Dependent pluractionality in Piipaash (Yuman)[1]

Robert HENDERSON — *University of Arizona*
Jérémy PASQUEREAU — *University of Surrey/Université de Poitiers*
John W. W. POWELL — *University of Arizona*

Abstract. Piipaash is a Yuman language spoken in Salt River Pima-Maricopa Indian Community (SRPMIC) and Gila River Indian Community (GRIC), both of which are located near Phoenix, Arizona. This work, based on text and other secondary sources, a novel analysis of a pluractional affix in Piipaash. In particular, Piipaash has what, at first pass, look like standard dependent definites (e.g., Balusu 2006; Farkas 1997; Henderson 2014). Looking more broadly we see that the marker of such indefinites, *-xper-*, has a wider distribution than markers of dependent indefinites in other languages discussed in the literature. Moreover, this distribution introduces two puzzles that we will solve in this talk by proposing a unified account of *-xper-* in terms of a novel kind of pluractionality that we dub ”dependent pluractionality”. The core proposal is that in most previously discussed languages the relevant dependent indefinite morphology marks an individual variable as dependent (i.e., the variable quantified over by a numeral or indefinite). In Piipaash, *-xper-* marks an event variable as dependent. What is special about Piipaash is that a wide variety of expressions are verbal, including numerals, and have an event argument.

Keywords: Pluractionality, Distributivity, Dependent Indefinites, Numerals, Yuman.

1. Introduction

Piipaash (Yuman) is an Indigenous language spoken in Arizona in two communities, Salt River Pima-Maricopa Indian Community (SRPMIC) and Gila River Indian Community (GRIC). See the circled regions below for the location of both nations.

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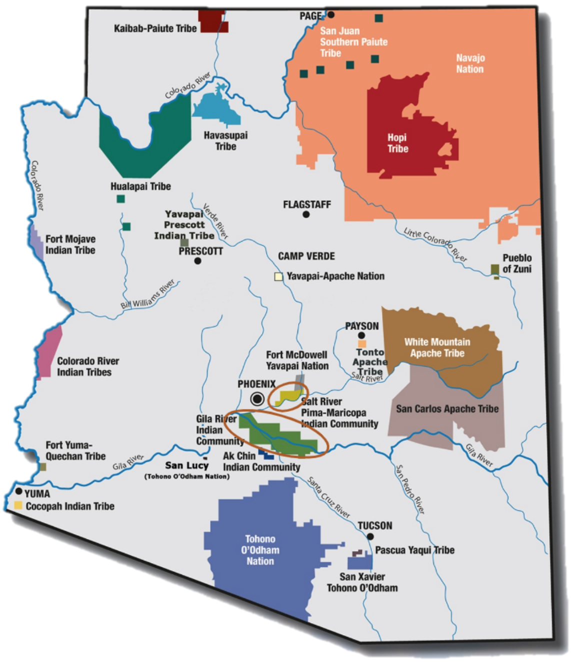


The language has, at first pass, what looks like standard dependent indefinites (Balusu 2006; Farkas 1997; Henderson 2014, among others). For instance, in the following example, the affix *-xper-*, traditionally glossed 'each', occurs on a numeral that co-varies in the scope of a distributively interpreted subject—i.e., for each of Pam and Heather there is a distinct set of three pieces of bread she ate.[2]

(1) Pam-sh Heather-m uudav-k paan xmuk-**xper**-m mash-k
Pam-NOM Heather-ASC accompany-SS bread three-**each**-DS eat.DU-REAL
'Pam and Heather each ate three pieces of bread.' (Gordon, 1986: p. 99)

While there is nothing surprising about examples like (1), looking more broadly we see that *-xper-* has a wider distribution than markers of dependent indefinites in other languages discussed in the literature, which introduces a pair of puzzles.

First, while (1) shows that *-xper-* can mark dependent numerals, it can also mark verbs to yield the same effect. In (2) *-xper-* appears on *tuuwamp* 'turn' and marks the event argument as dependent. It must co-vary in the scope of the subject—i.e., for each there is a distinct event of turning it.

(2) mat-cham-k kwnyminy-m tuuwamp-**xper**-k
REFL-all-SS different-DS turn.PL-**each**-REAL
'They all turned it around separately' (Gordon, 1986: p. 144)

The puzzle is then how to build an analysis of *-xper-* that can account for its prima facie cross-categorial distribution, applying to both numerals inside noun phrases, but also to main clause verbs. It is at first past not so clear how to do so given that most previous accounts of dependent

[2] Data for this paper comes from Gordon (1986) who conducted fieldwork with Piipaash speakers in the late 1970s in the Gila River Indian Community. Data also comes from Gil (1982) who attended a elicitation class at UCLA with Piipaash speakers. Thus, data comes exclusively from documents and no new data was collected for this paper.

indefinites in languages like Telugu, Hungarian, Kaqchikel, etc., involve morphology restricted to numerals / indefinite quantifiers (though see Pasquereau 2019, 2021 for an account of similar cross-categorial facts in Seri, and isolate spoken in the same region as Piipaash).

The second puzzle, which we dub *Gil's Puzzle* is due to an observation by Gil in his 1982 dissertation which introduces the generalization that *-xper-* marks distributive shares, that is, expressions that co-vary in the scope of the distributive operator like dependent numerals. In that same work, Gil also notes an apparent counterexample to this generalization, which he never solves. In particular, *-xper-* can appear on certain coordinations, where the coordinated nominals are interpreted as the distributive key.

(3) John-sh Bill-sh nyi-dush-**xper**-k 'ii xmok-m paaysh-k
John-NOM Bill-NOM PL.OBJ-be.DU-each-SS stick three.SG-DS carry.DU-REAL
'John and Bill each carried three sticks.' (Gil, 1982: p. 281, ex. 35c)

Note that here the existential verb, embedded under the subject, bears *-xper-*. Such examples disturbed Gil because *-xper* is inside the subject DP, yet this sentence has a similar interpretation as (1), where *-xper-* marks the object DP. We should only mark the latter if *-xper-* marked expressions co-varying under a distributively interpreted expression, not distributively interpreted expressions themselves.

In this paper we solve both problems by arguing that *-xper-* involves a novel kind of pluractionality that we dub *dependent pluractionality*. In particular, while in most previously discussed languages the morphology in dependent indefinite constructions marks an **individual variable** as dependent (i.e., the variable quantified over by a numeral or indefinite), in Piipaash, *-xper-* marks an **event variable** as dependent.

With this as background we immediately solve the first puzzle about the wide distribution of *-xper-* in Piipaash. The reason is that in Piipaash a wide variety of expressions are verbal, including numerals, coordination, etc., and so, we will argue, have an event argument. This means that *-xper-* can apply to a wider variety of constructions than the markers of dependence in many more familiar languages with dependent indefinites. Of course, we not only show that this account predicts the distribution of *-xper-*, but we also show that dependent marking can have a unified semantic account that predicts the truth conditions of dependent pluractionality across these different construction types.

Once we have developed this analysis, a simple extension solves Gil's puzzle. If *-xper-* marks dependent pluractionality, it is not marking the nominal in (3), but a verbal conjunction marker embedded under that nominal. Thus, Gil is right that *-xper-* can be taken broadly as a species of share-marking across all its uses. In this case, it is interpreted as dependent on the nominal that embeds the *xper*-marked conjunction. Because the head nominal embedding the *xper*-marked verb must be interpreted distributively, it may also take distributive scope over the main clause VP as well, generating the interpretation we see in (3). We thus account for the impression of key-marking while maintaining a uniform analysis of *-xper-*.

2. Presuppositions about post-suppositions

Henderson 2014 develops an account of dependent indefinites in the Mayan language Kaqchikel (and other languages) based on the notion of post-suppositions. We see an example of a dependent indefinite, the reduplicated quantifier in (4), which must be interpreted as co-varying in the scope of the higher quantifier, *konojel* ‘all of them’.

(4) K-onojel x-Ø-ki-kanöj 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.’

It is this account that we extend to develop an analysis of dependent pluractionality, and so first we will review how it treats examples like (4).

The backdrop for the analysis in Henderson 2014 is a version of Dynamic Plural Logic (DPlL) (van den Berg 1996) that has been stripped to its bare essentials. Like Dynamic Predicate Logic (Groenendijk and Stokhof, 1991), DPlL formulas are binary relations between variable assignments, which we can think of as input and output contexts. That is, a formula ϕ is true relative to g just in case there is an assignment h such that the result of updating g with ϕ is h. Where DPlL departs from Dynamic Predicate Logic is that instead of single variable assignments, formulas are interpreted relative to sets of variable assignments $\langle G,H\rangle$ (van den Berg, 1996; Brasoveanu, 2008; Nouwen, 2003: among others).

A set of assignments can be represented as a matrix. The columns of a matrix, like that in (5), represent variables (or discourse referents). The rows represent assignments $h_1,...,h_n$ in the set of assignments H. The cells of the matrix are the entities that each variable is mapped to under each assignment.

(5)

H	...	x	y	...
h_1	...	$entity_1$	$entity_4$	...
h_2	...	$entity_2$	$entity_4$	...
h_3	...	$entity_3$	$entity_4$	...
...	...	...	...	...

Brasoveanu 2011 calls the plurality of individuals stored in x above an EVALUATION PLURALITY, in contrast to a DOMAIN PLURALITY, which is a non-atomic entity (or group-entity) in the domain. We will continue to use this terminology in what follows.

Why should we move to a dynamic semantics with plural variable assignments? Answering this question provides insight into how the account of dependent indefinites, and subsequently, dependent pluractionality, works. One of the core uses of plural variable assignments was to allow for plural anaphora to pluralities derived from the interpretation of distributive quantifiers as in (6).

(6) Each student brought a^i lunchbox. They put them$_i$ on the shelf.

We see in (6) that a singular indefinite can yield a plural discourse referent when it is interpreted in the scope of a distributive quantifier. The idea in DPlL is that rather than treat the universal quantifier as a test, we keep track of the student–lunchbox pairs generated when interpreting the first sentence by storing them across a set of assignments. Subsequent pronouns can refer back to the plurality derived across a set of assignments storing such pairs. For us, though, and for Henderson (2014), the critical idea is that if dependent indefinites introduced a variable that said it must be plural across a set of assignments in the way that *a lunchbox* is in (6). Then, this would be a kind of indefinite that would have to be interpreted as co-varying in the scope of a distributive quantifier, which is exactly what dependent indefinites require.

Given that the variable introduced by indefinites like *a lunchbox* is evaluation plural after co-varying in the scope of a distributive operator, we get the formal typology of indefinite plurality in Figure 2, which Kaqchikel completely instantiates.

	Domain Singular	Domain Plural
Evaluation Singular	*jun*	*oxi'*
	one	three
Evaluation Plural	*ju-jun*	*ox-ox*
	one-RED	three-RED

Figure 1: Typology of indefinite plurality

Our core idea is that Piipaash does the exact same thing, but in the domain of events, rather than the domain of individuals.

	Domain Singular	Domain Plural
Evaluation Singular	verb	pluractional verb
Evaluation Plural	*xper*-marked verb	*xper*-marked pluractional verb

Figure 2: Typology of verbal plurality

We now elaborate the analysis of indefinite plurality in order to extend it to the domain of events.

As is standard, atomic formulas are tests (they only pass on input contexts that satisfy them), and dynamic conjunction is defined as relation composition.

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

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

We have classes of expressions that manipulate the two kinds of pluralities—domain plurality and evaluation plurality. Domain-level cardinality predicates—e.g., **one**(x), **two**(x), etc.—distributively check the cardinality of the set of atomic parts of an individual.

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

Essentially, given G, they check whether $|\textbf{atoms}(g_1(x))| = 2$, and $|\textbf{atoms}(g_2(x))| = 2$, etc.

In addition to this, we also have tests for evaluation-level cardinality. Essentially, given G, they check the cardinality of $\{g_1(x), g_2(x), g_3(x), \ldots\}$

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

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

Quantification proceeds via pointwise manipulation of assignment functions. We overload the notation [x] to define random assignment in the object language.

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

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

b. $g[x]h$ iff for any variable v, if $v \neq x$, then $g(v) = h(v)$

Verbs have an event argument, which is existentially closed by default. They are connected to their arguments via theta-roles (AG, TH, etc.), which are distinguished functional relations from the domain of events to the domain of individuals.[3]

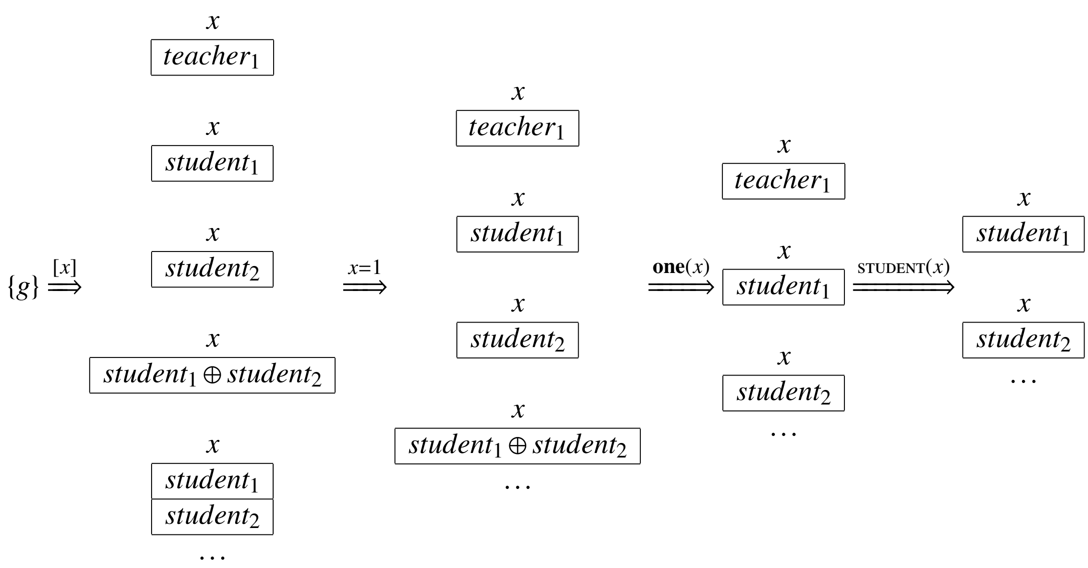
Putting things together, let's consider a simple example like the sentence 'A student danced'. It is translated as in (13).

(13) A student danced $\rightsquigarrow$
$\exists x[x = 1 \wedge \textbf{one}(x) \wedge \text{STUDENT}(x)](\exists e(e = 1 \wedge \text{DANCE}(e) \wedge \text{AG}(e, x)))$

The formula in example (13) just abbreviates the dynamic version in (14).

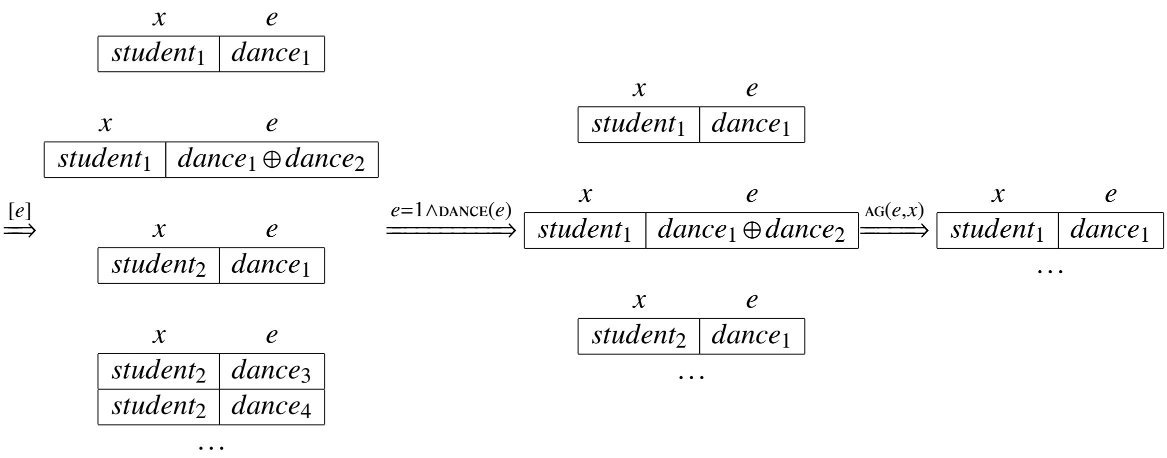
(14) $[x] \wedge x = 1 \wedge \textbf{one}(x) \wedge \text{STUDENT}(x) \wedge [e] \wedge e = 1 \wedge \text{DANCE}(e) \wedge \text{AG}(e, x)$

Suppose that our input context is a singleton assignment assigning some value to every variable: $[x] \wedge x = 1 \wedge \textbf{one}(x) \wedge \text{STUDENT}(x) \wedge [e] \wedge e = 1 \wedge \text{DANCE}(e) \wedge \text{AG}(e, x)$



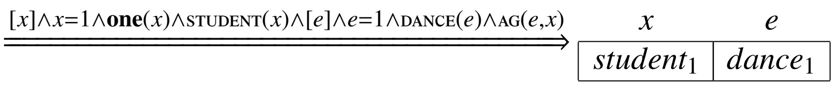
The next block begins by introducing an event e. Just as before, potential outputs could store in e a non-atomic event or an evaluation plurality.

[3]We also assume that these theta-roles, in addition to basic lexical relations (SEARCH, EAT, STUDENT, etc.), are cumulatively closed by default, though we suppress the common star notation for readability. That is, we assume that all theta-roles and n-ary lexical relations R are always $**R$, where $**R$ is the smallest set such that $R \subseteq **R$ and if $\langle a_1, ..., a_n\rangle \in **R$ and $\langle b_1, ..., b_n\rangle \in **R$, then $\langle a_1 \oplus b_1, ..., a_n \oplus b_n\rangle \in **R$. Note that domain-level cardinality predicates are not to be interpreted cumulatively, just like the metalanguage predicate **atom**, which is why they will also be marked in bold throughout.



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

In the illustrated examples that follow, we will only represent one typical path through the graph.



Because distributive quantifiers license dependent indefinites, let's consider how universal quantification is treated in DPlL. This will lay the foundation for analyzing how dependent indefinites are licensed in their scope. Universal quantification is decomposed into a maximization operation over the restrictor and a distributive operator over the nuclear scope (Brasoveanu, 2008). That is, $\forall x[\phi](\psi)$ abbreviates $\mathbf{max}^x(\phi) \wedge \delta(\psi)$.

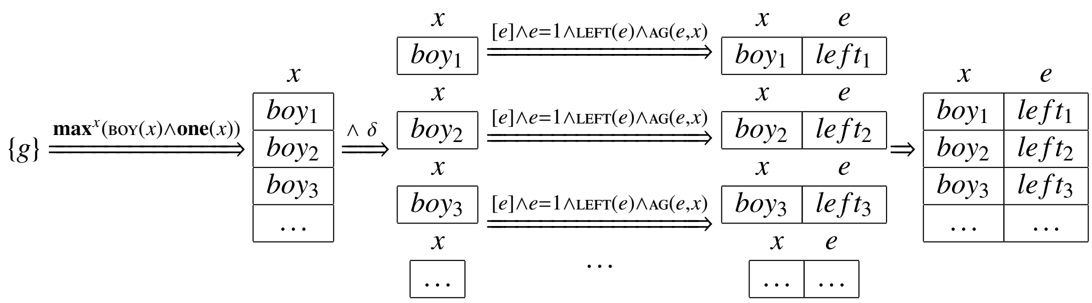
(16) $[\![\mathbf{max}^x(\phi)]\!]^{\langle G,H\rangle} = \mathbb{T}$ iff $[\![[x] \wedge \phi]\!]^{\langle G,H\rangle} = \mathbb{T}$ and
a. There is no H' such that $H(x) \subsetneq H'(x)$ and $[\![[x] \wedge \phi]\!]^{\langle G,H'\rangle} = \mathbb{T}$

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

Consider an example like *'Every boy left'*, whose translation appears in (18)-(19).

(18) $\forall x[\text{BOY}(x) \wedge \mathbf{one}(x)](\exists e(e = 1 \wedge \text{LEFT}(e) \wedge \text{AG}(e,x)))$

(19) $\mathbf{max}^x(\text{BOY}(x) \wedge \mathbf{one}(x)) \wedge \delta([e] \wedge e = 1 \wedge \text{LEFT}(e) \wedge \text{AG}(e,x))$



To quickly summarize the analysis of dependent indefinites, note that as long as more than one individual in the model satisfies the restrictor, interpreting a universal quantifier can result in evaluation plural discourse referents for indefinites in its scope. The heart of the proposal is that dependent indefinites are like simple indefinites, except that they must come to contribute an evaluation plurality from the perspective of the *global* discourse context. A dependent indefinite introducing says that the variable it introduces must be like x above in the output, and the only way that can happen is if the indefinite introducing x takes scope under a distributive quantifier.

In this way, dependent indefinites are similar to expressions bearing presuppositions or conventional implicatures. Just like these expressions, part of their meaning contributes to the at-issue content, while a second part is interpreted separately. The difference is where this secondary content is interpreted. For presuppositions, it must be interpreted relative to the input context, that is, before the at-issue content (van der Sandt, 1992; Kamp, 2001: among others). In contrast, we take this cardinality constraint of dependent indefinites to be a post-supposition interpreted *after* the at-issue update (Brasoveanu 2012; Constant 2012; Farkas 2002; Lauer 2009). In essence, this allows the dependent indefinite to be interpreted in-situ, but take a global perspective on the environment in which it is interpreted. We call this global restriction on the course of quantification, following Henderson (2014), a *post-supposition*.

Post-suppositions are not a new class of meanings. They are discussed in Constant 2012; Farkas 2002; Lauer 2009, though Brasoveanu 2012 gives the most thorough formal treatment, which we will follow closely. The core definition is that in (20), where post-suppositions are marked via an overline.

(20) $[\![\overline{\phi}]\!]^{\langle G[\zeta], H[\zeta']\rangle} = \mathbb{T}$ iff ϕ is a test, $G = H$ and $\zeta' = \zeta \cup \{\phi\}$.[4]

We now update the definition of truth for formulas bearing post-suppositions.

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

Finally, we can formalize the account of dependent indefinites. Recall that plain indefinites contribute variables that are evaluation singular in their local context.

(22) one ϕ is ψ $\rightsquigarrow \exists x[x = 1 \wedge \mathbf{one}(x) \wedge \phi](\psi)$

[4] ϕ is a test just in case for any sets of assignments G and H and any sets of formulas ζ and ζ', if $[\![\phi]\!]^{\langle G[\zeta], H[\zeta']\rangle} = \mathbb{T}$, then $G = H$ and $\zeta = \zeta'$.

Where dependent indefinites differ is that they place the post-suppositional test $\overline{x > 1}$ on the variable they bind.[5]

(23) $\text{one}_{dependent}\ \phi$ is $\psi \rightsquigarrow \exists x[\overline{x > 1} \wedge \mathbf{one}(x) \wedge \phi](\psi)$

The critical constraint is the post-supposition $\overline{y > 1}$. This condition will only be satisfied if x varies across the set of assignment the result by interpreting the sentence bearing the dependent indefinite, but this is only possible if this indefinite is interpreted in the scope of a distributive operator or distributive quantifier, exactly as required. We now extend this account to the domain of pluractionality, that is, the domain of plural events.

3. *-xper-* as a maker of dependent pluractionality

Our core proposal, developed in this section, is that we can run the same kind of analysis for *-xper-* that we saw in Kaqchikel for dependent indefinites, but recognize that *-xper-* is a pluractional marker (following the syntax semantics interface idea developed in Pasquereau 2019, 2021 for a similarly transcategorial marker in Seri). This means that *-xper-* should count events in output sets of assignments. Counting events, as is well known, is a tricky thing. We need to define some criterion on which events are individuated for counting. Crosslinguistically, pluractional morphemes may count events along many axes—temporal location, spatial location, participants, etc. Because we are dealing with a distributive pluractional, we take events to be individuated in terms of participants. We add a thematic parameter to the <-symbol in (24), and assume that the particular thematic role is set contextually. This is due to the fact that *-xper-* can target different theta roles. Note that counting events in this way predicts that *xper*-marked verbs should only involve participant pluractionality, which is the case—i.e., we don't have examples of *-xper-* being licensed by adverbial quantifiers over events.

(24) $e >_{\Theta} 1 =_{def} |\{\Theta(e') : e' \in G(e\}| > 1$
'The variable e stores more than one event across a set of assignment G just in case it stores at least two events that differ on Θ.'

We can now give an analysis of *-xper-* as in (25), which is the direct verbal analog of the dependent indefinite. We append to the standard denotation of V a cardinality post-supposition requiring the event variable to be evaluation plural in the output, where we count events in terms of their distinct participants.

(25) *-xper-* $\rightsquigarrow \lambda V \lambda e[V(e) \wedge \overline{e >_{\Theta} 1}]$

3.1. Solving puzzle 1: the distribution of *-xper*

Let's start with the case where *-xper-* targets a main-clause verb. This is the simplest case for the proposed analysis, which we can extend out to all the other cases to provide a unified analysis.[6]

(26) mxaa-sh ashuuvar-xper-k
boys-NOM 3.sang.PL-each-REAL

[5]For dependent numerals, replace **one** in (23) with the appropriate cardinality predicate (**two**, **three**, etc.).

[6]Note that verbs do not have a domain level cardinality condition like **one**. The reason is that non-pluractional verbs, unlike nominals, are number neutral, both in Piipaash, but also crosslinguistically.

‘Some/the boys each sang.’ (Gil, 1982: p.271 ex. 24)

If we take the stem *ashuuvar* ‘sing’ to denote a predicate of events, its *-xper-* form would be predicate of events that are evaluation plural.

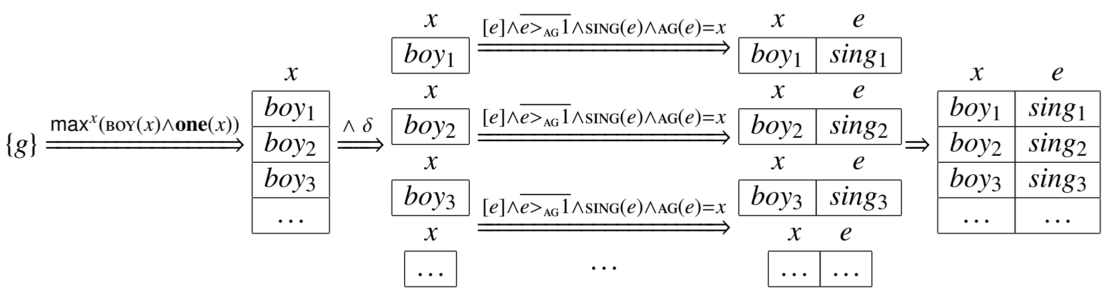
(27) *ashuuvar-xper-k* $\rightsquigarrow \lambda e[\textsc{sing}(e) \wedge \overline{e >_{\textsc{ag}} 1}]$

The result is a verb stem that must be existentially closed before being placed in the scope of a distributive operator. In this way, conditions like $\overline{e >_{\textsc{ag}} 1}$ act like powerful filters on representations. The filter can be met in sentences like (26) because Piipaash allows the covert distributive interpretation of subjects, like the following.

(28) kafe ’-sish-k pastel ’-mash-k
coffee 1-drink.DU-SS pie 1-eat.DU-REAL
‘We (two) drank coffee and ate pie.’ (Gordon, 1986: p. 116)

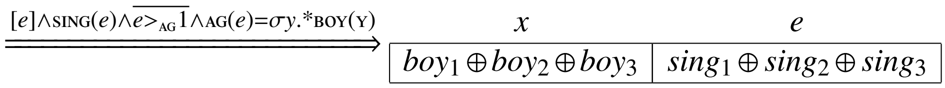
This means that (26) can be interpreted as in (29). We see the course of such an update in the figure below.

(29) $\forall x[x \leq \sigma y.{}^*boy(y) \wedge \mathbf{one}(x) \rightarrow \exists e[\textsc{sing}(e) \wedge \overline{e >_{\textsc{ag}} 1} \wedge \textsc{ag}(e) = x]]$
‘True just in case for every atomic boy, there is a singing event he is agent of, and there are at least two such events (with different agents).’



The universal quantifier introduces a new variable assignment for each restrictor entity—i.e., atomic boy in the sum of *BOY. Each of those assignments is extended with a possibly different e by existential quantification over the event variable allowing $\overline{e >_{\textsc{ag}} 1}$ to be satisfied. Note that without an intervening distributive quantifier, a *xper*-marked verb is necessarily false—e.g.,

(30) $\exists e[\textsc{sing}(e) \wedge \overline{e >_{\textsc{ag}} 1} \wedge \textsc{ag}(e) = \sigma y.{}^*\textsc{boy}(y)]$



The problem is that even if e is a plurality in the ontology—i.e., the variable assignment maps e to a sum—whose parts are mapped by AG to different boys, it cannot satisfy $\overline{e >_{\textsc{ag}} 1}$ because $\exists e$ only extends a single variable assignment rather than introducing a plurality of such assignments. The result is that a main verb marked with *-xper-* must be interpreted in the scope of a distributive operator with existential closure introducing at least two events that scope.

But why the runaround? Why not treat *-xper-* as the distributive operator itself, rather than an expression that forces a second operator to take scope over it. There are two strong arguments for this position. First, this approach correctly predicts that *xper*-marked verbs should not clash with other bona fide distributivity operator on the distributive key. Consider the example in (31).

(31) 'ny-ku-shiint nyaa xumar ku-shent '-ashkyet-xper-k
1-REL-one.PL 1.NOM child REL-one 1-cut.DIST-each-REAL
'Each of us spanked the child' (Gordon, 1986: p. 144)

It is perfectly fine for the distributively marked subject *'nykushiint nyaa* 'each of us' to co-occur with a *xper*-marked verb. As we have argued, *xper*-marked verbs, in fact, *must* be in the scope of a distributive operator, be it covert or overt. We explain then why -*xper*- patterns differently from doubling bona fide distributive operators which can produce clashes—e.g., 'Each of us (#each) spanked the child (#each).'

Second, this approach to -*xper*- will permit a unified account when we move to other constructions in which it occurs. In particular, consider the case where -*xper*- marks a DP-internal nominal as in (32).

(32) Pam-sh Heather-m uudav-k paan xmuk-xper-m mash-k
Pam-NOM Heather-ASC accompany-SS bread three-each-DS eat.DU-REAL
'Pam and Heather each ate three pieces of bread.' (Gordon, 1986: p. 99)

There are three critical things to see about this example. First, -*xper*- appears on the numeral *xmuk* 'three' inside the nominal constituent headed by *paan* 'bread'. Second, the numeral is actually a verb, which we can tell from the fact that it is marked DS for switch reference here.[7]

Finally, in this example it is the subject 'Pam and Heather' that is interpreted distributively. The last point, coupled with the first, shows why treating -*xper*- as a marker of dependent pluractionality (as opposed to a distributive operator) is required. While it is plausible in an example like (26) to let -*xper*- compose with the verb and quantify over the subject, a verbal argument, it is hard to imagine how -*xper*-, deeply embedded in an object numeral, quantifies over the subject. In contrast, the numeral in examples like (32) look almost exactly like dependent numerals in languages like Kaqchikel (Henderson, 2012, 2014)—i.e., a numeral that must covary in the scope of another expression.

We say that *xper*-marked numerals look almost like dependent numerals in languages like Hungarian because unlike dependent numerals in these more familiar languages, in Piipaash, numerals are verbs, as we see from the fact that they are marked for switch reference. Ultimately, this supports our analysis of -*xper*- as a kind of pluractionality, namely dependent pluractionality, but we must first understand how verbal numerals could work. Our ultimate goal is to show

[7]That numerals are verbs is not controversial in Yuman literature. In addition to switch reference morphology, they can take other morphemes that are exclusively found on verbs, including perfective and incompletive aspect.

(i) '-yoq-k '-xvik-ksh
1-vomit-SS 1-two-PERF
'I threw up twice' (Gordon, 1986: p. 304)

(ii) Pam-sh Parker-ly uuvaa-m nyaa xvik-uum
Pam-NOM Parker-LOC be.located-DS day two-INC
'Pam will be in Parker for two days' (Gordon, 1986: p. 238)

Moreover, numerals are always found in the syntactic position as other verbs. Indeed, Gordon remarked on this very fact: "In Yuman languages, numbers are verbs whose subjects are the items being enumerated" (Gordon, 1986: p. 70), an observation echoed by (Langdon and Munro, 1980: p. 122).

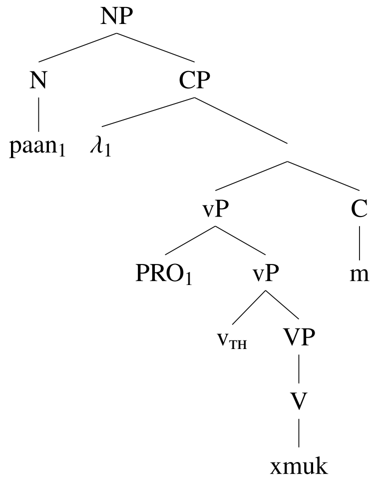
that a dependent pluractional marker on a verbal numeral has the exact same interpretive effect as other markers of dependence applying to numerals under their more common treatment as quantifiers over individuals.

Following Champollion 2016; Kuhn 2019; Pasquereau 2019, we can take numerals to be predicates of event(ualitie)s—events with *n* participants.

(33) *xmuk* $\rightsquigarrow \lambda e[|\textsc{th}(e)| = 3]$

We assume the following LF based on work in Seri (Pasquereau, 2019, 2021), itself assuming the analysis of internally-headed relative clauses in Toosarvandani 2014.[8]

(34) LF of NP *paan xmukm* "three (pieces of) bread"



The bottom-line truth conditions of a numerically quantified NP like *paan xmukm* 'three (pieces of) bread' would be as follows:

(35) *paan xmukm* $\rightsquigarrow \lambda x \exists e[|\textsc{th}(e)| = 3 \wedge \textsc{th}(e) = x \wedge \textsc{bread}(x)]$
'True of bread individuals that number three and participate in an event together.'

These type $\langle et \rangle$ expressions can then be further modified by standard quantifiers, definite articles, etc. Note that the numeral does not have existential force. Important for us, bare NPs in Piipaash most often get an existential interpretation—though such NPs are ambiguous with a definite interpretation. We assume this existential interpretation that numerals often have is due to a null indefinite quantifier, e.g. (36).

(36) $\emptyset_{ind} \rightsquigarrow \lambda P \lambda Q \exists x[P(x) \wedge Q(x)]$

We now have all the ingredients to show the dependent numeral effect familiar from languages like Kaqchikel or Hungarian, but through dependent pluractionality. Due to the fact that numerals in Piipaash are event-denoting, we predict that they can be subject to pluractional derivation. A numeral bearing *-xper-* would have the denotation in (37) as a dependent pluractional. Crucially, when that event argument is eventually existentially closed, it will have to co-vary in the

[8]We are being loose with our use of the term relative clause in this work. There are a variety of subkinds of relative clauses in Piipaash, and we do not fully understand the syntax of all of them. The constructions we call relative clauses here all involve switch reference subordination. All that is crucial for us is that dependent numeral is in an embedded clause which modifies a noun it forms a constituent with.

scope of a distributive operator / quantifier.

(37) *paan xmukxperm* $\rightsquigarrow \lambda x \exists e[|\textsc{th}(e)| = 3 \wedge \textsc{th}(e) = x \wedge \overline{e >_{\textsc{th}} 1} \wedge \textsc{bread}(x)]$
‘True of bread individuals that number three and participate in an event, where that event must co-vary across output assignments.’

If we assume a null indefinite quantifier takes this NP as an argument, we get the quantificational DP in (38).[9]

(38) $\emptyset_{ind}$ *paan xmukxperm* $\rightsquigarrow \lambda Q \exists x \exists e[|\textsc{th}(e)| = 3 \wedge \textsc{th}(e) = x \wedge \overline{e >_{\textsc{th}} 1} \wedge \textsc{bread}(x) \wedge Q(x)]$

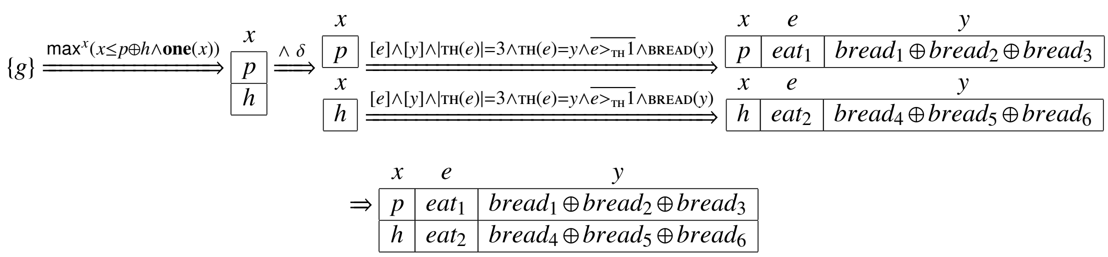
We now have the VP translation in (39) for *eat three-plurc bread* post-QR, and at the point where the subject DP composes with its remenant. Note that we are assuming the object DP (which contains the numeral relative clause) has undergone QR, as well as the subject DP.

(39) *paan xmukxperm mashk* $\rightsquigarrow \lambda x \exists y \exists e[|\textsc{th}(e)| = 3 \wedge \textsc{th}(e) = y \wedge \overline{e >_{\textsc{th}} 1} \wedge \textsc{bread}(y) \wedge$
$\exists e'[eat(e') \wedge \textsc{ag}(e') = x \wedge \textsc{th}(e') = y]]$

We are at the crucial step. If the subject of a sentence like (32), namely ‘Pam and Heather’, were fed as a type *e* argument to this verb phrase, the result would be infelicitous, a contradiction that could never be true. The problem is that there are only existential quantifiers in this sentence, and so $\overline{e >_{\textsc{th}} 1}$ is interpreted relative to a single variable assignment, and so cannot be satisfied. We must instead have a distributive operator so that the variable *e* can co-vary in its scope. That is, the subject should receive a distributive interpretation, like it in fact does, in the attested example. Our final bottom-line truth conditions for a sentence like (32), repeated below, appear in (41) with a typical update below.

(40) Pam-sh Heather-m uudav-k paan xmuk-xper-m mash-k
Pam-NOM Heather-ASC accompany-SS bread three-each-DS eat.DU-REAL
‘Pam and Heather each ate three pieces of bread.’ (Gordon, 1986: p. 99)

(41) $\forall x[x \leq p \oplus h \wedge \textbf{one}(x) \rightarrow \exists y \exists e[|\textsc{th}(e)| = 3 \wedge \textsc{th}(e) = y \wedge \overline{e >_{\textsc{th}} 1} \wedge \textsc{bread}(y) \wedge \exists e'[eat(e') \wedge$
$ag(e') = x \wedge \textsc{th}(e') = y]]]$
‘True if for each of Pam and Heather there is an event involving three bread participants *y* (and there must be at least two such events with different participants in the output), and there is a second event of eating in which she eats *y*.’



The only reading in which the event argument is evaluation plural—that is, one in which the

[9]In Piipaash unmarked nouns can receive either an indefinite or definite interpretation. The fact that we have existential, indefinite interpretation of the DP is what will allow both individuals and, critically, events to co-vary in the scope of some higher quantifier. We predict definite interpretations of nominals embedding *xper*-marked numerals to be infelicitous. While we have not been able to work with speakers to check this prediction, we have found no such examples in the existing literature, including corpora.

dependency condition on the verb is satisfied—is one in which Heather and Pam each get paired with their own three pieces of bread that they eat. This is exactly the observed truth conditions. Moreover, this is exactly the same truth conditions for analogous sentences with dependent-marked indefinites. The fact that different languages (e.g. Piipaash, Seri, Kaqchikel) have dependent numerals that have a similar effect on the global truth conditions of the sentences in which they occur, but achieve that effect through different routes is particularly satisfying, and shows the power of a unified account in terms of evaluation pluralities and post-suppositions.

3.2. Solving puzzle 2: Gil's puzzle

In Gil's 1982 dissertation he correctly notes that -*xper*- marks distributive shares. This descriptive fact follows from our analysis because the post-supposition introduced by -*xper*- can only be satisfied in the scope of a distributive operator. In that same work, though, Gil also notes an apparent counterexample to this generalization, which he never solves. In particular, -*xper*- can appear on certain coordinations, where the coordinated nominals are interpreted as the distributive key.

(42) John-sh Bill-sh nyi-dush-**xper**-k 'ii xmok-m paaysh-k
John-NOM Bill-NOM PL.OBJ-be.DU-each-SS stick three.SG-DS carry.DU-REAL
John and Bill each carried three sticks. (Gil, 1982: p. 281, ex. 35c)

Here the existential verb, embedded under the subject, bears the -*xper*-. Such examples are initially disturbing, and disturbed Gil, because the subject is the distributive key. Our analysis of -*xper*- as a marker of dependent pluractionality can immediately account for such examples.

Crucially, the stem *dush* 'to be' is just a verb. Moreover, it is embedded in exactly the same kind of relative clause as dependent numerals. Thus, just like in the dependent numerals, it's the event argument of this embedded verb that -*xper*- marks as dependent. In Gil's term, it is this embedded clause that is the distributive share. The question, then, is what is the distributive key. In the numeral case, the distributive key was a second clausal argument. That need not be the case, though. It is possible for the head of the relative clause—the subject of the main clause—to be interpreted distributively to satisfy the dependency requirement of the -*xper*-marked verb in its relative clause complement. But, if the main clause subject is interpreted distributively to satisfy a requirement of a dependent-marked embedded clause, it can also be interpreted distributively for the main clause. This generates prima facie distributive key-marking without distributive key-marking. We now show how this account works formally.

We assume the structure in (43) for *xper*-marked coordinated nominals in (42) (in Piipaash, nominative case marks (nominal) predicates).

(43) [$_{NP}$ pro$_i$ [$_{CP}$ John-sh Bill-sh$_i$ nyi-dush-**xper**-k]]
[pro [John-NOM Bill-NOM PL.OBJ-be.DU-each-SS]]
lit. 'Them being John, Bill'

Note that we assume the coordination is not contributed by the *dush* verb. Coordination, both conjunction and disjunction, is more generally marked by juxtaposition in Piipaash. We have already seen examples of this, e.g., (32). Instead, we take the contribution of *dush* to support the equative interpretation. Once marked pluractional, and after event closure and application of its external argument, we have the denotation in (44) for *Johnsh Billsh nyidushxperk* 'being John, Bill'.

(44) *Johnsh Billsh nyidushxperk* $\rightsquigarrow \lambda x \exists e[\textsc{be}(e) \wedge \textsc{th}(e) = x \wedge x \leq \mathbf{j} \oplus \mathbf{b} \wedge \overline{e >_{\textsc{th}} 1}]$
'True of individuals that are less than or equal to John and Bill that participate in at least two events of being that have different themes.'

Crucially, the only way the post-supposition in (44) can be satisfied is if it is interpreted in the scope of a distributive operator (and if we pass at least two individuals to x). But if *Johnsh Billsh nyidushxperk* must be interpreted distributively for the post-supposition in (44) to be satisfied, it follows that it can be interpreted distributively with respect to the main clause verb phrase *'ii xmokm paayshk* 'carry three sticks' in (42). This is precisely the observed interpretation of (42) which we derive in (45).

(45) $\forall x[x \leq \mathrm{i} \wedge \mathbf{one}(x) \rightarrow$
$\exists e[\textsc{be}(e) \wedge \textsc{th}(e) = x \wedge x \leq \mathbf{j} \oplus \mathbf{b} \wedge \overline{e >_{\textsc{th}} 1} \wedge$
$\exists z \exists e'[sticks(z) \wedge \textsc{th}(e') = z \wedge |\textsc{th}(e')| = 3 \wedge$
$\exists e''[carry(e'') \wedge ag(e'') = x \wedge \textsc{th}(e'') = z]]]]$
'True if for each individual x in i, there is (i) an event of x being and x is John or Bill, (ii) a second event involving three stick participants z, and (iii) a third event of carrying in which x carries z.'

Note that here that the *xper*-marked verb does very little truth conditional work. It merely forces the subject to be interpreted distributively. But, this is exactly what we wanted. We want to understand why the nominal that is the distributive key contains a *xper*-marked verb, when in other cases it was the distributive key. Crucially, our account in terms of dependent pluractionality allows us to get the correct truth conditions while maintaining a uniform denotation for *-xper-*.

4. Against a split-scope account

We have repeatedly seen that dependent expressions, both indefinites and pluractionals, involve interpreting part of an expression's content inside the scope of a distributivity operator—the existential operator—and part outside of it—the evaluation plurality constraint. We use post-suppositions to generate this effect. One might wonder whether there are other mechanisms, for instance, from the split-scope literature that could also be used to analyze dependent indefinites / pluractionals.

Kuhn 2017 argues for a split-scope account of dependent indefinites in the copy-movement style of Abels and Martí 2010. That is, the dependent indefinite moves outside of the scope of the distributivity operator, leaving a copy below, but at spell-out we interpret only part of the copy outside the scope of the distributivity operator, namely that part that forces co-variation (i.e. the plurality condition).

A primary argument for this proposal is that in languages like Hungarian dependent indefinites are not licensed in islands. This would make sense if the dependent indefinite were undergoing QR, as in a split-scope account. In contrast, a post-suppositional account would have to say that, in Hungarian, post-suppositions are discharged at island boundaries—clearly ad hoc. The Piipaash data we have considered here, as well as the generalizations from Seri made in

Pasquereau 2019, 2021 can bear on this argument.

First, as we have repeatedly emphasized, the dependence is marked on verbs in these languages. While a QR account is prima facie plausible for languages like Kaqchikel or Hungarian, where dependence is marked on indefinites and numerals, it is harder to argue that verbs undergo QR in languages like Piipaash. Second, even granting that verbs can move in Piipaash, we run into problems with a split scope account. In particular, dependent numerals are deeply embedded in relative clauses in Piipaash, which are islands to movement. This fact weighs in favor of a postsuppositional account, like that developed here, which is not inherently constrained by islands.

While we do not have space to fully mediate between these two accounts, the fact that we seem to have island sensitive and non-island-sensitive dependent expressions is itself an important empirical conclusion of this work. Figuring out the sources of these differences is an important question for future research.

5. Conclusions

The morpheme *-xper-* in Piipaash provides good evidence for a novel kind of pluractionality we call *dependent pluractionality*. Given that dependent indefinites are familiar from the literature, and predicates of eventualities, like verbs, in virtue of undergoing existential closure, have a kind of indefinite flavor, perhaps this is even expected. Once we make this move, we can solve two puzzles about *-xper-*. First, we understand why it has a wide distribution. This is because lots of expressions can be predicates of eventualities, including numerals. Our account additionally solves Gil's Puzzle—explaining why in certain cases it looks like *-xper-* is marking distributive keys. Our solution is that it always marks shares, but in virtue of marking eventuality predicates, it can appear inside a key that itself embeds a verbal predicate. It is thus locally, that is, inside the relative clause, share marking, even though the head of relative may be interpreted as key for the main clause verb phrase as well.

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