# Homogeneity in donkey sentences

Lucas Champollion
New York University
champollion@nyu.edu

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Donkey sentences sometimes give rise to "existential" interpretations (∃-readings) and sometimes to "universal" interpretations (∀-readings), but when the context is fixed they are usually not perceived as ambiguous. I predict how context disambiguates donkey sentences by linking the pragmatic account of homogeneous definite descriptions in Križ (2015) with a trivalent dynamic semantics that combines Brasoveanu (2008) (for dynamics), Eijck (1993) (for trivalence) and Eijck (1996) (for trivalence-sensitive quantifiers).

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***Overview:*** *Donkey sentences sometimes give rise to "existential" interpretations (∃-readings) and sometimes to "universal" interpretations (∀-readings), but when the context is fixed they are usually not perceived as ambiguous. I predict how context disambiguates donkey sentences by linking the pragmatic account of homogeneous definite descriptions in Križ (2015) with a trivalent dynamic semantics that combines Brasoveanu (2008) (for dynamics), Eijck (1993) (for trivalence) and Eijck (1996) (for trivalence-sensitive quantifiers).*

It is easy to judge the donkey sentence (1) if no man treats any two donkeys differently: in such scenarios, if every man beats every donkey he owns, it is clearly true, and if some donkey-owner beats no donkey he owns, it is clearly false.

(1) Every man who owns a donkey beats it.

But truth conditions become more difficult to ascertain in a *heterogeneous* scenario, where one of the men owns several—equally salient—donkeys and beats only one of them (e.g. Heim 1982, Rooth 1987). This contrasts with the *homogeneous* scenarios above, where members of the same quantificational case all agree on whether they satisfy the nuclear scope (Barker 1996). I will call a donkey sentence *heterogeneous* if it is readily judged true in relevant heterogeneous scenarios, and *homogeneous* otherwise. A homogeneous example is (2a) from Rooth (1987). Two heterogeneous examples are (2b) from Schubert & Pelletier (1989) and (2c) from Chierchia (1995); as for (1), it is heterogeneous in (3a) but homogeneous in (3b). This distinction cuts across the one between ∃-readings—(2a), (2b)—and ∀-readings—(2c).

(2) a. No man who has a son lets him drive the car. ∃-reading
b. If I have a dime in my pocket, I will put it in the meter. ∃-reading
c. No man who has an umbrella leaves it home on a day like this. ∀-reading

(3) a. *Context*: A shrink recommends that for stress-relief purposes every donkey-owner in the village should beat at least one of his donkeys, and the current issue is whether this recommendation is followed (Chierchia 1995). ⇝ ∃-reading
b. Same context except the shrink's recommendation is that every donkey-owner should beat all of his donkeys. ⇝ ∀-reading

Sentences with definite plurals exhibit a related phenomenon also called homogeneity (e.g. Löbner 2000, Križ 2015). For example, say I can reach a goal by going through any one of three doors, and that two of them are open. Here (4) could be readily judged true; but not so if the doors are arranged in a sequence and I need to pass through all of them.

(4) The doors are open.

To explain this, Križ (2015) assumes that when some but not all doors are open, (4) is literally neither true nor false but has an extension gap (Schwarzschild 1993) and that possible worlds are related by an equivalence relation $\approx_I$ that tells us whether or not two worlds resolve the contextually given current issue $I$ in the same way (cf. Malamud 2012). A sentence $S$ is called "true enough" at a world $w$ iff $S$ is true either at $w$ or at some $w' \approx_I w$ (cf. Lewis 1979, Lasersohn 1999). A sentence $S$ may be used at $w$ to address an issue $I$ as long as it is true enough at $w$ and not false at any $w'' \approx_I w$. Speakers may utter a sentence even if they do not believe it to be true, as long as they do not believe it to be false at any world that is equivalent to the actual world. Suppose for example that the current issue is whether there is a way to the goal, and that there is one as long as some door is open. Consider two worlds $w_{true}$, where all the doors are open, and $w_{mixed}$, where two of three doors are open. Since these worlds resolve the current issue in the same way, they are equivalent. So (4) counts as true enough at both of them and will be interpreted non-maximally (and hence, heterogeneously) as $\{w_{true}, w_{mixed}\}$. But if the doors are arranged in sequence and the only way to the goal leads through all of them, $w_{true}$ and $w_{mixed}$ resolve the current issue in different ways and are not equivalent. Instead, $w_{mixed}$ is equivalent to a world $w_{false}$ where no door is open. As for $w_{true}$, it is the only world at which (4) is true enough, so (4) is interpreted maximally as $\{w_{true}\}$. This is a homogeneous interpretation.

Although Križ did not design his theory for donkey sentences, we can directly apply it to them by assuming that they have extension gaps at heterogeneous worlds. I assume that (1) has the following literal truth conditions, exemplified by $w_{true}$, $w_{false}$ and $w_{mixed}$:

(5) a. **true** iff every donkey-owner beats every donkey he owns;
b. **false** iff at least one donkey-owner does not beat any donkey he owns;
c. **neither** in all other cases, in particular, if every donkey-owner beats exactly one donkey he owns and some of them own more than one donkey.

In scenario (3a), $w_{true}$ and $w_{mixed}$ are equivalent. Given the current issue of this scenario, (1) is true enough at $w_{mixed}$ and therefore heterogeneous. In scenario (3b), $w_{mixed}$ and $w_{false}$ are now equivalent to each other, but not to $w_{true}$. Therefore, unlike in the previous scenario, (1) is not true enough at $w_{mixed}$ and is therefore homogeneous.

As for (2c), it is correctly predicted heterogeneous if it has these literal truth conditions:

(6) a. **true** iff no umbrella-owner leaves any of his umbrellas home;
b. **false** iff at least one umbrella-owner leaves all his umbrellas home;
c. **neither** in all other cases, in particular, if every umbrella-owner takes exactly one umbrella along, and someone leaves an extra umbrella home.

Suppose that the current issue is whether any man with an umbrella is getting wet because he hasn't taken any umbrella along. This is the case at $w_{false}$. It is neither the case at $w_{true}$ nor at $w_{mixed}$, so these two worlds are equivalent. Given this issue, (2c) is therefore true enough at both $w_{true}$ and $w_{mixed}$. At either of these worlds, (2c) can be used to address the current issue since $w_{true}$ is not equivalent to $w_{false}$. This means (2c) will be pragmatically interpreted as $\{w_{true}, w_{mixed}\}$. Therefore, (2c) receives a heterogeneous reading.

Finally, (2a) is correctly predicted homogeneous if it has the following truth conditions:

(7) a. **true** iff no father lets any of his sons drive his car;
b. **false** iff at least one father lets all his sons drive his car;
c. **neither** in all other cases, e.g. if every father allows one of his sons to drive the car, and some of them have additional sons that they don't allow to drive.

Suppose that the current issue is whether there are reckless fathers, and that a father who allows just one of his sons to drive the car is just as reckless as one who gives permission to all of his sons. We have no reckless fathers at $w_{true}$. We do have them both at $w_{false}$ and at $w_{mixed}$, so these two worlds are equivalent. Hence (2a) is true enough only at $w_{true}$. It can be used to address the current issue since $w_{true}$ is not equivalent to $w_{false}$. This means (2a) will be pragmatically interpreted as $\{w_{true}\}$.

The next step consists in delivering the right trivalent meanings compositionally. It has been suggested that donkey pronouns can pick up both atoms and sums as discourse referents, so that the one in (1) could be paraphrased as *the donkey or donkeys he owns* (e.g. Lappin & Francez 1994, Krifka 1996). However, Kanazawa (2001) shows that just like ordinary singular prounouns, singular donkey pronouns are semantically singular and can only pick out atomic discourse referents. This favors PCDRT, in which a pronoun can restrict its discourse referent to be atomic (Brasoveanu 2008). PCDRT is a version of CDRT (Muskens 1996) in which sets of assignments are passed around. I assume that indefinites always receive a maximal interpretation ("strong" in Brasoveanu's sense); for example, *man*$^v$ *who owns a donkey*$^u$ in (1) returns an assignment set whose members between them map $u$ to every donkey owned by $v$. The original formulation of PCDRT assumes that a pronoun like *it*$_u$ tests whether all assignments in the input set agree on the referent of $u$. I replace this by a weaker requirement that only checks whether each assignment maps $u$ to some atom, but not necessarily to the same value. To let PCDRT deliver trivalent meanings, I integrate it with error-state semantics (Eijck 1993), using the empty set of assignments as our error state. I Montague-lift the pronoun *it*$_u$ to give it access to its continuation, and make it output an error whenever the continuation does not yield the same result for each value of $u$. For example, *beats it*$_u$ will take a subject argument $x$ and return an error whenever the assignments in its input set map $u$ to different values and when $x$ beats some but not all of these values. An error can be resolved later either to True or to False. I make embedding quantifiers supervaluationist in the sense of Eijck (1996). A supervaluation quantifier when applied to an error-generating predicate (such as *beats it*) returns a classical truth value whenever the underlying bivalent quantifier returns the same truth value no matter how error states are resolved, and returns Neither otherwise. For example, *Every man*$^v$ *who owns a donkey*$^u$ when applied to *beats it*$_u$ yields the trivalent truth conditions in (5).

I have followed Križ (2015) in not treating homogeneity as a presupposition. A different approach is adopted by Barker (1996), who claims that the use of a proportional quantifier presupposes a homogeneous scenario. The scenario in (8a) is a problem for Barker (1996) because sentence (8b) is false in it but Barker predicts it to be a presupposition failure.

(8) a. Our department has 11 professors, all of them male and not overly comfortable with computers, except John, the computational linguist. Last year he had to deal with 90 problems and solved 70 of them. As for his 10 colleagues, last year each of them had to deal with just one computer problem, but couldn't solve it.
b. When a professor has to deal with a computer problem, he usually solves it.

On Barker's account, (8b) presupposes a domain in which every professor who has a computer problem solves either all of his problems or none of them. In the scenario provided, this presupposition fails because John solves only 70 of his 90 problems. (I will argue in the talk that no domain narrowing is possible here.) This rules out (8b) as a presupposition failure, contrary to fact. On my account, there is no problem, because presuppositions are not involved, and (8b) is predicted false thanks to the supervaluation quantifier *usually*.

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