PRESUPPOSITIONS FOR PROPORTIONAL QUANTIFIERS

Author(s): CHRIS BARKER

Source: *Natural Language Semantics*, 1996, Vol. 4, No. 3 (1996), pp. 237-259

Published by: Springer

Stable URL: https://www.jstor.org/stable/23748433

CHRIS BARKER

PRESUPPOSITIONS FOR PROPORTIONAL QUANTIFIERS*

Most studies of the so-called proportion problem seek to understand how lexical and structural properties of sentences containing adverbial quantifiers give rise to various proportional readings. This paper explores a related but distinct problem: given a use of a particular sentence in context, why do only some of the expected proportional readings seem to be available? That is, why do some sentences allow an asymmetric reading when other, structurally similar sentences seem to require a symmetric reading? Potential factors suggested in the literature include the distribution of donkey pronouns, certain uniqueness implications, and focus structures. I argue here that the use of an adverbial quantifier presupposes HOMOGENEITY: all individual situations that get lumped into a single case for the purposes of evaluating the quantification must agree on whether they satisfy the nuclear scope. For instance, in order for a token of *Usually, if a farmer owns a donkey, he beats it* to be felicitous when construed under a farmer-dominant asymmetric reading, the context must be consistent with the proposition that each farmer either beats all or none of his donkeys. Thus proportional sentences are indeed systematically ambiguous, but only some readings will be felicitous in a given context.

1. Truth Conditions for Proportional Adverbial Quantifiers

It has been well known at least since Partee (1984) that sentences involving adverbial quantifiers can be ambiguous across a number of distinct sets of truth conditions, and ever since Kadmon (1987) the difficulties that arise in dealing formally with this ambiguity have been known as the 'proportion problem'. Predicting how proportional readings arise from lexical and structural properties of a sentence – let alone identifying the general principles from which these facts follow – is a delicate and complicated task, and the major issues have by no means been settled in the literature yet. This paper does not confront those issues directly, and any reader who hopes to find new arguments for deciding among the various formal approaches to the proportion problem will be disappointed. However, the work reported here does constrain these theories by refining the empirical data they need to explain, since I propose that the entailments associated with particular proportional readings (more specifically, their presuppositions) are more elaborate than previous descriptions suggest. Put another

* I gratefully acknowledge specific comments and advice from Jeroen Groenendijk, Irene Heim, Makoto Kanazawa, Angelika Kratzer, Manfred Krifka, Peter Lasersohn, Stanley Peters, Craige Roberts, Martin Stokhof, Henriëtte de Swart, and two anonymous referees.

Natural Language Semantics 4: 237–259, 1996.

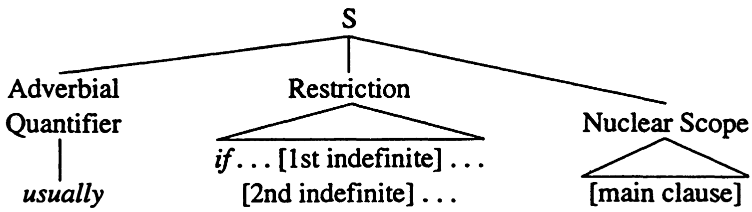
way, the analysis presented here is neutral with respect to predicting which proportional readings can be associated with a particular sentence type; however, it does give a criterion for felicitous use of a token of a sentence construed under a specific proportional reading. Thus the hypothesis makes empirical predictions about which proportional readings will be available on any specific occasion of use.

In order to make the pragmatic analysis presented below explicit and concrete, it will be necessary to describe the truth conditions of proportional sentences with some precision. For the sake of simplicity, I will adopt a refinement of Lewis's (1975) unselective binding approach to adverbial quantification; however, nothing crucial hinges on this choice. In particular, I see no obstacle to reconstructing the analyses developed here in a dynamic framework (cf. the discussions of the proportion problem in de Swart (1991) or Chierchia (1992)).

(1) a. Usually, if a woman owns a dog, she is happy.
  b. Usually, if an artist lives in a town, it is pretty.
  c. Usually, if a semanticist hears of a good job, she applies for it.

The sentences in (1) all share certain structural similarities as schematized in (2).

(2)



However, the most natural interpretations of these sentences have non-parallel truth conditions as suggested by the rough paraphrases in (3).

(3) a. Most women who own at least one dog are happy.
  b. Most towns which contain at least one artist are pretty.
  c. Most semanticist/good-job hearings lead to applications.

To adopt the descriptive terminology of Kadmon (1987), we can say that (1a) involves asymmetric quantification over the first indefinite; (1b) involves asymmetric quantification over the second indefinite; and (1c) involves symmetric quantification over both of the indefinites simultaneously. That is, we can distinguish the three readings in (1) by noting whether the quantifier "binds" the first indefinite, the second, or both.

To do this, we will need to keep track of two kinds of variables, primed and unprimed.

(4) a. E = a set of entities
$= \{d_1, d_2, \ldots, j_1, j_2, \ldots, s_1, s_2, \ldots, w_1, w_2, \ldots\}$
b. N = a set of entity-denoting variables, primed and unprimed
$= N_0 \cup N' = \{x, y, \ldots\} \cup \{x', y', \ldots\}$
c. F = a set of partial assignment functions from subsets of N into E
$= \{f, f_a, f_b, \ldots, g, g_a, g_b, \ldots\}$

This logical vocabulary allows translations of the sentences in (1) which are disambiguated in the relevant respect, as given in (5). Intuitively, the primed variables will be those variables which are dominant in the quantification.

(5) QUANTIFIER (RESTRICTION, NUCLEAR SCOPE)
a. $[\![usually]\!]$ ([**woman**(x') ∧ **dog**(y) ∧ **owns**(x', y)], [**happy**(x')])
b. $[\![usually]\!]$ ([**artist**(x) ∧ **town**(y') ∧ **lives-in**(x, y')], [**pretty**(y')])
c. $[\![usually]\!]$ ([**semanticist**(x') ∧ **good-job**(y') ∧ **hears-of** (x', y')], [**applies-for**(x', y')])

Note that I have given translations of the restrictions and the nuclear scopes as formulas containing free variables in the style of Heim's (1982, chapter II) elaboration of Lewis's basic approach. Without further elaboration, unselective binding is notoriously inadequate for distinguishing proportional readings. However, as pointed out in Root (1985) and elsewhere, this deficiency can be easily remedied by replacing Lewis's original conception of a quantificational case as an individual assignment function with an equivalence class of assignment functions.

(6) Given a formula ϕ, two assignment functions f and g are members of the same equivalence class relative to ϕ (i.e. the same quantificational *case*) iff they agree on what they assign to all primed variables that are free in ϕ:

$$\forall\alpha \in (N' \cap \mathbf{free}(\phi)) \, [f(\alpha) = g(\alpha)]$$

For our purposes, ϕ will always correspond to the restriction of a quantifier; thus given a translation involving primed and unprimed variables, each quantificational restriction induces a partition on the set of assignment functions.[1] To see how this works, consider the partial assignment functions specified in (7).

[1] In (6), the expression **free**(ϕ) denotes the set of variables that are free in formula ϕ; for example, **free**(**woman**(x') ∧ **dog**(y) ∧ **owns**(x', y)) = $\{x', y\}$.

(7) a. $f_a = \{\langle x', w_1\rangle, \langle y, d_1\rangle\}$
b. $f_b = \{\langle x', w_1\rangle, \langle y, d_2\rangle\}$
c. $f_c = \{\langle x', w_1\rangle, \langle y, d_3\rangle\}$
d. $f_d = \{\langle x', w_2\rangle, \langle y, d_4\rangle\}$
e. $f_e = \{\langle x', w_2\rangle, \langle y, d_5\rangle\}$

It will be more convenient to convey the information displayed in (7) as presented in the table in (8).

(8)

	x'	y
a.	w_1	d_1
b.	w_1	d_2
c.	w_1	d_3
d.	w_2	d_4
e.	w_2	d_5

The assignment functions given in (a), (b), and (c) are members of the same equivalence class, since they all assign the one primed variable to the same entity, namely, w_1. Similarly, the assignment functions specified in (d) and (e) constitute a second equivalence class.

The truth conditions of adverbial quantifiers, then, will depend on equivalence classes of assignment functions, rather than directly on individual assignment functions. In particular, the truth conditions of *usually* are given in (9).

(9) $[\![$*usually*$]\!]$ (ϕ, ψ) is true iff more than half of the equivalence classes relative to ϕ that contain an assignment function verifying ϕ also contain an assignment function verifying $[\phi \wedge \psi]$.

Two examples will illustrate how these rules predict a truth value for a sentence construed under a particular proportional reading when evaluated against a specific set of facts.

(10) Usually, if a woman owns a dog, she is happy.

We have seen that (10) favors a woman-dominant asymmetric reading, so we prime the woman variable but not the dog variable in the translations of the restriction ϕ and the nuclear scope ψ:

(11) a. $\phi = [\mathbf{woman}(x') \wedge \mathbf{dog}(y) \wedge \mathbf{owns}(x', y)]$
b. $\psi = [\mathbf{happy}(x')]$

Now consider the facts reported in (12).

(12)

	x'	y	verifies ϕ?	verifies$[\phi \wedge \psi]$?
a.	w_1	d_1	yes	yes
b.	w_2	d_2	yes	yes
c.	w_3	d_3	yes	no
d.	w_3	d_4	yes	no
e.	w_3	d_5	yes	no

Since x' is the only primed variable free in ϕ, we have three quantificational cases, one for each woman. The third case, the one corresponding to woman w_3, contains three distinct assignment functions, one for each dog she owns. The first two cases verify the nuclear scope as well as the restriction, so they confirm the generalization expressed by (10); the third case, however, contains no assignment function which simultaneously verifies both the restriction and the nuclear scope. Nevertheless, two out of three cases confirm the generalization, and the sentence is correctly predicted to be true in this situation under the specified reading.

(13) Usually, if a woman owns a donkey, she deducts it from her taxes.

This sentence favors a symmetric interpretation, so we prime both variables:

(14) a. $\phi = [\mathbf{woman}(x') \wedge \mathbf{donkey}(y') \wedge \mathbf{owns}(x', y')]$
b. $\psi = [\mathbf{deducts}(x', y')]$

(15)

	x'	y'	verifies ϕ?	verifies $[\phi \wedge \psi]$?
a.	w_1	d_1	yes	yes
b.	w_2	d_2	yes	yes
c.	w_3	d_3	yes	no
d.	w_3	d_4	yes	no
e.	w_3	d_5	yes	no

Here we have women owning donkeys instead of dogs, but the pattern of facts is exactly the same as for the previous example, as can be seen by comparing the last column of (15) with that of (12). The difference here is that both of the restriction's free variables are primed, so that two assignment functions will be members of the same case only if they agree both on what they assign to the woman variable and to the donkey variable. This means in effect that each assignment function constitutes a separate case. The result is that now only two out of five cases confirm the generalization, so the sentence is predicted to be false in this situation on the symmetric reading. Thus the same pattern of facts can either verify or falsify a proportional sentence, depending on which proportional reading it is construed under, that is, depending on which variables get primed.

The obvious question to ask at this point is: What are the structural or pragmatic factors related to whether or not a variable can be primed? It is the main purpose of this paper to advance and defend a specific hypothesis about what the pragmatic factors might be. As for the structural factors (lexical, syntactic, etc.), this issue is in essence the proportion problem proper. As mentioned above, the main hypothesis of this paper does not depend directly on any specific solution to the proportion problem, and, for better or for worse, the discussion will remain agnostic as to which approach is best. For the sake of concreteness, however, I will assume for adverbial quantifiers that in principle any non-empty set of free variables in the restriction can be primed (modulo presuppositions, of course, and perhaps only along with certain assumptions about prosody, focus structure, etc.). Although this assumption is consistent with most solutions to the proportion problem I am familiar with, it may someday be possible to justify a more restrictive theory.

2. Presuppositions for Proportional Adverbial Quantifiers

The analysis I would like to develop depends on the hypothesis stated informally (and given more precisely shortly) as follows: a variable can be primed only if the value of that variable is capable of determining the satisfaction of the nuclear scope independently of the values of the other variables. The rationale for such an assumption is that those variables that are most directly responsible for deciding the outcome of the quantification are naturally the best candidates for being primed.

This hypothesis explains why (16) favors a symmetric interpretation when evaluated against facts like those in (18).

(16) Usually, if a semanticist hears of a good job, she applies for it.

(17) a. $\phi = [\textbf{semanticist}(x') \wedge \textbf{good-job}(y') \wedge \textbf{hears-of}(x', y')]$
b. $\psi = [\textbf{applies-for}(x', y')]$

(18)

	x'	y'	verifies ϕ?	verifies $[\phi \wedge \psi]$?
a.	s_1	j_1	yes	yes
b.	s_1	j_2	yes	no
c.	s_2	j_1	yes	no
d.	s_2	j_2	yes	yes
e.	s_2	j_3	yes	yes

Considering first the assignment functions in (18a) and (18b), we see that semanticist s_1 applies for one job but not the other, so satisfaction of the nuclear scope clearly depends on the value of the job variable; hence, it makes sense for the job variable to be primed. Similarly, the assignment functions in (18a) and (18c) show that one semanticist applies for job j_1, but the other semanticist does not, and so the semanticist variable is also primed.

We can characterize the proposed connection between primed variables and the context by means of the formal condition defined in (19).

(19) *Homogeneity:*
A use of a proportional quantifier with restriction ϕ and nuclear scope ψ satisfies the *Homogeneity Condition* iff any pair of assignment functions f and g such that
a. f and g verify the restriction ϕ and
b. f and g are members of the same case relative to ϕ
also satisfy the following:
c. $[\![\psi]\!]^f = [\![\psi]\!]^g$

This criterion says that members of the same quantificational case must either all agree on verifying the nuclear scope, or all falsify it.

The homogeneity criterion leads to predictions concerning the availability of proportional readings in specific contexts under the assumption stated in (20).

(20) *The Homogeneity Hypothesis:*
A use of a proportional adverbial quantifier when construed under a particular proportional reading is felicitous only in a context which is consistent with the Homogeneity Condition.

Since different proportional readings give rise to distinct homogeneity presuppositions, only some readings will be consistent with a given context.

Thus the homogeneity presuppositions for the preferred readings of the basic examples in (1) are: that a woman is happy with respect to all of her dogs, or to none of them; that a town is pretty or not no matter which artists live in it; but that whether a semanticist applies for a job or not depends both on the identity of the semanticist and on the identity of the job in question. These assumptions are all relatively natural, which shows that the preferred readings of these prototypical examples are at least consistent with the homogeneity hypothesis. The remaining sections develop the empirical predictions of the hypothesis in more interesting cases.

One immediate consequence of the hypothesis is that a symmetric interpretation will always be consistent with it: if there is only one assignment function per case, then of course the homogeneity condition will be satisfied. And as far as I know, given an appropriate discourse situation, a symmetric interpretation is always at least possible (see especially section 5 below in this regard). To the extent that there are contexts in which an asymmetric reading seems to be systematically preferred over the symmetric one, that preference will have to be accounted for by some principle in addition to homogeneity. To give just one possibility which is neither semantic nor pragmatic, there may be some general processing constraint to the effect that, all else being equal, unprimed variables are preferred over primed variables (v. Heim 1990, p. 154); after all, the number of cases increases geometrically with the number of primed variables. Such a principle will predict that a symmetric interpretation will be prominent only in contexts which are inconsistent with any other proportional reading.

3. The Donkey Pronoun Rule

There have been a number of suggestions in the literature for predicting the availability of proportional readings. Bäuerle and Egli (1985) propose the rule of thumb given in (21).

(21) *The Donkey Pronoun Rule* (Bäuerle and Egli 1985):
A variable is (likely to be) primed iff there is a donkey pronoun in the nuclear scope which translates as that variable.

Note that this criterion depends only on structural properties of a sentence, and does not consider context at all. This generalization makes good predictions in many cases, including the examples given in (1) and repeated here:

(22) a. Usually, if **a woman** owns a dog, **she** is happy.
b. Usually, if an artist lives in **a town**, **it** is pretty.
c. Usually, if **a semanticist** hears of **a good job**, **she** applies for **it**.

Exactly those indefinites in the restriction which give rise to primed variables (under the preferred reading as described above) also serve as the antecedent of a donkey pronoun in the nuclear scope.

It is easy to understand why the donkey pronoun rule works as well as it does given the homogeneity hypothesis. If the nuclear scope of (22a) is the proposition that x is happy, where x is the woman variable, then it is no wonder that the value of x is likely to have a strong influence on the satisfaction of the nuclear scope.

However, despite its success with many examples, the donkey pronoun rule sometimes makes inaccurate predictions.

(23) Usually, if a story pleases a child, it must be read over and over.

Here the only donkey pronoun in the nuclear scope takes the story indefinite as its antecedent. We would naturally expect, therefore, that this sentence should prefer a story-dominant asymmetric reading. But such a reading would predict that this sentence could be truly asserted even if most situations in which a story pleases a child do not result in repeated readings, so long as the single readings are distributed over a minority of the child-pleasing stories. Judging from informants, this seems to be a highly unlikely reading for (23). On the homogeneity hypothesis, this fact is explained by observing that such a reading would presuppose that a given story will either be read repeatedly to every child it pleases or to none of them. In a neutral context, it is more plausible to assume that whether a story is repeated depends on the identity of the child involved as well as on the story, forcing a symmetric interpretation.

Furthermore, note that if a nuclear scope happens not to contain any donkey pronouns, then the donkey pronoun rule fails to make any prediction at all. Nevertheless, such sentences seem just as likely to prefer one proportional reading over another.

(24) Usually, if a man opens an umbrella, it is raining.

There are no donkey pronouns in this sentence. The symmetric reading seems to be the preferred interpretation, and a man-dominant asymmetric reading may also be possible. In any case, an umbrella-dominant asymmetric reading is out of the question. That is, (24) cannot normally be interpreted as asserting that most umbrellas have the property that they are only opened when it is raining. Such a reading would be predicted to be satisfied even if the majority of men compulsively opened umbrellas on sunny days over and over again, so long as only a minority of umbrellas were involved.

The absence of an umbrella-dominant asymmetric reading is exactly what the homogeneity hypothesis would predict. Such a reading would presuppose that some umbrellas would always be opened only in the rain, while other umbrellas would always be opened only when it is not raining, no matter who is carrying them. Since this is not a very plausible assumption in a neutral context, the homogeneity hypothesis predicts that (24) will not normally have such a reading.

Both referees suggest revising the donkey pronoun rule to cover implicit variables as well as overt pronouns. To see what they have in mind, note that the most natural interpretation of (24) can be paraphrased as *Usually, if a man opens an umbrella, it is raining* ***when he opens it.*** If only we could apply the donkey pronoun rule to (the interpretation of) this paraphrase rather than to the actual sentence, the donkey pronoun rule would make better predictions.

One difficulty with this idea is that it is not at all obvious how we can determine when adding implicit material to a logical translation is justified, or which material exactly should be added. However, this difficulty is just as much a problem for the homogeneity hypothesis. Note that in order for the homogeneity explanation for (24) to go through, we must show that the homogeneity presuppositions associated with the asymmetric readings are implausible. In order to do that, we must exhibit assignment functions which differ in the individual they assign to one variable or another and which also differ in the truth value they give rise to for the main clause. But the only way that the truth value of the main clause can depend on the value of a certain variable is if the variable in question occurs somewhere in the translation of the main clause, either as the translation of an overt pronoun or (somewhat magically) as an implicit variable. By similar reasoning, the explanation for (23) only goes through if the truth conditions for the main clause guarantee that the implicit experiencer argument of *read* is the same child mentioned by the indefinite in the restriction. Thus, since we apparently need implicit variables for the homogeneity story anyway, we can imagine revising the donkey pronoun rule to look for implicit donkey pronouns as well as overt ones.

Yet even the revised donkey pronoun rule would still be inadequate. As Kadmon (1987) and Heim (1990) note, even the presence of an overt donkey pronoun is not sufficient to guarantee that a variable will be primed.

(25) Usually, if a farmer owns a donkey, he beats it.

In this prototypical donkey sentence both indefinites are picked up by donkey pronouns in the nuclear scope. Yet (25) is perfectly compatible with a farmer-dominant asymmetric interpretation, and may even prefer such a reading over the symmetric one. As far as the donkey pronoun rule is concerned, it is a mystery why (25) can have any reading other than a symmetric one.

On the homogeneity hypothesis, the farmer-dominant asymmetric reading will be felicitous just in case the context of use is consistent with the presupposition that any given farmer beats either all or none of his donkeys. Under such an assumption, the value of the donkey variable cannot affect the satisfaction of the nuclear scope independently of the choice of a farmer.

This example contrasts with the discussion of the structurally identical (16) above, where most typical contexts force a symmetric interpretation. To the extent that these examples and others below show that the availability of proportional readings crucially depends on contextual assumptions (see especially the discussion of (29) and section 5), any rule based solely on syntactic or structural semantic properties will be inadequate.[2]

Thus the homogeneity hypothesis attempts to capture the insight embodied in the donkey pronoun rule while still making correct predictions in situations in which the donkey pronoun rule gives incorrect or incomplete predictions, or fails to make any predictions at all. Indeed, as far as I can see, it is only by assuming the homogeneity hypothesis (or something like it) that we have an explanation for why the presence of donkey pronouns in the nuclear scope should be correlated with the availability of proportional readings in the first place.

4. Uniqueness Presuppositions

Kadmon (1987, 1990) also suggests that different proportional readings can give rise to characteristic presuppositions, namely, implications of uniqueness or relative uniqueness. In general, Kadmon (1990, p. 301) asserts that symmetric readings never give rise to any uniqueness presuppositions, but asymmetric readings can: if the referent of an unprimed variable is referred to by a definite NP such as a donkey pronoun, then, as a result of the definiteness associated with that NP, the referent of the variable must be unique relative to the choice of the primed variables (see Kadmon 1990, p. 310).

(26) a. Usually, if a semanticist hears of a good job, she applies for it.
b. Usually, if a woman owns a dog, she talks to it.

As we have seen, the sentence in (26a) favors a symmetric interpretation, and Kadmon notes that there are no uniqueness implications for either of the variables involved. That is, (26a) can be felicitously uttered in a context in which each semanticist hears of more than one job (the referent of the

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2 It is worth pointing out that there are systematic classes of examples for which the (revised) donkey rule and the homogeneity hypothesis make different predictions.

(i) a. Usually, if a woman owns a dog, she is happy and it is identical to itself.
b. Usually, if a woman owns a dog, she possesses it and is happy.

If a pronoun occurs only in a subexpression that happens to be a tautology or a contradiction, as is the case for the pronoun *it* in (i.a), or if it occurs only in material that is entailed by the antecedent as in (i.b), the homogeneity hypothesis fails to predict that it is likely to be primed (since its value does not affect the truth of the main clause), whereas the donkey pronoun rule predicts that it (probably) will be primed. To the extent that these rather awkward sentences are felicitous, they seem to continue to favor a woman-dominant asymmetric reading rather than a symmetric reading, as predicted by the homogeneity hypothesis.

job variable is not unique relative to the choice of semanticist), and in which more than one semanticist hears of each job (the referent of the semanticist variable in not necessarily unique relative to the choice of job). In contrast, (26b) favors a woman-dominant asymmetric reading. Kadmon claims that there is a uniqueness implication, and that (26b) will be felicitous only under the assumption that there is a unique dog per woman.

However, as noted by Kadmon, there are important exceptions to this claim, including Heim's famous sage plant sentence, a variant of which appears in (27).

(27) Usually, if a woman buys a sage plant here, she buys two others along with it.

Clearly (27) strongly prefers a woman-dominant asymmetric reading, so that the presence of the donkey pronoun *it* should give rise to the presupposition that the referent of the sage plant variable is unique relative to the choice of a woman. However, Kadmon recognizes that there is no implication that any of the sage plants is distinguished in any way from the others.

Kadmon (1990, p. 317) offers the following explanation: if it can't possibly matter which sage plant we pick, then the sage plant variable is excused from uniqueness presuppositions.

(28)	x'	y'	x' buys two others along with y?
a.	w_1	s_1	yes
b.	w_1	s_2	yes
c.	w_1	s_3	yes
d.	w_2	s_4	yes
e.	w_2	s_5	yes
f.	w_2	s_6	yes
g.	w_3	s_7	no
h.	w_3	s_8	no
i.	w_4	s_9	no
j.	w_5	s_{10}	no

As can be seen by inspecting (28), for any choice of a woman, it doesn't matter which sage plant we pick as the referent of the pronoun: either it is true of all of them that two others were bought, or of none of them.

With respect to this example, Kadmon's relaxed uniqueness requirement is logically equivalent to the homogeneity presupposition for the relevant asymmetric reading. It is worth noting that sage plant sentences, far from being an exception to a general theory, as they are for Kadmon, are prototypical examples confirming the predictions of the homogeneity hypothesis.

However, there are examples similar to sage plant sentences in which homogeneity is not logically entailed, but rather is contingent on the context.

(29) Usually, if a person knows a symphony well, she can't help humming along with it when she hears it on the radio.

Clearly, this sentence has an asymmetric reading on which it can't be falsified by the existence of a single woman who knows dozens of symphonies but never hums. Furthermore, it is possible that someone always hums along with the theme of Beethoven's Ninth Symphony, but never with that of the Seventh, so in some sense it "matters" which symphony we have in mind. Therefore, thanks to the definiteness of the donkey pronouns in the nuclear scope, Kadmon predicts that there should be a unique symphony per person. However, a use of (29) certainly does not presuppose that the relevant people know at most one symphony, or that people who know more than one symphony somehow fall outside the scope of the asserted generalization. (Other discussions of the empirical accuracy of Kadmon's claims about the uniqueness implications associated with donkey pronouns include Rooth (1987), Heim (1990), and Chierchia (1992); see also section 6 below.) The homogeneity hypothesis, on the other hand, predicts that the asymmetric interpretation of (29) should be perfectly felicitous as long as it makes sense to assume that any particular person will hum along either with all or none of the symphonies they know.

Obviously it is possible to construe Kadmon's sage plant rationale as extending to examples like (29). Yet even if a more explicit treatment of this type of quasi-uniqueness turned out to make exactly the right predictions with respect to uniqueness implications, it could not by itself provide an adequate account of the availability of proportional readings. To see why, note that if homogeneity entailments were in fact just a reflex of principles governing uniqueness presuppositions, they should be detectable only in the presence of a donkey pronoun (or some other expression conventionally associated with a uniqueness presupposition). But as we have seen, even sentences without overt donkey pronouns (e.g., (23) and (24)) can be compatible with some proportional readings but not others.[3]

[3] As noted by a reviewer, it is conceivable that a definite-uniqueness based theory could be extended to apply to implicit variables. However, such an approach would work only if we assume that implicit variables typically or at least possibly trigger uniqueness implications, which seems unlikely to me.

Furthermore, the different homogeneity presuppositions associated with each proportional reading are just as much in evidence for such sentences as for sentences containing overt donkey pronouns. Therefore the homogeneity hypothesis is motivated independently of definite uniqueness facts.

4.1. *Rooth's Puzzle and Nominal Quantification*

Rooth (1987, p. 256) observes that the following sentence can be felicitous even given a context in which parents have more than one son still in high school.

(30) No parent with a son still in high school has ever lent him the car on a weeknight.

Heim (1990) observes that (30) seems to provide a counterexample to Kadmon's explanation for sage plant sentences.

(31)	x'	y	x' lends y the car
a.	p_1	s_1	yes
b.	p_1	s_2	no
c.	p_2	s_3	no
d.	p_2	s_4	no

The existence of even a single instance of a parent lending her son the car is intuitively sufficient to falsify (30). Because there is a definite donkey pronoun in the nuclear scope of (30), Kadmon's theory of uniqueness predicts that either there must be a unique son for each parent, or if a parent has more than one son, it must not matter which son is considered. In (31), parent p_1 lends the car to son s_1 but not to son s_2, so it does matter which son we have in mind. Therefore Kadmon should predict that this sentence is infelicitous in the context given in (31); however, I agree with Rooth and Heim that (30) is perfectly fine.

Many people have pointed out to me that Rooth's puzzle also seems to be a counterexample for the homogeneity hypothesis, since the two instances in the first case depicted in (31) differ with respect to satisfying the nuclear scope. However, (30) is a genuine counterexample for homogeneity only if at least two additional assumptions hold: first, there must be independent evidence that uses of nominal quantifiers uniformly give rise to homogeneity presuppositions in the same way proposed here for adverbial quantifiers; and second, the parent-dominant asymmetric reading as given in (31) must be the only possible case structure for (30).

I will tentatively assume that the first assumption is correct – that is, nominal quantifiers can give rise to homogeneity presuppositions – but I am much less certain about the second assumption. In chapter 4 of Barker (1995), I argue at length that nominal quantifiers can give rise to symmetric quantification under certain conditions. If (30) involves symmetric quantification, in which case both the parent variable and the son variable would be primed, then we get intuitively satisfying truth conditions for (30) as well as a case structure which is perfectly consistent both with the facts as portrayed in (31) and with the homogeneity hypothesis.

There are other approaches which can be pursued. For instance, note that Rooth's example crucially involves two independent instances of quantification: the nominal quantification associated with *no*, and the adverbial quantification associated with *ever*. Any complete investigation of such sentences must disentangle the interaction of these instances of quantification; judgments with respect to homogeneity get considerably murkier if *often* is substituted for *ever*. It is also worth mentioning that the account of weak readings offered below in section 6 can in principle be extended to examples such as (30).[4]

Having made these too-brief comments, I must reluctantly leave Rooth's observation as a puzzle for extending a homogeneity analysis to nominal quantification.

5. Explicit and Implicit Focus Structures

Kadmon (1987), Heim (1990), and others have observed that focus seems to affect the availability of proportional readings.

(32) a. Usually, if a drummer lives in an apartment building, it is half empty.
     b. Usually, if a drummer lives in an APARTMENT BUILDING, it is half empty.

For instance, the sentence in (32a) normally prefers an object-dominant asymmetric reading. Thus a single full apartment building which houses most of the drummers is not sufficient to falsify (32a). However, if the apartment building description receives contrastive stress, as in (32b), then

[4] To sketch how such an explanation would go, observe that family cars are a limited resource: if a parent lends a car to one son, it is quite understandable that they might not be in a position to lend another car to a second son on the same lending occasion. If this is indeed a factor, Kadmonian uniqueness or homogeneity effects might be expected to become more prominent for modified examples such as *No parent whose son brought home a bad report card praised him.*

a drummer-dominant asymmetric reading or a symmetric reading becomes more prominent. For these readings, it is the housing preferences of individual drummers that we are concerned with, and if a number of drummers live in the same apartment building, they can each constitute a separate counterexample to the generalization expressed by the quantificational token. Thus a single apartment building full of drummers can falsify (32b).

Contrasts like the one in (32) suggest the descriptive generalization in (33).

(33) Variables in focus don't get primed.

Krifka (1992) proposes a mechanism which accounts for this generalization. As part of a general theory of the interaction of focus with quantification, he proposes that *if*-clauses must routinely be factored into a focus and a quantificational background. In effect, this framework guarantees that variables in focus undergo existential quantification, and variables in the quantificational background are bound by the quantifier in question, giving truth conditions which, as near as I can tell, are compatible with the ones given here for proportional quantification. Thus Krifka suggests that predicting which variables are primed is just a special case of the more general problem of deciding which NPs are in semantic focus.

One difficulty with evaluating this hypothesis is that it is not always easy to tell which elements of a sentence are in focus, especially in the absence of any marked degree of intonational stress. However, following Krifka and may others (see especially Jacobs (1991) in this connection), we can assume that if an NP does receive contrastive intonational stress, then either it or some constituent containing it is in semantic focus. Our strategy for testing (33), then, will be to look for situations in which a description receives contrastive stress but nevertheless gives rise to a primed variable.

To further develop the drummer example, imagine that we are talking about the housing preferences of musicians in general. Most musicians usually prefer to live in isolated houses so that they can practice late at night without disturbing their neighbors. Therefore, if a musician lives in an apartment building instead, there must be some overriding advantage. For instance, perhaps cello players, bassoon players, and tuba players will live in an apartment building if it is sufficiently close to the conservatory practice rooms, since that means they won't have to carry their heavy instruments as far. In this context, consider a token of (34).

(34) Usually, if a DRUMMER lives in an apartment building, it is close to the bars downtown.

It seems to me that in this context, (34) can have a drummer-dominant asymmetric reading (and perhaps also a symmetric reading). To see this, note that (34) has a reading which can be verified merely if most of the drummers live in a single large apartment building downtown, even if a smaller number of drummers live in multiple apartment buildings closer to the conservatory. Such truth conditions result only when the drummer variable is primed.

Note also that the availability of such a reading is consistent with the homogeneity hypothesis, which requires that for any given drummer, when she chooses to live in an apartment building, she will either always choose one that is downtown or she never will, which is a plausible assumption in the specified context.

A similar type of example is discussed in some detail in Kratzer (1995):

(35) If a SICILIAN adores a piece of music, it is rarely a Bellini opera.

Kratzer observes that a piece-of-music asymmetric reading is completely impossible. That is, there is no reading of (35) which depends only on the number of Sicilian-liked pieces of music which happen to be Bellini operas. If there were, (35) could still be true even if there were thousands of Sicilians who adored Bellini operas, so long as there were a few Sicilians who like enough Mozart and Verdi operas to outnumber Bellini's oeuvre.

The existence of examples like (34) and (35) motivates the observation stated in (36).

(36) Sometimes an indefinite which receives contrastive stress gives rise to a variable which must be primed.

On the face of it, this fact at least calls into question the assumption that being in focus is incompatible with translating as a primed variable.

How serious of a problem is this for a focus-based theory of constraints on the availability of proportional readings? There may be a way out. Krifka (1992; personal communication) makes the point that there may be more than one focus structure involved in such examples: one focus structure for the *if*-clause, and a second focus structure for an implicit discourse-level focus operator associated with the sentence as a whole. In such cases of embedded focus, sentence accent aligns with the highest operator. It is possible, then, that the contrastive stress on *drummer* in (34) only reflects the fact that the drummer description is focused at the level of the sentence as a whole, at the same time that the drummer indefinite is not in focus with respect to the local *if*-clause. If so, then Krifka's theory at least doesn't make any wrong predictions with respect to these examples.

An embedded-focus story may turn out to be correct for these examples. If so, where does this leave us? To the extent that surface marking underdetermines the focus structure hypothesized by Krifka's theory, we are still faced with situations in which we cannot predict which variables will be in focus in the relevant semantic sense, and therefore have no explanation for the observed availability of proportional readings. To the extent that the homogeneity hypothesis is capable of making good predictions in such cases, it is motivated independently of the semantics of focus.

6. Weak Readings and Domain Narrowing

One potential threat to the generality of the homogeneity hypothesis comes from the so-called weak versus strong interpretations for some quantificational sentences as discussed by Heim (1982, pp. 61–62), Schubert and Pelletier (1989), Gawron, Nerbonne and Peters (1991), and Chierchia (1992), among others.

(37) Usually, if a man has a quarter in his pocket, he will put it in the meter.

The sentence in (37) (due to Schubert and Pelletier) favors an asymmetric reading on which there is exactly one case per man. Thus the homogeneity hypothesis would seem to predict that a use of (37) on this reading will presuppose that each man will either put all or none of his quarters in the meter. But a use of (37) seems to be perfectly felicitous in a context in which each man puts only as many quarters in the meter as he needs to: some quarters go into the meter, and some will remain in the man's pocket. Are homogeneity presuppositions somehow suspended for this example?

Gawron, Nerbonne and Peters (1991) and Chierchia (1992) suggest that strong readings arise from the presence of E-type pronouns. In essence, they restrict Kadmon's explanation for the failure of uniqueness for donkey pronouns in sage plant examples so as to apply specifically to pronouns with E-type denotations: a use of an E-type pronoun will be felicitous in a context in which multiple entities satisfy the implicit descriptive content of the pronoun only if the choice of such an entity is immaterial to the outcome of the quantification.

I see two empirical problems with this strategy. First, strong readings seem to be possible even without the presence of E-type pronouns.

(38) a. Usually, if a man saw a truck coming, he got out of the way.
b. Most men who saw a truck coming got out of the way.

Both sentences in (38) entail that each man confirming the generalization got out of the way of all of the trucks he saw coming.

One way of solving this problem might be to hypothesize that just as we can have implicit variables (see the discussion above in section 3), we can have implicit definite descriptions, so that (38a) means '. . . he got out of the way **of the truck he saw coming**'. Note, however, that the conjecture under consideration is that the strong/weak difference is an ambiguity specifically associated with pronouns: some pronouns are translated as simple variables (weak reading), and some (the E-type pronouns) are translated as definite descriptions (strong reading). If we allow implicit definite descriptions, the strong/weak split would no longer be tied directly to an independently motivated hypothesis about the interpretation of pronouns.

The second problem is that this account makes incorrect predictions in other contexts arguably involving E-type pronouns, such as paycheck sentences.

(39) a. The man who sent his grandmother to a nursing home was kinder than the man who threw **her** out on the street.
b. The woman who put her hand on the fridge was luckier than the woman who put **it** on the stove.

If the paycheck pronouns *her* and *it* are indeed E-type pronouns, then we should expect that (39a) presupposes that the second man threw both his grandmothers out on the street, and that (39b) presupposes that the second woman put both of her hands on the stove. But these sentences give rise to no such presuppositions.

I would like to suggest instead that weak readings are just a special case of the independently motivated mechanism of domain narrowing. Once contextual domain narrowing is taken into account, examples such as (37) can be seen to behave exactly as expected and require no weakening of the homogeneity hypothesis.

For nominal quantification, domain narrowing explains why, for example, a universal quantifier such as *every* can be true in the face of apparent counterexamples. Thus the reason that the sentence *Every tree is laden with wonderful apples* is not almost invariably false is that it can be understood as if it applied only to the trees within the bounds of a certain contextually salient orchard (see Kratzer (1989) or Roberts (1995)). For nominal quantification, then, domain narrowing allows for quantification over a contextually restricted set of individuals.

But adverbial quantifiers do not quantify over individuals; roughly speaking, they quantify over situations (or partial situations), approximated in this paper by partial assignment functions. Therefore domain narrowing for adverbial quantification would involve quantification over a restricted set of assignment functions.

In order to see which assignment functions are indeed relevant for discussions about parking, we must be more explicit about the assumptions implicit in the context. Do we need to consider every situation involving a man and a parking meter? Clearly not. A number of ancillary propositions must hold: the man must have just parked his car in front of the parking meter in question, it must be the law of the land that during certain hours of the day the meter must be fed, the man must be aware of these laws, the meter in question must not have time left on it from the last driver, and so on. Basically, a parking situation will be relevant for deciding the truth of (37) only if it is also a situation in which the meter needs to be fed.

Now consider a specific context in which homogeneity seems to be violated.

(40)	x'	y	x' put y in the meter/slot?
a.	m_1	q_1	Yes
b.	m_1	q_2	no
c.	m_1	q_3	no
d.	m_2	q_4	yes
e.	m_2	q_5	yes

In (40), man m_1 puts quarter q_1 into the meter and leaves quarters q_2 and q_3 in his pocket. The assignment functions in (40b) and (40c), then, are the ones which seem to violate homogeneity. However, I claim that these assignment functions are not relevant for deciding the truth of (37), since they correspond to situations in which the man has already put a quarter into the machine. They are no more relevant than situations in which, say, the meter is broken, or in which it is the middle of the night (when parking laws don't apply). Once we restrict the domain of quantification to exclude such assignment functions, the resulting set of assignment functions satisfies homogeneity.

But what precisely allows us to exclude the allegedly irrelevant assignment functions? As one referee put it, it seems as if all that distinguishes relevant functions from irrelevant ones is whether they verify the nuclear scope. What is needed is some property that is at least partially independent of the satisfaction of the nuclear scope. For example, assignment functions involving Canadian quarters clearly aren't relevant, since Canadian quarters do not work in parking meters found in Rochester, New York.

Although this property is strongly correlated with whether the nuclear scope will be satisfied (since no Canadian quarters will ever be put into the meter), it is not semantically equivalent to the nuclear scope (since only some non-Canadian quarters will be put into the meter).

Note that up until the moment at which a man first approaches a parking meter, there is no significant difference between any of the quarters in his pocket (by assumption). Therefore any attempt to predict in advance which quarters will participate in relevant assignment functions is hopeless. However, once we have the entire parking episode in view (as required merely in order to evaluate the truth of the nuclear scope), our expectations provide a number of suitable properties, one of the simpler of which is as follows: an assignment function will be irrelevant if it involves a quarter that can be found in the man's pocket after the parking laws have been satisfied. This rule does not excuse most assignment functions involving quarters that find their way into a parking meter (though consider the man who absentmindedly overpays), nor does it excuse assignment functions involving quarters in the pocket of the scofflaw who tries to get away without putting any money in the meter at all. Thus failing to satisfy the nuclear scope is neither necessary nor sufficient to justify irrelevance.[5]

One clear way to test this explanation is to hold everything but the contextual assumptions constant. Imagine, therefore, that we are talking about the behavior of men in gambling casinos.

(41) Usually, if a man has a quarter in his pocket, he will put it in the slot.

If we evaluate (41) in the situation depicted in (40), the pattern of facts with respect to truth conditions is identical to that for (37). The only difference is in the contextual assumptions. More specifically, there is no longer any assumption that the mechanism into which quarters are being fed will change state (in any relevant way) after the insertion of each quarter. Therefore a situation in which a man has just put a quarter into the slot machine is just as much an opportunity to gamble as before. Thus we correctly predict that the man-dominant asymmetric reading of (41) in this context does not allow a weak interpretation. That is, intuitively (41) cannot be verified merely if each man puts a single quarter in the slot machine. Here all of the assignment functions in (40) are equally relevant, and the

[5] Imagine a greedy town in which there is a two-quarter minimum deposit for parking. In (40), man m_1 has deposited only one quarter, and therefore remains in violation of the parking ordinances. My account predicts that a use of (37) should be infelicitous in such a situation.

force of the homogeneity presupposition comes through exactly as predicted (and, given facts as in (40), forces a symmetric interpretation).

Even if adverbial domain restriction is at the heart of at least some apparent weak/strong alternations, much work would be required to extend this idea into a more complete account of weak/strong alternations (see, e.g., Kang (1994) or Kanazawa (1994) for some of the intricacies involved). All I can hope to do here is to show one defensible way in which the homogeneity hypothesis can be reconciled with the apparent existence of weak interpretations.

7. Summary

We have seen that a sentence involving a proportional adverbial quantifier can be ambiguous across a number of readings which have distinct truth conditions. These readings are characterized by the status of indefinites in the restriction of the quantifier (whether or not they translate as primed variables). However, only some proportional readings will be felicitous in a given context. More specifically, the context must be consistent with the homogeneity presupposition induced by the reading in question, which requires that all members of a case must agree on whether they satisfy the nuclear scope. The homogeneity hypothesis explains why the distribution of donkey pronouns in the nuclear scope is such a good indicator of the preferred proportional reading in general, but it also makes correct predictions where the donkey pronoun rule makes incorrect predictions. The homogeneity hypothesis is also consistent with the relevant predictions of Kadmon's theory of uniqueness presuppositions for asymmetric quantification. In particular, sage plant contexts are prototypical examples of situations which satisfy the homogeneity condition. Furthermore, the homogeneity hypothesis makes good predictions in situations in which neither the donkey pronoun theory nor Kadmon's uniqueness theory make any predictions at all, notably sentences in which the nuclear scope does not contain any donkey pronouns. The homogeneity hypothesis is also consistent with Krifka's theory of the connection between focus structure and semantic interpretation, and makes good predictions in situations in which the relevant details of the focus structure are at best underdetermined.

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0108 Department of Linguistics
9500 Gilman Drive
University of California, San Diego
La Jolla, CA 92093, U.S.A.
E-mail: barker@ling.ucsd.edu