Distance Distributivity and Pluractionality in Tlingit (and Beyond) [1]

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ABSTRACT: This paper develops a formal semantic and syntactic analysis of distributive numerals in Tlingit, a highly endangered and understudied Na-Dene language of Alaska, British Columbia and the Yukon. Syntactically, distributive numerals in Tlingit can attach either adnominally or adverbially, a common, but not universal, feature of such numerals across languages (Gil 1982). Semantically, these numerals enforce a 'distributive reading' of the sentence, and thus are one instance of the broader phenomenon of 'distance distributivity' (Zimmermann 2002). As in many other languages, a Tlingit sentence containing a distributive numeral can describe two distinct kinds of 'distributive scenarios': (i) a scenario where the distribution is over some plural entity (*cf.* 'My sons caught three fish each'), and (ii) one where the distribution is over some plural event (*cf.* 'My sons caught three fish each time') (Gil 1982, Choe 1987, Zimmermann 2002, Oh 2005). Despite this apparent ambiguity, I put forth a univocal semantics for Tlingit distributive numerals, one whereby they consistently denote pluractional operators (Lasersohn 1995; Beck & von Stechow 2007). I argue that the ability for sentences with distributive numerals to describe both kinds of scenarios in (i) and (ii) is not due to an ambiguity, but instead to the sentences having relatively underspecified truth-conditions. Following this, I explore ways in which this analysis can be extended to distance distributivity in other languages. The analysis can account for various locality effects noted for distance distributives in Korean and German (Zimmermann 2002, Oh 2005), as well as an intriguing puzzle regarding distributive numerals and pluractionality in Kaqchikel (Henderson 2011). Finally, I show how the analysis can be extended to the well-known case of English 'binominal each'.

Keywords: distributivity, distributive numeral, distance distributivity, anti-quantifier, dependent indefinite, pluractional, pluractional adverb, Tlingit, binominal each

1. Introduction

This paper documents and analyzes the distributive numeral constructions of Tlingit, a highly endangered and understudied Na-Dene language of Alaska, British Columbia and the Yukon (Boas 1917, Naish 1966, Story 1966, Leer 1991, Dauenhauer & Dauenhauer 2000, Cable 2010). Although the traditional label 'distributive numeral' aptly applies to the construction in question (Gil 1982), the more recent terms 'Anti-Quantifier' (Choe 1987), 'Dependent Indefinite' (Farkas 1997), and 'Distance Distributivivty' (Zimmermann 2002) do as well. Indeed, the last of these – 'Distance Distributivity' – is often taken to be a broader concept, one that also encompasses so-called 'binominal each' in English, a construction that is not universally recognized as a type of

[1] Deepest thanks are owed first and foremost to Tlingit elders Beatrice Brown (Sa.áax̱w), Margaret Dutson (Chiksháani), William Fawcett (Kóoshdaak̲wísh), and Helen Sarabia (K̲áachku.aak̲w). I am deeply grateful for all that they have taught me regarding the Tlingit language, as well as for their generosity, patience, and good humor. I would also like to dedicate this work to the memory of Beatrice Brown (Sa.áax̱w). I was extremely fortunate to have gotten the chance to meet and learn from her during the summer of 2011. This project owes an immeasurable amount both to the depth of her knowledge and to the warmth and kind spirit that she brought to all of our meetings.

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'distributive numeral' (Gil 1982). As we will see, the analysis offered here for distributive numerals in Tlingit could offer new insights into the broader category of distance distributivity as well.

To recall, the term 'distributive numeral' is generally used with the meaning in (1) below.

(1) **Distributive Numeral (Gil 1982, Choe 1987, Zimmermann 2002)**
A morphosyntactic construction containing a numeral, whereby (i) the sentence as a whole receives a distributive reading, and (ii) under the allowable readings, the expression modified by the construction must be interpreted as if it is within the *scope* of a distributive operator.

These characteristics are nicely illustrated by the contrast between the Tlingit sentences in (2).

(2) **Plain Numerals and Distributive Numerals in Tlingit** [2]

a. **Nás'k** x̱áat has aawasháat. (HS) [3, 4]
three fish 3plS.3O.caught
'They caught three fish.'

b. **Nás'gig̱áa** x̱áat has aawasháat. (BB), (WF)
three.DIST fish 3plS.3O.caught
'They caught three fish each.' Or, 'They caught three fish each time.'

Sentence (2a) contains the unmarked numeral *nás'k* 'three'. As we will see in Section 3, this sentence can, like its English translation, receive both 'collective' and 'cumulative' readings, and generally resists a 'distributive' reading. Sentence (2b), however, contains the distributive numeral *nás'gigáa* 'three.DIST'. This sentence cannot receive either the collective or cumulative reading of (2a), and only permits a distributive interpretation. Furthermore, as suggested by the two translations under (2b), such sentences appear at first glance to be ambiguous, in that they can describe two very different kinds of 'distributive scenarios'. These two scenario types are sketched in more detail below.

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[2] In this paper, I use the following abbreviations in the glossing of example sentences: 1sgS 'first person singular subject', 2sgS 'second person singular subject', 3O 'third person object', 3plS 'third person plural subject', 3sgS 'third person singular subject', ACC 'accusative case', CL 'classifier', DIST 'distributive numeral marker', ERG '(optional) ergative case', FOC 'focus particle', NOM 'nominative case', PA 'pluractional suffix', Q 'question particle'.

[3] Throughout this paper, I indicate whether a Tlingit sentence structure was (i) constructed by the author and judged by speakers to be well-formed, or (ii) actually spontaneously spoken by the language consultants themselves. In the former case, the Tlingit sentence will be followed by a '(C)', for 'constructed'. In the latter case, I will provide the initials of the language consultant(s) who provided the sentence in question: (BB) for Beatrice Brown, (MD) for Margaret Dutson, (WF) for William Fawcett, and (HS) for Helen Sarabia. Again, it should be noted that all sentences marked with a '(C)' were judged by all the consultants to be well-formed.

[4] I will in this paper provide only the roughest of glosses for individual Tlingit words, which can be morphologically quite complex. This simplification is the most radical for verbs, as I provide glosses only for their lexical content and their agreement morphology, leaving out all their rich aspect and mood inflectional content.

(3) **Scenarios that Verify Distributive Numeral Sentence (2b)**

a. Participant-Distributive Scenario: Each of them caught three fish.
$\forall x . x \leq$ 'them' & atom(x) $\rightarrow \exists y$. **three.fish**(y) & x caught y

b. Event-Distributive Scenario: They caught fish three at a time.
$\exists e. \forall e' . e' \leq e$ & atom(e') $\rightarrow \exists y$. **three.fish**(y) & they caught y in e'

In the scenario described in (3a), each individual member of some contextually salient plurality catches three fish. Throughout this paper, I will refer to such scenarios as 'participant-distributive' scenarios, given that the distribution of 'three fish' appears to be over some plural participant in the described event. In scenario (3b), however, there are several *events* of some salient plurality catching three fish (altogether). Given that there are three fish to each event of catching, I will refer to scenarios like (3b) as 'event-distributive' scenarios.

As we will see in more detail below, Tlingit sentences like (2b) are true both in participant-distributive scenarios like (3a) and event-distributive scenarios like (3b). Furthermore, as the logical formulae in (3) make clear, if we attempt to characterize the scenarios in (3a,b) using a distributive operator (4), then in both (3a) and (3b) the denotation of 'three fish' lies within the scope of that operator. Consequently, we find that the Tlingit construction in (2b) fits the general definition in (1) of a 'distributive numeral'.

(4) **The Distributive Operator (Lasersohn 1995, Schwarzschild 1996)**

$$[[\, \mathit{DIST}\,]] \quad = \quad [\ \lambda P_{<et>} : \lambda y_e : \forall x \,.\, x \leq y \ \&\ \text{atom}(x) \rightarrow P(y)\ ]$$

Across many languages, the ability for sentences with distributive numerals to describe both participant-distributive and event-distributive scenarios has generally been viewed as a kind of ambiguity (Gil 1982, Zimmermann 2002, Oh 2005, Balusu 2006, Champollion, to appear). However, I will argue that Tlingit sentences like (2b) are not truly ambiguous. That is, I will show that such sentences can be given a single, general set of truth-conditions that covers both the scenarios in (3). Furthermore, we will see that this univocal semantics can also predict a number of more subtle facts regarding distributive numerals in Tlingit, Korean (Oh 2005), German (Zimmermann 2002), and Kaqchikel (Henderson 2011). Finally, we will see that a small change to the proposed semantics yields a novel analysis of the English binominal each construction, one that predicts certain curious differences between binominal each and canonical distributive numerals.

The remainder of this paper is structured as follows. Section 2 provides some basic background regarding the Tlingit language, and also explains how the original data appearing in this paper were collected. In Section 3, I discuss the morphosyntax of distributive numerals in Tlingit, showing in particular that such numerals can serve either as adverbial or adnominal modifiers. Section 4 introduces the core semantic properties of the construction. Amongst other facts, I show here that the syntactic attachment site of the distributive numeral has no effect upon the kind of distributive scenario the sentence describes. That is, no matter whether the distributive numeral is adverbial or adnominal, the sentence may be true in either participant-distributive or event-distributive scenarios. Section 5 presents the formal semantic and syntactic analysis of Tlingit distributive numerals, which is largely based upon the work of Beck & von

Stechow (2007) on pluractional adverbs like 'two by two' or 'in twos'.[5] In Section 6, we see how the proposed analysis could explain certain puzzles concerning distributive numerals in other languages, while Section 7 discusses the possible treatment of binominal each in English. Finally, Section 8 offers a concluding summary.

2. Linguistic and Methodological Background

The Tlingit language (Lingít) is the ancestral language of the Tlingit people of Southeast Alaska, Northwest British Columbia, and Southwest Yukon Territory. It is the sole member of the Tlingit language family, a sub-branch of the larger Na-Dene language phylum (Campbell 1997, Mithun 1999). It is thus distantly related to the Athabaskan languages (e.g., Navajo, Slave, Hupa), and shares their complex templatic verbal morphology (Leer 1991). As mentioned in Footnote 4, I will largely be suppressing this complex structure in my glossing of Tlingit verbs.

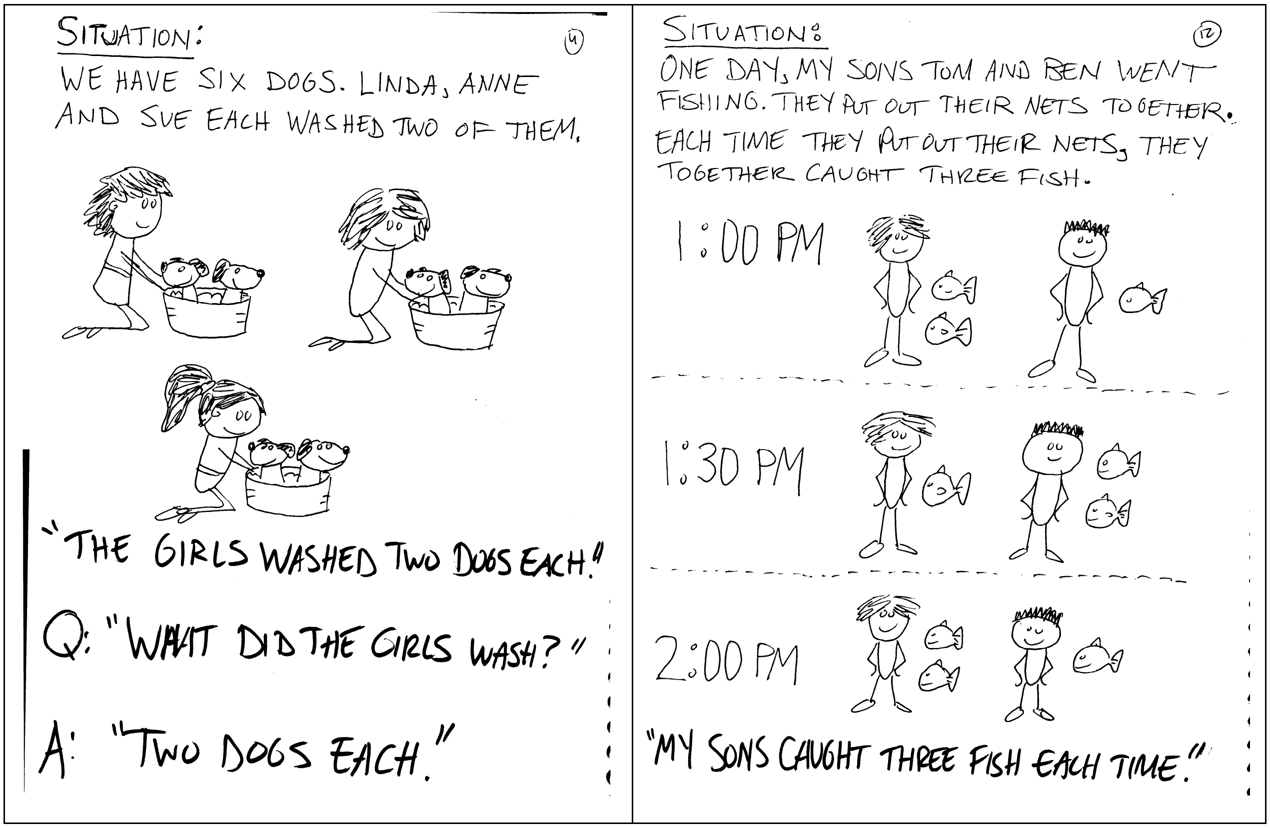
Tlingit is a highly endangered language. While there has been no official count of fully fluent speakers, it is privately estimated by some specialists that there may be less than 100. Most of these speakers are above the age of 70, and there is no known native speaker below the age of 50 (Dauenhauer & Dauenhauer 1987). There are extensive, community-based efforts to revitalize the language, driven by a multitude of Native organizations and language activists too numerous to list here. Thanks to these efforts, some younger adults have acquired a significant degree of fluency, and there is growing optimism regarding a new generation of native speakers.

Unless otherwise noted, all data reported here were obtained through interviews with native speakers of Tlingit. Four fluent Tlingit elders participated: Beatrice Brown (Sa.áax̱w), Margaret Dutson (Chiksháani), William Fawcett (Kóoshdaak̲wísh), and Helen Sarabia (K̲áachku.aak̲w). All four were residents of Juneau, AK at the time of our meeting, and are speakers of the Northern dialect of Tlingit (Leer 1991). Three to four elders were present at each of the interviews, which were held in a classroom of the University of Alaska Southeast.

The linguistic tasks presented to the elders were straightforward translation and judgment tasks. The elders were presented with various scenarios, paired with English sentences that could felicitously describe those scenarios. The scenarios were described orally to the elders, and also represented pictorially, through the use of cartoons like the following.

[5] The analysis also bears interesting, thematic similarities to Champollion's (to appear) treatment of English binominal each and German *jeweils*.

(5) **Sample of the Cartoons Used During Interviews**



The elders were asked to freely describe the scenarios, as well as to translate certain targeted English sentences describing them. In order to more systematically study their semantics, sentences containing distributive numerals were explored using truth/felicity judgment tasks, a foundational methodology of semantic fieldwork (Matthewson 2004). The elders were thus asked to judge the 'correctness' (broadly speaking) of various Tlingit sentences relative to certain scenarios. The sentences evaluated were either ones offered earlier by the speakers for other scenarios, or ones constructed by myself and judged by the speakers to be 'natural sounding' and correct for other scenarios. As mentioned in Footnote 3, I will notationally distinguish constructed examples from ones uttered spontaneously by the elders.

Finally, it should be noted that unless otherwise indicated, all speakers agreed upon the reported status of the sentences presented here.

3. The Morphology and Syntax of Distributive Numerals in Tlingit

As documented by Leer *et al.* (2001: 26), distributive numerals are formed in Tlingit by suffixing *–gaa* to the base of the unmarked numeral. As with many suffixes in Tlingit, this distributive suffix bears a tone opposite to that of the immediately preceding syllable. Moreover, for the numerals 1-3, certain phonological changes take place to the numeral root. The numerals 1-5 (for non-humans) are illustrated below.

(6) **Non-Human Distributive Numeral Series in Tlingit (Leer *et al.* 2001: 26)**

a. Unmarked Numerals		b. Distributive Numerals	
tléix’	*one*	tlék’gaa	*one by one, one each*
déix̱	*two*	dáx̱gaa	*in twos, two each*
nás’k	*three*	nás’gigáa	*in threes, three each*
dax’oon	*four*	dax’oongáa	*in fours, four each*
keijín	*five*	keijíngaa	*in fives, five each*

Numerals modifying human nouns in Tlingit appear with a ‘human classifier’ suffix *–náx̱* (7a). Similarly, when distributive numerals modify a human noun, they also take the classfier *–náx̱*. As illustrated in (7b), the classifier *–náx̱*, appears to the right of the distributive suffix *–gaa*.

(7) **Human Distributive Numeral Series in Tlingit (Leer *et al.* 2001: 26)**

a. Unmarked Numerals		b. Distributive Numerals	
tléináx̱	*one*	tlék’gaanáx̱	*one by one, one each*
dáx̱náx̱	*two*	dáx̱gaanáx̱	*in twos, two each*
nás’gináx̱	*three*	nás’gigáanáx̱	*in threes, three each*
dax’oonináx̱	*four*	dax’oongáanáx̱	*in fours, four each*
keijíninax̱	*five*	keijíngaanáx̱	*in fives, five each*

Distributive numerals are exceedingly rare in natural speech. The few examples that occur in published Tlingit texts appear to have an adverbial syntax, as illustrated below.

(8) **Distributive Numerals as Adverbial Modifiers in Tlingit**

Tlék’gaanáx̱ áwé has wuduwax̱oox̱.
one.DIST FOC 3plS.3O.call
‘They called them one by one.’ (Edwards 2009: 260)

Given that all languages allow distributive numerals to function as adverbs (Gil 1982), the possibility and prevalence of adverbial structures like (8) is not surprising. In many languages, however, distributive numerals can also function as adnominal modifiers (Gil 1982, Choe 1987, Zimmermann 2002, Oh 2005, Balusu 2006). Interestingly, it is not unusual to find Tlingit distributive numerals in positions where they appear as if they could be adjoined to a noun. For example, note the surface similarity between (2a) and (2b) above, where the former contains an unmarked numeral that is undoubtedly an adnominal modifier. This raises the question of whether distributive numerals in Tlingit can also, as in other languages, attach adnominally. Unfortunately, given the freedom of word order in the language, there are rather few clear, positive tests for constituency (Cable 2010). Nevertheless, certain facts point towards the conclusion that the language does also possess adnominal distributive numerals.

First, amongst the sentences spontaneously uttered during my interview sessions, several had the form illustrated below.

(9) **Distributive Numerals Preceding Left-Peripheral Nouns**

Nás'gigáa	keitl	**áwé**	has aawashúch.	(WF)
three.DIST	dog	**FOC**	3plS.3O.bathed	

'They bathed three dogs each.'

In sentences like (9), the focus particle *áwé* follows a string consisting of a distributive numeral and a noun. As detailed by Leer (1991), this focus particle optionally marks a phrase occupying a left-peripheral 'focus position'. This raises the question of the attachment site of the distributive numeral. Note that if the numeral were *not* attached to the noun, then it would have to occupy a separate, unmarked focus position. While it is possible for there to be two left-peripheral 'focus phrases' within a single clause, such structures are rather marked and uncommon (Leer 1991: 23); moreover, in such structures, the initial focus phrase is almost always a sentence connective (Leer 1991: 23). Consequently, given the relative frequency of sentences like (9) during my interviews, I conclude that the distributive numerals in such structures most likely have an adnominal attachment site. Supporting this conclusion is the fact that the distributive numeral in these sentences appears to form an intonational unit with the following noun, whereas distinct focus phrases are typically separated by a noticeable break. Incidentally, the ability for distributive numerals and nouns to form intonational units together is supported by the fact that, when considering certain constructed examples, speakers would sometimes repeat such strings to themselves, as clearly independent units.

(10) **Distributive Numerals and Nouns Forming Intonational Units**

…**Dáx̱gaa**	keitl …	… **dáx̱gaa**	keitl …	(WF)
two.DIST	dog	**two.DIST**	dog	

While it is imperfect evidence, these intonational facts lend further credence to the view that distributive numerals can in Tlingit be adnominal modifiers.

This conclusion is also supported by the ability for distributive numerals to appear in elliptical answers to wh-questions. As illustrated in (11b) and (12b), the answer to a wh-question can consist of a distributive numeral followed by a noun.

(11) **Distributive Numerals in Elliptical Answers**

a. Question Prompt:

Daa	sáwé	has aawasháat.	yá	i	k̲aa yátx'i?	(C)
what	Q.FOC	3plS.3O.caught	these	your	male children	

'What did your sons catch?'

b. Possible Elliptical Answers

(i)

Nás'k	x̱áat	(C)
three	fish	

'Three fish.'

(ii)

Nás'gigáa	x̱áat	(C)
three.DIST	fish	

'Three fish each.'

(12) **Distributive Numerals in Elliptical Answers**

a. Question Prompt:

Daa	sáwé	has aawashúch	wé	shaax'wsáani?	(C)
what	Q.FOC	3plS.3O.bathed	those	girls	

'What did the girls bathe?'

b. Possible Elliptical Answers

(i)	Déix̱	keitl	(C)	(ii)	**Dáx̱gaa**	keitl	(C)
	two	dogs			**two.DIST**	dog	
	'Two dogs'				'Two dogs each'		

Importantly, although speakers report that discourses consisting of (11a) and (11bii) [or (12a) and (12bii)] sound relatively natural, they emphatically reject discourses consisting of (13b) and (13c) below. That is, an elliptical answer to a wh-question cannot consist of an adverb followed by a noun, as in (13c).

(13) **Elliptical Answers in Tlingit Must be Constituents**

a. Target Sentence:

Tláakw	útlx̱i	x̱waax̱áa.	(C)
quickly	boiled.fish	1sgS.3O.ate	

'I ate the *utlx̱i* (boiled fish) quickly'.

b. Question Prompt:

Daa	sáwé	yeexáa?	(C)
what	Q.FOC	2sgS.3O.ate	

'What did you eat?'

c. Impossible Answer:

* Tláakw	útlx̱i	(C)
quickly	boiled.fish	

Given the sharp unacceptability of discourses like (13b)-(13c), the acceptability of (11a)-(11bii) and (12a)-(12bii) suggests that the distributive numerals in (11bii) and (12bii) are not adverbs, but rather adnominal modifiers.

One final argument that distributive numerals can be adnominal surrounds the unacceptability of sentences like those in (14).

(14) **Distributive Numerals and Demonstratives in Tlingit**

a.

* Ax̱	shaa	yátx'i	wé	**dáx̱gaa**	keitl	has aawashúch.	(C)
my	female	children	those	**two.DIST**	dog	3plS.3O.bathed	

b.

* Ax̱	shaa	yátx'i	**dáx̱gaa**	wé	keitl	has aawashúch.	(C)
my	female	children	**two.DIST**	those	dog	3plS.3O.bathed	

The ill-formedness of (14a,b) demonstrates that distributive numerals in Tlingit cannot directly modify NPs with demonstratives, a feature shared with distributive numerals in many other languages (Zimmermann 2002, Oh 2005). Importantly, there are two means for correcting the sentences in (14). The first is to move the demonstrative DP to a post-verbal position, as in (15) below.

(15) **Distributive Numerals as Adverbial Modifiers in Tlingit**

Ax̲	shaa	yátx'i	**dáx̲g̲aa**	has aawashúch	**yóo**	**keitl**	(BB) [6]
my	female	children	**two.DIST**	3plS.3O.bathed	**those**	**dog**	

'My daughters bathed those dogs two at a time.'

Note that, given the ill-formedness of (14a,b), the distributive numeral in (15) must be base-generated as an adverbial, and could not be a 'floated' adnominal modifier of the post-verbal demonstrative DP.[7]

At first glance, the contrast between (14b) and (15) is somewhat puzzling. After all, if distributive numerals can function as adverbs (15), why isn't (14b) accepted under a parse where the distributive numeral is an adverb, as sketched in (16) below?

(16) **Unallowable Parse of Sentence (14b)**

[$_{S}$ [$_{DP}$ Ax̲ shaa yátx'i] [$_{VP}$ [$_{Adverb}$ **dáx̲g̲aa**] [$_{VP}$ [$_{DP}$ wé keitl] has aawashúch]]
my female children **two.DIST** those dog 3plS.3O.bathed

The answer is that structures like (16) run afoul of a more general principle of Tlingit sentence formation. As detailed by Leer (1991), Tlingit speakers generally prefer to minimize the amount of phrasal material preceding the verb in a sentence. Thus, if there are more than three major constituents in a sentence, there is a very strong preference amongst speakers for at least one of those constituents to appear after the verb, as in (15).

Given this general word-order preference, the second means for improving (14a,b) is quite revealing. Speakers have explicitly observed that sentences (14a,b) become acceptable if one simply omits the demonstrative, as in (17) below.

(17) **Distributive Numerals as Adnominal Modifiers in Tlingit**

Ax̲	shaa	yátx'i	**dáx̲g̲aa**	keitl	has aawashúch.	(C)
my	female	children	**two.DIST**	dog	3plS.3O.bathed	

'My daughters bathed two dogs each'. Or, 'My daughters bathed two dogs each time'.

Importantly, the contrast between (14b) and (17) provides further evidence that distributive numerals in Tlingit can be adnominal. After all, if such numerals could only be adverbs, then

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[6] The difference between the demonstratives in (14) and (15) is inconsequential; speakers also accepted a constructed sentence identical to (15), but with the demonstrative *wé* instead of *yóo*. The difference between these two demonstratives is complex, but *yóo* generally indicates greater distance from the speaker (Leer 1991).

[7] Although it has not yet been studied in detail, Tlingit does seem to allow certain quantificational elements to 'float', especially the quantifier *ldakát* 'all'.

sentence (17) would necessarily have the dispreferred structure in (16), and there would be no substantive difference between (17) and (14b). However, if distributive numerals can attach to NPs, then sentence (17) would allow the parse in (18) below.

(18) **Allowable Parse of Sentence (17)**

[$_{S}$ [$_{DP}$ Ax̱	shaa	yátx'i]	[$_{VP}$ [$_{DP}$	**dáx̱g̱aa**	keitl]	has aawashúch]]
my	female	children		**two.DIST**	dog	3plS.3O.bathed

Note that, under this parse, sentence (17) places only *two* major constituents before the verb, just as in (15). Therefore, (17) does not run afoul of the general word-order preference that militates against (14b). Importantly, though, this explanation requires that the distributive numeral *dáx̱g̱aa* 'two.DIST' and the noun *keitl* 'dog' can together form a single constituent.

This explanation for the contrast between (14b) and (17) receives further support from the ill-formedness of the following sentences.

(19) **Rejected Word-Order Variants of (17)**

a.

* Ax̱	shaa	yátx'i	keitl	**dáx̱g̱aa**	has aawashúch.	(C)
my	female	children	dog	**two.DIST**	3plS.3O.bathed	

b.

* **Dáx̱g̱aa**	ax̱	shaa	yátx'i	keitl	has aawashúch.	(C)
two.DIST	my	female	children	dog	3plS.3O.bathed	

When presented the word-orders in (19), speakers strongly rejected them as 'incorrect', and offered the sentence in (17) as a correction. This contrast easily follows from the account offered above. In (19b), the subject 'my daughters' intervenes between the distributive numeral and the noun *keitl* 'dog'. Thus, the latter two cannot form a constituent, and so the sentence unacceptably contains three major phrases before the verb. Regarding sentence (19a), note that nearly all adnominal modifiers in Tlingit are pre-nominal (Naish 1966, Leer 1991).[8] Consequently, it would be natural to assume that adnominal distributive numerals in Tlingit must be pre-nominal as well. Therefore, the distributive numeral in (19a) cannot form a constituent with the NP *keitl* 'dog', and so the sentence again contains an unacceptable number of pre-verbal constituents. Finally, if it is assumed that distributive numerals can *only* be adverbs, then the contrast between (17) and (19) becomes obscure. After all, given the freedom of its word-order, adverbs in Tlingit can generally precede the subject or follow the object (Leer 1991).

Taken together, the facts in (9)-(19) indicate that distributive numerals in Tlingit can function as adnominal modifiers. Moreover, the contrast between (14b) and (17) shows that adnominal distributive numerals can attach only to bare NPs, never to DPs headed by demonstratives. This leads to the following generalization, which was noted earlier under (15).

(20) **Diagnostic for Adverbial Distributive Numerals in Tlingit**
If a sentence is of the form in (15) – 'Distributive Numeral' > 'Verb' > 'Demonstrative DP' – then the distributive numeral must be *adverbial.*

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[8] The only exceptions are a small, closed class of adjectival modifiers, such as *tlein* 'big' (Naish 1966, Leer 1991).

This generalization will be used in Section 4 as a diagnostic for showing that a distributive numeral is adverbial, and not adnominal. Furthermore, as we've just seen, the contrast between (14b) and (17) also leads to the generalization in (21).

(21) **Diagnostic for Adnominal Distributive Numerals in Tlingit**
If a sentence is of the form in (17) - 'Subject' > 'Distributive Numeral' > 'Bare NP' > 'Verb' – then the distributive numeral must be *adnominal*.

In the following section, I will use this generalization as a diagnostic showing that a distributive numeral is adnominal, rather than adverbial.

Finally, let us briefly note that, although nouns can be modified by distributive numerals, they cannot themselves bear the 'distributive' suffix -*gaa*.

(22) **The Distributive Suffix -*Gaa* is Specific to Numerals**

a.

Nás'gigáa	xáat	has aawasháat.	(BB), (WF)
three.DIST	fish	3plS.3O.caught	

'They caught three fish each.' Or, 'They caught three fish each time.'

b.

* Xáat**gaa**	has aawasháat.	(C)
fish.DIST	3plS.3O.caught	

4. Semantic Description of Distributive Numerals in Tlingit

A definitional feature of distributive numerals is that they enforce 'distributive' readings of sentences, and rule out both 'collective' and 'cumulative' readings (Gil 1982, Choe 1987, Oh 2005).[9] It can be easily shown that the same holds for distributive numerals in Tlingit. First, in scenarios like that in (23), where the predicate 'bathe two dogs' holds collectively of the subject, only sentence (23a) containing the unmarked numeral *déix* 'two' is true. Thus, sentence (23a) allows a 'collective' reading while (23b) does not.

(23) **Collective Readings are Incompatible With Distributive Numerals**

Scenario: Linda, Anne and Sue together bathed Sparky and Spot (at the same time).

a.

Wé	shaax'wsáani	**déix**	keitl	has aawashúch.	(BB)
those	girls	**two**	dog	3plS.3O.bathed	

'The girls bathed two dogs.' Judgment: True in the scenario above.

b.

Wé	shaax'wsáani	**dáxgaa**	keitl	has aawashúch.	(C)
those	girls	**two.DIST**	dog	3plS.3O.bathed	

Judgment: Not true in the scenario above

[9] For more on the distinction between 'collective', 'cumulative', and 'distributive' readings, I refer the reader to various foundational works in the literature on plural semantics: Link 1983, Scha 1984, Lasersohn 1995, Schwarzschild 1996, Landman 2000, Kratzer 2003, Kratzer 2008, Lasersohn 2011.

In a similar fashion, it can be shown that Tlingit distributive numerals do not allow for cumulative readings, while unmarked numerals do. For example, in the scenario under (24), the sons catch a total of three fish. Again the sentence containing the unmarked numeral is true (24a), while the one containing the distributive numeral is not (24b).

(24) **Cumulative Readings are Incompatible With Distributive Numerals**

Scenario: My sons Tom and Ben went fishing. Tom caught two fish. Ben caught one.

a.	Ax̲	k̲aa	yátx'i	**nás'k**	x̲áat	has aawasháat.	(C)
	my	male	children	**three**	fish	3plS.3O.caught	

‘My sons caught three fish.’ Judgment: True in the scenario above.

b.	Ax̲	k̲aa	yátx'i	**nás'gig̲áa**	x̲áat	has aawasháat.	(C)
	my	male	children	**three.DIST**	fish	3plS.3O.caught	

Judgment: Not true in the scenario above

Although distributive numerals do not allow for collective or cumulative readings, they do allow for distributive ones. Indeed, if one ever wishes to express a distributive meaning in Tlingit, then a distributive numeral is virtually obligatory, as shown in (25) and (26) below.

(25) **Distributive Readings Virtually *Require* Distributive Numerals**

Scenario: We have six dogs. Linda, Anne and Sue each bathed two of them.

a.	Wé	shaax'wsáani	**déix̲**	keitl	has aawashúch.	(BB)
	those	girls	**two**	dog	3plS.3O.bathed	

‘The girls bathed two dogs.’ Judgment: Not true in the scenario above. [10]

b.	Wé	shaax'wsáani	**dáx̲gaa**	keitl	has aawashúch.	(C)
	those	girls	**two.DIST**	dog	3plS.3O.bathed	

‘The girls bathed two dogs each.’ Judgment: True in the scenario above.

(26) **Distributive Readings Virtually *Require* Distributive Numerals**

Scenario: My sons Tom and Ben went fishing. Tom caught three fish, and Ben did too.

a.	Ax̲	k̲aa	yátx'i	**nás'k**	x̲áat	has aawasháat.	(C)
	my	male	children	**three**	fish	3plS.3O.caught	

‘My sons caught three fish.’ Judgment: Not true in the scenario above.[11]

[10] There is some evidence to suggest that speakers marginally allow plain numeral sentences like (25a) to receive a distributive reading. First, some speakers initially accepted (25a) as true in this scenario, though they later revised their judgment. In addition, one speaker (WF) offered *déix̲ keitl* ‘two dogs’ as the answer to the question *Daa sáwé has aawashúch?* ‘What did they bathe?’ under the scenario in (25).

[11] As with sentence (25a), some speakers initially accepted (26a) as true in the associated scenario. This suggests that a distributive interpretation of (26a) may be marginally possible.

b.	Ax̲	k̲aa	yátx'i	**nás'gig̲áa**	x̲áat	has aawasháat. (C)[12]
	my	male	children	**three.DIST**	fish	3plS.3O.caught

‘My sons caught three fish each.’ Judgment: True in the scenario above

Let us now recall the definition in (1) of a ‘distributive numeral’, repeated below. The facts in (23)-(26) indicate that distributive numerals in Tlingit possess the property in (i). Furthermore, the facts in (28) show that such numerals also possess the property in (ii).

(27) **Distributive Numeral (Gil 1982, Choe 1987, Zimmermann 2002)**
A morphosyntactic construction containing a numeral, whereby (i) the sentence as a whole receives a distributive reading, and (ii) under the allowable readings, the expression modified by the construction must be interpreted as if it is within the *scope* of a distributive operator.

(28) **NP Modified by Distributive Numeral Must be in Scope of Distributive Operator**

Scenario: We have three dogs. Six girls came over to bathe them. Each dog was bathed by a team of two (different) girls.

a.	**Dáx̲náx̲**	shaax'wsáani	**nás'gig̲áa**	keitl	has aawashúch. (HS)
	two	girls	**three.DIST**	dog	3plS.3O.bathed

‘The girls bathed three dogs each.’ Judgment: Not true in this scenario

b.	**Dáx̲gaanáx̲**	shaax'wsáani	**nás'k**	keitl	has aawashúch. (HS)
	two.DIST	girls	**three**	dog	3plS.3O.bathed

‘Three dogs were each bathed by two girls.’ Judgment: True in this scenario

The sentences in (28a,b) differ only in the location of the distributive suffix –*gaa*; in (28a), it marks the numeral in object position, while in (28b), it appears on the numeral modifying the subject. Importantly, only sentence (28b) is accepted as true in the scenario under (28). Finally, note that a logical representation of this scenario using the distributive operator in (4) would appear as in (29) below.

(29) **Representation of the Scenario in (28) Using the Distributive Operator (4)**

$$\exists z\,.\,\mathbf{three.dogs(z)}\ \&\ \forall x\,.\ \underbrace{x \leq \mathbf{z}\ \&\ \mathrm{atom}(x)}_{\text{Restrictor of } DIST} \rightarrow \underbrace{\exists y\,.\,\mathbf{two.girls}(y)\ \&\ y \text{ bathed } x}_{\text{Scope of } DIST}$$

‘There is a group of three dogs z, and for each atomic member x of z, there is a (possibly different) group of two girls y such that y bathed x.’

[12] Although (26b) was constructed, sentence (i) below was spontaneously offered as a description of the scenario under (26). In addition, the speaker explicitly translated this sentence back into English as ‘They caught three each’

(i)	**Nás'gigáa**	x̲áat	áwé	has aawasháat.	(WF)
	three.DIST	fish	FOC	3plS.3O.caught	

‘They caught three fish each.’

Crucially, under this representation, only the numeral 'two' modifying the subject appears within the *scope* of the distributive operator; the numeral 'three' modifying the object actually scopes above the operator. Consequently, the contrast between (28a) and (28b) demonstrates that the numeral suffixed with *–gaa* must be interpreted as if it is within the scope of the distributive operator. Thus, Tlingit distributive numerals indeed exhibit the property in (ii) under (1)/(27).

We have seen that distributive readings of numerals in Tlingit require the presence of the distributive suffix *–gaa*, and that numerals marked with *–gaa* must be interpreted as scoping below a distributive operator. A direct consequence of this, often reported for other languages with distributive numerals (Gil 1982, Oh 2005), is that an 'inverse scope' reading of a transitive sentence with a numerically modified subject is only possible if the subject is modified by a distributive numeral. The following data illustrate.

(30) **Distributive Numerals are Required for Inverse Scope Readings**

Scenario: We have three dogs. Six girls came over to bathe them. Each dog was bathed by a team of two (different) girls.

a. Unmarked Numeral

Dáx̱náx̱	shaax'wsáani	**nás'k**	keitl	has aawashúch.	(C) [13]
two	girls	**three**	dog	3plS.3O.bathed	

'Two girls bathed three dogs.' Judgment: Not true in scenario above

b. Distributive Numeral on Subject

Dáx̱gaanáx̱	shaax'wsáani	**nás'k**	keitl	has aawashúch.	(HS)
two.DIST	girls	**three**	dog	3plS.3O.bathed	

'Three dogs were each bathed by two girls.' Judgment: True in scenario above

In Section 1, we briefly saw that Tlingit sentences containing distributive numerals often appear at first glance to be ambiguous, in that they can often be true in either participant-distributive or event-distributive scenarios. Furthermore, in Section 2, we saw that such sentences in Tlingit can also sometimes be syntactically ambiguous, in that distributive numerals are able to attach both adnominally and adverbially in the language. This naturally raises the question of whether these ambiguities are linked. That is, does the syntactic attachment site of the distributive numeral at all affect what kind of distributive scenario the sentence can describe? Interestingly, as in other languages with distributive numerals, the answer appears to be 'no' (Zimmermann 2002, Oh 2005; *cf.* Gil 1982).

To begin, note that sentences (31a) and (31b) are judged as true in the participant-distributive scenarios they are paired with.

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[13] Note that sentence (30a) was strongly rejected in this scenario, even by those speakers who had earlier momentarily accepted the truth of (25a) and (26a) in their associated scenarios. This suggests that distributive readings of unmarked numeral sentences are only possible (marginally) in cases of surface scope.

(31) **Distributive Numerals and ‘Participant-Distributive Scenarios’**

a. Scenario: My sons Tom and Ben went fishing. Tom caught three fish; Ben did too

Ax̱	ḵaa	yátx’i	**nás’gig̱áa**	x̱áat	has aawasháat.	(C)
my	male	children	**three.DIST**	fish	3plS.3O.caught	

Judgment: True in the scenario above

b. Scenario: We have six dogs. Linda, Anne, and Sue each bathed two of them.

Dáx̱gaa	áwé	nás’gindruáx̱	shaax’wsáanich	has aawashúch	wé	keitl	(BB)
two.DIST	FOC	three	girls.ERG	3plS.3O.bathed	those	dog	

Judgment: True in the scenario above

In scenario (31a), there are three fish to each boy, and in scenario (31b), there are three dogs to each girl. Thus, in each of these scenarios, the distribution is over some plural participant in the sentence, and so they are both participant-distributive scenarios. Importantly, both sentence (31a) and (31b) are judged true in their paired scenario. Furthermore, note that sentence (31a) is of the form ‘Subject’ > ‘Distributive Numeral’ > ‘Bare NP’ > ‘Verb’. Consequently, given the generalization in (21), we know that the distributive numeral in (31a) must be *adnominal*. Moreover, sentence (31b) is of the form ‘Distributive Numeral’ > ‘Verb’ > ‘Demonstrative DP’. Thus, generalization (20) entails that the distributive numeral in (31b) is *adverbial*.[14] Taken together, the facts in (31) show that the attachment site of the distributive numeral does not affect whether the sentence can describe a participant-distributive scenario.

In a similar way, it can be shown that the syntactic status of the distributive numeral does not affect whether the sentence describes an event-distributive scenario.

(32) **Distributive Numerals and ‘Event-Distributive Scenarios’**

a. Scenario: Every day last week, my sons went out fishing. Every day, they together caught a total of three fish.

Ax̱	ḵaa	yátx’i	**nás’gig̱áa**	x̱áat	has aawasháat.	(C)
my	male	children	**three.DIST**	fish	3plS.3O.caught	

Judgment: True in the scenario above

b. Scenario: My neighbors have eight dogs. My daughters went over to bathe their dogs. First, they together bathed two dogs at the same time. Then, they together bathed another two dogs at the same time. Then, they did another two dogs together, and then another two together, until all eight dogs were bathed.

[14] The adverbial status of *dáx̱gaa* ‘two.DIST’ in (31b) is also ensured by the fact that it does not bear the human suffix *–náx̱*, and so could in no way be modifying the subject ‘three girls’. Intuitively, it is semantically ‘associating’ with the demonstrative DP *wé keitl* ‘those dogs’. However, given the facts discussed in Section 3, the distributive numeral could in no way be a ‘floated’ adnominal modifier of that DP, and so it must be adverbial in (31b).

Ax̲ shaa yátx'i **dáx̲g̲aa** has aawashúch yóo keitl (BB)
my female children **two.DIST** 3plS.3O.bathed those dog
Judgment: True in the scenario above

In scenario (32a), there are three fish to each event of my sons fishing (but not to each son), and in scenario (32b), there are two dogs to each event of bathing (but not to each daughter). Thus, in each of these scenarios, the distribution is over some plurality of fishing/bathing events, and so they are both event-distributive scenarios. Again, it's important to note that both (32a) and (32b) are true in their paired scenario. Moreover, given generalization (21), we know that (32a) contains an *adnominal* distributive numeral, while generalization (20) entails that (32b) contains an *adverbial* distributive numeral. Consequently, the facts in (32) show that both adnominal and adverbial distributive numerals allow readings that cover event-distributive scenarios. Altogether, then, we see from (31) and (32) that the syntactic status of the distributive numeral does not affect the kind of distributive scenario the sentence can describe.

There are, however, other factors that can affect the kinds of scenarios describable by a distributive numeral sentence. In particular, as has been reported for other languages (Gil 1982, Oh 2005), there are certain sentence structures that can only describe event-distributive scenarios. First, note that all the examples considered thus far are transitive sentences containing two plural arguments. Distributive numerals, however, are also possible in transitive sentences containing only one plural argument. As shown below, the only interpretation reported for such sentences describes an event-distributive scenario.

(33) **Sentence with a Distributive Numeral and Only One Plural Argument**

Nás'gig̲áa x̲áat áwé aawasháat. (WF)
three.DIST fish FOC 3sgS.3O.caught
'He caught three fish each time'.
Speaker Comment:
'This means every time he went out - in the morning, in the evening - he caught three'.

Furthermore, it is possible for distributive numerals to appear in intransitive sentences, just so long as the subject is plural. Again, the only interpretation reported is one that describes an event-distributive scenario.

(34) **Intransitive Sentence with a Distributive Numeral**

Dáx̲g̲aanáx̲ áwé has aawal'éx̲. (WF), (BB)
two.DIST FOC 3plS.danced
'They danced in twos'.
Target Scenario: We are watching a dance performance. As part of this performance, the girls have divided into pairs. Each pair of girls goes up on stage and dances in turn.

Finally, it is possible for a sentence to contain two distributive numerals, each modifying a different NP. As reported for other languages (Gil 1982, Oh 2005), such sentences are judged to be awkward and difficult to understand. However, the meaning speakers identify for them is one that covers an event-distributive scenario.

(35) **Transitive Sentences with Two Distributive Numerals**

Scenario: Our neighbor has a bunch of dogs, which are always very dirty. This week, every time we went over to their house, there were two (different) girls bathing three (different) dogs.

Dá<u>x</u>gaaná<u>x</u>	shaax'wsáani	**nás'gig<u>á</u>a**	keitl	has aawashúch.	(C)
two.DIST	girls	**three.DIST**	dog	3plS.3O.bathed	

'Each time, two girls bathed three dogs'. Or, 'Girls in twos bathed dogs in threes.'
Judgment: True in the scenario above.

The facts discussed thus far constitute the empirical core of this paper. In the following section, I develop a formal semantic analysis of these data, one that builds upon much recent work on the semantics of plurality and pluractionality (Beck & von Stechow 2007, Kratzer 2008, Henderson 2011). In addition to predicting the core facts above, this analysis can also account for certain interesting patterns observed for distributive numerals in other languages, and offers a novel perspective on the semantics of the English binominal each construction.

5. Formal Semantic Analysis: Tlingit Distributive Numerals as Pluractional Operators

This section presents the proposed formal semantic analysis of the distributive suffix *–g<u>a</u>a* in Tlingit. I begin in Section 5.1 with an overview of the key background assumptions.

5.1 The Key Ingredients

For reasons of space, much of my discussion here will presuppose some familiarity with the semantic literature on plurality, distributivity, and pluractionality (Lasersohn 1995, Schwarzschild 1996, Beck & von Stechow 2007, Kratzer 2008). To begin, I assume throughout the following central hypothesis.

(36) **The Cumulativity of all Natural Language Predicates (Krifka 1992, Kratzer 2008)**
If P is a lexical item of a natural language, then [[P]] satisfies the condition below

a. Cumulativity Condition
If $[[P]](x_1)\ldots(x_n) = T$, and $[[P]](y_1)\ldots(y_2) = T$, then $[[P]](x_1+y_1)\ldots(x_n+y_n) = T$

According to the principle in (36), for any natural language predicate *P*, if *P* holds between the entities $x_1,\ldots,x_n$, and holds between the entities $y_1,\ldots y_n$, then *P* holds for the plural sums $(x_1+y_1),\ldots,(x_n+y_n)$. To briefly illustrate, consider the relation 'father of' sketched in (37).

(37) **Illustration of Cumulative Relations**

Fathers	'father of'	Daughters
Bill		Sue
Frank		Jen
Bill+Frank		Sue+Jen

Suppose that, as sketched above, Bill is the father of Sue, and Frank is the father of Jen. Intuitively, Bill and Frank are therefore the father(s) of Sue and Jen. The validity of this inference is captured by the cumulativity hypothesis in (36). After all, if 'father of' holds between Bill and Sue, and between Frank and Jen, then (36) entails that – as sketched above – 'father of' must also hold between the pluralities Bill+Frank and Sue+Jen. I refer the reader to the works cited above for more background upon the key hypothesis in (36).

As in much work that assumes (36), I will employ an asterisk '*' as a small notational mnemonic, to remind the reader that the predicates in question are all assumed to be 'cumulative', as defined in (36a).[15] Thus, I will employ predicates like '[λx : *dog(x)]', where the '*' is simply a reminder that this predicate holds both of individual dogs and dog pluralities.

Next, regarding definite plurals, I adopt the commonplace view that definite determiners have the semantics in (38a), where the 'maximality' operator 'σ_x' is defined as in (38b).

(38) **The Semantics of Definite DPs**

a. [[the / this / that]] = [$\lambda P_{<et>} : \sigma_x . P(x)$]

b. <u>Definition of the Operator 'σ_x'</u>

(i) *Definition of Cumulative Closure:*
If S is a set, then *S is the smallest set such that (i) S $\subseteq$ *S, and (ii) if α and $\beta \in$ *S, then $\alpha+\beta \in$ *S

(ii) $\sigma_x . Q(x)$ $=_{df}$ the entity α such that $\alpha \in *\{ x : Q(x) \}$ and if $\gamma \in *\{ x : Q(x) \}$, then $\gamma \leq \alpha$

Note that, for purposes of simplicity, will also ignore here the deictic content of demonstratives, and will treat them as semantically akin to definite determiners. Therefore, a demonstrative DP such as 'those dogs' will denote the entity 'σ_x . *dog(x)', which equates to the largest possible plurality of dogs.

A third core assumption of my analysis is that verbs are pure (cumulative) relations between events and their internal arguments, as illustrated below.

(39) **Verbs are (Cumulative) Relations Between Events and Themes (Kratzer 2008)**

a. [[bathe]] = [$\lambda x_e : \lambda e_\varepsilon$: *bathe(e) & *Theme(e) = x]
b. [[catch]] = [$\lambda x_e : \lambda e_\varepsilon$: *catch(e) & *Theme(e) = x]

Thus, if the individual events of 'dog-bathing' are as in (40a), then the relation 'bathe' holds between all the event-dog pairs in (40b).

[15] In the broader literature on plurality, the '*'-operator creates a cumulative predicate from a non-cumualtive one.

(40) **Illustration of (Cumulative) Verbal Semantics**

a. <u>Atomic Events of Bathing</u>

Bathings	*Dogs Bathed*
e_1	Sparky
e_2	Spot
e_3	Rex

b. <u>Denotation of 'Bathe'</u>

$$\left\{ \begin{array}{l} < e_1 \ , \text{Sparky} > \\ < e_2 \ , \text{Spot} > \\ < e_3 \ , \text{Rex} > \\ < e_1{+}e_2 \ , \text{Sparky+Spot} > \\ < e_1{+}e_3 \ , \text{Sparky+Rex} > \\ < e_2{+}e_3 \ , \text{Spot+Rex} > \\ < e_1{+}e_2{+}e_3 \ , \text{Sparky+Spot+Rex} > \end{array} \right\}$$

Of course, if only the internal argument of a verb is represented in its lexical meaning (38), then additional syntactic means are required to link the verb to its external argument. Following much literature, I will assume that the external argument of the verb is provided by a little-*v* head, with the semantics below.

(41) **The Semantics of Little-*v* (Kratzer 1996)**
$[[\ v\ ]] \ = \ [\ \lambda x_e : \lambda e_\varepsilon : {}^*\text{Agent}(e) = x\ ]$

Assuming the semantic rule of Event Identification in (42), we can derive the meaning in (43b) for the *v*P represented in (43a).

(42) **The Rule of Event Identification (Kratzer 1996)**
If X consists of two daughter nodes, Y and Z, and Y is of type <e, εt>, while Z is of type <εt>, then $[[X]] = [\ \lambda x : \lambda e : [[Z]](e) \ \&\ [[Y]](x)(e)\ ]$

(43) **Illustration of the Compositional Semantics**

a. $[_{vP}\ [_{DP}\ \text{The girls}\ ]\ [_{vP}\ v\ [_{VP}\ \text{bathed}\ [_{DP}\ \text{the dogs}\ ]\ ]\ ]\ ]$

b. $[\ \lambda e_\varepsilon : {}^*\text{bathe}(e)\ \&\ {}^*\text{Agent}(e) = \sigma_x.{}^*\text{girl}(x)\ \&\ {}^*\text{Theme}(e) = \sigma_y.{}^*\text{dog}(y)\ ]$

To briefly unpack the meaning in (43b), note that the metalanguage predicates '*bathe', '*Agent', and '*Theme' are all cumulative. Consequently, if the individual events of dog bathing are as in (44a) below, then the cumulative relations in (44b) will all hold.

(44) **Illustration of the Cumulative Semantics of *v*P**

a.

Individual Bathings	Agent	Theme
e_1	Jen	Sparky
e_2	Sue	Spot
e_3	Laura	Rex

b. (i) *bathe($e_1+e_2+e_3$)
(ii) *Agent($e_1+e_2+e_3$) = Jen+Sue+Laura (= $\sigma_x.^*$girl(x))
(iii) *Theme($e_1+e_2+e_3$) = Sparky+Spot+Rex (= $\sigma_y.^*$dog(y))

Finally, since the plurality Jen+Sue+Laura is equivalent to '$\sigma_x.^*$girl(x)' and Sparky+Spot+Rex is '$\sigma_y.^*$dog(y)', it therefore follows that the plural event $e_1+e_2+e_3$ would satisfy predicate (43b).

Having provided a semantics for the *vP* in (43a), let us now consider the semantics of the sentence containing it. For purposes of simplicity, I will ignore tense and aspect in this paper. Indeed, the only assumption I will make concerning the sentence as a whole is the following.

(45) **Existential Closure of the Event Argument**
Above the *v*P, there is an existential binder over the event argument.

Consequently, the sentence in (46a) will be assumed to have the LF in (46b), and thus the truth-conditions in (46c).

(46) **Illustration of the Semantics**

a. The girls bathed the dogs.

b. <u>LF Structure:</u> $[_S\ \exists e\ [_{vP}\ [_{DP}$ The girls $]\ [_{vP}\ v\ [_{VP}$ bathed $[_{DP}$ the dogs $]\ ]\ ]\ ]\ ]$

c. <u>Truth-Conditions:</u> $\exists e\ .\ ^*\text{bathe}(e)\ \&\ ^*\text{Agent}(e) = \sigma_x.^*\text{girl}(x)\ \&\ ^*\text{Theme}(e) = \sigma_y.^*\text{dog}(y)$

Now, recall that under the scenario in (44a), the predicate in (43b) holds of the plural event $e_1+e_2+e_3$. Consequently, we predict that the existential truth-conditions in (46c) will also be true in that scenario. Thus, our semantics correctly predicts that sentence (46a) will be true in a scenario where (i) Jen bathes Sparky, (ii) Sue bathes Spot, and (iii) Laura bathes Rex.

The assumptions presented above are by no means unique in the semantic literature on plurality. However, there are three additional ingredients required by my analysis, which are relatively novel. The first is the metalanguage predicate 'Participant', defined as follows.

(47) **The Predicate 'Participant'**

Participant(e,*x*) *iff* x bears a 'theta relation' to e
iff x is Agent of e, or x is Theme of e, or x is Goal of e, …

That is, the predicate 'Participant' will hold between any event and some thematic participant in that event, *i.e.,* its Agent, its Theme, its Goal, *etc.*

The second additional ingredient is the binary 'maximality' operator '$\sigma_{<x,y>}$', defined below (*cf.* (38b)).

(48) **Binary Maximality Operator**

a. <u>Pair Addition:</u> $<x_1\ ,\ x_2> + < y_1\ ,\ y_2> \ =_{df}\ < x_1{+}y_1\ ,\ x_2{+}y_2>$

b. $\sigma_{<x,y>} . Q(x)(y) \quad =_{df}$ the pair $<\alpha,\beta>$ such that $<\alpha,\beta> \in *\{<x,y> : Q(x)(y)\}$, and if $<\gamma,\delta> \in *\{<x,y> : Q(x)(y)\}$, then $\gamma \leq \alpha$, and $\delta \leq \beta$

To define the operator '$\sigma_{<x,y>}$', we first define the '+' operator in (48a) for pairs (Krifka 1992, Kratzer 2008). Under this definition, the sum of the pair $<x_1 , x_2>$ and the pair $<y_1 , y_2>$ is the pair $<x_1+y_1 , x_2+y_2>$. With this in place, we can define the expression '$\sigma_{<x,y>} . Q(x)(y)$' in (48b) as being the sum of all the pairs in $\{ <x,y> : Q(x)(y) \}$. For example, in the scenario sketched in (44a), the formula '$\sigma_{<e,y>}$. *bathe(e) & Theme(e) = y' would be equal to '$<e_1$, Sparky> + $<e_2$, Spot> + $<e_3$, Rex>', and so would be the pair '$< e_1+e_2+e_3$, Sparky+Spot+Rex >'.

Finally, following Scha (1984) and Krifka (1990), I assume that there is a distinct type *n* of integers, and that numerals are expressions type *n*, as follows.

(49) **An Integer Semantics for Numerals (Scha 1984, Krifka 1990)**

a. [[one]] = 1
b. [[two]] = 2
c. [[three]] = 3

With these ingredients in place, we can now examine the proposed semantics for Tlingit distributive numerals.

5.2 The Semantics of Distributive Numerals in Tlingit

To begin, I assume that the distributive suffix *–gaa* in Tlingit is lexically ambiguous. That is, there are two homophonous *–gaa* suffixes, one creating adverbial distributive numerals, and the other creating adnominal distributive numerals. While this proposed ambiguity might justly be criticized, there are two difficult challenges facing any attempt at a fully unified semantics for adnominal and adverbial distributive numerals. The first is simply that many languages with adverbial distributive numerals do not permit them to be adnominal modifiers, and *vice versa* (Gil 1982, Oh 2005). Consequently, an analysis that predicts all adverbial distributive numerals to also function as adnominal modifiers would seem to drastically overgenerate. The second challenge is simply that *v*Ps and NPs have quite different semantic types - $<\varepsilon t>$ and $<et>$ - and so any unified analysis of adverbial and adnominal distributive numerals would *per force* need to appeal to specialized composition rules, undermining its presumed elegance.

For these reasons, I will assume that there is a distinct distributive suffix $–gaa_{ADV}$ in Tlingit with the semantics below.

(50) **Semantics for Adverbial Distributive Numerals**

$[[\text{gaa}_{ADV}]] =$

$[\lambda n_n : [\lambda P_{<e,\varepsilon t>} : [\lambda x_e : [\lambda e_\varepsilon : P(x)(e) \;\&$
$<e , x> \;=\; \sigma_{<e',y>} . y < x \;\&\; |y| = n \;\&\; e' < e \;\&\; \text{Participant}(e',y)] \ldots]$

The explicit examples below will help to clarify the content of this lexical entry. For the moment, however, we can break down the meaning in (50) as follows. The adverb-creating *–gaa* suffix takes as argument an integer 'n' and a relation 'P' between entities and events, and then returns a relation between entities and events, which holds of an entity 'x' and an event 'e' *iff* (i) the relation 'P' holds between 'x' and 'e', and (ii) the pair <e,x> is the sum of those pairs <e',y> such that (a) y is a proper part of x, and (b) y is a plurality of cardinality of n, (c) e' is a proper part of e, and (d) y is a participant in e'.

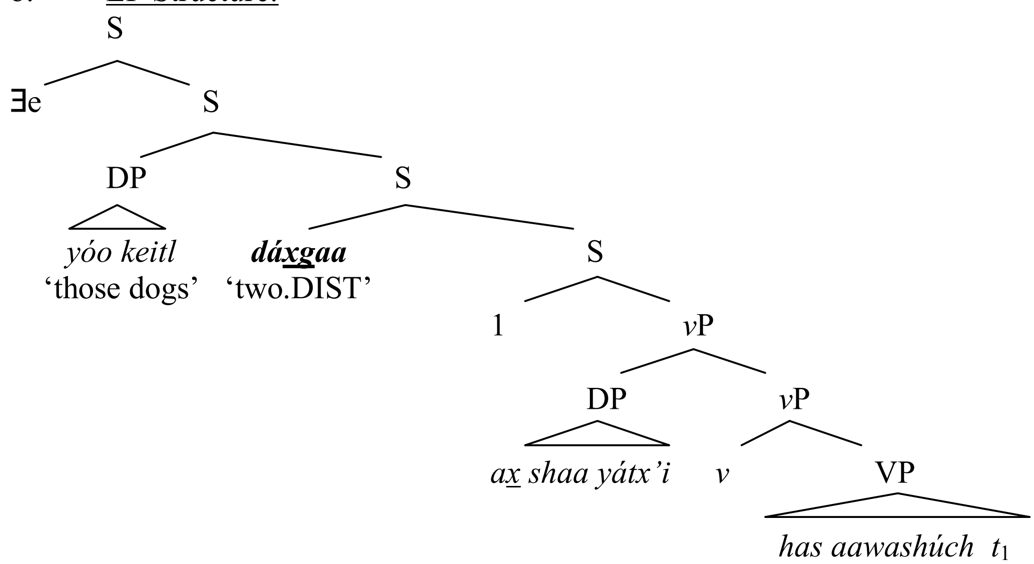
To get a better handle on this denotation, let us consider the sentence in (51a) below. Given generalization (20), the distributive numeral *dá<u>x</u>gaa* in (51a) is adverbial. Moreover, following Beck & von Stechow (2007), I will assume that the structure in (51b) is a possible LF for (51a). Under this LF structure, the DP *yóo keitl* 'those dogs' undergoes movement, creating the lambda operator '1' (Heim & Kratzer 1998). This movement of the direct object is followed by a 'tucking-in' movement of the distributive numeral, between the direct object and the lambda that its movement creates. I refer the reader to Beck & von Stechow 2007 for more discussion of this LF syntax. Given this LF, however, our semantics in (50) yields the truth-conditions in (51c).

(51) **The Compositional Semantics of Adverbial Distributive Numerals**

a. <u>Tlingit Sentence:</u>

A<u>x</u>	shaa	yátx'i	**dá<u>x</u>gaa**	has aawashúch	yóo	keitl	(BB)
my	female	children	**two.DIST**	3plS.3O.bathed	those	dog	

b. <u>LF Structure:</u>



c. <u>Predicted Truth-Conditions:</u>

$\exists e$. *bathe(e) & *Agent(e) = σ_x.*my.daughter(x) & *Theme(e) = σ_y.*dog(y) &
$\langle e, \sigma_y.{*}dog(y) \rangle = \sigma_{\langle e', y \rangle}.\ y < \sigma_y.{*}dog(y)\ \&\ |y| = 2\ \&\ e' < e\ \&$ Participant(e',y)

My daughters (cumulatively) bathed those dogs, and
the dogs are the ***proper*** *sum of pairs of things that took part in the bathing*

Given our assumptions from the previous section, the truth-conditions in (51c) can be read informally as follows: there is a (plural) event e of bathing, whose agent is my daughters and whose theme is the dogs, and the pair consisting of e and the dogs is the sum of those pairs <e',y> such that y is a pair of dogs, e' is a proper part of e, and y participates in e'. Breaking this down still further, we see that these truth-conditions amount to the claim that my daughters cumulatively bathed the dogs, and the dogs can be broken down into pairs, each of which is the theme of some sub-event of the larger event of bathing. While this is still quite a mouthful, consider how it applies to the participant-distributive scenario in (31b), repeated below.

(52) **Participant-Distributive Scenario**
We have six dogs. Linda, Anne, and Sue (my daughters) each bathed two of them.

Bathings	Agent	Theme
e_1	Linda	Sparky+Rex
e_2	Anne	Spot+Fido
e_3	Sue	Lucky+Lassie

Consider the plural event $e_1+e_2+e_3$. Given the assumptions from Section 4.1, it follows that $*\text{Agent}(e_1+e_2+e_3)$ = Linda+Anne+Sue = $\sigma_x.*\text{my.daughter}(x)$. Moreover, it follows that $*\text{Theme}(e_1+e_2+e_3)$ = Sparky+Rex+Spot+Fido+Lucky+Lassie = $\sigma_y.*\text{dog}(y)$. Therefore, in scenario (52), the condition '$\exists e\ .\ *\text{bathe}(e)\ \&\ *\text{Agent}(e) = \sigma_x.*\text{my.daughter}(x)\ \&\ *\text{Theme}(e) = \sigma_y.*\text{dog}(y)$' in (51c) holds. Now, consider the pair <$e_1+e_2+e_3$, Sparky+Rex+Spot+Fido+Lucky+Lassie >. Note that this pair is the sum of the pairs {<e_1,Sparky+Rex>, <e_2, Spot+Fido>, <e_3, Lucky+Lassie>}. Moreover, note that this set of pairs is equal to the set $\{ \langle e',y\rangle : y < \sigma_y.*\text{dog}(y)\ \&\ |y| = 2\ \&\ e' < e_1+e_2+e_3\ \&\ \text{Participant}(e',y) \}$. Therefore, it follows from our definition in (48b) that the pair $\langle e , \sigma_y.*\text{dog}(y) \rangle = \langle e_1+e_2+e_3$, Sparky+Rex+Spot+Fido+Lucky+Lassie $\rangle = \sigma_{\langle e',\ y\rangle}.\ y < \sigma_y.*\text{dog}(y)\ \&\ |y| = 2\ \&\ e' < e\ \&\ \text{Participant}(e',y)$. Putting both these observations together, we find that the entirety of the truth-conditions in (51c) hold in scenario (52).

Given that the predicted truth-conditions hold in scenario (52), we see that our semantics correctly predicts that sentences containing adverbial distributive numerals are interpreted as true in participant-distributive scenarios. Now let us consider the event-distributive scenario in (32b), repeated below

(53) **Event-Distributive Scenario**
My neighbors have eight dogs. My daughters went over to bathe their dogs. First, they together bathed two dogs at the same time. Then, they together bathed another two dogs at the same time. Then, they did another two dogs together, and then another two together, until all eight dogs were bathed.

Bathings	Agent	Theme
e_1	Linda+Anne+Sue	Sparky+Rex
e_2	Linda+Anne+Sue	Spot+Fido
e_3	Linda+Anne+Sue	Lucky+Lassie
e_4	Linda+Anne+Sue	Ruffles+Toto

Intuitively, in this scenario it is again the case that the girls cumulatively bathed the dogs, and the dogs can be broken down into pairs, each of which is theme to some sub-event of the larger (cumulative) bathing. Thus, it would seem our semantics correctly predicts (51a) to be true in scenario (53). We can also see this in more detail as follows. Consider the plural event $e_1+e_2+e_3+e_4$. As before, it is the case that $*bathe(e_1+e_2+e_3+e_4)$, $*Agent(e_1+e_2+e_3+e_4) = \sigma_x.*my.daughter(x)$, and $*Theme(e_1+e_2+e_3+e_4) = \sigma_y.*dog(y)$. Moreover, consider the pair $<e_1+e_2+e_3+e_4 , Sparky+Rex+Spot+Fido+Lucky+Lassie+Ruffles+Toto> = <e_1+e_2+e_3+e_4 , \sigma_y.*dog(y)>$. Clearly, this pair is the sum of the pairs $\{<e_1,Sparky+Rex>, <e_2, Spot+Fido>, <e_3, Lucky+Lassie>, <e_4 , Ruffles+Toto>\}$. Moreover, note that this latter set is equal to the set $\{<e',y> : y < \sigma_y.*dog(y) \ \& \ |y| = 2 \ \& \ e' < e_1+e_2+e_3+e_4 \ \& \ Participant(e',y) \}$. It therefore follows that $<e_1+e_2+e_3+e_4 , \sigma_y.*dog(y)> = \sigma_{<e', y>}. y < \sigma_y.*dog(y) \ \& \ |y| = 2 \ \& \ e' < e \ \& \ Participant(e',y)$. Putting both these observations together, we find that the entirety of the truth-conditions in (51c) hold in scenario (53).

Thus, we find that our semantics in (50) correctly predicts that sentences like (51a), containing adverbial distributive numerals, will be true both in participant-distributive and event-distributive scenarios. But, what of sentences containing adnominal distributive numerals? As noted earlier, I will assume that there is a second distributive suffix *–gaa*$_{ADN}$ in Tlingit, which derives adnominal distributive numerals and has the semantics below.

(54) **Semantics for Adverbial Distributive Numerals**

$[[\text{gaa}_{ADN}]] =$

$$[\lambda n_n : [\lambda Q_{<et>} : [\lambda P_{<e, \varepsilon t>} : [\lambda e_\varepsilon : \exists x. Q(x) \ \& \ P(x)(e) \ \& \\ <e , x> = \sigma_{<e', y>} . y < x \ \& \ |y| = n \ \& \ e' < e \ \& \ Participant(e',y)] \ldots]$$

Again, the proposed semantics is rather complex, but can be broken down as follows. The adnominal *–g̲aa* takes as argument an integer ‘n’ and an <et> predicate ‘Q’, supplied by the modified NP. It then takes as argument a relation ‘P’ between entities and events, and returns a predicate of events. This predicate of events holds of an event ‘e’ *iff* (i) there is an ‘x’ such that Q(x) holds, and the relation ‘P’ holds between ‘x’ and ‘e’, and (ii) the pair <e,x> is the sum of those pairs <e’,y> such that (a) y is a proper part of x, and (b) y is a plurality of cardinality of n, (c) e’ is a proper part of e, and (d) y is a participant in e’.

As before, we can clarify the content of this proposal through an illustrative example. Consider sentence (55a) below. Given generalization (21), this sentence contains an adnominal distributive numeral. I will assume that this sentence receives the simple LF structure in (55b), where the NP marked by the distributive numeral remains *in situ* within the *v*P. With this LF, the semantics in (54) predicts the truth-conditions in (55c).

(55) **The Compositional Semantics of Adnominal Distributive Numerals**

a. Tlingit Sentence:

Ax̲	k̲aa	yátx’i	**nás’gig̲áa**	x̲áat	has aawasháat.	(C)
my	male	children	**three.DIST**	fish	3plS.3O.caught	

b. LF Structure:
[$_S$ ∃e [$_{vP}$ ax kaa yátx'i [$_{vP}$ v [$_{VP}$ [**nás'gigáa** xáat] has aawasháat]]]]]

c. Predicted Truth-Conditions:

$$\exists e \,.\, \exists x \,.\, {*}\text{fish}(x) \;\&\; {*}\text{caught}(e) \;\&\; {*}\text{Agent}(e) = \sigma_x.{*}\text{my.son}(x) \;\&\; {*}\text{Theme}(e) = x \;\&$$
$$\langle e , x \rangle \;=\; \sigma_{\langle e', y\rangle} \,.\, y < x \;\&\; |y| = 3 \;\&\; e' < e \;\&\; \text{Participant}(e',y)$$

There are some fish x such that my sons (cumulatively) caught x, and
x is the ***proper*** *sum of triplets of things that took part in the catching*

As before, we can read the truth-conditions in (55c) informally as follows: there is a (plural) event e of catching, whose agent is my sons and whose theme is a bunch of fish *x*, and the pair consisting of e and x is the sum of those pairs <e',y> such that y is a triplet of fish, e' is a part of e, and y participates in e'. Mulling this over a bit, we find that this is equivalent to the claim that my sons cumulatively caught a bunch of fish, and the fish they caught can be broken down into triplets, each of which is the theme of some sub-event of the larger catching event.

Importantly, these predicted truth-conditions will again hold in both participant-distributive and event-distributive scenarios. Consider first the participant-distributive scenario in (31a), repeated below.

(56) **Participant-Distributive Scenario**
My sons Tom and Ben went fishing. Tom caught three fish; Ben did too

Catchings	Agent	Theme
e_1	Tom	$fish_1+fish_2+fish_3$
e_2	Ben	$fish_4+fish_5+fish_6$

Intuitively, in this scenario, there is indeed an event e_1+e_2 of my sons cumulative catching a bunch of fish, $fish_1+fish_2+fish_3+fish_4+fish_5+fish_6$. Moreover, this sextuplet of fish can be broken down into triplets, each of which participated in some subevent of e_1+e_2. Thus, under our informal reading, the truth-conditions in (55c) hold in scenario (56). We can also show the validity of (55c) in (56) in more formal detail. As the reader can confirm, the event e_1+e_2 witnesses the first sub-part of the truth-conditions in (55c): $\exists e \,.\, \exists x \,.\, {*}\text{fish}(x) \;\&\; {*}\text{caught}(e) \;\&\; {*}\text{Agent}(e) = \sigma_x.{*}\text{my.son}(x) \;\&\; {*}\text{Theme}(e) = x$. Now consider the pair $\langle e_1+e_2 , fish_1+fish_2+fish_3+fish_4+fish_5+fish_6\rangle$. This pair is indeed the sum of the pairs $\{\langle e_1, fish_1+fish_2+fish_3 \rangle , \langle e_2 , fish_4+fish_5+fish_6 \rangle\}$. Moreover, the reader can confirm that this set of pairs is equal to the set $\{\langle e',y\rangle : y < fish_1+fish_2+fish_3+fish_4+fish_5+fish_6 \;\&\; |y| = 3 \;\&\; e' < e_1+e_2 \;\&\; \text{Participant}(e',y) \}$. Thus, we find that the equation '$\langle e_1+e_2 , fish_1+fish_2+fish_3+fish_4+fish_5+fish_6\rangle = \sigma_{\langle e', y\rangle} \,.\, y < x \;\&\; |y| = 3 \;\&\; e' < e \;\&\; \text{Participant}(e',y)$' holds, and so the entire existential formula in (55c) is witnessed by e_1+e_2 and $fish_1+fish_2+fish_3+fish_4+fish_5+fish_6$.

Having seen that we predict (55a) to be true in participant-distributive scenarios, let us now consider the event-distributive scenario in (32a), repeated below.

(57) **Event-Distributive Scenario**
Every day last week, my sons went out fishing. Every day, they together caught a total of three fish.

Catchings	Agent	Theme
e_1	Tom+Ben	$fish_1$+$fish_2$+$fish_3$
…	…	….
e_7	Tom+Ben	$fish_{19}$+$fish_{20}$+$fish_{21}$

Again, in this scenario, there is indeed an event e_1+…+e_7 of my sons cumulative catching a bunch of fish, $fish_1$+…+$fish_{21}$. Moreover, this plurality of fish can be broken down into triplets, each of which participated in some subevent of e_1+…+e_7. It is apparent that under our informal reading of (55c), those truth-conditions hold in the event-distributive scenario above. We could again show in more formal detail that those truth-conditions hold in (57), but in the interest of space, this will be left as an exercise to the reader.

In summary, we have seen that our semantic analysis of distributive numerals in (50) and (54) correctly predicts the core pattern in (31)-(32): the syntactic attachment site of the distributive numeral has no effect upon whether the sentence can describe event-distributive or participant-distributive scenarios. Furthermore, it is important to note that under our analysis, the ability for sentences with distributive numerals to describe both kinds of distributive scenarios is *not* a case of ambiguity (*cf.* Gil 1982, Zimmermann 2002, Oh 2005, Balusu 2006). Rather, such sentences simply receive truth-conditions that are general enough to hold in both kinds of distributive scenarios. To put the matter more acutely, our semantics in (50)-(54) predicts that a sentence containing the phrase '*n-gaa NP*' will be true if there is a plural event that can be divided up into (proper) subevents, each of which contains '*n NP*'s in it.[16] Thus, our semantics most directly predicts the truth of such sentences in event-distributive scenarios. However, crucially, participant-distributive scenarios can themselves actually be viewed as a special *subcase* of event-distributive scenarios. That is, participant-distributive scenarios are simply event-distributive scenarios where each of the key subevents contains an atomic member of some other plural participant in the event. In this way, a semantics that guarantees that distributive numeral sentences are true in event-distributive scenarios will also capture their truth in participant-distributive ones.

Thus far, we've seen how the semantics in (50) and (54) operates, and how it derives the key facts in (31)-(32). In the following subsection, we will see that this semantics can also capture a variety of other facts observed for Tlingit distributive numerals.

5.3 Other Key Features of Tlingit Distributive Numerals

Although our semantics predicts that Tlingit sentences with distributive numerals can in principle describe both event-distributive and participant-distributive scenarios, we saw at the end of Section 4 that there are certain sentence types in the language that describe only event-distributive scenarios. Interestingly, our semantics in (50) and (54) predicts this range of facts.

[16] In this sense, our semantics is rather similar to the analysis of English 'binominal each' developed independently by Champollion (to appear). Note, however, that these accounts use very different formal means to achieve this general conceptual end.

First, let us consider sentences like (33), which contain only one plural NP. As shown below, our semantics predicts such sentences to have the truth-conditions in (58c).

(58) **Sentence with a Distributive Numeral and Only One Plural Argument**

a. Sentence:

Ax	yéet	**nás'gigáa**	xáat	aawasháat.	(C)
My	son	**three.DIST**	fish	3sgS.3O.caught	

'My son caught three fish each time'.

b. LF: $[_S\ \exists e\ [_{vP}\ [\ ax\ y\acute{e}et\ ]\ [_{vP}\ v\ [_{VP}\ [\ \textbf{nás'gigáa}\ x\acute{a}at\ ]\ aawash\acute{a}at\ ]\ ]\ ]\ ]\ ]$

c. Predicted Truth-Conditions

$\exists e\ .\ \exists x\ .\ {}^*fish(x)\ \&\ {}^*caught(e)\ \&\ {}^*Agent(e) = my.son\ \&\ {}^*Theme(e) = x\ \&$
$\langle e\ ,\ x\rangle\ =\ \sigma_{\langle e',\ y\rangle}\ .\ y < x\ \&\ |y| = 3\ \&\ e' < e\ \&\ Participant(e',y)$

As should now be familiar to the reader, the truth-conditions in (58c) state that there is a plural event e of my son catching some fish x, and the group of fish x can be divided into triplets, each of which participated in some subevent of e, the larger catching event. Clearly, these truth-conditions will hold in an event-distributive scenario where there are multiple events of my son catching three fish. Moreover, it is also clear that there is no comparable participant-distributive scenario where these truth-conditions hold, simply because the only participant in the plural event of catching besides the fish 'x' is the atomic individual 'my son'.

For similar reasons, our semantics predicts that intransitive sentences containing distributives numerals, such as (34), will only describe event-distributive scenarios.

(59) **Intransitive Sentence with a Distributive Numeral**

a. Sentence:

Dáxgaanáx	shaax'wsáani	has aawal'éx.	(C)
two.DIST	girls	3plS.danced	

'They danced in twos'.

b. LF: $[_S\ \exists e\ [_S\ [\ \textbf{dáxgaanáx}\ shaax'ws\acute{a}ani\ ]\ [_{vP}\ v\ [_{VP}\ has\ aawal'\acute{e}x\ ]\ ]\ ]\ ]$

c. Predicted Truth-Conditions

$\exists e\ .\ \exists x\ .\ {}^*girl(x)\ \&\ {}^*danced(e)\ \&\ {}^*Agent(e) = x\ \&$
$\langle e\ ,\ x\rangle\ =\ \sigma_{\langle e',\ y\rangle}\ .\ y < x\ \&\ |y| = 2\ \&\ e' < e\ \&\ Participant(e',y)$

As the reader can again confirm, the truth-conditions in (59c) state that there is a plural event e of some girls x dancing, and the group of girls x can be divided up into pairs, each of which participated in some subevent of e. As with (58c), these truth-conditions will hold in an event-distributive scenario where there are multiple events of two girls dancing. However, given that there is no other participant in the plural event e besides the girls, it is not possible to imagine a participant-distributive scenario where (59c) holds.

Finally, let us consider sentences like (35), which contain multiple distributive numerals.

(60) **Transitive Sentences with Two Distributive Numerals**

a. Sentence:

Dáxgaanáx	shaax'wsáani	**nás'gigáa**	keitl	has aawashúch.	(C)
two.DIST	girls	**three.DIST**	dog	3plS.3O.bathed	

'Each time, two girls bathed three dogs'. Or, 'Girls in twos bathed dogs in threes.'

b. LF: $[_S\ \exists e\ [_{vP}$ [**dáxgaanáx** shaax'wsáani] $[_{vP}\ v\ [_{VP}$ [**nás'gigáa** keitl] has aawashúch]…]

c. Predicted Truth-Conditions:

$$\exists e\ .\ \exists x\ .\ {*}girl(x)\ \&\ \exists z\ .\ {*}dog(z)\ \&\ {*}bathe(e)\ \&\ {*}Agent(e) = x\ \&\ {*}Theme(e) = z\ \&$$
$$\langle e\ ,\ x\rangle\ =\ \sigma_{\langle e',\,y\rangle}\ .\ y < x\ \&\ |y| = 2\ \&\ e' < e\ \&\ Participant(e',y)$$
$$\langle e\ ,\ z\rangle\ =\ \sigma_{\langle e',\,y\rangle}\ .\ y < z\ \&\ |y| = 3\ \&\ e' < e\ \&\ Participant(e',y)$$

The predicted truth-conditions in (60c) are rather complex, but basically amount to the following informal statement: (i) there is a plural event e of a group of girls x (cumulatively) bathing a group of dogs z, and (ii) x can be divided up into pairs, each of which participated in some subevent of e, and (iii) z can be divided up into triplets, each of which participated in some subevent of e. Thus, as the reader can confirm, the truth-conditions in (60c) will hold in a scenario like the one sketched below.

(61) **Event-Distributive Scenario Validating (60c)**

Bathings	Agent	Theme
e_1	Linda+Anne	Sparky+Rex+Spot
e_2	Sue+Jen	Fido+Lucky+Lassie
e_3	Peggy+Mary	Ruffles+Toto+Sparkles

In this scenario, there a plural event $e_1+e_2+e_3$ whose agent is a group of girls (Linda+Anne+Sue+Jen+Peggy+Mary), and whose theme is a group of dogs (Sparky+Rex+Spot+ Fido+Lucky+Lassie+Ruffles+Toto+Sparkles). Moreover, it is clear that the group of girls can be divided into pairs, each of which participated in some subevent of $e_1+e_2+e_3$, and that the group of dogs can be divided into triplets, each of which participated in some subevent of $e_1+e_2+e_3$. Thus, the truth-conditions in (60c) indeed hold in this event-distributive scenario. Furthermore, note that those truth-conditions require each subevent of $e_1+e_2+e_3$ to contain a *plurality* of girls and dogs. Consequently, it is not possible for each such subevent to contain an *atomic* member of some participant in the larger event $e_1+e_2+e_3$, and so there is no participant-distributive scenario where (60c) will hold true.

In this way, our semantics is able to predict the key facts in (33)-(35). It is also able to predict certain, more fundamental features of distributive numerals. First, given the lexical entries in (50) and (54), the inability for distributive numerals to modify demonstrative DPs (14) follows from simple type-theoretic considerations. Under the natural assumption that demonstrative DPs are of type *e*, the impossibility of (14b) follows from the fact that adnominal distributive numerals must combine with an expression of type <*et*> (54). Similarly, under the assumption that demonstratives are themselves of type <*et*,*e*> the impossibility of (14a) follows from the fact that NPs modified by distributive numerals are of type <<*e*,εt><εt>>. Finally, as the reader can confirm, the lexical entries in (50) and (54) both entail that the distributive suffix *gaa* will only affix to numerals, and never to NPs (22).

Let us also consider again the very defining properties of distributive numerals.

(62) **Distributive Numeral (Gil 1982, Choe 1987, Zimmermann 2002)**
A morphosyntactic construction containing a numeral, whereby (i) the sentence as a whole receives a distributive reading, and (ii) under the allowable readings, the expression modified by the construction must be interpreted as if it is within the *scope* of a distributive operator.

As we will now see, this range of properties follows directly from our semantics in (50) and (54). First, let us consider the property in (i): sentences with distributive numerals must receive distributive readings. It is easy to see that our semantics predicts the contraposition of this statement: sentences with distributive numerals *cannot* receive collective or cumulative readings. To see why, consider again the contrast between (23a) and (23b). Importantly, in the collective scenario under (23), there are exactly two dogs that are washed. However, sentence (23b), containing the distributive numeral, will receive the truth-conditions below.

(63) **Truth-Conditions of Sentence (23b)**

$$\exists e\ .\ \exists x\ .\ {}^*dog(x)\ \&\ {}^*bathe(e)\ \&\ {}^*Agent(e) = \sigma_x.{}^*girl(x)\ \&\ {}^*Theme(e) = x\ \&$$
$$<e\ ,\ x>\ =\ \sigma_{<e',\,y>}\ .\ y < x\ \&\ |y| = 2\ \&\ e' < e\ \&\ Participant(e',y)$$

There are some dogs x such that those girls (cumulatively) bathed x, and
x is the ***proper*** *sum of pairs of things that took part in the bathing*

Note that, according to these truth conditions, there are *multiple* events e' < e that contain a pair of dogs. Consequently, the truth-conditions above will only hold in scenarios that have *more than two* dogs, and so could not hold in a collective scenario like that in (23).

More generally, one can see that our semantics predicts that any sentence containing the distributive numeral '*n-gaa*' will only be true in scenarios where there are more than *n* things satisfying the associated NP. However, a collective or cumulative reading of a sentence containing the numeral *n* will necessarily be true in scenarios containing *only n* such things. Therefore, it follows that a sentence containing a distributive numeral '*n-gaa*' will not allow for the collective or cumulative readings observed for sentences containing the plain numeral *n*.

For exactly these reasons, the second defining property under (62) also follows: a sentence containing the distributive numeral '*n-gaa*' will be interpreted as if the numeral *n* falls within the scope of a distributive operator. To begin, note that if a numeral *n* falls within the scope of a distributive operator – like the numeral *two* in (29) – then the resulting truth-conditions will only hold if there are *more* than *n* things satisfying the associated NP. In this way, the interpretation yielded by our semantics is akin to one where the numeral modified by *gaa* falls within the scope of a distributive operator. Moreover, if a numeral *n* scopes above a distributive operator – like the numeral *three* in (29) – then the resulting truth-conditions hold if there are exactly *n* things satisfying the associated NP. For this reason, then, our proposed semantics predicts that distributive numerals will not have an interpretation akin to such widescope numerals. Finally, note that although our analysis predicts this core characteristic of distributive numerals, *it does not actually make use of the distributive operator in (4)*, unlike prior accounts (Zimmermann 2002, Oh 2005).

To close this section, let us now consider the fact that, like many languages with distributive numerals, obtaining either a distributive or an inverse scope reading in Tlingit requires the presence of such numerals (25), (26), (30). First, it is natural to assume that, like all people, speakers of Tlingit have a strong comprehension bias for 'surface level' parses, and against parses that employ covert *DIST* operators like (4), or covert movement like QR. Consequently, speakers will be inherently biased against distributive or inverse scope readings of sentences with plain numerals. Furthermore, note that the inclusion of a distributive numeral can create structures that are true *only* in the scenarios where the corresponding distributive or inverse scope reading would hold (25), (26), (30). Therefore, if a Tlingit speaker ever wishes to unambiguously express such truth-conditions, a sentence containing an overt distributive numeral is pragmatically preferable to a sentence containing plain numerals. As a result of this pragmatic pressure, speakers will be quite disinclined to interpret sentences with plain numerals as having either distributive or inverse scope readings.

We have seen thus far that our formal semantics in (50) and (54) can account for all the properties observed in Sections 3 and 4 for distributive numerals in Tlingit, as well as several fundamental characteristics of distributive numerals across languages. In the following section, we will see that this analysis might also offer novel treatments of certain puzzles observed in other languages containing distributive numerals.

6. Consequences for Distributive Numerals in Other Languages

It has often been reported that distributive numerals and other 'distance distributives' appear to be subject to certain locality conditions. For example, Choe (1987) and Oh (2001, 2005) observe that Korean sentences like (64a), which contain a distributive numeral inside a subordinate clause, do not admit of a reading akin to (64b), and so cannot describe a scenario like (64c).

(64) **Locality Conditions on Distributive Numerals (Choe 1987, Oh 2005)**

a. Chemwentuli [aituli phwungsen-hana-**ssik**-ul saessta] malhaessta
store.clerks children balloon-one-**DIST-ACC** bought said
'The store clerks said that the children bought one balloon each / each time.'

b. $\forall$x . x $\leq$ the.store.clerks & atom(x) $\rightarrow$
x said that $\exists$y. **one.ballon**(y) & the.kids bought y

c.

Sayings	Agent	Proposition Said
e_1	clerk$_1$	'The kids bought one balloon'
e_2	clerk$_2$	'The kids bought one balloon'
e_3	clerk$_3$	'The kids bought one balloon'

Note that in order to obtain such a meaning, the distributive numeral would need to be interpreted as if it scoped below a distributive operator sitting within the *matrix* clause. In other words, under the impossible reading in (64b), the understood restrictor of the distributive operator is separated from the distributive numeral by a clause boundary. Put even more informally, the data in (64) show that in Korean, an NP marked by a distributive numeral can only 'distributive over' a clausemate. Zimmermann (2002) reports similar facts for parallel sentences in German.

This set of facts follows directly from our analysis in Section 5.2, if we assume that the Korean distributive suffix *–ssik* has the semantics of adnominal *–gaa* in (54). To begin, our account would assign to sentence (64a) the LF in (65a), and so would derive the truth-conditions (roughly) in (65b).[17]

(65) **Predicted Structure and Meaning for (64a)**

a. $[_{S1}$ $[_{vP1}$ chemwentuli $[_{vP1}$ v $[_{VP1}$
$[_{S2}$ ∃e $[_{vP2}$ aituli $[_{vP2}$ v $[_{VP2}$ [phwungsen **hana-ssik**] saessta]…]
malhaessta] …]

b. said (σ_x.*store.clerk(x) ,
∃e . ∃x . *ballon(x) & *buy(e) & *Agent(e) = σ_y.*kid(y) & *Theme(e) = x
& <e , x> = $\sigma_{<e', y>}$. y < x & |y| = 1 & e' < e & Participant(e',y))

The store clerks said that
there is an event e of the kids buying some balloons x and
x is the sum of the individuals y that participated in some subevent of e

Thus, the LF in (65a) will be assigned a meaning where the distributive numeral *hanassik* 'one.DIST' scopes within the subordinate clause. The resulting truth-conditions will hold in either of the following scenarios: (i) the store clerks said that the kids (together) several times bought one balloon, or (ii) the store clerks said that each kid bought a balloon. Note, however, that these truth-conditions will *not* hold in the scenario in (64c), where each store clerk says that the kids bought (just) one balloon.

One might wonder, however, whether (64c) could be described by an LF where the NP *phwungsen hanassik* 'one.DIST balloon' undergoes QR into the matrix clause, as in (66) below.

(66) **Impossible LF for (64a)**

$[_{S1}$ [phwungsen **hana-ssik**] $[_{S1}$ 1 [chemwentuli $[_{vP1}$ v $[_{VP1}$
$[_{S2}$ ∃e $[_{vP2}$ aituli $[_{vP2}$ v $[_{VP2}$ t_1 saessta]…] malhaessta] …]

Note, though, that the QR assumed in (66) would violate the general condition that QR is clause bound (May 1985, 1988). Furthermore, as the reader can confirm, the truth-conditions assigned to (66) would still fail to hold in (64c). Such an LF would necessarily be assigned a 'transparent' or 'de re' reading, where there is a *specific* group of balloons x such that the store clerks said that the kids bought x, a condition that does not hold in scenario (64c) or fit the reading sketched in (64b). In summary, then, we find that our semantics correctly predicts that (64a) will not allow for a 'non-local' reading akin to (64b,c).

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[17] The truth-conditions in (65b) obviously abstract away from the more complex intensional semantics of 'say'.

Our semantics also predicts a fascinating interaction between pluractional morphology and distributive numerals in the Mayan language Kaqchikel. As first observed by Henderson (2011), distributive numerals in Kaqchikel appear to have the exceptional ability to scope below pluractional verbal suffixes. First, consider sentences like (67a), where an NP marked by a plain numeral is argument to a verb bearing the pluractional suffix. Speakers report that such sentences are only true if the *same* book is searched for multiple times.

(67) **Distributive Numerals, Pluractional Morphology, and Scope in Kaqchikel**

a. Xinkan**ala'** jun wuj
1sgS.searched.**PA** one book
'I looked for a book (various times)' (Henderson 2011)
Speaker Judgment: True only if I looked for the *same* book multiple times.

b. Xinkan**ala'** **ju-jun** wuj
1sgS.searched.**PA** **one.DIST** book
'I looked for books (various times).' (Henderson 2011)
Speaker Judgment: True only if I looked for a different book each time.

This contrasts strikingly with a sentence like (67b), which differs only in that the NP is modified by a distributive numeral. Unlike (67a), speakers report that (67b) is only true if a *different* book is searched for each time. Thus, with the plain numeral (67a), there is one book for every event of searching, whereas with the distributive numeral (67b), each event of searching involves a different book. In this sense, it seems that the numeral in (67a) must 'scope above' the pluractional suffix, while in (67b) it must scope below.

Henderson (2011) puts forth a detailed analysis of these and related facts in Kaqchikel, one making use of the 'DPlL' framework (van den Berg 1996). According to this analysis, distributive numerals in sentences like (67b) do not truly 'scope below' the pluractional affix, or differ at all in their scope from plain numerals in sentences like (67a). Rather, the semantics of the pluractional affix and the distributive numeral simply interact to produce the effect in question. While space precludes a detailed discussion of Henderson's account, it is worth noting that our semantics in (50) and (54) provides a similar explanation for the facts in (67), without making recourse to the special assumptions of the DPlL framework.

Following Lasersohn (1995) and much subsequent work, I will assume the following semantics for pluractional morphology.

(68) **Lasersohnian Analysis of Pluractional Morphology (Lasersohn 1995)**

$$[[\text{ PA }]] =$$

$$[\ \lambda P_{<\varepsilon t>} : [\ \lambda e : |e| > n\ .\ \forall e'\ .\ e' \leq e\ \&\ atom(e') \rightarrow P(e')$$
$$\&\ \forall e', e''.\ e', e'' \leq e\ \&\ atom(e')\ \&\ atom(e'') \rightarrow\ \neg\ T(e') \circ T(e'')\qquad]$$

According to this semantics, a pluractional affix takes a predicate of events P as argument, and returns a predicate of events that (i) is restricted to plural events (|e| > n), and (ii) is true of an event e iff e is composed of many atomic events that satisfy P and do not overlap in their time.

Of course, this semantics in (68) assumes that, contrary to what's stated in (39), lexical verbs are pure predicates of events, as sketched in (69a) below. Consequently, the internal arguments of verbs must also be introduced via special syntactic heads akin to little-*v*. For our discussion here, I will assume the head in (69b).[18]

(69) **Slight Changes to Background Semantic Assumptions**

a. <u>Verbs are Predicates of Events:</u> $[\![\text{ search }]\!] = [\ \lambda e : {}^*\text{search}(e)\ ]$

b. <u>Head Introducing Theme:</u> $[\![\text{ Th }]\!] = [\ \lambda x : \lambda e : {}^*\text{Theme}(e) = x\ ]$

With these semantic assumptions in place, the plain numeral sentence in (67a) will receive the LF in (70a), and thus the truth-conditions in (70b).

(70) **Truth-Conditions Derived for Sentence (67a)**

a. <u>LF-Structure:</u>
$[_S\ \exists e\ [_S\ [\text{ jun wuj }]\ [_S\ 1\ [_{vP}\ \textit{pro}_{1sg}\ [_{vP}\ v\ \ [_{VP}\ [_V \text{ xinkan PA }]\ [_{ThP} \text{ Th } t_1\ ] \ldots]$

b. <u>Truth-Conditions</u>
$\exists e\ .\ \exists x\ .\ {}^*\text{book}(x)\ \&\ |x| = 1\ \&\ {}^*\text{Agent}(e) = \text{speaker}\ \&\ {}^*\text{Theme}(e) = x\ \&$
$|e| > n\ \&\ \forall e' \leq e\ \&\ \text{atom}(e') \rightarrow {}^*\text{search}(e')\ \&$
$\forall e', e''.\ e', e'' \leq e\ \&\ \text{atom}(e')\ \&\ \text{atom}(e'') \rightarrow \neg\ T(e') \circ T(e'')$

There is a (plural) event e, whose agent is the speaker, and whose theme is a book x,
and e is composed of many atomic events e' of searching,
and these atomic events of searching do not overlap in their time.

The truth-conditions in (70b) state that there is a plurality of searching events e whose cumulative theme is a single book x. It follows, then, that this book x must also be the theme of the individual searching events contained in e. Therefore, we correctly predict that (67a) will only be true if the same book is searched for multiple times.

Now let us consider the distributive numeral sentence in (67b). Given our assumptions above, it will receive the LF structure in (71a) and so the truth-conditions in (71b).

(71) **Truth-Conditions Derived for Sentence (67b)**

a. <u>LF-Structure:</u>
$[_S\ \exists e\ [_{vP}\ \textit{pro}_{1sg}\ [_{vP}\ v\ \ [_{VP}\ [_V \text{ xinkan PA }]\ [_{ThP} \text{ Th } [\text{ jun-DIST wuj }]\ ] \ldots]$

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[18] The reader is invited to confirm that these changes in no way impact the results from Section 5.

b. Truth-Conditions

$\exists e . \exists x . *book(x) \& *Ag(e) = speaker \& *Thm(e) = x \&$
$|e| > n \& e' \leq e \& atom(e') \rightarrow *search(e')$
$\& \forall e', e''. e', e'' \leq e \& atom(e') \& atom(e'') \rightarrow \neg T(e') \circ T(e'')$
$\& \langle e , x\rangle = \sigma_{\langle e', y\rangle} . y < x \& |y| = 1 \& e' < e \& Participant(e',y)$

There is a (plural) event e, whose agent is the speaker,
and whose theme is a group of books x,
and e is composed of many atomic events e' of searching,
and these atomic events of searching do not overlap in their time,
and x is the sum of all the individuals that participate in a subevent of e

As the informal paraphrase in (71b) indicates, the predicted truth-conditions will hold if there is a plurality of searching events e, whose cumulative theme is a group of books x, and x can be divided up into individuals, each of which is theme to some subevent of e. Therefore, these truth-conditions will hold in a scenario like (72a), where many different books are searched for.

(72) **Scenarios Verifying and Falsifying (67b)**

a. Verifying Scenario

Searchings	Agent	Theme
e_1	speaker	$book_1$
e_2	speaker	$book_2$
e_3	speaker	$book_3$

b. Not a Verifying Scenario

Searchings	Agent	Theme
e_1	speaker	$book_1$
e_2	speaker	$book_1$
e_3	speaker	$book_1$

Furthermore, these truth-conditions will *not* hold in a scenario like (72b), where the same book is searched for multiple times. The issue is that the cumulative theme x of $e_1+e_2+e_3$ is just the individual $book_1$. Therefore, since $book_1$ is an atom, there is no y such that $y < book_1$ & $|y| = 1$, and so the condition '$\langle e , x\rangle = \sigma_{\langle e', y\rangle} . y < x \& |y| = 1 \& e' < e \& Participant(e',y)$' in (71b) will fail to hold in (72b).

Taking these results together, we find that our semantics in (50)/(54) can derive the intriguing pattern in (67) from a Lasersohnian treatment of pluractionals (68)-(69). Furthermore, as in the work of Henderson (2011), we do not actually view the distributive numeral in (67b) as 'scoping below' the pluractional morphology. Rather, as the LFs and truth-conditions in (70)-(71) make clear, our account treats both the plain numeral and the distributive numeral in (67) as scoping *above* the pluractional affix. However, the meaning of the distributive numeral *ju-jun* 'one.DIST' in (67b) independently serves to distribute 'one book' to each subevent of the larger plural event. Consequently, each such subevent will have a distinct book as its theme, which is akin to the numeral scoping below the pluractional.

We have thus seen that the analysis of Tlingit distributive numerals in Section 5 could offer viable analyses of distributive numerals in other languages as well. In the following section, we will see that this analysis might also advance our understanding of the broader category of 'distance distributivity', in that it could offer a novel approach to English's binominal each construction.

7. A Possible Extensions to 'Binominal Each' in English

The term 'binominal each' refers to the construction in (73a), where the distributive marker *each* is appended post-nominally to an NP modified by a numeral (Safir & Stowell 1988, Zimmermann 2002, Champollion, to appear, Dotlačil, to appear).

(73) **Binominal Each in English**

a. Illustrative Sentence: My sons caught [three fish **each**].

b. Apparent Truth-Conditions:
$\forall x . x \leq$ my.sons & atom(x) $\rightarrow \exists y$. **three.fish**(y) & x caught y
Each of my sons caught three fish.

As has long been observed (Gil 1982), English binominal each seems to have all the defining properties of a distributive numeral construction (1). After all, sentences like (73a) only allow for distributive readings, ones in which the numeral participating in the construction scopes below a distributive operator (73b). However, as has also long been observed (Gil 1982), English binominal each differs in one key way from canonical distributive numeral constructions. As shown below, binominal each sentences can only describe participant-distributive scenarios (74a); in event-distributive scenarios like (74b), such sentences are judged to be false.

(74) **Verifying and Falsifying Scenarios for (73a)**

a. Verifying Scenario:

Catchings	Agent	Theme
e_1	Tom	$fish_1+fish_2+fish_3$
e_2	Bill	$fish_4+fish_5+fish_6$

b. Not a Verifying Scenario:

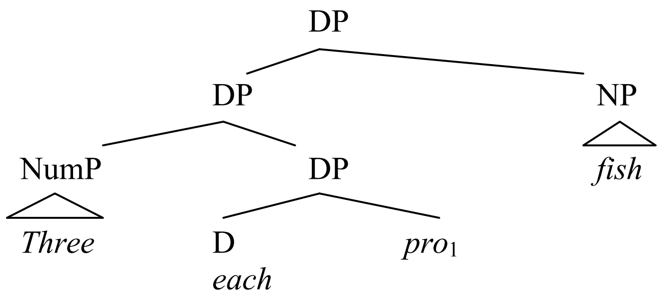
Catchings	Agent	Theme
e_1	Tom+Bill	$fish_1+fish_2+fish_3$
e_2	Tom+Bill	$fish_4+fish_5+fish_6$
e_3	Tom+Bill	$fish_7+fish_8+fish_9$

Ideally, an analysis of canonical distributive numerals, such as those found in Tlingit, should offer some perspective upon the semantics of English binominal each, as well as an explanation for the key difference between the two constructions. Let us therefore consider how our semantics in (50)/(54) might be augmented to apply to English sentences like (73a).

First, following Zimmermann (2002), I will assume that the binominal each construction contains a null pronoun, which must be bound by some higher argument within the clause.[19] That is, the phrase 'three fish each' will be assumed to have the structure below.

[19] Similar assumptions are also made by Champollion (to appear) and Dotlačil (to appear), who assume that phrases like 'three fish each' carry an index, and must be co-indexed with some higher expression.

(75) **Key Morpho-Syntactic Assumption (Zimmermann 2002)** [20]



Next, let us assume that the 'each' of the binominal each construction has the semantics below.

(76) **The Semantics of Binominal Each**

$$[[\text{ each}_{binom}]] = [\ \lambda z_e : [\ \lambda n_n : [\ \lambda Q_{<et>} : [\ \lambda P_{<e,\varepsilon t>} : [\ \lambda e_\varepsilon : \exists x.\ Q(x)\ \&\ P(x)(e)\ \&$$
$$<e , x> \;=\; \sigma_{<e', y>} .\ y < x\ \&\ |y| = n\ \&\ e' < e\ \&\ \text{Participant}(e',y)\ \&$$
$$<e , z> \;=\; \sigma_{<e', y>} .\ y < z\ \&\ |y| = 1\ \&\ e' < e\ \&\ \text{Participant}(e',y)\ ]\ \ldots]$$

Note that the lexical entry in (76) is nearly identical to that given in (54) for adnominal *gaa* in Tlingit. The key difference is that 'each_{binom}' first takes as argument the entity z denoted by the null pronoun. Furthermore, having taken this entity z as argument, 'each_{binom}' adds the condition that z is the sum of all those *atoms* y that participate in some subevent of the larger plural event.[21] To see the effect of this condition in greater detail, let us examine the meaning we derive for sentence (73a).

(77) **Predicted Truth-Conditions for Sentence (73a)**

a. <u>LF:</u> $[_S\ \exists e\ [_{vP}\ [\text{my sons}]\ [_{vP}\ 1\ [_{vP}\ t_1\ [_{vP}\ v\ [_{VP}\ \text{caught [three fish each } pro_1\ ]\ \ldots]$

b. <u>Predicted Truth-Conditions</u>

$$\exists e\ .\ \exists x.\ {}^*\text{fish}(x)\ \&\ {}^*\text{catch}(e)\ \&\ {}^*\text{Agent}(e) = \sigma_y.{}^*\text{my.son}(y)\ \&\ {}^*\text{Theme}(e) = x\ \&$$
$$<e , x> \;=\; \sigma_{<e', y>} .\ y < x\ \&\ |y| = 3\ \&\ e' < e\ \&\ \text{Participant}(e',y)\ \&$$
$$<e , \sigma_y.{}^*\text{my.son}(y)> \;=\; \sigma_{<e', y>} .\ y < \sigma_y.{}^*\text{my.son}(y)\ \&\ |y| = 1\ \&\ e' < e\ \&\ \text{Participant}(e',y)$$

There is a (plural) event e of my sons catching a group of fish x, and
x is the sum of all those ***triplets*** *that participated in a subevent of e, and*
my sons are the sum of all those ***atoms*** *that participated in a subevent of e*

---

[20] I will remain agnostic as to how the surface order 'three fish each' is to be derived from this structure.

[21] An interestingly similar approach to the semantics of binominal each has been independently developed by Champollion (to appear). As in our account here, Champollion (to appear) proposes that binominal each must be bound by another DP in the sentence, and that its meaning entails that the binder is composed of atoms, each of which participates in some subevent of the larger event described by the sentence. As noted earlier, however, the formal means for achieving this analytic end are quite different from the account defended here.

To begin, I will assume that sentence (73a) can receive the LF in (77a), where the null pronoun within the binominal each construction is bound by the subject *my sons.* Given this structure, our semantics in (76) yields the truth-conditions in (77b). As noted above, these truth-conditions can be read informally as follows: (i) there is a (plural) event e of my sons catching a group of fish x, and – as with a distributive numeral – (ii) the fish x can be divided into *triplets*, each of which participated in a subevent of the plural event e, and finally (iii) my sons can be divided into *atoms*, each of which participated in a subevent of e.

Given these truth-conditions, we correctly predict that (73a) will be judged true in a participant distributive scenario like (74a) above. Note that in (74a), the plural event e_1+e_2 will witness the existential truth-conditions in (77b). After all, this is a plural event of catching, with my sons as the (cumulative) agent, and a group of fish ($fish_1+...+fish_6$) as the (cumulative) theme. Moreover, the theme can divided up into triplets, each of which participated in some subevent of e_1+e_2. Finally, and most importantly, the agent of e_1+e_2 (Tom+Bill) can be divided up into atomic subparts, each of which participated in a subevent e_1+e_2. Thus, our semantics captures the truth of (73a) in participant-distributive scenarios. We also predict the falsity of (73a) in event-distributive scenarios like (74b). Note that in that scenario, there is no event where an individual son is agent. Consequently, the plurality 'my sons' (Tom+Bill) cannot be divided into atoms, each of which is agent to some subevent in the scenario, and so the truth-conditions in (77b) will fail to hold.

In addition to capturing the core facts in (73)-(74), our analysis also predicts the related fact in (78a). As has often been noted, binominal each in English differs from distributive numerals in that it requires there to be at least *two* plural NPs within the sentence (*cf.* (33)).

(78) **Binominal Each Requires Two Plural NPs**

a. Ill-Formed Sentence: * My son caught three fish each.

b. Predicted Truth-Conditions

$$\exists e\,.\,\exists x.\ {}^*fish(x)\ \&\ {}^*catch(e)\ \&\ {}^*Agent(e) = my.son\ \&\ {}^*Theme(e) = x\ \&$$
$$\langle e, x\rangle = \sigma_{\langle e', y\rangle}\,.\ y < x\ \&\ |y| = 3\ \&\ e' < e\ \&\ Participant(e',y)\ \&$$
$$\langle e, my.son\rangle = \sigma_{\langle e', y\rangle}\,.\ y < my.son\ \&\ |y| = 1\ \&\ e' < e\ \&\ Participant(e',y)$$

As the reader can confirm, our analysis in (75)-(76) predicts that (78a) will have the truth-conditions in (78b). Importantly, the truth-conditions in (78b) are contradictory. Given that the singular subject *my son* denotes an atom, it follows that there is no y such that $y < my.son$ & $|y| = 1$, and so the truth-conditions in (78b) could never be satisfied. It follows, then, that speakers will perceive sentences like (78a) to be anomalous (Gajewski 2009).

One final difference between binominal each and canonical distributive numerals concerns the possibility of inverse scope readings. While such readings are possible for sentences containing distributive numerals (30), (Zimmermann 2002, Oh 2005), binominal each strongly resists inverse scope, as illustrated below.

(79) **No Inverse Scope with Binominal Each**

a. Two flagpoles stood in front of every house. (*inverse scope possible*)
b. * Two flagpoles each stood in front of the houses. (*inverse scope impossible)*

Interestingly, this fact can be seen to follow from our core syntactic assumption in (75). Given the null pronominal within the binominal each construction, the only way to obtain an inverse scope reading for (79b) would be to QR the phrase *the houses* above *two flagpoles each*. However, as shown below, such movement would lead to a Weak Cross Over configuration, and so would violate general, well-known conditions on QR.

(80) **Inverse Scope with Binominal Each Leads to Weak Cross Over**

$[_{S}$ ∃e $[_{S}$ [the houses] $[_{S}$ 1 $[_{vP}$ [two flagpoles each *pro*$_1$] $[_{vP}$ *v* $[_{vP}$ stood in front of t_1]…]

Weak Cross Over Configuration

8. Conclusion

The principal focus of this paper has been the distributive suffix *–gaa* of Tlingit. We have seen that the expressions derived by this suffix are aptly labeled as 'distributive numerals' or 'distance distributives'. Moreover, we have seen that such expressions can, like distributive numerals in other languages, attach either adnominally or adverbially. Furthermore, sentences containing distributive numerals appear at first glance to ambiguous, in that they can describe either participant-distributive or event-distributive scenarios. While similar facts in other languages have been treated as genuine cases of ambiguity, we have seen that it is possible to provide a univocal semantics for Tlingit *–gaa*, one that yields truth-conditions broad enough to cover both participant- and event-distributive scenarios. This semantics also captures a number of additional features of Tlingit distributive numerals, ones that have been widely observed for distributive numerals in other languages.

It therefore seems that the general approach taken here might also yield viable analyses of distributive numerals across many languages. In support of this, we have seen that our semantics can offer novel answers to puzzles surrounding distributive numerals in Korean, German and Kaqchikel. Furthermore, a slight augmentation of the analysis can capture the distinctive properties of the English binominal each construction, including its intolerance for inverse scope readings.

Of course, much work remains to be done before the semantics developed here could be viewed as a general theory of distance distributivity. One difficult puzzle for future research concerns a phenomenon that might be labeled 'distributive concord'. As documented by Oh (2005), it is possible for distributive numerals in Korean to appear within the scope of the distributive marker *kakkak* 'each'. As illustrated below, in such sentences, the presence of the distributive suffix *–ssik* is felt to contribute nothing to the overall truth-conditions, but in some sense simply 'reinforces' the distributivity contributed by *kakkak* 'each'.

(81) **Korean *Kakkak* 'Each' Licenses the Appearance of Distributive *Ssik* (Oh 2005)**

Haksayng	twu-myeng-i	**kakkak**	sangca	han-kay-(**ssik**)-lul	wunpanhayssta.
student	two-CL-NOM	**each**	box	one-CL-**DIST**-ACC	carried

'Two students each carried one box.'

A similar phenomenon can be observed in English, as noted by Brasoveanu & Henderson (2009), Szabolcsi (2011), and Dotlačil (to appear). Note that in sentences like the following, the distributive determiner *each* is somewhat redundant, and seems only to reinforce the distributive contribution of *one by one*.

(82) **Interaction Between *One by One* and *Each* in English**

One by one, each student read a poem.

Like most other theories of distance distributivity (Zimmermann 20002, Champollion, to appear, Dotlačil, to appear), the semantics developed here cannot directly account for the reported meanings of (81) and (82). However, the failure here needn't necessarily lie in the proposed semantics for distance distributives, but could instead indicate that a more sophisticated semantics is needed for the distributive markers *kakkak* and *each*. At any rate, the exact consequences that such 'distributive concord' holds for the account proposed here constitute an important problem for future research along these lines.

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