Variation in Dependent Indefinites

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1 Introduction

In addition to morphologically simple indefinites like *a*, *some*, *one*, *two*, etc., many languages have special versions of these expressions with similar quantificational import, but one crucial difference—they must covary—or more precisely witnesses for these quantifiers must be given as a non-constant function of the interpretation of some other expression. The Kaqchikel (Mayan) examples in (1-4) illustrate this phenomenon.

(1)

K-onojel	*x-Ø-ki-kanö-j*	***jun***	*wuj.*
E3p-all	CP-A3s-E3p-search-SS	**one/a**	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.'

(2)

K-onojel	*x-Ø-ki-kanö-j*	***ju-jun***	*wuj.*
E3p-all	CP-A3s-E3p-search-SS	**one/a-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.'

(3)

K-onojel	*x-Ø-ki-kanö-j*	***oxi'***	*wuj.*
E3p-all	CP-A3s-E3p-search-SS	**three**	book

'All of them looked for three books (and at least four books were looked for).'
'There are three books and all of them looked for them.'

(4)

K-onojel	*x-Ø-ki-kanö-j*	***ox-ox***	*wuj.*
E3p-all	CP-A3s-E3p-search-SS	**three-RED**	book

'All of them looked for three books (and at least four books were looked for).'
#'There are three books and all of them looked for them.'

[0]Glossing Conventions: 1=First Person, 2=Second Person, 3=Third Person, A=Absolutive, CAUS=Causative, CP=Completive Aspect, DAT=Dative, DIR=Directional, E=Ergative, ICP=Incompletive, PAS=Passive, p=Plural Person, PL=Plural, RED=Reduplicant, SS=Status Suffix

Called DEPENDENT by Farkas (1997a), such indefinites have been reported in the theoretical literature for a variety of languages.

- **Hungarian** (Farkas, 1997a, 2001), **Romanian** (Farkas, 2002), **Telugu** (Balusu, 2006), **Korean** (Choe, 1987; Gil, 1993), **Russian** (Pereltsvaig, 2008; Yanovich, 2005), **Kaqchikel** (Henderson, 2014), **American Sign Language** (Kuhn, 2015), **Tlingit** (Cable, 2014), among others

Over time it has become clear that dependent indefinites are not monolithic, but show semantic variation both across languages and even within languages.

- Variation across languages is not so surprising...this is the nature of things.
- Within language variation seems to be centered around a contrast between DEPENDENT EXISTENTIALS and DEPENDENT NUMERALS, which is the terminology (coined by Farkas) I will be using.

Dependent Indefinites
- Dependent Existentials: "a-a book"
- Dependent Numerals: "one-one book", "two-two book", etc.

While the precise range of possible variation is still under investigation, it primarily concerns how this notion "covary" is cashed out. In particular, "covary" is an inherently relational notion, and so classes of dependent indefinites appear to differ in terms of:

(α) what kinds of entities are allowed to enter into the covariation relationship with the quantifier's witnesses

(β) how the covariation relationship can be established between these entities and the quantifier's witnesses

With respect to (α), one often finds that a particular type of dependent indefinite only permits its witnesses to covary with respect to a subset of kinds of entities.

(α') worlds » events [times / spaces] » individuals

- Russian dependent-existentials {worlds, events, individuals} — Pereltsvaig 2008
- Kaqchikel dependent-numerals {events, individuals} — Henderson 2014
- Hungarian dependent-existentials {events, individuals} — Farkas 2015
- Hungarian dependent-numerals {individuals} — Farkas 2015

With respect to (β), one often finds that a particular type of dependent indefinite only permits its witnesses to covary with respect to expressions of a particular kind.

(β') implicit licensing » plural arguments / events (i.e., pluractionals) » quantifiers

- Telugu dependent-numerals {implicit, plurals, quantifiers} — Balusu 2006
- Kaqchikel dependent-numerals {plurals, quantifiers} — Henderson 2014
- Hungarian dependent-numerals {plurals, quantifiers} — Farkas 2015
- Russian dependent-existentials {quantifiers} — Pereltsvaig 2008

This is not meant to be an exhaustive typology. Here are some big empirical questions that I would love to have the answers to:

- We still need to know how well these implications hold—e.g., are there languages that all dependent indefinites to covary with respect to worlds and individuals, but not events? Or, are languages with dependent indefinites that cannot covary with respect to overt quantifiers, but do permit covartion with respect to distributive predication or implicit spatio-temporal covariation?
- We still need to know whether there are interactions between these types of constraints—e.g., are dependent indefinites that can only covary with respect to bona fide quantifiers also more likely to only covary with respect to individual variables?
- We still need to know whether there are interactions between dependent existentials and dependent numerals with respect to these constraints—e.g., is it true that dependent numerals always have a more restricted distribution than dependent existentials in languages that have a contrast?

But faced with the kind of variation we see for the 10 or so languages we have good data for, we can already see the outline of the theoretical debate.

- What kind of semantics for dependent indefinites best captures their distributional restrictions, both in and across languages?
- What is the shape of the typological variation in dependent indefinites—i.e., is the space continuous with dependent indefinites differing only on single, independent parameters, or are there clumps, with dependent indefinites clustering into well-defined subtypes.
- Is a uniform semantics for dependent indefinites possible? Is that even desireable given the observed semantic typology?
- How should dependent indefinites be placed within a larger typology of special indefinites in the parlance of Farkas 2002; Brasoveanu and Farkas 2011?

In my dissertation (Henderson, 2012) and in a paper (Henderson, 2014), I propose an analysis of dependent indefinites in Kaqchikel that is perhaps not so great for capturing the typology of dependent indefinites—this is because it is a lean theory. There are not so many knobs to twist to get different flavors of dependent indefinites.

- Dependent indefinites are not anaphoric.
- Dependent indefinites do not talk about their own scope or the scope of other expressions.
- Dependent indefinites are licensed by way of the event variable alone, though dependent indefinites do not themselves talk about the event variable.

In contrast, in a talk at this workshop last year, Farkas 2015 (which updates Farkas 1997b, argues for an account of dependent indefinites with a radically different form:

- Dependent indefinites are anaphoric.
- Dependent indefinites talk about the scope of other expression—i.e., the domain variable / dependent variable distinction.
- Dependent indefinites talk directly about the sort of variables that license them—i.e., a dependent indefinite can say I need to stand in the appropriate relationship with a variable over worlds, or events, or individuals.

And crucially, the arguments Farkas 2015 provides for this richer theory are typological. They are meant to capture variation in dependent indefinites across languages and within languages.

Goal for this Talk: Defend the lean theory as much as possible.

- I will present counter-arguments to those arguments in Farkas 2015 that we need a theory of dependent indefinites in which they are not only anaphoric, but place fined-grained constraints on the expressions they are anaphoric to.
- I will consider how to deal with typological variation when one assumes the lean theory as a baseline for dependent indefinites.
  - I will show that some variation can be handled…
  - In the end, though, we probably need a "clumpy" theory…

In line with these goals, the talk has the following form:

§2 Summarizes the analysis in Henderson 2014

§3 Summarizes the analysis in Farkas 2015 and her arguments against the leaner theory. It also responds to those arguments.

§4 Looks at typological variation from the perspective that the lean theory is correct for languages with Kaqchikel-like dependent indefinites.

2 Henderson 2014: Dependent indefinites and evaluation plurality

Henderson 2014 was not targeted at addressing typological variation, but resolving a scope puzzle born of previous accounts of dependent indefinites.

- The (previously) standard accounts of data like (1-4) are parasitic on scope-taking (Brasoveanu and Farkas, 2011; Choe, 1987; Farkas, 1997a, 2001, 2002; Szabolcsi, 2010).
- As such, they make the following prediction:

(5) **The plain indefinite scope entailment:**
Everywhere a dependent indefinite is licensed, a plain indefinite should also have a narrow scope reading.

The empirical problem for the prediction in (5) arises through the interaction of dependent indefinites and a second construction in Kaqchikel, namely verbal pluractionality.

(6) *X-Ø-in-kan-öj* ***jun*** *wuj.*
CP-A3s-E1s-search-SS **one** book
'I looked for a book.'

(7) *X-Ø-in-kan-**ala'*** ***jun*** *wuj.*
CP-A3s-E1s-search-**la'** **one** book
'I looked for a book (in various locations or at various times).'
FALSE if there is only one looking-for event
FALSE if there is more than one book

When a dependent indefinite is used in the same environment, a contrast emerges.

(8) *X-Ø-in-kan-**ala'*** ***ju-jun*** *wuj.*
CP-A3s-E1s-search-**la'** **one-RED** book
'I looked for a book (in each location or at each time).'
FALSE if there is only one looking-for event
FALSE if there is only one book looked for

Core Question: How to alter the semantics of dependent indefinites so that:

- (i) they can covary with respect to a pluractional unlike a plain indefinite,
- (ii) yet remain paraphrasable with a narrow scope indefinite under more familiar operators.

Note: For space reasons I will not be providing the solution to the scope puzzle, but just introducing the theory as it applies to simple cases of dependent indefinites.

The intuition behind the alternative analysis presented in this section can be seen by considering the well-known fact that narrow scope indefinites license plural anaphora.

(9) Every^x student had a^y favorite poet. They$_y$ were all French.

(10) John had a^y favorite poet. He$_y$ was French. / *They$_y$ were all French.

Informal Proposal: Dependent indefinites are just like plain indefinites, but they require the variable they bind to be plural in the way that y is in (9) after the first clause has been evaluated.

- What we need is a way to let the plurality condition be evaluated after interpreting some expression containing the dependent indefinite.

- While not standard, Brasoveanu (2012, §2-3) argues that the cardinality conditions contributed by modified numerals should be interpreted in a delayed manner, which he calls *post-suppositional*.

2.1 Formal backdrop

The backdrop for the account is a version of Dynamic Plural Logic (DPlL) in van den Berg 1996 that has been stripped to its bare essentials.

- 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. W
- here 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 (11), represent variables (or discourse referents).

(11)

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

Brasoveanu 2010 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. I will continue to use this terminology in what follows.

Basic tech:
Atomic formulas are tests (they only pass on input contexts that satisfy them). Note that they are interpreted distributively with respect to assignments in H.

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

We clearly need expressions to manipulate these two kinds of pluralities.

- Domain-level cardinality predicates—$\textbf{one}(x)$, $\textbf{two}(x)$, etc.—distributively check the cardinality of the set of atomic parts of an individual.

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

- Essentially, given G, check whether $|\textbf{atoms}(g_1(x))| = 2$, and $|\textbf{atoms}(g_2(x))| = 2$, etc.
- We also have tests for evaluation-level cardinality. Essentially, given G, they check the cardinality of { $g_1(x)$, $g_2(x)$, $g_3(x)$,... }

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

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

Dynamic conjunction is defined as relation composition.

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

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

(17) 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.[1]

An example:
Putting things together, the sentence 'A student danced' is translated as in (18).

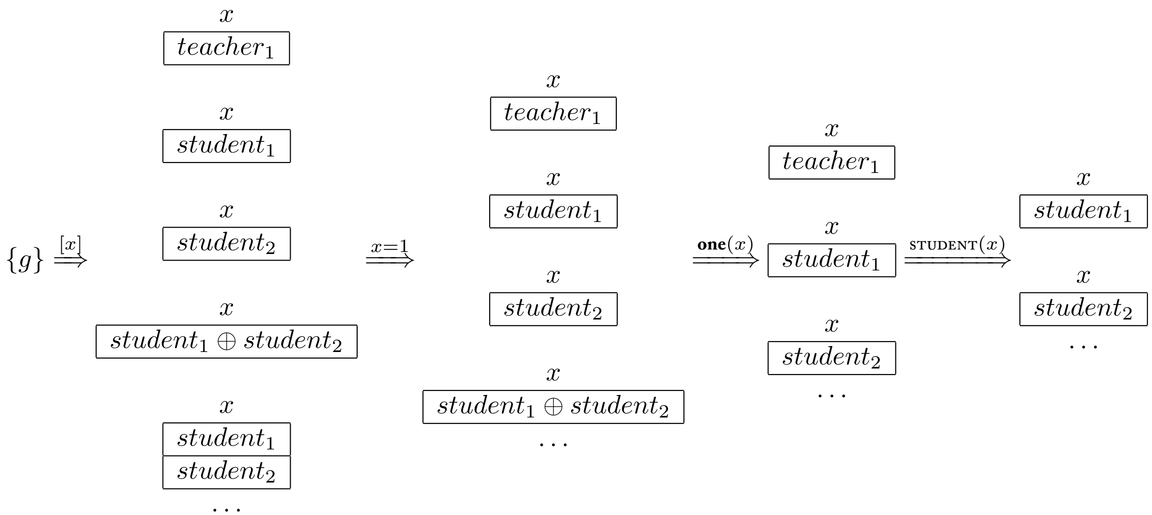
(18) A student danced $\rightsquigarrow$
$\exists x[x = 1 \wedge \textbf{one}(x) \wedge \textsc{student}(x)](\exists e(e = 1 \wedge \textsc{dance}(e) \wedge \textsc{ag}(e,x)))$

The formula in example (18) just abbreviates the dynamic version in (19).

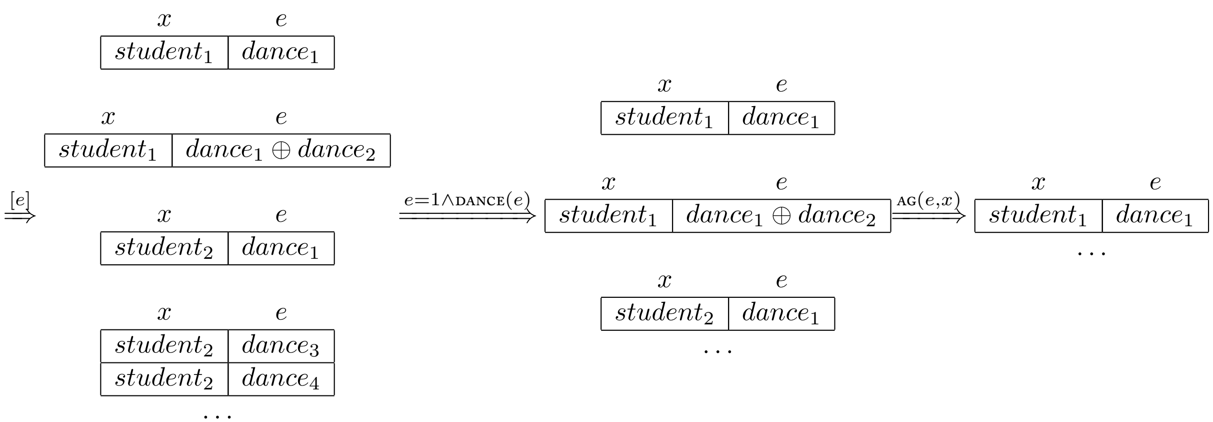
(19) $[x] \wedge x = 1 \wedge \textbf{one}(x) \wedge \textsc{student}(x) \wedge [e] \wedge e = 1 \wedge \textsc{dance}(e) \wedge \textsc{ag}(e,x)$

[1] I also assume that these theta-roles, in addition to basic lexical relations (SEARCH, EAT, STUDENT etc.), are cumulatively closed by default, though I 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.

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

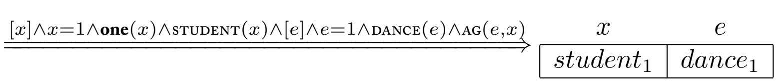


The next block begins by introducing an event e. Just as before, potential outputs could store in e a non-atomic event or an evaluation plurality.



(20) 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.

- We decompose universal quantification into a maximization operation over the restrictor and a distributive operator over the nuclear scope (Brasoveanu, 2008).
- That is, $\forall x[\phi](\psi)$ abbreviates $\mathbf{max}^x(\phi) \wedge \delta(\psi)$.

(21) $[\![\mathbf{max}^x(\phi)]\!]^{\langle G,H\rangle} = \mathbb{T}$ iff $[\![[x] \wedge \phi]\!]^{\langle G,H\rangle} = \mathbb{T}$ and

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

(22) $[\![\delta(\phi)]\!]^{\langle G,H\rangle} = \mathbb{T}$ 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.

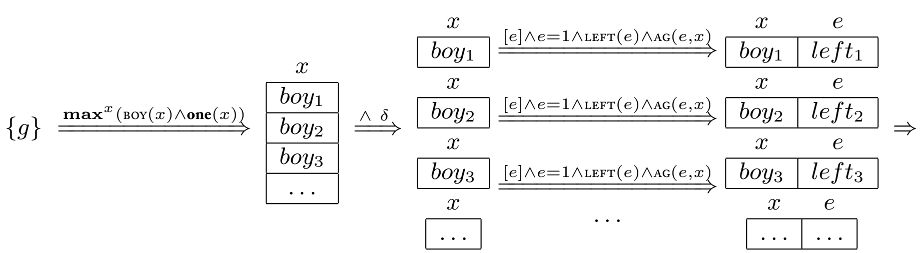
a. $G = \mathbf{Dom}(\mathcal{F})$ and $H = \bigcup \mathbf{Ran}(\mathcal{F})$

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 (23-24).

(23) $\forall x[\textsc{boy}(x) \wedge \mathbf{one}(x)](\exists e(e = 1 \wedge \textsc{left}(e) \wedge \textsc{ag}(e,x)))$

(24) $\mathbf{max}^x(\textsc{boy}(x) \wedge \mathbf{one}(x)) \wedge \delta([e] \wedge e = 1 \wedge \textsc{left}(e) \wedge \textsc{ag}(e,x))$



x	e
boy_1	$left_1$
boy_2	$left_2$
boy_3	$left_3$
...	...

To presage 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.

2.2 Dependent indefinites

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.

- 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 argue that the cardinality constraint of dependent indefinites is a post-supposition interpreted *after* the at-issue update.
- 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.

Post-suppositions are not a new class of meanings. They are discussed in Constant 2006; Farkas 2002; Lauer 2009, though Brasoveanu 2012 gives the most thorough formal treatment, which we will follow closely.

- The core definition is that in (25), where post-suppositions are marked via an overline

(25) $[\![\overline{\phi}]\!]^{\langle G[\zeta],H[\zeta']\rangle} = \mathbb{T}$ iff ϕ is a test, $G = H$ and $\zeta' = \zeta \cup \{\phi\}$.[2]

(26) 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 $[\![\psi_1 \wedge \ldots \wedge \psi_m]\!]^{\langle H[\emptyset],H[\emptyset]\rangle} = \mathbb{T}$.

For a concrete example, consider a formula like $\overline{\phi} \wedge \psi$, where ψ contains no post-suppositions.

[2] 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 $\zeta = \zeta'$.

(27) $[\![\overline{\phi} \wedge \psi]\!]^{\langle G[\emptyset], H[\{\phi\}]\rangle} = \mathbb{T}$ iff there is a $K[\zeta]$ such that

a. $G = K$

b. $\zeta = \emptyset \cup \{\phi\}$

c. $[\![\psi]\!]^{\langle K[\{\phi\}], H[\{\phi\}]\rangle} = \mathbb{T}$

d. $[\![\phi]\!]^{\langle H[\emptyset], H[\emptyset]\rangle} = \mathbb{T}$

Recall that plain indefinites contribute variables that are evaluation singular in their local context.

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

Where dependent indefinites differ is that they place the post-suppositional test $\overline{x > 1}$ on the variable they bind.[3]

(29) one-one ϕ is ψ $\rightsquigarrow \exists x[\overline{x > 1} \wedge \mathbf{one}(x) \wedge \phi](\psi)$

To see the translation in (29) in action, consider example (30), which has the reduplicated form of the indefinite *jun* 'one'.

(30) *Chi-ki-jujunal ri tijoxel-a' x-Ø-ki-q'etej ju-jun tz'i'.*
P-E3p-each the student-PL CP-A3s-E3p-hug one-RED dog

'Each of the students hugged a dog.'
FALSE if they all hugged the same dog.

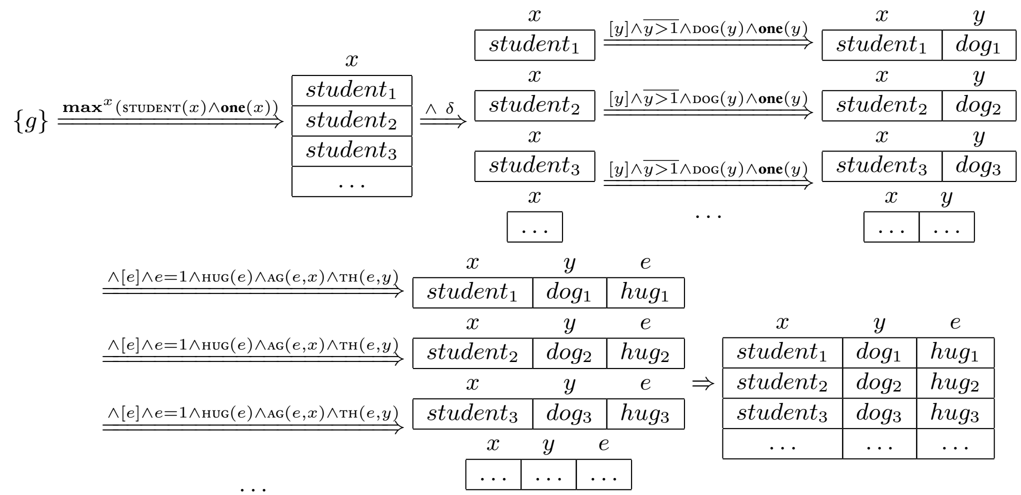
Example (31) gives a translation of (30) using the ∀/∃ shorthand making relative scope easier to see.

(31) $\forall x[\mathbf{one}(x) \wedge \textsc{student}(x)]$
$(\exists y[\overline{y > 1} \wedge \mathbf{one}(y) \wedge \textsc{dog}(y)]$
$(\exists e(e = 1 \wedge \textsc{hug}(e) \wedge \textsc{ag}(e, x) \wedge \textsc{th}(e, y))))$

Because the dependent indefinite's post-supposition is evaluated globally, (31) is equivalent to (32), where $y > 1$ takes widest scope.

(32) $\mathbf{max}^x(\mathbf{one}(x) \wedge \textsc{student}(x)) \wedge \delta([y] \wedge \mathbf{one}(y) \wedge \textsc{dog}(y) \wedge [e] \wedge e = 1 \wedge \textsc{hug}(e) \wedge \textsc{ag}(e, x) \wedge \textsc{th}(e, y)) \wedge y > 1$

[3] For dependent numerals, replace **one** in (29) with the appropriate cardinality predicate (**two**, **three**, etc.).



The figure above illustrates how the analysis hinges on treating the test $\overline{y > 1}$ as a post-supposition.

- If it were interpreted locally, that is, in the scope of the distributivity operator, we would have to satisfy $y > 1$ as we interpret the nuclear scope relative to each singleton assignment storing an atomic student.
- That is, we would incorrectly require each student to hug at least two dogs. Instead, the test $\overline{y > 1}$ is interpreted last, relative to the final matrix above.

Crucially, until the post-suppositional cardinality condition $\overline{y > 1}$ is evaluated, a formula like (32) is completely consistent with an output like (33).

(33) $\xRightarrow{\textbf{alternative output}}$

x	y	e
$student_1$	dog_1	hug_1
$student_2$	dog_1	hug_2
$student_3$	dog_1	hug_3
...	...	...

- The post-supposition $\overline{y > 1}$ will not be satisfied in an output like (33), preventing the indefinite from taking narrow scope, but failing to covary.

It is this same reasoning that prevents a dependent indefinite from taking wide scope and failing to covary.

Summarizing the Approach
A final product of this account is a clean picture of plurality in the determiner domain.

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

Figure 1: Typology of indefinite plurality

The *only* difference between dependent indefinites and canonical indefinites is that the latter have a condition that the dref they introduce is domain plural. They are thus minimally different from plain indefinites—i.e., moving between adjacent cells in the typology means changing just one slot in the translation schema.

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

(35) one$_{dep}$ ϕ is ψ $\rightsquigarrow \exists x[\overline{x > 1} \wedge \mathbf{one}(x) \wedge \phi](\psi)$

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

(37) three$_{dep}$ ϕ is ψ $\rightsquigarrow \exists x[\overline{x > 1} \wedge \mathbf{three}(x) \wedge \phi](\psi)$

Note that in this theory:

- Dependent indefinites are not anaphoric
  - they only talk about the dref / variable they introduce, just like plain indefinites.
- Dependent indefinites do not talk about scope, neither their own nor the scopes' of other expressions.
  - They only do so indirectly by introducing an evaluation plurality, which is like a bomb that will explode unless another expression intervenes on the event variable to make it evaluation plural.
- Dependent indefinites do not talk about the domain of over which a licensing expression quantifies.
  - All licensing procedes via the event variable, which must be pluralized to reckon with the evaluation plurality introduced by the dependent indefinite.

How strong is this lean account when looking at other kinds of dependent indefinites?

3 Farkas 2015: The domain variable account

Note: The following setup is taken directly from Farkas 2015

Dependent-indefinites are subject to a co-variation condition: the variable they introduce must receive multiple values (variation) and must be referentially dependent on another varying variable (co-variation)

Basic notions:

- A *domain variable* x is evaluated by a set of functions G_x that range exhaustively over x's non-singleton domain.
  - for each $g, g' \in G_x$, $g(x) \neq g(x')$
  - each element in the domain of x is assigned a value by some $g \in G_x$
  - for each $g \in G_x$, $g(x)$ is an element in the domain of x
- A *dependent variable* y is evaluated by a set of functions H obtained by updating each $g \in G_x$ on y.
- The *Co-variation condition* says there must be at least two functions $h, h' \in H$ such that $h(y) \neq h(x)$.

(38) *Evaluation constraint on dependent indefinites*
Dependent indefinites introduce variables subject to an evaluation constraint that requires them to co-vary relative to a domain variable.

While Farkas does not give truth condition for sentences with dependent indefinites via translation into a logical language, an approximation in DPlL can be done for comparison.

(39) one ϕ is $\psi \rightsquigarrow \exists y[y = 1 \wedge \mathbf{one}(y) \wedge \phi](\psi)$

(40) one$^{x,\zeta}_{dep}$ ϕ is ψ
$\rightsquigarrow \rho(\mathbf{max}^z(\zeta) \wedge z > 1 \wedge \mathbf{equal}(x, z)) \wedge \exists y[\overline{\mathbf{dep}(y, x)} \wedge \mathbf{one}(y) \wedge \phi](\psi)$

a. $[\![\mathbf{equal}(x, y)]\!]^{\langle G[\zeta], H[\zeta'] \rangle} = \mathbb{T}$ iff $G = H$, $[\zeta] = [\zeta']$, and for all $h \in H$ $h(x) = h(y)$

b. $[\![\mathbf{dep}(x, y)]\!]^{\langle G[\zeta], H[\zeta'] \rangle} = \mathbb{T}$ iff $G = H$, $[\zeta] = [\zeta']$, there are $h, h' \in H$ such that $h(x) \neq h'(x)$, and for all $h, h' \in H$, if $h(x) \neq h'(x)$, then $h(y) \neq h'(y)$

'x is dependent on y iff x is not constant across H and and if any two assignment in H disagree on x they disagree on y.'

That is, a dependent indefinite is anaphoric to a variable x and a condition ζ. It presupposes that x stores the (non-singleton) restrictor set of a quantifier whose restrictor is ζ—that is, it is a domain variable. It then introduces a new variable y and does what the indefinite usually does. Finally, as a post-supposition, it checks whether y depends on x.

This theory is not as lean as that proposed in Henderson 2014 and summarized in the previous section.

- Dependent indefinites are anaphoric, not just to a variable, but to the expression that determines what the variable stores.
- Dependent indefinites directly talk about scope (namely, semantic scope). They require that the variable they are anaphoric to store the restrictor set of some quantifier and then assert that the variable they introduce be dependent on this variable
- Dependent indefinites can impose fine-grained requirements (through presuppositions) on the variable they depend on. Here we only see the condition that this variable be a *domain variable*, but we see other kinds of conditions below.

The arguments for this richer account of dependent indefinites are mostly typological in nature, they focused on capturing variation, so let's consider them to see if we are forced to move to such a theory.

Argument 1: Stop dependent indefinites from being sortal keys rather than distributive shares

This argument says, in effect, that the domain variable is needed so that dependent indefinites need a licenser.

- i.e., the following are ungrammatical because there is no expression the dependent indefinite can be anaphoric to, and without being able to resolve its domain variable, a sentence with a dependent indefinite is infelicitous.

(41) Hungarian
*Egy-egy / Két-két gyerek énekelt.
'A-a / Two-two child sang.'
Intended interpretation: Each child in a contextually given group / each group of two children in such a group sang.

(42) Kaqchikel
X-e'-ok* ***ox-ox* *tz'i'.*
CP-A3p-enter **three-RED** dog
Desired reading: '(Groups of) three dogs entered.'

While this is true, it is not really an argument for the domain variable account over other analyses. The proposal in Henderson 2014 also requires licensing, and does so without requiring an anaphoric connection (i.e., a domain variable).

- With no quantifier over the event variable, the theta-role, which is a distributively satisfied lexical condition cannot be satisfied while satisfying the dependent numeral's post-supposition.
- The same event cannot have two distinct agents.

(43) $[x] \wedge \overline{x > 1} \wedge \textbf{two}(x) \wedge \textsc{child}(x) \wedge [e] \wedge e = 1 \wedge \textsc{hug}(e) \wedge \textsc{ag}(e, x)$

(44)

H	y	e	x	z
h_1	...	$sing_1$	$child_1 \oplus child_2$	...
h_2	...	$sing_1$	$child_1 \oplus child_3$	...
...	...	...	...	...

Argument 2: Dependent indefinites can sometimes only be licensed by quantifiers over particular domains. If dependent indefinites are anaphoric to a licensing variable, they can then require that variable be of a certain type.

For instance, Russian has a class of dependent indefinites that are license by quantifiers over more variable types than Kaqchikel.

- Russian has a series of dependent indefinites formed by affixing *–nibud'* to a WH-word. Example (45) gives representative examples from Pereltsvaig 2008.

(45) a. *kto-nibud'* 'x-person'
b. *kogda-nibud'* 'x-time'
c. *kak-nibud'* 'x-manner'
d. *otčego-nibud'* 'x-reason'
e. *čto-nibud'* 'x-place'

As in Kaqchikel, when a *nibud'*-indefinite co-occurs with a quantifier, it cannot have a wide scope reading. If it has no quantificational clause-mate, ungrammaticality results.

(46) Yanovich 2005, ex. 18a

Každyj	*mal'čik*	*vstretil*	*kogo-nibud'*	*iz*	*svoix*	*odnoklassnic.*
Every	boy	met	who-NIBUD'	of	his	girl-classmate

'Every boy met one of his girl classmates.'
FALSE if they all met the same classmate.

(47) Yanovich 2005, ex. 17

**Petja*	*vstretil*	*kogo-nibud'*	*iz*	*svoix*	*odnoklassnic.*
Petja	met	who-NIBUD'	of	his	girl-classmate

'Petja met one of his girl classmates.'

Kaqchikel dependent indefinites and *nibud'*-indefinites are also similar in that they are both also licensed by quantifiers over events, as examples (48-49) show.

(48) Yanovich 2005, ex. 18b

Petja	*často*	*vstrečal*	*kogo-nibud'*	*iz*	*svoix*	*odnoklassnic.*
Petja	frequently	met	who-NIBUD'	of	his	girl-classmates

'Petja frequently met a (different) girl.'

(49)

Jantape'	*e'*	*k'o*	*ox-ox*	*ixtan-i'*	*ch-u-wäch*	*r-ochoch*	*ajaw.*
Always	A3p	exist	three-RED	girl-PL	P-E3s-face	E3s-house	lord

'There are always three (different) girls out front of the church.'

While both *nibud'*-indefinites and Kaqchikel dependent indefinites are licensed by quantifiers over events, only the former are licensed by quantification over worlds. Examples (48-52) present the relevant contrasts.

(50) Yanovich 2005, ex. 18c

Petja	*xočet*	*vstretit'*	*kogo-nibud'*	*iz*	*svoix*	*odnoklassnic.*
Petja	want	to meet	who-NIBUD'	of	his	girl-classmates

'Petja wants to meet a girl (it doesn't matter which).'

(51)

#A	*Xwan*	*ni-Ø-r-ajo'*	*n-Ø-u-tz'ët*	*ka-ka*	*ixtan-i'.*
CLF	John	ICP-A3s-E1s-want	ICP-A3s-E3s-see	two-RED	child-PL

Desired reading: 'Juan wants to see two girls (it doesn't matter which).'

(52)

#A	*Xwan*	*k'o chi*	*n-Ø-u-löq'*	*ka-ka*	*äk'.*
CLF	John	must	ICP-A3s-E3s-buy	two-RED	chicken

Desired reading: 'Juan must buy two chickens (it doesn't matter which).'

The dependent variable account can account for this contrast between Kaqchikel and Russian with a constraint like the following imposed on Kaqchikel, but not Russian.

(53) Extensional dependency condition
The domain variable of dependent indefinites in Kaqchikel must be extensional. (see Farkas (1997), ex. (42))

This works, but the lean theory might be able to respond to these kind of data in another way.

- We know independently that the scope of modals and many attitude predicates block plural anaphora to indefinites.
- There is no such ban on referring back to pluralities of individuals introduced into the discourse by an indefinite interpreted in the scope of a quantifier over events or individuals.

(54)
a. Mary must be advising a^x student this semester. #They$_x$ are all working on indefinites.
b. Everyone is advising a^x student this semester. They$_x$ are all working on indefinites.
c. Every week I meet with a^x (different) student from class. They$_x$ all have to tell me about their final project.

(55)
a. John wants to eat a^x burrito for lunch. #They$_x$ all have guacamole and extra jalapeños.
b. Every one ate a^x burrito for lunch. They$_x$ all had guacamole and extra jalapeños.
c. I eat a^x burrito every week. They$_x$ always have guacamole and extra jalapeños.

- Since the account of dependent indefinites I proposed is inspired by the behavior of cross-sentential plural anaphora, these data suggest that there might be a natural constraint at work here.

The data in (54-55) are usually handled by treating drefs for individuals to be partial individual concepts, which involves relativizing them to worlds.

- That is, for any assignment g and variable x, $g(x)$ is a partial function from a non-empty subset of the set of worlds $\mathfrak{W}$ to the set of individuals $\mathfrak{D}$.

In this kind of setup, random assignment is relative to a world and ensures definedness, while basic lexical relations obviously must be satisfied distributively with respect to the worlds stored across a set of assignments.

(56) $[\![R_w(x_1,\ldots,x_n)]\!]^{\langle G[\zeta],H[\zeta']\rangle} = \mathbb{T}$ iff $G = H$ and $\zeta = \zeta'$ and for all $h \in H$, $\langle h(x_1)h(w),\ldots,h(x_n)h(w)\rangle \in \mathfrak{I}_{h(w)}(R)$.

(57) $G[x_w]H := \begin{cases} \text{for all } g \in G, \text{ there is a } h \in H \text{ such that } g[x_w]h \\ \text{for all } h \in H, \text{ there is a } g \in G \text{ such that } g[x_w]h \end{cases}$, where $g[x_w]h$ iff for any variable v, if $v \neq x$, then $g(v) = h(v)$ and $\mathbf{Dom}(h(x)) = \{h(w)\}$

Moving to evalutation level cardinality conditions, we have two choices. They can be satisfied by summing across worlds and variable assignments or by across variable assignments at a world.

- Note that (58) is the stronger constraint, namely if a set of assignments sastisfies (58), it satisfies (59).

(58) $[\![x \succ_w n]\!]^{\langle G[\zeta],H[\zeta']\rangle} = \mathbb{T}$ iff $G = H$, $\zeta = \zeta'$ and for all $\mathbf{w} \in H(w)$, $|\{h(x)(\mathbf{w}) : h \in H\}| > 1$

(59) $[\![x >_w n]\!]^{\langle G[\zeta],H[\zeta']\rangle} = \mathbb{T}$ iff $G = H$, $\zeta = \zeta'$ and $|\{h(x)h(w) : h \in H\}| > 1$

Now, if we say that the Russian dependent indefinites use $>_w$, but the Kaqchikel-style dependent indefinites use $\succ_w$, we make the following good predictions:

- Russian, but not Kaqchikel dependent indefinites are licensed distributive quantifiers over worlds.
- If a quantifier over some domain licenses a Kaqchikel dependent indefinite, it will license the Russian dependent indefinite (because the Kaqchikel constraint in terms of $<_w$ is stronger).

Does this proposal preserve the "lean" account of dependent indefintes that I have been advocating?—mostly, I think.

- Dependent indefinites across Russian and Kaqchikel are not treated completely uniformly. To do this, we would have to say something is special about modal quantification in Russian, but we have no evidence for this.
- But, dependent indefinites in this account are not licensed by being anaphoric to particular kinds of variables or differ in terms of what kinds of variables they are permitted to be anaphoric to.
  - All dependent indefinites, just like all expressions, are interpreted relative to a world parameter.
  - World parameters are a species of index, just like assignments.
  - Dependent indefintes, under the lean theory, care only about plurality with respect to an index.
  - When move to an intensional setup, dependent indefinites, like those in Kaqchikel, can be specialized to care only about plurality with respect to one kind of index (assignments, but not worlds). Russian dependent indefinites care about plurality with respect to any kind of index.
- In sum, the data from Russian do not force us to accept the notion of an anaphorically accessible domain-variable for dependent indefinites.

While I do not think the fact that only some dependent indefinites are licensed by quantification over worlds forces us to accept a domain-variable account, there are other more troublesome cases.

- In particular, there is a pronounced split in the distribution of dependent indefinites in Hungarian between dependent numerals and dependent existentials.
- Dependent numerals have a much more restricted distribution.

First, there are some event quantifiers that license dependent existentials, but not dependent numerals.

(60) A politikus néha / mindig megtapsolt egy-egy / *két-két ellenzéki hozzaászólaást.
'The politician sometimes / always applauded a-a / *two-two opposition comment.'
Only interpretation: Sometimes / always, the politician applauded an opposition comment—comments co-vary with occasions (Farkas, 2015, ex.12)

(61) Helyenként egy-egy / *két-két rendör leállított.
'In several places a-a / *two-two policemen stopped me.'
Only interpretation: In several places a policeman stopped me—policemen covary with places (Farkas, 2015, ex.13)

(62) Olykor, mikoregy-egy / *két-két olyank könyvet olvasok, ami a szívemhe szól, jól érzem magam.
‘Sometimes, when I read a-a / *two-two book that speaks to my heart, I feel well.’
Only interpretation: Sometimes, when I happen to read a book that speaks to my heart I feel well—book co-varies with times (Farkas, 2015, ex.10)

Note that not all adverbial quantification fails to license dependent numerals, though. Quantificational adjuncts that quantify over spatial or temporal entities are able to.

(63) Minden utcasarokra egy-egy / két-két rendoört állitottak.
‘Every corner a-a / two-two policeman placed.’
Only interpretation: On every corner, they placed a-a / two-two policeman—policemen co-vary with corners (Farkas, 2015, ex.14)

The core puzzle here is that if we give a unified analysis to dependent numerals and dependent existentials, where one is licensed the other should be able to appear.

- As with Russian, the solution Farkas provides requires dependent indefinites to be able to place conditions on their domain variable.

(64) Individual variable dependency condition
The domain-variable of dependent numerals in Hungarian must be a variable over individuals. (Farkas, 2015, ex.53)

- This condition will prevent dependent numerals like *két-két* ‘two-two’ from being licensed by adverbial quantifiers over events like *helyenként* ‘here and there’…
- …while permiting them to be licensed by expressions like *minden utcasarokra* ‘every corner’, which presumably involves quantification over individuals, corner being a reified spatial individual.

This argument causes much more trouble for the analysis in Henderson 2014 than the Russian data.

- The reason is covariation in Henderson 2014 is required by the evaluation-level post-supposition, but only satisfied in virtue of some expression “pluralizing” the event argument at the evaluation level, either through a pluractional operator or a distributive quantifier taking scope over the event argument.
- In fact, quantifiers over events should be the best licensors, or at least the most straightforward licensors, all things being equal.

There is something intriguing, though, about the contast between dependent existential and dependent numerals in Hungarian.

- Many of the event-modifying expressions that license the former but not the latter are not distributive quantifiers over the event.
- They neither generate distributive entailments about an argument, nor do they license a narrow scope reading of a plain indefinite.
- They merely pluralize the event argument.

Consider, for instance, the fact that pluractionals license dependent existentials, but neither dependent numerals nor narrow scope readings of plain indefinites.

(65) Context: Nurses are talking about how the night went in a children’s ward:

a. Egy-egy/*két-két gyerek fel-fel ébredt de más baj nem volt.
‘A child up-up woke but other trouble was not.’
Only interpretation: From time to time a child woke up but other than that there was no trouble—child co-varies with times.

b. Egy gyerek fel-fel ébredt de más baj nem volt.
From time to time a child (the same every time) woke up but other than that there was no trouble.

Similarly, dependent existentials, but not dependent indefinites are licensed in cases where there is no quantificational expression at all, but the context makes it clear we’re talking about multiple events.

(66) Context: We’re discussing how things are in the department generally. ”The students usually do well.”
Egy-egy / két-két diák megbukik de ez ritkán fordul elö.
‘A-a / *two-two student fails but this rarely comes up.’
Only interpretation: The students usually do well. From time to time, a student fails but this happens rarely—students co-vary with times

Once again, though, a plain indefinite cannot convary in such a context.

(67) Context: We’re discussing how things are in the department generally. ”The students usually do well.”
Egy diák pananszkodik de ez ritkán fordul elö.
‘A student complains but this rarely comes up.’
Only interpretation: From time to time, a student (the same) complains but this happens rarely.

The analysis in Henderson 2014 was built precisely to deal with cases like the Hungarian dependent existential, where a dependent indefinite can covary with respect to an expression, but a plain indefinite cannot.

- This is what was called the 'scope puzzle' in the previous section.
- But it seems like dependent numerals are instead not so puzzling. They have a similar distribution with respect to these eventive operators as a plain indefinite.
- These facts suggest an analysis in which dependent numerals have a post-suppositional requirement like dependent indefinites, but one that can only be satisfied in the scope of a **dist** / δ operator—the kind of operator that makes it possible for plain indefinites to covary
- We can then analyze pluractionals, advarbials (here and there, sometimes, etc.), and implicit licensing by saying that these create the right kinds evaluation plural events to license the dependent existential, but because there is no **dist** / δ operator, dependent numerals will not be licensed.

That is, let the Hungarian dependent existential behave exactly like dependent indefinites in Kaqchikel.

(68) egy-egy ϕ is $\psi \rightsquigarrow \exists x[\overline{x > 1} \wedge \textbf{one}(x) \wedge \phi](\psi)$

The special treatment is given to Hungarian dependent numerals. The only difference from dependent indefinites is this extra evaluation level cardinality condition $x = 1$.

(69) két-két ϕ is $\psi \rightsquigarrow \exists x[\overline{x > 1} \wedge x = 1 \wedge \textbf{two}(x) \wedge \phi](\psi)$

In this way, the dependent numeral is a hybrid of a dependent existential and a plain indefinite, which also has the evaluation level cardinality condition $x = 1$.

(70) egy ϕ is $\psi \rightsquigarrow \exists x[x = 1 \wedge \textbf{one}(x) \wedge \phi](\psi)$

The effect this has is that dependent numerals must introduce a variable that is evaluation plural in the output, but in virtue of the condition $x = 1$, it will be only able to sastisfy that condition by taking scope under a distributivity operator.

- This drives the difference between Hungarian dependent existentials, which can covary with respect to a plural event, even if there is no distributive operator over the event variable, and dependent
- The only additional assumption we need is that non-distributive pluractional operators and adverbial event quantifiers traffic in evaluation pluralities—it's this that makes them similar to distributive quantifiers.

That is, suppose verbal pluractionality in Hungarian has the following (surely simplifed) effect:

(71) fel ébredt $\rightsquigarrow \exists e[e = 1 \wedge \textsc{woke.up}(e)]$

(72) fel-fel ébredt $\rightsquigarrow \exists e[e > 1 \wedge \textsc{woke.up}(e)]$

The pluractional now fails to license a covarying plain indefinite or a dependent numeral:

- Note that the $x = 1$ condition of the plain indefinite requires that the same child participate in each event required by the pluractional (i.e., $e > 1$)

(73) $\exists x[x = 1 \wedge \textbf{one}(x) \wedge \textsc{child}(x)](\exists e[e > 1 \wedge \textsc{woke.up}(e) \wedge \textsc{ag}(e) = x])$

- The same is true with the dependent numeral, where the $x = 1$ condition of the plain indefinite requires that the same two children participate in each event required by the pluractional (i.e., $e > 1$).
- But this conflicts with the domain plurality condition of the dependent numerals, resulting in ungrammaticality. The best we can do is (75) or (76), but fail on some condition of the dependent numeral.

(74) $\exists x[\overline{x > 1} \wedge x = 1 \wedge \textbf{two}(x) \wedge \textsc{child}(x)](\exists e[e > 1 \wedge \textsc{woke.up}(e) \wedge \textsc{ag}(e) = x])$

(75) Satisfies $x = 1$, but fails the post-supposition $\overline{x > 1}$

H	y	e	x	z
h_1	...	$woke.up_1$	$child_1 \oplus child_2$	...
h_2	...	$woke.up_2$	$child_1 \oplus child_2$	...
h_3	...	$woke.up_3$	$child_1 \oplus child_2$	...
...	...	...	...	...

(76) Fails $x = 1$, but satisfies the post-supposition $\overline{x > 1}$

H	y	e	x	z
h_1	...	$woke.up_1$	$child_1 \oplus child_2$	...
h_2	...	$woke.up_2$	$child_1 \oplus child_3$	...
h_3	...	$woke.up_3$	$child_1 \oplus child_4$	...
...	...	...	...	...

- The result is that *két-két* and other dependent numerals will only be satisfied when a distributive operator takes scope over it

- The condition $x = 1$ will be satisfied distributively within its scope, while $\overline{x > 1}$ will be satisfied in the output.

In contrast, because *egy-egy* has no $x = 1$ condition, random assignment to x can freely introduce an evaluation plurality of children when some operator—here the pluractional—introduces an evaluation-level event plurality.

(77) $\exists x[\overline{x > 1} \wedge \textbf{one}(x) \wedge \textsc{child}(x)](\exists e[e > 1 \wedge \textsc{woke.up}(e) \wedge \textsc{ag}(e) = x])$

(78)

H	y	e	x	z
h_1	...	$woke.up_1$	$child_1$	...
h_2	...	$woke.up_2$	$child_2$	...
h_3	...	$woke.up_3$	$child_3$	...
...	...	...	...	...

Let's take stock of the counteranalysis I've proposed here.

- What we see is that the Hungarian dependent numerals have one additional condition, while the dependent existentials have one altered condition—both in reference to evaluation-level cardinality.
- In neither case are they anaphoric to other expressions or directly talk about their scopes.
- I haven't been able to preserve a fully uniform account of dependent indefintes, but the analysis is squarely in the spirit of Henderson 2014.
- Dependent indefinites are special in how they talk about evaluation level cardinality, but otherwise very similar to plain indefinites.
- In fact, there is an interesting structure between these three types of expressions.

Hungarian Dependent Indefinites

Dependent Numerals
$\overline{x > 1}, x = 1$

Dependent Existentials
$\overline{x > 1}$

Plain Indefinites
$x = 1$

The analysis works well for the pluractional. How well this works in general is general depends on whether we can analysis the class of adverbials that distinguish dependent existentials and dependent numerals similarly.

- I think it simply extends to *helyenként* 'here and there', *olykor* 'sometimes', *néha*, etc.
- *mindig* 'always' is going to be harder, but I have some ideas about this we can talk about in the Q & A.

Sidebar: I'm also a little skeptical of this generalization about always. I've found naturally occuring examples of dependent numerals covarying in the scope of *mindig* 'always'. I think further empirical work on adverbial licensing is needed.

(79) Ha szükséges a csonttányér elhelyezése, azt **mindig két-két** teríték közé tegyük.
A small dish to collect the bones found in a meal should always be placed between pairs of table settings.

(80) The Simpsons-hoz hasonlóan **mindig két-két** családtag kapott egy kis történetet.
Like in the Simpsons, family members always got a story in pairs.

The analysis does make a strong prediction that can distinguish it from the domain variable account of these data.

Prediction: In Hungarian an event quantifier that allows a plain indefinite to covary should license dependent numerals.

- The domain variable account would predicate that such an event quantifier should fail to license dependent numerals because what is at issue is the type of its variable, not the flavor of distributivity at issue.

Mini-summary
This has been a long section, but I do not think that the variation we observed in Russian or Hungarian is a knock down argument in favor of an anaphoric account of dependent indefinites—they do not need to make reference to a domain variable, and a fortiori, they do not need to place conditions on the kinds of variables that can serve as such.

- We don't need domain variables to keep dpendent indefinites from being sortal keys.
  - If dependent indefinites are license via operators (distributive or not) that pluralize the event argument, then dependent indefinites will not be able to be sortal keys.

- The fact that Russian dependent indefinites can covary with respect to worlds does not necessitate a special domain variable.
  - We know independently that all indefinites must be relativized to worlds—those worlds for which the individual concept it introduces is defined.
  - In this kind of system the plurality post-supposition for all dependent indefinites has to be relativized to worlds, and Russian dependent indefinites are special in using a slightly weaker condition.
  - Crucially, dependent in definites don't differ in whether they can be anaphoric to world varaibles, which is what the domain variable account must show is necessary.
- The fact that dependent numerals have a restricted distribution—not covarying with respect to event quantifiers—does not necessitate a domain variable account.
  - I showed that the real issue is that Hungarian dependent numerals, but not dependent existentials, have an additional evaluation-level cardinality condition (shared with plain indefinites), that requires their evaluation-level plurality post-supposition to be satisfied in the scope of a distributive operator.
  - The adverbial quantifiers in question do not fail to license dependent numerals, not because the implicate in the event variable, but because they do not instantiate distributive quantification over the event variable.

3.1 Other arguments for a domain variable account

Kuhn 2015 proposes an analysis of dependent indefinites that shares aspect of both Farkas's domain variable account (in terms of anaphoricity) and Henderson's account (in terms of evaluation plurals + exceptional scoping). It is also different in a few critical ways.

- I don't want to present his analysis in detail, because he is here and will be presenting it later. I will be focusing for the moment on its relation to the domain variable account.
- Kuhn's analysis is similar to Farkas's in two ways and different from Farkas's (and Henderson's) in two ways:
  - Similarities: (i) A dependent indefinite is anaphoric to the variable against which it covaries, and so in principle, (ii) it can impose conditions on that variable in the style of Farkas's domain variable account.
  - Differences: (i) A dependent indefinite does not require the variable it's anaphoric to be a domain variable (i.e., dependent indefinites don't talk about the scope of other expressions), (ii) dependent indefinites themselves expressive non-trivial distributive quantification.

- While I will return to the idea that dependent indefinites are themselves distributive quantifiers, I just wanted to note the Kuhn's analysis, like Farkas's, also treats dependent indefinites as anaphoric expressions.
- This means that his arguments in favor of an anaphoric account support, in principle, Farkas's domain variable account, even if we later have to abandon her version because we decide that dependent indefinites must themselves be distributive quantifiers.

Argument 3: In ASL (and other languages), dependent indefinites can be licensed by a non-local distributive quantifier

(81) ALL-a BOY-**a** GAVE ALL-b GIRL-b ONE-redup-**a** BOOK.
'All the boys gave all the girls one book each'

- In a theory where dependent indefinites can pick their licensors from anaphorically accessible plural expressions, this follows naturally.
- While this is true, Henderson (2014) can also account for examples like these as long as indefinites are free to QR.
- Note that this QR is necessary, not so that y is valued relative to x, but so that the post-supposition is not introduced in the scope of the distributivity operator associated with 'All the girls', where it would have to be discharged.
- If the post-supposition were trapped under the narrowest δ, every boy would have to give every girl at least two different books, which is not the reading we want.

(82) $\forall x[\mathbf{one}(x) \wedge \textsc{boy}(x)]$
$(\exists y[\overline{y > 1} \wedge \mathbf{one}(y) \wedge \textsc{book}(y)]$
$(\forall z[\mathbf{one}(z) \wedge \textsc{girl}](\exists e(e = 1 \wedge \textsc{give}(e) \wedge \textsc{ag}(e) = x \wedge \textsc{th}(e) = y \wedge$
$\textsc{gl}(e) = z))))$

(83) $\mathbf{max}^x(\mathbf{one}(x) \wedge \textsc{boy}(x)) \wedge \delta([y] \wedge \mathbf{one}(y) \wedge \textsc{book}(y) \wedge \mathbf{max}^z(\mathbf{one}(z) \wedge \textsc{girl}(z)) \wedge \delta([e] \wedge e = 1 \wedge \textsc{give}(e) \wedge \textsc{ag}(e) = x \wedge \textsc{th}(e) = y \wedge \textsc{gl}(e) = z) \wedge y > 1)$

(84)

H	x	y	z	e
h_1	boy_1	$book_1$	$girl_1$	$give_1$
h_2	boy_1	$book_1$	$girl_2$	$give_2$
h_3	boy_2	$book_2$	$girl_1$	$give_3$
h_4	boy_2	$book_2$	$girl_2$	$give_4$

Argument 4: In ASL, a dependent indefinite must be signed in spatial proximity with the expression it covaries with.

(85) EACH-EACH-**a** PROFESSOR NOMINATE ONE-redup-**a** STUDENT
‘Each professor nominated one$_{dep}$ student’ (Kuhn, 2015, ex. 56)

- Crucially, the same spatial strategy strategy is used in a variety of anaphoric phenomena in ASL.

(86) JOHN-**a** TELL BILL-b IX-**a** WILL WIN.
a. John told Bill that John will win.
b. #John told Bill that Bill will win.

- As for as I understand, there is still some debate in the literature about whether to interpret loci as varibles in ASL or morphosynactic features, like gender, which guide the resolution of anaphora even if not determining it.
- Nevertheless, it really looks like dependent indefinites in ASL are “talking about” the expression they depend on—whether or not we can eventually identify the relevant loci with Farkas’s domain variables.

This is a pretty convincing argument that dependent indefinites share something with more straightforward cases of anaphora, even if it is not, at this point, a direct morphological confirmation of the dependent variable account.

4 Dependent indefinites as distributive quantifiers

In focusing on Farkas’s domain variable account, the discussion has necessarily centered on the question of whether we need an anaphoric theory of dependent indefinites. There are other ways, though, that previous authors treat dependent indefinites

- In particular, many authors treat dependent indefinites as contributing the distributive force themselves—e.g, Balusu 2006; Cable 2014; Kuhn 2015

The biggest obstacle for these theories is always how they interact with higher-scoping distributive operators.

- When a dependent indefinite to take scope under a distributive operator, accounts of this kind often incorrectly predict ungrammaticality or fail to predict the actual attested readings.
- i.e., ‘Every girl read two-two books’ is predicted to be grammatical, only if the language allows the implicit covartion, and only then if each girl participates in multiple reading events with pairs of books covarying across events.
- Instead, we want girls to covary with books, just like in a sentence with no such operator—e.g., ‘The girls read two-two books’

An example of a theory with this problem is that in Cable 2014. Below I’ve given the translation of his dependent indefinite-deriving morpheme.

(87) $\lambda n \lambda Q \lambda P \lambda x \lambda e \exists x[Q(x) \wedge P(e) \wedge \textsc{theme}(e,x) \wedge \langle e,x \rangle = \sigma \langle e',y \rangle .y < x \wedge |y| = n \wedge e' < e \wedge \textsc{participant}(e',y)]$

Thus, the VP for a sentence like, ‘Every girl read two-two books’ is:

(88) $\lambda e \exists x[\textsc{book}(x) \wedge \textsc{read}(e) \wedge \textsc{th}(e,x) \wedge \langle e,x \rangle = \sigma \langle e',y \rangle .y < x \wedge |y| = 2 \wedge e' < e \wedge \textsc{participant}(e',y)]$

‘true of reading events e if there are some books x that are the theme of e and x is the proper sum of doubles of things that took part in subevents of e.

But now if ‘Every girl’ takes scope over the VP, like we would want (since the sentence is question is paraphrasable with ‘Every girl read two books’ under the narrow scope reading of the indefinite), things go wrong.

- In particular, note that each girl must now participate in a reading event that has subevents in which at least 3 books participate overall and each subevent has 2 books as a participant.

(89) $\forall z[\textsc{girl}(z) \rightarrow \exists e \exists x[\textsc{book}(x) \wedge \textsc{read}(e) \wedge \textsc{th}(e,x) \wedge \textsc{ag}(e,z) \wedge \langle e,x \rangle = \sigma \langle e',y \rangle .y < x \wedge |y| = 2 \wedge e' < e \wedge \textsc{participant}(e',y)]$

‘For every girl there is a reading event reading event e that she is the agent of and there are some books x that are the theme of e and x is the proper sum of doubles of things that took part in subevents of e.

- This is not the standard reading of dependent indefinites in which pairs of books covary with girls, not with respect to *each* girl.

I point out this problem because it makes the prediction that dependent indefinites that are themselves distributive quantifiers should be ungrammatical with a higher scoping distributive quantifier in languages that don’t allow implicit licensing.

- This is the case for English binomial *each*, and a nice argument that may be quantificational in ways other dependent indefinites are not.
- Other dependent indefinites, like Hungarian dependent numerals or Russian dependent existentials are special precisely because they *must* be interpreted in the scope of a distributive operator.
- I think this is a clear opposition point that can help distinguish different kinds of co-distributive operators.

(90) a. *Each student read a book each.
b. *Every student read a book each.
c. ?All the students read a book each.

While some quantificational theories of dependent indefinites have trouble with high scoping distributives—namely those that do not have an anaphoric component—those that treat dependent indefinites as both anaphoric and non-trivially quantificational can handle these data.

- Kuhn 2015 provides an example of a theory like this.
- Basically, if a dependent indefinite is anaphoric to a variable over which it quantifies, establishing covariation, then the dependent indefinite can occur outside the scope of a second distributive quantifier over that variable it anaphorically retrieves.
- Schematically: $[y] \wedge \delta^x(\ldots x \ldots y \ldots) \wedge \text{dependent}_x^y$

Kuhn 2015 provides one very strong argument in favor of this kind of richer theory in which dependent indefinites are also quantificational.

Argument 5: A conjunction of a plain indefinite and a dependent indefinite can get a mixed cumulative / distributive reading.

(91) *A diákok két elöételt és egy-egy föételt rendeltek.*
the student two appetizers and one-one main.dish ordered
'The students ordered two appetizers in total, and one main dish each'

The problem is that in theories like Henderson 2014 and Farkas 2015, the kind of operators that license dependent indefinites anti-license cumulative readings of plain indefinites.

- For instance, inserting a covert distributivity operator over the VP in (91) to make the dependent existential licit, would simultanously block a cumulative reading and require each student to order two appetizers.
- Instead, in a theory where dependent indefinites are themselves distributive quantifiers, entrees can be forced to co-vary with respect to students by the dependent existential itself, while 'two appetizers' is interpeted cumulatively.

This is a hard agrument to address. I think it would be possible to deal with it, but only by changing the architecture of in the background of Henderson 2014 so that cumulative readings of plain indefinites are generated in a different way.

- That said, I think examples of this form might be trouble for everyone.
- I don't know this to be the case, but I strongly suspect examples like (92) with an overt distributive quantifier taking scope over the plain indefinite are good.

(92) **pseudo-Hungarian**: Every student two appetizers and one-one entree ordered.
'Every student ordered two appetizers a piece and one entree each.'

- But in Kuhn 2015, ex. 189, dependent indefinites must not take scope under a distributive quantifier on pain of ungrammaticality.
- If the dependent indefinite is forced to scope with its plain indefinite conjunct, example like (92) should be ungrammatical.
- Thus, these examples with mixed indefinites might cause problems for everyone, though in different ways.
- The problem for theories that take dependent indefinites to themselves be distributive operators would flow from the familiar source—such theories often have trouble when the dependent indefinite is forced to interact with another distributive operators.

5 Conclusions

I have presented the account of dependent indefinites in Henderson 2014 in which indefinites are only different from plain indefinites in that they require their variable be evaluation plural (in the output) as opposed to singular.

- This kind of theory makes clear the connection between dependent indefinites and plurality, as well as their relation to narrow scope (covarying) plain indefinites.

I contrasted this theory with those that treat dependent indefinites as diverging greatly from plain indefinites in other ways:

- Dependent indefinites are anaphoric to variable against which they covary
- Dependent indefinites express non-trivial distributive quantification over a variable they are anaphoric to

I have presented five arguments in favor of these anaphoric / quantificational theories:

- Three do not decided between them.
- One is probably a jump ball.
- One is probably a strong argument in favor of an anaphoric theory, depending on how we can intepret loci in ASL.

I think what we most need is a better typological picture of dependent indefinites.

- If we find lots of different kinds of dependent indefinites, each of which differ minimally from those others in seemingly independent ways, then we want a richer theory with more parameters to fine tune.
- If we find only a few kinds of dependent indefinites, then we might prefer a more monolithic theory like that in Henderson 2014

A DPlL with post-suppositions and domain pluralities

We work with standard models $\mathfrak{M} = \langle \mathfrak{D}_e, \mathfrak{D}_\epsilon, \mathfrak{I} \rangle$, where $\mathfrak{D}_e$ is the domain of individuals, $\mathfrak{D}_\epsilon$ is the domain of events, and $\mathfrak{I}$ is the basic interpretation function assigning n-ary relations of type $\tau_1, \ldots, \tau_n$ a subset of $\mathfrak{D}_{\tau_1} \times \ldots \times \mathfrak{D}_{\tau_n}$.

The domain of individuals $\mathfrak{D}_e$ is the powerset of a designated set of individuals IN minus the empty set $\wp^+(\mathsf{IN}) = \wp(\mathsf{IN}) \setminus \emptyset$. Similarly, the domain of events $\mathfrak{D}_\epsilon$ is the powerset of a designated set of events EV minus the empty set $\wp^+(\mathsf{EV}) = \wp(\mathsf{EV}) \setminus \emptyset$. The 'part of' relation $\leq$ over individuals or events is set inclusion over $\wp^+(\mathsf{IN})$ or $\wp^+(\mathsf{EV})$. The sum operation $\oplus$ is set union over $\wp^+(\mathsf{IN})$ or $\wp^+(\mathsf{EV})$. Singleton sets in $\wp^+(\mathsf{IN})$ and $\wp^+(\mathsf{EV})$ are picked out by the predicate **atom**.

$\mathfrak{M}$-assignments are sets of total functions from variables of type τ to elements of $\mathfrak{D}_\tau$. $\mathfrak{M}$-interpretations are defined for post-suppositional DPlL as follows, where ζ and ζ' in $[\![\cdot]\!]^{G[\zeta],H[\zeta']}$ are sets of formulas.

(93) $G[x]H := \begin{cases} \text{for all } g \in G \text{, there is a } h \in H \text{ such that } g[x]h \\ \text{for all } h \in H \text{, there is a } g \in G \text{ such that } g[x]h \end{cases}$, where
$g[x]h$ iff for any variable v, if $v \neq x$, then $g(v) = h(v)$

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

(95) $|\cdot|$ is the cardinality of a set

(96) $\mathbf{atoms}_G(x) := \{y : \mathbf{atom}(y) \wedge y \leq \bigoplus G(x)\}$

(97) $\mathbf{parts}_G(x) := \begin{cases} G(x) & \text{if } |G(x)| > 1, \text{ else} \\ \mathbf{atoms}_G(x) \end{cases}$

(98) 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 $\zeta = \zeta'$

(99) $[\![R(x_1, \ldots, x_n)]\!]^{\langle G[\zeta],H[\zeta']\rangle} = \mathbb{T}$ iff $G = H$, $\zeta = \zeta'$ and $\forall h \in H$, $\langle h(x_1), \ldots, h(x_n)\rangle = \mathfrak{I}(R)$

(100) $[\![x = n]\!]^{\langle G[\zeta],H[\zeta']\rangle} = \mathbb{T}$ iff $G = H, \zeta = \zeta'$ and $|H(x)| = n$

(101) $[\![x > n]\!]^{\langle G[\zeta],H[\zeta']\rangle} = \mathbb{T}$ iff $G = H, \zeta = \zeta'$ and $|H(x)| > n$

(102) $[\![\mathbf{one}(x)]\!]^{\langle G,H\rangle} = \mathbb{T}$ iff $G = H$ and for all $h \in H$,
$|\{x' : x' \leq h(x) \wedge \mathbf{atom}(x')\}| = 1$

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

(104) $[\![\mathbf{r\text{-}part}(x, y)]\!]^{\langle G[\zeta],H[\zeta']\rangle} = \mathbb{T}$ iff $G = H, \zeta = \zeta'$ and $x \in \mathbf{parts}_G(y)$

(105) $[\![\phi \wedge \psi]\!]^{\langle G[\zeta],H[\zeta']\rangle} = \mathbb{T}$ iff there is a K and ζ'' such that $[\![\phi]\!]^{\langle G[\zeta],K[\zeta'']\rangle} = \mathbb{T}$ and $[\![\psi]\!]^{\langle K[\zeta''],H[\zeta']\rangle} = \mathbb{T}$

(106) $[\![\phi \vee \psi]\!]^{\langle G[\zeta],H[\zeta']\rangle} = \mathbb{T}$ iff $G = H$, $\zeta = \zeta'$ and there is a K and ζ'' such that $[\![\phi]\!]^{\langle G[\zeta],K[\zeta'']\rangle} = \mathbb{T}$ or $[\![\psi]\!]^{\langle G[\zeta],K[\zeta'']\rangle} = \mathbb{T}$

(107) $[\![[x]]\!]^{\langle G[\zeta],H[\zeta']\rangle} = \mathbb{T}$ iff $G[x]H$ and $\zeta = \zeta'$

(108) $[\![\mathbf{max}^x(\phi)]\!]^{\langle G[\zeta],H[\zeta']\rangle} = \mathbb{T}$ iff $[\![[x] \wedge \phi]\!]^{\langle G[\zeta],H[\zeta']\rangle} = \mathbb{T}$ and

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

(109) $[\![\mathbf{max}^{x,y}(\phi)]\!]^{\langle G[\zeta],H[\zeta']\rangle} = \mathbb{T}$ iff $[\![[x] \wedge [y] \wedge \phi]\!]^{\langle G[\zeta],H[\zeta']\rangle} = \mathbb{T}$ and

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

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

(111) $[\![\delta(\phi)]\!]^{\langle G[\zeta],H[\zeta']\rangle} = \mathbb{T}$ iff $\zeta = \zeta'$ and there exists a partial function $\mathcal{F}$ from assignments to sets of assignments such that

a. $G = \mathbf{Dom}(\mathcal{F})$ and $H = \bigcup \mathbf{Ran}(\mathcal{F})$

b. there is a possibly empty set of tests $\{\psi_i, \ldots, \psi_n\}$ such that for all $g \in G$, $[\![\phi]\!]^{\langle \{g\}[\zeta],\mathcal{F}(g)[\zeta \cup \psi_i,\ldots,\psi_n]\rangle} = \mathbb{T}$ and $[\![\psi_1, \ldots, \psi_n]\!]^{\langle H[\zeta],H[\zeta]\rangle} = \mathbb{T}$

(112) 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 $[\![\psi_1 \wedge \ldots \wedge \psi_m]\!]^{\langle H[\emptyset],H[\emptyset]\rangle} = \mathbb{T}$.

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