

**Distributivity across domains: A study of the
distributive numerals in Bangla**

by

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Submitted to the Department of Linguistics and Philosophy
in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

at the

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

September 2018

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September 7, 2018

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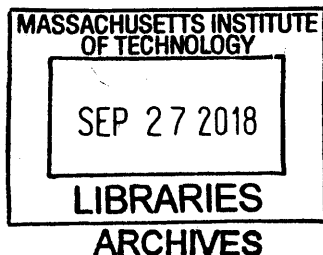
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Abstract

In this thesis, studying the numeral indefinites in Bangla, I argue that distributive numerals are not distributivity operators themselves. The distributive numerals introduce a plurality of discourse referents, and they require that this plurality of discourse referents must enter into a formal relationship with the plurality of individuals introduced by another discourse referent. This formal requirement is known as dependency. Conventionally the phenomenon is called covariation. A distributivity operator is such that it allows this formal relationship to hold in its scope. I argue that examples involving ditransitives provide clear evidence for such an analysis. Apart from this, I discuss that the different forms of numerals have an additional restriction about encoding specificity effects. I show that the requirement of specificity and the requirement of covariation interact with each other in the scope of a distributivity operator. This interaction is encoded morphologically by differentiating between simple and complex forms of distributive numerals. The proposal is implemented by using Dynamic Plural Logic. Finally I show that the particular formalization can be extended to account for the difference between adnominal distributive numerals and adverbial (which I call ‘pluractional’) distributive numerals. To analyze the adnominal and adverbial distributive numerals I propose to differentiate between distributivity in the domain of individuals and distributivity in the domain of events.

Thesis Supervisor: Roger Schwarzschild

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Acknowledgments

It is a pleasure to realize that this is (hopefully) the last thing I write to fulfill the requirements of grad-school. The grad-school came to an end with me learning to write things that I couldn't even dare to read before, (read, actually didn't even know existed) and well also learning a lot of Latex in the process. I guess these are substantial achievements, therefore I need to thank everybody that helped me arrive at this point.

Without Roger Schwarzschild, this thesis would not exist. I am grateful that he took the pains to help me read and understand the works that I needed to read for this research and much more. I wouldn't learn to do detailed analytical thinking without Roger teaching me to do so. I thank Sabine Iatridou from whom I learned a lot over the years and who actually motivated this research by drawing my attention to the fact that I do not get certain readings with numerals. The thesis got written to the extent that it did because of Kai von Fintel. I thank Kai for helping me conceptualize clearly and organize my thoughts, and for giving me practical advice over the years.

Discussions with Maribel Romero, Jeremy Kuhn, Lucas Champollion, Rahul Balusu, Ashwini Deo and Priyanka Biswas helped me understand the topic better. I thank them for their comments.

I thank everybody who patiently gave me judgments on the very tricky sentences that I needed to study for this research.

I want to thank Irene Heim, particularly for that one accidental conversation on the subway, at a time when I felt bewildered by Dynamic Semantics papers. Irene told me these were papers that she found hard to understand (probably a different use of 'understand'). I felt a lot less worried after that.

I thank all of the professors at MIT because they taught me a lot and I thank all the graduate students I met during my years at MIT.

I particularly thank my dear friends Ömer Demirok and Sophie Moracchini, whose constant companionship and love helped me finish this work. I thank all of my office mates, especially Christopher Baron for boosting my morale on a regular basis. I

thank Erin Olson particularly for teaching me Latex. I thank Maša Močnik for being very encouraging and for the discussions on semantics. Without Despina Oikonomu, Isa Bayirli and Benjamin Storme, I wouldn't survive the prolonged grad-school experience. I am glad to have known them. I thank all of my cohort-mates in Ling-12, especially Juliet Stanton, who inspired me a lot to do better. I thank the class of Ling-15 whom I TA-ed for. I learned a lot from them during recitations. It was good to have Diti Bhadra and Syed Saurov around for the final year in Cambridge.

Needless to say, I thank Tanmoy Bhattacharya, Ayesha Kidwai and Utpal Lahiri, from whom I learned linguistics and continue to do so.

I thank Mary Grenham for being encouragement personified. I thank Jen Purdy for practical advising and support, and I thank Matt Sikorski for being very helpful and friendly.

I thank all of my non-linguist friends at Cambridge, especially Julia Bishop, who has almost been family to me. I want to thank A. Sadeqi, who inspired me to work in a more disciplined fashion.

I thank my dearest friends back home, Asmita Chaudhuri and Subhasree Chatterjee for their continuous support since forever.

I am glad Anumitra exists, as she saw me through everything in the last six years.

Ma kept me reminding from time to time during this work, that nobody wanted to know the meaning of *du-To-du-To-kore*. I am glad she did so; it kept me grounded.

Most of all I want to thank my brother Arup, without whose support, I wouldn't be able to finish grad school.

Finally I want to express my love for Ragu and Moku, for being my constant companions, each single day I spent in Cambridge.

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Chapter 1

Introduction

1.1 Various readings of numeral indefinites

In English, two indefinite plural arguments of a transitive predicate, can either be interpreted cumulatively or collectively with respect to each other, or one of them can be interpreted to be referentially dependent on the other. The referentially dependent interpretation involves analyzing the plurality that is dependent to be in the distributive scope of the plurality on which it is dependent.

(1) Two girls read three books.

The sentence (1) has a cumulative reading when there were two girls and there were three books in total. Each girl read at least one book and each book was read by at least one girl, and in total two girls read books and three books were read by the girls. In this reading, each of the two girls may not have read all three of the books.

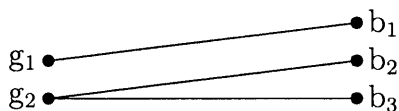


Figure 1-1: Cumulative situation

There is a special subcase of the cumulative reading in which both of the girls read each of the three books. Since there were only three books, each of the books also

ended up being read by both of the girls. Let us call this special case the *cumulative₂* reading.

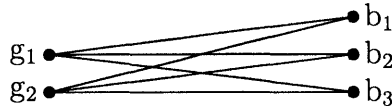


Figure 1-2: Cumulative₂ situation

One can imagine situations in which the cumulative₂ reading is implausible. Consider (2), (3) and (4).

- (2) Two girls ate three apples.
- (3) Two musicians from Cambridge got married to two musicians from Medford.
- (4) Two chess players won three games.

In a situation where there were two girls and three apples, if one of the girls ate one of the apples, then that apple cannot be eaten again. Thus sentence (2) cannot plausibly be true in a situation where both of the girls ate each of the three apples. Similarly, in a society following monogamous rules of marriage, if one musician from Cambridge got married to one musician from Medford, then as long as that marriage is on, the second musician from Cambridge cannot get married to the same musician from Medford. Therefore, at a given point of time the cumulative₂ reading is implausible for (3). Once a chess player has won a game, the same game cannot be won by anybody else, making the cumulative₂ reading implausible for (4).

The cumulative₂ reading is significantly different from a distributive reading. Consider (5) again.

- (5) Two girls read three books. (= (1))

Sentence (5) can be interpreted to have a distributive reading where each of the girls read three books, but each of the books was not read by each of the girls. This reading is analyzed to arise when the object indefinite is in the distributive scope of

the subject indefinite.

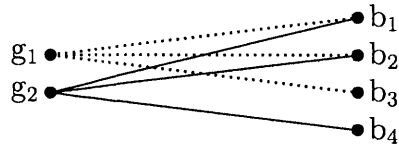


Figure 1-3: Distributive situation

The converse distributive scenario would be when each of the books were read by two girls, but each of the girls did not read three books. This reading analyzed to arise when the subject indefinite is in the distributive scope of the object indefinite.

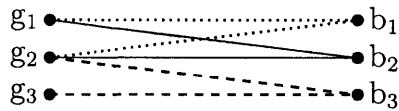


Figure 1-4: Cumulative₂ situation

The cumulative₂ reading of (5)(=(1)), can be paraphrased as there were two girls, each of whom read three books. But at the same time the reading can be paraphrased as each of the books were read by three girls.

In a distributive reading, the surface scope of indefinites does not entail the inverse scope of indefinites. However, in the cumulative₂ reading the surface scope relations seem to entail the inverse scope relations. Thus the following situation would satisfy a distributive reading of the sentence but it would not meet a cumulative₂ one. Thus these two kinds of readings require different analyses.

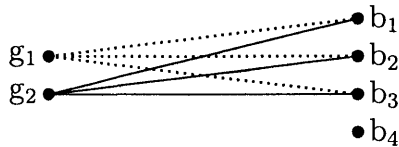


Figure 1-5: Distributive situation

Apart from the readings discussed above, sentence (5) is true of three kinds of situations where the indefinite is collectively interpreted.

First, a group of two girls read a group of three books. Second, each of the girls read the group of three books. Third, the group of two girls read each of the three

books. There is a question about whether these readings correspond to different structural analyses or not. We will refrain from these details.

1.2 The view from Bangla

Bangla encodes one of these various readings we discussed above by a class of morphologically marked numerals, and helps us understand the difference between these readings in further detail.¹

1.2.1 Plain and distributive numerals in Bangla

Bare cardinal numerals in Bangla consist of a numeral classifier construction.

- (6) Ritu [pāc-Ta-boi] poRe-chilo
Ritu five-cl-book read.pfv-be.PAST.3
'Ritu read five books.'

The bare numerals come in two kinds of morphological forms: simple and complex. I would call the simple form as instantiated by (6) a 'plain numeral' and the complex form a 'distributive numeral'.

When a plain numeral is accompanied by a higher plural noun phrase, there are two kinds of situations that the sentence holds true of: the cumulative and the collective.

- (7) [du-jon-mee] [tin-Te-boi] poRe-chilo
two-cl-girl three-cl-book read.pfv-be.PAST.3
'Two girls read three books.'

The sentence (7) is true of a situation where each of the two girls read at least one book and they read three books in total. This is a *cumulative* situation.

¹Bangla is certainly not unique in this feature, as can be observed in Gil (1982) and subsequent works, to mention a few: Farkas (1997) for Hungarian, Balusu (2005) for Telugu, Henderson (2014) for Kaqchikel, Cable (2014) for Tlingit, Kuhn (2017) for ASL, among others.

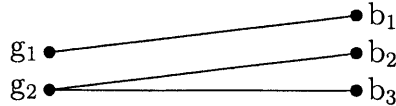


Figure 1-6: Cumulative situation

The sentence is also true of the special subcase of a cumulative scenario where two girls each read three books, but these were the same three books. This is a *cumulative₂* situation.

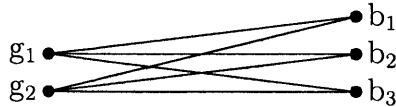


Figure 1-7: Cumulative₂ situation

Consider a *distributive* situation where there were five books and there were two girls who read them. One of the girls read *book₁*, *book₂* and *book₃*. The other girl read *book₁*, *book₄* and *book₅*.

Sentence (7) is not true of this scenario.

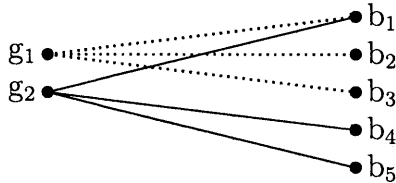


Figure 1-8: Distributive situation

A DISTRIBUTIVE numeral is only suitable for a distributive situation. So, if in (7) a distributive numeral were used as the direct object, as in (8), (9) and (10), which instantiate different morphological forms of distributive numerals in Bangla, the sentence would be true of the *distributive* scenario described above (in Figure 1-8), where each of the girls read three books.

- (8) [du-jon-mee] [tin-Te-kore-boi] poRe-chilo
 two-cl-girl three-cl-do.pfv-book read.pfv-be.PAST.3
 ‘Two girls read three books each.’

- (9) [du-jon-mee] [tin-Te-tin-Te-boi] poRe-chilo
 two-cl-girl three-cl-three-cl-book read.pfv-be.PAST.3
 ‘Two girls read three books each.’
- (10) [du-jon-mee] [tin-Te-tin-Te-kore-boi] poRe-chilo
 two-cl-girl three-cl-three-cl-do.pfv-book read.pfv-be.PAST.3
 ‘Two girls read three books each.’

The sentences (8), (9) and (10) would *not* be true of a cumulative situation (as in Figure 1-6) where each of the two girls read at least one book and each may not have read all three books, but together they read three books in total.

This cumulative situation (in Figure 1-6) can be exclusively expressed by the sentence (11).

- (11) [du-jon-mee] mil-e [moT tin-Te-boi] poRe-chilo
 two-cl-girl mix-pfv total three-cl-book read.pfv-be.PAST.3
 ‘Two girls between them read a total of three/ books.’

The sentences (8), (9), (10) would *not* be true of the *cumulative₂* situation (as in Figure 1-7) either, where each girl read the same three books.

Thus English and Bangla diverge in terms of the interpretations of the plain cardinal numeral. The plain numerals in English can be used in a cumulative, a cumulative₂ and a distributive situation. But the plain numerals in Bangla are not suited for distributive situations. The distributive numerals are reserved for distributive situations. Thus languages with distributive numerals morphologically encode the distinction between two kinds of cumulative situations we have discussed and the distributive situation.

The sentences discussed above contain an indefinite plural as the subject. We observe similar effects if the subject were a definite plural or a universal quantifier.

Sentence (12) is true of a situation with exactly three books and not more than three books. It is true of a cumulative situation where each of the girls read at least one book but may not have read all three, as long as in total three books were read by the girls.

- (12) [mee-ra] [tin-Te-boi] poRe-chilo
 girl-pl three-cl-book read.pfv-be.PAST.3
 ‘The girls read three books.’

It (12) is also true of the cumulative₂ situation where there were exactly three books and each of the girls read those three books.

But the sentences (13), (14) and (15) are not true of a situation containing exactly three books.

- (13) [mee-ra] [tin-Te-kore-boi] poRe-chilo
 girl-pl three-cl-do.pfv-book read.pfv-be.PAST.3
 ‘The girls read three books each.’

- (14) [mee-ra] [tin-Te-tin-Te-boi] poRe-chilo
 girl-pl three-cl-three-cl-book read.pfv-be.PAST.3
 ‘The girls read three books each.’

- (15) [mee-ra] [tin-Te-tin-Te-kore-boi] poRe-chilo
 girl-pl three-cl-three-cl-do.pfv-book read.pfv-be.PAST.3
 ‘The girls read three books each.’

Now consider a distributive situation (as in Figure 1-9) where there were seven books and there were three girls who read them. One of the girls read *book*₁, *book*₂ and *book*₃. Another girl read *book*₅, *book*₆ and *book*₇. The third girl read *book*₁, *book*₂ and *book*₄.

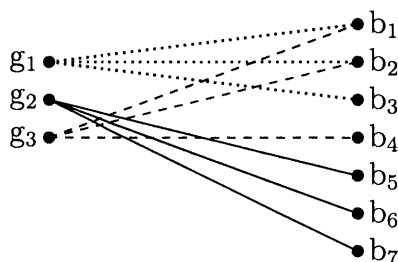


Figure 1-9: Distributive situation

The sentence (12) is not true of this scenario (Figure 1-9). But the sentences (13), (14) and (15) are true of this scenario.

What is interesting is that (16) with a distributive quantifier as subject and a

plain numeral direct object is not exactly perfect to describe this situation. The ‘?’ indicates that (16) would not be a true description of the situation in Figure 1-9. But the corresponding sentences with distributive numerals (17), (18) and (19) are true.

- (16) ?[prottek-Ti-mee-i] [tin-Te-boi] poRe-chilo
 each.one-cl-girl-I three-cl-book read.pfv-be.PAST.3
 ‘Each girl read three books.’
- (17) [prottek-Ti-mee-i] [tin-Te-kore-boi] poRe-chilo
 each.one-cl-girl-I three-cl-do.pfv-book read.pfv-be.PAST.3
 ‘Each girl read three books each.’
- (18) [prottek-Ti-mee-i] [tin-Te-tin-Te-boi] poRe-chilo
 each.one-cl-girl-I three-cl-three-cl.-book read.pfv-be.PAST.3
 ‘Each girl read three books each.’
- (19) [prottek-Ti-mee-i] [tin-Te-tin-Te-kore-boi] poRe-chilo
 each.one-cl-girl-I three-cl-three-cl-do.pfv-book read.pfv-be.PAST.3
 ‘Each girl read three books each.’

The sentence (16) would be true of a situation with exactly three books. For example, the speaker can continue the utterance by naming three books, as in (20). This looks like a cumulative₂ situation, as illustrated by Figure 1-10.

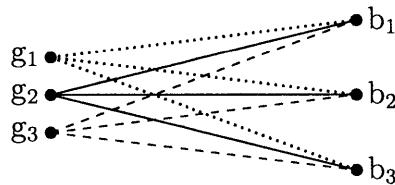


Figure 1-10: Cumulative₂ situation

- (20) [prottek-Ti-mee-i] [tin-Te-boi] poRe-chilo, book₁, book₂ ar
 each.one-cl-girl-I three-cl-book read.pfv-be.PAST.3, book₁, book₂ and
 book₃
 book₃
 ‘Each girl read three books, namely, book₁, book₂ and book₃.’

The indefinites like the one in (20) has been discussed under the phenomenon of Speaker Oriented Specificity. Speaker oriented specificity indicates that the hearer of

(20) was not familiar with the identity of the books, even though the speaker was. This in turn says that the books were not part of the common ground when (20) was uttered.

Plain numerals can also be used in contexts where the speaker is not aware of the complete identity of the books, but is aware of their exact number. In this case too (16) would not be a true description of the situation in Figure 1-9.

Importantly (16) or (20) are not true of a cumulative situation where each of the girls read at least one book but may not have read three. The distributive universal quantifier requires the sentence to be true in a situation where each girl read three books. But as we have seen from the discussion above, the plain numeral *tin-Te-boi* wants to be true of a situation where there are exactly three books. Thus (16) or (20) can only be true in what we have so far called, a cumulative₂ scenario. But the lack of cumulative interpretation already demands that we do not treat the cumulative₂ situation as a variant of the regular cumulative situation. Let us therefore, rename it as a *distributive₂* situation.

As expected from the description above, (17), (18) and (19) are not true of this distributive₂ situation with exactly three books. The discussion has revealed that the distributive numerals of the form *tin-Te-kore-boi*, *tin-Te-tin-Te-boi* or *tin-Te-tin-Te-kore-boi* are only usable in situations where there are more than three books.

If this is the correct description of the state of affairs then we predict that the following sentences would be odd irrespective of contexts, as they cannot be true in distributive₂ situations. These are indeed less than perfect ways of expressing the state of affairs.

(21) ?[prottek-Ti-mee-I] [tin-Te-apel] khee-chilo
 each.one-cl-girl-I three-cl.-book eat.pfv-be.PAST.3
 ‘Each girl ate three apples.’

(22) ?[prottek-dabaRu-I] [tin-Te-khæla] jite-chilo
 each.one-chess.player-I three-cl-game win.pfv-be.PAST.3
 ‘Each chess player won three games.’

A further confirmation of the observations come from the fact that the sentences (7),

(12) or (16) with the plain numeral *tin-Te-boi* can be continued with (23), which refers to the entities mentioned by the plain numeral by the maximal definite (Dayal, 2012, 2014) version of the plain numeral: *boi-tin-Te* ‘the three books’.

(23) *boi-tin-Te amar khub priyo*
book-three-cl I.GEN very favorite
(Intended) ‘I like those three books a lot.’

But continuing the sentences with the distributive numerals above, with (23) sounds like a contradiction.

Thus in the examples where a plain numeral is in the scope of a universal quantifier, the numerals are preferably interpreted to have a distributive₂ interpretation. The distributive interpretation that is associated with the distributive numerals is available but that is dispreferred. Thus the point of this discussion is to highlight the difference between distributive numerals and the plain numerals. For that purpose I will ignore the fact that plain numerals can have a distributive interpretation like the distributive numerals, and will simplify the data to only bring out the difference between the two kinds of numerals.

1.2.2 Scope of the universal quantifier

It is curious that a universal quantifier in the subject position does not make (20) perfect in a situation with more than three books. In English a universal quantifier does have that effect. Thus the sentences in (24) are true of a situation with three or more books.

- (24) a. Every girl read three books.
b. Each girl read three books.

This is the basis of the observation that a distributive quantifier usually introduces what is called ‘a covarying interpretation’ of an indefinite in its scope. Here the phrase ‘covarying interpretation’ refers to the distributive situations discussed above, but crucially, not the distributive₂ situation.

In light of the discussion of the difference between the English and Bangla bare cardinal numerals, it is expected that an English cardinal numeral would be true in a distributive scenario, but a Bangla plain cardinal numeral would not be true (or they would be dispreferred), as the distributive numerals in Bangla are particularly suited for covarying interpretation. A distributive universal quantifier at the subject position does not make any difference to that distinction between the bare numerals in the two languages.

The fact that a plain cardinal numeral in the scope of a distributive universal quantifier like *prottek* in Bangla does not induce a covarying interpretation of the numeral is puzzling. It shows that the distributive readings under universal quantifiers are not just the effect of the scope of the quantifier. For a language like Bangla, one could conjecture based on this description that the universal quantifier does not have scope over the numeral, plain or distributive, in the direct object position.

Theoretically a universal quantifier that does not take scope over a verb phrase would be quite perplexing. The universal quantifiers cannot be interpreted *in-situ*. For example, distributive universal quantifiers like *each* usually cannot be interpreted like cumulative or collective plurals.²

The quantifier *prottek* in Bangla in the direct object positions of transitive sentences with or without a classifier³ does not cumulatively interact with subject plurals.

- (25) tin-jon-šompadok prottek-Ta-bhul dhore-chilo
 three-cl-editor each.one-cl-mistake catch.pfv-be.PAST.3
 ‘Three editors caught each mistake.’

For (25) to be true each mistake must have been caught by three editors, either individually or as a group.

²However, Thomas and Sudo (2016) reported examples like (i) where *each* is interpreted cumulatively.:

- (i) Two farmers sold each sheep to one customer.

For (i) to be true each sheep is not required to be sold by both of the farmers.

³Biswas (2016) observes that *prottek* without classifier does not allow inverse scope readings of a numeral in its scope, but *prottek-Ta* with the classifier does allow inverse scope of the numeral.

- (26) tin-jon-oddhapok prottek-chatro-ke fon kore-chilo
 three-cl-professor each.one-student-ACC phone do.pfv-be.PAST.3
 ‘Three professors called each student.’

For (26) to be true, each students must have been called by three professors individually or as a group.

However, the main objection to an entry for an *in-situ* interpretation of a quantifier like *prottek* comes from the effect it has on its scope. Universal quantifiers like *every* or *each*, in subject position, are incompatible with strictly collective predicates in their scope. These restrictions motivate a scoped analysis of these universal quantifiers. The quantifier *prottek* in Bangla too imposes similar restrictions on the interpretation of the verb phrase. In (27) *prottek* is infelicitous in the subject position of a collective predicate.

- (27) #[prottek-Ti-mee-i] [gach-Ta-r car-paš-e gol hoe
 each.one-cl.-girl-I tree-cl-GEN four-side-LOC circle be.pfv
 daRie-chilo]
 stand.pfv-be.PAST.3
 ‘Each girl was standing around the tree in a circle.’

In the same vein, as discussed above, a sentence like (28) is not true in a situation that is cumulative but not distributive₂. On similar grounds the sentences (21) and (22) were odd.

- (28) [prottek-Ti-mee-I] [tin-Te-boi] poRe-chilo
 each.one-cl.-girl-I three-cl.-book read.pfv-be.PAST.3
 ‘Each girl read three books.’

In other words, *prottek* disallows cumulative interpretations of plurals in its scope. But it allows distributive₂ interpretations in its scope.

The plain numeral can have a cumulative interpretation and a distributive₂ interpretation. The distributive numeral can only have the distributive interpretation. We have seen that addressing this issue in terms of the scope of the universal quantifier would not suffice, as in the scope of the universal quantifier that the meaning contri-

butions of the two kinds of bare cardinal numerals diverge. Therefore, we must have a way to tell apart the distributive readings and the distributive₂ readings involving numerals. The present work explores this difference and proposes an analysis that can account for the facts discussed above.

1.3 Kaqchikel Dependent Indefinites (Henderson 2014)

Henderson (2014) observed similar issues regarding scopal interactions of simple and dependent indefinites in the Mayan language Kaqchikel. Henderson noticed that while both simple and dependent indefinites can have covarying (distributive) interpretations when placed under the scope of the universal quantifiers, only dependent indefinites have covarying interpretations with pluractionals.

With a universal quantifier subject, the simple indefinite in Kaqchikel can give rise to a covarying interpretation or a specific indefinite interpretation (29). But a dependent indefinite with a universal quantifier can only give rise to a covarying interpretation (30).

- (29) K-onojel x-∅-ki-kano-j jun wuj
 E3p-all CP-A3s-E3p-search-SS one book
 ‘All of them looked for a book (and at least two books were looked for).’
 ‘There is a book and all of them looked for it.’

- (30) K-onojel x-∅-ki-kano-j ju-jun wuj
 E3p-all CP-A3s-E3p-search-SS one-RED book
 ‘All of them looked for a book (and at least two books were looked for).’
 *‘There is a book and all of them looked for it.’

However, with a pluractional the simple indefinite cannot give rise to the covarying interpretation (32), but a dependent indefinite can (33).

- (31) x-∅-in-kano-j jun wuj
 CP-A3s-E1s-search-SS one book
 ‘I looked for a book.’
- (32) x-∅-in-kan-ala’ jun wuj
 CP-A3s-E1s-search-SS one book
 ‘I looked for a book(in various locations or at various times).’
 False if there is only one looking-for-event.
 False if there is more than one book.
- (33) x-∅-in-kan-ala’ ju-jun wuj
 CP-A3s-E1s-search-SS one-RED book
 ‘I looked for a book(in each location or at each time).’
 False if there is only one looking-for-event.
 False if there is only one book looked for.

The conclusion Henderson draws is that the covarying interpretation of the dependent indefinite cannot be attributed to the indefinite taking narrow scope under a distributive quantifier. If that were the case, the covarying interpretation of the indefinite in (33) would be attributed to the indefinite taking narrow scope under the pluractional. But in that case we would expect that the simple indefinite takes narrow scope under the pluractional too. But we see that the simple indefinite does not give rise to covarying interpretations (32).

Henderson proposed that the covarying interpretations associated with the dependent indefinites in Kaqchikel are a result of the indefinites having a post-suppositional cardinality constraint called ‘evaluation plurality’, which mandate plural discourse reference for the variable they bind. The simple indefinites on the other hand are evaluation singular although they do not have any post-supposition attached to their evaluation cardinality.

To analyze the difference between the specific or exact reading of the plain numerals and covarying reading of the distributive numerals, I propose an analysis that essentially follows the proposal in Henderson (2014). However, in this work, I dis-

cuss ditransitive sentences involving three plurals and show that Henderson’s proposal needs fine-tuning. These complex examples essentially provide further evidence for an analysis like Henderson’s, that distributive numerals are not distributivity operators themselves, but they have a meaning component that can be licensed in the scope of a distributivity operator. Moreover, in order to encode specificity on plain numerals, I define a constraint that also helps us capture examples with three plurals where we observe the distributive numeral may not covary with every c-commanding plurality in a sentence.

1.4 Organization of chapters

Chapter 2 provides a brief background on the plurals in Bangla based on the works of Dayal (2012, 2014) and Biswas (2016). It also introduces the basic of distributive numerals in Bangla.

Chapter 3 discusses the licensing conditions of the adnominal distributive numerals in Bangla. The discussion in the chapter shows that adnominal distributive numerals require a syntactically c-commanding plurality in the same clause. I also show that the distributive numerals are compatible with distribution over salient non-atomic cover of pluralities. The chapter also discusses the requirement of plural discourse reference associated with the distributive numerals, that yields the covarying reading.

Chapter 4 provides the empirical background for not analyzing distributive numerals as distributivity operators themselves by looking at ditransitive constructions in Bangla in detail. I argue that lack of covariation does not necessarily entail lack of distributivity. By discussing ditransitive examples that preclude cumulative interpretations for plain numeral indirect objects in examples when the direct object is a distributive numeral distributing over the members of the subject plurality, I argue that the scope of distributivity extends beyond the distributive numerals. I also lay out informally the formal analysis proposed in chapter 5.

Chapter 5 lays out the analysis of distributive numerals in a version of Dynamic Plural Logic van den Berg (1996), following the works of Brasoveanu (2013) and Henderson (2014) and Kuhn (2017). In the analysis proposed here, the plain numerals with specificity or exact reading are analyzed to have a not-at-issue component of meaning that is encoded as the constraint $\text{SAME}(i)_i$. The covarying reading associated with distributive numerals is encoded in terms of the not-at-issue constraint $\text{DIFFERENT}(j)_i$. The specific interpretation of distributive numerals is encoded in terms of the not-at-issue component of meaning $\text{SAME}(j)_i$. The not-at-issue constraint $\text{DIFFERENT}(j)_i$ can only be satisfied in the scope of a distributivity operator, which reflects the discussion and conclusion in chapter 4.

Chapter 6 briefly discusses the adverbial distributive numerals to highlight their difference from the adnominal distributive numerals. The chapter also sketches how the analysis of adnominal distributive numerals proposed in chapter 5 can be extended to account for the adverbial distributive numerals.

Chapter 7 concludes the work and talks about its future extensions.

Chapter 2

Background on Bangla

This chapter provides a background on the plurals in Bangla and intriduces the basics of distributive numerals.

2.1 Plurals in Bangla

Bangla uses classifiers to form nominal cardinality constructions for mass and count nouns alike. The noun in Bangla does not bear any number marking. Instead, there are two general classifiers: *-Ta* and *-gulo*. Among these two general classifiers, the noun phrases with numerals can only contain *-Ta* in them.

- (1) a. æk-**Ta**-mee b. du-**To**-mee c. tin-**Te**-mee
 one-cl-girl two-cl-girl three-cl-girl
 ‘one girl’ ‘two girls’ ‘three girls’

The bare nominals in Bangla are number neutral. In general, a *-Ta* marked nominal has strictly singular reference and a *-gulo* marked nominal has strictly plural reference.

- (2) a. mee-**Ta**
 girl-cl
 ‘the girl’ b. boi-**Ta**
 book-cl
 ‘the book’

- (3) a. mee-**gulo**
 girl-cl
 ‘the girls’
- b. boi-**gulo**
 book-cl
 ‘the books’

There is a general plural marker *-ra* in the language, which is restricted to animate plural nouns. But a *-ra* marked nominal can also refer to animate kinds.

- (4) a. bacca-**ra** khelche
 kid-pl play.PROG.be.PRES.3
 ‘The kids are playing.’
- b. pakhi-**ra** oRe
 bird-pl fly.PRES.3
 ‘The birds fly.’

In the next few sections, I lay out the meanings of the different kinds of plurals basing on Dayal (2012, 2014) and Biswas (2016).

2.1.1 Bare nominals

Dayal (2012, 2014) argues that a bare nominal in Bangla is a kind term. A kind-referring bare noun can be the subject of a kind predicate (5) or of a characterizing predicate (6).

- (5) gɔnDar šighroi bilupto hoe jabe
 rhino soon extinct be.pfv go.FUT.3
 ‘Rhinos will soon be extinct.’
- (6) bharot-e gɔnDar thake ašam-er jɔngol-e
 India-LOC rhino stay.PRES.3 Assam-GEN jungle-LOC
 ‘In India, rhinos are found in the forests of Assam.’

The bare nominals can receive weak indefinite interpretations in episodic sentences. In object positions they always take scope under negation (7).

- (7) ami gach kinini
 I plant buy.PRES.1.NEG
 ‘I didnt buy plants.’

Moreover, Biswas (2016) observes that partitive or non-partitive strong indefinite readings are not available for the bare nominals, and they also cannot take intermediate scope (8). Example (8) has the reading that each person wrote multiple essays.

- (8) prottek-e šob-kɔTa-bišɔe-r opor rɔcɔna likeheche
 each.one-agentive.case all-MANY-topic-GEN on essay write.pfv-be.PRES.3
 ‘Everybody wrote essays on all the topics.’

Un-case-marked bare nominals in the object position can have singular or plural reference (Biswas, 2016). In (9) the definite plural *hāš-gulo* ‘the ducks’ in the second sentence picks up on the plural reference introduced by the bare nominal *hāš* ‘duck’ in the first sentence. Importantly, the bare nominal in these examples are objects of a telic predicate. This shows that the number neutrality is not a derivative of iterativity contributed by the predicate (see relevant discussion in Dayal (2011) on Hindi bare nominals).

- (9) ami pukur-dhar-e hāš dekhe-chi. hāš-gulo poka
 I pond-edge-LOC duck see.pfv-be.PRES.1, duck-cl_{pl} worm
 kha-cchilo
 have.PROG-be.PAST.3
 ‘I saw ducks by the pond. They were eating worms.’

In (10) the singular definite *šap-Ta* ‘the snake’, is anaphoric to the singular reference introduced by the bare noun *šap* ‘snake’.

- (10) ami pukur-dhar-e šap dekhechi. šap-Ta jɔl-e
 I pond-edge-LOC snake see.pfv-be.PRES.3, snake-cl_{sg} water-LOC
 neme ja-cchilo
 descend.pfv go.PROG-be.PAST.3
 ‘I saw a snake by the pond. The snake was crawling into the water.’

The following sentences show that number neutrality is not limited to object of transitive predicates. The bare nominal in the first sentences in (11) and (12) is the object of an unaccusative verb.

- (11) *jɔŋgɔl-e* *bagħ berie-che.* *bagħ-Ta* *nɔro-khadok hote*
 jungle-LOC tiger come-out.pfv-be.PRES.3. tiger-cl_{sg} man-eater be.impv
 pare
 can.PRES.3
 ‘There is a tiger on the prowl in the jungle. The tiger may be a man-eater.’
- (12) *jɔŋgɔl-e* *bagħ berie-che.* *bagħ-gulo nodi perie*
 jungle-LOC tiger come-out.pfv-be.PRES.3. tiger-cl_{pl} river cross.pfv
 eše-che
 come.pfv-be.PRES.3
 ‘There are tigers on the prowl in the jungle. The tigers have arrived by
 crossing the river.’

Biswas (2016) argued that the bare nouns in Bangla can also have a singular definite interpretation. The referent of the bare noun in this case is unique. The speaker and the hearer can identify the individual based on the property referred to by the bare nominal. Interestingly, analogous reference to plural individuals is not possible by the bare nominal. The plural equivalent of these examples is indicated by the *-ra* marked plural as discussed below in section 2.1.3.

The take home point in this section is: the denotation of a bare nominal contains both singularities, i.e., atomic individuals, and pluralities, i.e., non-atomic individuals.

- (13) If the domain of individuals D contains three atomic individuals a , b and c that are in the extension of the predicate GIRL, then the denotation of the bare nominal *mee* ‘girl’ is the subset of D containing atomic individuals a , b and c and all the non-atomic individuals obtained by applying the operation of sum formation on the atomic individuals a , b and c .
- a. $\llbracket mee \rrbracket = \{a, b, c, a \oplus b, b \oplus c, a \oplus c, a \oplus b \oplus c\}$

2.1.2 Indefinite plurals

Cardinality phrases in Bangla are formed by combining the indefinite determiner with the nominal predicate that has been modified by the classifier *-Ta* (14).

- (14) tin-Te-mee
 three-cl-girl
 ‘three girls’

In the analysis of Dayal (2012, 2014), the classifier *-Ta* is a function from the domain of kinds to sets of object-level atomic individuals. Numerals in the view taken up in Dayal’s work, are predicate modifiers. They always combine with atomic predicates. This is why a numeral must combine with a nominal predicate modified with *-Ta*. Thus a numeral takes a set of atoms and yields a set of individuals, each of which can be partitioned into sets of the specified cardinality.

- (15) $\llbracket \text{tin-Te-mee} \rrbracket = \lambda x. \exists Y_{et} [\Pi(Y)(x) \wedge |Y| = 3 \wedge \forall y \in Y [girl(y) \wedge AT(y)]]$
 ... the set of x such that there exists a Y that is the partition (Π) of x and the cardinality of Y is 3 and all y in Y is a girl atom

The meaning (15) of the cardinality phrase (14) is predicative. Dayal (2012) proposes that a numeral (determiner) in Bangla is ambiguous between a predicative meaning and a quantificational meaning. The quantificational meaning is required to capture the strong indefinite readings of the numeral indefinites. Example (16) shows that the numeral indefinite does not have to take scope below negation. The intended reading is there is a particular plant that I did not buy.

- (16) ami æk-Ta-gach kinini
 I one-cl-plant buy.PRES.1.NEG
 ‘I didnt buy one plant.’

Example (17) has a reading in which each person wrote just one essay, that is on all the topic. It shows that the numeral indefinite does not have to scope below the quantifier *all*.

- (17) prottek-e šob-kōTa-bišōe-r opor æk-Ta-rōcona
 each.one-agentive.case all-MANY-topic-GEN on one-cl-essay
 likeheche
 write.pfv-be.PRES.3
 ‘Everybody wrote an essay on all the topics.’

Thus in the quantificational meaning (14) would involve an existential quantifier (18).

$$(18) \quad \llbracket \text{tin-Te-mee} \rrbracket = \lambda Q_{et}. \exists x [\text{girl}(x) \wedge 3(x) \wedge Q(x)]$$

2.1.3 Definite plurals

The definite plurals in Bangla are marked by the general plural classifier *-gulo*. A plural with *-gulo* only has non-atomic individuals in its denotation. Dayal (2014) defined the classifier as a function from a kind to non-atomic instantiations of the kind.

$$(19) \quad \llbracket \text{-gulo} \rrbracket = \lambda x^k. \lambda y [{}^u x(y) \wedge \neg AT(y)]$$

... the set of y such that y is an instantiation of the x kind y is non-atomic

(20) If the domain of individuals D contains three atomic individuals a , b and c that are in the extension of the predicate GIRL, then the denotation of the nominal predicate *boi* ‘book’ modified by the classifier *-gulo* is the subset of D containing the non-atomic individuals obtained by applying the operation of sum formation on the atomic individuals a , b and c .

$$a. \quad \llbracket \text{-gulo boi} \rrbracket = \{a \oplus b, b \oplus c, a \oplus c, a \oplus b \oplus c\}$$

Dayal argued that definiteness is not an inherent property of *-gulo*, but the definiteness on *-gulo*-marked plurals is derived via *iota* type-shift, which corresponds to syntactic NP-raising.

$$(21) \quad \begin{array}{l} \text{boi-gulo} \\ \text{book-cl}_{pl} \\ \text{‘the books’} \end{array}$$

Importantly maximal definite readings of indefinite plurals with *-Ta* is derived by *iota* type-shift, which again corresponds to NP-raising past the numeral in syntax (Dayal, 2012, 2014).

(22) mee tin-Te
 girl three-cl
 ‘the three girls’

(23) $\llbracket \text{mee-tin-Te} \rrbracket = \{a \oplus b \oplus c\}$
 ... if the domain of individuals D contains three atomic individuals a , b and c that are in the extension of the predicate GIRL

The indefinite plurals with *-gulo* in (24) do not have NP-raised versions.

(24) a. onek-gulo-boi
 many-cl_{pl}-book
 ‘many of the books’
 b. koto-gulo-boi
 a.few-cl_{pl}-book
 ‘a few of the books’

The definite plural denotes the maximal sum of the individuals in the extension of the predicate *boi* ‘book’.

(25) $\llbracket \text{boi-gulo} \rrbracket = \{a \oplus b \oplus c\}$

Definite plurals in Bangla are also formed by the plural marker *-ra* (26-a). But *-ra* is used to form kind terms as well, which are number-neutral (27-a).

(26) a. mee-ra eše gæ-che
 girl-pl come.pfv go.pfv-be.PRES.3
 ‘The girls have arrived.’

b. $\llbracket \text{mee-ra} \rrbracket = \{a \oplus b \oplus c\}$

(27) a. mee-ra šoktišali
 girl-pl powerful
 ‘Girls are powerful.’

b. $[[\text{mee-ra}]] = \{a, b, c, a \oplus b, b \oplus c, a \oplus c, a \oplus b \oplus c\}$

Because of its ability to form kind terms, Dayal argued that *-ra* does not include a restriction on non-atomicity in its meaning. Dayal proposed that *-ra* is a kind classifier that denotes an identity function defined only for animate kinds. In this analysis, definiteness is obtained by taking the maximal plural individual that instantiates the kind at a relevant index.

The associative use of *-ra* in (28), instantiated by examples where *-ra* forms plurals with proper names and pronouns, is analyzed as a function from individuals to sets of plural individuals that the *-ra* marked person is a part of.

(28) a. guho-ra
 Guha-pl
 ‘the Guhas’

b. am-ra/tom-ra
 I-pl/you-pl
 ‘we/ you_{pl}’

Importantly, Biswas (2016) proposed contra Dayal (2012, 2014) that *-ra* is not a classifier, but an associative plural marker that syntactically adjoins to DPs. The evidence for this proposal comes from examples that show that *-ra* can combine with conjoined DPs (29) and with degree quantifiers (30).

(29) Robi ar Ritu-ra ašbe
 Robi and Ritu-pl come-FUT.3
 a. ‘Robi and Ritu will come.’
 b. ‘Robi and Ritu and her associates will come.’
 c. ‘Robi and Ritu and their associates will come.’

(30) šob/ onek/ beširbhag chele-ra
 all/ many/ most boy-pl
 ‘all/ many/ most boys’

With this background on plurals, we will now briefly introduce the distributive numerals in the next section.

2.2 Distributive numerals

The distributive numerals in Bangla come in three morphological shapes. The distributive suffix occurs on the classifier in the numeral indefinite. The morphology is either a reduplication of the numeral-classifier string or the suffix *-kore*, or both.¹

- (31) a. du-jon-kore
two-cl-do.pfv
- b. du-jon-du-jon
two-cl-two-cl
- c. du-jon-du-jon-kore
two-cl-do.pfv

There are primarily two kinds of distributive numerals, adnominal and adverbial Gil (1982). The adnominal distributive numerals can be formed by all three of the forms in (31). The morphology appears on a bare nominal host (32). I will refer to (32-a) and (32-b) as simpler distributive numerals and (32-c) as the complex distributive numeral.

- (32) a. du-jon-kore-mee
two-cl-do.pfv
- b. du-jon-du-jon-mee
two-cl-two-cl
- c. du-jon-du-jon-kore-mee
two-cl-two-cl-do.pfv
'two girls'

The adverbial numerals are only of the most complex form (33) and they cannot appear on a bare nominal host.²

¹The distributive morphology is marked by putting it into a box.

²I mark the entire adverbial numeral in a box as it does not have a morphologically simpler

(33) du-jon-du-jon-kore
two-cl-two-cl-do.pfv

The adverbial distributive numerals follow the DP, that is their target of distribution.

(34) mee-ra du-jon-du-jon-kore
girl-pl two-cl-two-cl-do.pfv
'the girls in twos'

2.2.1 Identifying Adnominal distributive numerals

The adnominal morphology on the numerals can be characterized by the syntactic tests of coordination and movement. Here I show examples with the suffix *-kore*, but the same distribution applies to distributive numerals with reduplication and the complex forms as well.

- Coordination with another distributive numeral

(35) Mee-ra du-To-kore-boi ar tin-Te-kore-potrika kine-chilo
girl-plu two-cl-do.pfv-book and three-cl.-do.pfv-magazine buy.pfv-be.PAST.3
'The girls bought two books and three magazines each.'

- Coordination with another NP

(36) Mee-ra boi-Ta ar tin-Te-kore-potrika kine-chilo
girl-plu book-cl. and three-cl.-do.pfv-magazine read.pfv-be.PAST.3
'The girls bought the book and three magazines each.'

- Coordination and movement

(37) [du-To-kore-boi ar tin-Te-kore-potrika]-o mee-ra šokole-i
two-cl-do.pfv-book and three-cl.-do.pfv-magazine-ADD girl-pl. all-I
kinechilo
buy.pfv-be.PAST.3
'The girls all bought two books and three magazines each too.'

An interesting fact about the distributive numerals is that the suffix *-kore* is the correlate.

perfective form of the verb *kor-* ‘do’. The verb *kor-* ‘do’ forms activity predicates by incorporating properties.

- (38) a. *bagan kora*
garden do.prt
‘gardening’
- b. *bōRo kora*
big do.prt
‘bringing up’

Apart from the adnominal distributive numerals, there is a whole range of adverbial modifiers in Bangla that are formed with *-kore*. Arguably these are part of the secondary predicate formation strategy in the language, which usually uses a perfective verb form. These adverbial modifiers share at least two common properties: (a) they are sensitive to the presence of the ‘doer’ or the ‘causer’ in the verbal predication. Thus (39) with an anti-causative predicate is not compatible with a modifier formed with *-kore*; (b) they can only modify active predicates. Thus (40) shows that the adverbial modifier with *-kore* is not compatible with a stative predicate.

- (39) *phuldani-Ta du-Tukro-hoe/*kore bheje gæche*
vase-cl two-piece-be.pfv/do.pfv break.prt go.pfv.be.PRES.3
‘The vase broke into three pieces.’
- (40) *Ritu oi għor-Ta-e (*šundor-kore) ache*
Ritu that room-cl-LOC beautiful-do.pfv is
‘Ritu is in that room beautifully.’

However, the adnominal distributive numerals formed with *-kore* do not exhibit these properties. These numerals are not sensitive to the presence of the ‘doer’ or the ‘causer’ in the verbal predication. (41) shows that an adnominal distributive numeral is compatible with an anti-causative predicate.

- (41) *prottek-bar du-To-kore-phuldani bheje gæche*
each.one-time two-cl-do.pfv-vase break.prt go.pfv.be.PRES.3
‘Each time two vases broke.’

They are compatible with stative predicates.

- (42) *Tebil-gulo-r upor du-To-kore-phuldani ache*
Table-pl-GEN on two-cl-do.pfv-vase is

‘There are two vases each on the tables.’

As mentioned above, the adverbial distributive numerals cannot combine with a bare nominal host (43).

- (43) mee-ra du-jon-du-jon-kore-(**mee*) jəl-e jhāp dilo
girl-pl two-cl-two-cl-do.pfv water-LOC jump give.PAST.3
‘The girls jumped into the water in twos.’

The adnominal and the adverbial distributive numerals differ with respect to their compatibility with stative predicates. Just like the adverbs formed with *-kore* (39), (40), the adverbial distributive numerals are incompatible with stative predicates. The predicate ‘know’ is stative and (44) shows that an adverbial distributive numeral is incompatible with it.

- (44) **mee*-ra du-jon-du-jon-kore Hindi janto
girl-pl two-cl-two-cl-do.pfv Hindi know.hab.PAST.3
‘The girls knew Hindi in twos.’

Thus adnominal distributive numerals are a class of their own. In this work, I primarily focus on the semantics of adnominal distributive numerals.

2.2.2 Simpler and complex forms

The distributive numerals obligatorily give rise to a covarying interpretation with respect to a plural antecedent or licenser. The simpler and the complex forms of adnominal distributive numerals semantically differ in terms of the number of licensors they covary with.

In a sentence with two potential (syntactically c-commanding) plural licensors, the simpler forms of adnominal distributive numerals preferably are interpreted to covary with only one plural licenser. The sentence (45) can be interpreted to have the reading ‘each contestant made three particular judges listen to two songs’. This reading is compatible with a situation with a total of thirty songs. The sentence (45)

can also be interpreted to have the reading ‘fifteen contestants between them made three particular judges each listen to two songs’. This reading is compatible with a situation with a total of six songs.

- (45) ponero-jon-protijogi tin-jon-judge-ke du-To-kore-gaan
 fifteen-cl-contestant three-cl-judge-DAT two-cl-do.pfv-song
 šunie-chilo
 listen.caus.pfv-be.PAST.3
 ‘Fifteen contestants made three judges listen to two songs each.’

The sentence (46) on the other hand is preferably interpreted to have the reading where the songs covary with both the contestants and the judges. This reading is compatible with a situation with a total of ninety songs.

- (46) ponero-jon-protijogi tin-jon-judge-ke du-To-du-To-kore-gaan
 fifteen-cl-contestant three-cl-judge-DAT two-cl-two-cl-do.pfv-song
 šunie-chilo
 listen.caus.pfv-be.PAST.3
 ‘Fifteen contestants made three judges listen to two songs.’

The same distinction can be illustrated with examples with two syntactically c-commanding universal quantifiers. (47) is preferably interpreted to have the reading where each person is linked to one essay. The essays covaried with the each person but for each person, there is just one essay that is on all the topics. This is known as the intermediate reading of an indefinite. Thus the simpler forms can have intermediate readings.

- (47) prottek-e šob-kɔTa-bišœe-r opor æk-Ta-kore-rɔcona
 each.one-agentive.case all-MANY-topic-GEN on one-cl-do.pfv-essay
 likeheche
 write.pfv-be.PRES.3
 ‘Everybody wrote an essay on all the topics.’

A complex distributive numeral on the other hand, gives rise to the reading that there are more than one essay linked to each person, where each person wrote an essay on each of the topics (48).

Chapter 3

Adnominal Distributive Numerals

This chapter looks in detail the distributional patterns of adnominal distributive numerals in Bangla. I show that the antecedent of the adnominal distributive numeral must be a syntactically c-commanding plurality in the same clause. Moreover, the adnominal distributive numerals in Bangla are compatible with distribution over contextually salient covers of pluralities. I also discuss that the meaning of distributive numerals should involve a presupposition, which I have termed ‘differentness’.

3.1 Ways of looking into licensing

A licensor of a distributive item is a plurality with respect to which the indefinite covaries or has narrow scope interpretation. There are three overarching issues in the licensing of a distributive numeral. First, if the licensor of a distributive numeral needs to be an overt or covert clausemate plurality, or if a contextually salient plurality may suffice. Second, if the licensing plurality needs to be in a syntactically higher or c-commanding position with respect to the distributive numeral, or if a syntactically lower plurality may act as a licensor. Third, if the licensing plurality can only be a count plurality, with atoms of individuals in its domain or if non-count pluralities may serve as licensor. An additional dimension in the last dichotomy is whether contextually salient non-atoms or subpluralities of a count-plurality may be accessible to the distributive numeral.

Champollion (2016b) argued that all three of these issues can be subsumed under the question of atomic versus non-atomic distributivity. If a distributive numeral can distribute down to subpluralities of its licensing plurality, it can distribute over non-atomic individuals. This, according to Champollion bears on the question of whether the distributive element can be licensed by a contextually salient plurality, which is not a linguistic antecedent. Basing on Zimmermann (2002), among others, Champollion observed that cross-linguistically, distribution over contextually salient temporal or spatial domains and over conjunction of verb phrases are (largely) restricted to distributive elements that do not require a linguistic antecedent in the same clause (an example being German *jeweils*). By extension these elements can also have as their licensor a syntactically non-c-commanding plurality (eg. these can be licensed by conjunction of verb phrases).

Champollion's analysis builds into it Zimmermann's cross-linguistic generalization (Zimmermann, 2002) in (1) about distributive items.¹

- (1) All *each*-type distributive items that can also be used as determiners (like English *each*) can only distribute over individuals. This contrasts with *jeweils*-type (German) distributive items, many of which can also distribute over salient spatial or temporal domains.

Basing on cross-linguistic facts Champollion identifies two kinds of distributive items: (1) those that encode a distributivity operator like the *D* operator from Link (1987); Roberts (1987) that can only distribute down to atoms of pluralities and (2) those that encode a distributivity operator like the *Part* operator from Schwarzschild (1996) that can distribute over non-atomic covers of pluralities. The first kind of distributive items with a *D* operator in their denotation would require a syntactically c-commanding linguistic antecedent. The second kind of distributive items denoting *Part* would not require a linguistic antecedent.²

¹I do not take up the term distance-distributive from Champollion (2016b) or Zimmermann (2002).

²It must be noted that Brasoveanu (2011b) provides a classification of sentence internal and sentence external readings of the adjectives *same* and singular and plural *different*, based on the items

As Champollion (2017, p. 208) himself mentions, the import of Zimmermann’s generalization to bound-morphemes modifying determiners is unclear. These bound-morphemes cannot act like determiners themselves, so we expect distributive items bearing these to behave like *jewels*, i.e., the items should be able to distribute over contextually salient pluralities and not require a linguistic antecedent. Reduplicative morphemes in Telugu (Balusu, 2005), Tlingit (Cable, 2014), Hausa (Zimmermann, 2008) and Karitiana (Müller and Negrão, 2012) instantiate that this prediction is met. However, distributive items marked by a bound morpheme on the determiner in a large number of languages do not meet this prediction. Reduplicated indefinites in Hungarian (Farkas, 1997), Kaqchikel (Henderson, 2012, 2014) cannot distribute over contextually salient pluralities and need linguistic antecedents. Also works like Pereltsvaig (2012, for Russian) discuss that within the same language there can be different distributive items that differ in terms of their licensors. That there are different distributive strategies within the same language is discussed in works like Brasoveanu and Henderson (2009) and Brasoveanu (2011b) as well.

I show below that the distributive suffixes on numerals in Bangla behave like those in Hungarian or Kaqchikel in not being licensed by salient non-linguistic pluralities. Yet these can distribute over non-count domains and can distribute down to subpluralities, as long as the context makes the relevant cover of the licensing plurality salient. Therefore, I argue contra Champollion that ability to distribute over non-atomic covers of linguistic antecedents does not entail ability to license over non-linguistic antecedents. I show, basing on the facts from Bangla that the licensing by contextually salient pluralities is dependent on licensing by an overt clausemate plurality.

Section 3.2 lays down some basic facts about licensing of adnominal distributive numerals in Bangla; Section 3.3 goes over distribution down to subpluralities; Section

that can license the internal readings. In that work, Brasoveanu observed an implicational universal that if a language has a lexical item that can have sentence-internal readings under singular and distributive quantifiers, then that item can also have sentence-external readings. This observation strikes me as parallel to Zimmermann’s generalization, provided we assume that the determiners *each* and *every* cannot license adnominal *each* (note however Szabolcsi (2010) found this assumption is questionable).

3.4 discusses details of contextual licensing for adnominal distributive numerals.

Apart from the restrictions on the antecedent pluralities discussed above, there are further restrictions on the context about the nominal host of the distributive numerals. Section 3.5 discusses this under pragmatic licensing.

3.2 Licensing of adnominal distributive numerals

In this section I illustrate the preliminary facts about licensing an adnominal distributive numeral in Bangla using a *kore*-marked distributive numeral. The facts hold for reduplicated distributive numerals as well, unless otherwise mentioned.

3.2.1 Pluralities as licensors

A distributive numeral can be licensed by a syntactically c-commanding plurality in the same clause. The licensor can be a definite or an indefinite plural, or a quantifier that encodes plurality.

The definite plural noun phrases marked with the plural classifier *-gulo* or the plural marker *-ra* (Dayal, 2012, 2014; Biswas, 2016) can license a distributive numeral. In (2), we get the reading that each girl had two sweets. This shows that the distributivity operator associated with the distributive numeral distributes down to atoms of its plural licensor. The same holds for the maximal definite form (Dayal, 2012) of a plural plain numeral (3).

(2) *še-din mee-ra/mee-gulo du-To-kore-šōndeš khee-chilo*
that-day girl-pl/girl-cl_{pl} two-cl-do.pfv-sweet have.pfv-be.PAST.3
'That day the girls had two sweets each.'

(3) *še-din mee-du-jon du-To-kore-šōndeš khee-chilo*
that-day girl-two-cl two-cl-do.pfv-sweet have.pfv-be.PAST.3
'That day the two girls had two sweets each.'

Example (4) illustrates that an indefinite plural, a plain numeral in this case, can license a distributive numeral. Here again, by default we get the reading of distribution

down to atoms.

- (4) še-din du-jon-mee du-To-kore-šōndeš khee-chilo
that-day two-cl-girl two-cl-do.pfv-sweet have.pfv-be.PAST.3
'That day two girls had two sweets each.'

In general, the Quantifiers quantifying over a plurality can license distributive numerals, and the default reading is that of distribution down to atoms. The licensing of the distributive numerals is not sensitive to the monotonicity of the quantifier determiner. (5) shows that a distributive numeral can be licensed by the universal quantifier with the determiner *prottek-* which is monotone increasing (on its right argument). Similarly, the distributive numerals can be licensed by *bešir-bhag* 'most', *kichu* 'some/a few', *beš-kichu* 'several', *kō-ek* 'a few', *onek* 'many' and *ontoto-tin* 'at least three'.

- (5) prottek-chatro-i še-din du-To-kore-šōndeš khee-chilo
each.one-student-I that-day two-cl-do.pfv-sweet have.pfv-be.PAST.3
'That day each one of the students had two sweets.'

A distributive numeral can be licensed by a monotone decreasing quantifier determiner. (6) illustrates that with *khub kōm* 'very few'. The same holds for *kono* 'any', *khub-beši-hole-pāc/ šōrbadhik-pāc* 'at most five'.

- (6) khub-kōm-chatro-i še-din du-To-kore-šōndeš khee-chilo
very-less-student-I that-day two-cl-do.pfv-sweet have.pfv-be.PAST.3
'That day very few kids had two sweets each.'

The distributive numerals can be licensed by determiners that are neither increasing nor decreasing, as (7) illustrates with *Thik-3-* 'exactly three'. The same applies to *dui-theke-tin* 'two to three'.

- (7) Thik-3-jon-chatro-i še-din du-To-kore-šōndeš khee-chilo
exactly-three-cl-student-I that-day two-cl-do.pfv-sweet have.pfv-be.PAST.3
'That day exactly 3 kids had two sweets each.'

However, indefinite singulars cannot license distributive numerals. (8) illustrates the point with the determiner *kono-na-kono* ‘some or other’. The same holds for *æk* ‘one’ or *kono-æk* ‘some-one’.

- (8) #kono-na-kono-chatro nišcoi še-din du-To-kore-šõndeš
 some-or-some-student definitely that-day two-cl-do.pfv-sweet
 khee-chilo
 have.pfv-be.PAST.3
 ‘That day some or other student must have had two sweets each.’

The determiner *du-er-kõm* ‘less than two’ cannot felicitously license adnominal distributive numerals (9). Interestingly with *tin-er-kõm* ‘less than three’ the sentence is felicitous.

- (9) #du-er-kõm-chatro še-din du-To-kore-šõndeš khee-chilo
 two-GEN-less-student that-day two-cl-do.pfv-sweet have.pfv-be.PAST.3
 ‘That day less than two students had two sweets each.’

The determiner *æk-er-beši* ‘more than one’ can license a distributive numeral (10).

- (10) æk-er-beši-chatro še-din du-To-kore-šõndeš khee-chilo
 one-GEN-more-student that-day two-cl-do.pfv-sweet have.pfv-be.PAST.3
 ‘That day more than one student had two sweets each.’

Thus (8) and (9) show us that for quantificational licensors of distributive numerals, the requirement is that a plurality of individuals must satisfy the domain and the nuclear scope of the quantifier.

In terms of licensing of distributive numerals, groups act as singularities. Just as a singular individual cannot be the target of distribution for a distributive numeral (11), a group does not allow access to its sub-atoms for distribution (12).

- (11) #Ritu du-To-kore-šõndeš khee-chilo
 Ritu two-cl-do.pfv-sweet have.pfv-be.PAST.3
 *‘Ritu had two sweets each.’
- (12) #mee-der-dõl-Ta du-To-kore-šõndeš khee-chilo
 girl-GEN.pl-group-cl two-cl-do.pfv-sweet have.pfv-be.PAST.3

*‘The group of girls had two sweets each.’

Quantifiers over situations like *kəkhono-kəkhono* ‘sometimes’ (13), *majhe-majhe* ‘occasionally’ or *praei* ‘often’ can license adnominal distributive numerals.

- (13) Robi kəkhono-kəkhono du-To-kore-šəndeš kheto
Robi sometime-sometime two-cl-do.pfv-sweet have.hab.PAST.3
‘Sometimes Robi used to eat two sweets.’

However, universal or existential modals cannot license distributive numerals. (14) illustrates the facts with modal predicates and (15) shows that modal adverbs cannot serve as licensors.

- (14) a. #Ritu du-To-kore-šəndeš khete cae
Ritu two-cl-do.pfv-sweet have.impv want.PRES.3
#‘Ritu wants to eat two sweets each.’
- b. #Ritu du-To-kore-šəndeš khee thakte pare
Ritu two-cl-do.pfv-sweet have.pfv be.impv may.PRES.3
#‘Ritu may have eaten two sweets each.’
- (15) a. #Ritu nišcoi du-To-kore-šəndeš khee-che
Ritu definitely two-cl-do.pfv-sweet have.pfv-be.PRES.3
#‘Ritu definitely had two sweets each.’
- b. #Ritu həeto du-To-kore-šəndeš khee-che
Ritu possibly two-cl-do.pfv-sweet have.pfv-be.PRES.3
#‘Ritu possibly had two sweets each.’

Thus we have seen that only pluralities can license adnominal distributive numerals.

3.2.2 Syntactic restrictions on licensing

The distributive numerals in Bangla require their licensors to be in the same clause and the licensors must be syntactically c-commanding. Below I provide examples that

show that failure to meet these conditions blocks licensing of distributive numerals.

A distributive numeral in the subject position cannot be licensed by an indefinite plural DP in the direct object position (16).

- (16) #du-jon-kore-mee car-Te-boi poRe-che
 two-cl-do.pfv-girl four-cl-book read.pfv-be.PRES.3
 (Intended)‘Four books were read by two girls each.’

Similarly an indefinite plural DP at the direct object position of the double object construction cannot license covarying readings of a distributive numeral in the indirect object position.

- (17) #Robi du-jon-kore-mee-ke pāc-Ta-boi die-chilo
 Robi two-cl-do.pfv-girl-DAT five-cl-book give.pfv-be.PAST.3
 (Intended)‘Robi gave five books to two girls each.’

A distributive quantifier in the direct object position can only marginally license the covarying interpretation of the distributive numeral in the subject position, but certainly the corresponding scrambled version is the preferable way to express the relevant covarying reading.

- (18) a. ?du-jon-kore-mee prottek-Ta-boi poRe-che
 two-cl-do.pfv-girl each.one-cl-book read.pfv-be.PRES.3
 (Intended)‘Every book was read by two girls.’
- b. prottek-Ta-boi du-jon-kore-mee poRe-che
 each.one-cl-book two-cl-do.pfv-girl read.pfv-be.PRES.3
 (Intended)‘Every book was read by two girls.’

The contrast is in fact clearer when we add the (maximality denoting) exclusive particle *-i* on the universal quantifier as shown by (19-a) and (19-b).

- (19) a. #du-jon-kore-mee prottek-Ta-boi-i poRe-che
 two-cl-do.pfv-girl each.one-cl-book-I read.pfv-be.PRES.3
 (Intended)‘Four books were read by two girls each.’

- b. prottek-Ta-boi-i du-jon-kore-mee poRe-che
 each.one-cl-book-I two-cl-do.pfv-girl read.pfv-be.PRES.3
 (Intended)‘Every book was read by two girls.’

Similarly a non-distributive quantifier determiner in the direct object position cannot license a distributive numeral in the subject position (20-a). Scrambling of the quantifier to a position c-commanding the distributive numeral makes the intended covarying interpretation available (20-b).

- (20) a. #du-jon-kore-mee ɔnek-gulo-boi-i/ khub-kəm-boi-i
 two-cl-do.pfv-girl many-cl_{pl}-book-I/ very-less-book-I
 poRe-che
 read.pfv-be.PRES.3
 (Intended)‘Many books/ very few books were read by two girls.’
- b. ɔnek-gulo-boi-i/ khub-kəm-boi-i du-jon-kore-mee
 many-cl_{pl}-book-I/ very-less-book-I two-cl-do.pfv-girl
 poRe-che
 read.pfv-be.PRES.3
 (Intended)‘Many books/ very few books were read by two girls.’

A c-commanding distributive quantifier in the matrix clause cannot license a distributive numeral inside a finite embedded clause. (21-a) instantiates the fact with a finite post-verbal complement clause and (21-b) shows the same with a finite pre-verbal complement clause.

- (21) a. #protteke-i mone kəre [je Robi du-To-kore-boi
 each.one.agentive.case-I mind do.PRES.3 that Robi two-cl-do.pfv-book
 poRe-che]
 read.pfv-PRES.3
 #‘Everyone thinks that Robi read two books each.’
- b. #protteke-i [Robi du-To-kore-boi poRe-che
 each.one.agentive.case-I Robi two-cl-do.pfv-book read.pfv-be.PRES.3
 bole] mone kəre
 say.pfv mind do.PRES.3

#‘Everyone thinks that Robi read two books each.’

However, a null subject of a non-finite clause can license a distributive numeral, as long as the null subject is bound by an appropriate plural antecedent.

(22) protteke-i_i [PRO_i du-To-kore-boi poRte] cae
 each.one.agentive.case-I PRO two-cl-do.pfv-book read.impv want.PRES.3
 ‘Everyone wants to read two books each.’

(23) #protteke-i Robi-ke_i [PRO_i du-To-kore-boi poRte]
 each.one.agentive.case-I Robi-DAT PRO two-cl-do.pfv-book read.impv
 bole-che
 ask.pfv-be.PRES.3
 #‘Everyone asked Robi to read two books each.’

The examples in (24) show that in order for a distributive quantifier inside a non-finite clause to license a distributive numeral in the matrix clause, the distributive quantifier must be scrambled to a position c-commanding the numeral.³

- (24) a. #Robi du-jon-kore-mee-ke_i [PRO_i prottek-Ta-boi poRte]
 Robi two-cl-do.pfv-girl-DAT PRO each.one-cl-book read.impv
 bole-che
 ask.pfv-be.PRES.3
 ‘Robi asked two girls to read every book.’
- b. Robi prottek-Ta-boi_j du-jon-kore-mee-ke_i [PRO_i t_j poRte]
 Robi each.one-cl-book two-cl-do.pfv-girl-DAT PRO t read.impv
 bole-che
 ask.pfv-be.PRES.3
 ‘Robi asked two girls to read every book.’

Based on the facts above it can be concluded that the distributive numerals require a syntactically c-commanding plural antecedent in the same clause.

³Here we need to recognize the difference between (18-a) and 3. We could hypothesize that some covert scope shifting operation makes the covarying interpretation of the subject numeral marginally available in (18-a). Importantly 3 shows that that covert scope shifting operation is not available for this construction, which could be because of an intervening clause boundary. But shows that the overt scope-shifting by scrambling is not subject to the restriction on the covert shifting operation in .

3.3 Distribution down to subpluralities

The distributive numerals can distribute down to subpluralities instead of individual atoms of a plurality, if the subpluralities are contextually or grammatically made accessible. But the distributive numerals cannot determine the subpluralities. The determination of the particular cover of a plurality is facilitated by contextual or grammatical means.

Most definite plural noun phrases are ambiguous between various covers of the set denoted by the plurality. The distributive numerals can distribute over the members of a cover that is salient in a given situation. In (25-a) the pronoun *tara* denotes a group of groups and the distributive numeral assigns a different paper to each of the subgroups. Notice (25-b) containing adverbial quantifier *protteke* ‘each one of the people’, is contradictory in the context given in (25), as *protteke* forces distribution down to individual atoms but there wasn’t enough time for individual presentations.

(25) We did not have enough time to let each student present a paper. So the students in the class were divided into groups of three, and then ...

- a. ta-ra æk-Ta-kore paper present kore
pron.3-pl one-cl-do.pfv paper present do.PRES.3
‘They (each group) presented a paper.’
- b. ta-ra protteke æk-Ta-kore paper present kore
pron.3-pl each.one.agentive-case one-cl-do.pfv paper present do.PRES.3
‘They each presented a paper.’

That the distributive numeral can distribute down to subgroups is more easily detectable when we use *essentially plural predicates* (Hackl, 2002).

The main predicate of (26-a) is ‘make a pyramid formation’, which an individual gymnast cannot do. Thus the distributive numeral in this case is distributing over subgroups of the plurality denoted by the gymnasts.

As is expected, (26-b) with adverbial *protteke* ‘each one of the people’ leads to infelicity, because neither each gymnast can be divided into small groups nor can they

subgroup of the gymnasts has formed a pyramid.

Analogous observations can be made about (29) and (30) which use the essentially plural predicates ‘stand around a tree being circular’ and ‘elect’ respectively.

(29) The kids were divided into several small groups and then . . .

- a. ta-ra æk-Ta-kore-gach-er carpaš-e gol hoe
 pron.3-pl one-cl-do.pfv-tree-GEN four.side-LOC circular be.pfv
 dāRae
 stand.PRES.3
 ‘They stood around trees being circular (forming circles).’

(30) bidhanšobha-nirbacon-e, [bibhinno rajj-er loke-ra]
 assembly-election-LOC various state-GEN people.agentive-case-pl
 æk-jon-kore-mukkhomontri nirbacon kore-chen
 one-cl-do.pfv-chief.minister election do.pfv-be.PRES.3.hon
 ‘In the country wide state assembly elections, the people of the various states
 elected chief ministers.’

The preceding discussion shows that if a non-atomic cover of a plural noun phrase is contextually made salient then the distributive numeral can distribute over the non-atomic cover. This is pertaining to Champollion’s characterization that non-determiner distributive affixes encode a *Part* operator in their denotation. In the next subsection I discuss group denoting nouns that seem to provide evidence against the characterization.

3.3.1 Group-denoting nouns

There are noun phrases that are ambiguous between either a collective/group or a collection/sum of individual atoms. *dešer lokera* ‘the people of the country’ is an example of that kind. These resist distribution down to subpluralities unless there is a grammatical cue provided by adverbial modifiers. The reason that *dešer lokera* ‘the people of the country’ cannot be conceptualized as a set of contextually determined non-atomic subsets, it seems, is that we may have other more appropriate names for those subsets, and the term *dešer lokera* describes an individual distinct from a set

of these subsets.

Assembly elections in India are meant for the election of state assemblies. Thus only people of a given state can elect a chief minister of that state assembly. Even though this information is made salient by the use of the phrases ‘in the assembly elections’ or ‘chief minister’, dividing up the plural ‘the people of the country’ accordingly is not really possible, and hence the sentence (31) is odd. Since, individual citizens cannot elect chief ministers, it is not clear in (31) who elected each chief minister.

- (31) #deš-bæpi bidhanšobha-nirbacon-e, [deš-er loke-ra]
 country-wide assembly-election-LOC country-GEN people.agentive-case-pl
 æk-jon-kore-mukkhomontri nirbacon kore-chen
 one-cl-do.pfv-chief.minister election do.pfv-be.PRES.3.hon
 ‘In the country wide assembly elections, the people of the country elected
 chief ministers.’

Adding the phrase ‘in various states’ or similar device (‘in the states’, ‘in each state’) makes the sentence felicitous (32). This shows that the requirement of the essentially plural predicate is met by this post-positional modifier.

- (32) deš-bæpi bidhanšobha-nirbacon-e, [deš-er loke-ra]
 country-wide assembly-election-LOC country-GEN people.agentive-case-pl
 [bibhinno rajj-e] æk-jon-kore-mukkhomontri nirbacon
 various state-LOC one-cl-do.pfv-chief.minister election
 kore-chen
 do.pfv-be.PRES.3.hon
 ‘In the assembly elections, the people of the country in various states elected
 chief ministers.’

Although *dešer lokera* ‘the people of the country’ cannot on its own or by contextual cues be predicated of an essentially plural predicate like ‘elect’, it can satisfy distributive predicates.

- (33) deš-bæpi bidhanšobha-nirbacon-e, deš-er loke-ra
 country-wide assembly-election-LOC country-GEN people.agentive-case-pl

æk-Ta-kore-notun-poricæ-pətro pee-chen
 one-cl-do.pfv-new-identity-card get.pfv-be.PRES.3.hon
 ‘In the country wide assembly elections, the people of the country received a
 new identity card.’

Comparing between (31) and (33) we can conclude that the distributivity operator associated with the distributive numeral distributes over the members of a cover of the set denoted by the plurality (Champollion, 2016b, 2017). But the distributive numeral itself is not looking for non-atomic subsets of the cover, it is an additional restriction imposed by the predicate.

Much like the examples with ‘the people of the country’, the distributive numerals cannot distribute over context specific intermediate overlapping covers of a plurality (see discussion in Gillon (1987, 1990), Lasersohn (1995) and Schwarzschild (1996)). The conjunction in (34-a) cannot satisfy an essentially plural predicate like ‘to argue (among themselves) about a topic each’. The sentence (34-a) only allows distribution down to atoms and therefore it means each conjunct argued (among themselves) about a topic, which does not provide a plural licenser to the essentially plural predicate. Even if we add the context in (34), (34-a) remains infelicitous.

(34) The students were asked to debate about a topic of their choice, with one of their friends.

a. #Robi, Ritu ar Shomi gətokal æk-Ta-kore-bišœ nie tərko
 Robi, Ritu and Shomi yesterday one-cl-do.pfv-topic about argument
 kore-chilo
 do.pfv-be.PAST.3
 ‘Robi, Ritu and Shomi argued (among themselves) about a topic each
 yesterday.’

The only plausible ways of expressing the situation would be to make the overlapping covers explicit by structure, as in (35) and (36).

(35) Robi ar Ritu, ar Ritu ar Shomi gətokal æk-Ta-kore-bišœ nie
 Robi and Ritu, and Ritu and Shomi yesterday one-cl-do.pfv-topic about

tərko kore-chilo
 argument do.pfv-be.PAST.3
 ‘Robi and Ritu, and Ritu and Shomi argued (among themselves) about a
 topic each yesterday.’

- (36) Ritu Robi-r šoŋge ar Shomi-r šoŋge gətokal æk-Ta-kore-bišəe
 Ritu Robi-GEN with and Shomi-GEN with yesterday one-cl-do.pfv-topic
 nie tərko kore-chilo
 about argument do.pfv-be.PAST.3
 ‘Ritu, with Robi and with Shomi argued (among themselves) about a topic
 each yesterday.’

Thus the conjoined pluralities, like the plural DP ‘the people of the country’ do not have intermediate sums of atoms in their denotation. These plurals are ambiguous between the maximal sum of their atoms or the group. The intermediate covers therefore, have to be introduced by structural device.

The group nouns with the atomic classifier *-Ta* on them denote only a group individual and not a plurality (the maximal sum). Therefore, analogously to the cases discussed above they can only provide access to sub-atoms or the intermediate sums of sub-atoms by means of adverbial modifiers. Contextual clues alone will not suffice in this case.

Take for instance, the example (37-a). The context in (37) makes the the members of the group of girls salient. Yet it (37-a) cannot mean each of the girls in the group sang two songs.

- (37) There were three girls: Ritu, Shomi and Mollika, and a group of boys.
- a. #Mee-der dɔl-Ta du-To-kore-gaan gee-chilo
 girl-GEN.pl group-cl two-cl-do.pfv-song sing.pfv-be.PAST.3
 ‘The group of girls sang two songs each.’

One plausible way to get distribution over the sub-atoms of the group of girls is to add an adverbial modifier like the one in (38), though the modifier could be interpreted to talk about other non-atomic divisions too depending on the context.

- (38) Mee-der dɔl-Ta [tin-bhag-e bhag hoe] du-To-kore-gaan
 girl-GEN.pl group-cl three-division-LOC divided be.pfv two-cl-do.pfv-song
 gee-chilo
 sing.pfv-be.PAST.3
 ‘The group of girls being divided in three parts sang two songs each.’

In light of the discussion in this subsection, I will conclude that group nouns do not allow contextually motivated distribution down to subpluralities, because they do not denote pluralities to begin with (Landman, 1989, and citations therein). But that itself does not provide evidence against distribution down to subpluralities for plurals denoting sets of individuals. What the adverbial modifiers show is that once groups are reanalyzed as sets of individuals they can allow distribution down to contextually determined subpluralities. The appropriate formal analysis of these adverbials is an important issue in the question of licensing of distributive numerals, and I leave that for future work. Thus Champollion’s characterization about non-atomic distributivity can be maintained.

3.3.2 Distribution in *kind* and *mass* domains

Distributive numerals cannot distribute over kind denoting plurals out of the blue, as there is no salient cover of the plurality that is available for the distributivity operator to work on. The kind denoting bare nominal does not provide a plural cover consisting of individual atoms.

- (39) #adim manuš æk-Ta-kore-chobi ãkto
 ancient human one-cl-do.pfv-picture draw.hab.PAST.3
 ‘Ancient humans used to draw a picture.’

If a partition is introduced by a compatible adverbial modifier, then only the distributive numeral can be licensed (40). Otherwise, a different plurality has to license the numeral (41).

- (40) adim manuš [PRO bibhinno dɔl-e bibhəkto hoe]
 ancient human PRO various group-LOC divided be.pfv

æk-Ta-kore-chobi ākto
 one-cl-do.pfv-picture draw.hab.PAST.3
 ‘Ancient humans, being divided into various groups, used to draw a picture.’

- (41) adim manuš bibhinno guha-e thakto ebəŋ šekhan-e tara
 ancient human various cave-LOC stay.hab.PAST.3 and there-LOC they
 æk-Ta-kore-chobi ākto
 one-cl-do.pfv-picture draw.hab.PAST.3
 ‘Ancient humans used to live in various caves and there they used to draw a picture.’

The same can be observed for kind denoting animate plurals marked with *-ra*. For example, the sentences in (39) to (41) would show the same pattern if the bare nominal ‘*adim manuš*’ were replaced by *adim manuše-ra*.

A *-kore*-marked distributive numeral can distribute over mass denoting bare nominals in equative constructions. Thus (42-a) means the salient packages of clay are for five rupees each. Alternatively the corresponding plurality marked with the plural classifier *-gulo* could be used instead of the bare nominal.

- (42) They were selling clay in small packages at a pottery workshop.

- a. maTi pāc-Taka-kore COP
 clay five-rupee-do.pfv COP
 ‘Clay is for five rupees each.’
- b. maTi-gulo pāc-Taka-kore COP
 clay-cl_{pl} five-rupee-do.pfv COP
 ‘The (packets of) clay are for five rupees each.’

Distribution in mass domains again provide evidence that distributive numerals can distribute over contextually salient cover of a plurality.

However, a reduplicated distributive numeral is ungrammatical in these constructions. I can provide no explanation for that. But I suspect the reason has to with the particular syntactic construction and it is not about non-atomic distribution.

- (43) They were selling clay in small packages at a pottery workshop.

- a. *maTi pāc-Taka-pāc-Taka COP
 clay five-rupee-five-rupee COP
 ‘Clay is for five rupees each.’
- b. *maTi-gulo pāc-Taka-pāc-Taka COP
 clay-cl_{pl} five-rupee-five-rupee COP
 ‘The (packets of) clay are for five rupees each.’

3.4 Distribution over non-linguistic antecedents

In the previous section we have discussed cases where distributive numerals could distribute over contextually determined covers of pluralities. In this section we explore if contextually salient pluralities can license distributive numerals. First we would discuss examples with morphologically simpler distributive numerals with the suffix *-kore* and show that these numerals cannot be licensed by contextually salient pluralities at all. They need linguistic antecedents. The data from the morphologically complex distributive numerals however present a more complicated picture. These also cannot be licensed by contextually salient pluralities. But if they are licensed by a linguistic antecedent, they can distribute over a contextually salient plurality, as long as the linguistic antecedent and the contextual antecedent can be related by a one-to-one mapping.

3.4.1 Simpler distributive numerals

Although one can make sense of the sentence in (44-b) in the context (44-a), as describing that the group won a prize in each of the competitions, the utterance is ungrammatical or at best incomplete.

- (44) a. A group of students from our school were sent to several debate competitions.
- b. ??dɔl-Ta æk-Ta-kore-puroškar jite-che
 group-cl two-cl-do.pfv-prize win.pfv-be.PRES.3

*‘The group won one prize each.’

The contrast between a linguistic antecedent and a contextually salient antecedent is clear in cases where we provide both and see that the distribution over the contextually salient location argument is unavailable. First we look at a case where a cumulative relation holds between two pluralities. It would be very hard, if not impossible for the hearer to agree with the conclusion in (45-c) basing on the consecutive utterances in (45-a) and (45-b).

- (45) a. A total of three students from our school were sent to a total of four debate competitions. Each student went to at least one of the competitions, and not all the students went to all four of the competitions.
- b. o-ra æk-Ta-kore-puroškar jite-che
pron.3-pl two-cl-do.pfv-prize win.pfv-be.PRES.3
‘They won one prize each.’
- c. #Thus our school won four prizes in total.

Whereas, if the occasion adverbs are uttered, no such discomfort for the hearer arise. Thus (46-c) is a completely plausible conclusion from (46-a) and (46-b).

- (46) a. A total of three students from our school were sent to a total of four debate competitions. Each student went to at least one of the competitions, and not all the students went to all four of the competitions.
- b. o-ra competition-gulo-te æk-Ta-kore-puroškar
pron.3-pl competition-cl_{pl}-LOC two-cl-do.pfv-prize
jite-che
win.pfv-be.PRES.3
‘They won one prize in each of the competitions.’
- c. Thus our school won four prizes in total.

If the three students went to the same four competitions, even then the distributive numeral cannot covary with just the salient plurality of competitions, while only

the plurality of students is overtly mentioned in the sentence. Thus as before, it is quite implausible to conclude (47-c) from (47-a) and (47-b). However, this particular scenario does make a reading of (47-b) to some extent plausible (47-d), where the distributive numeral covaries with both the students and the competitions.

- (47) a. Three students from our school were sent to the same four debate competitions.
- b. o-ra æk-Ta-kore-puroškar jite-che
 pron.3-pl two-cl-do.pfv-prize win.pfv-be.PRES.3
 ‘They won one prize each.’
- c. #Thus our school won four prizes in total.
- d. Thus our school won twelve prizes in total.

In the discussion of contextually salient antecedents, it has been observed that salient temporal or spatial distributive readings are easier to access in certain languages. For example, Balusu (2005) (for Telugu) and Cable (2014) (for Tlingit) discuss that sentences with distributive numerals are compatible with either a participant distributive reading or a salient occasion distributive reading. Participant distributivity refers to cases where the distributive numeral covaries with individuals thematically related to the plurality of events denoted by the verbal predicate and occasion distributivity refers to the distributive numeral covarying with temporal or spatial traces of the plurality of events.

- (48) a. pilla-lu renDu-renDu kootu-lu-ni cuus-ee-ru *Telugu*
 kid-plu two-two monkey-plu-Acc see-Past-3-plu
 ‘The kids each saw two monkeys.’
 ‘The kids saw two monkeys on each occasion.’
- b. Ax káa yátx’i nás’gi-gáa xáat has aawasháat *Tlingit*
 my male children three.DIST fish pl.3O.pfv.3S.catch
 ‘My male children each caught three fish.’
 ‘My male children caught three fish on each occasion.’

As we have already seen, the salient occasion distributive readings in Bangla require an overt adverb. Like before, without the adverbial quantifier *prottek-bar*, the interpretation in (49-c) seems difficult with respect to (49-a) and (49-b).

- (49) a. Robi went on a bird watching tour and spotted birds on two occasions.
Ritu went on a separate tour and she too spotted birds on two occasions.
- b. ora *(prottek-bar) du-To-kore-pakhi dekhe-chilo
they each.one-time two-cl-do.pfv-bird see.pfv-be.PAST.3
'They saw two birds on each occasion.'
- c. #Thus in total eight birds were spotted by these two kids.

With a singular subject a distributive numeral sounds ungrammatical, even though there is a plausible licenser in the context, and one can make sense of an occasion distributive reading.

- (50) a. In a bird watching tour, Robi spotted birds on three occasions.
- b. o *(prottek-bar) du-To-kore-pakhi dekhe-chilo
pron.3sg each.one-time two-cl-do.pfv-bird see.pfv-be.PAST.3
'He saw two birds on each occasion.'

However, there is a salient occasion distributive reading available when the individuals and the events stand in a one-to-one relationship. Thus in (51-a), the individuals *Robi* and *Ritu* and the events of spotting birds stand in a one-to-one relationship. If Robi and Ritu saw two birds each, then they together saw two birds on each occasion. In this case there is no detectable difference between the participant distributive reading and the occasion distributive reading. Either way we get the conclusion in (51-c).

- (51) a. Robi and Ritu went on a bird-watching tour together and they spotted birds twice.

- b. o-ra du-To-kore-pakhi dekhe-chilo
 pron.3-pl two-cl-do.pfv-bird see.pfv-be.PAST.3
 ‘They saw two birds each.’
 ‘They saw two birds two birds on each occasion.’
- c. Thus they saw four birds in total.

It must be noted though that occasion distributive readings can be licensed by elided adverbials.

- (52) a. Robi ar Ritu prottek-bar du-To-kore-pakhi dekhechilo
 Robi and Ritu each.one-time two-cl-do.pfv-bird see.pfv-be.PAST.3
 kintu
 but
 ‘Robi and Ritu saw two birds on each occasion, but ...’
- b. Shomi tin-Te-kore-pakhi dekhe-chilo
 Shomi two-cl-do.pfv-bird see.pfv-be.PAST.3
 ‘Shomi saw three birds on each occasion.’

We can conclude that the distributive numerals require a plurality that is an overt or a covert linguistic antecedent. In terms of event semantics, we can conclude that the licenser must be a participant in the plurality of events denoted by the verb phrase containing the distributive numeral.

3.4.2 Complex distributive numerals

The complex distributive numerals are equally infelicitous as the simpler ones regarding licensing by contextually salient pluralities. Thus with a complex distributive numeral in (53-b), the conclusion in (53-c) still seems hard to access.

- (53) a. A total of three students from our school were sent to a total of four debate competitions.
- b. o-ra æk-ta-æk-Ta-kore-puroškar jite-che
 pron.3-pl one-cl-one-cl-do.pfv-prize win.pfv-be.PRES.3
 ‘They won one prize each.’

- c. #Thus our school won four prizes in total.

But when there are two pluralities available as antecedents, the complex numerals are biased towards an interpretation where the numeral covaries with both of the pluralities. Thus (54-b) in the context of (54-a) preferably leads to the conclusion in (54-c). In fact, even without the overt plurality of competitions, it would not be implausible to conclude (54-c) from (54-b).

- (54) a. Three students each from our school were sent to the same four debate competitions.
- b. o-ra competition-gulo-te æk-Ta-æk-Ta-kore-puroškar
 pron.3-pl competition-cl_{pl}-LOC one-cl-one-cl-do.pfv-prize
 jite-che
 win.pfv-be.PRES.3
 ‘They each won a prize in each of the competitions.’
- c. Thus our school won twelve prizes in total.

However, if there is no one-to-one relation between each student and each debate competition, the conclusion about twelve prizes does not arise.

- (55) a. A total of three students from our school were sent to a total of four debate competitions. Not all the students went to all of the competitions.
- b. o-ra competition-gulo-te æk-Ta-æk-Ta-kore-puroškar
 pron.3-pl competition-cl_{pl}-LOC one-cl-one-cl-do.pfv-prize
 jite-che
 win.pfv-be.PRES.3
 ‘They each won a prize in each of the competitions.’
- c. #Thus our school won twelve prizes in total.
- d. Thus our school won four prizes in total.
- e. Thus our school won three prizes in total.

It is crucial that the use of a complex distributive numeral in this case is not infelicitous, although it does seem somewhat redundant in this case. In other words, the complex distributive numerals can distribute over two overt pluralities, but the example (55) gives the impression that they are not required to do so. The question is how do we justify the use of a complex distributive numeral with just one overt plurality. The same question is prompted by examples like (56) or (57) where only one antecedent is available for the complex distributive numeral.

(56) chatre-ra du-To-du-To-kore-boi poRe-chilo
 student-pl two-cl-two-l-do.pfv-book read.pfv-be.PAST.3
 ‘The students read two books each.’

(57) prottek-Ti-chatro du-To-du-To-kore-boi poRe-chilo
 each.one-cl-student two-cl-two-l-do.pfv-book read.pfv-be.PAST.3
 ‘Each one of the students read two books each.’

I believe this is where using events in the analysis of distributive numerals directly helps. I propose that these cases as involving event distributivity on top of distributivity over individuals. But the sub-events of the plurality of events and the sub-pluralities of the plurality of individuals stand in a one-to-one relationship and therefore, the event distributivity does not add extra occasion distributive readings to these sentences. This case should be similar to (51) above.

In conclusion, the salient occasion distributive readings are only available as long as that reading is equivalent to the individual distributive reading, or the context has sufficiently established a one-to-one relationship between the individuals and the occasions such that even without mentioning the hearer can allow for an occasion distributive reading on top of the individual distributive reading. Beyond these two cases there is no licensing by salient pluralities in Bangla.

3.5 Pragmatic licensing of distributive numerals

Distributive numerals like *tin-Te-kore-boi* ‘possibly different sets of three books’ are used felicitously only when there are more than three books in the situation. This

availability of more than three individuals in the context is essential to the covarying interpretation commonly associated with distributivity.

Balusu (2005) called this requirement for covarying interpretation of reduplicated numerals in Telugu (58), the Plurality requirement associated with the Distributive numerals. Balusu argued that the plurality requirement is not a part of the asserted content of the sentence. He conjectured that the requirement would be either a presupposition or a conversational implicature and proposed the multi-dimensional analysis in (59) (notations minimally changed), where (59-b) represents the Plurality requirement parallel to the assertion.

(58) pilla-lu renDu-renDu-kootu-lu-ni cuus-ee-ru *Telugu*
 kid-pl two-two-monkey-pl-ACC see-PAST.3pl
 ‘Lit. (the) kids saw two-two monkeys.’

(59) a. $\exists e. \exists \pi(e) [\forall e' \in \pi(e) \exists X [\text{TWO.MONKEY}(X) \wedge \text{SAW}(\text{THE.KIDS}, X, e')]]$

b. $|\{X : \text{TWO.MONKEY}(X) \wedge \text{SAW}(\text{THE.KIDS}, X, e')\}| > 1$

Brasoveanu (2011b) argued that dependent indefinites have a reading of sentence-internal *possibly different*. He cites the following example (60) from Romanian containing a dependent indefinite, in which the particle *cîte* precedes an indefinite or a numeral.

(60) Din cînd in cînd, Linus scotea cîte o bilă din pungă,
 from when to when, Linus take.out.impv.3sg CÎTE a marble out bag,
 se uita la ea cu atenție, după care o punea la
 REFL look.impv.3.sg at it with care, after which it put.impv.3.sg at
 loc
 place
 ‘Every now and then, Linus would take out a marble from the bag, look at
 it carefully, then put it back.’ *Romanian*

Brasoveanu observed that ‘this example is felicitous and true in a situation in which

there are several marbles in the bag that are indistinguishable from each other and Linus happens to take the same marble out of the bag, over and over again. What is important for semantic covariation and the licensing of *cîte* is that every time he takes out a marble, it can be a marble that is different from the marble he took on a different occasion - not that it actually is a different marble.’ Crucially the sentence should be true in a situation where the common ground allows the two marbles to be different. It should be infelicitous in a situation in which a single marble is in the bag or in a situation where we know that Linus took out the same marble over and over again.

Taking up on Brasoveanu’s observation, I would call the requirement associated with distributive numerals the ‘differentness’ condition. In the following subsections, I would characterize the differentness condition associated with the distributive numerals in Bangla, as a presupposition, using the notions of context dependency, backgrounding and deniability, and the familiar devices of plugs and holes, borrowing primarily on the diagnostics provided in Potts (2005). Its characterization as a presupposition tells us about the requirement posed on the context for a felicitous use of the distributive numerals.

3.5.1 Projection through holes

The differentness condition associated with the distributive numerals projects when a sentence containing the distributive numeral and its licenser is embedded under negation, or inside a Yes/No question or in the antecedent of a conditional. Example (61) provides the context containing the proposition *that the number of Robi’s dogs is two*. In this context it is infelicitous to utter (62), (63) and (64). The infelicity shows that the differentness condition projects through embedding operators and therefore contradicts the context.

- (61) Robi-r kukur-er šonkha dui
 Robi-GEN dog-GEN number two
 ‘The number of Robi’s dogs is two.’

- (62) #o roj-i or-du-To-kore-kukur-ke bæRate
 pron.3.sg everyday-I pron.3.sg.GEN-two-cl-do.pfv-dog-ACC travel.impv
 nie jae-na
 take.pfv go.PRES.3-NEG
 ‘He does not take two different dogs of his for a walk everyday.’
- (63) #o ki roj-i or-du-To-kore-kukur-ke bæRate
 pron.3.sg Q everyday-I pron.3.sg.GEN-two-cl-do.pfv-dog-ACC travel.impv
 nie jae?
 take.pfv go.PRES.3
 ‘Does he take two different dogs of his for a walk everyday?’
- (64) #jodi o roj-i or-du-To-kore-kukur-ke
 if pron.3.sg everyday-I pron.3.sg.GEN-two-cl-do.pfv-dog-ACC
 bæRate nie jae, tahole kukur-gulo shustho thakbe
 travel.impv take.pfv go.PRES.3, then dog-cl_{pl} healthy stay.FUT.3
 ‘If he takes two different dogs of his for a walk everyday, then the dogs will
 stay healthy.’

3.5.2 Restriction on the Common ground

The distributive numerals must be uttered either when the differentness condition in them is part of the common ground or when the common ground does not entail that the differentness condition cannot hold.

Suppose it is in the common ground of a discourse that there are three elevators in the D-tower of Stata Center. The sentence (65-a) with the distributive numeral asserts that everyday two elevators stop working in D-tower. It presupposes that a different set of two elevators stops working everyday.

The sentence (65-b), on the other hand, asserts that everyday three elevators stop working in D-tower. But, it presupposes that a possibly different set of three elevators stops working everyday. The presupposition cannot be met as the set of three elevators cannot possibly differ per day, as there are only three. A slight confound in this example (65-b) is that it could be independently infelicitous because of (65-c). The asserted content of (65-b) can be appropriately described by (65-c) with the maximal definite form *elevator-tin-Te* ‘the three elevators’.

(65) There are three elevators in the D-tower of Stata Center.

- a. roj D-tower-er du-To-kore-elevator kaj kora bndho
everyday D-tower-GEN three-cl-do.pfv-elevator work do.prt stop
kore dæe
do.pfv give.PRES.3
'Everyday a different set of two elevators in the D-tower stops working.'
- b. #roj D-tower-er tin-Te-kore-elevator kaj kora bndho
everyday D-tower-GEN three-cl-do.pfv-elevator work do.prt stop
kore dæe
do.pfv give.PRES.3
'Everyday a different set of three elevators in the D-tower stops working.'
- c. roj D-tower-er elevator-tin-Te kaj kora bndho kore
everyday D-tower-GEN elevator-three-cl work do.prt stop do.pfv
dæe
give.PRES.3
'Everyday the three elevators in the D-tower stop working.'

To remove the maximal definite form from the list of lexical items that could be used, we could change the context minimally and let the judgements remain the same.

(66) There are less than four elevators in the D-tower of Stata Center.

- a. roj D-tower-er du-To-kore-elevator kaj kora bndho
everyday D-tower-GEN three-cl-do.pfv-elevator work do.prt stop
kore dæe
do.pfv give.PRES.3
'Everyday a different set of two elevators in the D-tower stops working.'
- b. #roj D-tower-er tin-Te-kore-elevator kaj kora bndho
everyday D-tower-GEN three-cl-do.pfv-elevator work do.prt stop
kore dæe
do.pfv give.PRES.3
'Everyday a different set of three elevators in the D-tower stops working.'

Examples (65-a) (or (66-a)) show that the distributive numeral can encode information that is already present in the common ground. This confirms the observation

(in the previous subsection) that these numerals have a non-asserted content, as an assertion must change (reduce) the common ground.

Examples (65-b) (or (66-b)) serve to show that when the common ground entails information that would contradict the presupposition associated with the distributive numeral, uttering a sentence containing such a numeral is infelicitous.

It is not enough for just the speaker to be aware of the content of this presupposition. Suppose I knew that there is a secret fourth elevator in D-tower just for women. But it is a secret and the male participants in the discourse are not aware of it. If the hearers knew about the maximum number of the elevators in D-tower, I could felicitously utter (65-b) (or (66-b)). But if they believed the maximum number to be ‘three’, then I couldn’t make that utterance felicitously. In other words, the presupposition associated with the distributive numeral can be accommodated as long as it does not contradict the common ground. It also serves to show that this not-at-issue content of the distributive numerals is different from conventional implicatures, which are always speaker-oriented and can in fact contradict the common ground.

3.5.3 Stopping the projection of the presupposition

Verbs of saying and operators like meta-linguistic negation can target the presupposition of the distributive numeral and prevent it from being part of the common ground.

- (67) roj D-tower-er tin-Te-KORE-elevator kaj kōra bōndho kore
 everyday D-tower-GEN three-cl-do.pfv-elevator work do.prt stop do.pfv
 dæe-na! D-tower-e tin-Te-i-elevator ache
 give.PRES.3-NEG D-tower-LOC three-cl-I-elevator be.PRES.3
 ‘Everyday a different set of three elevators in the D-tower DOES NOT stop
 working! There are only three elevators in D-tower.’

- (68) Robi bondhu-der bol-chilo roj D-tower-er
 Robi friend-OBL.pl say.PROG-be.PAST.3 everyday D-tower-GEN
 tin-Te-kore-elevator kaj kōra bōndho kore dæe. e-Ta
 three-cl-do.pfv-elevator work do.prt stop do.pfv give.PRES.3. this-cl

Thik Na. D-tower-e tin-Te-i-elevator ache
 exact NEG. D-tower-LOC three-cl-do.pfv-I-elevator be.PRES.3
 ‘Robi was telling (his) friends that everyday a different set of three elevators
 in D-tower stops working. That’s not right. D-tower only has three elevators.’

Thus we see that the presupposition can be plugged.

3.5.4 Difference from Scalar Implicatures

Scalar Implicatures of a proposition are cancelled when that proposition is embedded in Downward Entailing environments. As the example (64) already shows, when embedded inside the antecedent of a conditional, the differentness condition does not get cancelled. The differentness condition does not get cancelled in the scope of downward monotone determiners either. Thus (69-a) is odd in the context of (69).

(69) There are less than four elevators in the D-tower of Stata Center.

a. #khub-kōm-din-i D-tower-e tin-Te-kore-elevator kaj kōre
 very-less-day-I D-tower-LOC three-cl-do.pfv-elevator work do.PRES.3
 ‘The elevators in D tower work on very few days.’

Zweig (2008, section 7.2.2) observed that the ‘multiplicity condition’ associated with reduplicated numerals in Telugu shows contradictory behavior, in that the condition seems to get cancelled in modal and question environments, but remains intact under negation and in the scope of downward monotone quantifier determiners.

It is true that the question in (70) can be answered in affirmative when all the students read the same two books, just as Zweig observed for Telugu. But the speaker could not have asked the question felicitously believing that they all read the same two books. All the affirmative answer shows is that the context after the utterance can be updated to remove the differentness condition.

(70) chatre-ra ki škole-i du-To-kore-boi poRe-che?
 student-pl. Q all-I two-cl.-do.pfv-book read.pfv-be.PRES.3
 ‘Did all the students read two books each?’

- (71) a. #Na. ora škole-i Crime and Punishment ar The Idiot
 No. They all-I C and P and T I
 poRe-che
 read.pfv-be.PRES.3
 ‘No. They all read Crime and Punishment and The Idiot.’
- b. Ha. ora škole-i Crime and Punishment ar The Idiot
 Yes. They all-I C and P and T I
 poRe-che
 read.pfv-be.PRES.3
 ‘Yes. They all read Crime and Punishment and The Idiot.’

3.5.5 Conclusion of the section

I would stick to the conclusion that differentness condition is a restriction on the common ground and can be appropriately characterized as a presupposition. In the analysis that I propose in chapter 5, I formulate this not-at-issue content as a ‘post’-supposition, borrowing the concept from Brasoveanu (2013) and Henderson (2012, 2014). Following Kuhn (2017), in my formulation I have adopted the notion of dependency from van den Berg (1996) via Nouwen (2003), to encode differentness. The formulation I have adapted reflects that the covarying interpretation associated with distributive numerals is an effect of the satisfaction of this condition.

Chapter 4

Distributivity and Covariation

This chapter argues that distributivity and covariation are not one and the same phenomenon. We will see examples of ditransitive constructions from Bangla, where the effects of the two can be dissociated. The various scope interactions that we see in these examples motivates an analysis that allows distributivity to interact with specificity and covariation. The chapter provides argumentation for the formal analysis in the next chapter.

4.1 Introduction

A central question regarding distributive numerals is whether these indefinite forms denote distributivity operators themselves or not.

One school of analyses considers the distributive numerals to be existential quantifiers like the plain indefinites, except that they come with a special licensing condition that makes them felicitous only under overt or covert distributivity operators. Oh (2001); Oh (2005); Henderson (2012, 2014) among others are analyses of this kind. This analysis of the distributive numerals would be subsumed under the literature on distributivity that derives distributive interpretations of indefinites by postulating a covert adverbial distributivity operator (Link, 1987; Roberts, 1987; Schwarzschild, 1996, among others). A second school of analyses, assigns the distributive numeral itself the meaning of a type-shifted distributivity operator Champollion (2016b). Kuhn

(2015, 2017), Cable (2014), LaTerza (2014), Balusu (2005) instantiate different implementations of this analysis.

A crucial evidence in favor of the second school of analyses is the very localized scope of co-variation exhibited by the distributive numerals. LaTerza (2014) observed that English adnominal *each* only induces co-varying interpretation to its host indefinite and no other noun phrase. Similar argumentation has been put forward by Dotlačil (2013) for the reciprocal *each-other*. These observations resulted in doing away with previous analyses with adverbial distributivity operators and localizing the scope of the distributivity operator to the respective distributive noun phrases.

In this chapter I show that complex constructions with distributive numerals preclude cumulative interpretation of plurals, beyond the distributive numeral. Following Schwarzschild (1996); Schein (1993); Champollion (2017), we can attribute absence of cumulativity to the presence of a distributivity operator. Therefore, the narrow scope of covariation does not on its own provide evidence against adverbial distributive operators. I argue that instead of localizing the distributivity operator to the numeral, adopting an analysis that makes covariation a licensing condition of the distributive numeral and also allows a flexible placement of the distributivity operator, better accounts for the larger set of data. Thus I essentially argue that we need elements from both school of analyses. The distributivity operator must exist as an operator independently of the numeral but at the same time as Kuhn (2017) showed the numeral itself must have some condition to indicate where the operator should be located in the composition. To incorporate LaTerza (2014)'s observation about covariation, there should be an element in the meaning of the distributive numeral that yields localized effects of covariation.

4.2 Predictions of the two analyses

The distributive numerals can be licensed by quantifiers, and by indefinite and definite plurals. The analyses that do not take distributive numerals to be distributivity operators make examples like (1), illustrating licensing of the numeral by a universal

quantifier, the base case.

- (1) prottekei du-To-du-To-boi poRe-chilo
each.one.human.I two-cl-two-cl-book read.pfv-be.PAST.3
'Each person read two books.'

Examples (2) or (3), illustrating licensing of distributive numerals by indefinite and definite plurals respectively, are explained by postulating the presence of a covert adverbial distributivity operator (DIST), schematically represented in (3).

- (2) a. tin-jon-mee du-To-du-To-boi poRe-chilo
three-cl-girl two-cl-two-cl-book read.pfv-be.PAST.3
'Three girls each read two books.'
- b. mee-ra du-To-du-To-boi poRe-chilo
girl-pl two-cl-two-cl-book read.pfv-be.PAST.3
'The girls each read two books.'

- (3) Three girls/ the girls [DIST [read two-two books]].

The second school of analyses treat the numerals to include a distributivity operator in them. These take (2) and (3) to be the base cases. Examples like (1) are dealt with by making the dependent indefinite escape the scope of the universal quantifiers (as in Kuhn (2017)). (4) schematically indicates the analyses in which distributivity originates and is limited to the numerals.

- (4) Three girls/ the girls read [DIST-two-two] books.

If the numerals are associated with adverbial distributivity operators as in (3), then we expect to see effects of distributivity much beyond the distributive numeral. Several works, particularly LaTerza (2014) on adnominal *each* and Dotlačil (2013) on *each-other* observe that this expectation is not met. The next section looks into the details of this observation.

4.3 Limited scope of covariation

4.3.1 Scope of adnominal *each*

(5) Three boys gave five girls two books.

A sentence like (5), among its various interpretations, could be true in a situation where three boys gave a total of six books to the girls. This situation allows for a covarying interpretation of the direct object such that each boy is related to a different set of two books.

A covarying interpretation of the indirect object, on the other hand, in (5) would allow each of the boys to give books to different sets of five girls. Thus (5) could potentially be true in a situation when three boys gave books to a total of fifteen different girls.

When analyzed as (6) with a covert adverbial distributivity operator (Link, 1987; Roberts, 1987; Schwarzschild, 1996), (5) could potentially be true in a situation where three boys gave a total of fifteen girls, a total of six books.

(6) Three boys DIST [gave five girls two books].

In fact, (7) could indeed be true of such a situation.

(7) Three boys **each** gave five girls two books.

LaTerza (2014) observes however, that (8) with adnominal *each* on the direct object position, only has a subset of the interpretations available for (7). It could be true of a situation where three boys gave a total of six books to five girls, but it would be false if three boys gave six books to a total of fifteen girls. Thus what LaTerza shows is that (8) with adnominal *each* on the direct object cannot be analyzed as (9), because the analysis in (9) would predict (8) to be true in the scenario with fifteen girls.

(8) Three boys gave five girls two books **each**.

(9) Three boys DIST gave five girls two books **each**.

Just like (7) above, LaTerza observes that (10) with adverbial *each* can be used to describe a situation involving six judges, where Josh gave dessert₁ and dessert₂ to judge₁, judge₂ and judge₃, and Ben gave dessert₃ and dessert₄ to judge₄, judge₅ and judge₆. This shows that adverbial *each* in (39) can give rise to covarying interpretations for both the direct object and the indirect object.

(10) Josh and Ben **each** gave three judges two desserts.

But (11), like (8) above, with adnominal *each* on the direct object can only describe situations involving three judges. Crucially unlike (10), (11) cannot describe situations involving six judges. This again indicates that when adnominal *each* is on the direct object it cannot trigger covarying interpretation for the indirect object.

(11) Josh and Ben gave three judges [two desserts **each**].

LaTerza interprets this set of facts in terms of the scope of adverbial and adnominal *each*. He treats both adverbial and adnominal *each* as overt distributivity operators differing in their syntactic attachment sites. Therefore, indefinites may have covarying interpretation only if they are in the scope of *each*. If the indefinites are not in the scope of *each*, they do not allow covariance. Thus in (10) both the direct and indirect objects are in the scope of adverbial *each* (see (12-a)). But in (11) only the direct object is in the scope of adnominal *each* (see (12-b)).

(12) a. [Josh and Ben]_i [each_i [gave three judges two desserts]]

b. [Josh and Ben]_i gave three judges [[two desserts] each_i] .

Thus LaTerza's observation on the scope of adnominal *each* shows that the distributivity operator responsible for covarying interpretation of indefinites does not have

wide adverbial scope on the verb phrase. Although I have only picked the examples involving a double-object-construction to provide a clear parallel with the Bangla examples to be discussed below, LaTerza also illustrates that the phenomenon equally holds for ditransitive constructions with a prepositional indirect object.

The conclusion about the scope of adnominal *each* from LaTerza has been adopted in Champollion (2016b) and has been extended to adnominal *jeweils* in German.

4.3.2 Scope of *each-other*

Almost identical observations are made in Dotlačil (2013) about distributive interpretation in reciprocal clauses. Here too the chief line of argumentation is about the lack of co-varying interpretation of the non-reciprocal internal argument or adjunct of a reciprocal construction. Dotlačil (2013) discusses that example (13-a) from Moltmann (1992) can only mean that John and Mary wrote to each other on the same two cold days and it cannot mean that the days on which John wrote to Mary are different from the days when Mary wrote to John. Similarly, (13-b) from Williams (1991) is reported to be dispreferred or marked in a situation where each child gave a different Christmas present to the other.

- (13) a. John and Mary wrote to each other on two cold days.
- b. The two children gave each other a Christmas present.

Dotlačil points out that analyses that assume adverbial distributivity operators to license reciprocals, for example Heim et al. (1991) among others, cannot explain the dispreference for covarying interpretation of the non-reciprocal phrase reported in these examples.

Although I will not discuss reciprocals in Bangla, but given the similarity of argumentation, the observations about distributive numerals should be extendable to the reciprocals as well.

Dotlačil (2013) also presents two other arguments (about collective predicates

and about multiple reciprocals) in favor of the narrow scope of distributivity. I discuss below that parallel constructions that instantiate these, point to separate constructions and that they do not necessarily argue against adverbial distributivity operators.

4.4 Extending LaTerza’s arguments to Bangla

4.4.1 Distributive numerals in Ditransitive Constructions

In this subsection, I extend LaTerza’s argumentation about the scope of adnominal *each* to the distributive numerals Bangla.

In (14), the direct object of the ditransitive predicate ‘cause to listen’ is a distributive numeral. The indirect object is a plain numeral. The sentence (14) is compatible with situations with different sets of two songs. But it is not compatible with situations containing different sets of three judges. This is exactly as in English (11) with adnominal *each* on Theme, as observed by LaTerza.

- (14) Robi ar Ritu [tin-jon-judge-ke]_{IO} [du-To-kore-gaan]_{DO}
 Robi and Ritu 3-cl-judge-DAT 2-cl.-do.pfv-song
 šunie-chilo
 listen.caus.pfv-be.PAST.3
 ‘Robi and Ritu made three judges listen to two songs each.’

The same can be observed about (15) with the reduplicated form of the distributive numeral.

- (15) Robi ar Ritu [tin-jon-judge-ke]_{IO} [du-To-du-To-gaan]_{DO}
 Robi and Ritu 3-cl-judge-DAT two-cl-two-cl-song
 šunie-chilo
 listen.caus.pfv-be.PAST.3
 ‘Robi and Ritu made three judges listen to two songs each.’

In (16) we have a ditransitive construction with the same predicate ‘cause-to-listen’. But in this case, the indirect object is a distributive numeral and the direct

object is a plain numeral. The sentence (16) is compatible with situations involving more than three judges. It is also marginally compatible with situations containing more than two songs but this interpretation is dispreferred. Thus (16) is potentially ambiguous with respect to the interpretation of the plain numeral direct object.

- (16) Robi ar Ritu [tin-jon-kore-judge-ke]_{IO} [du-To-gaan]_{DO}
 Robi and Ritu 3-cl-do.pfv-judge-DAT 2-cl-song
 šunie-chilo
 listen.caus.pfv-be.PAST.3
 ‘Robi and Ritu made [three judges each] listen to two songs.’

If the speaker is aware that there are more than two songs, then she cannot acceptably use (16) to express that. Thus it is infelicitous for the speaker to describe a situation like (17-a) with more than two songs by (16) repeated as (17-b).

- (17) a. Scenario: Robi sang two songs (song₁ and song₂) to three judges (judge₁, judge₂ and judge₃). Ritu sang two other songs (song₃ and song₄) to three other judges (judge₄, judge₅ and judge₆).
- b. #Robi ar Ritu [tin-jon-kore-judge-ke]_{IO} [du-To-gaan]_{DO} šunie-chilo
 Robi and Ritu 3-cl.-do.pfv-judge-DAT 2-cl-song listen.caus.pfv-be.pst.3

The observations made about (16) holds for (18), where the indirect object is a reduplicated distributive numeral.

- (18) Robi ar Ritu [tin-jon-tin-jon-judge-ke]_{IO} [du-To-gaan]_{DO}
 Robi and Ritu three-cl-three-cl-judge-DAT two-cl-song
 šunie-chilo
 listen.caus.pfv-be.PAST.3
 ‘Robi and Ritu made [three judges each] listen to two songs.’

The scenario (17-a) containing more than three judges and more than two songs can be described with a construction like (19) (or (20)), where both the indirect object and the direct object are distributive numerals. Thus (19) has covariation effects

equivalent to English (10) with adverbial *each*.

- (19) Robi ar Ritu [tin-jon-kore-judge-ke]_{IO} [du-To-kore-gaan]_{DO}
 Robi and Ritu three-cl-do.pfv-judge-DAT two-cl-do.pfv-song
 šunie-chilo
 listen.caus.pfv-be.pst.3
 ‘Robi and Ritu each made three judges listen to two songs.’
- (20) Robi ar Ritu [tin-jon-tin-jon-judge-ke]_{IO} [du-To-du-To-gaan]_{DO}
 Robi and Ritu three-cl-three-cl-judge-DAT two-cl-two-cl-song
 šunie-chilo
 listen.caus.pfv-be.pst.3
 ‘Robi and Ritu each made three judges listen to two songs.’

4.4.2 A summery of the observations

So far we have observed that analogous to English adnominal *each* or the reciprocal *each-other*, the covariation effects are limited to the distributive numerals themselves. The presence of the distributive numerals does not trigger covariation effects on any other indefinite. Extending proposals of LaTerza and Champollion among others, we can make a tentative hypothesis that the distributivity operator responsible for the covarying interpretation of a distributive numeral in Bangla, only has scope on the distributive numeral.

The facts observed above for conjoined plural subjects holds for constructions involving indefinite plural subjects too.

- (21) tin-jon-protijogi [pāc-jon-judge-ke]_{IO} [du-To-kore-gaan]_{DO}
 three-cl-contestant five-cl-judge-DAT two-cl.-do.pfv-song
 šunie-chilo
 listen.caus.pfv-be.PAST.3
 ‘Three contestants made five judges listen to two songs each.’
- (22) tin-jon-protijogi [pāc-jon-kore-judge-ke]_{IO} [du-To-gaan]_{DO}
 three-cl-contestant five-cl-do.pfv-judge-DAT two-cl-song
 šunie-chilo
 listen.caus.pfv-be.PAST.3
 ‘Three contestants made [five judges each] listen to two songs.’

- (23) tin-jon-protijogi [pãc-jon-kore-judge-ke]_{IO} [du-To-kore-gaan]_{DO}
 three-cl-contestant five-cl-do.pfv-judge-DAT two-cl-do.pfv-song
 šunie-chilo
 listen.caus.pfv-be.PAST.3
 ‘Three contestants each made five judges listen to two songs.’

For now, we have reached the tentative conclusion that, like adnominal *each*, the distributivity operator associated with distributive numerals in Bangla cannot function like an adverbial distributivity operator with scope over a verb phrase. Examples like ?? seem to indicate that in terms of covariation effects, a distributive numeral does not have widescope over a verb phrase.

However, in the next section, I put forward evidence against the hypothesis we just made. I argue that while presence of covariation does test positively for distributivity, lack of covariation *does not* entail lack of distributivity. Specifically, I argue (following Schwarzschild (1996) and partly adapting argumentation from Schein (1993) and Champollion (2017) among others) that it is cumulativity that indicates lack of distributivity. Therefore, LaTerza’s arguments correctly represent only a part of the story.

4.5 Absence of cumulative reading

A very careful look at the ditransitive construction reveals that in a certain structural configuration, a plain numeral indirect object of the ditransitive predicate cannot receive a cumulative interpretation with respect to a plural subject.

If three girls had four apples and two other girls had three apples, then cumulatively five girls had seven apples. If Robin planted three tomato seedlings and Pat planted two, then Robin and Pat together planted a total of five tomato seedlings. The following examples from Bangla illustrate that such cumulative relation cannot hold between two plurals in the subject and indirect object positions of a ditransitive construction, when the subject and the direct object are in a distributive relationship.

Consider the following situation. In the summer of 2017, at a certain academic department, five students graduated and got jobs. Three professors wrote recommen-

dations for them. It turned out that the three professors each wrote two recommendations. However, most of the graduating students required just one recommendation for their jobs, only one among them needed two. This scenario *cannot be* felicitously described by (24).

- (24) gəto-bəchor, tin-jon-oddhapək pāc-jon-chatri-ke
 last-year, three-cl.-professor five-cl-student.F-DAT
 du-To-kore-recommendation die-chilen
 two-cl-do.pfv-recommendation give.pfv-be.PAST.hon
 ‘Last year, three professors gave five students two recommendations each.’

Consider another situation. Suppose there are three small scale companies A, B and C. A has ten employees and B and C each have twenty employees. In June each of the companies spent one lakh¹ rupees as salary. This situation *cannot be* described by the following sentence (25).

- (25) Jun maš-e tin-Te-company pəncəš-jon-kərmocari-ke
 June month-LOC three-cl-company fifty-cl-employee-DAT
 ək-lokkho-Taka-kore-maine die-che
 one-lakh-rupee-do.pfv-salary give.pfv-be.PRES.3
 ‘In the month of June, three companies paid 50 employees 1 lakh rupees each.’

Consider a third situation. There were two unemployed young men. They applied for four jobs each. There was one company that received applications from both of them. Six other companies received applications from just one of them. The ditransitive construction in (26) *cannot* represent this situation.

- (26) du-jon-bekar-jubək šat-Ta-company-te
 two-cl-unemployed-young.man seven-cl-company-LOC
 car-Te-kore-cakrir-dərkhasto paThie-chilen
 four-cl-do.pfv-job.GEN-application send.caus.pfv-be.PAST.hon
 ‘Two unemployed young men sent four applications each to seven companies.’

Consider yet another example. Robi and Ritu were assigned the job of decorating the

¹1 lakh= 100,000

tables for a party. Both Robi and Ritu used three flower vases each for decoration. There were four regular sized tables that needed one flower vase each, and there was a longer table that required two flower vases. Robi placed two vases on the longer table and one on one of the regular sized tables. Ritu decorated three remaining regular sized tables with a vase on each. The following sentence (27) *does not* represent this situation.

- (27) Robi ar Ritu pāc-Ta-Tebil-e tin-Te-kore-phul-dani
 Robi and Ritu five-cl-table-LOC three-cl-do.pfv-flower-holder
 rekhe-chilo
 keep.pfv-be.PAST.3
 ‘Robi and Ritu placed/kept three flower vases each on five tables.’

It is not the case that the indirect object in these constructions are not capable of receiving cumulative interpretations with respect to other plurals in general. In all of the four constructions above, if the direct object was a plain numeral being interpreted cumulatively with respect to the subject plural, the indirect object could be interpreted cumulatively with respect to the subject as well. Consider the situations above again, but this time with a ditransitive construction that does allow the cumulative interpretation for the indirect object with respect to the subject.

In the summer of 2017, at a certain academic department, five students graduated and got jobs. Three professors wrote recommendations for them. It turned out that the three professors each wrote two recommendations. Thus they wrote a total of six recommendations. However, most of the graduating students required just one recommendation for their jobs, only one among them needed two. This scenario *can* be felicitously described by (28).

- (28) gōto-bōchor, tin-jon-oddhapōk pāc-jon-chatri-ke
 last-year, three-cl-professor five-cl-student.F-DAT
 chō-Ta-recommendation die-chilen
 six-cl-recommendation give.pfv-be.PAST.hon
 ‘Last year, three professors gave five students six recommendations.’

Suppose there are three small scale companies A, B and C. A has ten employees and

B and C each have twenty employees. In June each of the companies spent one lakh² rupees as salary and thus the cumulative salary expenditure for the three companies were three lakh rupees. This situation *can be* described by the following sentence (29).

- (29) Jun maš-e tin-Te-company pōncaš-jon-kōrmocari-ke
 June month-LOC three-cl-company fifty-cl-employee-DAT
 tin-lokkho-Taka-mainie die-che
 three-lakh-rupee-salary give.pfv-be.PRES.3
 'In the month of June, three companies paid fifty employees three lakh rupees.'

There were two unemployed young men. They applied for four jobs each. Thus together they sent out eight applications. There was one company that received applications from both of them. Six other companies received applications from just one of them. The ditransitive construction in (30) *can* represent this situation.

- (30) du-jon-bekar-jubōk šat-Ta-company-te
 two-cl-unemployed-young.man seven-cl-company-LOC
 aT-Ta-cakrir-dōrkhasto paThie-chilen
 eight-cl-job.GEN-application send.caus.pfv-be.PAST.hon
 'Two unemployed young men sent eight applications to seven companies.'

Robi and Ritu were assigned the job of decorating the tables for a party. Both Robi and Ritu used three flower vases each for decoration. There were four regular sized tables that needed one flower vase each, and there was a longer table that required two flower vases. Robi placed two vases on the longer table and one on one of the regular sized tables. Ritu decorated three remaining regular sized tables with a vase on each. Thus together they used six flower vases. The following sentence (31) *can* represent this situation.

- (31) Robi ar Ritu pāc-Ta-Tebil-e chō-Ta-phul-dani rekhe-chilo
 Robi and Ritu five-cl-table-LOC six-cl-flower-holder keep.pfv-be.PAST.3
 'Robi and Ritu placed/kept six flower vases on five tables.'

²1 lakh= 100,000

Thus to summarize, in this section we have observed that when the direct object is distributed over the members of the subject plural, the indirect object cannot be interpreted cumulatively with respect to the subject plural.

4.6 Distributing over the indirect object

The situation looks different when the direct object is interpreted distributively with respect to the members of the indirect object. In such a reading, the indirect object *can* be interpreted cumulatively with respect to the subject plural.

Consider the following scenario. Robi and Ritu between them decorated five tables. Each table ended up having three flower vases on them, i.e., we are talking about fifteen flower vases here. The situation *can be* expressed by (27) repeated here as (32). Here the subject and the indirect object are in a cumulative relationship, and the indirect object is in a distributive relationship between the direct object.

- (32) Robi ar Ritu pãc-Ta-Tebil-e tin-Te-kore-phul-dani
 Robi and Ritu five-cl-table-LOC three-cl-do.pfv-flower-holder
 rekhe-chilo
 keep.pfv-be.PAST.3
 ‘Robi and Ritu placed/kept three flower vases each on five tables.’

I show the same reading to be available for the examples below. In the summer of 2017, at a certain academic department, five students graduated and got jobs. Each of them needed two recommendations for job applications. Three professors wrote the recommendations for them. No student received recommendations from all three of the professors. But in total five students received ten recommendations. This scenario *can be* felicitously described by (33), which is (24) repeated from above.

- (33) gɔto-bɔchor, tin-jon-oddhapɔk pãc-jon-chatri-ke
 last-year, three-cl.-professor five-cl-student.F-DAT
 du-To-kore-recommendation die-chilen
 two-cl-do.pfv-recommendation give.pfv-be.PAST.hon
 ‘Last year, three professors gave five students two recommendations each.’

Suppose there are three small scale companies A, B and C. A has ten employees and B and C each have twenty employees. In June each of the employees got one lakh³ rupees as salary. This situation *can be* described by (25) above, repeated here as (34).

- (34) Jun maš-e tin-Te-company p̄ncaš-jon-k̄ormocari-ke
 June month-LOC three-cl-company fifty-cl-employee-DAT
 æk-lokkho-Taka-kore-maine die-che
 one-lakh-rupee-do.pfv-salary give.pfv-be.PRES.3
 ‘In the month of June, three companies paid 50 employees 1 lakh rupees each.’

There were two unemployed young men. They applied for different job openings in a total of seven companies. Only three companies received applications from both of them. It turned out that, from these two men, each of the companies received four applications for various positions. The four companies in total received twenty-eight applications. Example (26), repeated here as (35) *can* represent this situation.

- (35) du-jon-bekar-jub̄ok šat-Ta-company-te
 two-cl-unemployed-young.man seven-cl-company-LOC
 car-Te-kore-cakrir-d̄arkhasto paThie-chilen
 four-cl-do.pfv-job.GEN-application send.caus.pfv-be.PAST.hon
 ‘Two unemployed young men sent four applications each to seven companies.’

In this section from the examples above, we have seen that it is possible to get a cumulative reading of the subject and the indirect object when the direct object is distributed over members of the indirect object.

For reference, I must point out that one of Schein (1993)’s arguments about essential separation of the Agent relation from the verb is based on the particular readings of ditransitive constructions of the kind we have seen in this section.

- (36) a. Three agents sold (the) two buildings (each) to exactly two investors.
 b. Three letters of recommendation from influential figures earned the two new graduates (each) two offers.

³1 lakh= 100,000

- c. Three automatic tellers gave (the) two new members (each) exactly two passwords.

The argumentation is easier to see in terms of (37). (37) has a reading in which every quarterback learned two possibly different new plays, i.e., *every quarterback* is in a distributive relation with *two new plays*. But importantly, as Schein observed, in the same reading, *every quarterback* and *three video games* are in a cumulative relationship, i.e., a total of three video games, between them, taught all the quarterbacks.

(37) Three video games taught every quarterback two new plays.

The parallelism between this reading of (37) and the Bangla examples discussed in this section is that, when the indirect object and the direct object are in a distributive relationship, the subject and the indirect object can be in a cumulative relationship. This must be contrasted with the examples in the last section, where we saw that in a reading where the subject and the direct object were in a distributive relationship, the subject and the indirect object cannot be in a cumulative relationship with each other.

4.7 Scope of Distributivity

We have observed over the last few sections that when the subject and the direct object are in a distributive relationship the subject and indirect object cannot be in a cumulative relationship. However, when the indirect object and the direct object are in a distributive relationship, the subject and the indirect object can be interpreted cumulatively with respect to each other. This set of facts are schematically represented in Figure 4-1 below.

I argue that these two possibilities of interpretation correspond to two different analyses of the ditransitive construction, i.e., the ditransitive construction is ambiguous between these two readings. When the direct object is distributed over the

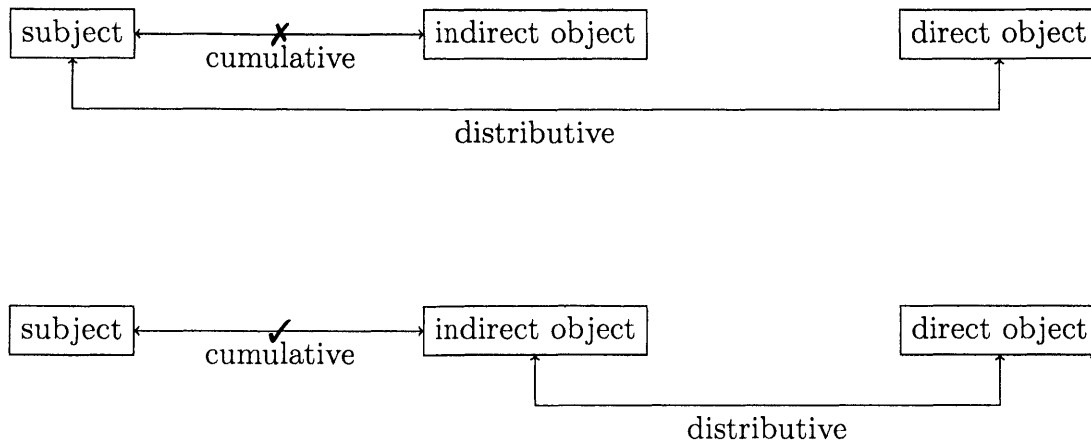


Figure 4-1: Two distributive readings

members of the plural subject, I will name the corresponding analysis of the ditransitive construction the *Agent-distributive* construction, borrowing names of thematic relations from event semantics. When the direct object is distributed over the members of the plural indirect object, I will use the term *Goal-distributive* construction to indicate the corresponding analysis of the ditransitive construction.

A distributivity operator blocks the cumulative interpretation of a noun phrase. For example, Schein’s conclusion about the essential separation of the Agent relation from the verb phrase is motivated by the need to put the subject out of the scope of the distributivity operator associated with the indirect object, or the Goal relation.

Analogously Champollion (2016a, 2017) had proposed that *for*-adverbials modify verb phrases that are already modified by covert distributivity operators or overt modifiers that have the effect of universally quantifying over the verb phrase. Champollion (2017, p. 261, ex. 52) also showed that *for*-adverbials block cumulative readings of verb phrases that they modify. A cumulative interpretation of (38) will be verified by a scenario where John saw thirty zebras pass by him one at a time. It is cumulative in the sense that each of the zebras are mapped to a time interval in which John sees them and the sum of those time-intervals map to a part of the runtime of the event overall.

(38) John saw thirty zebras.

Champollion observed that (39) with a *for*-adverbial cannot felicitously describe this cumulative scenario. Instead with the *for*-adverbial (39) describes a scenario where John had an entire herd of thirty zebras in his field of view, (say) from noon to 1pm.

(39) John saw thirty zebras for an hour.

Champollion proposed that this simultaneous reading is distributive in the sense that each of the zebras is matched to the whole timespan, and that in this case, the verb phrase *see thirty zebras* is modified by a covert distributivity operator.

Borrowing on these analytical proposals, I argue that the Agent and the Goal distributive constructions represent two different scopes of the distributivity operator associated with the distributive numeral at the direct object position. This is a genuine structural ambiguity, as neither of these scopes entails the other. In each case, the distributivity operator takes scope over the corresponding part of the verb phrase. In the Agent-distributive construction the distributivity operator takes scope over the verb phrase containing both the indirect object and the direct object (40) and this prevents the indirect object to be in a cumulative relationship with the subject. In the Goal-distributive construction the operator only has scope over the verb phrase containing the direct object (41). Consequently the Goal-distributive construction would allow for the subject and the indirect object to be interpreted cumulatively with respect to each other.

(40) [Subject] **DIST** [_{VP} [Indirect object] [Direct object]] (Agent distributive)

(41) [Subject] [Indirect object] **DIST** [_{VP} [Direct object]] (Goal distributive)

4.8 Specificity effects

I have illustrated in section 4.5 that in the Agent distributive construal the indirect object of a ditransitive construction cannot receive a cumulative interpretation. The indirect object in the cases we have discussed receives a collective reading. I would analyze the collective reading as an effect of specificity. This section explores the

interactions between specificity and distributivity.

4.8.1 Specific reading of the indirect object

First, consider the following situation. In a singing competition fifteen contestants had to sing two songs each. They sang in front of three judges. The judges were sitting in a room and each contestant would enter the room, sing two songs and go out. The following sentences (42) (with a *-kore-*marked numeral) or (43) (with a reduplicated numeral) can be interpreted to have this reading.

In this reading the judges work as a collective. The collective of judges remain the same across contestants. The songs differ from contestant to contestant. Let me call this the *collective* situation.

(42) ponero-jon-protijogi tin-jon-judge-ke du-To-kore-gaan
 fifteen-cl-contestant three-cl-judge-DAT two-cl-do.pfv-song
 šunie-chilo
 listen.caus.pfv-be.PAST.3
 ‘Fifteen contestants made three judges listen to two songs each.’

(43) ponero-jon-protijogi tin-jon-judge-ke du-To-du-To-gaan
 fifteen-cl-contestant three-cl-judge-DAT two-cl-two-cl-song
 šunie-chilo
 listen.caus.pfv-be.PAST.3
 ‘Fifteen contestants made three judges listen to two songs each.’

Schwarzschild (1996) argued that collectivity ensues when distribution takes place over the trivial cover of a plurality, i.e., when the plurality is interpreted as a singleton set. For example, (44) (Schwarzschild, 1996, p. 73) has a reading in which John and Mary together made \$1000, and it has a reading in which John and Mary each made \$1000. In Schwarzschild’s analysis in the context when the plurality of John and Mary is assigned a cover in which John and Mary occupy the same cell, we get the collective reading. In a context where John and Mary occupy different cells in the cover, we get the distributive reading. The assignment of the cover is context-dependent. There is a free variable *Cov* in the restriction of the distributivity operator (named *Part*) which gets its value from the context, depending upon the covers of the plural noun

phrase that are salient in a given context.

(44) John and Mary made \$1000.

Thus a collective interpretation of an indefinite follows if the individuals in the reference set of the indefinite is distributed over a singleton cover of a plurality.

But in examples like (42) and (43), I have proposed in the last section, that the distributivity operator responsible for distributively relating the songs with the contestants forces the indirect object to be interpreted non-cumulatively. If we took up Schwarzschild's proposal, we cannot implement this analysis. That is because, the distributivity operator associated with the collective of judges would require a cover of the contestants where all the fifteen contestants occupy the same cell, and the distributivity operator associated with the songs would require (assuming an atomic distributive context) a cover where each of the contestants occupy a different cell. One and the same distributivity operator scoping over the same verb phrase cannot be analyzed to have these two different domain restrictions.

(45) Fifteen contestants [Part-Cov_{coll}/Cov_{dist} [made three_{coll} judges listen to two_{dist} songs]]

To resolve this conflict and to go along with the proposal in the last section, I would formulate an independent restriction on the reference set of the indefinite borrowing upon the notion of specificity. The indefinite quantifying over judges has a specific interpretation, which causes the collective reading in these examples. The specific interpretation is indicated by the speaker in choosing a numeral with non-distributive morphology. This interpretation restricts the reference set of the numeral indefinite to a set of three particular judges. Given, the reference set has only these three judges that the speaker has in mind, even when the indefinite is under a distributivity operator that has a non-trivial partition of the plurality of contestants, we do not get covariation. We get the reading that each contestant made the same three judges listen to two possibly different songs.

Therefore, the proposal in a nutshell is that the plurality of judges does receive a distributive reading, but, due to specificity we do not get covariation.

4.8.2 Intermediate scope of the distributive numeral

Sentences (42) and (43) can also stand for a slightly more complicated situation. In this situation three judges were sitting in three different rooms. Each contestant went to each judge and sang the same two songs. Thus each contestant sang the same two songs on three occasions. However, each contestant sang a different pair of songs. Thus the songs varied with respect to contestants but for each contestant the songs remained the same for each of the judges. For example, say Robi and Ritu are two contestants. The sentence has a reading where *robi* sang *a* and *b* to j_1 , j_2 and j_3 , and *ritu* sang *c* and *d* to j_1 , j_2 and j_3 . So the songs vary with the contestants but not with the judges. Here, for each contestant, there is a specific pair of songs that they sang to each of the judges. This is the intermediate scope of the distributive numeral.

Thus, with respect to the distributive numeral, this situation could be technically analyzed as not just Agent-distributive, but Agent and Goal distributive. The direct object is distributed over the members of the plural subject and also over the members of the plural indirect object. But the Goal distributive part does not have covariation. The distributive numeral is interpreted as being specific with respect to the indirect object, and therefore there is no covariation there.

How do we know that the Agent and Goal distributive interpretation is actually a grammatically encoded possibility of interpretation? We can imagine a situation where, on top of the set-up just discussed (i.e., each judge in a different room), for each contestant, the songs vary with respect to the judges. In this situation, each contestant went to a judge and sang two different songs. Thus each contestant (potentially) sang six different songs in total, but they all sang to the same three judges. The songs varied from contestant to contestant, and the songs varied across judges. The most felicitous way to express that situation would be (46) which uses the complex form of the adnominal distributive numeral. As discussed in previous chapters, the complex form of the distributive numeral is biased towards a reading

when the distributive numeral covaries with more than one plurality.

- (46) ponero-jon-protijogi tin-jon-judge-ke du-To-du-To-kore-gaan
fifteen-cl-contestant three-cl-judge-DAT two-cl-two-cl-do.pfv-song
šunie-chilo
listen.caus.pfv-be.PAST.3
'Fifteen contestants made three judges listen to two songs.'

Thus (46) requires an Agent and Goal distributive analysis. In this case, the direct object is distributed over the members of the plural subject and also over the members of the plural indirect object. Both the Agent distributive part and the Goal distributive part has covariation. The distributive numeral in (46) *does not* have intermediate scope. It provides evidence for an Agent and Goal distributive analysis with two distributivity operators.

Let us look at a different example of intermediate scope of a distributive numeral. In (47) the indirect object has a distributive numeral. Let us suppose that Robi and Ritu are two contestants. The sentence would be true in a situation where Robi sang *a* and *b* to j_1 , j_2 and j_3 , and Ritu sang *c* and *d* to j_4 , j_5 and j_6 . The judges varied with contestants, and the songs varied with contestants too. But the songs remained the same across the judges for a given contestant. This again is where the distributive numeral at the direct object position has intermediate scope with respect to the indirect object. Thus the analysis needs to encode this intermediate scope.

- (47) ponero-jon-protijogi tin-jon-kore-judge-ke du-To-kore-gaan
fifteen-cl-contestant three-cl-judge-DAT two-cl-do.pfv-song
šunie-chilo
listen.caus.pfv-be.PAST.3
'Fifteen contestants each made three judges listen to two songs.'

The discussion on examples (42) and (47) have shown that when the distributive numeral in the direct object position of a double-object construction is distributed over the members of the subject plurality, the indirect object could receive either a collective or a covarying interpretation.

For the sake of completeness, we must look at an alternative Agent and Goal dis-

tributive conceptualization of the Goal distributive reading. In the Goal distributive reading of (48)(=(42)), the songs vary with the judges, but not with the contestants.

- (48) ponero-jon-protijogi tin-jon-judge-ke du-To-kore-gaan
 fifteen-cl-contestant three-cl-judge-DAT two-cl-do.pfv-song
 šunie-chilo
 listen.caus.pfv-be.PAST.3
 ‘Fifteen contestants made three judges listen to two songs each.’

Imagine a situation where, all fifteen contestants learned six particular songs. There were three judges in three different rooms. Each contestant went into a room and sang two different songs, i.e., a contestant sang a different pair of songs for each judge. Thus, for a particular contestant the songs differed across judges. But for the plurality of contestants the songs remained the same. This situation can be expressed by (48), but not *preferably* by (46) with a complex distributive numeral, as the complex form of the distributive numeral is preferred for indicating covariation with respect to more than one plurality. We would need to have access to the six songs per contestant to encode specificity with respect to the contestants in this case.

4.8.3 Summary of the section

To summarize the observations in this section, I argued that the analysis of an Agent distributive reading of a ditransitive construction, needs a way to encode specificity on the numeral indefinites. The plain numeral indirect object in the Agent-distributive reading needs an absolute notion of specificity, as it does not covary with any plurality. The direct object with a distributive numeral, needs a relative concept of specificity. The relative specificity would help us capture the fact that the distributive numeral is capable of covarying with the subject while at the same time remaining non-covarying with respect to the indirect object. Analytically capturing covariation with respect to the indirect object but specificity with respect to the subject requires access to both two songs per judge and the sum of the pairs of songs for each contestant. These analytical requirements drive the formal analysis adopted in the next chapter.

4.9 An informal sketch of the proposal

In the analysis proposed in the next chapter, specificity is analyzed as a constraint on a numeral determiner about its domain restriction. The restriction is descriptively called ‘sameness’. Similarly covariation is a constraint on the domain of individuals quantified over by the numeral determiner, and the restriction is descriptively called ‘differentness’. ‘Sameness’, because of the facts about intermediate scope, needs to build into it anaphoricity. A numeral may have ‘sameness’ with respect to a plurality, at the same time having ‘differentness’ with respect to another plurality. Analogously ‘differentness’ must have anaphoricity into its definition because a numeral may not covary with respect to all the c-commanding pluralities. Thus both ‘sameness’ and ‘differentness’ are relativized constraints.

Kuhn (2017) observed that the dependent indefinites in ASL morphologically mark anaphoricity. Both the dependent indefinite and the plurality with which it covaries are marked with arc-movement or a repeated or reduplicated movement over an area of space ‘a’ (49).

- (49) a. BOYS IX-arc-a READ ONE-arc-a BOOK.
b. EACH-EACH-a PROFESSOR NOMINATE ONE-redup-a STUDENT.

Kuhn also pointed out that similar morphological and spatial marking occurs on the adjectives *same* and *different* in their ‘internal’ reading.

- (50) ALL-a BOY READ SAME-arc-a BOOK

‘All the boys read the same book.’

- (51) ALL-a BOY READ DIFFERENT-redup-a BOOK

‘All the boys read a different book.’

The adjectives *same* and plural⁴ *different* in their ‘internal’ reading show distribu-

⁴Singular *different* is licensed by a subset of the licensors of plural *different*. See Brasoveanu (2011b); Moltmann (1992).

tional similarity with the distributive numerals (Carlson, 1987; Moltmann, 1992; Barker, 2007; Brasoveanu, 2011b, among others). The adjectives are licensed by distributive quantifiers and definite and indefinite plurals. But the internal reading cannot be licensed by singularities (52-d). Notice in (52-d) the ‘external’ reading of *same* or *different* would be licensed in an appropriate context.

- (52)
- a. Each student gave different answers/ the same answer.
 - b. The students gave different answers/ the same answer.
 - c. Two students gave different answers/ the same answer.
 - d. #A student gave different answers/ the same answer.

The identical morphological and spatial markings in both of the cases, along with the distributional similarities provided the basis for a unified analysis of the dependent indefinites and the adjective *same* in Kuhn (2017), where he treated both of these items as being inherently distributive.

Following Kuhn I have taken up the notion of ‘dependency’ from van den Berg (1996) via Nouwen (2003), in order to formalize the notions of relative ‘sameness’ and ‘differentness’. Kuhn has a cardinality constraint ($\text{‘inside}(y/x)=n\text{’}$, see the details in Kuhn (2017), ex. 61) as part of the at-issue meaning of distributive numerals, that involves universal quantification in its definition. The constraint checks that each member of the set of sets under the discourse referent introduced by the distributive numeral, has the cardinality n . Because of this universal quantification as part of its at-issue meaning, the distributive numeral in Kuhn’s analysis is inherently distributive. Therefore, for sentences involving indefinite or definite plural subjects as antecedents for the distributive numeral, in Kuhn’s analysis the meaning of the distributive numeral is enough to get the distributive reading and there is no need to postulate a covert adverbial distributivity operator. In fact an adverbial distributivity operator would over-generate distributive readings, when the distributive numeral is inherently distributive. Thus in Kuhn’s analysis, when the antecedent of the distributive numeral is a universally quantified noun phrase, or when the distributive numeral is in the scope of an overt adverbial distributive quantifier, Kuhn has to

move the constraints encoding cardinality and dependency out of the scope of the distributivity operator ($\delta(i)$), that is part of the meaning of the universal quantifier (see section 5.3 in Kuhn (2017)).

However, in the analysis I propose in the present work, distributivity is not part of the meaning of the distributive/ covarying numerals. The constraint on relative ‘differentness’ is defined in such a way (same as ‘dependency’ in Nouwen (2003)) that it can only be satisfied in the scope of a distributivity operator. There is no cardinality constraint equivalent to Kuhn’s that involves universal quantification in its definition. The cardinality constraint in my analysis is defined following Brasoveanu (2013) and Henderson (2014, ‘domain-level cardinality’ ex. 39,40). This move is intended to match Henderson’s proposal, that distributivity is not inherent to the distributive numerals, but the scope of the distributivity operator is such that it makes available sets of individuals upon which the constraint about covariation (‘differentness’ in my proposal) on the distributive numeral can be tested and satisfied. I have argued in the preceding sections that the need to have such an analysis is motivated by the Agent-distributive reading of the ditransitive construction.

To recapitulate briefly, in the Agent-distributive reading of a ditransitive construction like (42), the presence of a distributive numeral in the direct object position blocks the cumulative interpretation of the plain numeral indirect object with respect to the subject. I have argued that absence of cumulativity is caused by the presence of a distributivity operator over the VP containing both of the indirect and the direct objects. A distributivity operator at the direct object position cannot influence the non-cumulative interpretation of the syntactically higher indirect object. Thus localizing the distributivity operator would not help us take care of the Agent-distributive cases I have discussed above, and it would also not help us distinguish between Agent and Goal distributive readings.

As a matter of fact, Henderson’s analysis will not be able to account for the fact that the indirect object in the Agent-distributive cases lack a co-varying interpretation and a cumulative interpretation. For that, Henderson’s analysis needs to be modified to have an ‘evaluation singularity’ post-supposition, on top of non-post-suppositional

‘evaluation singularity’. To account for this lack of co-variation, and to account for the difference between the simpler and the complex distributive numerals, I have defined the relativized ‘sameness’ constraint.

Although the definition of ‘sameness’ in my analysis involves universal quantification, it does not require a distributivity operator for its satisfaction, and it does not make a numeral bearing it distributive. This is desirable because specificity is conceptually independent of distributivity, but it can interact with distributivity.

Examples (53) and (54) below schematically represent the analysis of the Agent distributive and Goal distributive readings of sentence (42) (or (43)) respectively. Example (55) schematically represents the analysis for (46). In all of these, the placement of **DIST**_{*i*} marks the scope of distributivity. The indexing on **DIST**_{*i*} indicates the plural whose atoms form the restrictor of the distributivity operator. ‘same_{*i*}’ and ‘different_{*i*}’ mark specificity and covariation respectively.

- Agent distributive reading

(53) [Subject₁] **DIST**₁ [_{*VP*} [Indirect object₂]_{same₁} [_{*VP*} [Direct object]_{same₂,diff₁}]]

- Goal distributive reading

(54) [Subject₁] [_{*VP*} [Indirect object₂]_{same₁} **DIST**₂ [_{*VP*} [Direct object]_{diff₂,same₁}]]

- Agent and Goal distributive reading

(55) [Subject₁] **DIST**₁ [_{*VP*} [Indirect object₂]_{same₁} **DIST**₂ [_{*VP*} [Direct object]_{diff₂,diff₁}]]

4.10 Consequences of the analysis

The analysis I propose dissociates covariation from distributivity. In the scope of a distributivity operator, we may see lack of covariation because of specificity. Importantly in this analysis specificity effects are not derived by movement.

Kuhn (2017) argues that in examples that involve coordination of a distributive numeral and a plain numeral, if we adopt an analysis where the distributive numeral is required to be under the scope of an adverbial distributive numeral, we would always expect a covarying interpretation of the plain numeral. A non-covarying interpretation of the plain numeral can be brought about by Quantifier Raising the plain numeral out of the scope of the distributivity operator. However, in an adverbial analysis, the distributivity operator scopes over the entire VP containing the coordinated numerals. Therefore, the plain numeral would be needed to undergo quantifier raising out of the conjunction and that would violate the Coordinate structure constraint (CSC) (Ross, 1967). Since we do encounter examples from across languages with distributive numerals where a plain numeral can receive a non-covarying interpretation (as evidenced by (56) and (57) from Bangla) even when conjoined with a distributive numeral, Kuhn argues we must give up the adverbial analysis of distributivity operators.

(56) otithi-ra du-hāRi-biriyani ar tin-Te-kore-firni khee-chilo
guest-pl. two-pot-Biriyani and three-cl.-do.pfv-Firni have.pfv-be.PAST.3
'The guests had two pot full of Biriyani and three Firnis each.'

(57) chatri-ra tin-Te-kore-paper ar du-To-boi poRe-chilo
student.F-pl. three-cl.-do.pfv-paper and two-cl.-book read.pfv-be.PAST.3
'The students read three papers each and two books.'

First, the analysis I propose do not require a numeral to undergo syntactic movements to achieve non-covarying or specific interpretations. So the technical problem Kuhn talks about does not arise in my analysis. Second, we may have to be careful about the

analysis of coordinations of direct objects in SOV languages, as they can be analyzed as coordination of VPs with right-node-raising of the verb. In this case even with a syntactic analysis of specificity effects there would not be any violation of the CSC.

Thus I do not think the coordination examples provide evidence against adverbial distributivity operators. On this note we can go into the actual formal analysis in the next chapter.

Chapter 5

A Dynamic Semantics for Numerals

5.1 The meaning of the distributive numerals

A distributive numeral like *tin-Te-kore-boi* ‘different sets of three books’ can be felicitously used in a context where there are more than one set of three books or there is no information in the context that contradicts that there are more than one set of three books. A plain numeral *tin-Te-boi* ‘three books’ on the other hand does not pose this requirement of ‘plurality’ on the utterance context. In fact, it can be used to convey the opposite of the ‘plurality’ requirement associated with the distributive numerals. A plain numeral like *tin-Te-boi* ‘three books’ can be used to convey that there are exactly three books in the context.

In one of the readings of (1), the sentence is true if each of the girls read three books. The plain numeral indicates that there are three books and therefore the books remained the same for each girl.

- (1) du-jon-mee tin-Te-boi poRe-chilo
 two-cl-girl three-cl-book read.pfv-be.PAST.3
 ‘Two girls read three books, and the books remained the same across the girls.’

Sentence (2) is true if each of the girls read three books, and the books differed from

girl to girl.

- (2) du-jon-mee tin-Te-kore-boi poRe-chilo
two-cl-girl three-cl-do.pfv-book read.pfv-be.PAST.3
'Two girls read three books, and the books differed across the girls.'

Therefore, both the distributive numeral and the plain numeral are distributed over the members of the antecedent plurality of two girls. But in addition to that the morphological shape of the numerals tells the hearer if the individuals quantified over by the numerals remained the same or they differed with respect to the atoms of antecedent plurality. In order to formalize this contribution of the numerals in examples like (1) and (2), we need to be able to simultaneously refer to both of the girl atoms and the corresponding sets of three books they read, and check if the books related to each girl are same or whether they are different.

To phrase it differently in terms of cardinality, it is not just enough to say how many books each girl read, but there is another dimension of information about cardinality simultaneously available. The morphology of the numerals tells us whether the plurality of girls read a total of three books or they read in total more than three books. Thus it seems, distributively interpreted numerals are not only anaphoric to the atoms of the antecedent plurality but also to the plurality itself, at the same time.

The scope of distributivity operators is known (from the literature on pronominal reference resolution) to allow for several such levels of structured reference (Nouwen, 2003; Brasoveanu, 2011a, among others). The operator relates the atoms of the plurality it distributes over to individuals introduced in the nuclear scope. At the same time the operator allows access to sums of the individuals related to each atom. The latter indicates that the distributivity operator can allow introduction of new discourse referents and storage of those referents, like a dynamic operator.

An example from inter-sentential plural pronominal anaphora illustrating an evidence for multiple tiers of reference is (3) from Nouwen (2003, p. 117).

- (3) Three students each wrote exactly two papers. They each sent them to L&P.

Nouwen discusses that in (3), the pronoun *them* could either be interpreted as the set of six papers written by the students or the set of two papers corresponding to each student. Analogous evidence for ‘plural discourse reference’ has been discussed in Brasoveanu (2011a) regarding donkey-anaphora.

That the dynamic analysis of distributivity operators for inter-sentential and intra-sentential plural anaphora is useful for analyzing the licensing of distributive elements in mono-clausal environments has been explored in Brasoveanu (2011b) for internal readings of the adjectives *same* and *different*. Brasoveanu (2013, section 4) extended this analysis to the interpretation of modified numerals. Henderson (2012, 2014) extended Brasoveanu’s extension of Dynamic Plural Logic to the analysis of dependent indefinites in the Mayan language Kaqchikel; Champollion (2015) explored a dynamic analysis of English adnominal *each* and Kuhn (2015, 2017) extended the dynamic distributivity operator formulated in Brasoveanu (2013, section 4) to the analysis of distributive numerals in ASL.

5.1.1 Henderson (2014) and Kuhn (2017)

Henderson (2014) proposed, following Brasoveanu (2011a), that a distributive numeral introduces a set of individuals and requires it to have plural discourse reference, that is, the set introduced must have non-trivial partition. In (2) above, this is the requirement for there being more than one set of three books. Henderson called this ‘evaluation plurality’ following Brasoveanu (2013). Importantly evaluation plurality is different from the information that each set of books has three members, which Henderson (following Brasoveanu (2013)) called ‘domain plurality’. Importantly, plural discourse reference is established when in the scope of a distributivity operator a distributive dependency is formed between the atoms of an antecedent plurality and the plurality of discourse referents introduced by the distributive numeral. The requirement for ‘evaluation plurality’ is contingent upon the establishment of the distributive dependency. Therefore, Henderson proposed that this requirement is a not-at-issue component of the meaning of the distributive numerals and it requires delayed satisfaction, at a point when the scope of the distributivity operator is suc-

cessfully updated. As Henderson (2014) observed for Kaqchikel, evaluation plurality of distributive numerals can be satisfied by a pluractional operator as well. A plain numeral in this analysis are ‘evaluation singular’. They do not require a non-trivial partition of the set of individuals that they introduced. The plain numerals can in fact introduce plural discourse reference when they are in the scope of universal quantifiers. In order to capture this property of the plain numerals, Henderson did not make evaluation singularity a not-at-issue component of meaning for the plain numerals. Evaluation singularity is satisfied where the numeral is interpreted.

Kuhn (2017) observed that in ASL the distributive numerals are morphologically marked for anaphoricity. In ASL, the numerals and the plurality with which they co-vary are both marked with an arc-movement or reduplication. Therefore, Kuhn’s proposal was that the meaning of the numerals must include information about anaphoricity, and not just evaluation (discourse) plurality. Kuhn proposed that the distributive numerals not only have a not-at-issue component of meaning that requires that the set of individuals that it introduces has a non-trivial partition, but on top of that it encodes information about how the partition is obtained. Kuhn proposed that the partition is obtained by anaphoricity.

Both of these analyses of distributive numerals (Henderson, 2014; Kuhn, 2017) has been implemented in Dynamic Plural Logic because it allows us to formally distinguish between domain plurality and evaluation plurality, and also to retain distinctly these two kinds of information.

However, the analyses in Henderson (2014) and Kuhn (2017) differ in terms of where they place distributivity relative to the distributive numeral. As discussed above, evaluation plurality in Henderson (2014) can be satisfied by a distributivity operator. Therefore, in Henderson (2014) the distributivity operator is not part of the meaning of the numeral, but it helps license evaluation plurality of the numeral. In Kuhn (2017)’s analysis the distributive numeral itself has an at-issue component of meaning about cardinality that makes it inherently distributive.

In the analysis proposed below, I will adopt Henderson’s position that distributivity is not part of the meaning of the distributive numeral. In the preceding chapter

I have argued that the effect of a distributivity operator extends beyond the distributive numeral. In the Agent-distributive reading of a ditransitive construction, when the direct object is a distributive numeral and the individuals quantified over by the distributive numeral is distributed over the members of the subject plurality, the plain numeral indirect object is barred from being cumulatively interpreted with respect to the subject.

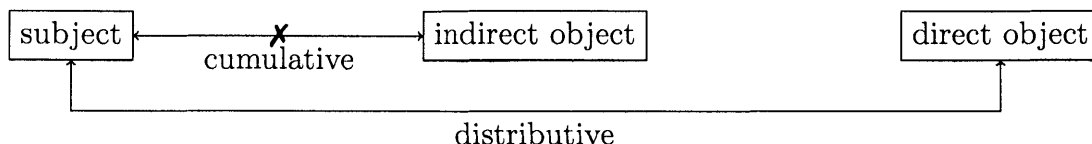


Figure 5-1: Agent distributive reading

- (4) du-jon-protijogi tin-jon-judge-ke du-To-kore-gaan
two-cl-contestant three-cl-judge-DAT two-cl-do.pfv-song
šunie-chilo
listen.caus.pfv-be.PAST.3
‘Two contestants made three judges listen to two songs each.’

I argued that this restriction on the cumulative interpretation of the indirect object with respect to the subject follows if the indirect object is under a distributivity operator.

- (5) [Subject] **DIST** [_{VP} [Indirect object] [Direct object]] (Agent distributive)

Given, this restriction on cumulativity co-occurs with the presence of a distributive numeral that is in a distributive dependency with the subject, I argued that the distributivity operator responsible for establishing the distributive dependency between the members of the subject plurality and distributive numeral at the direct object position ends up blocking the cumulative interpretation of the indirect object. Syntactically it can be captured if the distributivity operator takes scope over the VP including the indirect and the direct objects.

A distributivity operator at the direct object position cannot influence the interpretation of a noun phrase at the indirect object position without the postulation

of some additional mechanism (Quantifier Raising or making the operator higher-typed or both). If an analysis like Kuhn's is to be maintained, where the distributive numeral has a distributivity operator in it then that account must encode in itself a mechanism which would obligatorily make the distributivity operator take scope over the VP containing the indirect object. Instead, of doing that, in the analysis proposed below, I work with the adverbial distributivity operator *D* (Link, 1987; Roberts, 1987), which helps in establishing the anaphoric dependency between the numeral and the atoms of its licenser.

Following Kuhn, however, I propose that the distributive numerals have a component of meaning that has anaphoricity in it. Unlike ASL, the numerals in Bangla do not, however, encode anaphoricity by overt marking. My motivation for making the distributive numerals anaphoric comes from the difference in interpretation between simpler forms of distributive numerals and the complex form of distributive numeral. The simpler forms may not covary with all the c-commanding pluralities, and therefore can give rise intermediate readings. The complex form is preferably not used to express intermediate readings. The complex form of distributive numerals is used to encode covariation with more than one plurality. Therefore to encode intermediate readings I will extend Kuhn's formalization of anaphoricity to analyze the distributive numerals in Bangla.

Finally, I propose to introduce into the meaning of numerals a component which is like Henderson's evaluation singularity and it captures the exact reading of plain numerals, a non-covarying interpretation that is often subsumed under the term 'specificity'. But unlike evaluation singularity in Henderson (2014) this is a not-at-issue component of meaning, which helps explain why plain numerals often lack covarying readings under universal quantifiers. I account for the simultaneous lack of covariation and cumulativity on the indirect object in the Agent-distributive reading of (71), by this component of meaning. Moreover to encode the facts about intermediate readings of distributive numerals, this component of meaning capturing specificity must be anaphoric.

5.2 Dynamic Plural Logic

As Brasoveanu (2011a) explains, ‘plural discourse reference is reference to a quantificational dependency between sets of objects (e.g., atomic individuals or collections, but also times, eventualities, possible worlds etc.) that is established and subsequently elaborated upon in discourse.’ In Dynamic Plural Logic (DPIL) (van den Berg, 1996) natural language expressions represent formulas are interpreted as relations between sets of assignments and are not relations between single assignments. This is designed to allow the establishing of plural discourse reference and its retainment, so that the established plural discourse reference can be accessed in subsequent discourse. In the example (6) from Brasoveanu (2011a), the first conjunct introduces a quantificational dependency between the set y of girls in Linus’s class and the set x of gifts bought by Linus. Each girl in y is correlated with the gift(s) in x that Linus bought for her. This correlation is retained and further qualified in the second conjunct, that for each girl in y , Linus asked her deskmate to wrap her gift(s) in x . The superscript indicates the discourse referent (dref) introduced by an expression which serves as the antecedent and the subscript indicates the discourse referent (dref) that a pronoun is anaphoric to.

- (6) Linus bought a ^{x} gift for every ^{y} girl in his class and asked their _{y} desk mates to wrap them _{x} .

The sets of variable assignments are information states. They encode two kinds of information: value and structure (quantificational dependency).

I	...	i	j	...
g_1	...	α_1	β_1	...
g_2	...	α_2	β_2	...
...

Figure 5-2: The plural information state I

A plural information state can be represented as a matrix as in Figure 5-2, where the rows represent assignments. A dref stores sets of individuals assigned to it in a

plural information state in a column. For example, in I in Figure 5-2, the values assigned to the dref i by each assignment is stored in the column under i . The rows encode structure. For example, for each row in I , the individual assigned to the dref i by that an assignment is correlated with the individual assigned to the dref j by the same assignment. Thus the information state I encodes the binary relation $\{\langle \alpha_1, \beta_1 \rangle, \langle \alpha_2, \beta_2 \rangle, \dots\}$.

5.3 Information states and dependency

The analysis of plain numerals and adnominal distributive numerals in Bangla will be implemented in DPIL following Henderson (2014) and Kuhn (2017), to model plural discourse reference. In order to define anaphoric dependencies, I will use following Kuhn (2017) the formal notion of dependency from van den Berg (1996) via Nouwen (2003, ch.4).

G	...	x	y	...
g_1	...	$girl_1$	$book_1$...
g_2	...	$girl_2 \oplus girl_3$	$book_2 \oplus book_3$...
g_3	...	$girl_1$	$book_4$...
g_4	...	$girl_2 \oplus girl_3$	$book_4 \oplus book_5$...
...

Figure 5-3: The information state G

The set of assignments G is a plural information state, represented as the matrix in Figure 5-3). Since assignment functions are taken to be total functions from variables to individuals, an information state like G has infinite number of variables that get assigned values that are irrelevant with respect to the interpretation of the formulas. Discourse referents are variables that get assigned new values replacing previous arbitrary values. The rows of the matrix represent individual assignments (with g, h as variables over the individual assignment functions) g_1, g_2, g_3 , etc. in the set of assignments G . The columns represent the discourse referents (drefs) x, y , etc. An object in a cell of the matrix is the value assigned to a dref by an assignment: $girl_1 = g_1(x)$, $girl_2 \oplus girl_3 = g_2(x)$, $book_1 = g_1(y)$, $book_2 \oplus book_3 = g_2(y)$, etc. As discussed in

the last section, the matrices also express that there is some n -ary relation between say $girl_1$ and $book_1$ in the row and there are relations between columns as well.

In order to define the notion of dependency we will need to talk about particular operations on information states like G (Nouwen, 2003, section 4.1). The values of a dref x stored in a column of the matrix G is $G(x)$. Thus $G(x)$ is the set of values assigned to the dref x in G .

$$(7) \quad G(x) := \{g(x) : g \in G\}$$

We also need to identify specific substates of G . Thus $G|_{x=d}$ is the substate containing the set of all assignments in G where x has been assigned the value d .

$$(8) \quad G|_{x=d} := \{g : g \in G \ \& \ g(x) = d\}$$

Thus Figure 5-4 represents such a substate relative to the value $girl_1$ of x .

x	y
$girl_1$	$book_1$
$girl_1$	$book_4$

Figure 5-4: The information state $G|_{x=girl_1}$

Similarly, $G|_{x=d}(y)$ is defined as the set of values of y , relative to the value d of x in a substate of G .

$$(9) \quad G|_{x=d}(y) := \{g(y) : g \in G \ \& \ g(x) = d\}$$

Dependency is defined as follows:

- Dependency

$$(10) \quad \text{In an information state } G, y \text{ is dependent on } x \text{ iff} \\ \exists d, e \in G(x). G|_{x=d}(y) \neq G|_{x=e}(y)$$

5.4 Formal backdrop

The model \mathfrak{M} is structured as $\mathfrak{M} = \langle \mathfrak{D}_e, \mathfrak{D}_v, \mathfrak{I} \rangle$ where \mathfrak{D}_e is the domain of individuals \mathfrak{D}_v is the domain of events and \mathfrak{I} is the basic interpretation function such that $\mathfrak{I}(R) \subseteq \mathfrak{D}^n$, for any n -ary relation R .

The domain of individuals \mathfrak{D}_e is the powerset of a given non-empty set IN of individuals: $\mathfrak{D}_e = \wp^+(\text{IN}) := \wp(\text{IN}) \setminus \{\emptyset\}$. The domain of events \mathfrak{D}_v is the powerset of a given non-empty set EV of events: $\mathfrak{D}_v = \wp^+(\text{EV}) := \wp(\text{EV}) \setminus \{\emptyset\}$.

The part-of relation over individuals $x \leq y$ (x is a part of y) is the partial order induced by inclusion \subseteq over the set $\wp^+(\text{IN})$.

$$(11) \quad x \leq y := x \subseteq y.$$

Similarly, the part-of relation over events $e_1 \leq e_2$ (e_1 is a part of e_2) is the partial order induced by inclusion \subseteq over the set $\wp^+(\text{EV})$.

$$(12) \quad e_1 \leq e_2 := e_1 \subseteq e_2.$$

An \mathfrak{M} assignment g is a total function from the set of variables \mathcal{V} to $\mathfrak{D} (:= \mathfrak{D}_e \cup \mathfrak{D}_v)$.

Formulas are interpreted with respect to pairs of sets of total assignments $\langle G, H \rangle$. G is the input context and H is the result of evaluating a formula ϕ in G .

The notation $[x]$ is used to define random assignment in the object language.

$$(13) \quad \text{Random assignment: } \llbracket [x] \rrbracket^{(G,H)} = \mathbb{T} \text{ iff } G[x]H, \text{ where}$$

$$\text{a. } G[x]H := \begin{cases} \text{for all } g \in G, \text{ there is a } h \in H \text{ such that } g[x]h, \text{ and} \\ \text{for all } h \in H, \text{ there is a } g \in G \text{ such that } g[x]h \end{cases}$$

$$\text{b. } h[x]g := \text{for any variable } i, \text{ if } i \neq x, \text{ then } g(i) = h(i)$$

Atomic formulas for lexical relations are tests. They require the output context H to be the same as the input context G , that is, they simply pass on the input context.

after checking that H satisfies the lexical relation denoted by the predicates. The atomic formulas are interpreted distributively with respect to assignments in H .

$$(14) \quad \llbracket R(x_1, \dots, x_n) \rrbracket^{(G,H)} = \mathbb{T} \text{ iff } G = H \text{ and } \forall h \in H, \langle h(x_1), \dots, h(x_n) \rangle \in \mathcal{J}(R)$$

Dynamic conjunction is defined as follows:

$$(15) \quad \llbracket \phi \wedge \psi \rrbracket^{(G,H)} = \mathbb{T} \text{ iff there is a } K \text{ such that } \llbracket \phi \rrbracket^{(G,K)} = \mathbb{T} \text{ and } \llbracket \psi \rrbracket^{(K,H)} = \mathbb{T}$$

The definition of truth is as follows (48).

$$(16) \quad \text{Truth: A formula } \phi \text{ is true relative to an input set of assignments } G \text{ iff there is an output set of assignments } H \text{ such that } \llbracket \phi \rrbracket^{(G,H)} = \mathbb{T}.$$

- **The operators \mathbf{max} and δ**

Following Brasoveanu (2013) I adopt the convention that, a universal quantifier introduces the set of individuals i that satisfy the restrictor formula via a maximization operator \mathbf{max} and then checks that each of the the individuals under i also satisfies the nuclear scope formula, by the distributivity operator δ . The maximization operator is defined as in (49).

$$(17) \quad \llbracket \mathbf{max}(i)(\phi) \rrbracket^{(G,H)} = \mathbb{T} \text{ iff}$$

- a. $\llbracket [i] \wedge \phi \rrbracket^{(G,H)} = \mathbb{T}$
- b. there is no H' such that $\llbracket [i] \wedge \phi \rrbracket^{(G,H')} = \mathbb{T}$ and $H(i) < H'(i)$

As defined in (49), the $\mathbf{max}(i)$ operator introduces a new dref i and stores in H the maximal set of individuals satisfying the formula ϕ it scopes over.

The distributivity operator (Brasoveanu, 2013, section 4.3) δ takes the output of maximization and distributively updates over the variable i the set of assignments G with the nuclear scope formula ϕ . The update follows by first generating the i -

partition of G , i.e., the set of sets of assignments $\{G_{i=a} : a \in G(i)\}$. Then updating each cell $G_{i=a}$ in the partition with the formula ϕ . Then the resulting assignments are summed up for evaluation.

$$(18) \quad \llbracket \delta(i)(\phi) \rrbracket^{(G,H)} = \mathbb{T} \text{ iff}$$

- a. $G(i) = H(i)$
- b. for any $a \in G(i)$, $\llbracket \phi \rrbracket^{(G_{i=a}, H_{i=a})}$

The condition in (50-a) says that the values for i remain constant from input to output and ensures that no new values for i are introduced in the output context H . The condition in (50-b) defines the distributive update, that the formula ϕ relates each cell in the partition in the input context to the corresponding cell in the partition in the output context.

5.5 Formulas for the interpretation of numerals

Recall that the task at hand is to encode specific and covarying interpretations of numerals. I call specificity and covariation “sameness” and “differentness” respectively, which are not part of the asserted component of the meaning of the numerals.

- Covariation

In order to define covariation, I will borrow from Henderson (2014) the proposal that distributive numerals introduce a plurality of discourse referents which denotes a non-singleton set of individuals in a column of an information state. I will implement the notion in terms of Kuhn (2017), that the plurality introduced by the distributive numeral is divided into subpluralities and linked to atoms of the licensing plurality. Establishing this quantificational dependency, helps us establish the plural discourse reference associated with the meaning of the distributive numerals. The requirement for this dependency is a non-asserted component of the meaning of the numerals. I call the requirement “differentness”.

- Specificity

The numerals interpreted as specific introduce a singularity as a discourse referent which is a singleton set of individuals in the column of an information state. The notion is conceptualized as the opposite of dependency (10) and in analogy with the meaning of the adjective *same* in Kuhn (2017). It is conceptually similar to ‘evaluation singularity’ in Henderson (2014). But unlike Henderson (2014), it is not part of the asserted component of the meaning of the numerals. Like dependency (10), it is relativized to capture intermediate readings of distributive numerals. I call this requirement “sameness” and it is a non-asserted component of the meaning of the numerals.

- Cardinality

The cardinality component of numerals is conceptualized and formulated similarly to domain-level cardinality from Henderson (2014) and Brasoveanu (2013). The domain level cardinality is obtained by counting the atoms in a value assigned to a dref in a cell by an individual assignment. Cardinality is an asserted component of the meaning of the numerals. Importantly in the present analysis, there is no notion of relativized cardinality like *inside*(j/i)= n in Kuhn (2017).

5.5.1 Post-suppositional tests

The not-at-issue component of meaning encoding “sameness” or “differentness” shows projection behavior like presuppositions. I borrow the term post-supposition from Brasoveanu (2013), who used it to characterize the cardinality constraints associated with modified numerals, and from Henderson (2014), who extended Brasoveanu (2013)’s proposal to distributive numerals in Kaqchikel. Both of these works define post-suppositions as not-at-issue updates contributed by numerals. As I have discussed in chapter (3), following diagnostics in Potts (2005), the not-at-issue content of the distributive numerals can appropriately be characterized as a presupposition and not as conventional implicature. However, unlike say the presuppositions of definite

descriptions, the presuppositional content of distributive numerals cannot be satisfied right when the numeral is introduced. The presupposition is about sets of individuals being in a particular formal relationship/ dependency. Therefore, until the relevant sets of individuals are obtained, the dependency cannot be established. In this sense the presupposition associated with the distributive numerals needs delayed satisfaction. In this sense the not-at-issue content of these numerals is a ‘post’-supposition, which is a variety of presupposition that is interpreted after the context has been updated with at-issue updates.

I take “sameness” and “differentness” to be features on an indefinite numeral introduced by post-suppositional modifiers : SAME and DIFFERENT. These are not modifiers of the nominal predicate, i.e., these are not adjectives.

• **Evaluation of post-suppositions**

The evaluation of post-suppositions is defined with respect to pairs of sets of assignments indexed with (possibly empty) sets of post-suppositions. The post-suppositions introduced in the scope of the distributivity operator must be evaluated relative to the output set of assignments of the distributivity operator.

$$(19) \quad \llbracket \delta(x)(\phi) \rrbracket^{G[\zeta], H[\zeta']} = \mathbb{T} \text{ iff } \zeta = \zeta' \ \& \\
\begin{aligned}
\text{a. } & G(x) = H(x) \\
\text{b. } & \text{There is a possibly empty set of tests } \{\psi_1, \dots, \psi_n\} \text{ such that for all} \\
& a \in G(x), \llbracket \phi \rrbracket^{G_{x=a}[\zeta], H_{x=a}[\zeta \cup \{\psi_1, \dots, \psi_n\}]} = \mathbb{T} \text{ and } \llbracket \{\psi_1, \dots, \psi_n\} \rrbracket^{H[\zeta], H[\zeta']} \\
& = \mathbb{T}
\end{aligned}$$

Truth and satisfaction is defined relative to sets of assignments that have been indexed with sets of post-suppositional tests (ζ and ζ').

$$(20) \quad \llbracket \phi \rrbracket^{G[\zeta], H[\zeta']} = \mathbb{T} \text{ iff } \phi \text{ is a test, } G = H \text{ and } \zeta' = \zeta \cup \{\phi\}.$$

(20) shows that post-suppositions do not update input sets of assignments. They just get added to the input set of tests ζ to yield ζ' , which is passed along into the output.

(20) interacts with the definition of truth in (21) to ensure that post-suppositions are evaluated after the at-issue content. A formula ϕ is true relative to an input set of assignments indexed with the post-suppositions introduced in ϕ that satisfy two conditions : (i) The output is a possible output for the at-issue content ϕ relative to the input, and (ii) the post-suppositions are all satisfied relative to the output set of assignments alone.

(21) Truth: ϕ is true relative to an input context $G[\emptyset]$ iff there is an output set of assignments H and a (possibly empty) set of tests $\{\psi_1 \wedge \dots \wedge \psi_m\}$ s.t. $\llbracket \phi \rrbracket^{<G[\emptyset], H[\{\psi_1, \dots, \psi_m\}]>} = \mathbb{T}$ and $\llbracket \psi_1 \wedge \dots \wedge \psi_m \rrbracket^{<H[\emptyset], H[\emptyset]>} = \mathbb{T}$.

5.5.2 Relativized partitioning of a column

The post-suppositional formulas for “sameness” and “differentness” are defined based on the formal notion of dependency from (10) above. The formulas introduce a partition in a column (a set of values) relative to particular values of another dref. Formally the partition is defined as in (22) (Kuhn, 2017, ex. 56).

(22) $\{S : \exists d[d \in G(x) \ \& \ G|_{x=d}(y) = S]\}$

Thus for the information state G in Figure 5-3, when the value $girl_1$ is assigned to x , y has been assigned the set of values $\{book_1, book_4\}$. Similarly, when the value $girl_2 \oplus girl_3$ is assigned to x , y has been assigned the set of values $\{book_2 \oplus book_3, book_4 \oplus book_5, book_2 \oplus book_4\}$.

x	y
$girl_1$	$book_1$
$girl_1$	$book_4$
$girl_2 \oplus girl_3$	$book_2 \oplus book_3$
$girl_2 \oplus girl_3$	$book_4 \oplus book_5$
...	...

Figure 5-5: Partition of $G(y)$ with respect particular values of x

The relevant partition of the set of values of y , with respect to the particular

values of x in G would be (23).

$$(23) \quad \{S : \exists d[d \in G(x) \ \& \ G|_{x=d}(y) = S]\} = \{\{book_1, book_4\}, \{book_2 \oplus book_3, book_4 \oplus book_5\}\}$$

The identification of the partition in the formulas for “sameness” and “differentness” involves a bound variable, which makes the formulas anaphors. The binding of the variable, like anaphors, is subject to condition A of binding theory and therefore, it is required to be syntactically bound in the same clause. This is how these formulas make the indefinites have licensing condition like anaphors, in needing a syntactic licenser in the same clause. In interpretation, the bound variable is anaphoric to a semantic entity, i.e., a dref in the information state.

After the partition has been identified by binding of the variable, the formulas for “sameness” and “differentness” check if the partition satisfies dependency or not. We get ‘differentness’ when dependency is satisfied, i.e., when at least two cells in the partition are distinct from each other. When the values in all the cells of the partition are identical, we get ‘sameness’. For example, in Figure 5-5, the cell $\{book_1, book_4\}$ is distinct from the cell $\{book_2 \oplus book_3, book_4 \oplus book_5\}$, therefore y satisfies differentness with respect to the values of x .

5.5.3 Covariation as “differentness”

“Differentness” is a feature encoding covariation on a distributive numeral introduced by the ‘post-suppositional’ test $\text{DIFFERENT}(j)_i$ and is defined as follows, where i, j are metalanguage variables over drefs :

$$(24) \quad \llbracket \text{DIFFERENT}(j)_i \rrbracket^{(G,H)} = \text{T iff } G = H, \text{ and } \exists a, b \in H(i)[H|_{i=a}(j) \neq H|_{i=b}(j)]$$

The definition is identical to dependency (10).

- $\text{DIFFERENT}(j)_i$ introduces a partition in $H(j)$ with respect to individual values

in $H(i)$.

- The formula checks if at least two cells in the partition of $H(j)$ are distinct from each other.

“Differentness” is not a feature on a plain numeral.

The definition for $\text{DIFFERENT}(j)_i$ is comparable to $\text{outside}(j/i)>1$ from Kuhn (2017).

$$(25) \quad \text{outside}(j/i)>1 := \lambda GH. G = H \ \& \ |S : \exists d(d \in H(i) \ \& \ H|_{i=d}(j) = S)| > 1$$

Compare the post-suppositional cardinality test **evaluation plurality** from Henderson (2014, ex. 43) (specified to the value 1 for n):

$$(26) \quad \llbracket x > 1 \rrbracket^{(G,H)} = \mathbb{T} \text{ iff } G = H \text{ and } |H(x)| > 1$$

As is evident, the post-suppositional test for ‘evaluation plurality’ is not relativized to the individual values of another dref. Being non-relativized, evaluation plurality is not compatible with “sameness”, i.e., the requirement of the formula $\text{SAME}(j)_i$ as defined below in (27). That means a numeral having the post-supposition of evaluation plurality (26) cannot have specific interpretation. Hence with evaluation plurality, intermediate readings would be unaccounted for.

The post-supposition $\text{DIFFERENT}(j)_i$ is defined such that it can be satisfied only by the output of a distributivity operator. The details will be discussed below when we discuss interpretation of sentences.

5.5.4 Specificity as “sameness”

5.5.4.1 Relativized “sameness”

Relativized “Sameness” is a feature encoding specificity on a distributive numeral introduced by the ‘post-suppositional’ test $\text{SAME}(j)_i$ and is defined as follows, where

i, j are metalanguage variables over drefs :

$$(27) \quad \llbracket \text{SAME}(j)_i \rrbracket^{(G,H)} = \mathbb{T} \text{ iff } G = H, \text{ and } \forall a, b \in H(i) [H|_{i=a}(j) = H|_{i=b}(j)]$$

- $\text{SAME}(j)_i$ introduces a partition in $H(j)$ with respect to individual values in $H(i)$.
- The formula checks if all the cells in the partition of $H(j)$ are identical.

The definition of $\text{SAME}(j)_i$ is comparable to the formula *same*(j/i) from Kuhn (2017, ex. 91) which is part of the meaning of the adjective *same*.

$$(28) \quad \text{same}(j/i) := \lambda GH. G = H \ \& \ \forall S, T \in H|_{i=d}(j). S \equiv T$$

5.5.4.2 Trivial “sameness”

Trivial “Sameness” is a feature encoding specificity on a plain numeral introduced by the ‘post-suppositional’ test $\text{SAME}(i)_i$ and is defined as follows, where i, j are metalanguage variables over drefs :

$$(29) \quad \llbracket \text{SAME}(i)_i \rrbracket^{(G,H)} = \mathbb{T} \text{ iff } G = H, \text{ and } \forall a, b \in H(i) [H|_{i=a}(i) = H|_{i=b}(i)]$$

- $\text{SAME}(i)_i$ introduces a trivial partition in $H(i)$
- checks if the values assigned to a dref i by the set of assignments H are identical.

Trivial “sameness” cannot be a feature on a distributive numeral. It would conflict with “differentness”.

The conceptualization of trivial sameness is comparable to the **evaluation singularity** constraint from Henderson (2014, ex. 42) (specified to the value 1 for n):

$$(30) \quad \llbracket x = 1 \rrbracket^{(G,H)} = \mathbb{T} \text{ iff } G = H \text{ and } |H(x)| = 1$$

However, evaluation singularity is not a post-supposition in Henderson (2014). It is part of the at-issue updates. Being an at-issue update, evaluation singularity cannot account for the simultaneous absence of covariation and cumulativity on a plain numeral. As discussed above, the plurality at the indirect object position in the Agent-distributive reading of a ditransitive construction lacks a cumulative interpretation relative to the subject and it lacks covariation. The formula $\text{SAME}(i)_i$ needs to be a post-supposition to obtain this interpretation of the plain numeral.

5.5.5 A cardinality test for numerals

Interpretation of numerals involves a domain-level cardinality test.

$$(31) \quad \llbracket |j| = n \rrbracket^{(G,H)} = \mathbb{T} \text{ iff } G = H \text{ and } \forall h \in H : |h(j)| = n, \dots \text{ where}$$

- a. $\text{atom}(a) := \forall b \leq a (b = a)$
- b. $|h(j)| := |\{b : b \leq h(j) \wedge \text{atom}(b)\}|$

- The formula counts the atoms that are part of a value assigned to a dref in a cell by an individual assignment. The atoms are recognized via the metalanguage predicate **atom**.

The definition is similar to the definition of domain level cardinality constraints in Henderson (2012). However, compare $\mathbf{inside}(j)=n$ in Kuhn (2017):

$$(32) \quad \mathbf{inside}(j)=n := \lambda GH. G = H \ \& \ |H(j)| = n$$

The analysis in Kuhn (2017) assumes that assignment functions only assign atoms as values. Therefore, cardinality is obtained by counting the individuals in the column of a set of assignments. Since in the present analysis assignment functions are assumed to assign both singularities and pluralities as values, cardinality of values can only be counted by counting atoms.

Moreover, Kuhn's analysis has the at-issue cardinality test $\mathbf{inside}(j/i)=n$ in Kuhn

(2017, ex. 72), defined for distributive numerals.

$$(33) \quad \mathbf{inside}(j/i)=n:= \\ \lambda GH.G = H \ \& \ \forall T \in S : \exists d(d \in H(i) \ \& \ H|_{i=d}(j) = S).|T| = n$$

$\mathbf{inside}(j/i)=n$ requires that every cell in the partition of $H(j)$ with respect to individual values d of $H(i)$ has the cardinality n .

This at-issue test makes the distributive numerals in Kuhn (2017) inherently distributive. Compare it with the cardinality test in (31) above, which only checks cardinality of each *row* of a column and not the cardinality of each *cell* of a partition of a column. (31) does not make the distributive numerals inherently distributive. This is intended, as the proposal in this work is that the distributive numerals are not inherently distributive, but they are licensed in the scope of a distributivity operator.

5.6 Translations for lexical items

Within the grammar defined above, we can translate the lexical items as follows. The verbs are predicates of events. Nominal predicates denote sets of individuals. Definite plurals denote maximum sum individuals. Thematic roles denote functions from individuals to a function from events to individuals. The existential closure for events is a function from a predicate of events to truth-values. It introduces the at-issue “sameness” constraint $\text{SAME}(e)_e$. The constraint is an at-issue update because it helps us obtain a plurality of discourse referents for the dref e , under the distributivity operator.

$$(34) \quad \begin{array}{l} \text{a. } \text{poRechilo} \rightsquigarrow \lambda e.\text{READ}(e) \\ \\ \text{b. } \text{\v{s}uniechilo} \rightsquigarrow \lambda e.\text{CAUSE-TO-LISTEN}(e) \end{array}$$

$$(35) \quad \text{a. } \text{mee} \rightsquigarrow \lambda i.\text{GIRL}(i)$$

- b. $\text{boi} \rightsquigarrow \lambda i. \text{BOOK}(i)$
- c. $\text{gaan} \rightsquigarrow \lambda i. \text{SONG}(i)$
- d. $\text{judge} \rightsquigarrow \lambda i. \text{JUDGE}(i)$
- e. $\text{protijogi} \rightsquigarrow \lambda i. \text{CONTESTANT}(i)$ etc.

$$(36) \quad \Theta \rightsquigarrow \lambda i. \lambda e. \Theta(e, i)$$

$$(37) \quad \text{ExClosure} \rightsquigarrow \lambda V_{vt}. [e] \wedge \text{SAME}(e)_e \wedge V(e)$$

Basic lexical relations and the theta-roles are cumulatively closed by default. All theta-roles and n -ary relations R are always $**R$, where $**R$ is the smallest set such that $R \subseteq **R$ and if $\langle a_1, \dots, a_n \rangle \in **R$ and $\langle b_1, \dots, b_n \rangle \in **R$, then $\langle a_1 \oplus b_1, \dots, a_n \oplus b_n \rangle \in **R$. The star notation is suppressed for readability.

5.6.1 Translations for numerals

Incorporating these tests, the cardinality tests and the post-suppositional tests, the numerals will be interpreted as a conjunction of formulas. The post-suppositional tests are indicated by an overline on them in the translations.

- Plain numeral with specificity

The plain numeral in (38), marked with specificity (by intonation), would be translated as in (39).

$$(38) \quad \begin{array}{l} \text{du-jon-mee} \\ \text{two-cl-girl} \\ \text{'two girls'} \end{array}$$

$$(39) \quad \text{du-jon-mee}_i^i \rightsquigarrow \lambda P.[i] \wedge \text{GIRL}(i) \wedge |i| = 2 \wedge \overline{\text{SAME}(i)}_i \wedge P(i)$$

- Distributive numeral with and without specificity

A distributive numeral as in (40) would be translated as in (41-a) or (41-b).

$$(40) \quad \text{du-jon-}\boxed{\text{du-jon}}\text{-mee/ du-jon-}\boxed{\text{kore}}\text{-mee}$$

two-cl-two-cl-girl/ two-cl-do.pfv-girl
'two-two girls'

$$(41) \quad \text{a. du-jon-kore-mee}_i^j \rightsquigarrow \lambda P.[j] \wedge \text{GIRL}(j) \wedge |j| = 2 \wedge \overline{\text{DIFFERENT}(j)}_i \wedge P(j)$$

$$\text{b. du-jon-kore-mee}_{i,k}^j \rightsquigarrow \lambda P.[j] \wedge \text{GIRL}(j) \wedge |j| = 2 \wedge \overline{\text{DIFFERENT}(j)}_i \wedge \overline{\text{SAME}(j)}_k \wedge P(j)$$

- Morphologically complex distributive numeral

A complex distributive numeral as in (42) would be translated as in (43).

$$(42) \quad \text{du-jon-}\boxed{\text{du-jon-kore}}\text{-mee}$$

two-cl-two-cl-do.pfv-girl
'two-two girls'

$$(43) \quad \text{du-jon-du-jon-kore-mee}_{i,k}^j \rightsquigarrow \lambda P.[j] \wedge \text{GIRL}(j) \wedge |j| = 2 \wedge \overline{\text{DIFFERENT}(j)}_i \wedge \overline{\text{DIFFERENT}(j)}_k \wedge P(j)$$

The distributively interpreted numerals could have additional $\text{SAME}(j)_i$ or $\text{DIFFERENT}(j)_i$ post-suppositional tests depending on what the speaker intends to express in a sentence.

5.6.2 Translations for Universally quantified DPs

The universally quantified DPs as in (44) would be translated as in (45) breaking the universal quantifier into the operators $\max(i)$ and $\delta(i)$.

- (44) a. prott-ek-e
 each-one-agentive.case
 ‘each one of the people’
- b. prott-ek-(Ti)-mee
 each-one-cl-girl
 ‘each one of the girls’

- (45) a. $\text{prott-ek-e}^i \rightsquigarrow \lambda Q.\max(i)(|i| = 1 \wedge \text{PERSON}(i)) \wedge \delta(i)(Q(i))$
- b. $\text{prott-ek-Ti-mee}^i \rightsquigarrow \lambda Q.\max(i)(|i| = 1 \wedge \text{GIRL}(i)) \wedge \delta(i)(Q(i))$

5.6.3 Translation for the distributivity operator D^i

The analysis proposed here assumes that a covert adverbial distributivity operator licenses distributive numerals in the examples involving indefinite and definite plurals. The examples discussed below all instantiate only distribution down to atoms, because of which the atomic distributivity operator D^i (Link, 1987; Roberts, 1987) will be used in the analysis. The distributivity operator D^i would be translated as in (46).

- The formula breaks the universal quantifier into $\max(i)$ over the restrictor formula and $\delta(i)$ over the nuclear scope formula.

- (46) $D^i \rightsquigarrow \lambda P.\lambda j.\max(i)(\text{atom}(i) \wedge i \leq j) \wedge \delta(i)(P(i))$

5.6.4 Illustration of interpretation

With the lexical translations in place, we can derive the examples containing numerals and their licensors. Before going into the relevant examples, let us see how the interpretation proceeds with a baseline example without distributivity. Our example (47) repeated from above has a reading where both of the numerals are cumulatively interpreted. In other words the sentence (47) can be true in a situation where two girls each read at least one book and together they read a total of three books.

- (47) du-jon-mee_x tin-Te-boi_y poRe-chilo
 two-cl-girl three-cl-book read.pfv-be.PAST.3
 ‘Two girls read three books.’

The sentence in this reading will be translated as in (48).

- (48) $[x] \wedge \overline{\text{SAME}(x)_x} \wedge \text{GIRL}(x) \wedge |x| = 2 \wedge [y] \wedge \overline{\text{SAME}(y)_y} \wedge \text{BOOK}(y) \wedge |y| = 3 \wedge [e] \wedge \text{SAME}(e)_e \wedge \text{READ}(e) \wedge \text{AGENT}(e, x) \wedge \text{THEME}(e, y)$

The post-suppositions would be evaluated after the at-issue updates.

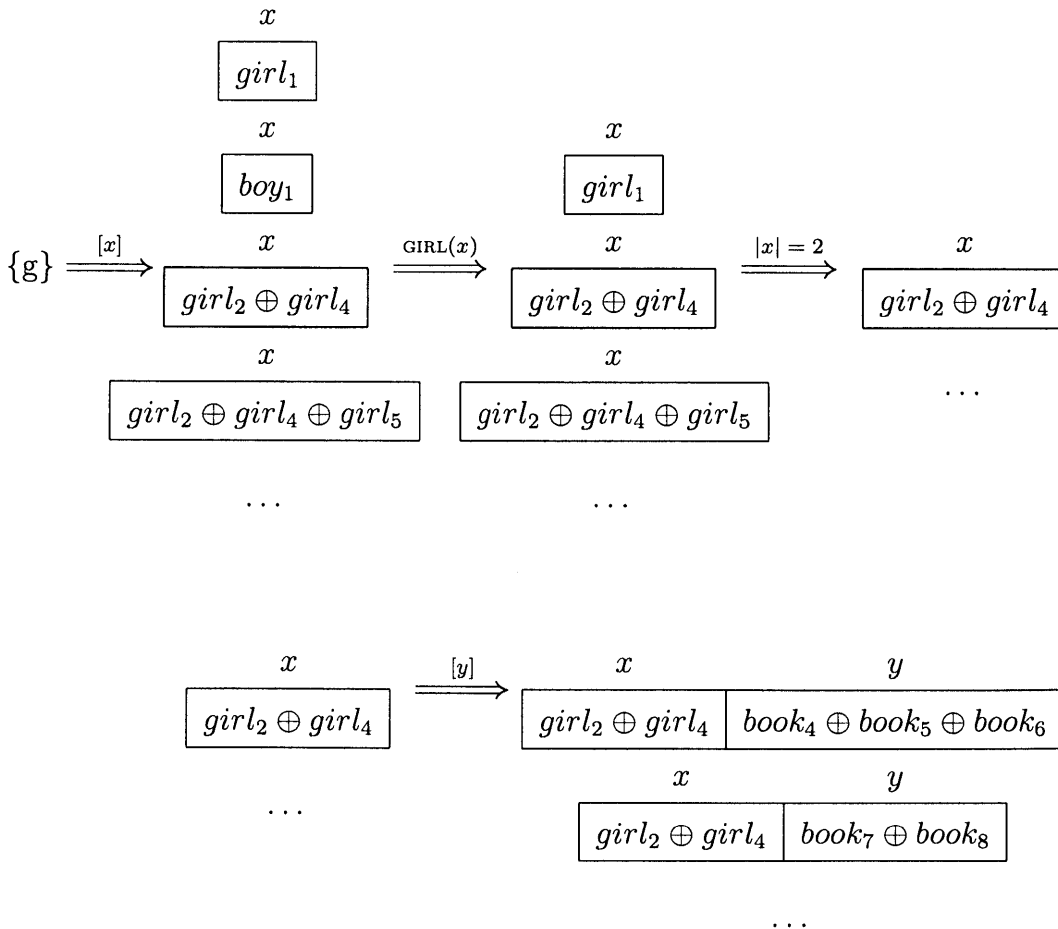
- (49) $([x] \wedge \text{GIRL}(x) \wedge |x| = 2 \wedge [y] \wedge \text{BOOK}(y) \wedge |y| = 3 \wedge [e] \wedge \text{SAME}(e)_e \wedge \text{READ}(e) \wedge \text{AGENT}(e, x) \wedge \text{THEME}(e, y)) \wedge \overline{\text{SAME}(x)_x} \wedge \overline{\text{SAME}(y)_y}$

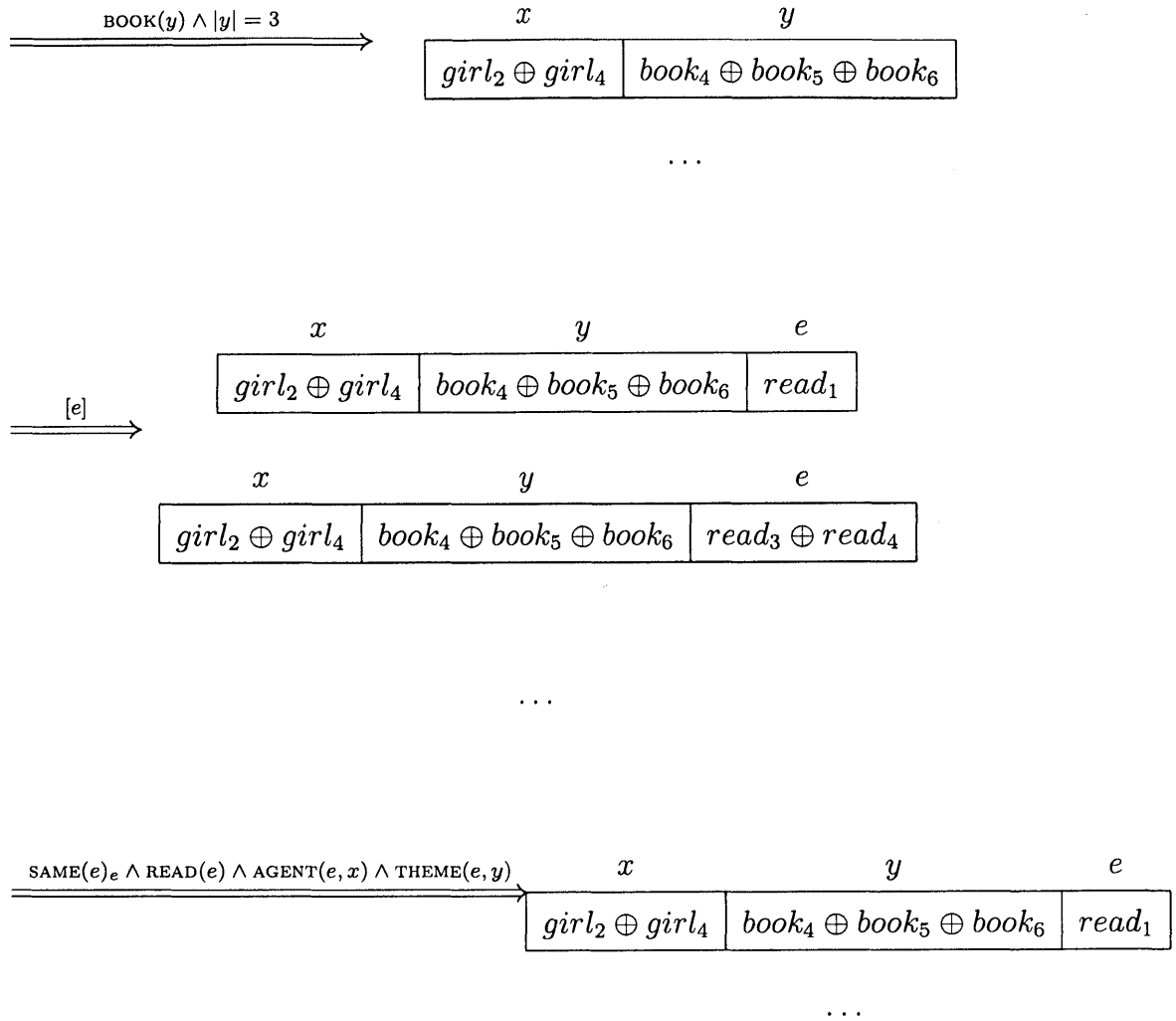
The updates would proceed as follows (illustrated in the flowchart below). We start with an input context G that is assumed to be the singleton set $\{g\}$. $\{g\}$ assigns arbitrary values to all variables. The random assignment assigns the dref x random values that are completely unrestricted and contain all possible individuals and their combinations. The next update filters out values of x that are not girls. The cardinality test only allows pairs of input and output assignments that contain sets with cardinality two. Next the dref y is introduced by assigning random values to it. The next two updates pass only those pairs of input-output assignments that contain sets

of books with cardinality three as values of y . Next the random assignment introduces all kinds of values for events under the dref e . $\text{SAME}(e)_e$ eliminates values with distinct values of events in a set of assignments. The next update only allows assignments that store reading events under e . The test $\text{AGENT}(e, x)$ removes all outputs where the event under e is not mapped to the value of x by the thematic role AGENT . Similarly $\text{THEME}(e, y)$ removes outputs where the theme of the events under e is not the individual under y .

Thus the sentence (47) is true if the formula in (49) can update an input set of assignments successfully to an output set of assignments.

- A successful path of updates





The output of updates by (49) will be Figure 5-6, on which the post-suppositions $\text{SAME}(x)_x$ and $\text{SAME}(y)_y$ will be evaluated. Since all the values of x are identical $\text{SAME}(x)_x$ is satisfied. Since all the values of y are identical $\text{SAME}(y)_y$ is satisfied.

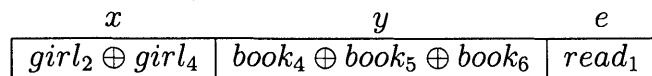


Figure 5-6: Output of the at-issue updates in (49)

In the following few sections, we will look at the interpretations of distributively interpreted numerals.

5.7 Mono-transitive sentences

In this section we will look at how the mono-transitive examples with distributively interpreted numerals work within the grammar sketched above.

5.7.1 Distributive numeral licensed by a universal quantifier

In (50), the distributive numeral in the object position is licensed by the universally quantified subject. For interpretation that means, the distributive numeral that introduces the dref y , has the post-supposition $\text{DIFFERENT}(y)_x$, where x is the dref introduced by the max operator in the universal quantifier.

- (50) prottek-Ti-mee-i^x tin-Te-kore-boi_x^y poRe-chilo
 each.one-cl.-girl-I three-cl.-do.pfv-book read.pfv-be.PAST.3
 (Intended) 'Each girl read three books and the set of books differed across girls.'

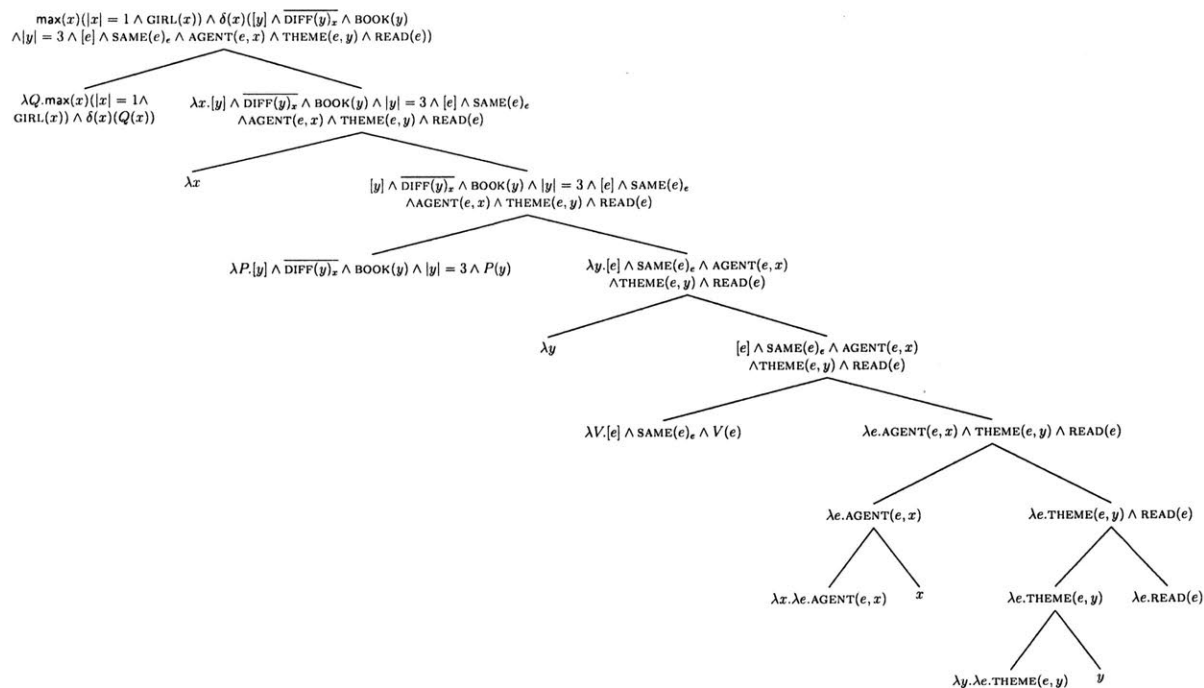


Figure 5-7: Composition of (51)

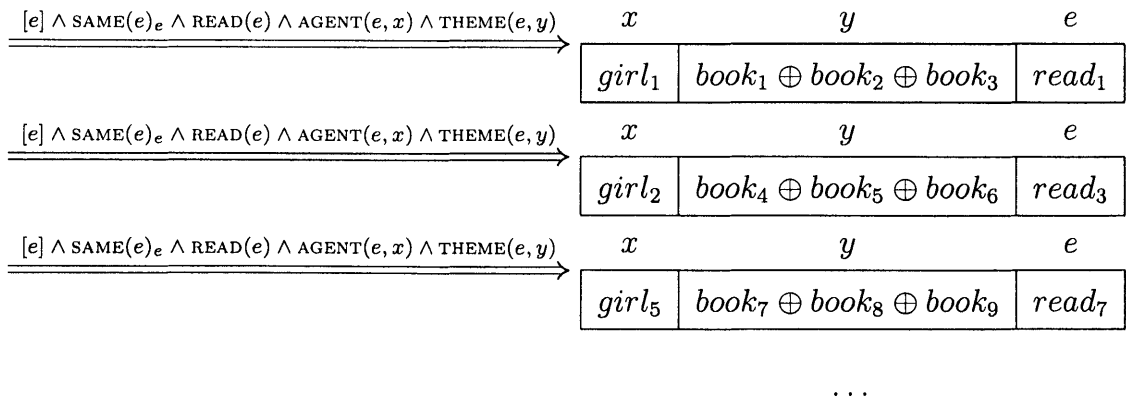
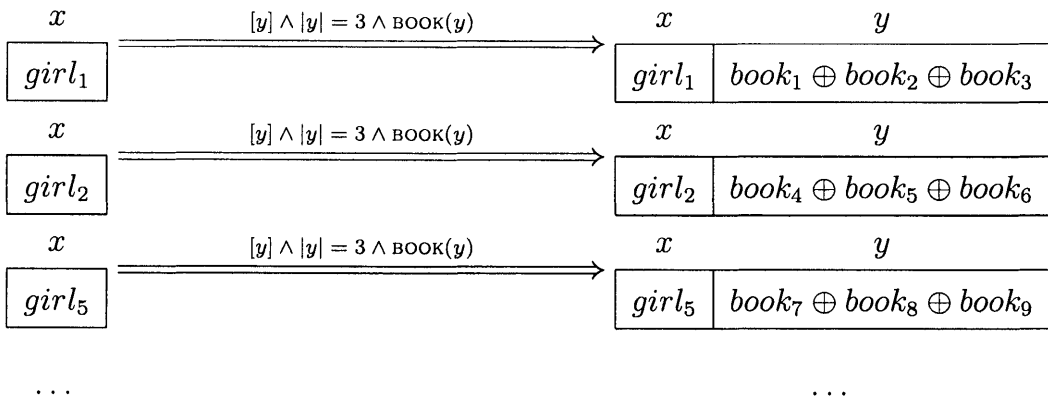
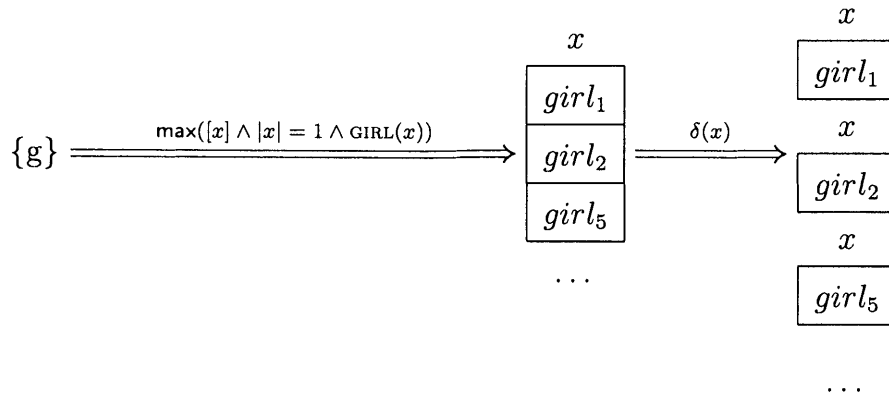
The sentence will be translated as the conjunction of formulas in (51).

$$(51) \quad \max([x] \wedge |x| = 1 \wedge \text{GIRL}(x)) \wedge \delta(x)([y] \wedge \text{BOOK}(y) \wedge |y| = 3 \wedge \overline{\text{DIFFERENT}(y)_x} \wedge [e] \wedge \text{SAME}(e)_e \wedge \text{READ}(e) \wedge \text{AGENT}(e, x) \wedge \text{THEME}(e, y))$$

The distributive numeral's post-supposition $\text{DIFFERENT}(y)_x$ is to be evaluated on the output of the updates with all the atomic formulas in the scope of the distributivity operator. This is represented in (52) where $\text{DIFFERENT}(y)_x$ has been placed outside the scope of δx .

$$(52) \quad \max([x] \wedge |x| = 1 \wedge \text{GIRL}(x)) \wedge \delta(x)([y] \wedge \text{BOOK}(y) \wedge |y| = 3 \wedge [e] \wedge \text{SAME}(e)_e \wedge \text{READ}(e) \wedge \text{AGENT}(e, x) \wedge \text{THEME}(e, y)) \wedge \text{DIFFERENT}(y)_x$$

The following flowchart illustrates the update in (52). The \max operator introduces a new dref $[x]$ and stores in a set of assignments the maximal set of atomic girls. The distributive operator $\delta(x)$ takes the output of maximization. It generates the x -partition of G and updates each cell in $G_{x=a}$ with the nuclear scope formula. The nuclear scope formula finds a set of three books for an atomic girl in each assignment g and an event of reading such that the books are the theme of the reading event and the atomic girl is the agent of the same reading event. If each cell in the partition can be updated like this, then the resulting assignment is stored in a set of assignments H . Since $\delta(x)$ checks updates on each value of $G(x)$, the post-suppositional formula $\text{DIFFERENT}(y)_x$, that is defined over sets of assignments, cannot be successfully tested by $\delta(x)$. As relative to a given value of x we only get the corresponding partition of $H(x)$. However, $\text{DIFFERENT}(y)_x$ needs to be evaluated at on the output set of assignments H . Therefore, the post-suppositional test $\text{DIFFERENT}(y)_x$ will be tested on the resulting set of assignments H successfully updated by $\delta(x)$.



The output of the $\delta(x)$ operator is a set of assignments on which the post-suppositional test $\text{DIFFERENT}(y)_x$ is evaluated.

x	y	e
<i>girl</i> ₁	<i>book</i> ₁ \oplus <i>book</i> ₂ \oplus <i>book</i> ₃	<i>read</i> ₁
<i>girl</i> ₂	<i>book</i> ₄ \oplus <i>book</i> ₅ \oplus <i>book</i> ₆	<i>read</i> ₃
<i>girl</i> ₅	<i>book</i> ₇ \oplus <i>book</i> ₈ \oplus <i>book</i> ₉	<i>read</i> ₇
...

The post-supposition is evaluated by introducing the x -partition in $H(y)$. The x -partition of $H(y)$ is as in (53). It can be represented by the substate of H in Figure 5-8.

$$(53) \quad \{\{book_1 \oplus book_2 \oplus book_3\}, \{book_4 \oplus book_5 \oplus book_6\}, \{book_7 \oplus book_8 \oplus book_9\}\}$$

H	x	y
h_1	<i>girl</i> ₁	<i>book</i> ₁ \oplus <i>book</i> ₂ \oplus <i>book</i> ₃
h_2	<i>girl</i> ₂	<i>book</i> ₄ \oplus <i>book</i> ₅ \oplus <i>book</i> ₆
h_5	<i>girl</i> ₅	<i>book</i> ₇ \oplus <i>book</i> ₈ \oplus <i>book</i> ₉
...

Figure 5-8: x -partition of $H(y)$

Since the cells of the partition are different from each other, the post-suppositional test $\text{DIFFERENT}(y)_x$ is satisfied.

5.7.2 Plain numeral under a universal quantifier

If the direct object were a plain numeral with specificity, as in (54) under the scope of a universal quantifier, the plain numeral introducing the dref y would have the post-suppositional test $\text{SAME}(y)_y$, where x is the dref introduced by the max operator in the universally quantified subject.

$$(54) \quad \text{prottek-Ti-mee-i}^x \text{ tin-Te-boi}^y \text{ poRe-chilo}$$

each.one-cl.-girl-I three-cl.-book read.pfv-be.PAST.3
‘Each girl read the same three books.’

Example (54) will be translated as the conjunction of formulas in (55). The sentence (54) will be true if the input context can be updated into an output context by the formulas successively in one contiguous path of updates.

$$(55) \quad \max([x] \wedge |x| = 1 \wedge \text{GIRL}(x)) \wedge \delta(x)([y] \wedge \text{BOOK}(y) \wedge |y| = 3 \wedge \overline{\text{SAME}(y)}_y \wedge [e] \wedge \text{SAME}(e)_e \wedge \text{READ}(e) \wedge \text{AGENT}(e, x) \wedge \text{THEME}(e, y))$$

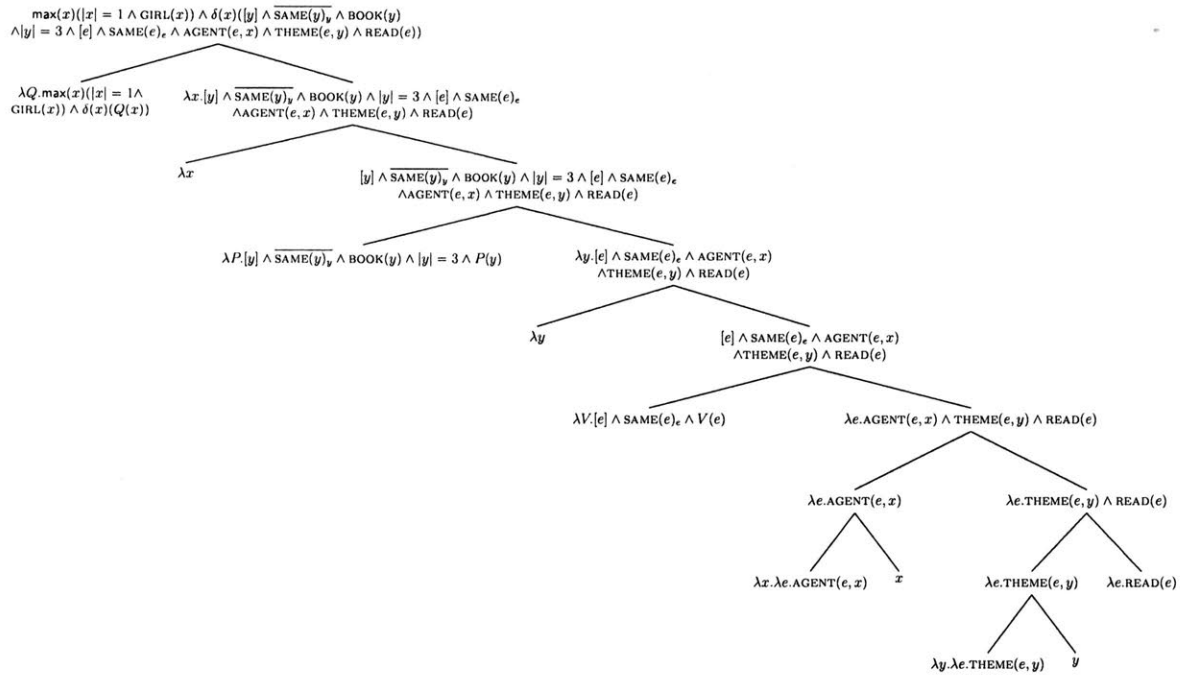


Figure 5-9: Composition of (55)

The plain numeral with specificity has the post-supposition $\text{SAME}(y)_y$ which is to be evaluated on the output of δx operator.

$$(56) \quad \max([x] \wedge |x| = 1 \wedge \text{GIRL}(x)) \wedge \delta(x)([y] \wedge \text{BOOK}(y) \wedge |y| = 3 \wedge [e] \wedge \text{SAME}(e)_e \wedge \text{READ}(e) \wedge \text{AGENT}(e, x) \wedge \text{THEME}(e, y)) \wedge \text{SAME}(y)_y$$

Like before, max operator introduces the dref $[x]$ and stores in a set of assignments the maximal set of atomic girls. The distributive operator $\delta(x)$ takes the output of maximization. It checks that we can successfully update each cell in the x -partition of G storing an atomic girl, with the nuclear scope formula. The nuclear scope formula finds a set of three books under the dref y for an atomic girl in each assignment g such that the girl and the set of three books are mapped to the same event of reading under e as agent and as theme respectively. If each assignment can be updated like this, then the resulting assignment is stored in a set of assignments H . The post-suppositional test $\text{SAME}(y)_y$ would be tested on the resulting set of assignments H successfully updated by δx .

Only an output like Figure 5-10, where each girl is mapped to the same set of three books will be satisfied by the post-supposition $\text{SAME}(y)_y$ of the plain numeral with specificity.

x	y	e
$girl_1$	$book_1 \oplus book_2 \oplus book_3$	$read_1$
$girl_2$	$book_1 \oplus book_2 \oplus book_3$	$read_2$
$girl_3$	$book_1 \oplus book_2 \oplus book_3$	$read_3$
...

Figure 5-10: Evaluation matrix for post-supposition $\text{SAME}(y)_y$

The post-supposition is evaluated by introducing a trivial partition in $H(y)$ as in (57) represented by the substate of H in Figure 5-11.

$$(57) \quad \{book_1 \oplus book_2 \oplus book_3, book_1 \oplus book_2 \oplus book_3, book_1 \oplus book_2 \oplus book_3\}$$

H	x	y
h_1	$girl_1$	$book_1 \oplus book_2 \oplus book_3$
h_2	$girl_2$	$book_1 \oplus book_2 \oplus book_3$
h_5	$girl_5$	$book_1 \oplus book_2 \oplus book_3$
...

Figure 5-11: Trivial partition of $H(y)$

Since the values in the partition are identical, the post-suppositional test $\text{SAME}(y)_y$ is satisfied.

5.7.3 Distributive numeral licensed by a plain numeral

In (58), a distributive numeral is licensed by a plain numeral. The post-supposition of the distributive numeral $\text{DIFFERENT}(y)_{x'}$ finds its antecedent in the dref introduced by the max operator in the distributivity operator D .

(58) du-jon-mee_x D^{x'} tin-Te-kore-boi_{x'}, poRe-chilo
 two-cl.-girl D three-cl.-do.pfv-book read.pfv-be.PAST.3
 ‘Two girls read different sets of three books.’

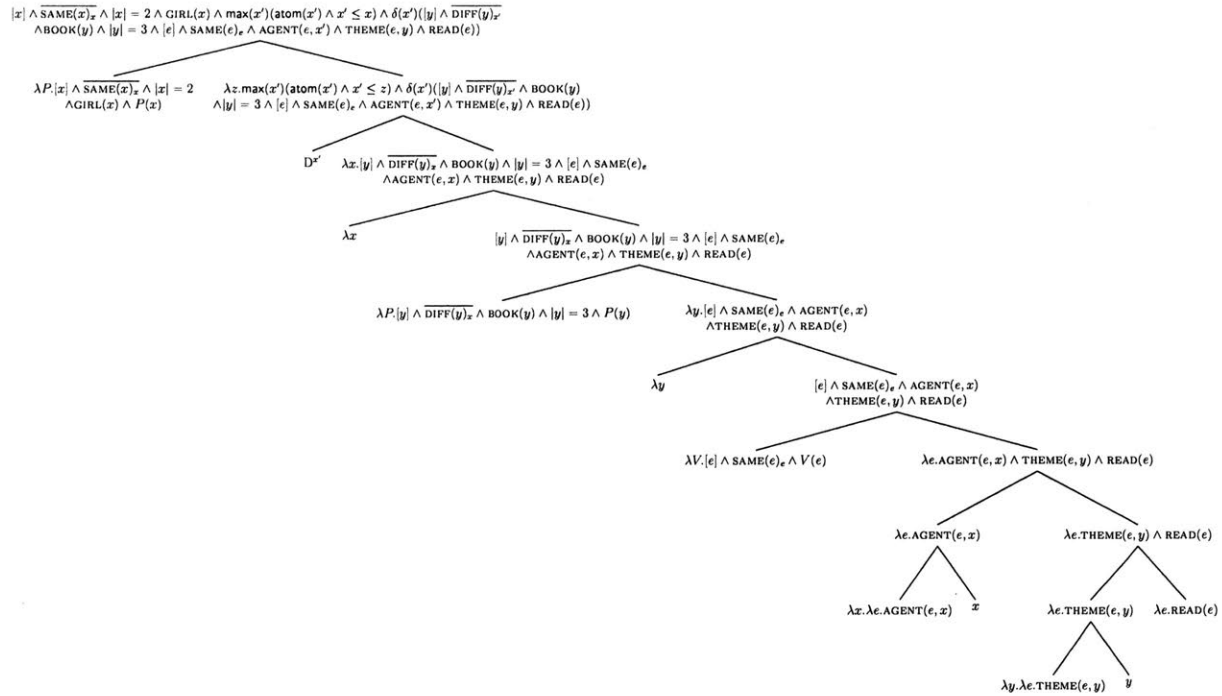


Figure 5-12: Composition of (59)

The sentence (58) is translated as the conjunction of formulas in (59). The distributivity operator $D^{x'}$ is broken up into $\text{max}(x')$ and $\delta(x)$ operators. The operator max introduces the dref x' . The formula in the scope of $\text{max}(x')$ defines x' as an

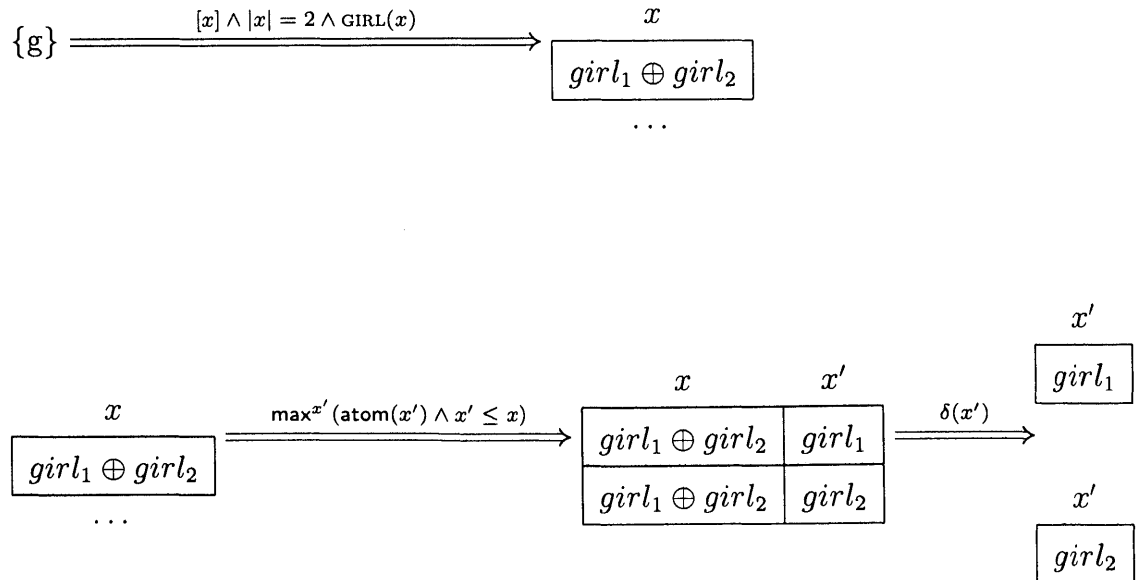
atomic part of x , which is the dref introduced by the plain numeral. The $\delta(x')$ operator takes each cell in the partition of $G(x')$ and checks if the corresponding partition $H(x')$ satisfies the nuclear scope formula.

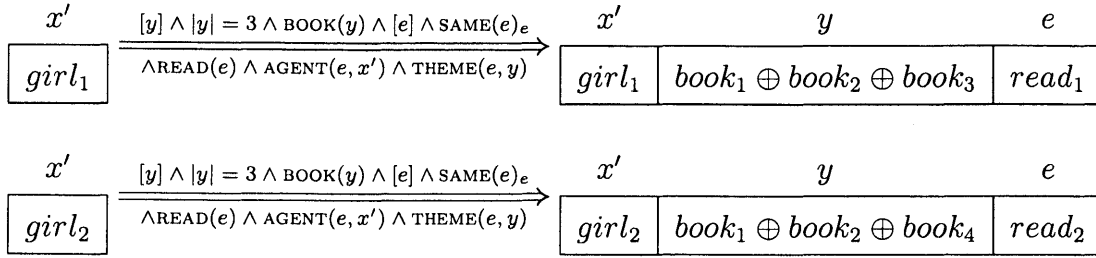
$$(59) \quad [x] \wedge \overline{\text{SAME}(x)_x} \wedge |x| = 2 \wedge \text{GIRL}(x) \wedge \max(x')(\text{atom}(x') \wedge x' \leq x) \wedge \delta(x')([y] \wedge |y| = 3 \wedge \text{BOOK}(y) \wedge \overline{\text{DIFFERENT}(y)_{x'}} \wedge [e] \wedge \text{SAME}(e)_e \wedge \text{READ}(e) \wedge \text{AGENT}(e, x') \wedge \text{THEME}(e, y))$$

The post-suppositions $\text{SAME}(x)_x$ and $\text{DIFFERENT}(y)_{x'}$ is tested on the output set of assignments of the $\delta x'$ operator.

$$(60) \quad ([x] \wedge |x| = 2 \wedge \text{GIRL}(x) \wedge \max(x')(\text{atom}(x') \wedge x' \leq x) \wedge \delta(x')([y] \wedge |y| = 3 \wedge \text{BOOK}(y) \wedge [e] \wedge \text{SAME}(e)_e \wedge \text{READ}(e) \wedge \text{AGENT}(e, x') \wedge \text{THEME}(e, y)) \wedge \text{DIFFERENT}(y)_{x'} \wedge \text{SAME}(x)_x$$

The following flowchart describes one path of successful updates.





The output of $\delta x'$ operator would look like Figure 5-13, a substate of which satisfies the post-supposition $\text{DIFFERENT}(y)_{x'}$ of the distributive numeral. As before, $\text{DIFFERENT}(y)_{x'}$ would introduce an x' -partition into column under y in the set of assignments in Figure 5-13 and check if for the pair of individual values under x' the corresponding values in y differ. Figure 5-14 represents the relevant substate with the partition.

x'	y	e
<i>girl</i> ₁	<i>book</i> ₁ \oplus <i>book</i> ₂ \oplus <i>book</i> ₃	<i>read</i> ₁
<i>girl</i> ₂	<i>book</i> ₁ \oplus <i>book</i> ₂ \oplus <i>book</i> ₄	<i>read</i> ₂

Figure 5-13: Output satisfying $\text{DIFFERENT}(y)_{x'}$

H	x'	y
h_1	<i>girl</i> ₁	<i>book</i> ₁ \oplus <i>book</i> ₂ \oplus <i>book</i> ₃
h_2	<i>girl</i> ₂	<i>book</i> ₁ \oplus <i>book</i> ₂ \oplus <i>book</i> ₄

Figure 5-14: x' -partition of $H(y)$

Without a distributivity operator that incorporates in itself the combined effects of the operators \max and δ , we would get as output a set of assignments where the same two girls are related to one or many sets of three books via the same event of reading. The translation of (58) in that case would be the conjunction of formulas in (61). In the absence of the $D^{x'}$ operator, the post-supposition would just apply to the output of the conjunction of formulas (62).

$$(61) \quad [x] \wedge \overline{\text{SAME}(x)_x} \wedge \text{GIRL}(x) \wedge |x| = 2 \wedge [y] \wedge \overline{\text{DIFFERENT}(y)_x} \wedge \text{BOOK}(y) \wedge |y| = 3 \wedge [e] \wedge \text{SAME}(e)_e \wedge \text{READ}(e) \wedge \text{AGENT}(e, x) \wedge \text{THEME}(e, y)$$

$$(62) \quad (([x] \wedge \text{GIRL}(x) \wedge |x| = 2 \wedge [y] \wedge \text{BOOK}(y) \wedge |y| = 3 \wedge [e] \wedge \text{SAME}(e)_e \wedge \text{READ}(e) \wedge \text{AGENT}(e, x) \wedge \text{THEME}(e, y)) \wedge \text{DIFFERENT}(y)_x) \wedge \text{SAME}(x)_x$$

Figure 5-15 illustrates one possible output. The output set of assignments in this case would fail to satisfy the post-supposition $\text{DIFFERENT}(y)_x$, because there would be only one individual value in the x column, whereas $\text{DIFFERENT}(y)_x$ needs at least two values in the x column to introduce a non-trivial partition into $H(y)$.

Moreover, the same event of reading is mapped to different sets of three books by the thematic role function THEME , which would violate Uniqueness of objects (Krifka, 1992) which requires the mapping of an event to an object by a thematic relation to be unique.¹

x	y	e
$girl_1 \oplus girl_2$	$book_1 \oplus book_2 \oplus book_3$	$read_1$
$girl_1 \oplus girl_2$	$book_4 \oplus book_5 \oplus book_6$	$read_1$
$girl_1 \oplus girl_2$	$book_7 \oplus book_8 \oplus book_9$	$read_1$

Figure 5-15: Output without a distributivity operator

An additional advantage of ruling out an output like Figure 5-15 is that we also rule out occasion distributive readings for sentences like (58) in Bangla (it can be extended to Hungarian, Kachikeli (Henderson, 2014)). With the same event of reading we do not have access to multiple occasions.

A singularity would fail to license a distributive numeral because it would lead to an output where the post-supposition $\text{DIFFERENT}(y)_x$ cannot be met. Figure 5-16 illustrates a possible output of updates with a distributivity operator. It fails to provide two distinct values for x' for $\text{DIFFERENT}(y)_{x'}$ to work on. A translation

¹This particular explanation based on Thematic Uniqueness is discussed in Henderson (2014, p. 32).

without a distributivity operator can be ruled out based on the explanation from thematic uniqueness above.

x'	y	e
$girl_2$	$book_1 \oplus book_2 \oplus book_3$	$read_1$
$girl_2$	$book_1 \oplus book_2 \oplus book_4$	$read_2$
$girl_2$	$book_1 \oplus book_3 \oplus book_4$	$read_3$

Figure 5-16: Output with singularity as licensor

5.8 Ditransitive sentences

5.8.1 Agent distributive readings

The sentence (63) can be interpreted in several ways.

- (63) du-jon-protijogi_x^x D^{x'} tin-jon-judge-ke_y^y du-To-kore-gaan_{x'}^z
two-cl-contestatnt D three-cl-judge-DAT two-cl-do.pfv-song
šunie-chilo
listen.cause.pfv-be.past.3
‘Two contestants made three judges listen to two songs each.’

Let us first analyze the reading of the sentence when it describes a situation where two contestants each sang two songs and the goal of their singing were three judges. The judges remained the same for each contestant, but the pair of songs differed. We have described this reading of (63) as the *Agent distributive* reading.

This reading of (63) will be translated as the conjunction of formulas in (64) and (65) shows that the post-suppositions $\text{SAME}(x)_x$ and $\text{SAME}(y)_y$ and $\text{DIFFERENT}(z)_{x'}$ are evaluated on the output of the δ operator.

- (64) $[x] \wedge |x| = 2 \wedge \text{CONTESTANT}(x) \wedge \overline{\text{SAME}(x)_x} \wedge \mathbf{max}(x')(\text{atom}(x') \wedge x' \leq x) \wedge$
 $\delta(x')([y] \wedge \overline{\text{SAME}(y)_y} \wedge |y| = 3 \wedge \text{JUDGE}(y) \wedge [z] \wedge \overline{\text{DIFFERENT}(z)_{x'}} \wedge |z| = 2 \wedge$
 $\text{SONG}(z) \wedge [e] \wedge \text{SAME}(e)_e \wedge \text{CAUSED-TO-LISTEN}(e) \wedge \text{AGENT}(e, x') \wedge \text{GOAL}(e, y) \wedge$

THEME(e, z)

$$(65) \quad ([x] \wedge |x| = 2 \wedge \text{CONTESTANT}(x) \wedge \max(x')(\text{atom}(x') \wedge x' \leq x) \wedge \delta(x')([y] \wedge |y| = 3 \wedge \text{JUDGE}(y) \wedge [z] \wedge |z| = 2 \wedge \text{SONG}(z) \wedge [e] \wedge \text{SAME}(e)_e \wedge \text{CAUSED-TO-LISTEN}(e) \wedge \text{AGENT}(e, x') \wedge \text{GOAL}(e, y) \wedge \text{THEME}(e, z)) \wedge \text{SAME}(y)_{x'} \wedge \text{DIFFERENT}(z)_{x'} \wedge \text{SAME}(x)_x$$

A successful update with this conjunction of formulas could yield an output like in Figure 5-17.

x	x'	y	z	e
$c_1 \oplus c_2$	c_1	$judge_1 \oplus judge_2 \oplus judge_3$	$song_1 \oplus song_2$	$c - t - l_1$
$c_1 \oplus c_2$	c_2	$judge_1 \oplus judge_2 \oplus judge_3$	$song_3 \oplus song_4$	$c - t - l_2$

Figure 5-17: Output for Agent-distributive situation

On this output the post-supposition $\text{SAME}(y)_y$ will be evaluated by checking if $H(y)$ has a trivial partition, which looks like (66-a). Since the values in the partition are identical to each other, the post-supposition $\text{SAME}(y)_y$ will be satisfied.

$$(66) \quad \begin{array}{l} \text{a. } \{judge_1 \oplus judge_2 \oplus judge_3, judge_1 \oplus judge_2 \oplus judge_3\} \\ \\ \text{b. } \{\{song_1 \oplus song_2\}, \{song_3 \oplus song_4\}\} \end{array}$$

Similarly the post-supposition $\text{DIFFERENT}(z)_{x'}$ will be evaluated by introducing the x' -partition in $H(z)$, which looks like (66-b). Since the cells are distinct in this case, the post-supposition would be satisfied.

5.8.2 The Goal distributive reading

$$(67) \quad \begin{array}{l} \text{du-jon-protijogi}_x^x \quad \text{tin-jon-judge-ke}_y^y \quad D^{y'} \text{ du-To-} \boxed{\text{kore}} \text{-gaan}_y^z, \\ \text{two-cl-contestatnt three-cl-judge-DAT D two-cl-do.pfv-song} \\ \text{\u0161unie-chilo} \\ \text{listen.cause.pfv-be.past.3} \\ \text{'Two contestants made three judges listen to two songs each.'} \end{array}$$

The sentence (63) repeated here as (67) can be interpreted to be describing a situation where each of the judges heard two songs from the two contestants. Since the judges are the goal of singing by the contestants, we would call this the *Goal distributive* reading. For this reading the post-supposition on the distributive numeral would be $\text{DIFFERENT}(z)_{y'}$, where z is the dref introduced by distributive numeral and y' is the dref introduced by the distributivity operator via the \max operator in it.

The sentence (67) will translated as the conjunction of formulas in (68) and (69) shows that the post-supposition $\text{DIFFERENT}(z)_{y'}$ is evaluated on the output of the δ operator.

$$(68) \quad [x] \wedge \overline{\text{SAME}(x)_x} \wedge |x| = 2 \wedge \text{CONTESTANT}(x) \wedge [y] \wedge \overline{\text{SAME}(y)_y} \wedge |y| = 3 \wedge \text{JUDGE}(y) \wedge \max(y')(\text{atom}(y') \wedge y' \leq y) \wedge \delta(y')([z] \wedge \overline{\text{DIFFERENT}(z)_{y'}} \wedge |z| = 2 \wedge \text{SONG}(z) \wedge [e] \wedge \text{SAME}(e)_e \wedge \text{CAUSED-TO-LISTEN}(e) \wedge \text{AGENT}(e, x) \wedge \text{GOAL}(e, y') \wedge \text{THEME}(e, z))$$

$$(69) \quad ([x] \wedge |x| = 2 \wedge \text{CONTESTANT}(x) \wedge [y] \wedge |y| = 3 \wedge \text{JUDGE}(y) \wedge \max(y')(\text{atom}(y') \wedge y' \leq y) \wedge \delta(y')([z] \wedge |z| = 2 \wedge \text{SONG}(z) \wedge [e] \wedge \text{SAME}(e)_e \wedge \text{CAUSED-TO-LISTEN}(e) \wedge \text{AGENT}(e, x) \wedge \text{GOAL}(e, y') \wedge \text{THEME}(e, z)) \wedge \text{DIFFERENT}(z)_{y'} \wedge \text{SAME}(x)_x \wedge \text{SAME}(y)_y$$

The output of successful updates with these formulas in (69) could yield a set of assignments as in Figure 5-18. The post-supposition $\text{DIFFERENT}(z)_{y'}$ will check that at least two cells in the y' -partition of $H(z)$ (70) have non-identical values.

x	y	y'	z	e
$c_1 \oplus c_2$	$judge_1 \oplus judge_2 \oplus judge_3$	$judge_1$	$song_1 \oplus song_2$	$c - t - l_1$
$c_1 \oplus c_2$	$judge_1 \oplus judge_2 \oplus judge_3$	$judge_2$	$song_3 \oplus song_4$	$c - t - l_2$
$c_1 \oplus c_2$	$judge_1 \oplus judge_2 \oplus judge_3$	$judge_3$	$song_4 \oplus song_5$	$c - t - l_3$

Figure 5-18: Output for Goal-distributive situation

$$(70) \quad \{\{song_1 \oplus song_2\}, \{song_3 \oplus song_4\}, \{song_4 \oplus song_5\}\}$$

5.8.3 Agent and Goal distributive readings

There is a parse of (71) in which the speaker is taken to have said that the songs varied across contestants but remained the same across judges. In that interpretation there will be two post-suppositions on the distributive numeral: $\text{DIFFERENT}(z)_{x'}$ and $\text{SAME}(z)_{y'}$ and the plain numeral indirect object must be marked to have $\text{SAME}(y)_y$. For the interpretation to go through there should be two distributivity operators in the translation (72) for (71).

- (71) du-jon-protijogi_x^x D^{x'} tin-jon-judge-ke_y^y D^{y'} du-To-kore-gaan_{x',y'}^z
two-cl-contestatnt D three-cl-judge-DAT D two-cl-do.pfv-song
šunie-chilo
listen.cause.pfv-be.past.3
‘Two contestants made three judges listen to two songs each.’

(73) shows that the post-suppositions $\text{SAME}(y)_y$ and $\text{DIFFERENT}(z)_{x'}$ are evaluated on the output of the $\delta x'$ operator, and the post-supposition $\text{SAME}(z)_{y'}$ is evaluated on the output of the $\delta y'$ operator.

- (72) $[x] \wedge \text{SAME}(x)_x \wedge |x| = 2 \wedge \text{CONTESTANT}(x) \wedge \max(x')(\text{atom}(x') \wedge x' \leq x) \wedge$
 $\delta(x')([y] \wedge |y| = 3 \wedge \text{JUDGE}(y) \wedge \overline{\text{SAME}(y)_{x'}} \wedge \max(y')(\text{atom}(y') \wedge y' \leq y) \wedge$
 $\delta(y')([z] \wedge |z| = 2 \wedge \text{SONG}(z) \wedge \overline{\text{DIFFERENT}(z)_{x'}} \wedge \text{SAME}(z)_{y'} \wedge [e] \wedge \text{SAME}(e)_e \wedge$
 $\text{CAUSED-TO-LISTEN}(e) \wedge \text{AGENT}(e, x') \wedge \text{GOAL}(e, y') \wedge \text{THEME}(e, z))$

- (73) $([x] \wedge |x| = 2 \wedge \text{CONTESTANT}(x) \wedge \max(x')(\text{atom}(x') \wedge x' \leq x) \wedge \delta(x')([y] \wedge$
 $|y| = 3 \wedge \text{JUDGE}(y) \wedge \max(y')(\text{atom}(y') \wedge y' \leq y) \wedge \delta(y')([z] \wedge |z| = 2 \wedge$
 $\text{SONG}(z) \wedge [e] \wedge \text{SAME}(e)_e \wedge \text{CAUSED-TO-LISTEN}(e) \wedge \text{AGENT}(e, x') \wedge \text{GOAL}(e, y') \wedge$
 $\text{THEME}(e, z)) \wedge \text{SAME}(z)_{y'} \wedge \text{SAME}(y)_y \wedge \text{DIFFERENT}(z)_{x'} \wedge \text{SAME}(x)_x$

The output of successful updates with the formulas could be the set of assignments in Figure 5-19.

The post-supposition $\text{SAME}(y)_y$ is evaluating the trivial partition of $H(y)$ and

x	x'	y	y'	z	e
$c_1 \oplus c_2$	c_1	$judge_1 \oplus judge_2 \oplus judge_3$	$judge_1$	$song_1 \oplus song_2$	$c - t - l_1$
$c_1 \oplus c_2$	c_1	$judge_1 \oplus judge_2 \oplus judge_3$	$judge_2$	$song_1 \oplus song_2$	$c - t - l_2$
$c_1 \oplus c_2$	c_1	$judge_1 \oplus judge_2 \oplus judge_3$	$judge_3$	$song_1 \oplus song_2$	$c - t - l_3$
$c_1 \oplus c_2$	c_2	$judge_1 \oplus judge_2 \oplus judge_3$	$judge_1$	$song_3 \oplus song_4$	$c - t - l_4$
$c_1 \oplus c_2$	c_2	$judge_1 \oplus judge_2 \oplus judge_3$	$judge_2$	$song_3 \oplus song_4$	$c - t - l_5$
$c_1 \oplus c_2$	c_2	$judge_1 \oplus judge_2 \oplus judge_3$	$judge_3$	$song_3 \oplus song_4$	$c - t - l_6$

Figure 5-19: Output for an Agent and Goal-distributive situation

checks if the values in this partition are identical (74). The post-supposition $\text{DIFFERENT}(z)_{x'}$ evaluates the x' -partition of $H(z)$ and checks if at least two of the cells in this partition are distinct (75). The post-supposition $\text{SAME}(z)_{y'}$ evaluates the y' -partition of $H(z)$ and checks if the cells are identical (76).

$$(74) \quad \{judge_1 \oplus judge_2 \oplus judge_3, judge_1 \oplus judge_2 \oplus judge_3, judge_1 \oplus judge_2 \oplus judge_3, judge_1 \oplus judge_2 \oplus judge_3, judge_1 \oplus judge_2 \oplus judge_3, judge_1 \oplus judge_2 \oplus judge_3, judge_1 \oplus judge_2 \oplus judge_3\}$$

$$(75) \quad \{\{\{song_1 \oplus song_2\}, \{song_1 \oplus song_2\}, \{song_1 \oplus song_2\}\}, \{\{song_3 \oplus song_4\}, \{song_3 \oplus song_4\}\}\}$$

H	x'	z
h_1	c_1	$song_1 \oplus song_2$
h_2	c_1	$song_1 \oplus song_2$
h_3	c_1	$song_1 \oplus song_2$
h_4	c_2	$song_3 \oplus song_4$
h_5	c_2	$song_3 \oplus song_4$
h_6	c_2	$song_3 \oplus song_4$

Figure 5-20: x' partition of $H(z)$

$$(76) \quad \{\{\{\{song_1 \oplus song_2\}, \{song_3 \oplus song_4\}\}, \{\{song_1 \oplus song_2\}, \{song_3 \oplus song_4\}\}\}, \{\{song_1 \oplus song_2\}, \{song_3 \oplus song_4\}\}\}$$

<i>H</i>	<i>y'</i>	<i>z</i>
h ₁	<i>judge</i> ₁	<i>song</i> ₁ ⊕ <i>song</i> ₂
h ₄	<i>judge</i> ₁	<i>song</i> ₃ ⊕ <i>song</i> ₄
h ₂	<i>judge</i> ₂	<i>song</i> ₁ ⊕ <i>song</i> ₂
h ₅	<i>judge</i> ₂	<i>song</i> ₃ ⊕ <i>song</i> ₄
h ₃	<i>judge</i> ₃	<i>song</i> ₁ ⊕ <i>song</i> ₂
h ₆	<i>judge</i> ₃	<i>song</i> ₃ ⊕ <i>song</i> ₄

Figure 5-21: *y'* partition of *H(z)*

As we can see the translation (72) or (73) with two distributivity operators does yield the desired result. However, the same situation can be described by the simpler Agent distributive translation in (65). A comparison between the Figures 5-17 and 5-19, makes this clear. Therefore we do not need the translation with two distributivity operators for describing the Agent and Goal distributive situation discussed above, as it can be subsumed under the Agent distributive situation.

Analogously there is an Agent and Goal distributive parse of the same sentence, where the songs varied with respect to judges but remained same across the contestants. And the judges remained the same for the contestants too. This parse with two distributivity operators again is unnecessary, as it yields results equivalent to the simpler Goal distributive translation.

However, we do need the Agent and Goal distributive translation for situations when the songs vary with respect to both the agent and the goal. For Bangla, the direct object in this case is preferably lexicalized by a complex distributive numeral². In (77) the distributive numeral will be translated with the post-suppositions DIFFERENT(*z*)_{*x'*} and DIFFERENT(*z*)_{*y'*}. The plain numeral indirect object will be translated with the post-supposition SAME(*y*)_{*y*}.

(77) du-jon-protijogi_{*x*}^{*x*} D^{*x'*} tin-jon-judge-ke_{*y*}^{*y*} D^{*y'*} du-To-du-To-kore-gaan_{*x',y'*}^{*z*}
two-cl-contestant D three-cl-judge-DAT D two-cl-two-cl-do.pfv-song

²If a language distinguishes between simple and complex distributive numerals, it usually uses the complex form to indicate distributivity over more than one plurality, which is a typological observation that can be derived from (Gil, 1982)

šunie-chilo

listen.cause.pfv-be.past.3

'Two contestants made three judges listen to two songs each.'

The sentence (77) will be translated as in (78) and (79) shows where the relevant post-suppositions will be evaluated.

$$(78) \quad [x] \wedge \overline{\text{SAME}(x)_x} \wedge |x| = 2 \wedge \text{CONTESTANT}(x) \wedge \max(x')(\text{atom}(x') \wedge x' \leq x) \wedge \delta(x')([y] \wedge |y| = 3 \wedge \text{JUDGE}(y) \wedge \overline{\text{SAME}(y)_y} \wedge \max(y')(\text{atom}(y') \wedge y' \leq y) \wedge \delta(y')([z] \wedge |z| = 2 \wedge \text{SONG}(z) \wedge \overline{\text{DIFFERENT}(z)_{x'}} \wedge \overline{\text{DIFFERENT}(z)_{y'}} \wedge [e] \wedge \text{SAME}(e)_e \wedge \text{CAUSED-TO-LISTEN}(e) \wedge \text{AGENT}(e, x') \wedge \text{GOAL}(e, y') \wedge \text{THEME}(e, z))$$

$$(79) \quad ([x] \wedge |x| = 2 \wedge \text{CONTESTANT}(x) \wedge \max(x')(\text{atom}(x') \wedge x' \leq x) \wedge \delta(x')([y] \wedge |y| = 3 \wedge \text{JUDGE}(y) \wedge \max(y')(\text{atom}(y') \wedge y' \leq y) \wedge \delta(y')([z] \wedge |z| = 2 \wedge \text{SONG}(z) \wedge [e] \wedge \text{SAME}(e)_e \wedge \text{CAUSED-TO-LISTEN}(e) \wedge \text{AGENT}(e, x') \wedge \text{GOAL}(e, y') \wedge \text{THEME}(e, z)) \wedge \text{DIFFERENT}(z)_{y'}) \wedge \text{SAME}(y)_y \wedge \text{DIFFERENT}(z)_{x'}) \wedge \text{SAME}(x)_x$$

The x' -partition of $H(z)$ looks like (80). Given that the cells in the partition are distinct, the post-supposition $\text{DIFFERENT}(z)_{x'}$ is satisfied.

$$(80) \quad \{\{\{song_1 \oplus song_2\}, \{song_1 \oplus song_3\}, \{song_1 \oplus song_2\}\}, \{\{song_3 \oplus song_4\}, \{song_3 \oplus song_5\}, \{song_3 \oplus song_4\}\}\}$$

The y' -partition of $H(z)$ looks like (81). Given that at least two of the cells in the partition are distinct, the post-supposition $\text{DIFFERENT}(z)_{y'}$ is satisfied.

$$(81) \quad \{\{\{song_1 \oplus song_2\}, \{song_3 \oplus song_4\}\}, \{\{song_1 \oplus song_3\}, \{song_3 \oplus song_5\}\}, \{\{song_1 \oplus song_2\}, \{song_3 \oplus song_4\}\}\}$$

Similarly all examples that can be interpreted to have both Agent and Goal distributive readings would require to be translated with two distributive numerals. Sentence (82) is most felicitously interpreted as having just an Agent distributive reading: each of the contestants made different sets of three judges listen to different sets of two

songs. Thus each contestant sang a total of two songs and for each contestant the goal of singing were three judges. This interpretation does not require a translation with two distributivity operators, for reasons discussed above. I will discuss this interpretation in section 5.9.2 below. The sentence can also be interpreted to be true in a situation where each contestant sang six songs, i.e., each contestant for each judge sang two songs. That situation is Agent and Goal distributive and needs to be translated with two distributivity operators. (82) schematically represents the LF with the two distributivity operators and (83) provides the actual translation.

- (82) du-jon-protijogi^x D^{x'} tin-jon-kore-judge-ke^y_{x'}, D^{y'} du-To-kore-gaan^z_{x',y'}
two-cl-contestant D three-cl-judge-DAT D two-cl-two-cl-do.pfv-song
šunie-chilo
listen.cause.pfv-be.past.3
‘Two contestants each made three judges listen to two songs.’

- (83) $[x] \wedge \overline{\text{SAME}(x)_x} \wedge |x| = 2 \wedge \text{CONTESTANT}(x) \wedge \max(x')(\text{atom}(x') \wedge x' \leq x) \wedge$
 $\delta(x')([y] \wedge |y| = 3 \wedge \text{JUDGE}(y) \wedge \overline{\text{DIFFERENT}(y)_{x'}} \wedge \max(y')(\text{atom}(y') \wedge y' \leq$
 $y) \wedge \delta(y')([z] \wedge |z| = 2 \wedge \text{SONG}(z) \wedge \overline{\text{DIFFERENT}(z)_{x'}} \wedge \overline{\text{DIFFERENT}(z)_{y'}} \wedge [e] \wedge$
 $\text{SAME}(e)_e \wedge \text{CAUSED-TO-LISTEN}(e) \wedge \text{AGENT}(e, x') \wedge \text{GOAL}(e, y') \wedge \text{THEME}(e, z))$

In fact this reading is most felicitously expressed by lexicalizing the theme with a complex distributive numeral as in (84). The sentence (84) is preferably used not to express the Agent distributive reading as (82) is. (84) is will be translated as (83).

- (84) du-jon-protijogi^x D^{x'} tin-jon-kore-judge-ke^y_{x'}, D^{y'}
two-cl-contestant D three-cl-judge-DAT D
du-To-du-To-kore-gaan^z_{x',y'} šunie-chilo
two-cl-two-cl-do.pfv-song listen.cause.pfv-be.past.3
‘Two contestants each made three judges listen to two songs.’

5.9 Revisiting ‘sameness’

5.9.1 Requirement for a distributivity operator

What we have done in the analysis of ditransitives, is to say that we need a distributivity operator for each ‘differentness’ constraint on a given distributive numeral. Thus there may be more than one distributivity operator in the translation of a ditransitive construction if required.

However, if the distributive numeral has a relativized “sameness” constraint with respect to a plurality, that itself *does not* require a translation with a distributivity operator. This is also evident from the definition (27) of the post-supposition $\text{SAME}(j)_i$, repeated below.

$$(85) \quad \llbracket \text{SAME}(j)_i \rrbracket^{(G,H)} = \mathbb{T} \text{ iff } G = H, \text{ and } \forall a, b \in H(i) [H|_{i=a}(j) = H|_{i=b}(j)]$$

If individual values a and b in $H(i)$ are non-distinct, i.e., $a = b$, then it is trivially true that $[H|_{i=a}(j) = H|_{i=b}(j)]$.

Thus we stick to our conclusion: the ‘sameness’ post-supposition does not on its own require a translation with a distributivity operator. With this conclusion, the Agent distributive case ((63) repeated as (86) with modification in indexing) can be translated as in (87), where the distributive numeral has a relativized “sameness” post-supposition anaphoric to the goal. In keeping with our conclusion, we do not need a distributivity operator to license this post-supposition. I would discuss the consequences of having this post-supposition in the next subsection.

$$(86) \quad \begin{array}{l} \text{du-jon-protijogi}^x \quad \text{D}^{x'} \text{ tin-jon-judge-ke}_y^y \quad \text{du-To-}\boxed{\text{kore}}\text{-gaan}_{x',y}^z \\ \text{two-cl-contestatnt D} \quad \text{three-cl-judge-DAT} \quad \text{two-cl-do.pfv-song} \\ \text{\v{s}unie-chilo} \\ \text{listen.cause.pfv-be.past.3} \\ \text{‘Two contestants made three judges listen to two songs each.’} \end{array}$$

$$(87) \quad [x] \wedge |x| = 2 \wedge \text{CONTESTANT}(x) \wedge \overline{\text{SAME}(x)_x} \wedge \max(x')(\text{atom}(x') \wedge x' \leq x) \wedge \delta(x')(\overline{[y] \wedge \text{SAME}(y)_y} \wedge |y| = 3 \wedge \text{JUDGE}(y) \wedge [z] \wedge \overline{\text{DIFFERENT}(z)_{x'}} \wedge \overline{\text{SAME}(z)_y} \wedge$$

$$|z| = 2 \wedge \text{SONG}(z) \wedge [e] \wedge \text{SAME}(e)_e \wedge \text{CAUSED-TO-LISTEN}(e) \wedge \text{AGENT}(e, x') \wedge \text{GOAL}(e, y) \wedge \text{THEME}(e, z))$$

5.9.2 Requirement for anaphoricity

We cannot eliminate the element of anaphoricity from the sameness post-supposition. Without the bound variable in its definition, the sameness post-supposition would be incompatible with a ‘differentness’ constraint on the same numeral. Recall that we needed relativized sameness to capture intermediate readings of distributive numerals. Imagine *robi* and *ritu* are two contestants. The translation (87) of (86) represents the situation, when *robi* sang *a* and *b* in front of j_1 , j_2 and j_3 , and *ritu* sang *c* and *d* in front of j_1 , j_2 and j_3 . Thus it represents the intermediate scope of the distributive numeral: the songs vary with the contestants but not with the judges.

Similarly, the intermediate scope of the distributive numeral theme is apparent in the Agent distributive reading of (88). It represents the situation when the songs vary with respect to the contestants, but they do not vary with respect to the judges. This is true in the scenario when *robi* sang *a* and *b* in front of j_1 , j_2 and j_3 , and *ritu* sang *c* and *d* in front of j_4 , j_5 and j_6 .

- (88) du-jon-protijogi^x D^{x'} tin-jon-kore-judge-ke_{x'}^y du-To-kore-gaan_{x',y}^z
two-cl-contestant D three-cl-judge-DAT two-cl-two-cl-do.pfv-song
šunie-chilo
listen.cause.pfv-be.past.3
‘Two contestants each made three judges listen to two songs.’

In the absence of appropriate morphological marking on the distributive numeral theme, the sentence can be interpreted with or without the intermediate scope of the theme. In other words, the hearer is free to translate either way as long as it does not contradict the context.

An interesting case of intermediate readings come from examples with modals.

- (89) protteke^x du-To-kore-sinema_{x,w}^y dekhte cae^w
each.one.person two-cl-do.pfv-cinema see.impf want.PRES.3
‘Everybody wants to watch two movies.’

The intermediate scope of the distributive numeral is true in a situation when for every person in the context there are two particular movies such that all worlds, doxastically accessible to that person where she watches those two movies are better than those worlds where she doesnot. In other words, the movies do not vary with the worlds and each person can be related to only two particular movies.

In conclusion, anaphoricity is necessary on the sameness post-supposition to allow for intermediate scope readings of the distributive numeral.

5.10 Summary of the proposal

Thus in this chapter I have sketched an analysis in an extended version of DPIL following Henderson (2014) and Kuhn (2017), where the covarying interpretation of the distributive numerals come from the post-suppositional component of their meaning called $\text{DIFFERENT}(j)_i$. The requirement of $\text{DIFFERENT}(j)_i$ can be satisfied by the dependency established in the scope of a distributivity operator. The distributive numerals may also have as part of their meaning the post-suppositional test $\text{SAME}(j)_i$, which helps account for their intermediate readings. Importantly intermediate readings of distributive numerals are not captured by a mechanism like QR but by a post-supposition.

The plain numerals with specificity come with the post-suppositional component of meaning called $\text{SAME}(i)_i$. It helps us capture the simultaneous lack of covariation and cumulativity on a plain numeral under the scope of a distributivity operator.

The idea behind the analysis proposed is that we need a combination of the analyses proposed in Henderson (2014) and Kuhn (2017). In other words we need both relativized not-at-issue components of meaning for the distributive numerals that will make the numerals anaphoric and we also need an adverbial distributivity operator to satisfy this not-at-issue meaning.

Chapter 6

Event Distributive Numerals

This chapter discusses the adverbial distributive numerals and shows that these numerals are distributionally different from the adnominal distributive numerals. On top of that the chapter provides a sketch of an analysis for the adverbial distributive numerals which is an extension of the analysis proposed for the adnominal distributive numerals in the last chapter (chapter 5).

6.1 Introduction

Empirically there are at least two forms of numerals that distinguish themselves from the adnominal distributive numerals we have seen so far. One of these include a morphologically modified numeral determiner-classifier complex similar to the complex adnominal distributive numerals, *n-cl-n-cl-kore*. But unlike the adnominal variety, the ones under discussion do not form indefinite quantifiers by combining with a bare nominal. Examples of these would be *du-jon-du-jon-kore* ‘in groups of two’, *tin-jon-tin-jon-kore* ‘in groups of three’ etc. Apart from these we will discuss the numerals containing the morphologically modified determiner *æk-ek-* which I will translate as ‘each different’. Forms like *du-jon-du-jon-kore* ‘in groups of two’ and numerals containing *æk-ek-* ‘each different’ share a distributive strategy that is different from that exhibited by the adnominal distributive numerals and a universal quantifier with the determiner *prottek-*.

The distributivity encoded by *du-jon-du-jon-kore* ‘in groups of two’ and numerals containing *æk-ek-* ‘each different’ involves distributively relating two or more pluralities, as opposed to distributivity operators that divide up just one plurality.

The difference between these two kinds of distributivity has been encoded in terms of recognizing distributive quantification in the domain of events to be different from distributive quantification in the domain of individuals. For example, *one by one* has been analyzed by Brasoveanu and Henderson (2009) as encoding distributive quantification over events or temporal traces of events, which is essentially dividing a set of events into a plurality of atomic subevents and then relating atoms of individuals to the atomic events. On the other hand, *each* encodes distributive quantification over individuals, dividing a set of individuals into atomic individuals.

6.2 Adverbial numerals

6.2.1 Introduction

The Adverbial numerals are morphologically complex numeral expressions like *du-jon-du-jon-kore* ‘in groups of two’ that are modifiers of events. They can indicate distributivity over salient temporal or spatial domains. Gil (1982) observed that cross-linguistically usually the most complex morphological form among distributive numerals in a given language is used to form the distributive numerals that can encode occasion distributivity and they are usually adverbial. In this study of the adverbial distributive numerals I will call these numerals pluractional, instead of adverbial. Although the term pluractionality indicates distributive morphology on verbs, encoding temporal, spatial or participant distributivity, I use the term for these numerals to highlight the fact that like pluractional morphology on verbs (Lasersohn, 1995), these numerals can encode both participant and salient occasion distributivity. I refrain from calling them ‘adverbial’ numerals primarily because of their limited syntactic distribution (to be discussed below) compared to ‘pluractional adverbials’.

The following examples illustrate pluractional numerals.¹ We start by looking at salient spatial distribution.

- (1) a. Situation: Imagine a swimming pool. Next to each lane of the pool there were two girls waiting to jump into the water.
- b. {Thik dɔʃ-Ta-r šomɔe-e} / {ghɔnTa pɔRar šɔnge šɔnge},
 exactly ten-cl.-GEN time-LOC / bell ring.prt.GEN with with
 ora du-jon-du-jon-kore jɔl-e jhãp dilo
 they two-cl-two-cl-do.pfv water-LOC jump give.PAST.3
 ‘Exactly at ten / as soon as the bell rang, they jumped into the pool in twos.’

In (1-b) the pairs of girls are organized spatially relative to each lane. Thus the distributive numeral in this case is anaphoric to the salient atomic cover of the plurality of lanes. Thus (1-b) is an example of a spatially distributive pluractional numeral.

Suppose the situation was such that in lane₁ two girls jumped, but in lane₂ one girl jumped and in lane₄ one girl jumped. No one jumped in lane₃. This scenario cannot be described as (1-b).

In (1-b), the plurality (of lanes) with respect to which the girls are divided is not overtly mentioned but is contextually retrieved. In (2) below, lanes are explicitly encoded as a participant plurality and the distributive numeral distributes the pairs of girls with respect to that.

- (2) dɔʃ-Ta-r šomɔe-e, prottek-lane-e mee-ra du-jon-du-jon-kore jhãp
 ten-cl-GEN time-LOC each.one-lane-LOC girl-pl two-cl-two-cl-do.pfv jump
 dilo
 give.PAST.3
 ‘At ten, the girls jumped in twos in each lane.’

Likewise, example (3-b) illustrates a temporally distributive pluractional numeral. The girls jumped into the water in twos but in a temporally sequenced manner. No

¹I indicate the numeral by putting it into a box. Since there is no morphologically simpler form, I do not single out any subpart of the morphology.

two groups of two girls jumped simultaneously.

- (3) a. Situation: The girls were standing next to the diving board in a cue.
 b. ghɔnTa pɔRar pɔr, ora du-jon-du-jon-kore jɔl-e jhãp
 bell ring.prt.GEN after they two-cl-two-cl-do.pfv water-LOC jump
 dilo
 give.PAST.3
 ‘After the bell rang, they jumped into the water in twos.’

Example (4) illustrates a participant distributive pluractional numeral. The pluractional numeral indicates that each girl read books in twos. The inanimate classifier *-Ta* on the numeral helps in identifying the target plural as *boi-gulo* ‘the books’.

- (4) mee-ra boi-gulo du-To-du-To-kore poRe-che
 girl-pl book-cl_{pl} two-cl-two-cl-do.pfv read.pfv-be.PRES.3
 ‘The girls read the books in twos.’

If the context provided a partition of the sum of girls into sub-pluralities, then the sentence could indicate that each member of the salient cover of the set of girls read the books in twos (5-a).

- (5) The girls formed small groups with their friends and then
 a. o-ra boi-gulo du-To-du-To-kore poRe-che
 pron.3-pl book-cl_{pl} two-cl-two-cl-do.pfv read.pfv-be.PRES.3
 ‘They read the books in twos.’

Thus, the pluractional distributive numerals target a plurality and they introduce a partition into the set denoted by the plurality and assert that the verb phrase holds for each subset in the partition. The cardinality of each subset in the partition is indicated by the numeral. For example, the target of the pluractional numeral in (3-b) is the plural pronoun *ora* ‘they’. Apart from the target plurality, the pluractional numeral is anaphoric to the salient cover of another plurality. This plurality can be a non-overt but contextually salient spatial or temporal argument of the event predicate. In (3-b) this is the temporal trace of the event. It can also be an overt participant plurality

as in (2),(4),(5-a). The pluractional numeral assigns each subset of the target plural to each member of the cover of the plurality it is anaphoric to.

The following two sections characterize the pluractional numerals by comparing them with adnominal distributive numerals and pluractional adverbials.

6.2.2 Difference from adnominal distributive numerals

The pluractional numerals differ from the adnominal distributive numerals not only in terms of morphological complexity but also in terms of the noun phrase they associate with, in terms of their syntax and most importantly for the present discussion in terms of their compatibility with the nature of the eventuality denoted by the verb phrase.

The adnominal distributive numerals are morphologically complex versions of numeral indefinites. The nominal predicate in indefinites in Bangla cannot be suffixed with nominal plural markers *-gulo* or *-ra*. Thus the host of adnominal distributive numerals are bare nouns (6). However, the target of a pluractional distributive numeral must be a definite (7) or indefinite plural DP.

- | | | | |
|-----|--|-----|--|
| (6) | du-jon-kore-mee-(*ra)
two-cl-do.pfv-girl-pl | (7) | mee-*(ra) du-jon-du-jon-kore
girl-pl two-cl-two-cl-do.pfv |
|-----|--|-----|--|

The adnominal distributive numerals cannot be structurally separated from their host noun phrase (8). The example (9) shows that the target plural and the pluractional numeral can be syntactically separated. In (9), the human classifier *-jon* helps identify the plural target of the pluractional numeral.

- | | |
|-----|--|
| (8) | *mee pool-er lane-gulo-r šamne du-jon-du-jon-kore
girl pool-GEN lane-pl.-GEN front.LOC two-cl-two-cl-do.pfv
dāRie-chilo
stand.pfv-be.PAST.3
'The girls were standing in front of the lanes of the pool in twos.' |
| (9) | mee-ra pool-er lane-gulo-r šamne du-jon-du-jon-kore
girl-pl pool-GEN lane-pl-GEN front.LOC two-cl-two-cl-do.pfv
dāRie-chilo
stand.pfv-be.PAST.3
'The girls were standing in front of the lanes of the pool in twos.' |

The pluractional numerals are incompatible with stative predicates. The examples (10), (11) and (12) illustrate the point for temporally distributive, spatially distributive and agent distributive pluractional numerals respectively, using the stative predicates ‘were sick’ and ‘knew’.

- (10) #gɔto maš-e prottek-šɔptah-e mee-ra du-jon-du-jon-kore ɔšustho
 last month-LOC each.one-week-LOC girl-pl. two-cl.-two-cl.do.pfv sick
 chilo
 be.PAST.3
 #‘Last month, in each week the girls were sick in twos.’
- (11) #prottek-class-e mee-ra du-jon-du-jon-kore Hindi janto
 each.one-class-LOC girl-pl two-cl-two-cl-do.pfv Hindi know.hab.PAST.3
 #‘In each class, the girls in twos knew Hindi.’
- (12) #mee-ra formula-gulo du-To-du-To-kore janto
 girl-pl formula-cl_{pl} two-cl-two-cl-do.pfv knew.3
 ‘The girls knew the formulas in twos.’

The adnominal distributive numerals, however, *are compatible* with stative predicates, as (13), (14) and (15) show us.

- (13) gɔto maš-e prottek-šɔptah-e du-jon-du-jon-kore-mee ɔšustho
 last month-LOC each.one-week-LOC two-cl.-two-cl.do.pfv-girl sick
 chilo
 be.PAST.3
 ‘Last month, in each week two girls were sick.’
- (14) prottek-class-e du-jon-du-jon-kore-mee Hindi janto
 each.one-class-LOC two-cl-two-cl-do.pfv-girl Hindi know.hab.PAST.3
 ‘Two girls in each class knew Hindi.’
- (15) mee-ra du-To-du-To-kore-formula janto
 girl-pl two-cl-two-cl-do.pfv-formula knew.3
 ‘The girls knew two formulas each.’

Like the pluractional numerals, pluractional adverbials are incompatible with stative predicates as well. The adverbial *æk-æk-kore* ‘one by one’ is incompatible with ‘knew’ (16), or ‘were sick’ (17). The English adverbial *one by one* is incompatible with stative

predicates as well, as has been observed by Brasoveanu and Henderson (2009).

- (16) #mee-ra æk-æk-kore Hindi janto
 girl-pl one-one-do.pfv Hindi know.hab.PAST.3
 #‘The girls knew Hindi one by one.’
- (17) #gɔto maš-e prottek-šoptah-e mee-ra æk-æk-kore ošustho
 last month-LOC each.one-week-LOC girl-pl one-one-do.pfv sick
 chilo
 be.PAST.3
 #‘Last month, in each week the girls were sick one by one.’

Example (18) illustrates that the adverbial *bar-bar* ‘again and again’ is incompatible with the stative predicate ‘be sick’. The same is illustrated by (19) for the spatially distributive pluractional adverbial *jaegae-jaegae* ‘place after place’.

- (18) #gɔto maš-e bar-bar mee-ra ošustho chilo
 last month-LOC time-time girl-pl. sick be.PAST.3
 #‘Last month, again and again the girls were sick.’
- (19) #gɔto maš-e jaegae-jaegae chatre-ra ošustho chilo
 last month-LOC place.LOC-place.LOC student-pl sick be.PAST.3
 #‘Last month, place after place the students were sick.’

Thus the take home point in this section is that unlike the adnominal distributive numerals, the pluractional numerals are incompatible with stative predicates, as are the pluractional adverbials. To provide an analysis I will assume following Brasoveanu and Henderson (2009) that states denote an atomic indivisible eventuality. However, this is a simplification and needs to be modified for a more nuanced analysis. Basing on these premises, I will analyze the pluractionals to have a requirement about the event being non-atomic.

The next section compares the pluractional numerals with the adverbial *æk-æk-kore* ‘one by one’ in detail and provides further justification for grouping together the two kinds of expressions in terms of their semantics.

6.2.3 Comparison with *æk-æk-kore* ‘one by one’

The pluractional adverbial *æk-æk-kore* ‘one by one’ and the pluractional numerals differ in terms of their morphological make-up, syntactic productivity and the requirement on temporal sequencing of the subparts of the modified event. However, neither of these pluractional elements can license adnominal distributive numerals.

The pluractional adverbial *æk-æk-kore* ‘one by one’ and the series of pluractional numerals are different in their morphological make up. The adverbial *æk-æk-kore* only involves the reduplication of the numeral *one* and it does not have a classifier following the numeral. The pluractional numerals involve reduplication of a numeral classifier complex as in *æk-jon-æk-jon-kore* or *æk-Ta-æk-Ta-kore*.

None of the cardinal numerals other than *æk* ‘one’, have classifier-less adverbial forms like *æk-æk-kore*. For example, **dui-dui-kore* ‘two-two-do.pfv’ or **tin-tin-kore* ‘three-three-do.pfv’ etc. do not exist. The pluractional numerals on the other hand, can be formed with any cardinal numeral.

The pluractional adverbial *æk-æk-kore* ‘one by one’ can target a plural at various syntactic positions. This is similar to what is reported about English *one by one* in Brasoveanu and Henderson (2009) and Henderson (2012). Examples (25) to (29) illustrate *æk-æk-kore* targetting a subject, a direct object, an indirect object and a postpositional object.

- (20) [mee-ra] [æk-æk-kore] ghore Dhuk-lo. *Subject*
 girl-pl. one-one-do.pfv room-LOC enter-PAST.3
 ‘The girls entered the room one by one.’
- (21) šomi [boi-gulo] [æk-æk-kore] poR-lo *Direct Object*
 Shomi book-pl. one-one-do.pfv read-PAST.3
 ‘Shomi read the books one by one.’
- (22) še [otithi-der] [æk-æk-kore] ca poribešon kor-lo *Indir. Object*
 pron.3 guest-OBL.pl one-one-do.pfv tea serving do-PAST.3
 ‘(S)he served the guests tea one by one.’

(23) še [otithi-der] æk-æk-kore boi-Ta dækha-lo *Indir. Object*
 pron.3 guest-OBL.pl one-one-do.pfv book-cl. see.caus-PAST.3
 ‘(S)he showed the book to the guests one by one.’

(24) oddhapok [chatri-der šoŋge] æk-æk-kore kotha bol-len *PP*
 professor student.F-OBL.pl with one-one-do.pfv talk tell-PAST.3.hon
 ‘The professor talked to the students one by one.’

Unlike *æk-æk-kore* ‘one by one’, the pluractional numerals can target plurals at only a subset of the syntactic positions listed for *æk-æk-kore*. These numerals in Bangla are limited to targeting only subject and direct object positions. They cannot target an indirect object or a post-positional phrase. The following examples have the pluractional numerals *æk-jon-æk-jon-kore* or *æk-Ta-æk-Ta-kore*.

(25) [mee-ra] æk-jon-æk-jon-kore ghore Dhuk-lo *Subject*
 girl-pl. one-cl.-one-cl.-do.pfv room-LOC enter-PAST.3
 ‘The girls entered the room one by one.’

(26) šomi [boi-gulo] æk-Ta-æk-Ta-kore poR-lo *Direct Object*
 Shomi book-pl. one-cl.-one-cl.-do.pfv read-PAST.3
 ‘Shomi read the books one by one.’

(27) *še [otithi-der] æk-jon-æk-jon-kore ca poribešon kor-lo *I. Obj.*
 pron.3 guest-OBL.pl one-cl.-one-cl.-do.pfv tea serving do-PAST.3
 ‘(S)he served the guests tea one by one.’

(28) *še [otithi-der] æk-jon-æk-jon-kore boi-Ta dækha-lo *I. Obj.*
 pron.3 guest-OBL.pl one-cl.-one-cl.-do.pfv book-cl. see.caus-PAST.3
 ‘(S)he showed the book to the guests one by one.’

- (29) *oddhapək [chatri-der šəŋge] æk-jon-æk-jon-kore kōtha
 professor student.F-OBL.pl with one-cl.-one-cl.-do.pfv talk
 bol-len PP
 tell-PAST.3.hon
 ‘The professor talked to the students one by one.’

The difference in their distribution shows that the pluractional numerals do not have adverbial syntax. Syntactically they are modifiers of the noun phrase (DP) they target.

The adverbial *æk-æk-kore* necessarily induces temporal sequencing of the subevents of the modified event. Thus (30-b) is only plausible if the girls did not jump into the pool all at the same time. The situation in (30-a) is only compatible with the girls jumping into the pool exactly at ten. (30-b) is infelicitous in this situation. Similarly, (31-b) is infelicitous in the situation in (31-a).

- (30) a. Situation: Imagine a swimming pool. Next to each lane of the pool there was a girl waiting to jump into the pool.
- b. #Thik dōš-Ta-r šomə-e, ora æk-æk-kore jəl-e jhāp
 exactly ten-cl.-GEN time-LOC they one.-one.-do.pfv water-LOC jump
 dilo
 give.PAST.3
 ‘Exactly at ten they jumped into the pool one by one.’
- (31) a. Situation: There was a given set of questions. Each boy was in a separate room and was asked one of the questions. All the boys were asked the questions simultaneously.
- b. #chele-ra æk-æk-kore prošno-gulo-r uttor dilo
 boy-pl one-one-do.pfv question-cl_{pl}-GEN answer give.PAST.3
 ‘One by one, the boys answered the questions.’

There are three situations (32) in which (31-b) can be felicitous. Each situation has some temporal sequencing.

- (32) a. Situation 1: One boy at a time answered the collective of questions.
 b. Situation 2: The boys collectively answered one question at a time.
 c. Situation 3: At a given point of time one boy answered one question, and there are multiple such events.

Compared to this, a pluractional numeral like *du-jon-du-jon-kore* does not necessarily yield a reading of temporal sequencing. The Examples (1-b) and (2) encoding spatial distribution and example (4) encoding participant distributivity illustrate the point.

In spite of their differences, the adverbial *æk-æk-kore* and a pluractional numeral like *du-jon-du-jon-kore* behave similarly with respect to the licensing of an adnominal distributive numeral. An adnominal distributive numeral in the direct object position is infelicitous with the pluractional numeral *du-jon-du-jon-kore* targeting the subject if the adnominal distributive numeral distributes over the members of the subject plurality (33). Similarly, the pluractional adverbial *æk-æk-kore* targeting the plurality at the subject position (34) is infelicitous with an adnominal distributive numeral at the direct object position that distributes over the members of the plurality denoted by the subject. Schematically, the restriction is represented in Figure 6-1.

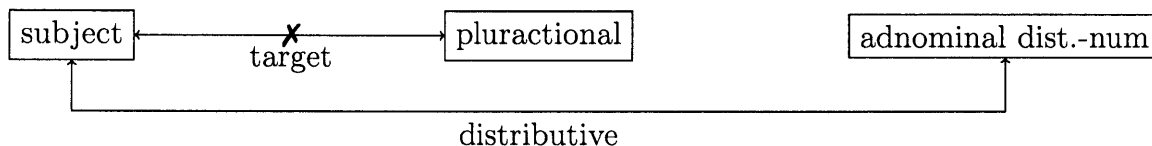


Figure 6-1: Incompatibility between Pluractionals and Adnominal distributive numerals

- (33) #mee-ra du-jon-du-jon-kore æk-Ta-kore boi poRlo
 girl-pl two-cl-two-cl-do.pfv one-cl-do.pfv book read.PAST.3
 #‘The girls in twos read one book each.’

- (34) #mee-ra æk-æk-kore du-To-kore-boi poRlo
 girl-pl one-one-do.pfv two-cl-do.pfv-book read.PAST.3
 #‘One by one the girls read two books each.’

However, the pluractionals (numeral or adverbial) are compatible with an adnominal distributive numeral in the same clause, if they target a different plurality to distribute over.

- (35) mee-ra du-jon-du-jon-kore prottek-Ti-chele-ke æk-Ta-kore boi
 girl-pl two-cl-two-cl-do.pfv each.one-cl-boy-dat one-cl-do.pfv book
 dieche
 give.pfv-be.PRES.3
 ‘The girls in twos gave a book to each of the boys.’

- (36) mee-ra æk-æk-kore prottek-Ti-chele-ke æk-Ta-kore boi
 girl-pl one-one-do.pfv each.one-cl-boy-dat one-cl-do.pfv book
 dieche
 give.pfv-be.PRES.3
 ‘One by one, the girls gave a book to each of the boys.’

The examples above highlight the difference between the pluractionals in (33)-(34) and *prottek*- in (35)-(36) in terms of their scope. This is exactly parallel to the difference between *one by one* and *each* discussed in Brasoveanu and Henderson (2009). This brings us to the question of the two kinds of distributivity that are exhibited by *prottek*- on the one hand, and the pluractionals (numerals and adverbials) on the other. The next subsection elaborates on this difference and lays the ground for discussing the *ækek*- numerals in Bangla.

6.2.4 Difference from *prottek*-

The first difference between a pluractional numeral and the universal determiner *prottek*- has to do with the effects they have on their respective scopes. The pluractional numeral targeting a subject, allows for a cumulative interpretation of the verb phrase or cumulative interpretation of a plurality in the verb phrase (37). The universal determiner however, does not allow cumulative interpretation of its nuclear scope (38). These facts are also evidenced by (35) above.

(37) mee-ra du-jon-du-jon-kore ponero-Ta-boi poReche
 girl-pl two-cl-two-cl-do.pfv fifteen-cl-book read.pfv-be.PRES.3
 ‘The girls in twos read fifteen books.’ (each pair of girls read at least one
 book and the plurality of girls between them read a total of fifteen books)

(38) prottek-Ti-mee-(i) ponero-Ta-boi poReche
 each.one-cl-girl-I fifteen-cl-book read.pfv-be.PRES.3
 ‘Each of the girls read fifteen books.’
 #‘Each girl read at least one book and the plurality of girls between them
 read a total of fifteen books.’

Therefore, assuming that the scope of a distributivity operator precludes cumulative interpretation of pluralities, we are lead to the following conclusions. The distributivity operator associated with the pluractional numeral does not have scope over the verb phrase, but that related to the universal determiner must have so.

The second difference between these two distributive items is regarding licensing of adnominal distributive numerals. The pluractional numeral targeting a plurality cannot license an adnominal distributive numeral that distributes over members of the same plurality (Fig6-1), see (39)(=(33)). However, the adnominal distributive numeral can distribute over the domain of the distributive determiner *prottek-* (40) and (35) above.

(39) #mee-ra du-jon-du-jon-kore æk-Ta-kore-boi poRlo
 girl-pl two-cl-two-cl-do.pfv one-cl-do.pfv book read.PAST.3
 #‘The girls in twos read one book each.’

(40) prottek-Ti-mee-(i) æk-Ta-kore-boi poRlo
 each.one-cl-girl-I one-cl-do.pfv-book read.PAST.3
 ‘Each one of the girls read one book.’

I analyze this contrast in terms of the distributivity operators associated with a pluractional numeral and *prottek-*. The difference between these two distributivity operators has to do with their respective domains. The distributive determiner *prottek-*

quantifies over individuals, whereas the distributivity operator associated with the pluractional numeral quantifies over events.

In addition to this contrast, the pluractional numeral and the distributive determiner differ in terms of licensing the determiner *ækek-* in their scope. *ækek-*, which I am translating as ‘each different’ (in its reciprocal reading), is compatible with a pluractional numeral (41) but odd in the scope of the quantifier *prottek-* (42). This makes the *ækek-* numerals exactly opposite of the adnominal distributive numerals.

(41) mee-ra du-jon-du-jon-kore æk-ek-Ta-boi poRlo
 girl-pl two-cl-two-cl-do.pfv one-one-cl-do.pfv-book read.PAST.3
 ‘The girls in twos read different books.’

(42) #prottek-Ti-mee-(i) æk-ek-Ta-boi poRlo
 each.one-cl-girl-I one-one-cl-book read.PAST.3
 ‘Each one of the girls read one book.’

The division that emerges at this point is that the adnominal distributive numerals group together with *prottek-*, whereas the pluractional numerals form a class with the numerals with *ækek-*. A plausible explanation of these facts seems to be that the adnominal distributive numerals require an individual based distributivity operator taking scope over them, which is why they are incompatible with a pluractional numeral. The *ækek-* numerals on the other hand require to be not taken scope over by such an operator, and therefore they are compatible with pluractionals but bad in the scope of *prottek-*. I leave the study of the *ækek-* numerals for another occasion. The following sections provide an analysis of the pluractional numerals that is an extension of the analysis in the last chapter.

6.3 Formal backdrop

The model \mathfrak{M} is structured as $\mathfrak{M} = \langle \mathfrak{D}_e, \mathfrak{D}_v, \mathfrak{J} \rangle$ where \mathfrak{D}_e is the domain of individuals \mathfrak{D}_v is the domain of events and \mathfrak{J} is the basic interpretation function such that $\mathfrak{J}(R) \subseteq$

\mathfrak{D}^n , for any n -ary relation R .

The domain of individuals \mathfrak{D}_e is the powerset of a given non-empty set IN of individuals: $\mathfrak{D}_e = \wp^+(\text{IN}) := \wp(\text{IN}) \setminus \{\emptyset\}$. The domain of events \mathfrak{D}_v is the powerset of a given non-empty set EV of events: $\mathfrak{D}_v = \wp^+(\text{EV}) := \wp(\text{EV}) \setminus \{\emptyset\}$.

The part-of relation over individuals $x \leq y$ (x is a part of y) is the partial order induced by inclusion \subseteq over the set $\wp^+(\text{IN})$.

$$(43) \quad x \leq y := x \subseteq y.$$

Similarly, the part-of relation over events $e_1 \leq e_2$ (e_1 is a part of e_2) is the partial order induced by inclusion \subseteq over the set $\wp^+(\text{EV})$.

$$(44) \quad e_1 \leq e_2 := e_1 \subseteq e_2.$$

An \mathfrak{M} assignment g is a total function from the set of variables \mathcal{V} to $\mathfrak{D} := \mathfrak{D}_e \cup \mathfrak{D}_v$.

Formulas are interpreted with respect to pairs of sets of total assignments $\langle G, H \rangle$. G is the input context and H is the result of evaluating a formula ϕ in G .

The notation $[x]$ is used to define random assignment in the object language.

$$(45) \quad \text{Random assignment: } \llbracket [x] \rrbracket^{(G,H)} = \mathbb{T} \text{ iff } G[x]H, \text{ where}$$

- a. $G[x]H := \begin{cases} \text{for all } g \in G, \text{ there is a } h \in H \text{ such that } g[x]h, \text{ and} \\ \text{for all } h \in H, \text{ there is a } g \in G \text{ such that } g[x]h \end{cases}$
- b. $h[x]g := \text{for any variable } i, \text{ if } i \neq x, \text{ then } g(i) = h(i)$

Atomic formulas for lexical relations are tests. They require the output context H to be the same as the input context G , that is, they simply pass on the input context after checking that H satisfies the lexical relation denoted by the predicates. The atomic formulas are interpreted distributively with respect to assignments in H .

$$(46) \quad \llbracket R(x_1, \dots, x_n) \rrbracket^{(G,H)} = \mathbb{T} \text{ iff } G = H \text{ and } \forall h \in H, \langle h(x_1), \dots, h(x_n) \rangle \in \mathcal{J}(R)$$

Dynamic conjunction is defined as follows:

$$(47) \quad \llbracket \phi \wedge \psi \rrbracket^{(G,H)} = \mathbb{T} \text{ iff there is a } K \text{ such that } \llbracket \phi \rrbracket^{(G,K)} = \mathbb{T} \text{ and } \llbracket \psi \rrbracket^{(K,H)} = \mathbb{T}$$

The definition of truth is as follows (48).

$$(48) \quad \text{Truth: A formula } \phi \text{ is true relative to an input set of assignments } G \text{ iff there is an output set of assignments } H \text{ such that } \llbracket \phi \rrbracket^{(G,H)} = \mathbb{T}.$$

- **The operators \mathbf{max} and δ**

A universal quantifier introduces the set of individuals i that satisfy the restrictor formula via a maximization operator \mathbf{max} and then checks that each of the the individuals under i also satisfies the nuclear scope formula, by the distributivity operator δ .

$$(49) \quad \llbracket \mathbf{max}(i)(\phi) \rrbracket^{(G,H)} = \mathbb{T} \text{ iff}$$

$$\text{a. } \llbracket [i] \wedge \phi \rrbracket^{(G,H)} = \mathbb{T}$$

$$\text{b. there is no } H' \text{ such that } \llbracket [i] \wedge \phi \rrbracket^{(G,H')} = \mathbb{T} \text{ and } H(i) < H'(i)$$

$$(50) \quad \llbracket \delta(i)(\phi) \rrbracket^{(G,H)} = \mathbb{T} \text{ iff}$$

$$\text{a. } G(i) = H(i)$$

$$\text{b. for any } a \in G(i), \llbracket \phi \rrbracket^{(G_{i=a}, H_{i=a})}$$

6.3.1 Meaning of the pluractional numerals

The pluractional numerals will be analyzed as being event-distributive. The pluractionals are analyzed as requiring event-distributivity because their inherent reading of holding over a multiplicity of events.

To capture the properties of the pluractionals, I will add a differentness post-supposition that requires multiple atomic subevents. The post-supposition can be satisfied by a non-trivial partition of the event modified by the event-based distribu-

tivity operator associated with the numeral.

$$(51) \quad \llbracket \text{DIFFERENT}(i)_e \rrbracket^{(G,H)} = \mathbb{T}, \text{ iff } G = H \ \& \ \exists e', e'' \in H(e) [H_{e=e'}(i) \neq H_{e=e''}(i)]$$

As was proposed in chapter 5, the adnominal distributive numerals have the following differentness post-supposition.

$$(52) \quad \llbracket \text{DIFFERENT}(j)_i \rrbracket^{(G,H)} = \mathbb{T}, \text{ iff } G = H \ \& \ \exists a, b \in H(i) [H_{i=a}(j) \neq H_{i=b}(j)]$$

6.3.2 Translation of the pluractional numeral

A pluractional numeral like *du-jon-du-jon-kore* ‘in twos’ is oriented towards a thematic role of an event. The numeral asserts that each event has two counts of the individual introduced by the numeral. The individual and the event are related by the thematic role it is anaphoric to. On top of this the numeral has a differentness post-supposition that requires a dependency to hold between the event and the individual. This post-supposition ensures that there are multiple events and multiple pairs of individuals which are distributively related. In (53), θ is the thematic role of the target plural. The numeral bears the index of this thematic role to ensure that it can only modify an individual that bears the same thematic role.

$$(53) \quad \text{du-jon-du-jon-kore}_{e,\theta}^x \rightsquigarrow \lambda e. [x] \wedge \overline{\text{DIFFERENT}(x)_e} \wedge \theta(e, x) \wedge |x| = 2$$

I assume for uniformity with the adnominal distributive numerals, that the pluractional numeral does not itself introduce a distributivity operator. But it necessitates a distributivity operator for the satisfaction of its ‘differentness’ post-supposition. Since the post-supposition introduced by the pluractional numeral is anaphoric to the dref e introducing events, the distributivity operator (54) licensing the pluractional numeral must quantify over events.

$$(54) \quad D^{e'} \rightsquigarrow \lambda V_{vt}. \lambda e. \max(e') (\text{atom}(e') \wedge e' \leq e) \wedge \delta e' (V(e'))$$

The distributivity operator applies to the pluractional numeral and yields the event

distributive pluractional numeral (55) which can modify a predicate of events intersectively. I take it to be an intersective modifier of the predicate of events denoted by the noun phrase. The theta role index on the pluractional numeral serves to identify the appropriate predicate of events the distributive pluractional numeral can intersectively modify.

$$(55) \quad D^{e'}(\text{du-jon-du-jon-kore}_{e',\text{AGENT}}^x) \rightsquigarrow \lambda e.\max(e')(\text{atom}(e') \wedge e' \leq e) \wedge \delta e'([x] \wedge \overline{\text{DIFFERENT}(x)}_{e'} \wedge \text{AGENT}(e', x) \wedge |x| = 2)$$

In a sentence like (56)(=(37)), the pluractional numeral targets the thematic role AGENT. Therefore, the pluractional numeral would be translated as in (57).

$$(56) \quad \begin{array}{l} \text{mee-ra [D}^{e'} \text{ du-jon-du-jon-kore}_{e',\text{AGENT}}^x \text{] ponero-Ta-boi poReche} \\ \text{girl-pl D two-cl-two-cl-do.pfv fifteen-cl-book read.pfv-be.PRES.3} \\ \text{'The girls in twos read fifteen books.' (each pair of girls read at least one} \\ \text{book and the plurality of girls between them read a total of fifteen books)} \end{array}$$

$$(57) \quad \text{du-jon-du-jon-kore}_{e,\text{AGENT}}^x \rightsquigarrow \lambda e.[x] \wedge \overline{\text{DIFFERENT}(x)}_e \wedge \text{AGENT}(e, x) \wedge |x| = 2$$

As an illustration of how a noun phrase modifier like (55) allows for the cumulative interpretation of the verb phrase, I discuss the rest of the composition for the sentence (56) below.

Thematic roles denote functions from individuals to functions from events to individuals(58) and the target definite plural (59).

$$(58) \quad \text{AGENT} \rightsquigarrow i.\lambda e.\text{AGENT}(e, i)$$

$$(59) \quad \text{mee-ra}^i \rightsquigarrow \oplus \text{GIRL}(i)$$

The result of composition is (60), which gives the translation for the subject of (56).

(61) is the subject modified by the event distributive pluractional numeral.

$$(60) \quad \text{R}(\text{AGENT})(\text{mee-ra}) \rightsquigarrow \lambda e.\text{AGENT}(e, \oplus \text{GIRL})$$

$$(61) \quad [\text{R}(\text{AGENT})(\text{mee-ra})][\text{D}^{e'}(\text{du-jon-du-jon-kore}_{e',\text{AGENT}}^x)] \rightsquigarrow \lambda e.\text{AGENT}(e, \oplus\text{GIRL}) \wedge$$

$$\max(e')(\text{atom}(e') \wedge e' \leq e) \wedge \delta(e')(\overline{[x] \wedge \text{DIFFERENT}(x)_{e'} \wedge \text{AGENT}(e', x) \wedge |x| = 2})$$

The indefinite plural object (62) is combined with its thematic role (63). The verbal predicate is translated as in (64). The indefinite must be Quantifier Raised to resolve type-mismatch. The raised indefinite takes scope after the event predicate has been existentially closed by the Ex-closure operator (65).

$$(62) \quad \text{ponero-Ta-boi} \rightsquigarrow \lambda P.[y] \wedge |y| = 15 \wedge \text{BOOK}(y) \wedge P(y)$$

$$(63) \quad \text{THEME} \rightsquigarrow \lambda i.\lambda e.\text{TH}(e, i)$$

$$(64) \quad \text{poRechilo} \rightsquigarrow \lambda e.\text{READ}(e)$$

$$(65) \quad \text{Ex-closure} \rightsquigarrow \lambda V_{vt}.[e] \wedge V(e)$$

The sentence (56) would be translated as follows:

$$(66) \quad [y] \wedge |y| = 15 \wedge \text{BOOK}(y) \wedge [e] \wedge \text{AGENT}(e, \oplus\text{GIRL}) \wedge \max(e')(\text{atom}(e') \wedge e' \leq e) \wedge \delta(e')(\overline{[x] \wedge \text{DIFFERENT}(x)_{e'} \wedge \text{AGENT}(e', x) \wedge |x| = 2}) \wedge \text{TH}(e, y) \wedge \text{READ}(e)$$

6.3.3 Incompatibility with an adnominal distributive numeral

As we have seen above, an adnominal distributive numeral distributing over the members of the plurality denoted by the subject, is incompatible with a pluractional numeral targetting the same subject plurality (Figure 6-1).

An adnominal distributive numeral is an indefinite that has at least one differentness post-supposition. A distributive numeral as in (67) would be translated as in (68).

$$(67) \quad \text{du-jon-}\boxed{\text{du-jon}}\text{-mee/ du-jon-}\boxed{\text{kore}}\text{-mee} \\ \text{two-cl-two-cl-girl/ two-cl-do.pfv-girl}$$

‘two-two girls’

$$(68) \quad \text{du-jon-kore-mee}_i^j \rightsquigarrow \lambda P.[j] \wedge \text{GIRL}(j) \wedge |j| = 2 \wedge \overline{\text{DIFFERENT}(j)}_i \wedge P(j)$$

The post-supposition introduced by the distributive numeral is met by the distributivity operator D^i introduced later in the composition. The distributivity operator associated with the adnominal distributive numeral quantifies over individuals.

$$(69) \quad D^i \rightsquigarrow \lambda P.\lambda j.\text{max}(i)(\text{atom}(i) \wedge i \leq j) \wedge \delta(i)(P(i))$$

The distributivity operator associated with the pluractional numeral is event distributive and does not directly distribute the verb phrase over atomic members of the subject plurality. Therefore, it is technically possible to have an individual-based distributivity operator like (69) to distribute over the with the target of the pluractional numeral.

However, whenever these two distributive numerals associate with the same set of individuals, one directly via the individual based distributivity operator (69) and the other anaphorically via the theta-indexing, there is going to be a contradiction between their asserted content. The example (70) helps us illustrate that.

$$(70) \quad \begin{array}{l} \#m\ddot{e}e\text{-}r\ddot{a}_y \text{ D}^{y'} \text{ ExCl} \quad [D^{e'} \text{ \ae}k\text{-}j\ddot{o}n\text{-}\text{\ae}k\text{-}j\ddot{o}n\text{-}k\ddot{o}r\ddot{e}_{e'}^z, \text{AGENT}] \\ \text{girl-pl} \quad \text{D} \quad \text{Exclosure} \quad \text{D} \quad \text{one-cl-one-cl-do.pfv} \\ \text{\ae}k\text{-}T\ddot{a}\text{-}\underline{\text{kore}}\text{-}b\ddot{o}i_y^x, \text{ poRe-chilo} \\ \text{one-cl-do.pfv-book read.pfv-be.PAST.3} \\ \# \text{‘The girls individually read one book each.’} \end{array}$$

In order to license the adnominal distributive numeral with the differentness post-supposition anaphoric to the dref y' , we need the individual-based distributivity operator (69). But at the same time the pluractional numeral is anaphoric to AGENT. Compositionally we get the following translation for the sentence (70). The contribution of the pluractional numeral is underlined for ease of identification.

$$(71) \quad \max(y')(\text{atom}(y') \wedge y' \leq \oplus \text{GIRL}) \wedge \delta(y')([x] \wedge \text{DIFFERENT}(x)_{y'} \wedge \text{BOOK}(x) \wedge |x| = 1 \wedge [e] \wedge \text{SAME}(e)_e \wedge \text{AGENT}(e, y') \wedge \max(e')(\text{atom}(e') \wedge e' \leq e) \wedge \delta(e')([z] \wedge \text{DIFFERENT}(z)_{e'} \wedge |z| = 1 \wedge \text{AGENT}(e', z)) \wedge \text{THEME}(e, x) \wedge \text{READ}(e))$$

The pairs of books introduced by x are themes of reading events which have atoms of the sum of girls as agents and each of these reading events have multiple atomic subevents with one girl as agent.

The translation is contradictory because the event e is both mapped to one girl via the individual based distributivity operator and at the same time to multiple girls via its subevents that are introduced by the event based distributivity operator. While the verb phrase holds for each girl, the subevents with one girl should also be subevents of the set of events denoted by the verb phrase. Thus the verb phrase is required to hold for both one girl and for multiple girls, which leads to infelicity.

6.4 Summary of the proposal

The discussion and brief analysis provided here proposes that adnominal and adverbial or pluractional numerals encode distributivity in the domains of individuals and events respectively. Because of this difference they display two different kinds of distributive behavior and show incompatibility with each other. However, the underlying framework of the analyses of the two items remain the same. The numerals have ‘differentness’ post-suppositions which can be satisfied by two kinds of distributivity operators: individual-based and event-based.

Chapter 7

Conclusion

The present work proposes that distributive numerals are not distributivity operators themselves but they introduce a plurality of discourse referents, which require to be in a quantificational dependency with another plurality. The proposal is an extension of Henderson (2014)'s analysis of Kaqchikel distributive numerals. I provide evidence for dissociating distributivity from distributive numerals from the ditransitive constructions, that show that the scope of distributivity is not limited to the distributive numeral.

In contrast with the distributive numerals the plain numerals with specificity introduce a 'singular' discourse reference. This singular reference can be relativized to analyze the intermediate readings with distributive numerals. Analyzing these two kinds of discourse reference in terms of not-at-issue components of meaning allows us to capture the intermediate scope of distributive numerals without a scope-shifting mechanism. In a language like Bangla that usually achieves scope shifting via scrambling, capturing intermediate readings without assuming QR is an advantage. However, it remains to be seen how far this proposal can be extended.

In the analysis in chapter 5, I have given conjunctive meanings to the numerals. It needs to be studied how the distributive morphemes compositionally interact with the rest of the parts of the numeral, especially how it interacts with the classifiers.

We have seen in chapter 6 that the analysis of adnominal distributive numerals can be extended to adverbial numerals as well. Study of *ækek*-numerals would reveal

more about event-distributivity.

Finally, the distinction between the strategies of reduplication and the suffixation with *-kore* remains to be explored.

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