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Pluractional Distributivity and Dependence*

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1 Introduction

This paper builds an account of a new scope puzzle that arises through the interaction of two lesser-studied constructions, dependent indefinites and verbal pluractionality. The result is a new account of dependent indefinites that correctly predicts their grammaticality with pluractionals by recognizing two ways of establishing the co-variation they require: (i) true distributive quantifiers, and (ii) pluractional operators that structure thematic dependencies. The core insight is that both routes, while compositionally different, lead to similar output structures, which is what dependent indefinites constrain. Along the way we produce the first detailed description and analysis of these phenomena in Kaqchikel (Mayan).

We start with the empirical observation that in addition to morphologically simple indefinites like *a*, *some*, *one*, *two*, etc., many languages have special versions of these expressions with similar quantificational meanings, but one crucial difference: they must covary with respect to some operator.[1] Called DEPENDENT by Farkas (1997), such indefinites have been reported in the theoretical literature for a variety of languages, including Hungarian (Farkas 1997, 2001), Romanian (Farkas 2002), Korean (Choe 1987; Gil 1993), and Russian (Pereltsvaig 2008; Yanovich 2005). One goal for this work is to add the Mayan language Kaqchikel to this list. While we will discuss the facts more deeply in §3, examples (1-2) show the basic contrast. In (1), as in English, the plain indefinite *jun* 'a/one' can take either wide or narrow scope with respect to the universal quantifier *konojel* 'all (of them)'. In contrast, when the indefinite is partially reduplicated as in (2), the wide scope reading is unavailable.

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0 Glossing Conventions: 1=First Person, 2=Second Person, 3=Third Person, A=Absolutive, CAUSE=Causative, CP=Completive Aspect, E=Ergative, p=Plural Person, PDIST=Pluractional Distributive, PL=Plural, PLRC=Pluractional, SS=Status Suffix

1 See Gil 2011 for the morphological typology of indefinites of this type.

The indefinite must covary with respect to the universal quantifier.

(1) K-onojel x-ki-kan-oj **jun** wuj.
E3p-all CP-E3p-search-SS **a** book
'All of them looked for a (different) book.'
'There is a book and all of them looked for it.'

(2) K-onojel x-ki-kan-oj **ju-jun** wuj.
E3p-all CP-E3p-search-SS **a-a** book
'All of them looked for a (different) book.'
*'There is a book and all of them looked for it.'

In addition to dependent indefinites, Kaqchikel also exhibits pluractionality. Many different phenomena have been talked about under the heading of pluractionality (see Cusic 1981; Wood 2007 for an overview). In this work, I will use the term for verbal derivational morphology generating predicates that are false in one-event scenarios. The Kaqchikel suffix *–(V)la* meets this criterion, which we can see from (3-4). While example (3) requires that there be at least one event of me looking for a book (though maybe more), example (4), which bears the pluractional suffix, is false if there is only one event of me looking for a book.

(3) X-in-kan-oj jun wuj.
CP-E1s-search-SS a book
'I looked for a book.'

(4) X-in-kan-**ala'** jun wuj.
CP-E1s-search-**PLRC** a book
'I looked for a book (various times).'
→ FALSE if there is only one looking-for event

It is important to note that in example (4) the plain indefinite cannot covary with respect to the plurality of events introduced by the pluractional operator. That is, I must look for the same book in each event that is a member of the plural event satisfying the pluractional predicate.

When a dependent indefinite is used in the same environment, an interesting contrast emerges. While a plain indefinite cannot introduce a new witness for every pluractional subevent, this is exactly what a dependent indefinite *can* do, as in (5).

(5) X-in-kan-**ala'** **ju-jun** wuj.
CP-E1s-search-**PLRC** **a-a** book
'I looked for some books one by one.'
→ FALSE if there is only one looking-for event
→ FALSE if I look for the same book in each looking-for event

The contrast between example (4) and (5) presents a puzzle for previous accounts of dependent indefinites in a variety of languages (Brasoveanu & Farkas 2009; Choe 1987; Gil 1993; Farkas 1997, 2001, 2002; Pereltsvaig 2008; Yanovich 2005). In all of these approaches dependent indefinites take scope in the same way as plain indefinites, albeit obligatorily narrow, allowing for covariation.[2] The problem is that if we assimilate dependent indefinites to narrow scope plain indefinites, then we predict that every environment that licenses a dependent indefinite also licenses a narrow scope plain indefinite. But this cannot be the case, as we see from the contrast in examples (4-5).

The question is then how to alter the semantics of dependent indefinites so that (i) they can covary with respect to a pluractional unlike a plain indefinite, (ii) yet remain paraphrasable with a narrow scope indefinite under more familiar operators. The proposal we pursue here is that dependent indefinites contribute a variable like a plain indefinite, but also contribute a constraint that the variable is *evaluation plural* (Brasoveanu 2010b), that is, not constant in a context, which we take to be a set of variable assignments (van den Berg 1996; Nouwen 2003: a.o.). Example (6) presents the relevant contrast.

(6)

H	...	x	...
h_1	...	$entity_2$	...
h_2	...	$entity_2$	...
h_3	...	$entity_2$	...

vs

G	...	x	...
g_1	...	$entity_1$	...
g_2	...	$entity_2$	...
g_3	...	$entity_3$	...

Here we have two sets of assignments, G and H, and a variable x. Each assignment in H maps x to the same entity, so it is evaluation singlar. In contrast, the assignments in G map x to more than one entity, making the variable evaluation plural. We'll argue that dependent indefinites introduce a variable like x and the constraint that x be evaluation plural in the output set of assignments. That is, they require that the set of assignments that result from interpreting a formula with a dependent indefinite look like G with respect to x.

What we will show is that distributive quantifiers and the Kaqchikel pluractional can both create output contexts that license dependent indefinites. In order to draw a difference between plain indefinites and dependent indefinites, though, we will

2 Crosslinguistically, dependent indefinites can differ from plain indefinites in other ways. For instance, in Korean there is a locality condition requiring that the wide scope quantifier be a clausemate of the dependent indefinite it licenses (Choe 1987). Another constraint on the licensing of dependent indefinites, first noted in Farkas 1997, is that some dependent indefinites can take scope under quantifiers over worlds, while others can only covary under quantifiers over events/times or individuals. While we do not have space to analyze these differences, they do not affect the point we make here. Even with these extra constraints, previous accounts still incorrectly predict that the distribution of dependent indefinites should be a subset of the distribution of narrow scope plain indefinites (in fact, they just make it a smaller subset).

show that they create them in very different ways. Distributive quantifiers do this by evaluating the nuclear scope incrementally relative to each assignment that satisfies the restrictor. The pluractional does this by directly constraining a neo-davidsonian theta role. Since the former case is scopal, while the latter is scopeless, we predict that plain indefinites should not take scope under the pluractional operator. That being said, since the constraint contributed by dependent indefinites is a constraint on the structure of sets of variable assignments, and not LFs directly, it can be satisfied in both scopal and scopeless manners.

Since we mean to analyze the interaction of dependent indefinites and the pluractional suffix, we must first develop independent accounts of the two phenomena. The paper starts in §2 with an account of the Kaqchikel pluractional and the distributive entailments it generates. In §3 we introduce Kaqchikel dependent indefinites and our core proposal for their semantics. Section 4 presents the analysis of their interaction, while §5 concludes.

2 Kaqchikel Distributive Pluractionality

In this section we develop an analysis of the Kaqchikel pluractional suffix *–(V)la* as a pluractional distributivity operator. This may be surprising from the first examples of the suffix where it is difficult to see any evidence for distributive entailments. In fact, example (4) has only singular arguments, which is illicit with most distributive operators, suggesting that *–(V)la* does not require a distributive interpretation of any verbal arguments. The situation is different when we consider verbs with plural objects. Just as in English, plural objects of many predicates in Kaqchikel are compatible with both distributive and collective readings. Example (7), for instance, is true if I hugged the children individually, gave them a single group hug, or even hugged different-sized subgroups.

(7) X-e'-in-q'etej ri ak'wal-a'.
CP-A3p-E1s-hug the child-PL
'I hugged the children.

If we derive (7) with the pluractional, though, the sentence can only be true in a situation where I hug the children individually. Group hugs are banned.

(8) X-e'-in-q'ete-**la'** ri ak'wal-a'.
CP-A3p-E1s-hug-**PLRC** the child-PL
'I hugged the children individually.'

A good paraphrase of (7) is that there were many hugging events, and for each, I hugged one of the children. The paraphrase captures both aspects of the contribution of *–(V)la*. It is pluractional in that it entails a multiplicity of events. It is distributive in that it blocks collective readings of plural objects of transitive predicates. The following is another example of forced distribution over plural objects.

(9) X-e'-in-kam-isa-**ala'** ri sanik.
CP-A3p-E1s-die-CAUS-**PLRC** the ant
'I killed the ants individually.'
→ FALSE if I killed any subset of the ants simultaneously

In the absence of a plural object, the use of a pluractional predicate is not ungrammatical. Instead, the various events required by *–(V)la* are distinguished by times/locations, not distribution over participants.

(10) X-in-tik-ila' jun che'.
CP-E1s-plant-PLRC a tree
'I planted a tree various places.'
COMMENT: For example, if the boss kept telling me to move the tree somewhere else after every time I planted it.

The object must be the target for distribution because the plural subject of a transitive verb can have collective readings, even if the object cannot be distributed over.

(11) X-ki-tik-ila' jun che'.
CP-E1p-plant-PLRC a tree
'They planted a tree various places.'
COMMENT: For example, if a crew plants a tree and then the have to keep moving it because it isn't in the right place.

These examples show that the distributivity entailments of the pluractional are conditionalized. The object of a transitive verb must be interpreted distributively if possible, otherwise the only requirement is that a simple plurality of events satisfies the predicate. A second lesson from these examples it that since they contain indefinite internal arguments, they show, like (4), that however distributivity is generated, it cannot take scope over the internal argument. That is, the indefinite cannot introduce a new witness for each event required by the pluractional. The goal for the rest of this section is to build an account of how the distributive dependencies we see in examples like (8-9) are established, paying particular attention to the fact that distributivity is scopeless (or at least narrowest scope), and that distributive interpretations are conditional on the existence of a plural internal argument. But before presenting the account of the pluractional in §2.2, a few necessary formal preliminaries are discussed in the following section.

2.1 DPlL Account of Distributive Pluractionality

The backdrop for the account is a version of Dynamic Plural Logic (DPlL) in van den Berg 1996 that has been stripped to its bare essentials. First and foremost, instead of single variable assignments g, we make use of sets of total variable assignments G, called contexts. Formulas are interpreted relative to pairs of sets of total assignments $\langle G, H\rangle$. These represent input and output contexts, where H is the result of evaluating ϕ in a context G. As we have seen before, a set of assignments can be represented as a matrix.

(12)

H	$\ldots$	x	y	$\ldots$
h_1	$\ldots$	$entity_1$	$entity_4$	$\ldots$
h_2	$\ldots$	$entity_2$	$entity_4$	$\ldots$
h_3	$\ldots$	$entity_3$	$entity_4$	$\ldots$
$\ldots$	$\ldots$	$\ldots$	$\ldots$	$\ldots$

Following Brasoveanu (2010b); van den Berg (1996); Nouwen (2003), i.a., domain-level singularity/plurality depends on individual cells of the matrix. It is determined by checking whether an assignment h in H maps a variable to a singular individual or plural individual. Evaluation singularity/plurality depends on a column of the matrix. It is determined by checking whether or not the assignments in H map a variable to more than one individual across a column.

So far we have been treating domain-level singular/plurality at an intuitive level, but it can be formalized as follows. In addition to the domain of truth values $D_t = \{\mathbb{T}, \mathbb{F}\}$, we follow Link (1983/2002) by letting the domain of individuals D_e be the powerset of a designated set of entities IN minus the empty set: $D_e = \wp^+(\mathsf{IN}) = \wp(\mathsf{IN}) \setminus \emptyset$. Variables of type e are $x, y, \ldots$. Following Lasersohn (1995), the domain of events D_ε is the powerset of a designated set of events EV minus the empty set: $D_\varepsilon = \wp^+(\mathsf{EV}) = \wp(\mathsf{EV}) \setminus \emptyset$. Variables of type ε are $e, e', \ldots$.

Atomic individuals and atomic events are the singleton sets in $\wp^+(\mathsf{IN})$ and $\wp^+(\mathsf{EV})$ respectively; they are identified by a predicate **atom** (which applies to both individuals and events). The "part of" relation $\leq$ over individuals / events is set inclusion over $\wp^+(\mathsf{IN})$ / $\wp^+(\mathsf{EV})$ such that $a \leq b$ iff $a \subseteq b$. The sum operation $\oplus$ is set union over $\wp^+(\mathsf{IN})$ / $\wp^+(\mathsf{EV})$ such that $a \oplus b := a \cup b$.

Connecting the domain of events with the domain of events are a finite set of thematic roles (**ag**, **th**, etc.) which are functions of type εe from events (type ε) to individuals (type e). We use θ-role functions for their argument indexing ability alone. That is, we do not assume that they generate the traditional entailments about their arguments. An account using referent systems, like Kracht 2002, would better match our assumptions, but we will continue to use θ-roles for expository simplicity.

We will assume that θ-roles, in addition to basic lexical relations (STUDENT, HUG, etc.), are cumulatively closed. Cumulativity is defined as below, following

Link (1983/2002) and Krifka (1986).

(13) properties: for any set P, $*P$ is the smallest set such that $P \subseteq *P$ and, if $a \in *P$ and $b \in *P$, then $a \oplus b \in *P$

(14) relations (or functions): for any n-place relation R, $**R$ is the smallest relation 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 $\langle a_1 \oplus b_1, \dots, a_n \oplus b_n \rangle \in **R$

That being said, we usually suppress the star-notation for readability.

We now show how basic formulas are interpreted, as well as introduce special formulas for managing domain-level and evaluation-level plurality. In addition to the domains discussed before, models consists of the basic interpretation function $\mathfrak{I}$, which assigns to any $n-$ary relation R of type τ a subset of $\mathfrak{D}_\tau^n$. As noted before, formulas are interpreted relative to pairs of sets of total assignments $\langle G, H \rangle$. Atomic formulas are tests (they only pass on input contexts that satisfy them).

(15) $[\![R(x_1, \dots, x_n)]\!]^{\langle G,H \rangle} = \mathbb{T}$ iff $G = H$ and $\forall h \in H$, $\langle h(x_1), \dots, h(x_n) \rangle \in \mathfrak{I}(R)$

Domain-level cardinality is managed via the predicate **atom**.

(16) $[\![\mathbf{two}(x)]\!]^{\langle G,H \rangle} = \mathbb{T}$ iff $G = H$ and for all $h \in H$,
$|\{x' : x' \leq h(x) \wedge \mathbf{atom}(x')\}| = 2$

(17) $[\![\mathbf{three}(x)]\!]^{\langle G,H \rangle} = \mathbb{T}$ iff $G = H$ and for all $h \in H$,
$|\{x' : x' \leq h(x) \wedge \mathbf{atom}(x')\}| = 3$

We also have tests for evaluation-level cardinality. They work by gathering all values of a variable under a set of assignments, as in (18), and checking the cardinality of the resulting set, as in (19).

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

(19) $|G(x)|$ is the cardinality of the set of individuals $G(x)$

(20) $[\![x = n]\!]^{\langle G,H \rangle} = \mathbb{T}$ iff $G = H$ and $|H(x)| = n$

(21) $[\![x > n]\!]^{\langle G,H \rangle} = \mathbb{T}$ iff $G = H$ and $|H(x)| > n$

Dynamic conjunction is defined as relation composition.

(22) $[\![\phi \wedge \psi]\!]^{\langle G,H \rangle} = \mathbb{T}$ iff there is a K s.t. $[\![\phi]\!]^{\langle G,K \rangle} = \mathbb{T}$ and $[\![\psi]\!]^{\langle K,H \rangle} = \mathbb{T}$

Quantification procedes via point-wise manipulation of assignment functions. We overload the notation [•] to define random assignment in the object language.

(23) Random assignment: $[\![[x]]\!]^{\langle G,H \rangle} = \mathbb{T}$ iff $G[x]H$, where

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

We'll translate plain indefinites according to the following schema. Note that brackets [•] demarcate the restrictor and parentheses (•) the nuclear scope.

(24) $\exists x[x = 1 \wedge \mathbf{atom}(x) \wedge \phi]\ (\psi)$ "one ϕ-atom is ψ"

VPs bring along their theta roles and are translated with existential quantification over the event argument. Putting it together, the sentence 'A student left' is translated as in (25).

(25) A student left $\rightsquigarrow$
$\exists x[x = 1 \wedge \mathbf{atom}(x) \wedge \text{STUDENT}(x)](\exists e(e = 1 \wedge \text{LEFT}(e) \wedge \mathbf{ag}(e,x)))$

The formula in example (25) just abbreviates the dynamic version in (26).

(26) $[x] \wedge x = 1 \wedge \mathbf{atom}(x) \wedge \text{STUDENT}(x) \wedge [e] \wedge e = 1 \wedge \text{LEFT}(e) \wedge \mathbf{ag}(e,x)$

Given the definition of truth in (27), examples (25-26) are true relative to an input set of assignments just in case there is an accessible set of output assignments storing in x one atomic student who is the agent of one leaving event stored in e. It is important to note that the evaluation-level cardinality constraints $x = 1$ and $e = 1$ ensure that a simple indefinite or existential quantification over events does not introduce a multiplicity of entities into the discourse satisfying the restrictor and nuclear scope.

(27) Truth: a formula ϕ is true relative to an input context G iff there is an output set of assignments H s.t. $[\![\phi]\!]^{\langle G,H \rangle} = \mathbb{T}$.

2.2 The Contribution of Pluractional *–(V)la'*

We propose that the pluractional morphology signals a special theta dependency that distributes to atoms.[3] That is, each atomic event in the big event must gets mapped to an atomic individual in the big participant by relevant role. It does this by introducing two variables to store the maximal set of atoms of both the event and individual arguments, and then asserting that a thematic dependency holds between these two new variables. Using $\mathbf{Max}^x$ (defined in (28)) and a domain-level cardinality test, the theme θ-role of pluractional predicate is translated as in (29).[4]

3 We say 'signals' because we treat pluractional predicates syncategorematically for expository simplicity. A compositional account of the pluractional morpheme is possible if it is treated as a θ-role modifier. That is, we represent θ-roles in the syntax and allow *–(V)la'* to compose with them directly (before composing with the verb).

4 $\mathbf{Max}^{\{x,y\}}(\phi)$ is like $\mathbf{Max}^x(\phi) = \mathbf{Max}^{\{x\}}(\phi)$, but selectively targets every variable in $\{x_1,...,x_n\}$.

(28) $[\![\mathbf{Max}^x(\phi)]\!]^{\langle G,H\rangle} = \mathbb{T}$ iff $[\![[x] \wedge \phi]\!]^{\langle G,H\rangle} = \mathbb{T}$ and
a. For all H', if $H(x) \subseteq H'(x)$ and $[\![[x] \wedge \phi]\!]^{\langle G,H'\rangle} = \mathbb{T}$ then:
b. $H'(x) \subseteq H(x)$

(29) $\mathbf{Max}^{\{e',x'\}}(e' > n \wedge e' \leq e \wedge x' \leq x \wedge \mathbf{atom}(e') \wedge \mathbf{atom}(x')) \wedge \mathbf{th}(e',x')$
a. $\mathbf{Max}^{\{e',x'\}}($
b. $e' > n \wedge$
c. $e' \leq e \wedge x' \leq x \wedge \mathbf{atom}(e') \wedge \mathbf{atom}(x')) \wedge$
d. $\mathbf{th}(e',x')$

The formula in (29) is broken up for perspicuity. It starts in (29a) by introducing a variable over events and a variable over individuals and then maximizes over them. That is, we store in each of them the maximal set of entities that satisfies the rest of the formula. Example (29b) shows the pluractionality constraint requiring the cardinality of the set of events stored in e' to exceed some contextual standard n. The third conjunct, (29c), ensures that e' and x' store atomic parts of the big event and big participant respectively. Finally, the last conjunct in (29d) establishes a thematic dependence between the maximal set of atomic events and atomic individuals.[5]

The following example illustrate the contribution of *–(V)la'*. Examples (30) and (31) have indefinite plural objects and only differ in that the latter has a pluractional predicate.

(30) X-e'-in-q'etej oxi' ak'wal-a'.
CP-A3p-E1s-hug three child-PL
'I hugged three children.'

(31) X-e'-in-q'ete-**la'** oxi' ak'wal-a'.
CP-A3p-E1s-hug-**PLRC** three child-PL
'I hugged three children individually (many times).'

5 One piece of evidence supporting a theta-role-based account is that while the pluractional cannot target the intransitive subject of (1), it can target the intransitive subject of (2) derived through passivization. This makes sense if the pluractional tracks thematic role and not syntactic position.

(1) *X-e-tzaq-**ala'**.
CP-A3p-fall-**PLRC**
DESIRED READING: 'They fell individually.'

(2) X-e-pitz'-**ilä**-x.
CP-A3p-enter-**PLRC**-PAS
'They were squeezed individually.'

Examples (32-33) give the bottom-line truth conditions for the VP in (30), which is not pluractional. The matrix in (34) provides a representative set of output assignments satisfying (32-33).

(32) $\exists x[x = 1 \wedge \mathbf{three}(x) \wedge \text{CHILD}(x)](\exists e(e = 1 \wedge (\text{HUG}(e) \wedge \mathbf{th}(e,x)))$

(33) $[x] \wedge x = 1 \wedge \mathbf{three}(x) \wedge \text{CHILD}(x) \wedge [e] \wedge e = 1 \wedge \text{HUG}(e) \wedge \mathbf{th}(e,x)$

(34)

H	...	e	x
h_1	...	hug_7	$three.children_4$
h_2	...	hug_7	$three.children_4$
h_3	...	hug_7	$three.children_4$

We introduce an evaluation singularity in x and require that it store a plural individual composed of three atomic children. Similarly, we introduce an evaluation singularity in e and require that e and x stand in the *theme* relation and that there be a function between them.

Examples (35-36) alter the bottom-line truth conditions of (32-33), taking into account the discussion of the pluractional. Note that the only difference is that the theta dependency in (35-36) is replaced by that contributed by *–(V)la'*.

(35) $\exists x[x = 1 \wedge \mathbf{three}(x) \wedge \text{CHILD}(x)](\exists e(e = 1 \wedge \text{HUG}(e) \wedge$
$\mathbf{Max}^{\{e',x'\}}(e' > n \wedge e' \leq e \wedge x' \leq x \wedge \mathbf{atom}(e') \wedge \mathbf{atom}(x')) \wedge \mathbf{th}(e',x')))$

(36) $[x] \wedge x = 1 \wedge \mathbf{three}(x) \wedge \text{CHILD}(x) \wedge [e] \wedge e = 1 \wedge \text{HUG}(e) \wedge$
$\mathbf{Max}^{\{e',x'\}}(e' > n \wedge e' \leq e \wedge x' \leq x \wedge \mathbf{atom}(e') \wedge \mathbf{atom}(x')) \wedge \mathbf{th}(e',x')$

(37)

H	...	e	x	e'	x'
h_1	...	hug_7	$three.children_4$	hug_1	$child_2$
h_2	...	hug_7	$three.children_4$	hug_2	$child_3$
h_3	...	hug_7	$three.children_4$	hug_3	$child_9$
h_4	...	hug_7	$three.children_4$	hug_4	$child_3$
h_5	...	hug_7	$three.children_4$	hug_5	$child_2$
h_6	...	hug_7	$three.children_4$	hug_6	$child_9$
...	...	...	...	...	...

Focusing on the contribution of *–(V)la'* in the second line of (36), we break the hugging event e into its atomic parts and store it in e'. The cardinality constraint requires that there be more than n such atoms stored by various functions in the current context, that is, (35-36) contribute an evaluation plurality of events — it is *evaluation pluractional*. In the same way, the pluractional breaks up the plural individual consisting of the three children and stores each atomic child in x'. Finally, the pluractional requires there be a function between e' and x', that is, they stand in the theme relation.

Importantly, the account correctly predicts the distributive entailments of (31). Group hugs are ruled out because the variables e' and x' can only store atoms and in virtue of being a function, the theta dependency cannot map the same atomic event to two different atomic individuals. Moreover, since nothing requires the function to be an injection, we correctly predict that the pluractional, while distributive, should be grammatical with singular themes. In this case, we get repetition with the same theme because each pluractional subevent is mapped to the same participant.

3 Dependent Indefinites

The core generalization is that the indefinite article and numerals in Kaqchikel can reduplicate, at which point they have a *dependent* interpretation (Farkas 1997, 2001), which has been described as necessary covariation in the scope of an operator. For example, in (38), pluralities of three tortillas must covary with respect to the students quantified over. In (39), pluralities of three men must covary with respect to the events/times quantified over.

(38) K-onojel ri tijoxel-a x-ki-tz'ët ox-ox wäy.
E3p-all the student-PL CP-E3p-see three-three tortilla
'All of the students saw three tortillas.'
→ FALSE if they each saw the same three tortillas.

(39) Jantape' x-in-tz'ët ox-ox achi'a'.
always CP-E1s-see three-three men
'I always see three men'
→ FALSE if these are always the same three men.

If no co-variation is possible, as in (40), these indefinites are ungrammatical.[6]

(40) *X-in-chäp ox-ox wäy.
CP-E1s-touch three-three tortilla
'DESIRED READING: 'I took (groups of) three tortillas.'

As mentioned in the introduction, many languages have special indefinites of this sort (Farkas 1997, 2001, 2002; Choe 1987; Gil 1993; Pereltsvaig 2008; Yanovich 2005). While couched in different frameworks, all of these accounts satisfy the co-variation requirement by forcing dependent indefinites to take narrow scope. If there is no operator they can take scope under, like in (40), they are predicted to be ungrammatical. Importantly, dependent indefinites take scope in the same way as

6 We can get a grammatical reading by putting *oxox* in adverbial position with the preposition *chi* or *pa*. But this is a different construction akin to English *three by three.*

plain indefinites (albeit obligatorily). The prediction is that everywhere a dependent indefinite is licensed, we should also permit a narrow scope reading of a plain indefinite. Examples (41-42) show that this is not the case. The pluractional cannot take scope over the plain indefinite, but it licenses the appearance of a dependent indefinite.

(41) X-in-chap-ala' oxi' wäy.
CP-A1s-touch-PDIST three tortilla
'I touched three tortillas individually (many times).'
$\rightarrow$ FALSE if there are more than three tortillas involved

(42) X-in-chap-ala' ox-ox wäy.
CP-A1s-touch-PDIST three-three tortilla
'I touched tortillas in threes.'
$\rightarrow$ FALSE if there are three tortillas in total (or only one touching event).

The heart of our proposal is that dependent indefinites are not like simple indefinites with a requirement forcing narrow scope, but indefinites that contribute an evaluation plurality. That is, reduplicated numerals place the constraint $x > 1$ on the variable they introduce, where a normal indefinite or numeral contributes the constraint $x = 1$.

(43) one $\rightsquigarrow \exists x[x = 1 \wedge \textbf{atom}(x) \wedge \phi]\ (\psi)$

(44) one$_{dependent}$ $\rightsquigarrow \exists x[x > 1 \wedge \textbf{atom}(x) \wedge \phi]\ (\psi)$ (to be amended in 47)

This requires that x be assigned different values across any set of assignments that satisfy the expression containing the reduplicated numeral. Furthermore, we will argue that this constraint is satisfied on output contexts, an idea we flesh out now.

In a dynamic framework, we can think of presuppositions anaphorically as tests on input contexts (Van der Sandt 1992; Kamp 2001). Some have proposed that natural language makes use of the mirror image notion as well, that is, post-suppositions, or tests on output contexts (Constant 2006; Brasoveanu 2010a; Farkas 2002; Lauer 2009). Just like presuppositions are introduced locally and can "float" up to be interpreted relative to the input set of assignments, post-suppositions are introduced locally, but passed along uninterpreted until they can be interpreted globally relative to an output context. In defining post-suppositions for DPlL, we follow Brasoveanu (2010a) closely. Post-suppositions are marked via superscripting, as ϕ is below.

(45) $[\![\bullet^{\phi}]\!]^{\langle G[\zeta],H[\zeta']\rangle} = \mathbb{T}$ iff ϕ is a test, $G = H$ and $\zeta' = \zeta \cup \{\phi\}$.

(46) Truth: a formula 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 $\{\psi_1,\ldots,\psi_m\}$ s.t. $[\![\phi]\!]^{\langle G[\emptyset],H[\{\psi_1,\ldots,\psi_m\}]\rangle} = \mathbb{T}$ and $[\![\psi_1 \wedge \ldots \wedge \psi_m]\!]^{\langle H[\emptyset],H[\emptyset]\rangle} = \mathbb{T}$.

As we see in (45), post-suppositions don't update input sets of assignments, they just get added to the input set of tests ζ and constrain permissible output sets of assignments through the second conjunct in (46). A post-suppositional formula therefore gets something like obligatory widest scope, but instead of being first to update an input context, it is last to update an output context.

Updating the definition in (44), dependent indefinites are translated according to the following schema. For dependent numerals, replace **atom** with the appropriate cardinality predicate (**two**, **three**, etc.).

(47) $\text{one}_{dependent} \rightsquigarrow \exists x[^{x>1} \wedge \mathbf{atom}(x) \wedge \phi]\ (\psi)$

To see the translation in (47) in action, consider example (48), which has the reduplicated form of the indefinite/numeral *jun* 'one'. This forces a narrow scope reading of the indefinite with respect to the distributive quantifier.

(48) K-onojel ri tijoxel-a x-ki-chäp ju-jun wäy.
E3p-all the student-PL CP-E3p-touch a-a tortilla
'All of the students took a tortilla.'
→ FALSE if they took one tortilla total (perhaps to share).

We assume *konojel* can be translated as a universal quantifier and follow the basic strategy in Brasoveanu (2008), decomposing universal quantification into a maximization operation over the restrictor and a distributive operation over the nuclear scope formula, that is, $\forall x[\phi](\psi)$ abbreviates $\mathbf{Max}^x[\phi]\delta(\psi)$. We have already seen $\mathbf{Max}^x$. The distributive operator δ takes the output of maximization and distributively updates the singleton assignments $\{g\}$ in G with the nuclear scope formula. Finally, we sum all the resulting assignments.

(49) $[\![\delta(\phi)]\!]^{\langle G,H\rangle} = \mathbb{T}$ iff there exists a partial function $\mathcal{F}$ from assignments g to sets of assignments K, i.e., of the form $\mathcal{F}(g) = K$, s.t.

- $G = \mathbf{Dom}(\mathcal{F})$ and $H = \bigcup \mathbf{Ran}(\mathcal{F})$
- for all $g \in G$, $[\![\phi]\!]^{\langle\{g\},\mathcal{F}(g)\rangle} = \mathbb{T}$

With this mind, example (48) gets the translation in (50-51).

(50) $\forall x[\mathbf{atom}(x) \wedge \textsc{student}(x)](\exists y[^{y>1} \wedge \mathbf{atom}(y) \wedge \textsc{tortilla}(y)](\exists e(e = 1 \wedge \textsc{take}(e) \wedge \mathbf{ag}(e,x) \wedge \mathbf{th}(e,y))))$

(51) $\mathbf{Max}^x(\mathbf{atom}(x) \wedge \textsc{student}(x)) \wedge \delta([y] \wedge^{y>1} \wedge \textsc{tortilla}(y) \wedge \mathbf{atom}(y) \wedge [e] \wedge e = 1 \wedge \textsc{take}(e) \wedge \mathbf{ag}(e,x) \wedge \mathbf{th}(e,y))$

(52)

x		x	e	y
$student_3$	$\xrightarrow{[y]\wedge^{y>1}\wedge e=1\wedge \textsc{tor}(y)\wedge\ldots\wedge \mathbf{ag}(e,x)\wedge \mathbf{th}(e,y)}$	$student_3$	$take_3$	$tortilla_8$
$student_6$	$\xrightarrow{[y]\wedge^{y>1}\wedge e=1\wedge \textsc{tor}(y)\wedge\ldots\wedge \mathbf{ag}(e,x)\wedge \mathbf{th}(e,y)}$	$student_6$	$take_8$	$tortilla_9$
$student_{17}$	$\xrightarrow{[y]\wedge^{y>1}\wedge e=1\wedge \textsc{tor}(y)\wedge\ldots\wedge \mathbf{ag}(e,x)\wedge \mathbf{th}(e,y)}$	$student_{17}$	$take_2$	$tortilla_5$

$\xrightarrow{\textbf{output set of assignments H}}$

x	e	y
$student_3$	$take_6$	$tortilla_8$
$student_6$	$take_8$	$tortilla_9$
$student_{17}$	$take_2$	$tortilla_5$

Example (52) shows graphically why we want the evaluation plurality constraint that the dependent indefinite contributes to be interpreted relative to the output context. If it were interpreted locally, that is, in the scope of the distributivity operator, we would have to satisfy $y > 1$ as we interpret the nuclear scope relative to each student. That is, we would incorrectly require each student to take at least two tortillas. Instead, the test $^{y>1}$ is interpreted relative to the output set of assignments H, where it is satisfied due to the fact that the indefinite takes narrow scope and covaries with respect to x and e. The same constraint rules out the case where the indefinite takes wide scope and stores the same tortilla across $H(y)$, pictured in (53).

(53) $\overset{\mathbf{H}}{\Rightarrow}$

x	e	y
$student_3$	$take_6$	$tortilla_5$
$student_6$	$take_8$	$tortilla_5$
$student_{17}$	$take_2$	$tortilla_5$

We capture the ungrammaticality of a dependent indefinite without a quantificational clausemate due to the fact that, by default, other existential quantifiers contribute evaluation singularities. In particular, the existential closure of the event argument introduces a variable that is evaluation singular. Without a quantificational clausemate (or a pluractional, as we will see), a theta dependency linking the event and dependent indefinite will always fail to hold. Consider again the sentence in (55) and the translation of its VP in (55-56).

(54) *X-e'-in-q'etej ox-ox ak'wal-a'.
CP-A3p-E1s-hug three-three child-PL
DESIRED READING: 'I hugged groups of three children.'

As a dependent indefinite, *oxox* contributes the cardinality constraint in the restrictor of the existential quantifier over individuals. It requires the variable x to store an evaluation plurality.

(55) $\exists x[\,^{x>1} \wedge \textbf{three}(x) \wedge \text{CHILD}(x)](\exists e(e = 1 \wedge \text{HUG}(e) \wedge \textbf{th}(e,x)))$

(56) $[x] \wedge^{x>1} \wedge \textbf{three}(x) \wedge \text{CHILD}(x) \wedge [e] \wedge e = 1 \wedge \text{HUG}(e) \wedge \textbf{th}(e,x)$

If x were evaluation singular, as with a plain indefinite, every $h \in H$ would store the same sum of three children in x. Therefore a θ-role function can hold between e and x.

(57)

H	...	e	x
h_1	...	hug_1	$three.children_1$
h_2	...	hug_1	$three.children_1$
h_3	...	hug_1	$three.children_1$

The situation is completely different with (55-56), as we see graphically below.

(58)

H	...	e	x
h_1	...	hug_1	$three.children_1$
h_2	...	hug_1	$three.children_2$
h_3	...	hug_1	$three.children_3$

Here e is still evaluation singular—every $h \in H$ assigns e to the same event. But now the reduplicated numeral requires that at least two $h \in H$ disagree on their assignments to x because it is evaluation plural. Now no exhaustive θ-role function can hold between e and x because there can be no functional dependency between e and x.

It should now be clear why pluractional distributivity licenses Kaqchikel dependent indefinites. The reason is that its interpretation results in output contexts that look a lot like a distributive quantifier over events taking scope over an indefinite quantifier over individuals. Recall that the pluractional works by storing the atoms of a domain plural event in an evaluation plurality, and then requiring a theta dependency to hold between them and a variable storing the atomic parts of an argument. Since the pluractional generates distributive dependencies by creating an evaluation plurality of events, it will be able to compose with reduplicated numerals which do the same in the individual domain. To compare the result to the discussion of universal quantification, consider the following example.

(59) X-in-piskoli-**la'** ju-jun wäy.
CP-E1s-flip-PLRC a-a tortilla
'I kept flipping tortillas one by one.'
FALSE if there is only one flipping event or if I keep flipping the same tortilla.

Examples (60-61) combine the analysis of PDIST and reduplicated numerals, while the following matrix illustrates a typical set of output assignments.

(60) $\exists x[^{x>1} \wedge \mathbf{atom}(x) \wedge \text{TORTILLA}(x)](\exists e(e = 1 \wedge \text{FLIP}(e) \wedge$
$\mathbf{Max}^{\{e',x'\}}(e' > n \wedge e' \leq e \wedge x' \leq x \wedge \mathbf{atom}(e') \wedge \mathbf{atom}(x')) \wedge \mathbf{th}(e',x')))$

(61) $[x] \wedge^{x>1} \wedge \mathbf{atom}(x) \wedge \text{TORTILLA}(x) \wedge [e] \wedge |e| = 1 \wedge \text{FLIP}(e) \wedge$
$\mathbf{Max}^{\{e',x'\}}(|e'| > n \wedge e' \leq e \wedge x' \leq x \wedge \mathbf{atom}(e') \wedge \mathbf{atom}(x')) \wedge \mathbf{th}(e',x')$

(62)

H	...	e	x	e'	x'
h_1	...	$flip_1$	$tortilla_4$	$flip_2$	$tortilla_4$
h_2	...	$flip_1$	$tortilla_7$	$flip_3$	$tortilla_7$
h_3	...	$flip_1$	$tortilla_3$	$flip_4$	$tortilla_3$

The first line in (60-61) gives the contribution of the reduplicated numerals, specifically an evaluation plurality of atomic tortillas. The pluractional alters the usual theta dependency in the second line, as before. It introduces an event variable e' and stores in it an evaluation plurality of atomic events from the event satisfying the verbal predicate. Simultaneously, it stores the atomic members of $G(x)$, here just atomic tortillas in x'. Finally, it asserts that there is a dependency between these two new variables and that it satisfies the theme relation. The crucial contribution of the pluractional is the variable e' storing an evaluation plurality of events. Unlike the main event variable e, this new variable can stand in a theta dependency with the variable storing an evaluation plurality of individuals introduced by the reduplicated numeral. What allows the dependent indefinite to introduce an evaluation plurality is that the pluractional introduces an evaluation plurality of events as well. As we have seen, it does so in order to establish distributive dependencies between an event and an individual.

4 Conclusions

To sumarize, this paper provided an analysis of pluractional distributivity that captures its core properties. It is pluractional because it breaks the event down into its atoms and stores them as an evaluation plurality exceeding a certain cardinality. It is distributive in that it bans collective readings of objects of transitive verbs. It does this by breaking the object into its atomic parts and asserting a thematic dependence holds between these two variables storing evaluation pluralities. Finally, we showed how dependent indefinites could be licensed by distributive pluractionality, even though such indefinites cannot fall in its scope. The big idea is that dependent indefinites put constraints on sets of output assignments, not constraints on the structure of LF. What unifies pluractionals and distributive quantifiers is that their interpretation generates output sets of assignments with similar structure, even though their LFs are very different.

A last advantage of this analysis is that we end up with a nice picture of plurality in the determiner domain. Indefinites introduce variables that, in addition to being either domain singular or domain plural, can also be either evaluation singular or evaluation plural.

(63)

	Domain Singular	Domain Plural
Evaluation Singular	jun *one*	oxi' *three*
Evaluation Plural	jujun *one one*	oxox *three three*

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