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Universal and Existential Readings of Donkey-Sentences

and the Role of a Structural Form of Domain Restriction in the Explanation of Some Distributional Anomalies

Fabio Del Prete*

Abstract

I propose that a particular form of quantifier domain restriction is responsible for the unexpected readings of some donkey-sentences. The pragmatic restrictions that I take into account are shown to be recoverable from the linguistic structure of the sentences involved, according to a syntactic algorithm. Making domain restrictions explicit at LF enables one to keep both quantifying determiners and donkey-pronouns unambiguous, and to preserve monotonicity properties of quantifiers.

1 Two types of reading

The problem that I consider in this paper concerns the distribution of universal and existential readings of donkey sentences. This problem has to do with the interpretive patterns of sentences like (1) and (2), as they are schematized in (1') and (2'):

- (1) Every farmer who owns a donkey beats it.
(1') $\text{EVERY}_x [\text{farmer}(x) \wedge \exists y (\text{donkey}(y) \wedge \text{own}(x, y))] [\forall y ((\text{donkey}(y) \wedge \text{own}(x, y)) \rightarrow \text{beat}(x, y))]$
- (2) No farmer who owns a donkey beats it.
(2') $\text{NO}_x [\text{farmer}(x) \wedge \exists y (\text{donkey}(y) \wedge \text{own}(x, y))] [\exists y (\text{donkey}(y) \wedge \text{own}(x, y) \wedge \text{beat}(x, y))]$

The two formulas, which I assume to give the most natural interpretations of (1) and (2), make it clear what the semantic difference between these sentences amounts to: (1) is interpreted as involving universal quantification over donkeys owned by any farmer x , while (2) as involving existential quantification over the same domain. I will say that a sentence α has a *universal (existential)* reading, whenever the matrix formula in α 's first-order translation is universal (existential).

The fact that (1) and (2) have different semantic construals may seem to posit a threat to a compositional analysis, given their formal identity up to their lexical determiners. In the semantic framework I adopt, based on Kanazawa's Dynamic Generalized Quantifiers (DGQs), the alternation of universal and existential matrices does not constitute *per se* a challenge for compositionality, as long as it can be seen as a reflex of distinct types of dynamics associated univocally to

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distinct types of determiners. In the case of (1) and (2), we translate the quantifying determiners ‘every’ and ‘no’ by means of DGQs with different dynamic properties; more exactly, the dynamic counterparts of the static generalized quantifiers ‘EVERY’ and ‘NO’ are defined on the basis of the following schemes¹:

$$(A) \ Q_x^\forall [\varphi(x)] [\psi(x)] \quad =_{\text{def}} \ Q_x [\varphi(x)] [\varphi(x) \rightarrow \psi(x)]$$

(for the dynamic counterpart of ‘EVERY’)

$$(B) \ Q_x^\exists [\varphi(x)] [\psi(x)] \quad =_{\text{def}} \ Q_x [\varphi(x)] [\varphi(x) \wedge \psi(x)]$$

(for the dynamic counterpart of ‘NO’)

If we take ‘ $\varphi(x)$ ’ = ‘ $\exists y\alpha(x, y)$ ’ (where the existential quantifier is defined as in DPL) and ‘ $\psi(x)$ ’ = ‘ $\beta(x, y)$ ’ (where the latter meta-formula is quantifier free), we get into the donkey case; the dynamic effects of our two DGQs will come down to the following:

- (a) $EVERY_x^\forall [\exists y\alpha(x, y)] [\beta(x, y)]$
- (b) $EVERY_x [\exists y\alpha(x, y)] [\exists y\alpha(x, y) \rightarrow \beta(x, y)]$
- (c) $EVERY_x [\exists y\alpha(x, y)] [\forall y(\alpha(x, y) \rightarrow \beta(x, y))]$
- (d) $NO_x^\exists [\exists y\alpha(x, y)] [\beta(x, y)]$
- (e) $NO_x [\exists y\alpha(x, y)] [\exists y\alpha(x, y) \wedge \beta(x, y)]$
- (f) $NO_x [\exists y\alpha(x, y)] [\exists y(\alpha(x, y) \wedge \beta(x, y))]$

I.e., we will have universal quantification of the donkey variable in the first case, and existential quantification of the same variable in the second. The difference in the quantificational structure is explained in this approach as one that comes down in the end to a difference in the dynamic properties of some lexical items (namely, quantifying determiners).

2 Anomalies for a monotonicity-based theory

Kanazawa shows that the choice of translating ‘every’ and ‘no’ by means of DGQs with different properties of dynamic binding is motivated by a *principle of monotonicity preservation*, for whose discussion I refer the reader to Kanazawa (1993). According to Kanazawa’s theory of DGQs (hereafter, KDGQ), the distribution of universal and existential readings is indeed expected to correlate with monotonicity patterns of determiners. This is a prediction which has a significant amount of evidence in its favour. However, there are well known distributional phenomena that seem to undermine KDGQ. I am referring to some anomalous variations in reading-type that have been observed for donkey sentences with the same initial determiner. I will be concerned with the following representative pair:

¹ ‘Q’ stands for the static quantifier corresponding to some determiner δ , and ‘ \rightarrow ’, ‘ \wedge ’, denote DPL’s implication and conjunction.

- (3) Every student who borrowed a book from the library returned it on time.
- (3') $EVERY_x [\text{student}(x) \wedge \exists y (\text{book}(y) \wedge \text{borrow}(x, y))] [\forall y ((\text{book}(y) \wedge \text{borrow}(x, y)) \rightarrow \text{return}(x, y))]$
- (4) Every person who had a credit card paid the bill with it.
- (4') $EVERY_x [\text{person}(x) \wedge \exists y (\text{card}(y) \wedge \text{have}(x, y))] [\exists y (\text{card}(y) \wedge \text{have}(x, y) \wedge \text{pay-with}(x, y))]$

Intuitively, (3) and (4) get different types of reading, formalized by (3') and (4') respectively. This might strike one as a refutation of KDGQ, given that these sentences are construed with the same quantifying determiner 'every', which is translated unambiguously as the DGQ ' $EVERY^{\forall}$ '. (4) clearly receives the existential reading (4'), thus it seems to require a different dynamic counterpart for 'EVERY', namely one that give the existential binding of donkey variables. An existential counterpart of 'EVERY', such as the one introduced through the scheme (B), would do the work. But such a quantifier would not preserve the full monotonicity pattern of 'EVERY'. Moreover, if we let in this new hypothetical quantifier, we would have two different interpretations for the same lexical item 'every', as long as we would still need the old ' $EVERY^{\forall}$ ', in order to generate the intuitive readings of sentences like (1) and (3). We would end in putting a lexical ambiguity in quantifying determiners, what seems an unlikely result.

My thesis is that variation in reading-type displayed by the pair (3), (4), is a surface phenomenon, something that does not bear on the underlying semantics neither of determiners nor of pronouns. The fact that (4') provides a suitable formalization of (4)'s most natural reading, does not force us to recognize an existential construal of (4) in the grammar. Indeed, (4') can be taken as nothing more than the formal correlate of a 'lazy' paraphrase: 'every person who had a credit card paid the bill with *a credit card she/he had*'. My claim is that (4') conceals the underlying LF-structure of (4), and that the latter involves universal binding of the donkey pronoun, as predicted by KDGQ. According to this view of the matter, the problem with (4) comes down to determine what we must take the restrictor formula to be in the LF representation (4_{LF}):

$$(4_{LF}) \text{ } EVERY^{\forall}_x [\exists y \alpha(x, y)] [\text{pay-with}(x, y)]$$

An LF representation such as this would be rightly considered to have too strong consequences only under the tacit assumption that its restrictor ' $\exists y \alpha(x, y)$ ' be determined on the exclusive ground of the nominal restriction 'person who had a credit card'. In that case, (4_{LF}) would be identical to the formula ($4_{LF}'$), that would reduce in turn to ($4_{LF}''$), by definition of ' $EVERY^{\forall}$ ':

$$(4_{LF}') \text{ } EVERY^{\forall}_x [\exists y (\text{person}(x) \wedge \text{credit-card}(y) \wedge \text{have}(x, y))] [\text{pay-with}(x, y)]$$

$$(4_{LF}'') \text{ } EVERY_x [\text{person}(x) \wedge \exists y (\text{card}(y) \wedge \text{have}(x, y))] [\forall y ((\text{card}(y) \wedge \text{have}(x, y)) \rightarrow \text{pay-with}(x, y))]$$

This is too strong, insofar it predicts that a person x who had three credit cards used each of his/her credit cards to pay the bill. The fact that x used just one of his/her credit cards to pay the bill would suffice to falsify formula (4_{LF}), but it would not be taken as evidence against sentence (4). The conclusion I draw from these facts is not that a different dynamic counterpart of ‘EVERY’ has to be introduced into our theoretical frame, but that a different restrictor formula must be in place in the case at hand. Before saying what I claim the quantifier restriction to be exactly, and how the extended restriction is determined on the present view, let me expand a bit on the basic idea through a brief discussion of a different example. Let’s consider the following sentence:

- (5) Every townsman puts his bicycle in front of the station.
 (5') $\text{EVERY}_x [\text{townsman}(x)] [\text{THE}_y [\text{bicycle}(y) \wedge \text{of}(y, x)] [\text{put-in-front-of-the-station}(x, y)]]$

Here the presupposition triggered by the definite ‘his bicycle’ calls for accommodation at some level of the information structure. The minimal option is to accommodate the presupposition at the level of the quantifier domain restriction. The output of such a process would be as follows:

- (5'') $\text{EVERY}_x [\text{townsman}(x) \wedge \exists!y (\text{bicycle}(y) \wedge \text{of}(y, x))] [\text{THE}_y [\text{bicycle}(y) \wedge \text{of}(y, x)] [\text{put-in-front-of-the-station}(x, y)]]$

We can devise a formal procedure operating in cases similar to (5), with a definite NP occurring in the VP of a quantified sentence. In general, the presuppositions of the definite NP are accommodated so as to restrict the domain of the quantified subject, according to a rule like (R):

$$(R) \quad Q_x [\varphi(x)] [\psi(x, (\iota y)(\zeta y))] \quad \Rightarrow \\ \Rightarrow \quad Q_x [\varphi(x) \wedge \exists!y \zeta(x, y)] [\psi(x, (\iota y)(\zeta(x, y)))]$$

The upshot of integrating the definite’s presuppositions into the quantifier’s restriction is that they get bound in the resulting structure; we want indeed everything to be bound in our semantic representations. Accommodation at the level of the quantifier domain is not the only available option in a case such as (5); it is of course open to us to accommodate higher in the information structure. Anyhow, (5'') is the most general solution to the binding problem, one that is logically compatible with accommodating higher. This example should point to the possibility of syntax-driven pragmatic processes such as the projection schematized in (R).

3 Structural Domain Restriction

I propose that the proper treatment of the anomalous reading of (4) has to keep track of a pragmatic process of accommodation at LF. An utterance of (4) will be accompanied in the most natural cases by a

presupposition to the effect that every person used at most one credit card to pay his/her bill. We may take (π) as the LF of such a presupposition:

$$(\pi) \quad \forall x [(person(x) \wedge \exists y (card(y) \wedge have(x, y))) \rightarrow \exists y (card(y) \wedge have(x, y) \wedge \forall z((card(z) \wedge have(x, z) \wedge z \neq y) \rightarrow \neg pay-with(x, z)))]$$

(π) is integrated at the level of the restrictor formula in (4)'s LF. The effect of this process can be dynamically represented as follows²:

$$(4_{LF}) \quad EVERY^{\forall}_x [\exists y(person(x) \wedge credit-card(y) \wedge have(x, y))] [pay-with(x, y)]$$

$$(4_{LF1}) \quad EVERY^{\forall}_x \left[\begin{array}{l} person(x) \\ \exists y(card(y) \wedge have(x, y)) \\ (\pi) \end{array} \right] [pay-with(x, y)]$$

(from (4_{LF}) , by accommodation of (π) at the restrictor level)

$$(4_{LF2}) \quad EVERY^{\forall}_x \left[\begin{array}{l} person(x) \\ \exists y(card(y) \wedge have(x, y)) \\ \exists y(\mathbf{card(y) \wedge have(x, y) \wedge \forall z((\mathbf{card(z) \wedge} \\ \mathbf{\wedge have(x, z) \wedge z \neq y}) \rightarrow \neg \mathbf{pay-with(x, z))})} \end{array} \right] [pay-with(x, y)]$$

(from (4_{LF1}) , by elimination of ' $\forall x$ ' and application of *modus ponens*)

$$(4_{LF3}) \quad EVERY^{\forall}_x \left[\begin{array}{l} person(x) \\ \exists y(card(y) \wedge have(x, y)) \\ \forall z(\mathbf{ca(z) \wedge have(x, z) \wedge z \neq y} \rightarrow \\ \rightarrow \neg \mathbf{pay-with(x, z)}) \end{array} \right] [pay-with(x, y)]$$

(from (4_{LF2}) , by splitting of the third restrictor-formula into an existential and a universal formula, and elimination of the existential component)

The last formula corresponds to the verbal statement (4res), that can be seen, according to my view, as an explicit version of sentence (4), where the pragmatic restriction on the quantified NP is made overt.

(4res) Every person who had [a credit card]_y **and didn't pay with any [other]_y credit card he/she had** paid the bill with [it]_y.

The idea is that the restriction made explicit in (4res) is causally linked with the rising of what may be phenomenally described as an existential reading of (4). Indeed, such 'existential reading' construal of (4) comes down to be equivalent to the universal reading of (4res). Once we have recognized the equivalence relation between (4) and (4res), we are in a position to explain away the apparent existential reading of (4): this sentence is processed in context as (4res), whereas this latter sentence can be shown to have an unproblematic

² In the logical formulas and in the subsequent paraphrase I specify the adjoined predicate in boldface, in order to mean that it is contextually integrated. I also give the relevant LFs in a non-linear notation; in this notation, the lines in the restrictive part of a KDQG-formula have to be interpreted as dynamically conjoined in the top-down order.

representation in KDGQ, namely (4_{LF3}); the latter formula does not have the unwanted consequence that a person x who had five credit cards used all of them to pay the bill: if x has a ‘normal’ behaviour (i.e. x pays bills with no more than one credit card at once), then (4_{LF3}) predicts that x paid his/her bill with a credit card. I could say, with a maxim, that the apparent existential reading of (4) is explained away as *universal reading + domain restriction*.

KDGQ should thus be integrated into a more powerful theory, where contextual effects of domain restrictions of the kind I have just considered are represented in LF without postulating *ad hoc* ambiguities. Such a theory produces LFs of the following kind for quantified sentences whatsoever:

$$(\Sigma) Qx_i [\varphi(x_i) \wedge (f(x_j))(x_i)] [\psi(x_i)]$$

‘ f ’ and ‘ x_j ’ are variables of type $\langle e, \langle e, t \rangle \rangle$ and e , respectively. Hence, ‘ $f(x_j)$ ’ is a complex variable of type $\langle e, t \rangle^3$. This is called ‘domain variable’, since its values contribute to determine which is the exact domain of the quantifier ‘ Qx_i ’. ‘ f ’ and ‘ x_j ’ may be either free or bound to some quantifier which have semantic scope over them. When a donkey sentence α is modeled within the scheme (Σ) , we will have that ‘ Q ’ stands for the right DGQ, while ‘ $\varphi(x_i)$ ’ stands for an existential formula ‘ $\exists y \alpha(x, y)$ ’. Let’s suppose that α have an anomalous reading for KDGQ. My generalized hypothesis is that this reading can be eliminated by assigning suitable values to ‘ f ’ and ‘ x_j ’, i.e. by suitably restricting the quantificational domain of α . More exactly, in the overall structure modeling α , the individual variable ‘ x_j ’ gets dynamically bound to the existential quantifier translating the antecedent indefinite NP, while the interpretation of the functional variable ‘ f ’ is driven by an algorithm defined on the LF associated with α . The syntactic algorithm can be expressed as follows:

$$(\text{SDR}) \quad Q_x^X [\varphi(x) \wedge \exists y \psi(x, y) \wedge (f(y))(x)] [V(x, y)] \quad \Rightarrow \\ \Rightarrow \quad \lambda y. \lambda x. \forall z ((\psi(x, z) \wedge z \neq y) \rightarrow \chi(x, z))$$

The λ -expression is the value of ‘ f ’. The predicate ‘ χ ’ may stay alternatively either for the verb V of the main clause of α or for its negation $\neg V$. More exactly, the formula ‘ $\chi(x, z)$ ’ in the λ -expression will be identical to ‘ $V(x, z)$ ’ whenever the DGQ ‘ Q_x^X ’ in the LF of α is ‘ Q_x^{\exists} ’, while it will be identical to ‘ $\neg V(x, z)$ ’ whenever the same DGQ is ‘ Q_x^{\forall} ’. If we look back at the previous analysis of (4), we can see this: the DGQ there involved is of type ‘ Q_x^{\forall} ’, and in the adjoined predicate ‘ $\forall z ((\text{card}(z) \wedge \text{have}(x, z) \wedge z \neq y) \rightarrow \neg \text{pay-with}(x, z))$ ’ we have negation of (4)’s main verb (the corresponding verbal restriction, as made explicit by (4res), is indeed the complex predicate ‘(who) _{x} did *not* pay with any other _{y} credit card he _{x} /she _{x} had’); it is properly the negation of its matrix verb, in the presuppositional form I have

³ For a justification of complex domain variables of this form, see Stanley & Szabó (2000).

described, that induces the mirage of a switch from the expected universal construal of (4) to the unexpected existential one. But consider now (6)'s reading: it is expected to be existential, while being intuitively judged universal.

(6) No man_x who has an umbrella_y leaves it_y home on a day like this.

I expect a presupposition π to be made salient in this case. Notice that, in order to get (6)'s reading right, accommodation of π should generate a restrictive predicate with the following LF:

$[\lambda y. \lambda x. \forall z((\text{umbrella}(z) \wedge \text{have}(x, z) \wedge z \neq y) \rightarrow \text{leave-home}(x, z))](y)(x)$

This will correspond to a complex verbal predicate like '(who)_x leaves-home every other_y umbrella he_x has'. In this case, the presuppositional predicate should thus contain the matrix verb itself, *not* its negation. A presupposition π , to the effect that a man takes at most one umbrella with him when he goes out on a rainy day, would do this work. And it seems plausible to assume that such a presupposition be there in the context of an utterance of (6). This latter example, involving an underlying DGQ of type ' Q^{\exists} ', should provide an illustration of what I have previously stated with respect to (SDR): the predicate ' χ ' in the λ -expression that gives the value of ' f ' stands for the matrix predicate of the sentence, whenever the initial quantifier translates as a DGQ of type ' Q^{\exists} '. This is intuitively justifiable, given that in deviant sentences with LF-structure ' $Q^{\exists}_x [\exists y \phi(x, y) \wedge (f(y))(x)] [\psi(x, y)]$ ' the generated reading is existential, and in order to get at the surface universal reading we have to extend application of the matrix predicate ' ψ ' to any object y satisfying the antecedent clause, besides the one introduced by the antecedent indefinite NP.

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