

Uniqueness Effects in Donkey Sentences and Correlatives: A Unified Account

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The Phenomenon. The goal of this paper is to provide a unified account of (the variability of) the uniqueness implications associated with cross-clausal anaphora in: **(i)** the donkey sentences (1) and (2) ([3] attributes (2) to B. Partee) and **(ii)** the Hindi correlatives (3) and (4) (from [1]).

- (1) Every^{*u*} farmer who owns a^{*u'*} donkey beats it_{*u'*}. (2) Every^{*u*} man who has a^{*u'*} son wills him_{*u'*} all his_{*u*} money.
 (3) jo^{*u*} laRkii khaRii hai, vo_{*u*} lambii hai. (4) jis^{*u*} laRkii-ne jis^{*u'*} laRke-ke saath khelaa, us_{*u'*}-ne us_{*u*}-ko haraayaa.
 which girl standing is, she tall is. which girl-Erg which boy-with together played, she-Erg he-Acc. defeated.

Sentence (1) does not exhibit donkey-uniqueness effects, i.e. it is (generally) taken to apply to any farmer that owns one or more donkeys, while sentence (2) intuitively applies only to men that have exactly one son (see [3]). Similarly, (3) exhibits girl-uniqueness effects, i.e. it is interpreted as "the one girl who is standing is tall", while (4) does not, i.e. it is interpreted as "every girl who played with a boy defeated him (i.e. the one boy she played with)" (see [1]).

The Dynamic System. The analysis of the variable uniqueness effects associated with donkey anaphora and correlatives is formulated in a novel compositional dynamic system couched in classical type logic, which extends Compositional DRT (CDRT; see [2]) with *plural information states* (following [4]). That is, besides individuals (type *e*) and truth-values (type *t*), we add a basic type *s* whose elements *i_s*, *j_s* etc. model variable assignments (subscripts on terms represent their types) – and plural info states *I_{st}*, *J_{st}* etc. are modeled as sets of assignments of type *st*.

Given the underlying type logic, compositionality follows automatically: in a Fregean / Montagovian framework, the compositional aspect of interpretation is largely determined by the types for the 'saturated' expressions, i.e. names and sentences. Let's abbreviate them as **e** and **t**. An extensional static logic is the simplest: **e** is *e* (individuals) and **t** is *t* (truth-values). We go dynamic by making the 'meta-types' **e** and **t** finer-grained. Thus, **e** will stand for the type *se* of discourse referents (dref's) *u_{se}*, *u'_{se}* etc. A dref *u_{se}* is a function from assignments to individuals: intuitively, *u_{se}i_s* is the individual assigned to the dref *u* by the assignment *i*. Sentences are interpreted as binary relations between plural info states, i.e. **t** will stand for *(st)((st)t)*. A sentence is represented as a DRS of the form [**new dref's** | **conditions**], which abbreviates the following term of type **t**: $\lambda I_{st}.\lambda J_{st}. I/[\mathbf{new\ dref's}]J \wedge \mathbf{conditions}J$, where [**new dref's**] is of type *(st)((st)t)* and **conditions** of type *(st)t*. That is, the output state *J* differs from the input state *I* at most with respect to the **new dref's** and each **condition** is satisfied in the output state *J*. If there are no new dref's, we have a DRS of the form [**conditions**], i.e. a test, which abbreviates the term $\lambda I_{st}.\lambda J_{st}. I=J \wedge \mathbf{conditions}J$. Lexical items are assigned denotations of the expected type, e.g. the denotation of the common noun *man* is of type **et** and the denotation of the generalized determiner *every* is of type **(et)((et)t)**, as shown in (10) below.

Crucially, plural info states enable us to store and pass on both **(i)** the sets of individuals introduced in discourse and **(ii)** the quantificational dependencies between these sets. Consider (4) above, for example. After the update contributed by the relative clause, we have a plural info state *I_{st}* and two dref's *u_{se}* and *u'_{se}* that store two sets of individuals with respect to *I*, namely $uI := \{ui: i \in I\}$, i.e. the set of girls that played with a boy, and $u'I := \{u'i: i \in I\}$, i.e. the set of boys that the *u*-girls played with. Moreover, the plural info state *I* encodes the quantificational dependency between these two sets: we require each assignment *i* ∈ *I* to be such that the girl *ui* played with the boy *u'i*. The matrix clause in (4) is simultaneously anaphoric to the sets of individuals and the dependency / correlation between them: each assignment *i* ∈ *I* has to be such that *ui* defeated *u'i*.

The Analysis. The (variable) uniqueness effects emerge as a consequence of three ingredients. First, the indefinites in (1) & (2) and the wh-indefinites in (3) & (4) contribute a maximization

operator $\mathbf{max}''(D)$, which introduces the dref u and stores in it the maximal set of entities that satisfies the DRS D (a dynamic form of λ -abstraction). Analyzing the wh-elements as indefinites is independently motivated by languages in which they are morphologically identical / related, e.g. Yucatec Mayan, Romanian etc. Second, the singular number morphology on the anaphors in (1) through (4) contributes a uniqueness condition $\mathbf{unique}\{u\}$. Third, we have a distributivity operator \mathbf{dist}_u (or $\mathbf{dist}_{u,u'}$) contributed by the determiner *every* in (1) & (2) and by the entire quantificational structure (e.g. aspect can influence which particular operator – \mathbf{dist}_u , $\mathbf{dist}_{u,u'}$ etc. – is selected) in (4); $\mathbf{dist}_u(D)$ requires D to be interpreted one u -individual at a time.

(5) $\mathbf{max}''(D) := \lambda I_{st}. \lambda J_{st}. \exists H_{st}(I[u]H \wedge DHJ) \wedge \forall K_{st}(\exists H_{st}(I[u]H \wedge DHK) \rightarrow uK \subseteq uJ)$

(6) $\mathbf{dist}_u(D) := \lambda I_{st}. \lambda J_{st}. uI = uJ \wedge \forall x_e \in uI(DI_{u=x}J_{u=x})$, where $I_{u=x} := \{i \in I: ui = x\}$

(7) $\mathbf{unique}\{u\} := \lambda I_{st}. I \neq \emptyset \wedge \forall i_s, i'_s \in I(ui = ui')$ (8) $\mathbf{dist}_{u,u'}(D) := \mathbf{dist}_u(\mathbf{dist}_{u'}(D)) [= \mathbf{dist}_{u'}(\mathbf{dist}_u(D))]$

The lexical entries for the relevant items are given below. The symbol ';' stands for dynamic conjunction, defined as $D; D' := \lambda I_{st}. \lambda J_{st}. \exists H_{st}(DIH \wedge D'HJ)$. Indefinite articles are ambiguous: the entry without \mathbf{max} yields the *weak* donkey reading needed to account for examples like *Every man who has a^{wk:u} dime will put it_u in the meter*, while the entry with \mathbf{max} yields the *strong* donkey reading, needed for (1) and (2) above (the full paper justifies this analysis of weak/strong readings and compares it with alternative static and dynamic approaches). Wh-indefinites are strong; this is independently justified by their interpretation in 'exhaustive-answer' questions.

(9) $it_u \rightsquigarrow \lambda P_{et}. [\mathbf{unique}\{u\}]; P(u)$ (10) $every^u \rightsquigarrow \lambda P_{et}. \lambda P'_{et}. \mathbf{max}''(P(u)); \mathbf{dist}_u(P'(u))$ (or: $\mathbf{dist}_{u,u'}$)

(11) $a^{str:u} / jo^u / jis^u \rightsquigarrow \lambda P_{et}. \lambda P'_{et}. \mathbf{max}''(P(u); P'(u))$ (12) $a^{wk:u} \rightsquigarrow \lambda P_{et}. \lambda P'_{et}. [u]; P(u); P'(u)$

Example (3) is compositionally interpreted as $\mathbf{max}''([girl\{u\}, standing\{u\}]); [\mathbf{unique}\{u\}, tall\{u\}]$. The uniqueness effect is due to the combination of \mathbf{max} and \mathbf{unique} : the strong wh-indefinite jo^u introduces the set of all girls that are standing, while the singular anaphor vo_u requires this set to be a singleton. We derive the uniqueness effects in (2) in a similar way: (2) is interpreted as $\mathbf{max}''([man\{u\}]; \mathbf{max}''([son\{u'\}, have\{u,u'\}]))$; $\mathbf{dist}_u([\mathbf{unique}\{u'\}, \mathbf{unique}\{u\}, will_money\{u,u'\}])$, i.e., for every u -father, we introduce the u' -set of all his sons and, then, for each u -individual, we require the corresponding u' -set to be a singleton. Crucially, the $\mathbf{unique}\{u\}$ condition contributed by his_u in (2) is vacuously satisfied because it is in the scope of the \mathbf{dist}_u operator.

We use the same ' \mathbf{dist} & \mathbf{unique} ' strategy in (4), which is interpreted as $\mathbf{max}''([girl\{u\}]; \mathbf{max}''([boy\{u'\}, play_with\{u,u'\}]))$; $\mathbf{dist}_u([\mathbf{unique}\{u\}, \mathbf{unique}\{u'\}, defeat\{u,u'\}])$. The condition $\mathbf{unique}\{u\}$ is again vacuously satisfied, while the fact that the u' -boy is intuitively unique relative to each u -girl (as observed in [1]) is captured in the same way as the son-uniqueness in (2). Finally, the strong non-unique donkey reading of sentence (1) is captured by letting *every* contribute a $\mathbf{dist}_{u,u'}$ operator, which neutralizes the condition $\mathbf{unique}\{u'\}$ contributed by the donkey pronoun it_u . In general, which operator is contributed by *every* is pragmatically determined, i.e. the indexation on \mathbf{dist} is used to pragmatically specify the granularity level of the quantifier domain: we can quantify over u -individuals, as in (2) (hence, u' -uniqueness), or over cases/minimal situations in which a u -farmer owns a u' -donkey, as in (1) (hence, no uniqueness).

The fact that, in principle, we can also use any distributivity operator in correlatives enables us to successfully generalize the account to single and multiple wh correlatives in Romanian which can have universal (non-unique) readings, e.g. (3) can be interpreted as "every girl who is standing is tall" and (4) as "every girl defeated every boy she played with".

References: [1] Dayal, V. 1996. *Locality in Wh Quantification*, Kluwer. [2] Muskens, R. 1996. Combining Montague Semantics and Discourse Representation, *Linguistics & Philosophy* 19. [3] Parsons, T. 1978. Pronouns as Paraphrases, UMass Amherst, ms. [4] van den Berg, M. 1994. A Direct Definition of Generalized Dynamic Quantifiers, 9th Amsterdam Colloquium.