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Indefiniteness in Counting

Luka Crnic
Massachussetts Institute of Technology, crnic@mit.edu

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1 Introduction

This paper investigates the interaction between counting quantifiers (*more than three boys, how many girls*), collective predicates (*meet, be a team*), and adverbial quantification. This interaction results in three sets of facts, which obtain across many languages (at least German, Italian, Slovenian, Uyghur). First: Although most collective predicates are compatible with counting quantifiers in episodic contexts (1)–(2) (mixed and essentially plural main predicates), Hackl (2000, 2002) and Winter (2001) observe that this does not hold across the board (3) (genuinely collective main predicates). We call this the collectivity contrast.

(1) a. More than three boys built a boat yesterday.
b. How many movers carried the piano?

(2) a. More than three boys met in a pub yesterday.
b. How many cars collided in that crash?

(3) a. #More than three boys constituted a team that played well yesterday.
b. #How many students elected a president?

Second: The collectivity contrast disappears in generics (Hackl, 2000; Winter, 2001) and other adverbial quantification constructions. In (4-a), we have an example with an overt adverb of quantification; in (4-b), we have a *how many* question with a non-scalar predicate. We call this the genericity contrast.

(4) a. More than three students usually constitute a good team.
b. How many people can elect a president?

Finally: Although both Hackl and Winter note that the pattern in (3) does not hold for simple number indefinites (*seven professors*), the speakers that we have consulted do not share these judgments. We will discuss this issue only briefly in this paper and call it the referentiality contrast.

We account for these contrasts by relying on the idea that counting quantifiers decompose into an existential quantifier and a noun phrase that consists of a gradable adjective and a nominal predicate (cf. Hackl, 2009). First: We derive the collectivity contrast by proposing that all quantificational determiners, especially the indefinite existential quantifier, are inherently and non-vacuously distributive. A formal implementation of this idea is modeled after Brisson's (1998, 2003) treatment of *all*-phrases. Second: We provide an explanation of the genericity contrast that is based on some standard assumptions about the semantics of adverbial quantification—in particular, that the indefinite nouns can be bound by adverbial quantifiers (Heim, 1982, and others). Third: In relation to the referentiality puzzle, it will be indicated that the adoption of our approach to issues at hand can lead one to adjudicate between quantificational and choice-functional approaches to specific readings of indefinites (cf. Schwarzschild, 2002; Reinhart, 1997; Kratzer, 2002).

We start by presenting a decompositional account of counting quantifiers in section 2 (Hackl, 2000, 2009). We also present Hackl's treatment of the collectivity contrast and some of its issues. In section 3, a description of the collectivity contrast with *all*-phrases is provided. We explicate an account of it that relies on the notion of cover-dependent distributivity (Brisson, 1998, 2003). In section 4, we extend Brisson's analysis to explain the collectivity contrast. In sections 5 and 6, the genericity and the referentiality contrasts are tackled. Section 7 concludes.

2 A Decompositional Account of Counting Expressions

We start this section by presenting the standard decompositional account of counting quantifiers: namely that counting quantifiers are composed of an existential quantifier, a gradable Q adjective, and a noun phrase (Hackl, 2009). On the basis of a version of this decompositional approach, Hackl (2000, 2002) proposes an explanation of the collectivity contrast, which we explicate and discuss some of the issues of[1].

2.1 The Syntax and Semantics of Counting Quantifiers

The main argument for a decompositional analysis of counting quantifiers comes from the fact that different parts of the counting quantifier can take distinct scopes in the sentence. For example, the question *How many books did Diana decide to publish?* has two readings: The first reading is the transparent reading of the indefinite phrase, also known as the object reading (Rett, 2008), according to which the questioner is asking about the number of existing books that Diana decided to publish. The second reading involves the opaque reading of the indefinite phrase, also known as the amount reading, according to which the questioner is asking for the number of books that may not have been written yet that Diana had the intention of publishing. These readings can be derived on the basis of LFs where the indefinite quantifier takes distinct scopes in relation to the intensional operator, while the degree operator *how* always takes the widest scope. Such structures can be derived by assuming that the base-generated counting DP has the structure in (5) with the quantificational and degree operator components having the denotations in (6). Accordingly, in the example at hand, both the indefinite phrase and the degree phrase QR for type reasons.

(5) $[_{DP}\ \exists\ [_{AP}\ [_{DegP}$ OP] many] NP]

(6) a. $[\![\exists]\!]^g = \lambda P.\lambda Q.\ \exists x[P(x) \wedge Q(x)]$
b. $[\![\text{many}]\!]^g = \lambda d.\lambda x.\ \mu(x) \geq d$
c. $[\![\text{how}]\!]^g = \lambda D_{\langle d,t\rangle}.\lambda p.\ \exists d[p=D(d)]$
d. $[\![\text{er than three}]\!]^g = \lambda D_{\langle d,t\rangle}.\ \max(D) > 3$

An explicit derivation of the truth-conditions of a sentence containing a modified number indefinite is given in (7). The syntactic representation of the sentence is in (b). According to (c), the sentence is true iff the maximal number of students that have arrived is larger than three.

(7) a. More than three students arrived.
b. [er than three] λd [$\exists$ d-many students] arrived
c. $[\![(7)]\!]^g = 1$ iff $[\![\text{er than three}]\!]^g(\lambda d.\ \exists x[\text{students}(x) \wedge \mu(x) \geq d \wedge \text{arrive}(x)])$ iff $\max(\{d \mid \exists x[\text{students}(x) \wedge \mu(x) \geq d \wedge \text{arrive}(x)]\}) > 3$

2.2 An Account of the Collectivity Contrast

The existential quantifier that is defined in (6) takes two arguments: the denotation of the determiner's NP sister and the denotation of the VP. Hackl (2002) proposes that these arguments are subject to a commensurability constraint:

(8) NP and VP arguments of the existential quantifier have to range over the same type of atomic individuals.

The application of this rule requires, on one hand, stipulating a sortal distinction between predicates and, on the other hand, determining which predicate falls into which class (cf. Winter, 2001

[1]It has to be pointed out that the formulation of the syntax of comparative quantifiers in this paper differs slightly from the one in Hackl (2000). In particular, we are assuming that the existential closure is independent of *many* (Schwarzschild, 2006; Hackl, 2009: and others). We will accordingly rephrase some of the original characterizations, though our proposal can also be straightforwardly implemented in Hackl's (2000) framework.

for a criterion). Consequently, Hackl assumes that distributive, mixed and essentially plural predicates —*smoke, carry a piano, meet*—range over regular individuals and sums of regular individuals. Genuinely collective predicates—*team, elect a president*—range over group individuals and sums of group individuals. The condition in (8) and the sortal differentiation between predicates correctly predicts the felicity observed in (1)–(2) and the infelicity observed in (3). This is illustrated in (9) where the relevant expressions are framed: *constitute a team*—in contrast to *(many) boys*—ranges over group individuals, resulting in a violation of the commensurability condition.

(9) a. #More than three $\boxed{\text{boys}}$ $\boxed{\text{constituted a good team yesterday.}}$
b. [er than three] λd [$\exists$ [d many] boys] were a good team
c. $\max\{d \mid \exists x[\text{boys}(x) \wedge \text{team}(x) \wedge \mu(x) \geq d]\} > 3$

There are at least three issues that this approach faces. The first has already been touched upon above: it necessitates an adoption of an enriched ontology of individuals and, relatedly, an *ad hoc* restriction on sort/type shifting operations (cf. $\uparrow$- and $\downarrow$-operators in Landman, 1989). An analysis that would avoid such assumptions should be sought: we will provide one below, though a more fine-grained account of verbal predicates will need to be assumed. The second problem is of an empirical nature and has been acknowledged by Hackl (2002): (10) is a licit sentence, even though the NP argument, *teams*, and the VP argument, *met in the hallway*, range over different sorts of individuals, in violation of (8).

(10) a. More than three $\boxed{\text{teams}}$ $\boxed{\text{met in the hallway.}}$
b. [er than three] λd [$\exists$ [d many] teams] met in a hallway
c. $\max\{d \mid \exists x[\text{teams}(x) \wedge \text{meet}(x) \wedge \mu(x) \geq d]\} > 3$

Finally, as we will discuss in more detail in section 4, it is not only sentences where the NP denotes a set of groups and the VP denotes a set of regular individuals, like in (10), that are felicitous. If the context is appropriate, even the sentences in (3), which otherwise exhibit markedness, are acceptable. Accordingly, an account that predicts these sentences to be systematically infelicitous requires some revision.

3 *All* and Collective Predication

This section presents an account of Brisson's (1998, 2003) treatment of co-occurrence restrictions on *all*-phrases and collective predicates. Her analysis is based on the following three assumptions: (i) the agentive Voice heads (DO) come with a bleached activity predicate, (ii) the distributivity operator takes a cover argument, and (iii) *all* constrains what this cover argument can be. On the grounds of economy, *all* imposing a restriction on the cover should have a truth-conditional effect. This necessitates an adjunction of the distributivity operator that is semantically non-vacuous.

3.1 Taub's Generalization

Although they may occur with collective predicates like *meet* and *build* (11), *all*-phrases cannot occur with predicational expressions like *constitute a team* and *elect a president* (12). Dowty's descriptive generalization of this state of affairs was that *all*-phrases are compatible only with distributive predicates and with predicates that license the so-called distributive sub-entailments (Dowty, 1986).

(11) a. All the students convened in the hallway.
b. All the students built a boat together.

(12) a. #All the students constituted a group of ten.
b. #All the students elected a president.

Facts analogous to (11)–(12) have been shown to obtain also with quantifying expressions like *most of the NP* by Nakanishi and Romero (2004). The same holds also for indefinites *many/few/several NP* (Frey, Kamp and Root, reported in Dowty, 1986). It is also clear that this behavior is mimicked by sentences containing counting quantifiers (1)–(3), as will be discussed in more detail below.

(13) a. Most of the students built a boat.
b. Most of the students met in the hallway.
c. #Most of the students constituted a team.
d. #Most of the students elected a president.

(14) a. Many students built a boat.
b. Many students met for dinner.
c. #Many students constituted a large group.
d. #Many students elected a president.

Taub (1989) has observed that the compatibility of collective predicates with *all*- and *most*-phrases is conditioned by the aspectual properties of those predicates (15), and presented an empirical generalization along the lines of (16) (cf. Brisson, 1998, 2003).

(15) a. Essentially plural predicates and mixed predicates
(i) Accomplishment predicates: *meet, gather, build a boat*
(ii) Activity predicates: *carry a piano*
b. Genuinely collective predicates
(i) State predicates: *be a team, constitute a majority*
(ii) Achievement predicates: *elect a president*

(16) **Extended Taub's generalization**
The collective state and achievement predicates are incompatible with *all*, *most* and plural indefinites *many, several* etc. The collective activity and accomplishment predicates are compatible with *all*, *most* and plural indefinites *many, several* etc.

3.2 Distributivity, Covers and VP-shells

Brisson (1998, 2003) proposed an account of *all* couched in Schwarzschild's (1996) semantics of plurals. The basic ingredients of her analysis are the distributivity operator that takes a cover argument, a decompositional analysis of activity and accomplishment predicates, and a domain-adjusting import of *all*. We will describe these ingredients in turn.

The distributive operator is defined in (17). The presence of the distributivity operator is optional and can be triggered by a plural DP (cf. Kratzer, 2002). The covers are thereby defined mereologically as in (18), whereby Y is usually taken to be the domain of individuals.

(17) $[\![\text{Dist}]\!]^g = \lambda C_{\langle e,t\rangle}.\lambda P_{\langle e,\langle v,t\rangle\rangle}.\lambda x_e.\lambda e_v.\ \forall z[z \leq x \wedge C(z) \rightarrow \exists e' \leq e[P(e',z)]]$

(18) C is a cover of Y iff
a. $\forall x \in C[x \leq \Sigma Y]$
b. $\forall y \in Y \exists x \in C[y \leq x]$

Following the basic insight of the generalization in (16) and the preceding work in the aspect literature (Dowty, 1979; Mittwoch, 1982), Brisson adopts a decompositional analysis of collective predicates. Thereby, activity and accomplishment predicates consist of a VP-internal activity head DO and an overt lexical subcomponent which is in the case of accomplishments a stative predicate. When it comes to state and achievement predicates, we will simplify Brisson's treatment and assume that they do not share the complex structure of activities/accomplishments. These syntactic assumptions are illustrated on *build a boat* (accomplishment) and *elect a president* (achievement):

(19) a. $[_{VP}$ DO $[_{VP}$ build a boat$]]$
b. $[_{VP}$ elect a president$]$

(20) $[\![\text{DO}]\!]^g = \lambda x_e.\lambda e_v.\ \text{ag}(e,x) \wedge \text{do}(e)$

With activity and accomplishment predicates, the distributivity operator can be adjoined either to the complex VP or to the activity head DO, as it is shown in (21). With achievements and states, there is only one attachment possibility, leading only to a strictly distributive reading; this results in a clash if a collective predicates is distributed over atomic individuals. Finally, to interpret the structures in (21), Brisson adopts the principle of Event Composition, which is a variation of Event Identification (Kratzer, 1996). It is defined in (22) (for more details and some issues, cf. Brisson, 1998).

(21) a. $[_{VP}$ [Dist Cov] $[_{VP}$ DO $[_{VP}$ build a boat]]]
b. $[_{VP}$ [[Dist Cov] DO] $[_{VP}$ build a boat]]

(22) For any tree of the form A = [[(Dist Cov) DO] VP], it holds

$$[\![\mathrm{A}]\!]^g = \lambda x.\lambda e.\ [\![\mathrm{VP}]\!]^g(e) \wedge \exists e' \leq e[[\![(\mathrm{Dist\ Cov})\ \mathrm{DO}]\!]^g(e',x)]$$

The computation of the meanings of the structures given in (21) is given in (23). In (23-a), we have a tentatively distributive interpretation of the predicate according to which each part of the individual argument that is in the cover has to be an agent of building a boat event. In (23-b), we have a tentatively collective interpretation according to which each part of the individual argument that is in the cover has to be an agent of some activity sub-event of building a boat event.

(23) a. $[\![$[Dist Cov][DO build a boat]$]\!]^g$ = λx.λe. for every part of x that is in the cover holds: x built a boat in some sub-event of e

b. $[\![$[[[Dist Cov] DO] build a boat]$]\!]^g$ = λx.λe. e is a building of a boat and for every part of x that is in the cover holds: there is a sub-event of the event e in which it is an agent

3.3 The Meaning of *all*

The main idea behind Brisson's characterization of the meaning of *all* is that it constrains what the cover argument of the distributivity operator can be. This is articulated by using the notion of ill- and good-fitting covers. Although Brisson characterizes the notion of a good fit relative to an individual (24), it can be naturally characterized also relative to a set of individuals (25).

(24) **Good fit wrt individuals** (gf_{ind})
For any cover of the universe of discourse *C* and any plurality *x*, *C* is a good fit with respect to *x* iff $\forall y[y \leq x \rightarrow \forall z[C(z) \wedge y \leq z \rightarrow z \leq x]]$
[$\approx$ *C* is a good fit with respect to *x* iff no part of *x* is lumped with a non-*x*-part in *C*]

(25) **Good fit wrt predicates** (gf_{pred})
For any cover of the universe of discourse *C* and any set of individuals *P*, *C* is a good fit with respect to *P* iff $\forall y[y \leq \Sigma P \rightarrow \forall z[Cov(z) \wedge y \leq z \rightarrow z \leq \Sigma P]]$
[$\approx$ *C* is a good fit with respect to *P* iff no *P* is lumped with a non-*P* in *C*]

All conditions the cover to be a good-fit with respect to its sister argument. Although Brisson does not discuss this in detail, the good-fit constraint can be encoded as an indexical presupposition (Kai von Fintel, p.c.). These presuppositions tend to project past plugs, which seems to be the case with the good-fit requirement.

(26) $[\![\mathrm{all}]\!]^g = \lambda Cov.\lambda x{:}\ gf_{ind}(Cov,x).\ x$

In cases where *all* occurs with a collective state/achievement predicate (27), the (good-fitting) distributivity tends to result in markedness: if the cover contains at least some (relevant) atomic students, as it is usually the case, the sentence results in an infelicitous meaning (individual students cannot be teams). The situation is different with collective activity/accomplishment predicates (28) where adjunction of Dist to the activity head—and thus a purely collective reading—is possible: even if the distribution is to atomic individuals, the sentence does not entail that more than one boat was built.

(27) $[\![$[All Cov_1] [the students] [Dist Cov_1] make a good team$]\!]^g$ = 1 iff $\exists e \forall x[x \leq \mathrm{the.students} \wedge C(x) \rightarrow \exists e' \leq e[\mathrm{good.team}(e',x)]]$, defined only if gf_{ind}(C, the.students)

(28) $[\![$[All Cov_1] [the students] [[Dist Cov_1] DO] built a boat$]\!]^g$ = 1 iff $\exists e[\mathrm{build.a.boat}(e) \wedge$

$\forall$x[x$\leq$the.students $\wedge$ C(x) $\rightarrow$ $\exists$e'$\leq$e[ag(e',x) $\wedge$ do(e')]]], defined only if gf_{ind}(C, the.students)

The characterization of good-fitting covers (24) leaves the option open that the cover contains solely (non-trivial) non-atomic parts of the individual argument of *all*, i.e. that the distribution is not to atomic elements. As Brisson notes, this prediction is borne out. Namely, the sentence in (29) can felicitously describe a situation in which each school grade elected a president, i.e., the distribution is not to atomic students but to collections of students. However, such readings are harder to obtain and require an appropriate context.

(29) a. All the students elected a president.
b. [All Cov_1] [the students] [Dist Cov_1] elected a president
c. g(Cov_1) = {first.graders, second.graders,..., eighth.graders}
d. $\exists$e$\forall$x[x$\leq$the.students $\wedge$ g(Cov_1)(x) $\rightarrow$ $\exists$e'$\leq$e[elect.a.president(e',x)]]

4 Collectivity Contrast: Distributivity and Indefinites

This section presents a generalization of Brisson's treatment of *all* to existentially interpreted indefinites. The main idea is that the semantic contribution of indefinite quantifiers involves imposing a restriction on the cover and consequently necessitating the presence of a distributivity operator somewhere in the syntactic representation. The section consists of two parts: the first part provides some motivation for having (indefinite) quantifiers impose a restriction on the cover and thus force distributivity, while the second part presents an analysis of simple and complex plural indefinites. If indefinite quantifiers are inherently distributive, the collectivity asymmetry observed with counting quantifiers follows immediately. Moreover, the extension of Brisson's account also qualifies the asymmetry: the contrast disappears in appropriate contexts.

4.1 An Initial Motivation for Distributivity

All the standard characterizations of sentences containing counting existential quantifiers assume that they have a meaning along the lines of (30) where P is the denotation of the NP and Q is the denotation of the VP.

(30) a. Seven NP did VP
b. $\exists$e$\exists$x[P(x) $\wedge$ Q(e,x) $\wedge$ μ(x)$\geq$7]

Clearly, if the main predicate of the sentence is strictly distributive, e.g. *jump in the lake*, Q in the representation in (b) will contain a distributivity operator Dist. If no restriction is imposed on the cover argument of this operator, it can easily be ill-fitting with respect to the verifying instances of the sentence. However, if the cover is ill-fitting and we have a representation given in (31), where Q' is roughly Q without the distributivity operator, the sentence of the form *seven NP did VP* could describe situations in which just six P did Q. This is incorrect. That is, if no restriction on the cover is imposed with plural existential quantifiers, the predicted truth-conditions are too weak.

(31) $\exists$e$\exists$x[P(x) $\wedge$ $\forall$x'[x'$\leq$x $\wedge$ Cov(x') $\rightarrow$ $\exists$e'$\leq$e[Q'(e',x')]] $\wedge$ μ(x)$\geq$7]

An imposition of a good-fit restriction on the cover is necessary to alleviate this problem. Although it is not immediately clear where the good-fit requirement comes from, the contrast between the definites and indefinites indicates that it is likely due to the presence of the (indefinite) quantifier. Accordingly, we will encode it as a presupposition of the existential quantifier and take it to necessitate the insertion of a distributivity operator on economy grounds.

4.2 Simple and Complex Plural Indefinites

The main ingredient underlying our analysis is the following: indefinite quantifiers are inherently distributive, i.e. a distributivity operator has to be adjoined somewhere in the scope of the indefinite quantifier. As we have seen in Brisson's treatment of *all*, there are different positions for the adjunction of Dist with different classes of collective predicates. In particular, besides to the complex VP, Dist can also adjoin to the predicative activity head in the case of activities and accomplishments, while such adjunction position is not available with collective achievement and state predicates.

The decompositional treatment of plural indefinites like *many NP* and *several NP* that we are adopting takes these expressions to contain an existential quantifier. Now, assuming that indefinite plural expressions constrain the cover argument, the restriction should happen with respect to the domain of quantification of the existential quantifier. Accordingly, we will encode the good-fit restriction on the cover as a presupposition on the nominal argument of the quantifier (32-b).

(32) a. $[_{DP}$ [∃ Cov] $[_{NP}$ [d many] students]]
b. $[\![\exists]\!]^g = \lambda Cov.\lambda P$: $gf_{pred}(Cov,P).\lambda Q.\lambda e.\ \exists x[P(x) \wedge Q(e,x)]$
c. $gf_{pred}(Cov,P) = 1$ iff $\forall y[y \leq \Sigma P \rightarrow \forall z[Cov(z) \wedge y \leq z \rightarrow z \leq \Sigma P]]$

As it was indicated above, the adjunction of the distributivity operator is usually optional. However, whenever a condition is imposed on the cover, it becomes necessary – otherwise the restriction on the cover would be without semantic bite and thus redundant on economy grounds (Brisson, 1998, 2003). Sentences with counting quantifiers and collective main predicates, which exhibited a pattern that paralleled the data with *all*-phrases, can now receive the same explanation. The sentence in (33-a) has a sensible interpretation only if the cover variable is assigned a value along the lines of (33-e). In that cover there are no atomic students but only appropriate sums of students. If such a cover is not contextually given, the default cover is assigned to the cover variable and the sentence receives an unusual interpretation – each student elected his own president. Therefore, the above analysis derives both the oddness of sentences like (33-a) in the default case, as well as the correct prediction that these sentences are in certain contexts felicitous. We have noted above that the latter fact was problematic for Hackl's resolution of the collectivity contrast.

(33) a. Many students elected a president.
b. [[∃ Cov] [[POS many] students] [Dist Cov] elect a president
c. $[\![(33\text{-b})]\!]^g = 1$ iff $\exists e \exists x[students(x) \wedge \forall x'[x' \leq x \wedge C(x') \rightarrow \exists e' \leq e[elect.a.president(e',x')]] \wedge \mu(x) \geq d_c]$
d. $[\![(33\text{-b})]\!]^g$ is defined only if $\forall y[y \leq \Sigma\big(students \cap \{x \mid \mu(x) \geq d_c\}\big) \rightarrow \forall z[Cov(z) \wedge y \leq z \rightarrow z \leq \Sigma\big(students \cap \{x \mid \mu(x) \geq d_c\}\big)]]$
e. $g(Cov) = \{x \mid \exists n[x$ is the plurality of n^{th} graders$]\}$

(34) If the cover does not lump any student with non-students, $[\![(33\text{-b})]\!]^g = 1$ iff there is a sum of students that consists of many individuals, and the different grades comprised of these individuals each elected a president

The felicity of combining counting expressions containing collective nouns and essentially plural predicates—activity and accomplishment predicates—which proved to be problematic for Hackl's account (10), does not pose any difficulties to the analysis propounded here. We take collective nouns to denote sets of sums of regular individuals and not *sui generis* individuals, as Hackl and Winter do. Accordingly, we can say that the description of the sums as *teams* predisposes the cover to contain sums of individuals that correspond to teams. This is similar to Schwarzschild's example *The cows and the pigs filled the barn to capacity* where a particular description of the individuals influences the content of the cover. The derivation of the two possible readings proceeds from the structures of the form given in (35).

(35) a. Many teams built a boat.
b. [∃ Cov [POS many] teams] [Dist Cov] [DO build a boat]
c. [∃ Cov [POS many] teams] [[[Dist Cov] DO] build a boat]

(36) If the cover does not lump any teams with non-teams, $[\![(35\text{-c})]\!]^g = 1$ iff there is a sum of teams that contains many teams, and this sum built a boat together

Complex plural indefinites are derived from simple indefinites, in particular *many NP* (32-b), and accordingly contain an existential quantifier. Since it is this quantifier that imposes a condition on the cover and necessitates the presence of the distributive operator, distributivity expectedly occurs also in the interpretation of the sentences containing complex plural indefinites. We illustrate this by deriving a collective reading of *build a boat* (37), where Dist is generated on the activity head: the structure of the sentence is in (b), while in (c) we compute its truth-conditions.

(37) a. More than three students built a boat.
b. [er than three] λd [[$\exists$ Cov] [d many] students] [[Dist Cov] DO] build a boat
c. $\max\{$d | $\exists$e.$\exists$x[students(x) $\wedge$ build.a.boat(e) $\wedge$ $\forall$x'[x'$\leq$x $\wedge$ g(Cov)(x') $\rightarrow$ $\exists$e'$\leq$e[ag(e',x') $\wedge$ do(e')]] $\wedge$ μ(x)$\geq$d]$\} > 3$

5 Genericity Contrast: Adverbial Quantification and Indefinites

This section deals with the genericity contrast, i.e., the contrast between (3) and (4): collective achievement and state predicates are compatible on purely collective readings with all types of counting quantifiers in adverbial quantification environments. This is explained by recognizing that the expressions at hand are indefinites. As such they are bound by adverbs of quantification and not the distributivity-inducing existential quantifier.

5.1 Indefinites in a Bound Variable Approach to Adverbial Quantification

It is well-known that in adverbial quantification constructions indefinites can be bound by adverbial quantifiers and interpreted in their restrictors. The analysis that we adopt treats adverbs of quantification as unselective binders (cf. Heim, 1982: and many others). Furthermore, as with VPs, the semantic content of an indefinite prior to an existential or generic interpretation is a property with an appropriately saturated event argument position. The nominals by themselves take both an event and an individual argument. In (38-a), we have the meaning of an indefinite prior to the saturation of the event argument and the insertion of a covert existential operator. In the case of adverbial quantification constructions, the individual and the event argument are bound by adverbial operators that have meanings along the lines of (38-b).

(38) a. $[\![$a green-eyed dog$]\!]^g$ = λe.λx. dog(x) $\wedge$ in(e,x)
b. $[\![$usually$]\!]^g$ = λQ.λP. MOST$_{x,e}$[P(x,e)][Q(e,x)]

The meaning of the sentence in (39) is in (40). The LF of (39), given in (40-a), reflects the tripartite semantics: the adverbial quantifier takes as its first argument a verbal property; its second argument is the semantic content of the indefinite. The sentence states that most of the relevant individual-event pairs where the individual is a dog and is in the event are such that they are pairs in which the individual barks in the event. This corresponds to the the paraphrase in (39).

(39) A green-eyed dog is usually intelligent.
[$\approx$ When a dog is green-eyed, it is usually intelligent]

(40) a. [a green-eyed dog] usually [DO barks]
b. MOST$_{x,e}$ $\left[\lambda\text{e. } \lambda\text{x. green.eyed.dog(x)} \wedge \text{in(e,x)}\right]$ $\left[\lambda\text{x.}\lambda\text{e. ag(e,x)} \wedge \text{bark(e)}\right]$

5.2 Deriving the Genericity Contrast

An example of a sentence with an adverb of quantification in which a counting quantifier is the subject of a collective state predicate is given in (41), where it is accompanied by a paraphrase.

(41) More than three students usually make a good team.
[$\approx$ When something is more than three students, then that something is usually a good team]

The denotation of (41) is given in (42): as we have illustrated in the preceding subsection, the individual and event variables of the indefinite are bound by the adverb of quantification. All the components of the indefinite are interpreted in the restrictor of the quantifier, while the VP is interpreted in the nuclear scope. The meaning of the sentence is that most individual–event pairs where the individual is more than three students and is in the event are such that the individual is a good team in that event.

(42) $[\![[\lambda e\ \lambda x\ \text{[er than three]}\ \lambda d\ x\ e\ \text{[d many students]][be a good team]}]\!]^g = 1$ iff
$\text{MOST}_{x,e}\big[\lambda e.\lambda x.\ [\max(\{d \mid \text{students}(x) \wedge \mu(x) \geq d \wedge \text{in}(e,x)\}) > 3]\big]\ \big[\lambda x.\lambda e.\ \text{good.team}(e,x)\big]$

It is clear that the existential quantifier does not occur in the representations at hand and, consequently, the distributivity requirement is not necessitated by it, i.e., an insertion of Dist is optional.

6 Referentiality Contrast: Referential Interpretation of Indefinites

The markedness of *Twenty-four students elected a president*, which has been reported by our consultants, follows from the fact that simple number indefinites share the structural and semantic properties of other plural indefinites: they involve existential quantification that forces an effective presence of Dist. This also holds for cases where the indefinite is interpreted referentially, i.e., where the restrictor of the quantifier is a singleton set (Schwarzschild, 2002). The judgments in Hackl and Winter are incompatible with this analysis. However, if a choice-functional approach to referentiality of indefinites is adopted (Reinhart, 1997; Kratzer, 1998), a different prediction is made:

(43) A counting expression is compatible with a purely collective reading of collective achievement and state predicates iff it can be interpreted referentially

Namely, according to the choice-functional approach, the sentence *Twenty-four students elected a class president* can have the representations generated in (44). The representation in (b) does not lead to an infelicitous interpretation – this is sketched in (45).

(44) a. [[$\exists$ Cov] [24 students]] [Dist Cov] [elect a president]
b. [f [24 students]] [elect a president]

(45) $[\![$(44-b)$]\!]$ = 1 iff the specific collection of 24 students picked out by the choice function elected a president

Analogous representations are not available for modified number indefinites: they resist wide-scope and thus choice-functional readings (cf. Beghelli and Stowell, 1997; Takahashi, 2006: and others). The same has been claimed to hold also for vague number indefinites like *many NP*, *several NP* and plural *SOME NP* (cf. Zamparelli, 2000). This would explain the facts reported by Hackl/Winter: the unavailability of referential (choice-function) readings for modified numerals is responsible for their inability to combine with episodic collective state/achievement predicates.

To conclude: whatever turns out to be the case empirically, the adoption of our proposal gives us a way to adjudicate between two different approaches to specific indefinites, since they make incompatible predictions with respect to the referentiality contrast.

7 Conclusion and Further Research

This paper presented an account of the collectivity and the genericity contrast that can be observed when combining counting quantifiers with collective predicates. It also presented two explanations for two sets of judgments concerning the referentiality contrast. The account was crucially based on the idea that counting quantifiers decompose into an indefinite determiner, a gradable modifier and a noun phrase.

All the contrasts follow from some property of the indefinite determiner. The collectivity contrast was derived by incorporating a notion of distributivity into the characterization of the determiner and by appropriately characterizing the lexical semantics of the predicates involved. The genericity contrast was shown to follow from the general behavior of indefinites in adverbial quantification constructions. Finally, the referentiality contrast was shown to be able to provide some insight into the discussion of referential readings of indefinites.

There are several issues and extensions that require further exploration. First: The distributivity of the indefinite determiner is somewhat stipulative. Although we relate it to the good-fit requirement of existential quantification, further functional explanations should be investigated. Second: We have adopted a bound variable approach to adverbial quantification. Although an analogous explanation should be available in a situation-based approach, this has to be worked out. Third: The syntactic analysis of distinct types of collective predicates that we have adopted from Brisson was crucial for our account of the collectivity contrast. Further motivation for it is necessary.

References

Beghelli, Filippo, and Tim Stowell. 1997. *The Syntax of Each and Every*, 71–107. Springer.

Brisson, Christine. 1998. Distributivity, Maximality, and Floating Quantifiers. Doctoral Dissertation, Rutgers University.

Brisson, Christine. 2003. Plurals, all, and the nonuniformity of collective predication. *Linguistics and Philosophy* 26:129–184.

Dowty, David. 1979. *Word Meaning and Montague grammar*, volume 7. Dordrecht, The Netherlands: Kluwer Academic Publishers.

Dowty, David. 1986. Collective predicates, distributive predicates and emphall. In *Proceedings of the Eastern States Conference on Linguistics, ESCOL3*.

Hackl, Martin. 2000. Comparative Quantifiers. Doctoral Dissertation, Massachusetts Institute of Technology. URL
`http://www.linguistics.pomona.edu/mhackl/NThesis5.pdf`.

Hackl, Martin. 2002. The ingredients of essentially plural predicates. In *Proceedings of NELS*, volume 32, 171–182.

Hackl, Martin. 2009. On the grammar and processing of proportional quantifiers: *most* versus *more than half*. *Natural Language Semantics* 17:63–98.

Heim, Irene. 1982. The semantics of definite and indefinite noun phrases. *Electronic Doctoral Dissertations for UMass Amherst* .

Kratzer, Angelika. 1996. Severing the external argument from its verb. In *Phrase Structure and the Lexicon*, ed. Johan Rooryck and Laurie Zaring, 109–137. Dordrecht, The Netherlands: Kluwer Academic Publishers.

Kratzer, Angelika. 1998. Scope or pseudoscope? Are there wide-scope indefinites? *Events in Grammar* 163–196.

Kratzer, Angelika. 2002. The event argument and the semantics of verbs. Technical report, UMass, Amherst. URL `http://semanticsarchive. net/Archive/GU1NWM4Z`.

Landman, Fred. 1989. Groups, 1. *Linguistics and Philosophy* 12:559–605.

Mittwoch, Anita. 1982. On the difference between *eating* and *eating something*: activites versus accomplishments. *Linguistic Inquiry* 13:113–122.

Nakanishi, Kimiko, and Maribel Romero. 2004. Two constructions with *most* and their semantic properties. In *The Proceedings of the 34th Conference of the North East Linguistic Society (NELS 34)*, 453–468.

Reinhart, Tanya. 1997. Quantifier scope: How labor is divided between QR and choice functions. *Linguistics and Philosophy* 20:335–397.

Rett, Jessica. 2008. Degree Modification in Natural Language. Doctoral Dissertation, Rutgers.

Schwarzschild, Roger. 1996. *Pluralities*. Dordrecht ; Boston: Kluwer Academic.

Schwarzschild, Roger. 2002. Singleton indefinites. *Journal of Semantics* 19:289–314. URL `http://jos.oxfordjournals.org/cgi/content/abstract/19/3/289`.

Schwarzschild, Roger. 2006. The role of dimensions in the syntax of noun phrases. *Syntax* 9:67–110.

Takahashi, Shoichi. 2006. Decompositionality and Identity. Doctoral Dissertation, Massachusetts Institute of Technology.

Taub, Anita. 1989. Collective predicates, aktionsarten and *all*. In *Papers on Quantification*, ed. Emmon Bach, Angelika Kratzer, and Barbara Partee. University of Massachusetts at Amherst.

Winter, Yoad. 2001. *Flexibility Principles in Boolean Semantics*. MIT Press.

Zamparelli, Roberto. 2000. *Layers in the Determiner Phrase*. Routledge.