependency is a byproduct of structural configuration, and thus plays no direct role. Within a QR-based approach along the lines of Heim (1982), variables that are dependent on extensional domains would be defined as variables bound by an existential quantifier introduced by an existential closure rule associated with a quantifier that binds an extensional variable. In a system that uses long distance binding, as in Reinhart (1995) and Winter (1996), the relevant notion would be that of a choice functional variable bound by an existential quantifier immediately commanded by a quantifier binding an extensional variable. It is not clear why either of these definitions is meant to isolate a natural class. By contrast, in a theory of scope in which variation and co-variation are basic, one expects exactly such distinctions to matter.

Turning now back to Hungarian D-reduplication, there are two questions that arise: (i) is there a need to distinguish cardinal reduplication from reduplication of the indefinite article?, and (ii) on the theoretical side, is the distinction between situation and individual level variables relevant to D-reduplication? We see below that these questions are related and both receive an affirmative answer.

As already mentioned, *egy* does double duty as the indefinite article and the cardinal numeral 'one'. The other cardinals are unequivocally cardinal. Now there are contexts in which both *egy* and unequivocally cardinal Ds may reduplicate, as in [34], and [36]. There are, however, contexts which only allow the reduplicated *egy-egy* and exclude reduplicated cardinals. Thus, swiching the determiner in [47] or [48] to an unambiguously cardinal morpheme results in ungrammaticality, as exemplified in [50].

[50] * Ahányszor két-két hires személy meglátogatta a várost
Whenever two-two famous person visited the town
'Whenever two famous persons visited the town
elvitték a kastélyba.
they-took-him the castle-to
they took them to the castle.'

There are two morals to be drawn from the contrast between [47] and [50], which answer the two questions raised above: (i) Indefinite article reduplication is to be distinguished from cardinal reduplication, and therefore we have to recognize an indefinite article morpheme *egy* semantically distinct from cardinal *egy.* (ii) Reduplication of cardinals is allowed only when the domain variable is individual-level, and therefore the distinction between individual and situation level variables is relevant to D-reduplication in Hungarian.

Note now that given the notions of dependency and domain variables, and the fact that there are noun phrase types that must contribute a dependent variable, one is led

to expect to find noun phrases that must contribute a domain variable. One candidate comes from English: noun phrases whose D is *each.* It has been proposed (see Vendler (1967), Beghelli and Stowell (to appear)) that these noun phrases require a co-variant, which explains the contrast in [51]:

[51] a. Each child brought a book.

b. *Each child was intelligent.

If this is indeed the right constraint noun phrases whose D is *each* must contribute a domain variable.

In Hungarian there is a reduplicated form which has to be analysed as introducing a domain variable: *ki-ki* 'who-who'. This form is interpreted as a D-linked distributive universal that must serve as domain variable. This latter condition explains the contrast between [52] and [53] below.

[52] Ki-ki leült a székére / egy-egy székre.
who-who sat-down the chair.their.on / a-a chair
'Everybody sat down on their chair / a chair.'

[53] *Ki-ki leült.
who-who sat-down.
'Everybody sat down.'

Note that example [52] is grammatical in the absence of D-reduplication as well, as long as the indefinite is understood as having narrow scope, i.e., as being dependent on the universal. *Ki-ki* differs from *each* in that the latter is grammatical in case its dependent is the event variable associated with the predicate, while the former is not. This is shown by the contrast between [53] and [54]:

[54] Each student sat down.

We see then that the distinctions drawn in Section 2 are needed in accounting for the distribution and interpretation of real-life noun phrase types.

5. Conclusion

Having established that D-reduplication in Hungarian obeys the Extensional Dependency Condition in [42], the natural question that arises is why should this be so. Answering it involves connecting the semantic effect of D-reduplication with that of reduplication elsewhere in Hungarian. Hungarian allows the reduplication of preverbal particles, illustrated in [55], as well as the reduplication of temporal adverbials, illustrated in [56]:

[55] A gyerek fel-fel ébredt.
the child up-up woke
'The child kept waking up.'

[56] Olykor-olykor (fel)-fel ébredt.
then-then up-up woke
'He/she kept waking up.'

The semantic function of reduplication here is to indicate the iteration of the event denoted by the predicate. Thus, the unreduplicated version of [55] is interpreted as referring to a single waking up event, while [55] is necessarily interpreted as iterative. I suggest that reduplication in the nominal realm is also connected to iterativity. More specifically, it signals *iterated plurals.* Variables that are dependent on extensional domain variables, I suggest, are iterated plurals in the sense that they are assigned a multiplicity of values because of their iterative association with the values of the domain variable. As a result their reference is semantically both plural and iterative. The connection with plurality may be invoked to explain the restriction to extensional domain variables. Note that singular noun phrases that depend on extensional variables license plural discourse anaphora, while those that depend on intensional variables do not:

[57] Mindenki meglátogatott egy-egy rokont és aztán írt nekik.
everybody visited a-a relative and then wrote them
'Everybody visited a relative and then wrote them.'

[58] Mari kell találkozzon egy tanárral és aztán írjon neki /*nekik.
Mari must meet a professor and then write him/them.
'Mari must meet a professor and then write to him/*them.'

As the glosses indicate, the facts are parallel in English. The notion of plurality, it appears, is necessarily extensional.

We have isolated here a new kind of plural, namely the iterative plural, whose semantic characterization involves the notions of dependent and domain variables, as well as the distinction betwen intensional and extensional variables, and have found a language, namely Hungarian, where D-reduplication is used as a morphological mark for these plurals. The empirical questions we are left with are the following: (i) are there other languages that mark this particular class of noun phrases, and, more interestingly, (ii) what other types of noun phrases are there. The latter question leaves us with the task of developing a semantics that accounts for the occurring, as well as the non-occurring noun phrase types.

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