Deictic and Sentence-Internal Readings of *Same / Different* as Anaphora: A Unified Compositional Account

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Abstract

The paper proposes the first unified account of deictic and sentence-internal readings of *same/different*. The analysis is executed in a stack-based dynamic system and it is fully compositional because the system is couched in classical type logic. The main proposal is that distributive quantification temporarily makes available two discourse referents within its nuclear scope, the values of which are required by sentence-internal uses of *same/different* to be identical/distinct – much as their deictic uses require the values of two discourse referents to be identical/distinct. The system is independently motivated by quantificational subordination, the availability of both dependent and independent readings for anaphora in the scope of *each* and, finally, dependent indefinites in various languages. Thus, *same* and *different* provide further support for the idea that natural language quantification is a composite notion, to be analyzed in terms of discourse reference to dependencies that is multiply constrained by the various components that make up a quantifier.

1 Deictic and Sentence-Internal Readings of *Same/Different*

The goal of this paper is to provide a unified account of deictic / sentence-external and sentence-internal readings of *same / different*, exemplified in (1)/(2) and (3) respectively. These readings have been known to exist at least since Carlson (1987), but no unified account has been proposed (see Barker (2007) and Matushansky (2007) for recent discussions) despite the fact that, in language after language, if a lexical item can have sentence-internal readings, then it can also have sentence-external readings.[1]

(1) **a.** Mary recited *The Raven.* **b.** Then, Linus recited a different poem.
(deictic/sentence-external: different from *The Raven*)

(2) **a.** Mary recited *The Raven.* **b.** Then, every boy recited a different poem.
(deictic/sentence-external: different from *The Raven*)

(3) Every boy recited a different poem.
(sentence-internal: for any two boys *a* and *b*, *a*'s poem is different from *b*'s poem)

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[1] See the preliminary survey in Brasoveanu (2008). The cross-linguistic generalization seems to be the following: (*i*) if a language has a lexical item that can have sentence-internal readings under morphologically singular and semantically distributive quantifiers like *every/each boy*, then that item can also have sentence-external readings (e.g., the English *different* or the German *anders*); (*ii*) a language can have a lexical item that allows only for sentence-external readings, e.g., the English *other/another* or the French *autre*; (*iii*) a language can have a lexical item that can be used with morphologically plural DPs like *the boys* that have a distributive interpretation, but not with morphologically singular and semantically distributive quantifiers; when used with such plural distributive DPs, the item can have sentence-internal readings, e.g., the German *verschieden*. See also Beck (2000) for more discussion of German and Laca & Tasmowski (2003) for more discussion of French.

The interpretation of *different* in (1b)/(2b) is sentence external in the sense that it is anaphoric to a discourse referent (dref) introduced in the previous sentence (1a)/(2a). In (1)/(2), *different* relates two drefs and requires their values, i.e., the actual entities, to be distinct.

The sentence-internal reading in (3) seems to relate values of only one dref, introduced by the narrow-scope indefinite *a poem*. These values, i.e., the recited poems, covary with the values of the dref introduced by the universal quantifier *every boy* – and *different* requires the poems to be distinct relative to distinct boys.

Carlson (1987) proposes the following generalization about the distribution of sentence-internal readings of *same/different* in English: such readings are licensed by morphologically singular and semantically distributive quantifiers like *every boy* in (3) above or by distributively interpreted plurals DPs like *the boys* in (4) below. Sentence-internal readings are not licensed by singulars or collectively interpreted plural DPs, as (5) and (6) below show.

(4) The boys recited different poems. (Carlson 1987)

(5) #Mary recited a different poem.

(6) #The boys gathered around different fires.[2]

In this paper, we focus on sentence-external readings and sentence-internal readings under morphologically singular and semantically distributive quantifiers like *every boy*, since these are the readings that are cross-linguistically realized by the same lexical item.

The main proposal is that distributive quantification temporarily makes available two drefs within its nuclear scope, the values of which are required by sentence-internal uses of *same* / *different* to be identical / distinct, much as their deictic uses require the values of two drefs to be identical / distinct. The analysis is formalized in a stack-based version of Plural Compositional DRT (PCDRT, Brasoveanu 2007).

The more general project that the present investigation is a part of can be characterized as *decomposing quantification*: *same* / *different* provide further support for the idea that natural language quantification is a composite notion (see Brasoveanu (2007) and references therein), to be analyzed in terms of discourse reference to dependencies that is multiply constrained by the various components that make up a quantifier.

2 Sentence-External Readings as Cross-Sentential Anaphora

Deictic / sentence-external readings are just an instance of cross-sentential anaphora, of the same kind as the typical discourse in (7) below.

(7) **a.** A^{u_0} man came in. **b.** He$_{u_0}$ sat down.

This discourse is straightforwardly analyzed in DRT (Kamp 1981) / FCS (Heim 1982) / DPL (Groenendijk & Stokhof 1991). The indefinite in sentence (7a) introduces a dref u_0, which is symbolized by the superscript on the indefinite article. This dref is then retrieved by the pronoun in (7b), which is symbolized by the subscript on the anaphoric pronoun. Discourse (7) as a whole is represented by the two Discourse Representation Structures (DRSs), a.k.a. (linearized) boxes, in (8) below. DRSs are pairs of the form [**new drefs** | **conditions**], the first member of which consists of the newly introduced drefs, while the second member consists of the conditions that the previously introduced drefs have to satisfy.

(8) $[u_0 \mid man\{u_0\}, come\_in\{u_0\}];\ [sit\_down\{u_0\}]$

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[2] The sentence-internal reading is available if *the boys* denotes a set of groups of boys – and each group gathered around a different fire. Such group-level distributivity is basically the same as individual-level distributivity, modulo the fact that it licenses collective predicates like *gather*. This reading will not be discussed in the paper.

The first DRS in (8) is contributed by sentence (7a): we introduce a new dref u_0 and require its value to be a man that came in. The second DRS, contributed by sentence (7b), does not introduce any new drefs (the first member of the pair is empty, so we omit it) – it just further constrains the previously introduced dref u_0 to store an individual that sat down. The two DRSs are dynamically conjoined, symbolized by ";". Dynamic conjunction ensures that the anaphoric information contributed by the first DRS (i.e., the fact that u_0 stores a man that came in) is available to the second DRS.

The analysis of deictic / sentence-external readings follows the same general format.

(9) **a.** Mary^{u_0} recited *The Raven*^{u_1}. **b.** Then, every^{u_2} boy recited a^{u_3} different$_{u_1,u_3}$ poem.

The proper name *The Raven* in (9a) introduces a new dref u_1 storing the poem *The Raven*. This dref is subsequently retrieved by the adjective *different* in (9b). *Different* constrains the value of the anaphorically retrieved dref u_1 in two ways. First, it requires u_1 to satisfy the conditions contributed by the nominal phrase following *different* – in this case, it requires u_1 to be a poem. To see this, replace the indefinite *a poem* in (9b) with the indefinite *a different passage of Scripture*: this yields an infelicitous discourse. This requirement is a presupposition, as shown by the standard S-tests for presupposition projection, e.g., the question *Did every boy recite a different passage of Scripture?* is also infelicitous in the context of sentence (9a). Secondly, *different* requires the value of the anaphorically retrieved dref u_1 to be distinct from the value of the dref contributed by the indefinite article that precedes *different* – in this case, u_3. This requirement is part of the asserted / at-issue content, as the S-tests also show. For example, consider the *different* under negation: *Mary recited* The Raven*, as she promised, but Linus didn't recite a different poem, despite what he promised* – we actually negate the requirement contributed by *different* that the poem Linus recited is distinct from *The Raven*.

The PCDRT representation that is compositionally assigned to discourse (9) is provided in (10) below. The **Appendix** provides all the formal details, including the meaning assigned to the adjective *different*. The $\mathbf{max}^{u_2}$ operator introduces the dref u_2 and requires it to store the (maximal) set of boys, i.e., the restrictor set of the quantifier *every*^{u_2} *boy*. The **dist** operator is discussed in the next section.

(10) $[u_0, u_1 \mid u_0 = mary, u_1 = the\_raven, recite\{u_0, u_1\}]$; $\mathbf{max}^{u_2}([boy\{u_2\}])$;
$\mathbf{dist}_{u_2}([u_3 \mid \mathbf{singleton}\{u_3\}, \mathbf{disjoint}\{u_1, u_3\}, poem\{u_3\}, recite\{u_2, u_3\}])$

3 Sentence-Internal Readings as Quantifier-Internal Anaphora

The main proposal of the paper is that sentence-internal readings of *same* / *different* are parallel to the sentence-external ones in that they also involve anaphora and relate two drefs, requiring their values to be identical (for *same*) or distinct (for *different*). Distributive quantifiers like *every*^{u_0} *boy* introduce a distributive operator $\mathbf{dist}_{u_0}$ relative to which the nuclear scope of the quantifier is evaluated, as shown in (11) below. The $\mathbf{dist}_{u_0}$ operator checks in a *distributive, pointwise* manner whether the restrictor set of the quantifier (stored in the dref u_0) satisfies the nuclear scope of the quantification.

(11) Every^{u_0} boy $\mathbf{dist}_{u_0}$(recited a^{u_1} different$^{+2}_{u_0,u_1}$ poem).

This pointwise, distributive update proceeds as shown in (12) below. First, the quantifier *every boy*^{u_0} introduces a new dref u_0 that stores the restrictor set of the quantifier, i.e., the set of boys. Then, we temporarily introduce two new drefs, each storing one and only one boy in the restrictor set u_0; the two boys stored by the two drefs must be distinct. Then, we predicate the nuclear scope of the quantification of each temporary dref and simultaneously make all the necessary updates ('simultaneously' means something like 'simultaneous recursion' here). In particular, we associate each of the two boys with their corresponding u_1-poems.

The sentence-internal $\textit{different}^{+2}_{u_0,u_1}$ is anaphoric to the restrictor dref u_0 and is interpreted *in situ*, i.e., within the indefinite a^{u_1} … *poem*. $\textit{Different}^{+2}_{u_0,u_1}$ tests that the two u_0-boys that we are currently considering are distinct and, also, that their corresponding u_1-poems are distinct (*same* would check that the two u_0-boys are distinct and that their u_1-poems are identical).

The superscript $+2$ on *different* is the one that tells us where to look for the boys and their corresponding poems: the two boys are stored by the drefs u_0 and u_{0+2} (i.e., u_2); their corresponding poems are stored by the drefs u_1 and u_{1+2} (i.e., u_3). This is a consequence of the fact that the $*$ operator in (12) below concatenates 'boy-poem' sequences, for example:

$$\begin{array}{|c|c|}\multicolumn{1}{c}{u_0} & \multicolumn{1}{c}{u_1}\\\hline boy_1 & poem_1\\\hline\end{array} * \begin{array}{|c|c|}\multicolumn{1}{c}{u_0} & \multicolumn{1}{c}{u_1}\\\hline boy_2 & poem_2\\\hline\end{array} = \begin{array}{|c|c|c|c|}\multicolumn{1}{c}{u_0} & \multicolumn{1}{c}{u_1} & \multicolumn{1}{c}{u_2} & \multicolumn{1}{c}{u_3}\\\hline boy_1 & poem_1 & boy_2 & poem_2\\\hline\end{array}$$

The superscript on sentence-internal *different* is not arbitrary: it reflects how many drefs have been introduced prior to the occurrence of sentence-internal *different*. In our case, the superscript is $+2$ because we have previously introduced the two drefs u_0 and u_1. Thus, the superscript is basically the length of the sequence of individuals relative to which *different* is interpreted.[3] However, a more systematic theory of anaphora 'indexation' in stack-based PCDRT is a project I leave for future research (as Bittner (2007) argues, such a theory can and should be provided in stack-based dynamic systems).

The final step depicted in (12) is to repeat the above procedure for any two distinct boys stored in u_0, i.e., any two individuals in the restrictor set – and, then, to sum together all the updates thus obtained.

(12)
$$\emptyset \xrightarrow{\text{Every}^{u_0}\text{ boy}} \begin{array}{|c|}\multicolumn{1}{c}{u_0}\\\hline boy_1\\\hline boy_2\\\hline boy_3\\\hline\end{array} \xrightarrow{\mathbf{dist}_{u_0}(\text{recited a}^{u_1}\text{different}^{+2}_{u_0,u_1}\text{poem})}$$

$$\left\{\begin{array}{l}
\begin{array}{|c|c|}\multicolumn{1}{c}{u_0} & \multicolumn{1}{c}{u_1}\\\hline boy_1 & poem_1\\\hline\end{array} * \begin{array}{|c|c|}\multicolumn{1}{c}{u_0} & \multicolumn{1}{c}{u_1}\\\hline boy_2 & poem_2\\\hline\end{array} \;\& poem_1 \neq poem_2\\
\begin{array}{|c|c|}\multicolumn{1}{c}{u_0} & \multicolumn{1}{c}{u_1}\\\hline boy_1 & poem_1\\\hline\end{array} * \begin{array}{|c|c|}\multicolumn{1}{c}{u_0} & \multicolumn{1}{c}{u_1}\\\hline boy_3 & poem_3\\\hline\end{array} \;\& poem_1 \neq poem_3\\
\begin{array}{|c|c|}\multicolumn{1}{c}{u_0} & \multicolumn{1}{c}{u_1}\\\hline boy_2 & poem_2\\\hline\end{array} * \begin{array}{|c|c|}\multicolumn{1}{c}{u_0} & \multicolumn{1}{c}{u_1}\\\hline boy_1 & poem_1\\\hline\end{array} \;\& poem_2 \neq poem_1\\
\begin{array}{|c|c|}\multicolumn{1}{c}{u_0} & \multicolumn{1}{c}{u_1}\\\hline boy_2 & poem_2\\\hline\end{array} * \begin{array}{|c|c|}\multicolumn{1}{c}{u_0} & \multicolumn{1}{c}{u_1}\\\hline boy_3 & poem_3\\\hline\end{array} \;\& poem_2 \neq poem_3\\
\qquad\qquad\qquad\text{etc.}
\end{array}\right\} \xrightarrow{\text{sum all updates}} \begin{array}{|c|c|}\multicolumn{1}{c}{u_0} & \multicolumn{1}{c}{u_1}\\\hline boy_1 & poem_1\\\hline boy_2 & poem_2\\\hline boy_3 & poem_3\\\hline\end{array}
\quad
\begin{array}{c}\textbf{where}\\ boy_1\text{ recited }poem_1\\ boy_2\text{ recited }poem_2\\ boy_3\text{ recited }poem_3\\ \textbf{and}\\ poem_1 \neq poem_2\\ poem_1 \neq poem_3\\ poem_2 \neq poem_3\end{array}$$

The procedural flavor of the above informal description is largely just an expository device. The actual definition of the **dist** operator (provided in the **Appendix**) directly encodes the non-procedural, guiding intuition that sentence-internal readings of *same* / *different* provide a window into the internal structure of distributive quantification: distributivity does not merely involve selecting one individual at a time from the restrictor set and checking that the nuclear scope holds of this individual, but distributivity involves selecting *pairs* of distinct individuals and *simultaneously* evaluating the nuclear scope relative to each individual.

This is why *same* / *different* are licensed only in the nuclear scope of distributive quantifiers or distributively interpreted pluralities (as Carlson (1987) observes): the very process of distributively evaluating the nuclear scope temporarily constructs the same kind of contexts that license anaphoric, sentence-external readings. Thus, in a nutshell, the analysis is just this: sentence-internal readings are quantifier-internal / distributivity-internal anaphora.

The compositionally obtained PCDRT representation for the sentence-internal reading of *different* exemplified in (11) above is provided in (13) below. All the formal details can be found in the **Appendix**, including a meaning for sentence-internal *different* that includes as its main component the meaning for sentence-external *different* discussed in the previous section.

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[3] More precisely, the length of the initial sub-sequence up to and including the dref that is introduced by the indefinite DP that *different* is a part of.

Thus, we formally capture the cross-linguistic generalization that, if a language has a lexical item that can have sentence-internal readings under morphologically singular and semantically distributive quantifiers, then this item can also have sentence-external readings.

(13) $\mathbf{max}^{u_0}([\mathit{boy}\{u_0\}]);$
$\mathbf{dist}_{u_0}([u_1 \mid \mathbf{singleton}\{u_1\}, \mathbf{disjoint}\{u_{1+2}, u_1\}, \mathit{poem}\{u_1\}, \mathit{recite}\{u_0, u_1\}])$

4 Stacks, Plural Info States and Pair-based Distributivity

This section discusses the formalization of the three main features of the analysis and provides independent empirical motivation for them. These features are: (*i*) interpreting expressions relative to *sets* of variable assignments and not single assignments (the assignments are the rows storing boys and poems in (12) above; **dist** operators distribute over such sets of assignments); (*ii*) making multiple drefs simultaneously available by *concatenating* variable assignments (this is what happens when we 'simultaneously' consider multiple boys and their corresponding poems in the scope **dist** operators); (*iii*) finally, the fact that we distribute over *pairs* of individuals instead of single individuals.

These three features of the analysis are independently motivated by: (*i*) quantificational subordination, the PCDRT analysis of which also relies on sets of assignments (see Brasoveanu 2007); (*ii*) the availability of both dependent and independent anaphora in the scope of distributors like *each*, which Nouwen (2007) accounts for by means of variable assignment concatenation; (*iii*) the interpretation of dependent indefinites in languages like Hungarian and Romanian, discussed in Farkas (1997, 2007).

I will propose a novel analysis of dependent indefinites that crucially relies on the availability of two individuals in the scope of distributive quantifiers. This analysis will effectively equate dependent indefinites and 'possibly different' indefinites in English that always take narrow scope relative to a distributive quantifier, e.g. *Every boy recited a possibly different poem.* In the process, we will be able to define a notion of covariation that is the semantic counterpart of the syntactic notion of narrow scope.

4.1 Stacks

We work with stacks / sequences of individuals instead of total or partial variable assignments, following Bittner (2001, 2007), Nouwen (2003, 2007) and references therein, in particular Vermeulen (1993) and Dekker (1994). The main motivation for using stacks is that, when we introduce new drefs, we never override old drefs and, therefore, never lose previously introduced anaphoric information: we always add information to a stack and we do this in an orderly manner, based on the particular position in the stack that the update targets. One important consequence of this fact for our analysis is that we can easily define the notion of stack concatenation that is a crucial component of the **dist** operators we need.

We indicate the empty positions in a stack i by storing the dummy individual # there. The dummy individual # makes any lexical relation false, i.e., # is the universal falsifier.[4]

0	1	$\dots$	$n-1$	n	$n+1$	$\dots$
α_0	α_1	$\dots$	α_{n-1}	#	#	$\dots$

The length of a stack i, abbreviated $\mathbf{lng}(i)$, is provided by the 'leftmost' position in which the stack stores an individual different from the universal falsifier # – to which we need to add 1, because the first position in the stack is the 0-th position. An example of a stack of length 4 (that is, $\mathbf{lng}(i) = 4$) is provided in (15) below; the cells storing the universal falsifier # are

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[4] We ensure that any lexical relation R of arity n, i.e. of type $e^n t$, where $e^0 t := t$ and $e^{m+1} t := e(e^m t)$, yields falsity whenever # is one of its arguments by letting $R \subseteq (D_e^{\mathfrak{M}} \setminus \{\#\})^n$.

simply omitted. The positions in a stack can be indicated by either natural numbers or – as we will do from now on – drefs that have natural numbers as indices. Indices on drefs are essential: they indicate the stack position where the value of the dref is stored.

(14) **Abbreviation – stack length**[5]

$$\mathbf{lng}(i) := \begin{cases} 1 + \iota n.\ (i)_n \neq \# \wedge \forall n' > n((i)_{n'} = \#) & \text{if } \exists n((i)_n \neq \# \wedge \forall n' > n((i)_{n'} = \#)) \\ 0 & \text{if } \forall n((i)_n = \#) \\ \# & \text{otherwise} \end{cases}$$

(15) $\begin{array}{cccc} 0 & 1 & 2 & 3 \\ \hline \multicolumn{1}{|c|}{\alpha} & \multicolumn{1}{c|}{\beta} & \multicolumn{1}{c|}{\gamma} & \multicolumn{1}{c|}{\delta} \\ \hline \end{array}$ or, equivalently: $\begin{array}{cccc} u_0 & u_1 & u_2 & u_3 \\ \hline \multicolumn{1}{|c|}{\alpha} & \multicolumn{1}{c|}{\beta} & \multicolumn{1}{c|}{\gamma} & \multicolumn{1}{c|}{\delta} \\ \hline \end{array}$

4.2 Plural Information States

Just as in Dynamic Plural Logic (van den Berg 1996), information states $I, J, \ldots$ are modeled as *sets* of stacks $i_1, i_2, i_3, \ldots, j_1, j_2, j_3, \ldots$. Such *plural* info states can be represented as matrices with stacks (sequences) as rows, as shown below.

<table>
<tr><th>Info State I</th><th>u_0</th><th>u_1</th><th>u_2</th><th>$\ldots$</th></tr>
<tr><td>i_1</td><td>α_1 (i.e., $u_0 i_1$)</td><td>β_1 (i.e., $u_1 i_1$)</td><td>γ_1 (i.e., $u_2 i_1$)</td><td>$\ldots$</td></tr>
<tr><td>i_2</td><td>α_2 (i.e., $u_0 i_2$)</td><td>β_2 (i.e., $u_1 i_2$)</td><td>γ_2 (i.e., $u_2 i_2$)</td><td>$\ldots$</td></tr>
<tr><td>i_3</td><td>α_3 (i.e., $u_0 i_3$)</td><td>β_3 (i.e., $u_1 i_3$)</td><td>γ_3 (i.e., $u_2 i_3$)</td><td>$\ldots$</td></tr>
<tr><td>$\ldots$</td><td>$\ldots$</td><td>$\ldots$</td><td>$\ldots$</td><td>$\ldots$</td></tr>
<tr><td colspan="2">Quantifier domains (sets) are stored columnwise: $\{\alpha_1, \alpha_2, \ldots\}$, $\{\beta_1, \beta_2, \ldots\}$ etc.</td><td colspan="3">Quantifier dependencies (relations) are stored rowwise: $\{\langle\alpha_1, \beta_1\rangle, \langle\alpha_2, \beta_2\rangle, \ldots\}$, $\{\langle\alpha_1, \beta_1, \gamma_1\rangle, \langle\alpha_2, \beta_2, \gamma_2\rangle, \ldots\}$ etc.</td></tr>
</table>

Plural info states enable us to encode discourse reference to both quantifier domains, i.e. *values*, and quantificational dependencies, i.e. *structure*. The values are the sets of objects that are stored in the columns of the matrix, e.g., the dref u_0 stores a set of individuals $\{\alpha_1, \alpha_2, \alpha_3, \ldots\}$ relative to a plural info state because u_0 is assigned an individual by each stack/row. The structure is encoded in the rows of the matrix: for each stack/row i_1, i_2 etc. in the info state, the individual assigned to the dref u_0 (for example) by that stack is structurally correlated with the individual assigned to the dref u_1 (and/or u_2, and/or u_3 etc.) by the same stack.

From now on, we will use simpler representations for plural info states – we will only indicate the drefs and the stored individuals (omitting the universal falsifier), as exemplified below.

$$\begin{array}{|c|c|c|c|} \multicolumn{1}{c}{u_0} & \multicolumn{1}{c}{u_1} & \multicolumn{1}{c}{u_2} & \multicolumn{1}{c}{\ldots} \\ \hline \alpha_1 & \beta_1 & \gamma_1 & \ldots \\ \hline \alpha_2 & \beta_2 & \gamma_2 & \ldots \\ \hline \alpha_3 & \beta_3 & \gamma_3 & \ldots \\ \hline \ldots & \ldots & \ldots & \ldots \\ \hline \end{array}$$

4.3 Concatenating Stacks and Plural Info States

The stack and plural info state concatenation operations are defined in (19) and (20) below.

(16) **Projection functions over stacks**: $(i)_n$ is the individual stored at position n (a.k.a. u_n) in stack i.

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[5] The "otherwise" case covers stacks of infinite length, for example, the stack storing the universal falsifier # at all odd-number positions $1, 3, 5, \ldots$ and individuals different from # at the other positions.

(17) **Stack update**: $i[n]j$ (a.k.a. $i[u_n]j$) $:= \forall m < n((j)_m = (i)_m) \wedge \forall m > n((j)_m = (i)_{m-1})$
(j is the stack obtained by shifting all the i-individuals at positions greater than or equal to n by one position and introducing a new random individual at position n)[6]

(18) **Concatenating stacks and individuals** (based on Bittner 2007, Nouwen 2007):
$i * x \ := \ \iota j.\ i[\mathbf{lng}(i)]j \wedge (j)_{\mathbf{lng}(i)} = x$
($i * x$ is the stack obtained by appending the individual x at the end of stack i)

(19) **Concatenating stacks** (based on Nouwen 2007): $i * j \ := \ (i * (j)_0) * ... * (j)_{\mathbf{lng}(j)-1}$
($i * j$ is obtained by appending the first individual in stack j, namely $(j)_0$, at the end of stack i, then appending the second individual in j at the end of the resulting stack etc.)

(20) **Concatenating plural info states** (Nouwen 2007): $I * J \ := \ \{i * j : i \in I \wedge j \in J\}$

For example, we concatenate two stacks of length 2 to obtain a stack of length 4 – or two plural info states of length 2 to obtain a plural info state of length 4:

$$\begin{array}{|c|c|} \multicolumn{1}{c}{u_0} & \multicolumn{1}{c}{u_1} \\ \hline boy_1 & poem_1 \\ \hline \end{array} \ * \ \begin{array}{|c|c|} \multicolumn{1}{c}{u_0} & \multicolumn{1}{c}{u_1} \\ \hline boy_2 & poem_2 \\ \hline \end{array} \ = \ \begin{array}{|c|c|c|c|} \multicolumn{1}{c}{u_0} & \multicolumn{1}{c}{u_1} & \multicolumn{1}{c}{u_2} & \multicolumn{1}{c}{u_3} \\ \hline boy_1 & poem_1 & boy_2 & poem_2 \\ \hline \end{array}$$

$$\begin{array}{|c|c|} \multicolumn{1}{c}{u_0} & \multicolumn{1}{c}{u_1} \\ \hline boy_2 & poem_2 \\ \hline \end{array} \ * \ \begin{array}{|c|c|} \multicolumn{1}{c}{u_0} & \multicolumn{1}{c}{u_1} \\ \hline boy_1 & poem_1 \\ \hline boy_2 & poem_2 \\ \hline boy_3 & poem_3 \\ \hline \end{array} \ = \ \begin{array}{|c|c|c|c|} \multicolumn{1}{c}{u_0} & \multicolumn{1}{c}{u_1} & \multicolumn{1}{c}{u_2} & \multicolumn{1}{c}{u_3} \\ \hline boy_2 & poem_2 & boy_1 & poem_1 \\ \hline boy_2 & poem_2 & boy_2 & poem_2 \\ \hline boy_2 & poem_2 & boy_3 & poem_3 \\ \hline \end{array}$$

4.4 Independent Motivation for Plural Info States and Stacks

Both plural info states and stacks are independently motivated. We will discuss them in turn.

Brasoveanu (2007) argues that we need a semantics based on plural info states to account for quantificational subordination (among other things). Consider the example of quantificational subordination in (21) below (from Karttunen 1976). One of the interpretations of discourse (21) is that Harvey courts a different woman at every convention and, at each convention, the woman courted by Harvey at that convention comes with him to the banquet of the convention. The singular pronoun she_{u_0} and the adverb $always_{u_1}$ in sentence (21b) elaborate on the quantificational dependency between conventions and women introduced in sentence (21a).

(21) **a.** Harvey courts a^{u_0} woman at every^{u_1} convention. **b.** She$_{u_0}$ always$_{u_1}$ comes to the banquet with him. [**c.** The$_{u_0}$ woman is usually$_{u_1}$ also very pretty.]

Plural info states enable us to give a semantics for sentence (21a) that, as a result of the very process of interpreting sentence (21a): (*i*) introduces two quantifier domains (the conventions and the women) and a quantificational dependency between them (the 'being courted by Harvey' relation), (*ii*) stores the quantifier domains and quantificational dependency in a plural info state and, finally, (*iii*) passes on this info state to sentence (21b), which further elaborates on it.

Thus, we need plural info states not only for the quantifier-internal dynamics that licenses the sentence-internal readings of *same* / *different*, but also for the quantifier-external dynamics involved in quantificational subordination.

The example of cross-sentential anaphora to quantifier domains in (22) below (based on an example in Nouwen 2007) provides similarly independent motivation for the use of stacks and stack-concatenation operations. In sentence (22b), we can refer back to the narrow-scope indefinite *a*^{u_1} *poem*: (*i*) with the singular pronoun it_{u_1}, in which case (22b) says that each boy recited the poem he chose – that is, we elaborate on the quantificational dependency between boys and poems introduced in sentence (22a), or (*ii*) with the plural pronoun $them_{u_1}$, in which case (22b) says that each boy recited all the poems under consideration.

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[6] A stricter version is possible whereby you can update a position in a stack only if all the 'previous' positions have already been updated, i.e., none of them stores the universal falsifier #: $i[u_n]j \ := \ \forall m < n((j)_m = (i)_m \wedge (i)_m \neq \#) \wedge \forall m > n((j)_m = (i)_{m-1})$.

(22) **a.** Every^{u_0} boy chose a^{u_1} poem. **b.** Then, they$_{u_0}$ each$_{u_0}$ recited it$_{u_1}$ / them$_{u_1}$.

Thus, in the scope of the distributor each$_{u_0}$ in sentence (22b), we need to have access to both the dependency between boys and poems and the entire set of poems introduced in sentence (22a). Nouwen (2007) proposes to give a semantics for *each*$_{u_0}$ in terms of stack concatenation to account for the availability of both distributive / dependent and collective / independent anaphora in its scope. The update contributed by sentence (22a), schematically represented in (24) below, relates an input and an output plural info state. The input state is the singleton set containing the empty stack – this is the initial info state that stores no anaphoric information. The output state is a set of stacks that stores all the boys in its first column and their corresponding poems in the second column (the boy-poem dependency is stored stack-wise).

(23) $i_{\#} := \iota i.\ \mathbf{lng}(i) = 0$ (the empty stack)

(24) $$\{i_{\#}\} \xrightarrow{\text{Every}^{u_0}\text{ boy chose a}^{u_1}\text{ poem}} \begin{array}{|c|c|} \multicolumn{1}{c}{u_0} & \multicolumn{1}{c}{u_1} \\ \hline \mathit{boy}_1 & \mathit{poem}_1 \\ \hline \mathit{boy}_2 & \mathit{poem}_2 \\ \hline \mathit{boy}_3 & \mathit{poem}_3 \\ \hline \end{array} \begin{array}{l} \\ \mathit{boy}_1 \text{ chose } \mathit{poem}_1 \\ \mathit{boy}_2 \text{ chose } \mathit{poem}_2 \\ \mathit{boy}_3 \text{ chose } \mathit{poem}_3 \end{array}$$

The update contributed by sentence (22b) and, in particular, by the distributor *each*$_{u_0}$, further updates this output info state as shown in (25) below. First, we temporarily introduce each boy, one at a time, and his corresponding poem and concatenate this stack with the entire input stack. Then, we check that the update in the scope of *each*$_{u_0}$ holds relative to the resulting stacks of length 4, which can license both distributive / dependent anaphora (i.e., the singular pronoun) and collective / independent anaphora (i.e., the plural pronoun).

(25) $$\begin{array}{|c|c|} \multicolumn{1}{c}{u_0} & \multicolumn{1}{c}{u_1} \\ \hline \mathit{boy}_1 & \mathit{poem}_1 \\ \hline \mathit{boy}_2 & \mathit{poem}_2 \\ \hline \mathit{boy}_3 & \mathit{poem}_3 \\ \hline \end{array} \xrightarrow{\text{They}_{u_0}\text{ each}_{u_0}\text{ (recited it}_{u_1}\text{/them}^{+2}_{u_1}\text{)}} \left\{ \begin{array}{c} \begin{array}{|c|c|c|c|} \multicolumn{1}{c}{u_0} & \multicolumn{1}{c}{u_1} & \multicolumn{1}{c}{u_2} & \multicolumn{1}{c}{u_3} \\ \hline \mathit{boy}_1 & \mathit{poem}_1 & \mathit{boy}_1 & \mathit{poem}_1 \\ \hline \mathit{boy}_1 & \mathit{poem}_1 & \mathit{boy}_2 & \mathit{poem}_2 \\ \hline \mathit{boy}_1 & \mathit{poem}_1 & \mathit{boy}_3 & \mathit{poem}_3 \\ \hline \end{array} \\ \begin{array}{|c|c|c|c|} \multicolumn{1}{c}{u_0} & \multicolumn{1}{c}{u_1} & \multicolumn{1}{c}{u_2} & \multicolumn{1}{c}{u_3} \\ \hline \mathit{boy}_2 & \mathit{poem}_2 & \mathit{boy}_1 & \mathit{poem}_1 \\ \hline \mathit{boy}_2 & \mathit{poem}_2 & \mathit{boy}_2 & \mathit{poem}_2 \\ \hline \mathit{boy}_2 & \mathit{poem}_2 & \mathit{boy}_3 & \mathit{poem}_3 \\ \hline \end{array} \\ \begin{array}{|c|c|c|c|} \multicolumn{1}{c}{u_0} & \multicolumn{1}{c}{u_1} & \multicolumn{1}{c}{u_2} & \multicolumn{1}{c}{u_3} \\ \hline \mathit{boy}_3 & \mathit{poem}_3 & \mathit{boy}_1 & \mathit{poem}_1 \\ \hline \mathit{boy}_3 & \mathit{poem}_3 & \mathit{boy}_2 & \mathit{poem}_2 \\ \hline \mathit{boy}_3 & \mathit{poem}_3 & \mathit{boy}_3 & \mathit{poem}_3 \\ \hline \end{array} \end{array} \right\}$$

The plural pronoun *them*$^{+2}_{u_1}$ is marked as independent / collective by its superscript +2; this superscript indicates that the pronoun retrieves not the single u_1 poem currently under consideration, but all the poems, which are stored two positions to the right of u_1, i.e., by dref $u_{1+2} = u_3$. Just as in the case of sentence-internal *different*, the superscript on independent pronouns is not arbitrary: it depends on how many drefs have been previously introduced. In our case, the superscript is +2 because we introduced the two drefs u_0 and u_1 prior to the occurrence of the independent pronoun *them*.

The cross-sentential availability of multiple drefs in (22) is made possible by the fact that the distributor *each* temporarily introduces new drefs by (*i*) selecting a subset of stacks from a particular plural info state and (*ii*) concatenating this subset of stacks with another set of stacks. We use the same stack-concatenation technique to define the quantifier-internal distributive operator that we need to give a unified account of sentence-internal and sentence-external readings of *same* / *different*. Moreover, the stack-based PCDRT system defined in the **Appendix** goes beyond Nouwen (2007) and actually provides a *compositional* interpretation procedure that derives the intuitively correct meaning for discourse (22).

However, the stack-based PCDRT definition of **dist** operators – except for the fact that it makes use of Nouwen-style concatenation – builds on the notion of distributivity in van den Berg (1996) and Brasoveanu (2007) rather than on the one defined by Nouwen (2007) to capture the meaning of *each*. The difference is that the full input state is never available in the scope of **dist** operators. This is motivated by the fact that we cannot have collective / independent anaphora of the kind exemplified in (22) above in the scope of distributive quantifiers. This is shown by the fact that the sentence *Every lawyer hired a secretary they liked* cannot be interpreted as: each of the lawyers hired a secretary they all liked – at least, not in a discourse-initial position where there is no contextually-salient set of lawyers that the plural pronoun *they* could refer to.

4.5 Independent Motivation for Pair-based Distributivity: Dependent Indefinites, *Possibly Different* and the Nature of Covariation

The availability of two drefs in the scope of distributive quantification is independently motivated by the interpretation of dependent indefinites. Such indefinites were first discussed in Farkas (1997), where it was noted that the indefinite determiner and cardinal numerals in Hungarian may reduplicate, in which case the DP must be interpreted as covarying with an individual or event/situation variable bound by a quantifier within the same clause. Farkas (2007) shows that the same effect is obtained in Romanian by having the item *cîte* precede an indefinite or numeral, as exemplified in (26) below.

(26) *Fiecare*^{u_0} *băiat* *a* *recitat* *cîte*$^{+2}_{u_1}$ *un*^{u_1} *poem.*
Every boy HAS recited CÎTE a poem.
'Every boy recited a possibly different poem.'

The English translation captures the exact meaning of the Romanian particle *cîte*, which means the same thing as *possibly different*. That is, *cîte* requires covariation, which is the semantic counterpart of the syntactic notion of narrow scope. To see this, consider the Romanian example in (27) below. The particle *cîte* is licensed by the quantification over times contributed by *din cînd în cînd*^{u_0} (every now and then).

(27) *Din cînd în cînd*^{u_0}*, Linus scotea cîte o*^{u_1} *bilă din pungă,*
From when to when, Linus take.out.impf.3.sg CÎTE a marble out bag,
se uita la ea cu atenţie, după care o punea la loc.
REFL look.impf.3.sg at it with care, after which it put.impf.3.sg at place.
'Every now and then, Linus would take out a marble from the bag, look at it carefully, then put it back.'

Importantly, this example is felicitous and true in a situation in which there are several marbles in the bag that are indistinguishable from each other and in which it might very well be that Linus is taking the same marble out of the bag, over and over again. What is important for semantic covariation, hence, for the licensing of *cîte*, is that, every time he took out a marble, it *could* have been a marble that was different from any other particular time he took out a marble – not that it *actually was* a different marble every single time.

The contribution of Romanian *cîte* is the same as the contribution of the English *possibly different*: we rule out situations in which there is a single marble in the bag or in which we know that Linus took out the same marble over and over again, but we allow for situations in which Linus ends up taking out the same marble over and over again as long as, as far as we know, situations in which he takes out distinct marbles are also possible. Semantic covariation requires only that, on any two occasions, the two marbles could – as far as we know, i.e., as far as the common ground knowledge is concerned – be different, not that they actually are.

Thus, stack-based PCDRT provides a framework in which we can define the notion of covariation, i.e., the semantic counterpart of the syntactic notion of narrow scope – while classical (first-order) semantics can only distinguish between lack of covariation and actual covariation, but cannot express the *possibility* thereof. Consequently, stack-based PCDRT enables us to give a novel analysis of dependent indefinites in terms of *possibly different* – and, conversely, dependent indefinites provide independent motivation for the analysis of sentence-internal readings of *same* / *different* proposed in the present paper.

The compositionally derived PCDRT representation for example (26) above is provided in (28) below. Informally, the $\diamond$ operator expresses possibility and it requires the DRS in its scope to be satisfied relative to some common-ground world. I will not provide here the extension of stack-based PCDRT with modal quantification – see the very similar intensional ('total assignment' based) PCDRT in Brasoveanu (2007).

(28) $\mathbf{max}^{u_0}([\mathit{boy}\{u_0\}]);\ \mathbf{dist}_{u_0}([\diamond([u_1 \,|\, \mathbf{singleton}\{u_1\}, \mathit{poem}\{u_1\}, \mathit{recite}\{u_0, u_1\}, \mathbf{disjoint}\{u_{1+2}, u_1\}])];$
$[u_1 \,|\, \mathbf{singleton}\{u_1\}, \mathit{poem}\{u_1\}, \mathit{recite}\{u_0, u_1\}])$

The representation in (28) is very similar to the representation of sentence-internal readings in (13) above. Interestingly, sentence-internal readings are expressed in Romanian by means of the particle *cîte* together with the adjective *alt* (other), which is also used for sentence-external readings – as the examples in (29) and (30) below show. The addition of the adjective *alt* in (30) requires *actual* covariation (for any two boys, their corresponding poems have to be distinct), over and above the *possibility* of covariation that is required by the particle *cîte.*

(29)	**a.**	*Maria*	*a*	*recitat*	Corbul.	**b.**	*Apoi,*	*Linus*	*a*	*recitat*	*un*	*alt*	*poem.*
		Mary	HAS	recited	*Raven.the*		Then,	Linus	HAS	recited	a	other	poem

'Mary recited *The Raven.* Then, Linus recited another poem.'

(30)	*Fiecare*	*băiat*	*a*	*recitat*	*cîte*	*un*	*alt*	*poem.*
	Every	boy	HAS	recited	CÎTE	a	other	poem.

'Every boy recited a different poem.'

5 Extensions: Distributing over Times and Events

To conclude, I will only mention that the same kind of distributivity operators can be used to license sentence-internal readings of *same* / *different* in the scope of distributively interpreted pluralities of time intervals or events, exemplified by *Linus read different poems every day* and *Linus wrote and read the same poem* respectively. We only need to add two more basic types, one for temporal instants (in terms of which we can define temporal intervals) and one for events. We will then be able to distribute over a set of times or a set of events stored in a plural info state in much the same way as we distribute over a set of individuals.

Appendix. Stack-based Plural Compositional DRT (PCDRT)

Stack-based Dynamic Ty2

We work with a Dynamic Ty2 logic, i.e., basically, with the Logic of Change in Muskens (1996), which reformulates dynamic semantics (Kamp 1981, Heim 1982) in Gallin's Ty2 (Gallin 1975). We have three basic Types: (*i*) e (individuals, including the set of natural numbers $\mathbb{N}$) – variables: $x, y, ...$; constants: $\mathit{linus}, \mathit{gabby}, ...$; variables over natural numbers: $m, n, ...$, (*ii*) t (truth values) – $\mathbb{T}, \mathbb{F}$; (*iii*) s (stacks) – variables: $i, j, ...$ Four axioms ensure that the entities of type s behave as stacks.

(31) **Ax1** (stack identity in terms of projection functions): $\forall i_s \forall i'_s \forall n((i)_n = (i')_n \rightarrow i = i')$
Ax2 (stacks have finite length): $\forall i_s(\exists n(\mathbf{lng}(i) = n))$[7]
Ax3 (the empty stack exists): $\exists i_s(\mathbf{lng}(i) = 0)$
Ax4 (enough stacks): $\forall i_s \forall n \forall x_e(\exists j(i[n]j \wedge (j)_n = x))$

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[7] This is equivalent to $\forall i_s(\mathbf{lng}(i) \neq \#)$.

Stack-based PCDRT

Discourse referents (drefs) u_0, u_1 etc. of type se are just projection functions over stacks. Conditions are sets of info states, i.e., sets of sets of stacks (terms of type $(st)t$). DRSs are binary relations between info states / sets of stacks (i.e., terms of type $(st)((st)t)$).

(32) $u_n := \lambda i_s.\ (i)_n,\quad$ e.g., $u_0 := \lambda i.\ (i)_0,\ u_1 := \lambda i.\ (i)_1$ etc.

(33) $i[u_n]j := \forall m < n((j)_m = (i)_m) \wedge \forall m > n((j)_m = (i)_{m-1})$[8]

(34) $I[u_n]J := \forall i_s \in I(\exists j_s \in J(i[u_n]j)) \wedge \forall j_s \in J(\exists i_s \in I(i[u_n]j))$

(35) $I_{u_{m_1} \neq \#, \ldots, u_{m_n} \neq \#} := \{i_s \in I : u_{m_1} i \neq \# \wedge \ldots \wedge u_{m_n} i \neq \#\}$

(36) $R\{u_{m_1}, \ldots, u_{m_n}\} := \lambda I_{st}.\ I_{u_{m_1} \neq \#, \ldots, u_{m_n} \neq \#} \neq \emptyset \wedge \forall i_s \in I_{u_{m_1} \neq \#, \ldots, u_{m_n} \neq \#}(R(u_{m_1} i, \ldots, u_{m_n} i))$
(lexical relations, for any n-ary relation R of type $e^n t$, where $e^0 t := t$ and $e^{n+1} t := e(e^n t)$)

(37) $I_{u_n = x} := \{i_s \in I : u_n i = x\}$

(38) $I_{u_n \neq x} := \{i_s \in I : u_n i \neq x\}$

(39) $u_n I := \{u_n i : i_s \in I_{u_n \neq \#}\}$

(40) $u_n = x := \lambda I_{st}.\ u_n I = \{x\}$ (identity between drefs and individuals – needed for proper names)

(41) $u_n = u_m := \lambda I_{st}.\ I \neq \emptyset \wedge \forall i_s \in I(u_n i = u_m i)$ (identity between drefs)

(42) Atomic DRSs: $[C] := \lambda I_{st}.\lambda J_{st}.\ I = J \wedge CJ$

(43) Tests: $[C_1, \ldots, C_m] := \lambda I_{st}.\lambda J_{st}.\ I = J \wedge C_1 J \wedge\ \ldots\ \wedge C_m J$

(44) Dynamic conjunction: $D; D' := \lambda I_{st}.\lambda J_{st}.\ \exists H_{st}(DIH \wedge D'HJ)$

(45) Multiple dref introduction: $[u_{m_1}, \ldots, u_{m_n}] := [u_{m_1}];\ \ldots\ ; [u_{m_n}]$

(46) DRSs: $[u_{m_1}, \ldots, u_{m_n} \mid C_1, \ldots, C_m] := [u_{m_1}, \ldots, u_{m_n}]; [C_1, \ldots, C_m]$

(47) Truth: a DRS D of type $\mathbf{t}$ is *true* with respect to an input info state I_{st} iff $\exists J_{st}(DIJ)$.

Maximization and Distributivity

(48) $\mathbf{max}^{u_n}(D) := \lambda I_{st}.\lambda J_{st}.\ ([u_n]; D)IJ \wedge \forall K_{st}(([u_n]; D)IK \rightarrow u_n K \subseteq u_n J)$

(49) $\mathbf{each}_{u_n}(D) := \lambda I_{st}.\lambda J_{st}.\ u_n I = u_n J \wedge I_{u_n = \#} = J_{u_n = \#} \wedge \forall x_e \in u_n I(D(I_{u_n = x} * I)(J_{u_n = x} * I))$
(based on Nouwen 2007)

(50) $\mathbf{dist}_{u_n}(D) := \lambda I_{st}.\lambda J_{st}.\ u_n I = u_n J \wedge I_{u_n = \#} = J_{u_n = \#} \wedge (|u_n I| = 1 \rightarrow D I_{u_n \neq \#} J_{u_n \neq \#}) \wedge \forall x_e \in u_n I \forall x'_e \in$
$u_n I(x \neq x' \rightarrow D(I_{u_n = x} * J_{u_n = x'})(J_{u_n = x} * J_{u_n = x'}))$

Compositionality

Given the underlying type logic, compositionality at sub-clausal level follows automatically and standard techniques from Montague semantics become available. In more detail, the compositional aspect of interpretation in an extensional Fregean / Montagovian framework is largely determined by the types for the (extensions of the) 'saturated' expressions, i.e. names and sentences. Abbreviate them as $\mathbf{e}$ and $\mathbf{t}$. An extensional static logic identifies $\mathbf{e}$ with e and $\mathbf{t}$ with t. The translation of the English noun $\texttt{boy}$ is of type $\mathbf{et}$, i.e. et: $\texttt{boy} \rightsquigarrow \lambda x_e.\ boy_{et}(x)$. The generalized determiner $\texttt{every}$ is of type $(\mathbf{et})((\mathbf{et})\mathbf{t})$, i.e. $(et)((et)t)$: $\texttt{every} \rightsquigarrow \lambda S_{et}.\lambda S'_{et}.\ \forall x_e(S(x) \rightarrow S'(x))$. PCDRT assigns the following dynamic types to the 'meta-types' $\mathbf{e}$ and $\mathbf{t}$: $\mathbf{t}$ abbreviates $(st)((st)t)$, i.e. a sentence is interpreted as a DRS, and $\mathbf{e}$ abbreviates se, i.e. a name is interpreted as a dref. The denotation of the noun $\texttt{boy}$ is still of type $\mathbf{et}$, the determiner $\texttt{every}$ is still of type $(\mathbf{et})((\mathbf{et})\mathbf{t})$ etc.

Basic Translations

(51) $\texttt{boy} \rightsquigarrow \lambda v_{\mathbf{e}}.\ [boy_{et}\{v\}],\quad$ i.e. $\texttt{boy} \rightsquigarrow \lambda v_{\mathbf{e}}.\lambda I_{st}.\lambda J_{st}.\ I = J \wedge boy_{et}\{v\}J$

(52) $\texttt{recite} \rightsquigarrow \lambda Q_{(\mathbf{et})\mathbf{t}}.\lambda v_{\mathbf{e}}.\ Q(\lambda v'_{\mathbf{e}}.[recite\{v, v'\}])$

(53) $\texttt{each} \rightsquigarrow \lambda P_{\mathbf{et}}.\lambda v_{\mathbf{e}}.\ \mathbf{each}_v(P(v))$

(54) $\texttt{every}^{u_n} \rightsquigarrow \lambda P_{\mathbf{et}}.\lambda P'_{\mathbf{et}}.\ \max^{u_n}(P(u_n));\ \mathbf{dist}_{u_n}(P'(u_n))$

(55) $\mathbf{singleton}\{u_n\} := \lambda I_{st}.\ |u_n I| = 1$

(56) $\texttt{a}^{u_n} \rightsquigarrow \lambda P_{\mathbf{et}}.\lambda P'_{\mathbf{et}}.\ [u_n \mid \mathbf{singleton}\{u_n\}];\ P(u_n);\ P'(u_n)$

(57) $\texttt{it}_{u_n} \rightsquigarrow \lambda P_{\mathbf{et}}.\ [\mathbf{singleton}\{u_n\}];\ P(u_n)$

(58) independent pronouns: $\texttt{it}^{+m}_{u_n} \rightsquigarrow \lambda P_{\mathbf{et}}.\ [\mathbf{singleton}\{u_{n+m}\}];\ P(u_{n+m})$

(59) $u_n \neq \emptyset := \lambda I_{st}.\ u_n I \neq \emptyset$

(60) $\texttt{they}_{u_n} \rightsquigarrow \lambda P_{\mathbf{et}}.\ [u_n \neq \emptyset];\ P(u_n)$

(61) independent pronouns: $\texttt{they}^{+m}_{u_n} \rightsquigarrow \lambda P_{\mathbf{et}}.\ [u_{n+m} \neq \emptyset];\ P(u_{n+m})$

(62) $\texttt{Linus}^{u_n} \rightsquigarrow \lambda P_{\mathbf{et}}.\ [u_n \mid u_n = linus];\ P(u_n)\quad$ (where $linus_e$ is an individual constant of type e)

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[8] Or we can use the stronger version: $i[u_n]j := \forall m < n((j)_m = (i)_m \wedge (i)_m \neq \#) \wedge \forall m > n((j)_m = (i)_{m-1})$.

(63) $\mathbf{disjoint}\{u_n, u_{n'}\} := \lambda I_{st}.\ I \neq \emptyset \wedge u_n I \cap u_{n'} I = \emptyset$

(64) $\textsc{different}_{u_n, u_{n'}} := \lambda P_{\mathbf{et}}.\lambda v_{\mathbf{e}}.\ \underline{P(u_n)};\ [\mathbf{disjoint}\{u_n, u_{n'}\}];\ P(v)$ (presuppositions are underlined)

(65) sentence-external: $\texttt{\textit{different}}_{u_n, u_{n'}} \rightsquigarrow \textsc{different}_{u_n, u_{n'}}$

(66) sentence-internal: $\texttt{\textit{different}}^{+m}_{u_n, u_{n'}} \rightsquigarrow \lambda P_{\mathbf{et}}.\lambda v_{\mathbf{e}}.\ \underline{[\mathbf{disjoint}\{u_{n+m}, u_n\}]};\ \textsc{different}_{u_{n'+m}, u_{n'}}(P)(v)$

(67) $\mathbf{identical}\{u_n, u_{n'}\} := \lambda I_{st}.\ I \neq \emptyset \wedge u_n I = u_{n'} I$

(68) $\textsc{same}_{u_n, u_{n'}} := \lambda P_{\mathbf{et}}.\lambda v_{\mathbf{e}}.\ \underline{P(u_n)};\ [\mathbf{identical}\{u_n, u_{n'}\}];\ P(v)$

(69) sentence-external: $\texttt{\textit{same}}_{u_n, u_{n'}} \rightsquigarrow \textsc{same}_{u_n, u_{n'}}$

(70) sentence-internal: $\texttt{\textit{same}}^{+m}_{u_n, u_{n'}} \rightsquigarrow \lambda P_{\mathbf{et}}.\lambda v_{\mathbf{e}}.\ \underline{[\mathbf{disjoint}\{u_{n+m}, u_n\}]};\ \textsc{same}_{u_{n'+m}, u_{n'}}(P)(v)$

(71) $\texttt{\textit{cîte}}^{+m}_{u_n} \rightsquigarrow \lambda Q_{(\mathbf{et})\mathbf{t}}.\lambda R_{((\mathbf{et})\mathbf{t})(\mathbf{et})}.\lambda v_{\mathbf{e}}.\ [\diamond(R(Q)(v);\ [\mathbf{disjoint}\{u_{n+m}, u_n\}])];\ R(Q)(v)$

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