

# Plural Quantifiers Inversely Linked

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## Abstract

Inverse Linking constructions display an asymmetric requirement of “number concord” that can be summarized as follows: if the inversely linked quantifier is plural the host NP has to be plural as well. This paper argues that under suitable assumptions Beck’s proposal in [2] for definite plural DP-arguments of nouns can be extended to quantificational plural DPs in Inverse Linking constructions. The paper argues furthermore that a number of apparent exceptions to the generalizations can be explained through independently motivated constraints on movement and pluralization.

## 1 Introduction

Inverse Linking constructions such as the ones in (1) from [8] are complex DPs, where a quantificational DP (the inversely linked QP or  $QP_{IL}$ ) is embedded inside at least one other DP (the host DP or  $DP_H$ ), while taking semantic scope over  $DP_H$  and potentially binding a bound variable pronoun in the matrix.

- (1) a. Some people from every walk of life like jazz.
- b. Some houses near all of the nuclear power plants in New Mexico will be contaminated within five minutes of meltdown.
- c. Somebody from every city despises it.

The literature on Inverse Linking focuses primarily on two closely related questions: 1. How can the apparent conflict between surface scope and semantic scope be resolved within a general theory of quantifier scope ([8], [9], [6], [4], [1], etc.)? 2. How can we allow for variable binding while maintaining the basic tenets of Binding Theory ([10], [3], etc.)? Pivotal in these debates is whether  $QP_{IL}$  is allowed to vacate  $QP_H$  with the trading off exceptional movement and variable binding against standard denotations for  $QP_{IL}$ . This paper aims to contribute to this debate by examining little studied interactions between the determiners of  $DP_H$  and  $QP_{IL}$  as they reveal themselves through a phenomenon that will be called “number concord.”

## 2 Asymmetric Number Concord in Inverse Linking

The data in (1)a and b from [8] indicate implicitly an unexpected interaction between the number marking of  $QP_{IL}$  and  $DP_H$  that can be summarized as in (2).

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- (2) Asymmetric Number Concord in IL  
For any  $DP_H$  containing a quantifier  $QP_{IL}$ , if  $QP_{IL}$  is plural marked inverse scope over  $DP_H$  is possible for  $QP_{IL}$  only if the  $DP_H$  is plural as well.

The data in (3), (4) and (5) provide initial support for the generalization in (2).<sup>1</sup> All the examples involve a definite  $DP_H$  *the mayor(s) of* with either a morphologically singular  $QP_{IL}$  or its plural counterpart. The a- and the c-examples receive standard IL interpretations, the b-examples, where a plural quantifier is embedded in a singular host DP, are, instead, pragmatically awkward: they suggest that there is a unique individual that is the mayor of all/at least two/no cities that were hit by the wildfires. This indicates that the IL interpretation for  $QP_{IL}$  is not available.

- (3) a. The mayor of every city that was hit by wildfires asked for assistance.  
b. #The mayor of all the cities that were hit by wildfires asked for assistance.  
c. The mayors of all the cities that were hit by wildfires asked for assistance.
- (4) a. The mayor of more than one city that was hit by wildfires asked for assistance.  
b. #The mayor of at least two cities that were hit by wildfires asked for assistance.  
c. The mayors of at least two cities that were hit by wildfires asked for assistance.
- (5) a. The mayor of no city that was hit by wildfires asked for assistance.  
b. #The mayor of no cities that were hit by wildfires asked for assistance.  
c. The mayors of no cities that were hit by wildfires asked for assistance.

This contrast can be replicated with a singular indefinite  $DP_H$  versus a bare plural  $DP_H$  as the triplets in (6), (7) and (8) show.<sup>2</sup>

- (6) a. A representative of every city that was hit by wildfires asked for assistance.  
b. #A representative of all the cities that were hit by wildfires asked for assistance.  
c. Representatives of all the cities that were hit by wildfires asked for assistance.
- (7) a. A representative of more than one city hit by wildfires asked for assistance.  
b. #A representative of at least two cities hit by wildfires asked for assistance.  
c. Representatives of at least two cities hit by wildfires asked for assistance.
- (8) a. A representative of no city that was hit by wildfires asked for assistance.  
b. #A representative of no cities that were hit by wildfires asked for assistance.  
c. (?) Representatives of no cities that were hit by wildfires asked for assistance.

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<sup>1</sup> Because of space limitations the paper focuses almost exclusively on IL-constructions with  $QP_{IL}$  being the internal argument of the noun of  $DP_H$ . Cases where  $QP_{IL}$  is inside a PP modifier of  $DP_H$  are neglected. While the data are for the most part comparable, it does seem to be the case that  $QP_{IL,S}$  inside PP-adjuncts are subject to somewhat weaker constraints, which make them in general more natural but also less reliable as the sharpness of contrasts fades more quickly. Quite generally, it appears that the sensitivity of native speakers for the relevant contrasts discussed in this paper fades relatively quickly not unlike in the case of WCO -this parallelism suggests a connection that will have to be left for further research.

<sup>2</sup> (8)a is marginal to begin with, however the added awkwardness in b is still clearly felt.

Interestingly the effect of number concord goes only in one direction. If  $DP_H$  is plural, there is no general requirement for  $QP_{IL}$  to be plural as well. Incidentally, plural marking on  $DP_H$  affects the interpretation of the IL-construction so that it is implicated (possibly even presupposed) that the cities under consideration have a plurality of representatives/mayors. This is different from the cases where  $QP_{IL}$  is plural as well.

- (9) a. (The) representatives of every city that was hit by wildfires asked for assistance.  
 b. (The) representatives of more than one city hit by wildfires asked for assistance.  
 c. (The) representatives of no city that was hit by wildfires asked for assistance.  
 d. #The mayors of every/more than one/no city hit by wildfires asked for assistance.

### 3. Extending Beck's Account to IL


[2] provides an analysis of closely related constructions such as in (11), where a definite plural DP (or proper name conjunction) occupies the internal argument position of a relational noun. This noun, in turn, is the argument of the  $**$ -operator, defined in (10) (cf. [5], [15], [11], [2]). This operator pluralizes the relation described by *daughter of* to yield appropriately weak truth-conditions involving at least one daughter per defense player, but no daughter that is a daughter of all the defense players, a reading which is excluded for pragmatic reasons.

- (10) For any function  $R$  of type  $\langle e, et \rangle$  and individuals  $x, y$  in  $D$ ,  
 $**R(x)(y)=1$  iff  $R(x)(y)=1$  or  $\exists x_1, x_2, y_1, y_2 [x_1+x_2=x \ \& \ y_1+y_2=y \ \& \ **R(x_1)(y_1)=1 \ \& \ **R(x_2)(y_2)=1]$

- (11)a. Reinier compared the daughters of the defense players (Greg and Norm).  
 b. \*Reinier compared the daughter of the baseball players (Greg and Norm).

Together with the stipulation that nominal predicates and relations need to be morphologically plural to be able to range over/relate pluralities, [2] derives the fact that *daughter of* needs to be plural marked in cases like (11).

This account can be extended to plural  $QP_{IL}$ s, under the assumption that plural QPs quantify over pluralities. The most transparent execution of this extension assumes that a plural  $QP_{IL}$  vacates its base position to resolve the type mismatch generated by a QP in object position, takes scope over  $DP_H$  and leaves behind a trace that is interpreted as variable ranging over pluralities (similar to definite plural DPs).<sup>3</sup>

- (12)a.  $[[\text{All the cities } x] [\text{the } **\text{mayors of the cities } x]_{DP}]_{DP}$  asked for assistance.
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<sup>3</sup> (12) assumes that  $QP_{IL}$  is adjoined to  $DP_H$  along the lines of [9], [6] and [4] which requires a higher type for  $QP_{IL}$  namely  $\langle ee, ett \rangle$  as sketched in **Error! Reference source not found.** or  $\langle \langle e, ett \rangle, ett \rangle$ . Cf. [3] for a variant of this proposal in which the compositional machinery is enriched to be able to deal with QPs that are adjoined to DPs or QPs and [1] for more radical revision of the compositional machinery to allow for  $QP_{IL}$  to stay inside  $DP_H$ .

- b.  $[[\text{all the cities}]](f_{ee})(g_{et}) = 1$  iff for all cities  $x$ ,  $g(f(x)) = 1$

### 3.1 Bare Numeral and Quantificational $DP_H$ s and *Every*

The proposal sketched above predicts that any plural  $DP_H$  should be able to host any plural  $QP_{IL}$  while a singular  $DP_H$  shouldn't. This expectation is not borne out as the data in (13) to (15) show.<sup>4,5</sup>

- (13)a. Four residents of three cities hit by wildfires lost their houses.  
 b. #Four residents of exactly/more than/at least three cities lost their houses.  
 c. #Four residents of (almost) all the cities hit by wildfires lost their houses.<sup>6</sup>  
 d. Four residents of (almost) every city hit by wildfires lost their houses.
- (14)a. Exactly/at least/more than four residents of three cities lost their houses.  
 b. #Exactly/at least/more than four residents of exactly/more than/at least three cities lost their houses.  
 c. #Exactly/at least/more than four residents of (almost) all the cities that were hit by wildfires lost their houses.  
 d. Exactly/at least/more than four residents of (almost) every city that was hit by wildfires lost their houses.
- (15)a. Every resident of three cities hit by wildfires lost his house.  
 b. Every resident of exactly/more than/at least three cities lost his house.  
 c. Every resident of (almost) all the cities hit by wildfires lost his house.  
 d. Every resident of (almost) every city hit by wildfires lost his house.

These data suggest that there are unexpected gaps in the availability of IL with plural quantifiers. More specifically, modified numeral  $QP_{IL}$  and *all the*  $QP_{IL}$  seem to not be able to take inverse scope over bare numeral or plural quantificational DP while bare numeral  $QP_{IL}$ s can. Secondly, *every* QPs seem to be exceptionally tolerant in both positions: they can take inverse scope over any  $QP_H$  as well as host any  $QP_{IL}$ . The facts above together with the data in (3) to (9) suggest that definite, indefinite determiners and *every* form a natural class modulo number concord wrt. Inverse Linking. This is not expected under the proposal developed above.

### 3.2 Inverse Linking as Adjunction to NP

In this section a modification of the previous proposal is sketched that is in the spirit of proposals in [12] [16] and [7']. It is assumed that definite and indefinite determiners as

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<sup>4</sup> Since the *\*\**-operator is independently motivated in the derivation of cumulative readings [13], [5],[15], etc. a more cautious expectation would be that the availability of IL between a plural  $QP_{IL}$  inside a quantificational host DP correlates with the availability of a cumulative reading between the two quantifiers. However even this more restrictive prediction is not borne out in general.

<sup>5</sup> Proportional quantifiers in IL like *most residents of most cities* give rise to a number of intricate complications and will be left for future research.

<sup>6</sup> Almost prevents a collective reading that is at least marginally available for *all the MLB teams*.

well as bare numerals can be analyzed as NP modifiers in conjunction with choice function analysis of quantificational force in these constructions cf. [16]. With this much in place, Inverse Linking can be re-analyzed as NP-adjunction rather than DP-adjunction as sketched below.

- (16)a.  $\exists f \text{ CH}(f) \ \& \ [f \ [ \text{All the cities } x ]_{\text{DP}} \ [ \text{the **mayors of the cities } x ]_{\text{NP}} ]_{\text{DP}}$  asked for assistance.
- b.  $[[\text{all the cities}]](f_{\text{set}}) = \lambda y. \text{ for all cities } x, f(x)(y) = 1$
- c.  $[[\text{the mayors of the cities } x]] = \lambda y. y = \max z \text{ st. **mayor of (the cities } x)(z) = 1$

Note that the definite plural determiner is treated as NP modifier that makes sure that *the mayors of the cities x* denotes a singleton set containing the biggest plurality of individuals that stands in the cumulative *mayor of* relation with *the cities x*. This extension is passed on by the inversely linked quantifier *all the cities* so that leaving the existentially closed choice function only one choice: the biggest plurality *y* such that for all cities *x* there is a mayor in *y*. The indefinite cases can be treated analogously however there is no uniqueness condition on the extension of *representative of the cities x*.

Assuming that true quantificational determiners like *modified numerals* project a DP layer on top of the NP more or less in the traditional sense following again [16] an explanation for the data in (13) to (15) can be given in terms of a constraint on movement while maintaining the basic insight in [2] that cumulation plays an essential role. Since it is natural to assume that  $\text{QP}_{\text{IL}}$  cannot be moved out of a DP – independent support for this assumption comes from the so called specificity constraint on extraction out of NP –  $\text{QP}_{\text{IL}}$  cannot take scope over quantificational determiners.

An account of the tolerance of *every* in Inverse Linking constructions within this set of ideas would have to analyze *every* as NP modifier as well so that  $\text{QP}_{\text{IL}}$  can take inverse scope. Interestingly a recent proposal in [12] decomposes *every* into a definite determiner and a “part-quantifier.” Future work has to reveal whether this proposal can be suitably adopted to fit the proposal sketched here.

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