Pluractionality and Distributivity on the Edge of Mesoamerica*

The Workshop on the Languages of Meso-America (WLMA)

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1 Introduction

Just going to drop this image here in our defence.

Wupatki Pueblo an Ballcourt(!) near Flagstaff 500-1255 CE.

Our goals in this talk are twofold:

- Provide a quick, high-level introduction to our new, ongoing project on pluractionality, plurality, and distributivity in Seri (Iso), Hiaki (Uto-Aztecan) and Piipaash (Yuman).
- Zoom in on pluractionality and distributivity in Piipaash, situating it relative to nearby languages, and providing the first formal account.

Our main results are:

- Piipaash has a rather standard so-called *event-external* pluractional
- Piipaash has what looks like a novel kind of marker of quantificational dependence—what we call *dependent pluractionality* on analogy with the more well-known dependent indefinites.

2 Compositional morphosemantics of plurality

Our project aims to document and analyze the morphosemantics of plurality and pluractionality in several languages of the Sonoran desert, focusing on Hiaki (Uto-Aztecan), Piipaash/Maricopa (Yuman-Cochimí), and Seri (isolate).

- Languages of this area, though not (all) genetically related, show typologically-remarkable similarities in the complexities of their respective number marking system:

*We would like to thank the other members of the *Compositional Morphosemantics of Plurality Group*—Homar Aguilar, Matthew Baerman, Heidi Harley, and Megan Harvey—for their invaluable feedback and support.

- They mark different types of pluralities
- There is no one-to-one marking between meaning and exponent

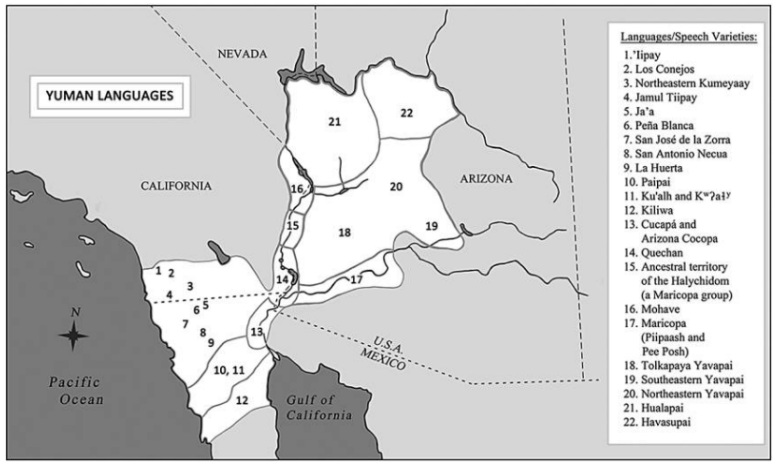
These which raise the following questions:

- How do we implement pluractionality in a featureal system alongside nominal plurality to control the complex morphological systems we see in the target languages?
- How do we do compostional semantic interpretation below the level of the word in the opaque morphological systems of Seri and Piipaash?
- What are the consequences of the plurality and pluractionality systems of these languages for morphological and semantic monotonicity of word formation operations?

In this talk, we report our first take on Piipaash.

3 Distributivity in Piipaash

Yuman is a family of Indigenous languages spoken in Arizona, Southern California, Baja California, and Northern Sonora.



Piipaash is an Indigenous language spoken in Arizona in two communities: Salt River Pima-Maricopa Indian Community (SRPMIC) and Gila River Indian Community (GRIC) along with the Akimel O'odham community, see circled in (3) for map of both nations.

Piipaash has a variety of ways to that an individual argument is interpreted distributively. We focus on two, though with the aim of extending to others.

- First, there is a morpheme *t-/sh-* that forms pluractional verbal stems that support distributive readings.[1] We gloss this morpheme DIST.[2]

(1) nyaa mxaa-ny-a nyi-'-ashxam-k
1.NOM boy.PL-DEM-Vaug PL.OBJ-1/3-hit.DIST-REAL
I hit the boys (Gordon, 1986, p. 100)

As reported in Gordon 1986, using the non-pluractional stem *aham-* 'hit' is infelicitous here in any sort of standard situation in which the boys receive their own hit.

[1] We return in the following section to discuss the connection to pluractionality.

[2] All Piipaash examples are represented in the standard orthography of Salt River Pima-Maricopa Indian Community as accepted in the Community Council meeting on 7 June 2017.

- There is a second morpheme, *-xper*, that also forces the distributive interpretation of an individual argument. We gloss this morpheme *each*.

(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)

Remember! *t-/sh-*: DIST, *-xper*: each

Finally, we see that these two morphemes can actually co-occur, which is immediately intriguing because double distributive marking in some language can lead to infelicity, like the English examples (4).

(3) '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)

(4) a. Every student read a book (#each).
b. Every student (#each) read book.

We begin with the *t-/sh-* distributive, which has a more narrow morphosyntactic distribution, and, as we will see, a wider range of semantic interpretations. We will then zoom in on the *-xper* distributive which we think needs a slightly more complex treatment.

3.1 Pluractionality and distributivity with *t-/sh-*

The *t-/sh-* morpheme forms stems that have distributive interpretations, as in (1), but such stems stand out in allowing other interpretations as well.

- We find pure repetition readings, with no individual argument being distributed over.

(5) a. taqsk 'jump'
b. **sh**taqsk 'jump around' (Gordon, 1986, p. 101)

- We also find cases where pluractional stems receive either habitual or generic readings.

(6) a. miim 'cry'
b. **sh**shmii**sh**k 'be a crybaby' / 'cry a lot' (Gordon, 1986, p. 101)

(7) a. 'ayuuravk 'be sick'
b. 'ayuu**sh**ravk 'be sickly' (Gordon, 1986, p. 101)

Combined with (1), we see that the *t-/sh-* stems have a variety of readings that all fall under the heading *pluractional*.

- A pluractional verb denotes a predicate of events that can only be satisfied by pluralities of events.
- Event pluralities require some kind of counting criterion—a way to know when have two events versus a single event that happens to complex spatiotemporal instantiation.

The *t-/sh-* appears to allow some leeway here. It says, give me a plurality of events that satisfy the underlying predicate, where two events are distinct for counting purposes if:

- They have different **participants**—e.g., (1) 'hit each'
- They occur at different **times**—e.g., (7) 'sickly'
- They occur in different **places/times**—e.g., (5) 'jump around'

As is standard, we think of access an event's participant(s), temporal location(s), and spatial location(s) via trace functions.

- a theta role, like **th**, for theme, is a partial function from the domain of events to the domain of individuals.
- a trace like τ is a partial function from the domain of events to the domain of times.
- a trace like σ is a partial function from the domain of events to the domain of spatial locations.

Pasquereau 2019; Pasquereau and Cabredo Hofherr 2020 develop an account of pluractionality in Seri where k is a variable over traces (like those above), whose contextually-determined value(s) provides the dimension according to which eventualities are individuated as in (8).

(8) $e' <_k e =_{\textbf{def}} k(e') < k(e)$
'The k-trace of e' is less than the k-trace of e (on the relevant ordering of the range of the k).'

We can thus define the partition operator in (9).

(9) $\mathsf{Part}_k^V(\mathsf{P}, e) =_{\textbf{def}} \mathsf{Part}(e, \mathsf{P}) \wedge \forall e' \in \mathsf{P}[V(e') \wedge e' <_k e]$
P is a Vk-Partition of e just in case P partitions e and every member of the partition e' satisfies V and is k-less than e.

Note that, as discussed in Pasquereau 2019,

- the $e' <_k e$ requirement rules out the trivial partition, so any Vk-partition of e will contain a plurality (at least 2) of subevents of e
- assuming the "neo-Davidsonian method" (where arguments are associated with their verbs via secondary predicates), we predict that themes and agents will be predicated of the plural events; this, in combination with the cumulativity of theta-roles hypothesis, predicts that pluractional verbs in Piipaash can distribute over any of their arguments

We can now give a translation for *t-/sh-* based on Vk-partitions.

(10) t-(/sh-) $\rightsquigarrow \lambda V_{\epsilon t} \lambda e[V(e) \wedge \exists \mathsf{P}[\mathsf{Part}_k^V(\mathsf{P}, e)]]$
'*t-/sh-* denotes a verbal modifier that returns a predicate of events, events that satisfy V and can partitioned into at least two subevents such that (i) each of those events satisfies V, (ii) at least two subevents have different k-traces, (iii) no subevents have the same k-trace as e.

This analysis passes a sanity check, making a series of correct predictions.

- A sentence containing a verb marked with *t-(/sh-)* is not acceptable when predicated of "oneic" events (i.e., events not permitting a k-based partition in the context).
- *t-(/sh-)* can target both eventive and stative eventualities because k can range over all sorts of traces.
- the sub-eventualities of V can be individuated by their participants (i.e. "distribution over participants")

(11) uushlyesh-k
break.DIST-REAL
He broke them (Gordon, 1986, p. 23)

(12) $\exists e[\textsc{break}(e) \wedge \textsc{th}(e) = y \wedge \exists \mathsf{P}[\mathsf{Part}_{\textsc{th}}^{\textsc{break}}(\mathsf{P}, e)] \wedge \textsc{ag}(e) = x]$

- the sub-eventualities of V can be individuated by their time (i.e. temporal distribution)

(13) da-sh ayuu-**sh**rav-k
DEM-NOM some.thing-3.be.sick.DIST-REAL
'He/she is sickly' (constructed example)

(14) $\exists e[\textsc{sick}(e) \wedge \exists \mathsf{P}[\mathsf{Part}_{\tau}^{\textsc{sick}}(\mathsf{P}, e)] \wedge \textsc{ag}(e) = x]$

- Same for other k like locations, etc.

We now have a fairly standard-looking account of a standard-looking event-external pluractional in Piipaash. Going forward we can use it to compare and contrast other potential markers of verbal plurality.

3.2 Pluractionality and distributivity with *-xper-*

We have already seen the suffix *-xper-* on verbs, like the following repeated from (2).

(15) 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)

When we look more broadly, though, we see that *-xper-* has a fairly wide distribution. Moreover, this distribution introduces a series of intriguing puzzles for a unified account of *-xper-* (and pluractionality in Piipaash more widely.

- First, *-xper-* occurs on numerals

(16) Pam-sh Heather-m uudav-k paan xmuk-xper-m
Pam-NOM Heather-ASC accompany-ss bread three-each-DS
mash-k
eat.DU-REAL

'Pam and Heather each ate three pieces of bread.' (Gordon, 1986, p. 99)

Even more intriguing, it appears that *t-/sh-* does not appears on numerals. At least, we have found no examples in our corpus and Gil (1982) does not mention them in an dissertation on the topic of distributive numerals.

A cool aside. If this generalization holds up, our analysis of the *-t/-sh* pluractionals predicts it, at least for participant readings. Below we treat numerals as predicates of events. If we apply *-t/-sh-* to a numeral predicate of events we get a contradiction.

(17) $*$*t-(/sh-)* + *xmuk* $\rightsquigarrow \lambda e[|th(e)| = 3 \wedge \exists \mathsf{P}[\mathsf{Part}_{th}^{\lambda e[|th(e)|=3}](\mathsf{P}, e)]]$
'a predicate of events, events that must have three participants and can partitioned into at least two subevents such that (i) each of those events satisfies has three participants, (ii) at least two subevents have different *th*-traces, (iii) no subevents have the same *th*-trace as *e*.

For the other *k*-traces we don't get an immediate contradiction, but we get truth conditions that are trivially equivalent to an unmarked numeral, which perhaps explains why we don't see it in our sources.

- Second, *-xper-* can occur on markers of conjunction.

(18) John-sh Bill-sh nyi-dush-xper-k 'ii xmok-m
John-NOM Bill-NOM PL.OBJ-be.DU-each-SS stick three.SG-DS
paaysh-k
carry.DU-REAL
John and Bill each carried three suitcases (Gordon, 1986, p. 281)

Furthermore, we have a mysterious semantic split. Note in (18) that *-xper-* occurs in the so-called *distributive key*—i.e., in quantifier parlance it is the restrictor for the distributive operator. In contrast, when *-xper-* appears on numerals it marks the *distributive share*—repeated from directly above

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

In this example, the *-xper-* appears on an expression in the scope of a distributive operator that has the subject, here unmarked, as its restrictor.

- Finally, as mention in (3), and repeated below, *t-/sh-* can co-occur with other markers of distributivity, which needs explanation.

(20) '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)

The question is then how to provide a unified analysis of *-xper-* that will allow it to appear on main verbs as well as inside DPs, while apparently either marking keys or shares.

3.3 *-xper-* as a maker of dependent pluractionality

Our core proposal, developed in this section, is that

- *-xper-* is a marker of novel species of pluractionality, which we call *dependent pluractionality*, on analogy with *dependent indefinites* (e.g., Henderson 2014; Farkas 1997, 2001, among others).

Henderson 2014 develops an account of dependent in indefinites in the Mayan language Kaqchikel (and other languages) based on the notion of post-suppositions.

(21) 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.'

The proposal is that reduplicated indefinites like *jujun* 'one one' express two levels of cardinality in Dynamic Plural Logic (van den Berg, 1996), following ideas in Brasoveanu 2013.

(22) $\lambda P \lambda Q \exists x[\mathbf{one}(x) \wedge \overline{x > 1} \wedge P(x) \wedge Q(x)]$

H	...	x	x	...
h_1	...	$entity_1$	$entity_4 \oplus entity_5$	...
h_2	...	$entity_2$	$entity_4 \oplus entity_5$	...
h_3	...	$entity_3$	$entity_4 \oplus entity_5$	...
...	...	...	...	...

- **one**(x) requires that x denote an oneic individual, i.e., it speaks about cardinality in the domain of individuals.
- $\overline{x > 1}$, in contrast requires there be two output assignment functions that assign x to different entities, i.e., it is plural at the level of evaluation.

The latter condition can only be satisfied if the indefinite is interpreted in the scope of a distributivity operator. Why?

- Such operators introduce a plurality of plurality of assignment functions—one for each restrictor entity.
- Each of these assignments must individual make the scope formula true
- Providing an environment in which the dependent x can get multiple values.

Note: We are not necessarily wedded to this particular dynamic postsuppositional account. We could, for instance, use a Charlow (to appear)-style higher order dynamic generalized quantifier approach to postsuppositions, or a completely different account of dependent indefinites. Our main goal here is to draw parallels between *-xper-* and other known kinds of dependent expressions.

We can run the same kind of analysis for *-xper-*, but recognizing that *-xper-* is a pluractional marker.

- This means that *-xper-* should count events in output sets of assignments.
- Because events require a counting criterion, we add a parameter to the <-symbol.
- We let the Θ parameter be set contextually (because *-xper-* can target different theta roles, but we could set this compositionally if the pluractional were a theta role modifier.)

(23) $e >_\Theta 1 =_{def} |\{\Theta(e') : e' \in G(e)\}| < 1$
'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.'

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

- Note that counting verbs in this way predicts that *xper*-marked verbs should only involve participant pluractionality, which is the case—i.e., we don't *-xper-* being licensed by adverbial quantifiers over events.

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.

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

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

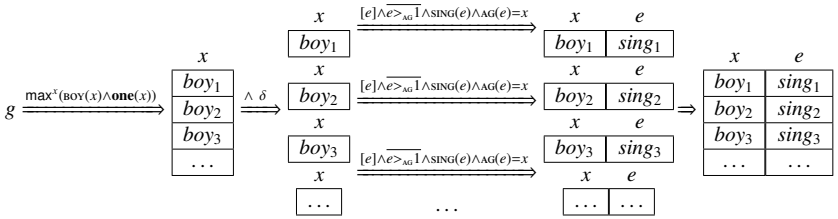
The result is a verb stem that must be existentially closed before being placed in the scope of a distributive operator. In this way, conditions like $\overline{e >_{\textsc{ag}} 1}$ act like powerful filters on representations.

- The filter can be met in sentences like (25) because Piipaash allows the covert distributive interpretation of subjects, like the following.

(27) 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 (25) can be interpreted as in (28).

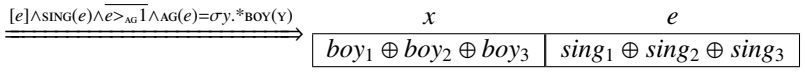
(28) $\forall x[x \in \sigma y.{*boy}(y) \wedge \textbf{one}(x) \rightarrow \exists e[\textsc{sing}(e) \wedge \overline{e >_{\textsc{ag}} 1} \wedge \textsc{ag}(e) = x]]$
'True just in case for every oneic boy, there is a singing event he is agent of, and at there are at least two such events (with different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



- The universal quantifier introduces a new variable assignment for each restrictor entity—i.e., oneic 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 $\overline{e >_{AG} 1}$ to be satisfied.

Note that without an intervening distributive quantifier, a *xper*-marked verb is necessarily false—e.g.,

(29) $\exists e[\text{SING}(e) \wedge \overline{e >_{AG} 1} \wedge \text{AG}(e) = \sigma y.{*}\text{BOY}(y]$



- The problem is that even if e is an ontologically plurality—i.e., the variable assignment maps e to a sum—whose parts are mapped by AG to different boys, it cannot satisfy $\overline{e >_{AG} 1}$ because $\exists e$ will only introduce a single variable assignment.

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? But? Why the runaround? Why not treat *-xper-* as the distributive operator itself?

First, this approach correctly predicts that *xper*-marked verbs should not clash with other bona fide distributivity operator on the distributive key. Consider the following repeated from (3).

(30) '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)

The fact that these kinds of example are common was one of the puzzles we started with.

- 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.

- 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 DP-internal nominal.

(31) Pam-sh Heather-m uudav-k paan xmuk-xper-m
Pam-NOM Heather-ASC accompany-ss bread three-each-DS
mash-k
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 is marked DS for switch reference.

- 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 is required.

- While it plausible in example like (25) 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 (31) look almost exactly like dependent numerals in languages like Kaqchikel—i.e., a numeral that must covary in the scope of another expression.

- We say almost because unlike dependent numerals in more familiar languages, in Piipaash, numerals are verbs.

- 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.

Following Pasquereau 2020; Champollion 2016; Kuhn 2019 we can take numerals to predicates of events—events with *n* participants.

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

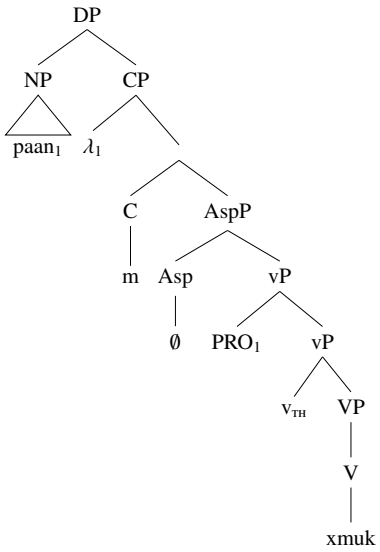
Like any other verb, they can have their external argument added by event identification.

- Because numerals occur in a kind of relative clause construction, this external argument is not directly satisfied. It instead, it composes with head noun by predicate modification.

- Moreover, it occurs after standard relative clause operator movement and existential closure of the event argument.

We assume the following LF based on work in Seri (Pasquereau, 2020), itself inspired by Toosarvandani 2014.

(33) LF of DP *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:

(34) $paan\ xmukm \rightsquigarrow \lambda x \exists e[|\textsc{th}(e)| = 3 \wedge \textsc{th}(e) = x \wedge \textsc{bread}(x)]$
'True of 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.

- 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 is due to a null indefinite quantifier.

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

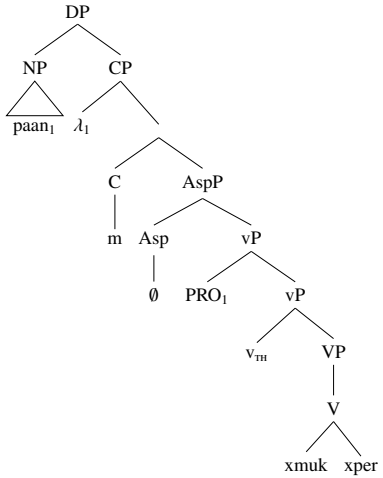
We know have all the ingredients to show the dependent numeral effect familiar from languages like Kaqchikel or Hungarian, but through pluractionality.

- Because numerals in Piipaash are event-denoting, we predict that they can be subject to pluractional derivation.
- A numeral bearing *-xper-* would have the following denotation as a dependent pluractional.
- Crucially, when that event argument is eventually existentially closed, it will have to co-vary in the scope of a distributive operator / quantifier.

(36) $xmukxperm \rightsquigarrow \lambda e[|\text{TH}(e)| = 3 \wedge \overline{e >_{\text{TH}} 1}]$

Embedding this expression in relative clause like (33) give the following NP denotation.

(37) LF of DP *paan xmukxperm* "three (pieces of) bread"



(38) $paan\ xmukxperm \rightsquigarrow \lambda x \exists e[|\text{TH}(e)| = 3 \wedge \text{TH}(e) = x \wedge \overline{e >_{\text{TH}} 1} \wedge \text{BREAD}(x)]$
'True of individuals that number three and participate in an event together, where that event must co-vary in output assignments.'

If we assume a null indefinite quantifier takes this NP as an argument, we get the following quantificational DP.

(39) $\emptyset_{ind}\ paan\ xmukxperm \rightsquigarrow \lambda Q \exists x \exists e[|\text{TH}(e)| = 3 \wedge \text{TH}(e) = x \wedge \overline{e >_{\text{TH}} 1} \wedge \text{BREAD}(x) \wedge Q(x)]$

Note: The fact that we have existential 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.

As is standard in neo-davisonian event semantics, all quantifiers must QR, binding a variable that a thematic role maps an event to.

- The VP *paan xmukxperm mashk* 'eat three-dist bread' would have the following denotation, assuming the subject has also undergone QR.

(40) $paan\ xmukxperm\ mashk \rightsquigarrow \lambda x \exists y \exists e[|\text{TH}(e)| = 3 \wedge \text{TH}(e) = y \wedge \overline{e >_{\text{TH}} 1} \wedge \text{BREAD}(y) \wedge \exists e'[eat(e') \wedge \text{AG}(e') = x \wedge \text{TH}(e') = y]]$

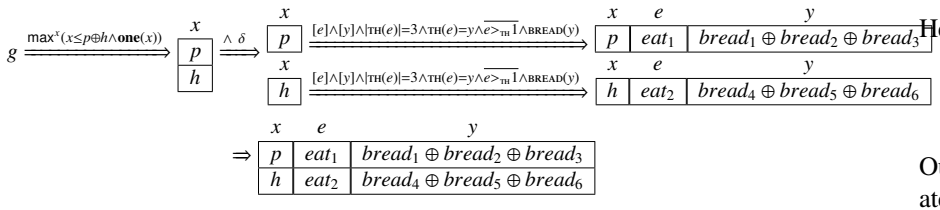
We are at the crucial step. If the subject of a sentence like (31), namely 'Pam and Heather', were fed as a type e argument to this verb phrase, the result would be infelicitous, a contradiction that could never be true.

- The problem is that there are only existential quantifiers in this sentence, and so $\overline{e >_{\text{TH}} 1}$ 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 it's 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 (31), repeated below, are thus:

(41) 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)

(42) $\forall x[x \leq p \oplus h \wedge \textbf{one}(x) \rightarrow \exists y \exists e[|\text{TH}(e)| = 3 \wedge \text{TH}(e) = y \wedge \overline{e >_{\text{TH}} 1} \wedge \text{BREAD}(y) \wedge \exists e'[eat(e') \wedge ag(e') = x \wedge th(e') = y]]]$
'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 analysis thus shows:

- We can extend the account of dependent indefinites in Henderson 2014 to a new phenomenon—dependent pluractionality.
- Moreover, this account allow us to understand dependent numerals in languages like Piipaash, which are verbs.
- The fact that Piipaash and Kaqchikel both 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, well, quite beautiful.

3.4 Solving Gil's puzzle

In Gil's dissertation 1982 he correctly notes that *-xper-* marks distributive shares.

- This 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, Gil also notes an apparent counterexample to this generalization, which he never solves.

- In particular, *-xper-* can appear on certain conjunctions, where the conjoined nominals are interpreted as the distributive key.

(43) John-sh Bill-sh nyi-dush-**xper**-k 'ii xmok-m
John-NOM Bill-NOM PL.OBJ-be.DU-each-SS stick three.SG-DS
paaysh-k
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!
- The head of the relative clause—the conjunction—must be interpreted distributively to satisfy the dependently verb in its relative clause complement.

But, if conjoined subject is interpreted distributively to satisfy a requirement of a dependent-marked embedded clause, it will also be interpreted distributively for the main clause.

- Voilà, prima facie distributive key-marking without distributive key-marking.

We assume the following structure for *xper*-makred conjoined nominals in (43).

(44) [$_{DP}$ John-sh Bill-sh$_i$ [$_{CP}$ PRO$_i$ nyi-dush-**xper**-k]]
John-NOM Bill-NOM PRO PL.OBJ-be.DU-each-SS

Note that we assume the conjunction is not contributed by the *dush* verb.

- Conjunction is more generally marked by juxtaposition in Piipaash. We have already seen examples of this—e.g., (31).
- Instead, we take the contribution of *dush* to merely assert the existence of some individual (through their particiation in an event at some location).

(45) $dush \rightsquigarrow \lambda e \exists y[\textsc{be}(e) \wedge \textsc{loc}(e, y)]$

Once marked pluractional (and after event closure and application of it's external argument), we have the following denotation for *nyidushxperk*.

(46) $nyidushxperk \rightsquigarrow \lambda x \exists e \exists y[\textsc{be}(e) \wedge \textsc{loc}(e, y) \wedge \textsc{th}(e) = x \wedge \overline{e >_{\textsc{th}} 1}]$
'True of individuals that participate in at least two events of being at a location which have different themes stored in different assignments in the output.'

Crucially, the only way this 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).

- Both constraints can simultaneously be satisfied if the head of the relative clause in which *nyidushxperk* is embedded is interpreted distributively.
- This is precisely the observed interpretation of (18).

(47) $\forall x[x \leq j \oplus b \wedge \mathbf{one}(x) \rightarrow$
$\exists e \exists y[\textsc{be}(e) \wedge \textsc{loc}(e, y) \wedge \textsc{th}(e) = x \wedge \overline{e >_{\textsc{th}} 1} \wedge$
$\exists z \exists e'[sticks(z) \wedge \textsc{th}(e') = z \wedge |\textsc{th}(e')| = 3 \wedge$
$\exists e''[carry(e'') \wedge ag(e'') = x \wedge th(e'') = z]]]]$
'True if for each of John and Bill there is (i) an event of him being at a location (distinct from the other's), (ii) a second event involving three stick participants z, and (iii) a third event of eating in which he 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 dependent pluractionality allows us to get the correct truth conditions while maintaining a uniform denotation for *-xper-*.

3.5 Comparing pluractional-marked numerals in Piipaash and Seri

As in Piipaash, in Seri:

1. numerals are verbs,
2. verbs express pluractionality,
3. and pluractional numerals have properties of distributive numerals

As in Piipaash, the distributive key can be

- participants

(48) Hoeen quih **zixcam quih isnaap c-azlc**
1SG.son.PL DEF fish DEF SBJ.NMLZ-be_SIX.PLUR
iyoocöt.
3;3.RLYO.kill.PL
'My sons caught six fish (each).'
(Context: My three sons went fishing today. Each one went in his own boat but they all came back at the same time: at 2pm. Juan caught 6 fish, Miguel 6, and Eruviel 6 as well. True)
(Pasquereau, 2020, ex. 16)

- times

(49) Juan quih **zixcam quih c-apxoj** iyoocö.
Juan DET fish DET SBJ.NMLZ-be_three.PLUR 3;3.RLYO.kill
'Juan caught three fish (repeatedly).'
(Context: Today, every hour, my son Juan caught 3 fish. True.)
(Pasquereau, 2020, ex. 17)

- locations

(50) **Xicaquiziil cmajiic quih c-apxoj** yopancojc
child.PL woman.PL DET SBJ.NMLZ-be_three.PLUR RLYO.run.PL
'Women ran in threes.'
(Context: Groups of three women raced each other.) (Pasquereau, 2020, ex. 18)

In Seri, the distributive key can also be pluralities that are more specific to the sentence or context. We wonder if the same is possible in Piipaash.

(51) Juan quih **hapaspoj hanoocaj quih**
Juan DET SBJ.NMLZ:PASS:write SBJ.NMLZ[:PASS]-carry_under_arm DET
c-oocalcam sacaaitom caha.
SBJ.NMLZ-be_two.PLUR IRR.IND.read SBJ.NMLZ.AUX
'Juan is going to read two books on a variety of themes.' SC: 2 on a similar theme, 2 more on another theme, ...) (Pasquereau, 2020, ex. 20)

As in Piipaash, a Seri pluractional numeral can occur redundantly in the scope of a subject universal quantifier. (Interestingly, a pluractional verb must be interpreted non-redundantly in the scope of a subject universal quantifier Pasquereau 2020).

(52) Cmajiic coi iij càap tazo cah **hateeya quih**
woman.PL DEF.PL each bottle DET
coocalcam iyoonec.
SBJ.NMLZ.be_two.PLUR 3;3.RLYO.carry.PL
'Each of the women carried 2 bottles.'
Context: Six women, they carry two bottles each. TRUE

The sentence without the subject quantifier is also true in this context. (Pasquereau (2019) shows that the difference between the presence/absence of the quantifier has to do with oneiticity and exhaustivity of the distribution.)

(53) Cmajiic coi **hateeya quih coocalcam**
woman.PL DEF.PL bottle DET SBJ.NMLZ.be_two.PLUR
iyoonec.
3;3.RLYO.carry.PL
'The women carried 2 bottles (each).'
Context: Six women, they carry two bottles each. TRUE

Questions:

- can PLUR be on coordinating "be" as in Piipaash?
- can Piipaash dist num be licensed by more specific, lexically determined dist keys as in Seri?

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