Unifying Dependent and Independent Numeral Reduplication in Newar

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Outline

Reduplicated numerals in Hungarian

(1) Minden gyerek olvasott egy-egy / hét-hét könyvet.
every child read.PAST 1-1 / 7-7 book-ACC
'Each child read one/seven books.'
(Farkas, 1997)

Farkas observes that "they must have non-rigid reference";
"the indefinite must be within the scope of the universal."

Hence the term **dependent indefinites**.

Kaqchikel (Henderson, 2014)

Require plural or universal licensor:

(2) K-onojel x-∅-ki-kano-j ju-jun wuj
E3p-all CP-A3s-E3p-search-SS one-one book
'All of them looked for a book [multiple books]'

(3) *X-e'-in-chäp ox-ox wäy
CP-A3p-E1s-handle three-three tortilla
(Intended: 'I took groups of three tortillas')

Or pluractional:

(4) X-e'-in-tij-la ox-ox wäy
CP-A3p-E1s-handle-PLACT three-three tortilla
'I kept eating the tortillas in groups of three'

Telugu (Balusu, 2006)

(5) ii pilla-lu renDu renDu kootu-lu-ni cuus-ee-ru
these kid-PL 2 2 monkey-PL-ACC see-PAST-3PL
'These kids...
... each saw 2 monkeys.' Participant key
... saw 2 monkeys each time.' Temporal key
... saw 2 monkeys in each location.' Spatial key

Event-key readings not dependent on overt pluractional.

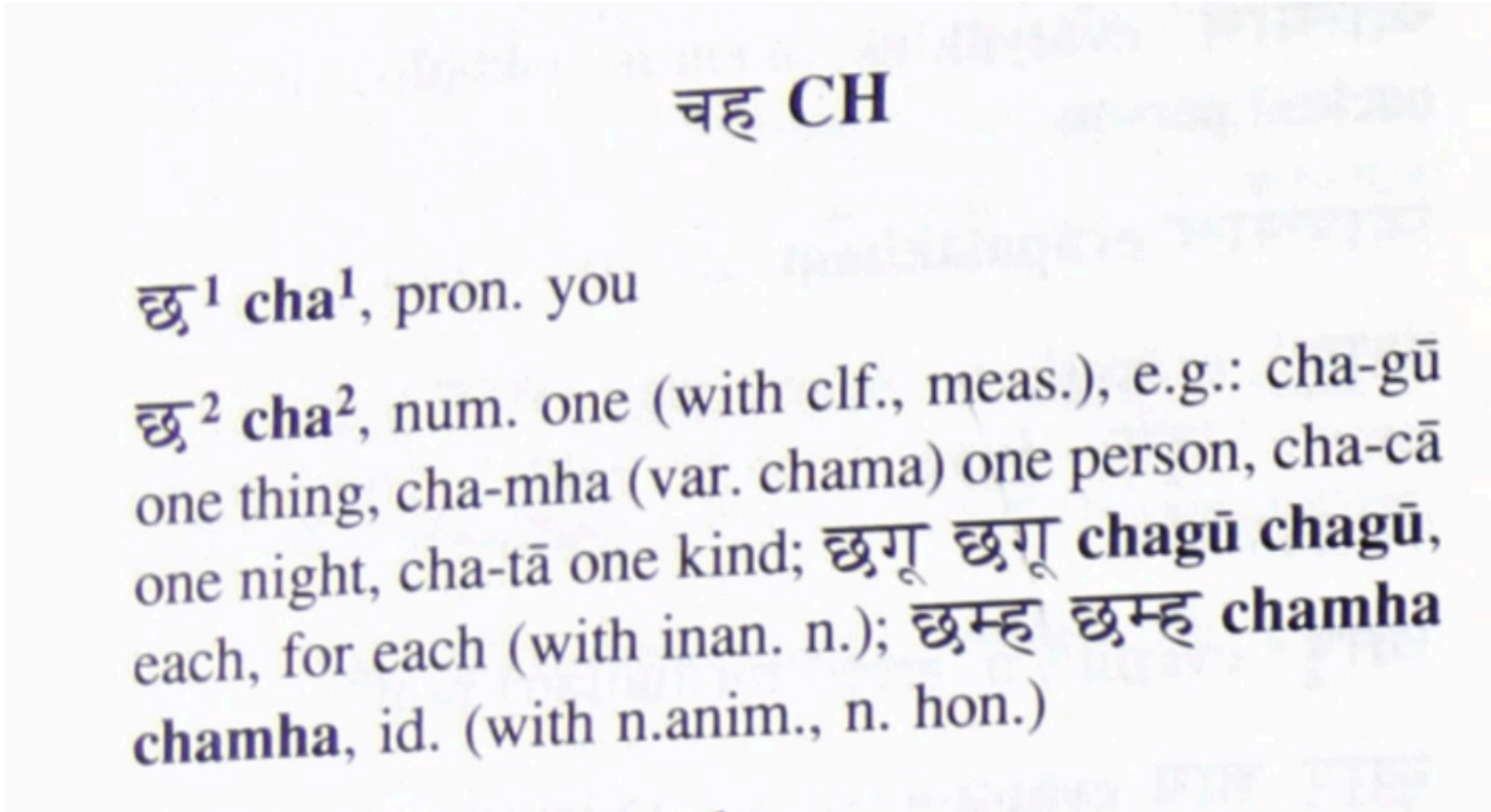
Today: Reduplicated numerals in Newar (a.k.a. Nepal Bhasa)

Minority languages recommended for official use in Nepal

at the province level

National language: Nepali / Gorkhali

Newar dictionary entry for छा (cha) 'one'



चह CH

छ[1] **cha**[1], pron. you

छ[2] **cha**[2], num. one (with clf., meas.), e.g.: cha-gū one thing, cha-mha (var. chama) one person, cha-cā one night, cha-tā one kind; **छगू छगू chagū chagū**, each, for each (with inan. n.); **छम्ह छम्ह chamha chamha**, id. (with n.anim., n. hon.)

(Kölver & Shresthacarya, 1994)

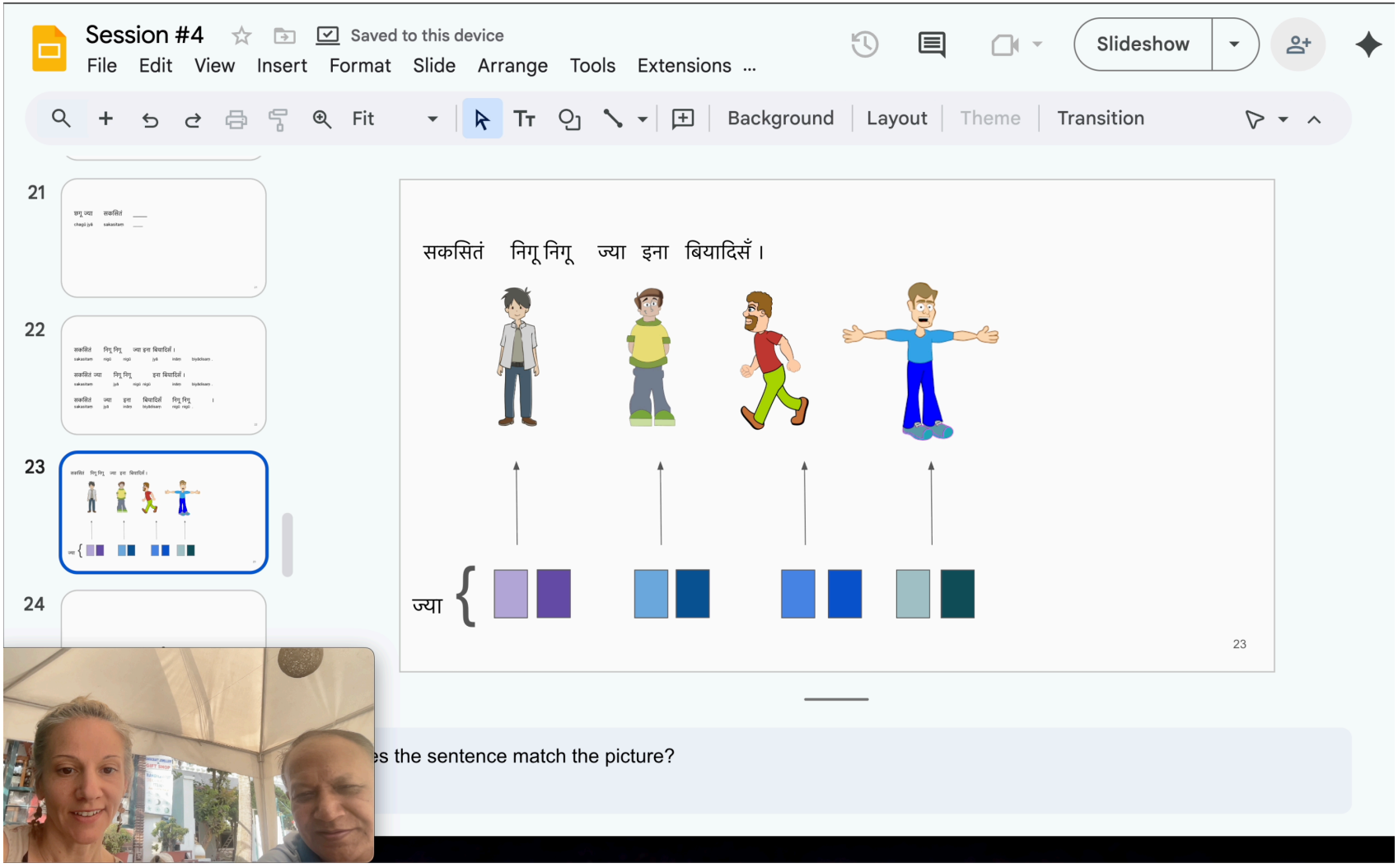
Host

Dipak Tuladhar

Language activist and founder, Modern Newa English School

Some consultants

Screenshot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सकसितं निगू निगू ज्या इना बियादिसँ।
ज्या
23
s the sentence match the picture?

Preview of conclusions

Main point:

- Reduplicated numerals in Newar have both dependent-indefinite and independent-universal uses.
- A unified analysis can be obtained via unification of the share and key for the independent-universal case.

Outline

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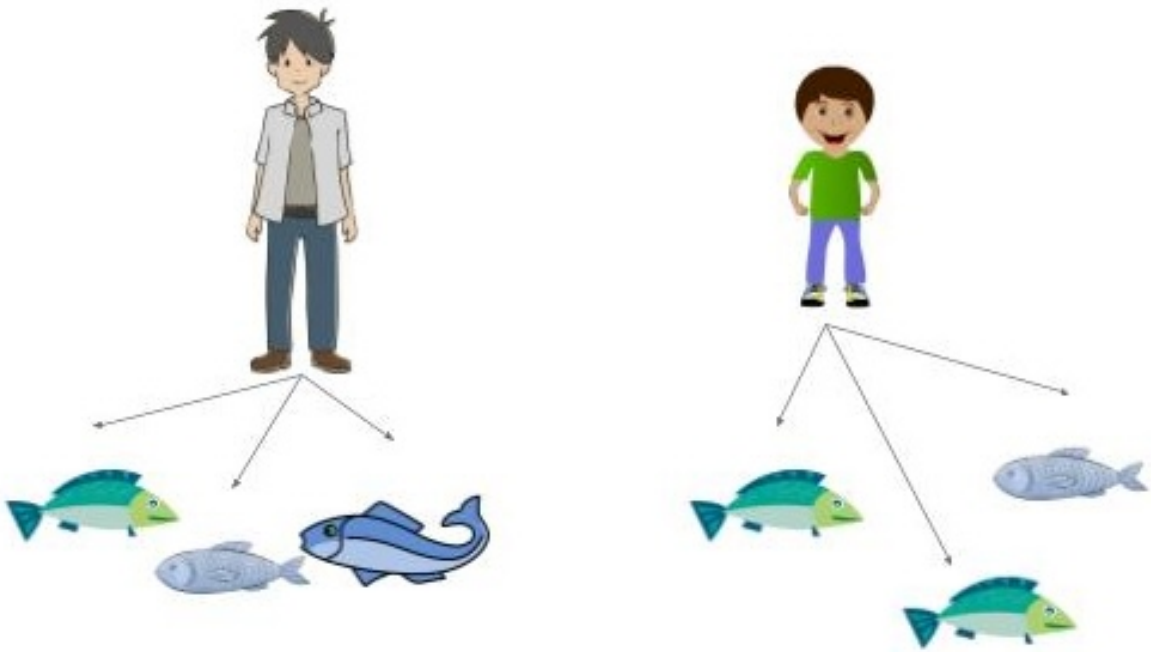
Reduplicated numerals in Newar

(6) जि कायपिसं स्वम्ह स्वम्ह न्याचात लात ।
ji kāypisaṃ svamha svamha nyā-cā-ta lāta .
1sg son-pl-erg 3-clf 3-clf fish-small-pl caught



*Newar is commonly written in Devanagari. Romanization convention I adopt here: IAST except that chandrabindu → M, e.g. छेँ 'house' → cheM. Anusvara → ṃ.

Distributive concord with reduplicated numerals

(Cable, 2014)

(7) फुक्क मिसामस्तय्सं निम्ह निम्ह खिचातय्त म्व:ल्हुकल ।
phukka misāmas-ta-ysaṃ ni-mha ni-mha khicā-ta-yta mva:lhukala .
every girl-pl-erg 2-clf 2-clf dog-pl-to bathed

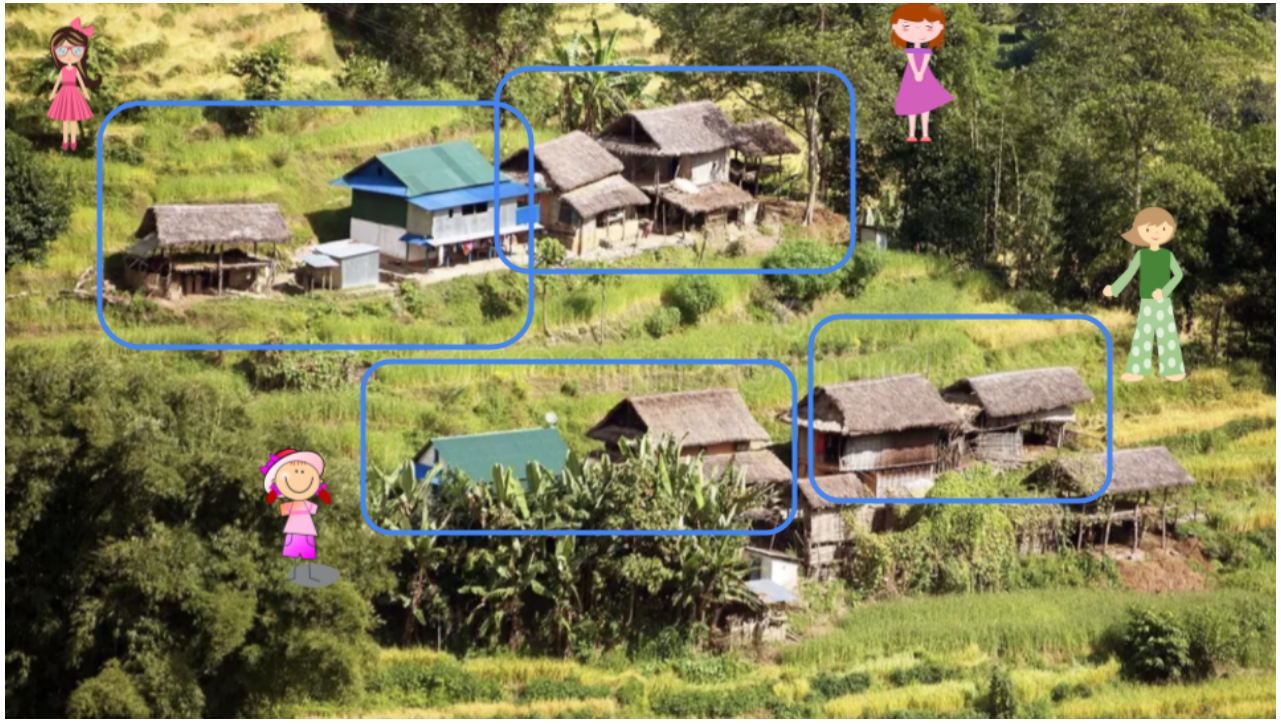
Number agreement

(image from Cable 2014 on Tlingit)

(8) फुक्क मिसामस्तय्सं छम्ह छम्ह खिचायात म्व:ल्हुकल ।
phukka misāmas-ta-ysaṃ cha-mha cha-mha khicā-yāta mva:lhukala .
every girl-pl-erg 1-clf 1-clf dog-to bathed
'Every girl bathed one dog each.'

Reduplicated ‘two’ with implicit key

(9) थन चिचिखागु सां निखा निखा छेँ दु ।
thana ci-ci-khā-gu sāṃ ni-khā ni-khā cheM du .
here small-small-clf-agr though 2-clf 2-clf house be .
‘Even if they are small, [we] have two houses each here.’
(Hale & Shrestha, 2006, p. 95)



X-by-X uses

Reduplicated numerals can mean ‘X by X’ with no noun:

(10) छम्ह छम्ह याना दुने वा
cha-mha cha-mha yānā dune vā
1-clf 1-clf by in come
‘They came in one by one.’

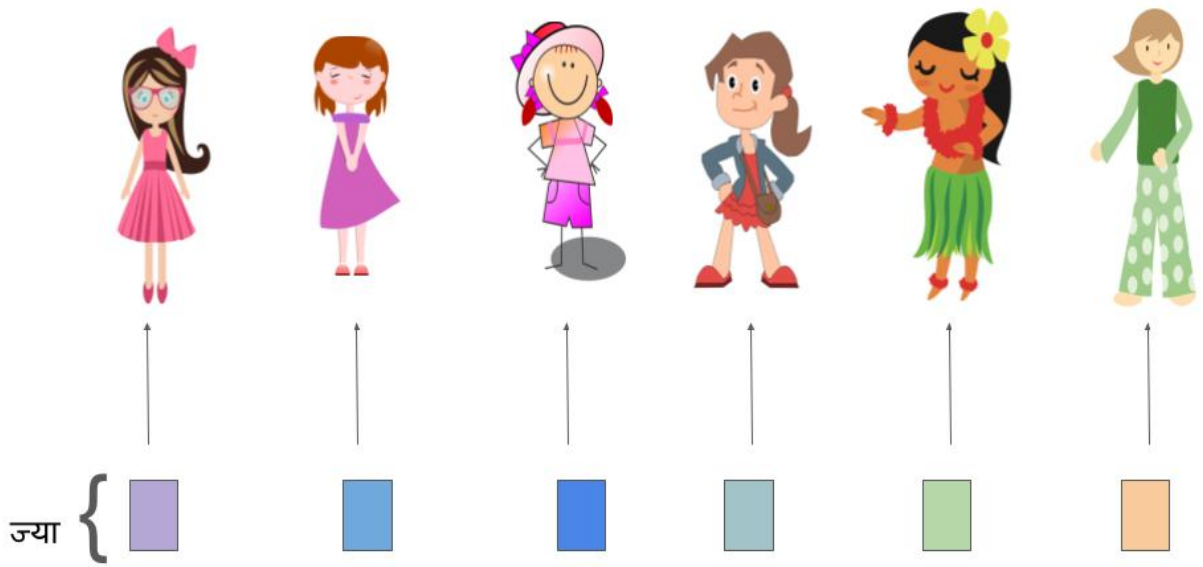
Dipak: “Not all together. One, and one. Small door, haha.”

X-by-X uses also possible with higher numerals:

(11) निम्ह निम्ह याना दुने वा
ni-mha ni-mha yānā dune vā
2-clf 2-clf by in come
‘They came in two by two.’

Adverbial reduplicated numerals

(12) सकसितं छगू छगू यानाः ज्या इना बियादिसँ ।
saka-sitaṃ cha-gū cha-gū yānāḥ jyā inā biyādisaM .
every-to 1-clf 1-clf by work share / distribute
'Distribute one job to each person'



Adverbial reduplicated numerals

(13) *सकसितं छगू यानाः ज्या इना बियादिसँ ।
saka-sitaṃ cha-gū yānāḥ jyā inā biyādisaM .
every-to 1-clf by work share / distribute

Adverbial reduplicated numerals

(14) सकसितं छगू ज्या इना बियादिसँ ।
saka-sitaṃ cha-gū jyā inā biyādisaM .
every-to 1-clf work share / distribute
'Distribute one job to each person'

Can reduplicated numerals be adnominal?

- Clearly there are adverbial uses
- Are they all adverbial uses, or are some adnominal?

Post-nominal reduplication

Reduplicated numerals can precede or the noun, just like ordinary numerals:

(15) a. सकसितं निगू निगू ज्या इना बियादिसँ ।
sakasitaṃ nigū nigū jyā ināṃ biyādisaṃ .
everyone work 2 2 share give

b. सकसितं ज्या निगू निगू इना बियादिसँ ।
sakasitaṃ jyā nigū nigū ināṃ biyādisaṃ .
everyone work 2 2 share give
'Give everyone two jobs each.'

Dipak on noun-numeral order: "Correct, not that natural but correct."

Word order flexibility with non-reduplicated numerals

Non-reduplicated numerals can appear either before or after the noun (focus-related)

(16) a. दिपकयात छगू ज्या बियादिसँ ।
dipakayāta chagū jyā biyādisaM .
Dipak-to 1-clf job give
'Give Dipak one job'

b. दिपकयात ज्या छगू बियादिसँ ।
dipakayāta jyā chagū biyādisaM .
Dipak-to job 1-clf give
'Give Dipak one job'

Pre-VP position not always possible

(17) ज्हिमि दाजुपिंन्सं छम्ह छम्ह जित श:ता:हल ।
jhimi dājupiṃnsaṃ cha-mha cha-mha jita śaḥtāḥhala .
my brothers 1-clf 1-clf me-to called

"You mean one by one calling? That's not what this means."

(18) छम्ह छम्ह दाजुपिंन्सं जित श:ता:हल ।
cha-mha cha-mha dājupiṃnsaṃ jita śaḥtāḥhala .
1-clf 1-clf brothers me-to called

"This one is good. One calls, another calls. One by one."

Outline

Copying each book

In the context of an article about the development of the printing press:

(19) छपं-छपं सफू ल्ह्यय्त अप्वः ई काइगु |
chapaṃ-chapaṃ saphū lhyayta apvaḥ ī kāigu .
one.CLF-I.CLF book copy-INF much time take
'It takes much time to copy each book.'

Writing each letter

Attested (simplified):

(20) दकले न्हापां छगः छगः आखः च्वयेगु ।
dakale nhāpāṃ cha-gaḥ cha-gaḥ ākhaḥ cvayegu .
first of all 1-clf 1-clf letter write
'First, write each letter.'

This word order works too (constructed):

(21) दकले न्हापां आखः छगः छगः च्वयेगु
dakale nhāpāṃ ākhaḥ cha-gaḥ cha-gaḥ cvayegu
first of all letter 1-clf 1-clf write

Independent uses

Constructed example:

(22) छगः छगः आखः मिले-जु ।
cha-gaḥ cha-gaḥ ākhaḥ mile-ju .
1-clf 1-clf letter good-be
'Each letter is correct.'

Speaker comment: "Yes, that's possible. More particularly going."

Here, 'one' cannot be replaced by 'two':

(23) *निगः निगः आखः मिले-जु ।
ni-gaḥ ni-gaḥ ākhaḥ mile-ju .
2-clf 2-clf letter good-be

Writing each truth

In an article on the nature of writing personal essays:

(24) च्वमिं छगू छगू सत्य खँ च्वइ ।
cvamiṃ cha-gū cha-gū satya khaM cvi .
writer 1-CLF 1-CLF true matter write
'The writer will write each truth.'

Here 'one' cannot be replaced by 'two':

(25) *च्वमिं निगू निगू सत्य खँ च्वइ
cvamiṃ ni-gū ni-gū satya khaM cvi
writer 2-clf 2-clf true matter write

Reduplicated ‘one’ meaning ‘every’

(3) Angolar (Maurer 2013a)

Ka	*pê*	*taya*	*kôôndja*	*lêtu*	*fia*	*e*	*ki*	*ũa*	*ũa*	*taminha*	*e.*
PST	put	slice	coconut	inside	leaf	DEM	with	one	one	bowl	DEM

‘They put slices of coconut in the [banana] leaves, [which were at the bottom of] every bowl.’

(9) Tok Pisin (Smith & Siegel 2013)

Tripela	*taim*	*long*	*wanpela*	*wanpela*	*yia*	*yupela*	*mas*	*makim*	*bikpela*	*de*	*bilong*	*lotu*	*bilong*	*mi.*
three	time	in	one	one	year	2PL	must	mark	big	day	for	worship	POSS	1SG

‘Three times each year you must reserve a feast day for worship.’

(12) Sango (Samarin 2013)

na	*ya*	*ti*	*abar*	*oko*	*oko*
LOC	belly	of	PL.bar	one	one

‘in each one of the bars (site for drinking).’

See example 59-124

Atlas of Pidgin and Creole Language Structures (APiCS) Online Chapter 34

Reduplicated nouns in Mandinka

Also have a universal interpretation (Cisse & Coppock, 2023):

(26) Musu-woo-musu ye kini taboo noo le
woman-DIST-woman PRED rice cooking know PERF
'Each woman knows how to cook rice.'

Summary: Two uses of reduplicated numerals

Dependent indefinite	**Independent universal**
Depend on a plural licensor	Grammatically **independent**
Understood as **indefinite**	Understood as **universal**
'one' **can** be replaced by 'two'	'one' **cannot** be replaced by 'two'

Outline

Main idea

Dependent indefinites anaphorically linked to licensor:

- Every^{x} girl bathed two-two$^{y}_{x}$ dogs.

Independent universals unify the share and key variables:

- One-one$^{x}_{x}$ letter is correct.

So:

- From key: universality
- From key: atomicity
- From share: domain

Outline

Domain-plural vs. evaluation-plural

Three imaginable sets of assignments of values to the variable x:

x

$student_1$
$student_2$

← evaluation-plural, domain-singular

x

$student_1 \oplus student_2$

← evaluation-singular, domain-plural

x

$student_1$
$student_1$

← evaluation-singular, domain-singular

Licensing by evaluation plurality

Every^{x} student hugged one-one^{y} dog

à la Henderson (2014), using Dynamic Plural Logic:

$$H = \begin{array}{|c|c|c|} \hline x & y & e \\ \hline student_1 & dog_1 & hug_1 \\ \hline student_2 & dog_2 & hug_2 \\ \hline student_3 & dog_3 & hug_3 \\ \hline \end{array}$$

Here y is domain-singular, but evaluation-plural, as one-one^{y} requires.

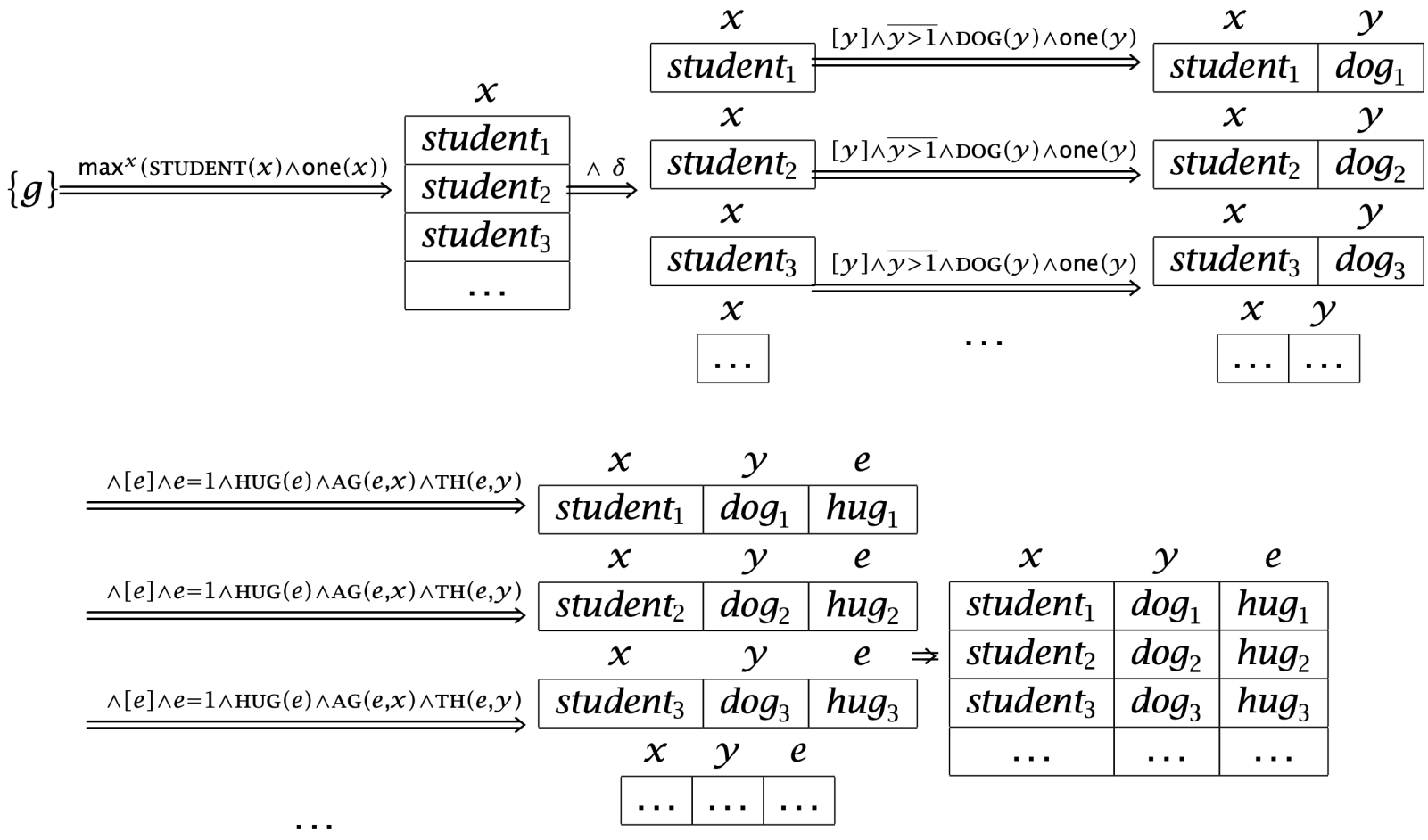
Henderson's Recipe

Every^{x} student hugged one-one^{y} dog

- Introduce the variable x via random assignment
- Restrict x to students
- Make sure that x is domain-singular
- Maximize: Make sure that no singular student is left out
- Distribute: For each distinct value of x:
  - Introduce the variable y
  - Restrict y to singular dogs
  - Introduce e; restrict e to huggings
  - Ensure x is the agent of e and y is the theme
- Collect together the resulting sets of assignments
- Check post-supposition: Ensure evaluation-plurality wrt y

Full derivation (Henderson, 2014)

Every^x student hugged one-one^y dog



American Sign Language (ASL)

"ASL overtly represents the dependency relation between a dependent indefinite and its licensor" (Kuhn, 2017, 408)

(27) BOY IX-arc-a READ ONE-arc-a BOOK
'The boys read one book *each*'

Suggests a direct anaphoric link (contra Henderson). Schematically:

Every^{x} student hugged one-one$^{y}_{x}$ dog

Useful for us! We can make use of the access to both variables to unify dependent-indefinite and independent-universal uses.

Outline

Tools

$R(x_1, \ldots, x_n)$	requires that R hold of $x_1 \ldots x_n$ in every row
$[x]$	introduces a new variable and fills it with random stuff
$\mathsf{one}(x)$	x is atomic in every row (domain-singular)
$x = n$	total number of distinct values across all rows is n
$y > 1$	y is evaluation-plural
$\delta(\phi)$	distributivity operator; applies ϕ to every row
$\overline{\phi}$	post-supposition operator; delays evaluation of ϕ
$\mathsf{max}(x)$	eliminates matrices with non-maximal coverage for x

Formal definitions in Henderson (2014), except for $\mathsf{max}(x)$.
See appendix.

General schema for reduplicated numerals in Newar

$$[\text{ n-n}^{y}_{x}\ \phi]\ [\psi] \rightsquigarrow$$
$$[y] \wedge \phi \wedge n(y) \wedge \overline{y > 1}$$
$$\wedge \mathsf{one}(x) \wedge \mathsf{max}(x)$$
$$\wedge \psi$$

- The atomicity requirement and maximality operations apply to the key variable (x) after the share variable (y) is introduced and restricted by the nominal predicate.
- So when $x = y$, we will get a universal interpretation with the same restrictor.

Example: dependent indefinite + indefinite plural licensor

Three^{x} students saw two-two$^{y}_{x}$ zebras

$[x] \wedge \mathsf{student}(x) \wedge |x| = 3$
$\wedge [y] \wedge \mathsf{zebra}(y) \wedge \mathsf{two}(y) \wedge \overline{y > 1}$
$\wedge \mathsf{one}(x) \wedge \mathsf{max}(x)$ (here max is vacuous)
$\wedge \mathsf{see}(x, y)$

x	y
$student_1$	$zebra_1 \oplus zebra_2$
$student_2$	$zebra_3 \oplus zebra_4$
$student_3$	$zebra_3 \oplus zebra_4$

Example: dependent indefinite + universal licensor

Every^{x} student saw two-two$^{y}_{x}$ zebras

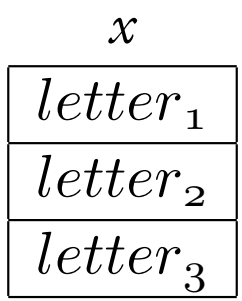
$[x] \wedge \mathsf{student}(x) \wedge \mathsf{max}(x)$
$\wedge\, \delta([y] \wedge \mathsf{zebra}(y) \wedge \mathsf{two}(y) \wedge \overline{y > 1}$
$\wedge\, \mathsf{one}(x) \wedge \mathsf{max}(x)$ (both vacuous)
$\wedge\, \mathsf{see}(x, y))$

x	y
$student_1$	$zebra_1 \oplus zebra_2$
$student_2$	$zebra_3 \oplus zebra_4$
$student_3$	$zebra_3 \oplus zebra_4$

Example: independent-universal

One-one$^{x}_{x}$ letter is correct

$[x] \wedge \mathsf{letter}(x) \wedge \mathsf{one}(x) \wedge \overline{x > 1}$
$\wedge \mathsf{one}(x) \wedge \mathsf{max}(x)$ (key to universal!)
$\wedge \mathsf{correct}(x)$



*Independent with numerals > 1

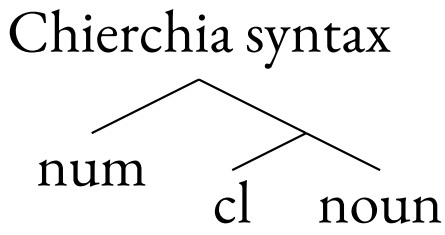
Two-two^x_x letter is correct

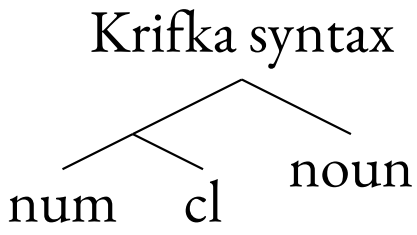
$[x] \wedge \mathsf{letter}(x) \wedge \mathsf{two}(x) \wedge \overline{x > 1}$
$\wedge \mathsf{one}(x) \wedge \mathsf{max}(x)$ (clash!)
$\wedge \mathsf{correct}(x)$

x
$letter_1$
$letter_2$
$letter_3$

Outline

Classifier syntax issue





(Chierchia, 1998; Krifka, 1989; Bale et al., 2019; Dékány, 2024)

Arguments for Krifka syntax

1. The classifier is reduplicated along with the numeral (unlike in, for example, Nepali)
2. There are irregular forms

घौ (ghau) 'hour'	छघौ, निघौ, स्वघौ, ...	(chaghau, nighau, svaghau, ...)
न्हु (nhu) 'day'	छन्हु, निन्हु, स्वन्हु, ...	(chanhu, ninhu, svanhu, ...)
ला (lā) 'month'	लाछि, निला, स्वला, ...	(lāchi, nilā, svalā, ...)
दँ (daṁ) 'year'	दँछि, निदँ, स्वदँ, ...	(daṁchi, nidaṁ, svadaṁ, ...)

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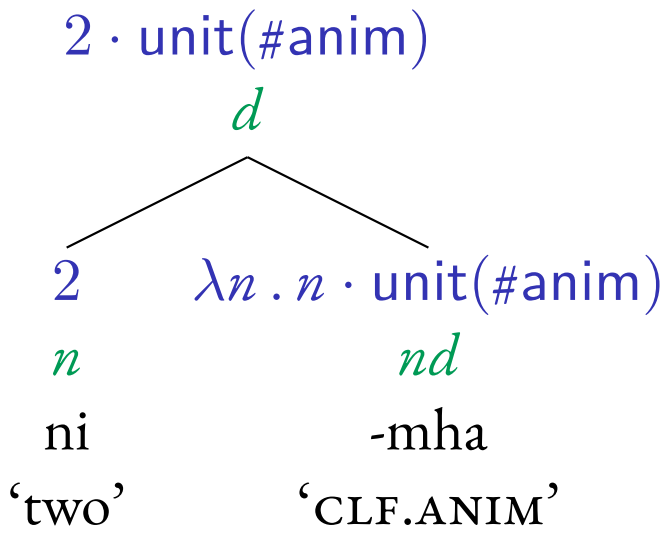
दँ (daṁ) 'year'	दँछि, निदँ, स्वदँ, ...	(daṁchi, nidaṁ, svadaṁ, ...)

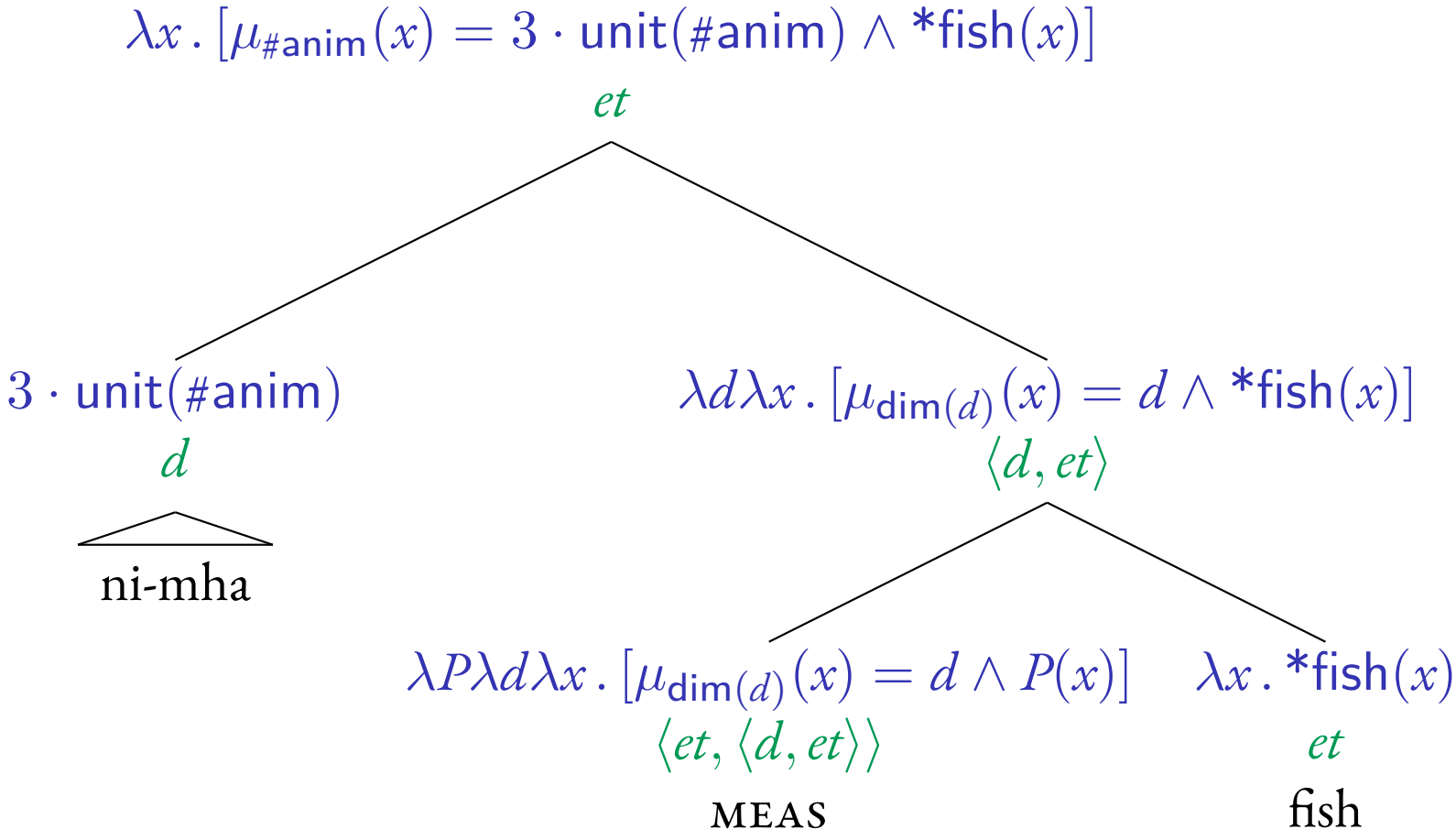
Structure of a classifier-affixed numeral



where, following Coppock (2022):

- $\mathsf{unit}(D)$ is the ‘unit quantity’ for dimension D in a dimension-centric quantity calculus (Raposo, 2019)
- $\#\mathsf{anim}$ is the ‘cardinality dimension’ counting animate beings

Structure of 'three fish'



where, following Coppock (2022),

- μ_D is the 'canonical measure' for dimension D, and
- $\mathsf{dim}(d)$ is the dimension for degree d

To do list

- relativize domain cardinality to a given classifier
- give a compositional analysis
- ...

Outline

Summary

- Reduplicated numerals in Newar have both dependent-indefinite and independent-universal uses with the numeral 'one'.
- A unified analysis can be obtained through
  - a variation on Henderson (2014) with a dash of Kuhn (2017)
  - where atomicity and maximality on the key variable follow introduction of the share variable with its nominal restriction

  In independent uses, share and key are coindexed:
  - exhaustivity and atomicity come from the key;
  - the domain comes from the share.
- The restriction to the numeral 'one' follows from the atomicity requirement on the key, which gets inherited by the share.

Outlook

This analysis offers a new lens on ‘simultaneous distributivity’, where one single element simultaneously marks the share and the key.

- Mandinka X-woo-X (Cisse & Coppock, 2023)
- French Sign Language (Kuhn & Aristodemo, 2017)
- Comox-Sliammon (Henderson, 2019)
- Any language where *one-one* means ‘every’?

Thank you!

This project would not have been possible without Dipak Tuladhar, who hosted me at the Modern Newa English School in Kathmandu, Nepal, introduced me to excellent informants, even driving me to nearby towns in some cases, helped with translation, taught me how to type, and deepened my understanding of Newar culture in myriad ways. I would also like to extend gratitude to my other consultants, Professor Emeritus of Newar Culture Madan Sen Bhattacharya, Newar language teachers Ramita Shakya and Yachu Joshi, Newar student, poet and journalist Riden Maharjan, and jewelry merchant Raj Kaji Shakya. This project was carried out under the auspices of a post-tenure sabbatical granted by Boston University, for which I am also grateful.

Outline

Formal definitions for DPlL

Atomic formulas

$M = \langle D_e, I \rangle$
I assigns to any n-ary relation R of type $\tau_1, \ldots, \tau_n$ a subset of $D_{\tau_1} \times \ldots \times D_{\tau_n}$.

$\langle G, H \rangle \models R(x_1, \ldots, x_n)$ iff $G = H$ and for all $h \in H$,
$\langle h(x_1), \ldots, h(x_n) \rangle \in I(R)$

Dynamic conjunction

Dynamic conjunction is defined as relation composition.

$\langle G, H \rangle \models \phi \wedge \psi$ iff there is a K such that $\langle G, K \rangle \models \phi$ and $\langle K, H \rangle \models \psi$

Random assignment

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

$G[x]H$ holds iff

- for all $g \in G$, there is an $h \in H$ such that $g[x]h$
- for all $h \in H$, there is a $g \in G$ such that $g[x]h$

$\langle G, H \rangle \models [x]$ iff $G[x]H$

Domain-level cardinality predicates

$\langle G, H \rangle \models \mathsf{one}(x)$ iff $G = H$ and for all $h \in H$,
$|\{x' : x' \leq h(x) \text{ and } \mathsf{atom}(x')\}| = 1$

$\langle G, H \rangle \models \mathsf{two}(x)$ iff $G = H$ and for all $h \in H$,
$|\{x' : x' \leq h(x) \text{ and } \mathsf{atom}(x')\}| = 2$

Evaluation-level cardinality

$$G(x) := g(x) : g \in G$$

$$\langle G, H \rangle \models x = n \text{ iff } G = H \text{ and } |H(x)| = n$$

$$\langle G, H \rangle \models x > n \text{ iff } G = H \text{ and } |H(x)| > n$$

Maximization

From Henderson:
$\langle G, H \rangle \models \max^x(\phi)$ iff $\langle G, H \rangle \models [x] \wedge \phi$ and there is no H' such that

- $H(x) \subset H'(x)$ and
- $\langle G, H' \rangle \models [x] \wedge \phi$

My version:
$\langle G, H \rangle \models \max(x)$ iff

- $H(x) \subseteq G(x)$ and
- there is no H' such that $H'(x) \subseteq G(x)$ and $H'(x) \subset H(x)$.

Distributivity

$\langle G, H \rangle \models \delta(\phi)$ iff there exists a partial function F from assignments g to sets of assignments K, i.e., of the form $F(g) = K$, s.t.

- $G = \mathsf{Dom}(F)$ and $H = \mathsf{Ran}(F)$
- for all $g \in G$, $\langle \{g\}, F(g) \rangle \models \phi$

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