Varieties of Distributivity: *One by One* vs *Each*

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1. Introduction

Consider the contrast in interpretation between the examples in (1) and (2) below. While example (1) is compatible with events that unfold in very different ways, the addition of *one by one* in (2) constrains how the leaving events can proceed. Intuitively, *one by one* is an event modifier that targets a plural participant in the event. More precisely, it breaks the event down into temporally sequenced subevents and it distributes the plural participant over these subevents, as depicted in (3) below.

(1) The boys left.

(2) The boys left one by one.

(3)
$$\begin{array}{cccccccc} \mathbf{e} & = & \mathbf{e}_1 & \oplus & \mathbf{e}_2 & \oplus & \dots \\ & & \text{LEAVE}(\mathbf{e}_1) & & \text{LEAVE}(\mathbf{e}_2) & & \dots \\ & & \textbf{runtime}(\mathbf{e}_1) & \prec & \textbf{runtime}(\mathbf{e}_2) & \prec & \dots \\ \textit{the.boys} & = & \textit{boy}_1 & \oplus & \textit{boy}_2 & \oplus & \dots \\ & & \textbf{ag}(\mathbf{e}_1) = \textit{boy}_1 & & \textbf{ag}(\mathbf{e}_2) = \textit{boy}_2 & & \dots \end{array}$$

The present paper has two goals. The immediate goal, to which most of the paper is dedicated, is to investigate the constraints on the distribution and interpretation of *one by one* and give a compositional semantics for *one by one* that captures them. The larger goal is to motivate two routes to establishing distributive quantificational dependencies – exemplified by *each* and *one by one*, respectively.

The first route is based on the *decomposition* of the distributive quantification into sets of assignments, such that each *n*-tuple of quantificationally dependent entities is individually stored in a variable assignment. Quantifiers are interpreted relative to such sets of assignments and operate over them collectively – and not in a distributive, assignmentwise manner, as classical Tarskian semantics would have it (van den Berg 1996, Nouwen 2003 and Brasoveanu 2007 among others). Consider, for example, the sets of boys and poems that are correlated by *each* in example (4) below (we are focusing exclusively on the narrow-scope indefinite reading).

(4) The boys each recited a poem.

(5)

G	$\dots$	x (boys)	y (poems)	$\dots$	
g_1	$\dots$	$\textit{boy}_1\ (= g_1(x))$	$\textit{poem}_1\ (= g_1(y))$	$\dots$	$\textit{boy}_1$ recited $\textit{poem}_1$
g_2	$\dots$	$\textit{boy}_2\ (= g_2(x))$	$\textit{poem}_2\ (= g_2(y))$	$\dots$	$\textit{boy}_2$ recited $\textit{poem}_2$
$\dots$	$\dots$	$\dots$	$\dots$		$\dots$

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The decompositional route to distributivity stores the correlated $\langle boy, poem\rangle$-pairs in a set of assignments G, as shown in matrix (5) above. The distributor *each* breaks the plural individual *the.boys* into atoms and stores every boy-atom in a variable assignment: boy_1 in g_1, boy_2 in g_2 etc. The remainder of the sentence is interpreted relative to each variable assignment: in each assignment, i.e., relative to each boy, we store a possibly different poem. The distributive quantification is decomposed in the sense that the dependency between boys and poems is stored in an assignmentwise fashion. Formally, this dependency is the binary relation over individuals $\{\langle g(x), g(y)\rangle : g \in G\}$.

The second route to distributivity is based on encapsulation into a function. Functions, e.g., Skolem functions, store quantificational dependencies as a whole, mapping each entity to the (possibly non-atomic) entity that depends on it (Stone 1999, Bittner and Trondhjem 2008 and Dekker 2008 among others). For example, *one by one* in (6) below associates each boy-atom with an event of reciting a poem and, thereby, induces a dependency between boys and the recited poems encapsulated in a function like f in (7) below. The dependency is encapsulated in the sense that it is stored in its entirety by a single assignment g.

(6) The boys recited a poem one by one.

(7)

	x (boys)	f (boy-poem dependency)
g	$the.boys$ $(= g(x))$	$\begin{bmatrix} boy_1 & \mapsto & poem_1 \\ boy_2 & \mapsto & poem_2 \\ & \dots & \end{bmatrix}$ $(= g(f))$

Both encapsulation and decomposition accounts enable us to capture cross-sentential anaphora to quantificational dependencies, exemplified for *one by one* in (8) below and for *each* in (9). We will not discuss this here, but see the references mentioned above for analyses of similar examples of quantificational subordination in both decompositional and encapsulation frameworks.

(8) a. One by one, the boys chose a book.

b. Then, one by one, they opened it and read out the title.

(9) a. The boys each chose a book.

b. Then, they each opened it and read out the title.

While cross-sentential anaphora to dependencies does not distinguish between these two routes to distributivity, sentence-internal readings of *different* do. Such internal readings are licensed only by *each* and not by *one by one*, as shown by the contrast between the available readings of the sentences in (10) and (11) below.

(10) The boys each recited a different poem.

(11) The boys recited a different poem one by one.

Both *each* and *one by one* are compatible with sentence-external readings of *different*. For example, if the sentences in (10) and (11) above follow the sentence *Mary recited 'The Raven'*, they both have a reading to the effect that every single boy recited a poem different from *'The Raven'*. This reading is sentence-external in the sense that the interpretation of *different* involves a referent from outside its own sentence – in this particular case, the poem recited by Mary (see Carlson 1987 for an early discussion of the readings of *different* and Barker 2007 and Brasoveanu 2008 and references therein for more recent accounts).

However, only *each* licenses sentence-internal *different*, i.e., only sentence (10) has a reading to the effect that, for any two boys *a* and *b*, the poem recited by *a* is different from the poem recited by *b*. This reading is sentence-internal in the sense that *different* relates distinct referents that are available within its own sentence – namely, the distinct values that the indefinite *a poem* takes when it is in the scope of the distributor *each*.

The contrast between decomposed and encapsulated distributivity enables us to account for the presence vs absence of sentence-internal readings of *different*. The distributivity contributed by *each* introduces a matrix like the one in (5) above and sentence-internal *different* is licensed because we are able to compare variable assignments in a pairwise way and require the distinctness of the two poems stored in those assignments (see Brasoveanu 2008 for more details). *One by one* does not license sentence-internal readings because the distributivity-based dependencies are encapsulated in only one variable assignment, as shown in (7) above, so comparison of referents across pairs of assignments is not possible.

Our core proposal is that *one by one* is an event modifier that encapsulates part of a θ-role function. Such θ-role functions map events to their participants – and *one by one* targets a θ-role function and structures it so that linearly ordered atomic subparts of the event are mapped onto atomic subparts of the plural participant introduced by the θ-function. Thus, *one by one* does not directly introduce the boy-poem function f in (7) above, but it indirectly induces such a function via event modification and the fact that it targets θ-role functions.

The paper is structured as follows. Section 2 discusses the distribution and interpretation of *one by one*. The analysis of *one by one* is provided in section 3. Finally, section 4 briefly discusses previous approaches.

2. The Distribution and Interpretation of *One by One*

Unless explicitly stated otherwise, the examples in this section are from the Corpus of Contemporary American English (COCA, `www.americancorpus.org`) – a large, balanced corpus of 385 million (M) words that includes 20M words each year from 1990-2008, divided among spoken, fiction, popular magazines, newspapers and academic texts (78.8M, 74.9M, 80.7M, 76.3M and 76.2M, respectively). There are 2774 tokens of *one by one* in COCA, i.e., approx. 7 tokens per 1M words (spoken 4/M, fiction 19.7/M, magazines 6.1/M, newspapers 4.3/M, academic 2.1/M).

The two main generalizations are that (*i*) *one by one* needs to target a nominal argument / adjunct and (*ii*) the nominal argument / adjunct has to be local – basically, in the same clause as the verbal predicate that *one by one* modifies. We examine each generalization in turn.

2.1. *Types of Nominal Targets*

The types of nominals that *one by one* can target are exemplified below.

(12) Subjects:

a. One by one, 63 North Koreans stepped through the heavily fortified border zone.

b. The sucker holes closed, one by one.

(13) Direct objects:

a. One by one, he eliminates the contestants.

b. I brought him my singers one by one.

(14) Prepositional phrases:

a. Joe came back for the boxes, one by one.

b. He waved forked fluorescent scanners over the vials one by one to catch anything in the solutions that didn't register chemically.

c. He was followed, one by one, by his companions.

However, there are restrictions on the kind of nominals that *one by one* can target. Consider, for example, the contrasts between the *load/spray* alternations below (these are constructed examples). The pattern seems to be that *one by one* is more acceptable when it targets direct objects as opposed to prepositional phrases (PPs).

(15) I loaded { ✓pumpkins onto the truck / ??the truck with pumpkins } one by one.

(16) I sprayed { ✓the walls with (a can of) paint / ??(a can of) paint onto the walls } one by one.

The felicity of the sentences with a PP target is influenced by the appositive vs non-appositive status of *one by one*: the clearer the intonational break that separates *one by one* from the remainder of the sentence, the more acceptable the sentence.[1] We

[1]This preliminary generalization should be systematically investigated by examining the full range of argument-alternation+*one-by-one* combinations for a variety of verbs that allow argument alternations. The constructed examples below provide the basic structure for such an investigation.

(1) a. Mary showed { the books to John / John the books / a book to the boys / the boys a book } one by one.

b. Mary loaded { the carts with hay / hay into the carts / pumpkins into the cart / the cart with pumpkins } one by one.

leave this problem open here and pursue a weak account that does not discriminate between the grammatical functions that the *one by one*-targeted nominals can have.

One by one targets a variety of arguments / adjuncts – but crucially, it must have a target. Out of 1000 occurrences in COCA that we examined closely, there is only one more or less felicitous example without a nominal target.

(17) [Inside an old factory building in Cambridge, Mass., a remarkable machine with the improbable name Zeus is hard at work. Flexing its two robotic arms, the computer-driven device reaches again and again into a storage area the size of a toddler's crib, where thousands of individual samples of genetic material sit in tiny wells etched into plastic plates, each one identified by a unique bar code.]
One by one, Zeus searches for a particular code, dips into the corresponding well with a fine, quill-like probe and picks up a minuscule droplet of liquid DNA.

(18) [Compare with:] Sample by sample, Zeus searches for a particular code.

Replacing *one by one* with *sample by sample*, as shown in (18) above, markedly improves the example. The contrast between *one by one* and *sample by sample* in (17-18) is not an isolated fact. The requirement to have a semantically-plural nominal target distinguishes *one by one* from other similar event modifiers, e.g., *brick by brick*, *simultaneously* or *consecutively* / *successively*, as the constructed examples below show.

(19) I tore the house down { ✓brick by brick / *one by one }.

(20) The city ordered the demolition to be done { ✓brick by brick / *one by one }.

(21) It got dark and it started to rain { ✓simultaneously / consecutively / successively / *one by one }.

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c. Mary cleared { the table of dishes / dishes from the table / the tables of spilled wine / spilled wine from the tables } one by one.

d. Mary sprayed { a can of paint on the walls / the walls with a can of paint / several cans of paint on the wall / the wall with several cans of paint } one by one.

e. Mary served { the quiche to the guests / the guests with the quiche / the quiches to Jane / Jane the quiches } one by one.

f. { Fireflies glowed in the field / The field glowed with fireflies / Music resounded in the halls / The halls resounded with music } one by one.

(22) The houses were not earthquake-proof, so the city ordered the demolition of the neighborhood $\left\{\begin{array}{l}\checkmark\text{house by house}\\ \text{*one by one}\end{array}\right\}$.

(23) John gathered stones for the new path and patiently built it $\left\{\begin{array}{l}\checkmark\text{stone by stone}\\ \text{*one by one}\end{array}\right\}$.

Like *consecutively / successively*, *one by one* imposes a linear order on a set of subevents. Like morphologically-similar *N by N* adjuncts, it specifies how the subevents are partitioned. It is distinct from these two classes of modifiers, though, in requiring a local, semantically-plural nominal target.

The examples in (22) and (23) above are particularly important because they show that *one by one* cannot be reduced to the use of *one* as an N-anaphor. Consider, for example, the felicitous use of N-anaphoric *one* in (24) below.

(24) I read a couple of statistics books last week and I read another one this week.

Under the N-anaphor analysis, *one by one* in (22) above should be as acceptable as *house by house*, since N-anaphora can be established across clausal boundaries (as (24) shows).

The idea that *one by one* cannot be reduced to *N by N* modification is also supported by the fact that the two constructions are morphologically distinct cross-linguistically. For example, the Romanian counterpart of *house by house* involves a preposition (*casă după casă*), while the counterpart of *one by one* involves the particle *cîte* (*una cîte una*), the same particle as the one used to mark dependent indefinites. Similar differences can be observed in other Romance languages.[2]

2.2. Locality of the Nominal Target

One by one does not require strict adjacency to its nominal target, as the examples in (12b) and (13a) above show. However, the nominal target has to be in the same clause as the event-contributing predicate that *one by one* modifies, as shown by the contrast between the examples in (25) (based on a COCA example) and (26) (constructed) below. These two sets of examples indicate that the position of *one by one* determines whether *one by one* modification is felicitous and, if it is, what interpretation it receives. In each example, the noun phrase targeted by *one by one* is italicized and the verbal predicate modified by *one by one* is given in small caps.

(25) a. When, **one by one**, *their units* were ACTIVATED, Mr. Lozano slowly realized that if war in the Persian Gulf came his family could be wiped out.

b. ***One by one**, when their units were activated, Mr. Lozano slowly realized that if war in the Persian Gulf came his family could be wiped out.

c. *When their units were activated, Mr. Lozano slowly realized that if war in the Persian Gulf came **one by one**, his family could be wiped out.

[2] We are indebted to Ivano Caponigro for discussion of this point.

d. When their units were activated, Mr. Lozano slowly realized that if war in the Persian Gulf came, *his family* could be WIPED OUT **one by one**.

(26) a. If *the students* ARRIVE **one by one**, tell them to come back when I can examine them.

b. If the students arrive, TELL *them* **one by one** to come back when I can examine them.

c. If the students arrive, tell them to *PRO* COME BACK **one by one** when I can examine them.

d. If the students arrive, tell them to come back when I can EXAMINE *them* **one by one**.

Another argument for the locality of *one by one* modification is that *one by one* can operate across multiple, conjoined predicates only when it syntactically scopes over them. This is shown by the contrast between the available readings for the minimal pairs of examples provided in (27) and (28) below.

(27) a. Over those busy decades, as **one by one** *our nestlings* FLEDGED and TOOK WING ... (✓fledge one by one)

b. Over those busy decades, as *our nestlings* fledged and **one by one** TOOK WING ... (*fledge one by one)

(28) a. It was sad that **one by one** *our nestlings* FLEDGED and TOOK WING. (✓take wing one by one)

b. It was sad that **one by one** *our nestlings* FLEDGED and that they took wing. (*take wing one by one)

Locality can be specified in syntactic terms, e.g., clause-boundedness, as we have done up until now, or it can be specified in semantic terms. For example, we could require semantic locality by saying that *one by one* needs to target a participant in the event it modifies. Since events can have a complex internal structure, e.g., *make regret* in the constructed example in (29) below has a causative structure, semantic locality predicts that *one by one* can target a participant in an embedded subevent even if the embedded subevent is syntactically non-local.

(29) One by one, I'm going to make Harvey regret all those lies he told.[3]

If causative structures like *make regret* are syntactically biclausal, then characterizing the locality of *one by one* in semantic rather than syntactic terms is more adequate. It may be necessary to examine the interpretation of *one by one* in languages that have independent diagnostics for monoclausality vs biclausality (e.g., clitic-climbing in Romance languages) to adjudicate between a syntactic vs a semantic formulation of this locality requirement. Pending such an investigation, we will continue to characterize the locality of *one by one* in syntactic terms for expository simplicity.

[3]We are indebted to Jorge Hankamer for this example.

Another factor that seems to influence the acceptability of biclausal structures is the information-structure status of the nominal target. For example, sentence (30) below is acceptable if the nominal target *every rank-and-file Democrat* is focused (marked by capitalization), but acceptability decreases if the subject is focused, as in sentence (31) below[4] (constructed).

(30) One by one, he has been trying to speak to EVERY RANK-AND-FILE DEMOCRAT.

(31) ??One by one, OBAMA (and not Clinton) has been trying to speak to every rank-and-file Democrat.

If the information-structure status of the nominal target is indeed relevant, it might be that the locality requirement contributed by *one by one* is best formulated in terms of the locality of the smallest focus-topic-background partitioning containing the verbal predicate targeted by *one by one*. We leave this question open here and turn to a more in-depth examination of the semantic constraints that *one by one* enforces on its nominal target.

2.3. The Internal Structure of the Nominal Target

One by one requires its nominal target to be semantically plural, but not necessarily morphologically plural. As the examples below show, *one by one* allows for a variety of morphologically-singular nominal targets if they can be construed as semantically plural.

(32) Group-denoting nouns:

a. His party gradually peeled off, one by one, on the approaches.

b. One by one that baffled, costumed crew slunk away into the shadows.

c. She said good-bye to her staff one by one.

(33) Conjoined NPs:

a. Jan dredged from a Safeway bag, one by one, a can of baby corn cobs, a tin of Norwegian sardines, and a glass jar crammed with tiny white cocktail onions.

b. In the next hour, a manager, a lawyer and three publicists will, one by one, approach Ms. Paltrow's table.

(34) Quantifiers headed by *every* / *each*:

a. One by one, every student present began to applaud.

b. Papa isn't saying anything and Mama is just looking at everyone, one by one, around and around, like she's waiting.

c. One by one, Pepe debunks every conceivable component of Don Inocencio's ideological convictions.

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[4] We are indebted to Sandy Chung for this observation and the example in (31).

d. The provost called each man in the company one by one to be interviewed.

e. One by one each tells his story of life around the King of Kings.

(35) Pseudo-partitives:

a. A squad of unknown terrorists walked one by one into several subway stations during the peak of rush hour Friday afternoon.

b. A big crowd of students stood in front of the door, waiting to be called in, one by one.

c. One by one, he dropped on the table a series of snapshots he had taken.

(36) Partitives, including partitives based on *most* / *each*:

a. Linguini watches – stunned – as, one by one, the rest of the staff exits.

b. Then, one by one, at several-minute intervals, each of us sets out on a solitary walk.

Summarizing, we extracted the following three generalizations about the distribution and interpretation of *one by one*: (*i*) *one by one* targets a nominal argument / adjunct, (*ii*) the nominal argument / adjunct has to be local, i.e., in the same clause as the verbal predicate that *one by one* modifies, and finally (*iii*) the nominal target needs to be semantically, but not morphologically, plural.

3. *One by One* Modification as θ-role Encapsulation

Syntactically, *one by one* is a verbal adjunct, as Jackendoff (2008) observes. Semantically, *one by one* is an event modifier that targets a plural participant in the event it modifies. The problem for a formal account that integrates these syntactic and semantic observations is that it is not immediately clear how to compositionally capture the fact that *one by one* simultaneously targets an event and an individual.

Our proposal is that *one by one* targets a θ-role function. Thus, the distributive dependencies introduced by *one by one* are the dependencies encapsulated in the targeted θ-role function. This proposal enables us to capture the nominal target constraint because θ-roles are not assigned when there is no overt argument (generalization (*i*) above). We are also able to capture locality, since θ-roles are clause-bounded (generalization (*ii*)). Finally, we will show how we account for cases with nominal targets that are morphologically singular, but semantically plural and distributive, e.g., nominals headed by *every* / *each* (generalization (*iii*)).

3.1. The Framework: Type Logic with Sum Individuals and Sum Events

We work with classical (many-sorted) type logic. The domain of truth-values D_t is $\{\mathbb{T}, \mathbb{F}\}$. Building on Link (1983), the domain of individuals D_e is the powerset of a designated set of entities IN minus the empty set $\wp^+(\mathsf{IN}) = \wp(\mathsf{IN}) \setminus \emptyset$. Variables of type e: $x, y \ldots$. Building on Lasersohn (1995), the domain of events D_ε is the powerset of a designated set of events EV minus the empty set $\wp^{+}(\mathsf{EV}) = \wp(\mathsf{EV}) \setminus \emptyset$. Variables of type ε: $\mathbf{e}, \mathbf{e}' \ldots$.

For any individual x_e and any event $\mathbf{e}_\varepsilon$ (subscripts on terms indicate their type), their cardinality is $|x|$ and $|\mathbf{e}|$. Atomic individuals and atomic events are the singleton sets in $\wp^{+}(\mathsf{IN})$ and $\wp^{+}(\mathsf{EV})$, identified by two predicates $\mathbf{atom}_{et}$ and $\mathbf{atom}_{\varepsilon t}$. 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 $\wp^{+}(\mathsf{EV})$.

(37) $\mathbf{atom}_{et} := \lambda x_e.\, |x| = 1$ and $\mathbf{atom}_{\varepsilon t} := \lambda \mathbf{e}_\varepsilon.\, |\mathbf{e}| = 1$

(38) $[\![x_e \leq y_e]\!] = \mathbb{T}$ iff $[\![x]\!] \subseteq [\![y]\!]$ and $[\![\mathbf{e}_\varepsilon \leq \mathbf{e}'_\varepsilon]\!] = \mathbb{T}$ iff $[\![\mathbf{e}]\!] \subseteq [\![\mathbf{e}']\!]$

(39) a. $[\![x_e \oplus y_e]\!] = [\![x]\!] \cup [\![y]\!]$ and $[\![\mathbf{e}_\varepsilon \oplus \mathbf{e}'_\varepsilon]\!] = [\![\mathbf{e}]\!] \cup [\![\mathbf{e}']\!]$

b. $[\![\oplus(X_{et})]\!] = \bigcup [\![X]\!]$ and $[\![\oplus(\mathbf{E}_{\varepsilon t})]\!] = \bigcup [\![\mathbf{E}]\!]$

We take θ-roles to be functions from events to individuals of type εe: **th** is the theme role, **ag** is the agent role etc. Arguments and adjuncts are event-property modifiers. They have translations of the form $\lambda \mathbf{E}_{\varepsilon t}.\lambda \mathbf{e}_\varepsilon.\, \mathbf{E}(\mathbf{e}) \wedge \ldots$ (of type $(\varepsilon t)(\varepsilon t)$).

We assume that arguments and adjuncts are syntactically indexed with their θ-roles and this indexation percolates up and down the tree. The θ-role indices of all nominal arguments and adjuncts are collected and are available at every phrasal node that is part of the lexical or functional layer projected by the main verb, as shown in (40) and (41) below. These θ-indices are not visible beyond the top functional projection of the verb. Hence, *one by one* modification is clause-bounded.

(40) One by one, $[_{\{\mathbf{ag},\mathbf{th}\}}$ the$^{\mathbf{ag}}$ boys $[_{\{\mathbf{ag},\mathbf{th}\}}$ recited 'The Raven'$^{\mathbf{th}}$ $_{VP}]$ $_{IP}]$

(41) Our$^{\mathbf{ag}}$ nestlings $[_{\{\mathbf{ag}\}}$ $[_{\{\mathbf{ag}\}}$fledged$]$ and $[_{\{\mathbf{ag}\}}$one by one $[_{\{\mathbf{ag}\}}$took wing$]]$ $_{VP}]$

But within the clause, *one by one* modification can be syntactically non-local. For example, *one by one* in (41) above is syntactically trapped in the second VP-conjunct, but it can still access the θ-role introduced by the subject.

We use θ-roles only for their argument-indexing function, without any commitment to the entailments traditionally associated with them. A more appropriate formalization (which, for expository simplicity, we don't pursue here) would make use of referent systems along the lines of Kracht (2002) (see also Krifka 1989).

3.2. *The Grammar of* One by One

On the syntactic side, we take *one by one* to be subject to the following constraint: *one by one* can target, i.e., can be indexed with, a θ-role only if its syntactic sister is also indexed with that θ-role. This is summarized in (42) below. Since *one by one* needs to target a θ-role, this constraint effectively requires its sister node to be indexed with at least one θ-role.

(42) one by one$_\theta$ $[_{\{\theta_1,\theta_2,\ldots\}}$ $\ldots$ $_{XP}]$, where $\theta \in \{\theta_1, \theta_2, \ldots\}$

On the semantic side, the meaning of *one by one* is of the form in (43) below.

(43) *one by one*$_\theta \rightsquigarrow \lambda\mathbf{E}_{\varepsilon t}.\lambda\mathbf{e}_\varepsilon.\ \mathbf{E}(\mathbf{e}) \wedge$
$\mathbf{linear.order}(\{\mathbf{e}' \leq \mathbf{e} : \mathbf{atom}(\mathbf{e}')\}) \wedge$
$|\{\theta(\mathbf{e}') : \mathbf{e}' \leq \mathbf{e} \wedge \mathbf{atom}(\mathbf{e}')\}| > 1 \wedge$
$\forall \mathbf{e}' \leq \mathbf{e}(\mathbf{atom}(\mathbf{e}') \rightarrow \mathbf{atom}(\theta(\mathbf{e}')))$

The last three conjuncts give the specific contribution of *one by one*. The first of these $\mathbf{linear.order}(\{\mathbf{e}' \leq \mathbf{e} : \mathbf{atom}(\mathbf{e}')\})$ requires the atomic subevents of the event **e** under discussion – and which *one by one* modifies – to be temporally sequenced.

The second conjunct $|\{\theta(\mathbf{e}') : \mathbf{e}' \leq \mathbf{e} \wedge \mathbf{atom}(\mathbf{e}')\}| > 1$ ensures that *one by one* targets only participants in the event **e** that are semantically plural. This requirement seems to be presuppositional in nature, but we make it part of the at-issue content for simplicity. In certain cases, *one by one* seems to require more than two participants rather than more than one, but examples with only two participants are attested – see (44) below, so we take this kind of strengthening to be pragmatic.

(44) She lifts her heels one by one and leaves him on the floor like a crumpled pair of pants.

The third conjunct $\forall \mathbf{e}' \leq \mathbf{e}(\mathbf{atom}(\mathbf{e}') \rightarrow \mathbf{atom}(\theta(\mathbf{e}')))$ ensures that each atomic subevent $\mathbf{e}'$ is mapped to an atomic individual by the function θ that *one by one* targets. If we change the numeral in the construction, e.g., *two by two*, *three by three* etc., this is the only conjunct that we need to modify. For example, *two by two* receives the same translation as the one in (43) above except that this last conjunct is $\forall \mathbf{e}' \leq \mathbf{e}(\mathbf{atom}(\mathbf{e}') \rightarrow \mathbf{2.atoms}(\theta(\mathbf{e}')))$, where $\mathbf{2.atoms}_{et} := \lambda x_e.\ |x| = 2$. That is, the number of θ-participants in each atomic subevent is two instead of one.

The atomicity requirements on the domain and range of the function θ encapsulated by *one by one*, i.e., $\mathbf{atom}(\mathbf{e}')$ and $\mathbf{atom}(\theta(\mathbf{e}'))$, account for the fact that *one by one* can target neither stative predicates like *know* nor mass nouns like *water*.

(45) *The students knew French one by one.

(46) *John drank water one by one.

States and mass nouns are similar in that they do not have atomic subparts. The atomicity requirements in (43) allow us to capture their unacceptability with *one by one* in a uniform way, based on their underlying commonality.

In sum, *one by one* targets a plural event and a plural participant in the event and contributes part of the dependency encapsulated in the θ-role function associated with the targeted participant: the part that relates the atomic subevents of the plural event **e** and the atomic individuals that the plural participant consists of. Formally, *one by one* contributes the function $\theta \upharpoonright \{\mathbf{e}' \leq \mathbf{e} : \mathbf{atom}(\mathbf{e}')\}$, i.e., the function θ restricted by the set of atoms that are part of the modified event **e**.

3.3. One vs Multiple Potential Targets for One by One

Consider the sentence in (47) below. In principle, *one by one* could be indexed with either the **ag** role or the **th** role here. However, the theme *'The Raven'* is singular and *one by one* requires the targeted participant to be plural. That is, the conjunct $|\{\mathbf{th}(\mathbf{e}') : \mathbf{e}' \leq \mathbf{e} \wedge \mathbf{atom}(\mathbf{e}')\}| > 1$ cannot be satisfied because the set of individuals $\{\mathbf{th}(\mathbf{e}') : \mathbf{e}' \leq \mathbf{e} \wedge \mathbf{atom}(\mathbf{e}')\}$ is the singleton set $\{\text{THE-RAVEN}\}$.

(47) The$^{\mathbf{ag}}$ boys recited 'The Raven'$^{\mathbf{th}}$ one by one$_{\mathbf{ag}}$.

Thus, although the indexation of *one by one* with the **th** role is syntactically possible, it is semantically ruled out. The only available reading for sentence (47) is derived based on the indexation with the **ag** role.

The neo-Davidsonian-style translations for the lexical items in (47) are provided below. Verbs like *recite* are properties of events. Nominals like *'The Raven'*$^{\mathbf{th}}$ are indexed with their θ-role and they make use of this θ-role function to further modify the property of events contributed by verbs. Definite descriptions contribute maximal sum individuals, following Link (1983). Plural nouns like *boys* contribute the cumulative closure * of their singular counterparts. For example, for any individual x, $^*\text{BOY}(x)$ is true iff $\text{BOY}(x)$ is true or there is some set of individuals X such that $X \subseteq \text{BOY}$ and $x = \oplus X$. Tense morphology contributes existential closure over the property of events that is the final result of semantic composition. If it's past tense morphology, the runtime of the event is located before the utterance time stored by the designated temporal variable $\mathbf{t}_{now}$.

(48) a. *recite* $\rightsquigarrow \lambda \mathbf{e}_{\varepsilon}.\ \text{RECITE}(\mathbf{e})$

b. *'The Raven'*$^{\mathbf{th}} \rightsquigarrow \lambda \mathbf{E}_{\varepsilon t}.\lambda \mathbf{e}_{\varepsilon}.\ \mathbf{E}(\mathbf{e}) \wedge \mathbf{th}(\mathbf{e}) = \text{THE-RAVEN}$

c. *the*$^{\mathbf{ag}} \rightsquigarrow \lambda X_{et}.\lambda \mathbf{E}_{\varepsilon t}.\lambda \mathbf{e}_{\varepsilon}.\ \mathbf{E}(\mathbf{e}) \wedge \mathbf{ag}(\mathbf{e}) = \sigma x.\ X(x)$

d. *boys* $\rightsquigarrow \lambda x_e.\ ^*\text{BOY}(x)$

e. *PAST* $\rightsquigarrow \lambda \mathbf{E}_{\varepsilon t}.\ \exists \mathbf{e}_{\varepsilon}(\mathbf{E}(\mathbf{e}) \wedge \mathbf{runtime}(\mathbf{e}) \prec \mathbf{t}_{now})$

The compositionally-derived translation for sentence (47) is provided in (49) below and the resulting interpretation is schematically depicted in (50).

(49)
$$\begin{array}{l}
\exists \mathbf{e}_{\varepsilon}(\text{RECITE}(\mathbf{e}) \wedge \mathbf{th}(\mathbf{e}) = \text{THE-RAVEN} \wedge \\
\mathbf{ag}(\mathbf{e}) = \sigma x.\ ^*\text{BOY}(x) \wedge \mathbf{runtime}(\mathbf{e}) \prec \mathbf{t}_{now} \wedge \\
\mathbf{linear.order}(\{\mathbf{e}' \leq \mathbf{e} : \mathbf{atom}(\mathbf{e}')\}) \wedge \\
|\{\mathbf{ag}(\mathbf{e}') : \mathbf{e}' \leq \mathbf{e} \wedge \mathbf{atom}(\mathbf{e}')\}| > 1 \wedge \\
\forall \mathbf{e}' \leq \mathbf{e}(\mathbf{atom}(\mathbf{e}') \rightarrow \mathbf{atom}(\mathbf{ag}(\mathbf{e}'))))
\end{array}$$

(50)
$$\begin{array}{ccccccc}
\mathbf{e} & = & \mathbf{e}_1 & \oplus & \mathbf{e}_2 & \oplus & \ldots \\
 & & \mathbf{atom}(\mathbf{e}_1) & & \mathbf{atom}(\mathbf{e}_2) & & \ldots \\
 & & \mathbf{runtime}(\mathbf{e}_1) & \prec & \mathbf{runtime}(\mathbf{e}_2) & \prec & \ldots \\
\textit{the.boys} & = & \textit{boy}_1 & \oplus & \textit{boy}_2 & \oplus & \ldots \\
 & & \mathbf{atom}(\textit{boy}_1) & & \mathbf{atom}(\textit{boy}_2) & & \ldots \\
 & & \mathbf{ag}(\mathbf{e}_1) = \textit{boy}_1 & & \mathbf{ag}(\mathbf{e}_2) = \textit{boy}_2 & & \ldots
\end{array}$$

The first four conjuncts in (49) (on the first two lines) say that there is a (plural) recitation event **e** whose theme is *'The Raven'*, whose agent is the maximal sum of (contextually-salient) boys and that took place in the past. The remaining three conjuncts are contributed by *one by one*. First, the atomic recitation events that are part of **e** are linearly ordered. Second, the set of agents of these atomic recitations is not a singleton, i.e., we are dealing with a plurality of agents. Third, each of these agents is an atomic individual. In other words, each boy was the agent of an atomic recitation event whose theme was *'The Raven'*.

In contrast to (47), sentence (51) below is ambiguous: *one by one* can target either the **ag** role or the **th** role because they are both associated with plural individuals. The corresponding translations are provided in (52) below.

(51) The$^{\mathbf{ag}}$ boys recited the$^{\mathbf{th}}$ poems one by one$_{\mathbf{ag/th}}$.

(52) $$\exists \mathbf{e}_{\varepsilon}(\text{RECITE}(\mathbf{e}) \wedge \mathbf{th}(\mathbf{e}) = \sigma y.\ {}^{*}\text{POEM}(y) \wedge \mathbf{ag}(\mathbf{e}) = \sigma x.\ {}^{*}\text{BOY}(x) \wedge \mathbf{runtime}(\mathbf{e}) \prec \mathbf{t}_{now} \wedge \mathbf{linear.order}(\{\mathbf{e}' \leq \mathbf{e} : \mathbf{atom}(\mathbf{e}')\}) \wedge \left\{ \begin{array}{l} |\{\mathbf{ag}(\mathbf{e}') : \mathbf{e}' \leq \mathbf{e} \wedge \mathbf{atom}(\mathbf{e}')\}| > 1 \wedge \forall \mathbf{e}' \leq \mathbf{e}(\mathbf{atom}(\mathbf{e}') \rightarrow \mathbf{atom}(\mathbf{ag}(\mathbf{e}'))) \\ |\{\mathbf{th}(\mathbf{e}') : \mathbf{e}' \leq \mathbf{e} \wedge \mathbf{atom}(\mathbf{e}')\}| > 1 \wedge \forall \mathbf{e}' \leq \mathbf{e}(\mathbf{atom}(\mathbf{e}') \rightarrow \mathbf{atom}(\mathbf{th}(\mathbf{e}'))) \end{array} \right\})$$

These translations show that one the main contributions of *one by one* is the partitioning of the main plural event **e** into a set of subevents. We have chosen here the simplest way of generating such a partition, namely in terms of the atomic subevents of **e**. The resulting partition, i.e., the set of subevents $\{\mathbf{e}' \leq \mathbf{e} : \mathbf{atom}(\mathbf{e}')\}$, plays a crucial role in each of the three conjuncts that *one by one* contributes. There are various ways to make the partitioning procedure more flexible, e.g., we could use covers and, thereby, add further contextual parameters to the meaning of *one by one*, *two by two* etc. We leave for future research the examination of examples involving interactions between *one by one* and conjunctions, quantifiers, reciprocals, other adverbs etc. that may require such additions.

3.4. Apparent Targeting of Embedded Possessors

Our θ-role-based account predicts that *one by one* cannot target possessors trapped inside the arguments of the verb that *one by one* modifies. However, the examples in (53) and (54) below seem to allow for such readings.[5] For example, (53) can have a reading under which exactly one leg per soldier is amputated – hence, *one by one* seems to target the soldiers and not their legs.

(53) The doctor amputated the soldiers' legs one by one.

(54) She destroyed her staff's confidence one by one.

We think that these are only apparent counterexamples to the locality requirement contributed by *one by one*. The nominal target in (53) is the plurality of legs that were amputated, i.e., the theme of the amputation event, and not the plural possessor *the soldiers*. This possessor partitions the theme and *one by one* targets the theme partitioned in this way – and not the possessor.

Similarly, the theme argument in (54) is partitioned in such a way that each staff member is associated with their own confidence-level – and *one by one* targets the plurality of confidence-levels rather than the staff members.

[5] We are indebted to Chris Barker, Ashwini Deo and Chung-chieh Shan for bringing this issue to our attention and for these examples.

This is supported by the fact that only a plural possessum makes a licit nominal target for *one by one*, even if the possessor is plural.

(55) a. She talked to the soldier's commanders one by one on his behalf.

b. *She talked to the soldiers' commander one by one on their behalf.

There is a plausible senario for (55b) where there are a plurality of conversations with the commander, one on each soldier's behalf, but (55b) does not have this reading, nor any reading. In our view, the unacceptability of this sentence follows from the fact that *one by one* targets functions from events to their plural participants – and *one by one* has no plural participant to target in (55b) because the possessor *the soldiers* is not a participant in the talking event.

Thus, although an embedded possessor cannot be targeted by *one by one*, it can ensure, in virtue of its relation with the possessum, that the latter is carved up in such a way as to create the appearance that *one by one* targets it.

3.5. Nominal Targets Headed by Each / Every

In this subsection, we show that the proposed analysis for *one by one* accounts for cases in which the nominal target is a morphologically-singular and semantically-distributive nominal phrase headed by *each* / *every*. The account follows from the fact that the event-partitioning $\{\mathbf{e}' \leq \mathbf{e} : \mathbf{atom}(\mathbf{e}')\}$ is the crucial ingredient of all three conjuncts contributed by *one by one*, including the second conjunct that requires the targeted participant to be semantically plural.

Consider, for example, the sentence in (56) below.

(56) One by one$_{\mathbf{ag}}$, each$^{\mathbf{ag}}$ boy recited ‘The Raven’$^{\mathbf{th}}$.

For simplicity, we give *each*$^{\mathbf{ag}}$ an encapsulated treatment. The translation is provided in (58) below. The basic idea is that *each*$^{\mathbf{ag}}$ simultaneously distributes over the event $\mathbf{e}$ and the set of individuals X contributed by the noun and relates them by means of the $\mathbf{ag}$ function.

(57) $\mathbf{ag}[\mathbf{E}] = X \ := \ X = \{\mathbf{ag}(\mathbf{e}) : \mathbf{e} \in \mathbf{E}\}$ (X is the image of $\mathbf{E}$ under $\mathbf{ag}$)

(58) $each^{\mathbf{ag}} \rightsquigarrow \lambda X_{et}.\lambda \mathbf{E}_{\varepsilon t}.\lambda \mathbf{e}_{\varepsilon}.\ \forall \mathbf{e}' \leq \mathbf{e}(\mathbf{atom}(\mathbf{e}') \rightarrow \mathbf{E}(\mathbf{e}')) \wedge$
$\mathbf{ag}[\{\mathbf{e}' \leq \mathbf{e} : \mathbf{atom}(\mathbf{e}')\}] = \{x \in X : \mathbf{atom}(x)\}$

This simultaneous distributivity is packaged in a way that makes the translation of *each*$^{\mathbf{ag}}$ parallel to the translation of the determiner *the*$^{\mathbf{ag}}$ in (48c) above. The first conjunct distributes over the event $\mathbf{e}$ and predicates the property $\mathbf{E}$ of each atomic subevent $\mathbf{e}'$ (instead of predicating it of the entire event $\mathbf{e}$, as non-distributive determiners like *the* do). The second conjunct further modifies the event $\mathbf{e}$ by means of the $\mathbf{ag}$ function. Once again, this is done distributively: each atomic subevent $\mathbf{e}'$ is related by the $\mathbf{ag}$ function to an atomic individual x in the set of individuals X contributed by the noun – and *vice versa*, each atom x has to be the agent of some atomic subevent $\mathbf{e}'$. The resulting translation of sentence (56) is provided in (59).

(59) $\exists \mathbf{e}_{\varepsilon}(\forall \mathbf{e}' \leq \mathbf{e}(\mathbf{atom}(\mathbf{e}') \rightarrow \text{RECITE}(\mathbf{e}') \wedge \mathbf{th}(\mathbf{e}') = \text{THE-RAVEN}) \wedge$
$\mathbf{ag}[\{\mathbf{e}' \leq \mathbf{e} : \mathbf{atom}(\mathbf{e}')\}] = \{x \in \text{BOY} : \mathbf{atom}(x)\} \wedge$
$\mathbf{runtime}(\mathbf{e}) \prec \mathbf{t}_{now} \wedge \mathbf{linear}.\mathbf{order}(\{\mathbf{e}' \leq \mathbf{e} : \mathbf{atom}(\mathbf{e}')\}) \wedge$
$|\{\mathbf{ag}(\mathbf{e}') : \mathbf{e}' \leq \mathbf{e} \wedge \mathbf{atom}(\mathbf{e}')\}| > 1 \wedge \forall \mathbf{e}' \leq \mathbf{e}(\mathbf{atom}(\mathbf{e}') \rightarrow \mathbf{atom}(\mathbf{ag}(\mathbf{e}'))))$

The morphologically singular *each*-phrase satisfies the plurality requirement $|\{\mathbf{ag}(\mathbf{e}') : \mathbf{e}' \leq \mathbf{e} \wedge \mathbf{atom}(\mathbf{e}')\}| > 1$ contributed by *one by one* because this requirement targets the atomic subevents of the event **e** – and singular morphology on *each* is interpreted as distributivity over the event **e** and not as an atomicity requirement.

Finally, we capture the fact that there is a certain amount of redundancy when both *one by one* and *each* target the same θ-role: both the conjunct $\mathbf{ag}[\{\mathbf{e}' \leq \mathbf{e} : \mathbf{atom}(\mathbf{e}')\}] = \{x \in \text{BOY} : \mathbf{atom}(x)\}$ contributed by *each* and the conjunct $\forall \mathbf{e}' \leq \mathbf{e}(\mathbf{atom}(\mathbf{e}') \rightarrow \mathbf{atom}(\mathbf{ag}(\mathbf{e}')))$ contributed by *one by one* ensure that there is an **ag**-based correspondence between atomic recitations $\mathbf{e}'$ and atomic boys x.

3.6. Collective Verbal Targets

In the above discussion of *each*, we noted that it distributes over the main event and requires each atomic subevent to satisfy the property contributed by the VP. This is the reason for the infelicity of *each* with collective predicates, exemplified in (60) below. As the translation in (61) shows, *each* requires every atomic subevent $\mathbf{e}'$ to be a gathering event. At the same time, the **ag** role maps each atomic gathering event to an atomic entity – but, since *gather* is a collective predicate, it cannot have atomic entities as agents, hence the infelicity.

(60) *Each student gathered.

(61) $\exists \mathbf{e}_{\varepsilon}(\forall \mathbf{e}' \leq \mathbf{e}(\mathbf{atom}(\mathbf{e}') \rightarrow \text{GATHER}(\mathbf{e}')) \wedge$
$\mathbf{ag}[\{\mathbf{e}' \leq \mathbf{e} : \mathbf{atom}(\mathbf{e}')\}] = \{x \in \text{STUDENT} : \mathbf{atom}(x)\} \wedge \mathbf{runtime}(\mathbf{e}) \prec \mathbf{t}_{now})$

The meaning overlap between *each*-distributivity and *one by one*-distributivity pulls apart in such cases: *one by one* does not require each atomic subevent to satisfy the VP-property, which accounts for the fact that the type of distributivity contributed by *one by one* is compatible with collective predicates, as shown in (62) below.

(62) The students gathered one by one.

(63) $\exists \mathbf{e}_{\varepsilon}(\text{GATHER}(\mathbf{e}) \wedge \mathbf{ag}(\mathbf{e}) = \sigma x.\, {}^{*}\text{STUDENT}(x) \wedge \mathbf{runtime}(\mathbf{e}) \prec \mathbf{t}_{now} \wedge$
$\mathbf{linear}.\mathbf{order}(\{\mathbf{e}' \leq \mathbf{e} : \mathbf{atom}(\mathbf{e}')\}) \wedge |\{\mathbf{ag}(\mathbf{e}') : \mathbf{e}' \leq \mathbf{e} \wedge \mathbf{atom}(\mathbf{e}')\}| > 1 \wedge$
$\forall \mathbf{e}' \leq \mathbf{e}(\mathbf{atom}(\mathbf{e}') \rightarrow \mathbf{atom}(\mathbf{ag}(\mathbf{e}'))))$

As shown in (63), *one by one* distributes over a gathering event **e** by establishing an **ag**-based correspondence between atomic students and atomic subevents of **e**. Crucially, *one by one* does not require every atomic subevent to be a gathering event. Instead, *one by one* sequences a set of subevents $\mathbf{e}'$ that sum to a gathering event **e**. For example, each $\mathbf{e}'$ in (63) could be an arrival event, the agent of which is a student-atom. Since arrival subevents permit singular participants, they can stand in a distributive correspondence with atomic subparts of the plural subject, rendering the sentence felicitous.

The fact that *one by one* can be sublexically distributive does not mean that it is felicitous with all collective predicates. As Dowty (1987) and Brisson (2003) among others observe, only certain collective predicates, e.g., *gather*, but not *elect*, have such distributive subentailments. For example, (64) below is infelicitous.

(64) *The students elected the president one by one.

We can account for this contrast in the same way in which Brisson (2003) accounts for the fact that *all* is compatible with *gather*, but not *elect*.

4. Comparison with Previous Approaches

In the present analysis, *one by one* is an event modifier that targets a plural participant in the event it modifies. *One by one* simultaneously distributes over this participant and the event by targeting the θ-role function that connects the two and by distributing over the dependencies encapsulated in this function.

Our analysis has clear points of contact with the analysis of *N by N*-constructions in Beck and von Stechow (2007) – and this section is dedicated to a comparison of the two accounts. Beck and von Stechow (2007) take the term "pluractionality" at face value and introduce syntactically-covert pluralization operators, defined basically as in (65) below (see Beck and von Stechow 2007: 234,(66)).

(65) $$PL \rightsquigarrow \lambda Cov.\lambda R_{e(\varepsilon t)}.\lambda x_e.\lambda \mathbf{e}_\varepsilon. \\ PARTITION(Cov, \mathbf{e} \oplus x) \wedge [{**}\lambda y_e.\lambda \mathbf{e}'_\varepsilon.\, Cov(\mathbf{e}') \wedge Cov(y) \wedge R(y)(\mathbf{e}')](x)(\mathbf{e})$$

The operator *PL* applies to a cover, a relation *R* between individuals and events of type $e(\varepsilon t)$, a plural individual x and a plural event $\mathbf{e}$ and require: (*i*) the cover to be a partition of (the sum of) the plural event and the plural individual and (*ii*) each pair of subparts in the cover to satisfy the relation *R*. The operator ** is cumulative closure over relations: for any *R* of type $e(\varepsilon t)$, $**R$ is the smallest relation such that $R \subseteq **R$ and, if $\langle x, \mathbf{e}\rangle, \langle y, \mathbf{e}'\rangle \in **R$, then $\langle x \oplus y, \mathbf{e} \oplus \mathbf{e}'\rangle \in **R$.

The contribution of pluractional adverbials is to further constrain the cover over individuals *Cov* that the pluralization operator *PL* requires. For example, the adverbial *piece by piece* requires each y that is a part of x (according to *Cov*) to be a piece (see (67c) and (70) in Beck and von Stechow 2007: 234-235).

The example in (66) below is assigned the logical form (LF) in (67) and is compositionally interpreted as shown in (68) (see Beck and von Stechow 2007: 234,(67)). To derive the intuitively-correct interpretation, the direct object *the cake* has to be QR-ed and, crucially, we need to assume that the λ-abstractor associated with the QR-ed direct object is syntactically independent from it. This is needed because the pluralization operator PL_{Cov} and the adverbial *piece by piece* have to be tucked between the QR-ed object and its associated λ-abstractor.

(66) John ate the cake piece by piece.

(67) [the cake] [PL_{Cov} [piece by piece [$\lambda 2$ [John ate t_2]]]]

(68) $\exists \mathbf{e}(\mathbf{runtime}(\mathbf{e}) \prec \mathbf{t}_{now} \wedge PARTITION(Cov, \mathbf{e} \oplus \text{THE-CAKE}) \wedge \langle \mathbf{e}, \text{THE-CAKE} \rangle \in {**}\lambda y.\lambda \mathbf{e}'.\, Cov(y) \wedge Cov(\mathbf{e}') \wedge \text{PIECE}(y) \wedge \text{EAT}(\mathbf{e}', \text{JOHN}, y))$

While Beck and von Stechow (2007) do not discuss *one by one* explicitly, they indicate that it should be analyzed as *piece by piece* (see the discussion and examples on pp. 215-217). Thus, *one by one* presumably requires each individual in the cover to be atomic – and the example in (69) below is interpreted as shown in (71), based on the LF in (70).

(69) John ate the cakes one by one.

(70) [the cakes] [PL_{Cov} [one by one [$\lambda 2$ [John ate t_2]]]]

(71) $\exists \mathbf{e}(\mathbf{runtime}(\mathbf{e}) \prec \mathbf{t}_{now} \wedge PARTITION(Cov, \mathbf{e} \oplus \text{THE-CAKES}) \wedge \langle \mathbf{e}, \text{THE-CAKES} \rangle \in {**}\lambda y.\lambda \mathbf{e}'.\, Cov(y) \wedge Cov(\mathbf{e}') \wedge \mathbf{atom}(y) \wedge \text{EAT}(\mathbf{e}', \text{JOHN}, y))$

If we ignore the linear-ordering requirement, both their and our analysis derive the intuitively-correct interpretation for examples like (69). There are, however, two important differences in how the derivations proceed. Beck and von Stechow (2007) crucially rely on (*i*) a partition of both the main event and the targeted individual and (*ii*) a particular syntactic structure at the LF level. In contrast, our analysis needs only a partition of the main event and does not require a particular LF structure because the clause-boundedness of *one by one* modification is captured by means of θ-role indexation and percolation.

Consequently, the accounts make distinct predictions with respect to several kinds of examples. First, by (presumably) conflating *one by one* and *N by N* modification, Beck and von Stechow (2007) predict that *N by N* should be infelicitous when there is no nominal target overtly realized in the clause, because there is nothing that can be QR-ed to produce the right kind of LF. That is, the examples in (18), (20) and (22) above are predicted to be infelicitous.

Second, it is not clear how Beck and von Stechow (2007) account for the fact that, within its clause, *one by one* modification can be syntactically non-local. For example, to derive the correct interpretation for sentence (41) above, i.e., the fact that *one by one* modifies only the second conjunct *took wing*, a λ-abstractor associated with the subject has to somehow be generated within the second conjunct. It is not obvious what kind of syntactic operation would asymmetrically target only one of the two conjuncts to generate the necessary LF.

On the semantics side, Beck and von Stechow (2007) predict that *one by one* should not be able to target nominals headed by *each* (see the discussion of "singular interpretation" on pp. 234-236). This is because *each* necessarily λ-abstracts over atomic individuals and *one by one*, which is tucked between *each* and its λ-abstractor, would have to target (trivial covers of) atomic individuals. This predicts that the following two sentences should be equally unacceptable: *One by one, each student left* and **One by one, Mary left*.

Finally, Beck and von Stechow (2007) predict that *one by one* modification is incompatible with collective predicates like *gather*. The reason is that, in examples like (62) above, the collective property *gather* is within the scope of the cumulative closure operator ** and is infelicitously predicated of each student-atom.

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