Pluractionality, iconicity, and scope in French Sign Language*

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Abstract Many languages across the world are known to have constructions that indicate pluractionality, entailing the existence of a multitude of events. In this paper, we introduce a pattern of pluractionality in sign language, via reduplication of verbal forms. We focus on the semantics of two pluractional markers that appear pervasively in French Sign Language (LSF): exact repetition (/-rep/) and two-handed alternating repetition (/-alt/). We show that /-rep/ and /-alt/ fit into a larger typology of pluractionality in (spoken) language, where pluractional morphology specifies distribution over various dimensions. Additionally, however, the LSF pattern shows several novel properties. First, we observe a compositional puzzle, wherein the pluractional morphemes appear to be trivially redundant when they appear under distributive operators. Taking inspiration from work on 'dependent indefinites' in the nominal domain, we propose an analysis in which pluractional markers are scope-taking predicates, that are licensed by distributive operators by taking scope over them. Second, we show that the rate of reduplication for both forms is iconically mapped to the rate of event repetition over time. We show that this iconic mapping is an at-issue entailment that must be able to interact with logical meaning throughout the composition of a sentence. We propose an integrated model, in which pluractional morphemes incorporate an iconically defined predicate. In the context of our compositional system, this proposal makes the novel prediction of 'scopable iconicity,' in which the iconic meaning can be evaluated at different structural positions.

Keywords: pluractionality, iconicity, sign language, distributivity, event semantics, scope

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1 Overview

Many languages across the world are known to have constructions that indicate *pluractionality* — that is, constructions that entail the existence of a multitude of events. These patterns have been shown to bear on compositional questions regarding plurality and syntactic/semantic dependency. In this paper, we approach the topic of pluractionality from the point of view of sign language, in which reduplication of a verbal form communicates that there is a plurality of events.

Over the last forty years, a rich body of descriptive work on verbal inflection in sign languages has established that, by repeating a verb form in a variety of different ways, a variety of different meanings can be communicated (Fischer 1973, Klima & Bellugi 1979, Wilbur 2009). Here, we focus on the semantics of two pluractional markers that appear pervasively in French Sign Language (Langue des Signes Française, LSF): exact repetition (/-rep/) and two-handed alternating repetition (/-alt/). Sentences (1) and (2) provide examples of the pluractional meanings generated by these inflections.[1]

(1) JEAN CAMERA BRING FORGET-rep.
'John repeatedly forgot to bring a camera.'

(2) FRIEND POSS-1 IX-arc CAMERA BRING FORGET-alt.
'My friends each forgot to bring a camera.'

Here, we will show that there is a categorial semantic difference between these two pluractional forms: /-rep/ entails that sub-events with the same participants are distributed over time; /-alt/ entails that sub-events are distributed across participants. In this respect, the LSF pattern fits into a broader typology of spoken languages where pluractional morphology (often reduplication) specifies distribution over participants or time (Cusic 1981). Additionally, though, the pattern of verbal inflection in LSF expands the typology known from spoken language in two interesting ways, both of which inform our broader understanding of pluractional phenomena in natural language.

First, we observe a compositional puzzle regarding the interaction of /-alt/ and /-rep/ with distributive operators. Specifically, under the operators EACH, 'each (one),' and EVERY-DAY, 'every day,' the two pluractional markers may appear innocuously,

1 Following standard convention, signs in both LSF and ASL will be glossed with their closest English translation in small capitals. Personal pronouns, signed with a pointing index finger in both LSF and ASL, are glossed as IX (for 'index'); possessive pronouns are glossed as POSS. Lowercase letters a, b, and c are used to notate locations in the horizontal plane in front of the signer at which signs are produced. The first person marker, 1, is the location of the signer; thus, IX-1 corresponds to English *I*/*me*. The inflection /-arc/ indicates movement a sign over a horizontal arc in space and is used as a plural marker; thus, the pronoun IX-arc corresponds to English *they*.

with an apparently redundant semantic effect — in particular, they need not introduce an additional layer of pluractionality under the distributive operator. To date, this is the first systematic documentation of this compositional puzzle in the verbal domain; of note, though, the situation turns out to be formally identical to a puzzle regarding the licensing of 'dependent indefinites' in the nominal domain (Balusu 2005, Henderson 2014). In this paper, following insights from Henderson (2014), we argue for an analysis in which pluractional markers are scope-taking predicates, that are licensed by distributive operators by taking scope over them.

Second, we show that the pattern of pluractionality in LSF displays iconic effects, where the pluractional constructions seem to communicate 'pictorial' meaning as well as logical meaning. Focusing on cases where gradient phonetic manipulations yield gradient semantic effects (Emmorey & Herzig 2003), we argue that LSF verbal forms include an iconic mapping that preserves information about the rate at which an event occurs. We show that this mapping is sensitive to complex changes in speed and duration that cannot be easily generated by a discrete combinatorial grammar alone. Moreover, we argue that this iconic mapping must be able to interact with logical meaning throughout the composition of a sentence. In particular, we show that iconic meaning in sign language can be at-issue, taking scope below other logical operators. We propose that the iconic component of pluractionals in LSF is incorporated into the same, scopable morpheme that checks for a plurality of events.

New evidence for these design choices comes from an interaction between distributive operators and at-issue iconicity. Specifically, under the distributive quantifiers EACH and EVERY-DAY, pluractional meanings can be interpreted high or low; critically, we show that the level at which the iconic condition is evaluated is exactly the structural position at which the grammatical condition is evaluated. These cases of 'scopable iconicity' can only be accounted for if (a) pluractional morphemes may be evaluated above distributive operators and (b) the iconic meaning is morphologically tethered to the logical meaning.

Methodology: This paper presents novel data from both LSF and ASL (American Sign Language). Judgments reported for LSF are based on the responses from three native signers (Deaf children of Deaf signing adults). Reported judgments for ASL are based on repeated judgements from a single native signer. Elicitation was adapted from the 'playback method' (Schlenker 2011). The signer was asked to sign a paradigm of sentences for a video recording, then asked to judge the grammaticality of the sentence and answer any interpretation questions. Grammaticality judgments for two signers of LSF and the signer of ASL were based on a 7-point scale (7 = best). All grammaticality judgements and answers to interpretation questions were also video recorded.

2 Pluractionality

In many languages of the world, verbs may show pluractional inflection; often (but not always) this is indicated by reduplication of all or part of a verb; the examples in (3) illustrate this morphophonological tendency.

(3) a. **Hausa:** kiraa → kirkiraa ‘keep on calling’/‘call many people’
b. **Pomo:** quo → quoquot ‘cough up’
c. **Dyirbal:** balgan → balbalgan ‘hit too much’
d. **Yokuts:** simwiyi → simimwiyi ‘keep on drizzling’
(Newman 2012, Moshinsky 1974, Dixon 1972, Newman 1944)

Semantically, pluractional inflection communicates that there is a multitude of events: either an event happened again and again, or many things happened at the same time. Sentence (4) provides an example from Upriver Halkomelem (Thompson 2009). The verb /yáq/ means ‘to fell.’ With the pluractional inflection, /yáleq’/, the sentence can be used to describe a range of different contexts: it can mean that multiple people felled a tree; it can mean that one person felled multiple trees; it can mean that one person felled one (magical) tree again and again. On the other hand, it cannot be used to describe a single event in which one person felled one tree one time.

(4) **Upriver Halkomelem** (Thompson 2009)

yáleq’	-et	-es	te	theqát
fell.pl	-tr.	-3	det.	tree

(cf. yáq’-et)

(5) True if . . .

a. He felled the trees. (all in one blow, or one after the other)
b. He felled the same (magic) tree over and over.
c. They felled the tree.
d. They felled the trees.

False if . . .

e. He felled the tree (once).

Figure 1 provides pictures to illustrate the range of meanings. Along the y-axis, θ indicates participants; time is along the x-axis. So, Figure 1a depicts a repeating event, as in (5b); Figure 1b depicts the multi-participant contexts in (5a), (5c) and (5d); Figure 1c depicts the singular event in (5e). What it means to be pluractional is that the picture has more than one line.

Cross-linguistically, Cusic (1981) shows that the range of meanings of pluractional markers is subject to variation across several parameters, including, most

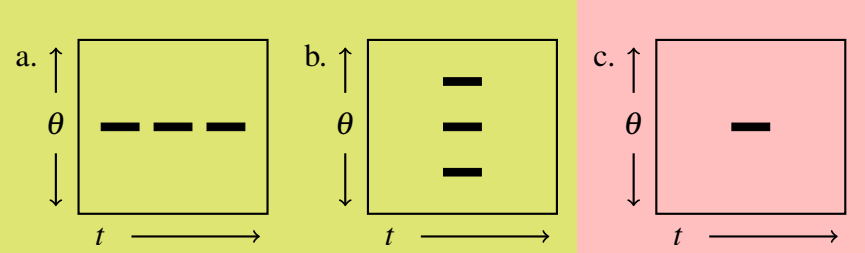


Figure 1 Different kinds of events; green outlines pluractional events.

relevantly here, a distributive parameter, which specifies the dimension over which the plurality of events may be distributed. As we have seen, the pluractional marker in Upriver Halkomelem is compatible with events which are distributed over either time or participants; however, pluractional markers in other languages may require distribution over a specific dimension, allowing only the interpretation depicted by Figure 1a or the interpretation depicted by Figure 1b. Another dimension across events which can be distributed is location (though this will be less relevant for the LSF data).

The following sentences provide examples from two languages. In ǂHoan (Collins 2001), the pluractional inflection *kí*-VERB-*q‖o* requires distribution over space; in (6) the inflected verb *kí'amq‖o*, 'eat around,' must be interpreted as denoting eating events at different places (evidenced by incompatibility with the continuation 'in one place'). In West Greenlandic (van Geenhoven 2004), the affix *-tar-* requires distribution over time; in (7), the inflected verb *saniuqquttarpuq*, 'go by repeatedly,' must be interpreted as denoting an event that occurred repeatedly, as in Figure 1a.

(6) **ǂHoan** (Collins 2001)

titi i- kí-'am-q‖o *(ki ci m⊙un)
Titi PAST pl-eat-around *(PREP place one)
'Titi eats around *(in one place).'

(7) **West Greenlandic** (van Geenhoven 2004)

Nuka ullaa-p tunga-a tama-at
Nuka morning-Erg direction-Sg.Sg.Abs all-3Sg
saniuqqut-tar-puq.
go.by-repeatedly-Ind.[–Tr].3Sg
'Nuka went by repeatedly for the whole morning.'

Furthermore, a single language can sometimes have several pluractional markers that distribute across different dimensions. For example, Faller (2012) reports that Cuzco Quechua has at least six pluractional morphemes indicating a plurality of events: /-raya/, /-nya/, /-paya/, /-kacha/, /-na/, /-pa/. These six pluractional morphemes specify different dimensions over which these events can be distributed; for example, while /-na/ allows distribution over either time or participants (Figure 1a or b), /-raya/ requires distribution over time (Figure 1a).

2.1 Pluractionality in English

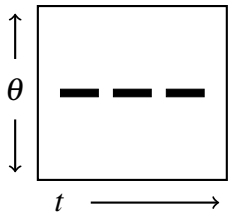
Unlike the languages above, English does not express pluractionality through verbal affixes; neverthless, there are a few constructions that seem to produce pluractional meanings. We will spend some time on these now, both because there are a few interesting differences which have until now been unremarked in the literature, and because it will allow us to introduce new methodological tools that will be used in the semantic description of the pluractional forms in LSF.

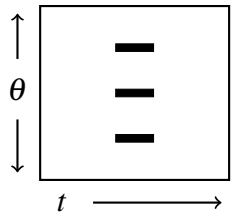
In English, there are several constructions that entail that a plurality of events are distributed over time. These include auxiliary modification (in (8a)), adverbial modification (in (8b)), and verbal conjunction (in (8c)).

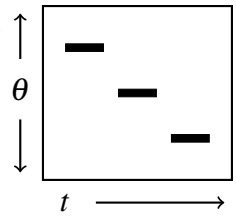
(8) a. John kept coughing.
b. John coughed repeatedly.
c. John coughed and coughed.

Comparing the forms in (8), one is hard-pressed to give hard-and-fast truth-conditional differences between the meanings. Each sentence is true if John coughed multiple times, spread over time. As it turns out, though, these forms act slightly differently when combined with a plural subject — thus allowing the possibility of distribution over participants. For each construction, there must still be distribution over time. However, there is a difference in whether the plurality of events is *able* to additionally vary with respect to participants. For example, consider a scenario in which each of my friends coughed a single time, but these single coughs were spread out over a length of time. This scenario could be described by sentence (9a), but not (9b) or (9c). The range of potential meanings are illustrated in (10).

(9)	a. My friends kept coughing.	✓(10a)	*(10b)	✓(10c)
	b. My friends coughed repeatedly.	✓(10a)	*(10b)	*(10c)
	c. My friends coughed again and again.	✓(10a)	*(10b)	*(10c)

(10) a. 

b. 

c. 

This contrast becomes very striking with so-called 'once-only' predicates — predicates that are not compatible with repetitive meanings (Cabredo Hofherr & Laca 2012). To illustrate this, consider the sentences in (11).

(11) a. # John kept leaving the party.
b. # John left the party repeatedly.
c. # John left the party again and again.

Although the sentences in (11) are perfectly well-formed syntactically, there is something bizarrely contradictory about a repetitive meaning with 'left': once one has already left, one can't leave again. (Possibly a context could be constructed where this could be used, but it requires quite a bit of work.) This fact brings out the contrast in the English pluractional constructions, by turning interpretation judgments into acceptability judgments. Sentence (12a) is perfectly fine, referring to a scenario where the friends left one by one; in contrast, (12b) and (c) retain the degraded grammaticality of the sentences in (11).

(12) a. My friends kept leaving the party.
b. # My friends left the party repeatedly.
c. # My friends left the party again and again.

As before, it may be possible to envision a context to satsify (12b) and (c), but this should be exactly as hard as it is for the sentences in (11). These contrasts become even stronger with the verb *die*, as in (13).[2]

(13) a. My friends keep dying.
b. # My friends die repeatedly.
c. # My friends die again and again.
d. ? My friends die and die.

2 A reviewer observes that the anti-distributivity inference of *repeatedly* perhaps only holds for predicates that are lexically distributive, based on the observation that the sentence '*My friends lifted the table repeatedly*' seems somewhat more amenable to a reading on which a different friend lifted the table on each occasion. (Two native speakers of English tentatively confirm this intuition.) If this is true, it suggests that the anti-distributivity requirement in (9b), (12b), and (13b) arises through some interaction between the semantics of *repeatedly* and the lexical semantics of the verb in question.

Cabredo Hofherr & Laca (2012) show that similar paradigms can be found for pluractional morphemes in other languages. For example, in (6), we saw that the pluractional verb *kí'amq‖o* ('eat around') in ǂHoan necessarily distributes events over locations. Collins (2001) shows that these events *cannot* differ in their participants. For example, Collins (2001) reports that the sentence in (14) is not satisfied if, e.g., Chris ate in one place, Titi ate in another place, and Leha ate in a third place; they each must eat in different places; either together or separately.

(14) **ǂHoan** (Collins 2001)

tsi i kí-'am-q‖o.
3Pl PAST pl-eat-around
'They ate around.'

Thus, the representations in (10) provide another possible locus of variation. In cases of temporal pluractionals, we have seen that change-of-state verbs provide a clear test for the availability of these meanings.

2.2 Pluractionality in LSF

In LSF as well, verbs may be inflected with reduplication to indicate pluractionality. We will be focusing on two different morphemes which appear across a wide range of verbs. The first, which we will call /-rep/, is full repetition of the exact same motion of the verb. The second, which we will call /-alt/, is alternating motion of the two hands. The sign for FORGET is shown in Figure 2. Inflection of FORGET with /-rep/ is shown in Figure 3. Inflection of FORGET with /-alt/ is shown in Figure 4.

Figure 2 Picture of FORGET

These two inflections appear productively across a wide range of verbs, including agreeing and non-agreeing verbs and verbs of a variety of phonological forms

Figure 3 Picture of FORGET-rep

Figure 4 Picture of FORGET-alt

(including two-handed signs like ARRIVE). We note that since these forms appear on both agreeing and non-agreeing verbs, the effects that we will see here cannot be attributed solely to interactions with plural marking in the nominal domain.

What do these forms mean? Roughly speaking, FORGET-rep means 'forget repeatedly'; FORGET-alt means 'forget many things' or 'many people forget.' In other words, these are exactly the same dimensions of pluractionality that we saw in the spoken language typology earlier: /-alt/ and /-rep/ just carve up the space of pluractional meanings along specific dimensions. In the following subsections, we motivate these claims, and hone in on more precise denotations for the two forms.

2.3 /Alt/: distribution over participants

Inflection with /-alt/ entails that subparts of a plural event vary with respect to their participants. The effect of this variation condition is that the use of /-alt/ is only grammatical when licensed by a plural argument elsewhere in the sentence; however, this licensor may appear in any argument position. So, (15) and (16), in which the

subjects are plural, are grammatical with /-alt/; (17) and (18), in which the direct objects are plural, are also grammatical with /-alt/.

(15) FRIENDS POSS-1 IX-arc ARRIVE-alt.
'My friends arrived.'

(16) GROUP PEOPLE BOOK GIVE-1-alt.
'A group of people gave me books.'

(17) FRIEND POSS-1 IX-a IX-1 CARD PAPER BOOK OBJECT VARIOUS 1-GIVE-alt.
'My friend gave me a card, paper, book, and a variety of other objects.'

(18) ONE PERSON FORGET-alt SEVERAL WORDS.
'One person forgot several words.'

These sentences become ungrammatical when all arguments are singular. Sentences (19-21), minimally different from those in (15-18), are not grammatical with /-alt/. We note that each sentence becomes grammatical again with an uninflected verb.

(19) * JEAN ARRIVE-alt.
Intended: 'Jean arrived.'

(20) * FRIEND POSS-1 IX-a, IX-1 BOOK ONE 1-GIVE-alt.
Intended: 'My friend gave me one book.'

(21) * ONE PERSON FORGET-alt ONE WORD.
Intended: 'One person forgot one word.'

Sentences (16-18) are compatible with events spread over time. However, distribution over time alone is not sufficient for /-alt/. For example, (22) is ungrammatical even with the presence of the word 'often', which (when grammatical) entails that there is a plurality of events distributed over time.

(22) * OFTEN ONE PERSON FORGET-alt ONE WORD.
Intended: 'One person often forgot one word.'

Elsewhere, it has been observed that certain verbs show spatial agreement with their arguments, and agreement with a plural noun over an area of space may similarly indicate distribution over the indicated argument (e.g., Klima & Bellugi 1979). In light of these facts, it bears noting that the pattern observed for /-alt/ cannot be reduced to facts about agreement and space. In particular, the verb FORGET does not agree with any of its arguments, yet 'FORGET-alt' nevertheless requires a plural licensor, as seen in the contrast between (18) and (22). Likewise, although GIVE *is* an agreeing verb, it only shows agreement with respect to the subject and the

indirect object; nevertheless, the contrast between (17) and (20) demonstrates that the variation condition of /-alt/ can additionally be satisfied by a plural direct object, which induces no spatial agreement on the verb.

In sum, /-alt/ entails that a plurality of events vary with respect to their thematic arguments; the presence of a plural argument is therefore necessary to license the presence of /-alt/.

2.4 /Rep/: distribution over time

In contrast, /-rep/ does the opposite; /-rep/ requires distribution over time. Sentences (23) and (24), minimally different from (20) and (21)/(22), are grammatical, with the entailment that the events happened repeatedly. The sentences are grammatical with or without the overt temporal adverbial OFTEN, and entail in either case that the events repeated.

(23) FRIEND POSS-1 IX-a, IX-1 BOOK ONE 1-GIVE-rep.
'My friend repeatedly gave me one book.'

(24) (OFTEN) ONE PERSON FORGET-rep ONE WORD.
'One person often forgot one word.'

Of note, distribution across participants alone is not sufficient to license /-rep/; even if one of the verbal arguments is plural, /-rep/ entails distribution over time. This is demonstrated by (25); although the subject, 'MY FRIENDS CL:plural' is plural, the sentence cannot be used to describe a situation in which all friends forgot to bring a camera on a single occasion. (This is in contrast to a sentence like (15), which does allow a reading in which all friends arrived simultaneously.)

(25) MY FRIENDS CL:plural FORGET-rep BRING CAMERA.
'My friends repeatedly forgot to bring a camera.'

Following our discussion Section 2.1, we might ask whether /-rep/ *allows* the variation of participants across each subevent. (Recall from sentences (9-13) that such variation was not possible for English *repeatedly*.) For example, considering the sentence in (25), a relevant situation that has distribution over time *and* participants would be a situation in which a different friend forgot a camera on each of several occasions. In order to judge the availability of this reading, two subjects were asked to do a situation matching task: they were asked whether the sentence could be used to describe each of several situations, described in LSF. For both, the sentence in (25) was judged to be compatible with a scenario in which there were multiple occasions on which all members of the group forgot to bring a camera (as in (26a)). One signer additionally observed that the sentence could be used if *each* of the

friends repeatedly forgot to bring a camera (as in (26b); this reading was not tested for the other signer). However, both signers judged the sentence to be incompatible with a scenario in which there is distribution over time *and* participants. Specifically, it cannot be used in a context in which John forgot a camera on Monday, Mary forgot a camera on Tuesday, and Bill forgot a camera on Wednesday (as in (26c)). As reported above, the sentence was also judged incompatible with a scenario in which there is no distribution over time (as in (26d)). Thus, in general, /-rep/ was only allowed with scenarios in which an event with the same participants repeats several times.

(26) *Possible readings of (25)*

a. ✓ several occasions on which all members of the group forgot
b. ✓ for each individual, several occasions on which he or she forgot
c. * for each individual, a single occasion on which he or she forgot (but several occasions overall)
d. * a single occasion on which all members of the group forgot

The empirical situation, however, seems to be somewhat more complex, with the availability of a reading with distribution over both time and participants depending on a variety of factors, including the use of space and non-manual markers (i.e. facial expressions).

For English, we saw that creating paradigms with change-of-state verbs allowed us to turn context-matching tasks into acceptability tasks. In LSF, exactly the same test can be constructed to probe the possible readings of /-rep/ by using 'once-only' verbs like LEAVE or DIE. As it turns out, though, in such cases, both grammaticality and interpretation are determined in part by the use of space. Specifically, in (27), when the verb LEAVE is repeated in exactly the same location, the sentence received a degraded judgement for two signers, albeit a higher judgement on average than for an analogous sentence with a singular subject. One of three signers rated the sentence as perfectly grammatical, but noted that it came with a particular meaning: namely, that the friends lined up, then left one by one from the same location.

(27) ? MY FRIENDS LEAVE-rep.
When possible: 'My friends lined up, then left one by one.'

On the other hand, when a change-of-state verb inflected with /-rep/ moves over an area of space, the sentence becomes perfectly grammatical. Sentence (28) demonstrates this with the verb DIE moving over a horizontal arc in space. With this movement, the sentence is rated as grammatical, with no additional interpretive effects.

(28) SEVERAL MAN DIE-rep-arc.
'Several men died.'

Synthesizing these results, it appears that inflection with /-rep/ does not itself prevent distribution over participants; however, further interaction with space *can* add additional restrictions. In particular, when a verb is repeated in exactly the same position, it can introduce the inference that each subevent involved the same individual or involved the same location. For this reason, we will posit a relatively weak meaning for /-rep/ — namely, mandatory distribution across time and optional distribution across participants — and allow other inflectional properties to strengthen this meaning. Because the analysis of nominal plurality is complex in its own right though (see Kuhn to appear), we will not attempt to give an analysis of these additional factors in the present paper.

2.5 Generalizations: /-alt/ and /-rep/

Figure 5 provides pictures to illustrate the descriptive generalizations. On the left, /-rep/ denotes events which are distributed over time, and that can optionally vary with respect to participants. On the right, /-alt/ denotes events which must vary over the participants (so is only licensed by a plural argument), and which can optionally vary over time.

	/-rep/	/-alt/
a. distribution over only time	✓	*
b. distribution over participants and time	✓	✓
c. distribution over only participants	*	✓

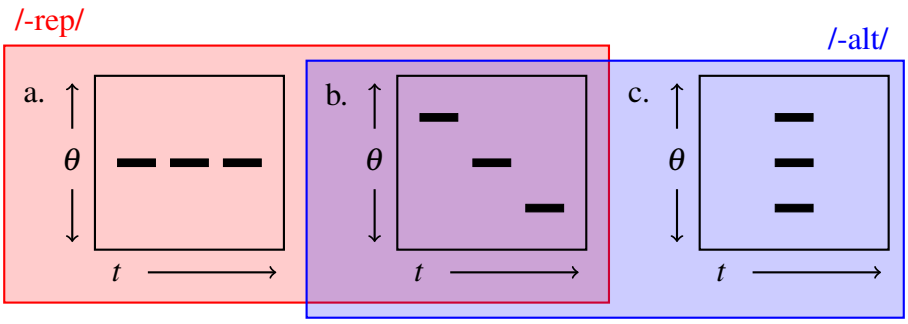


Figure 5 Summary of available readings with /-rep/ and /-alt/

Both /-alt/ and /-rep/ entail that there are a plurality of events. The difference between the two morphemes is that /-alt/ requires subevents to have different thematic arguments; /-rep/ requires subevents to have different runtimes.

3 Compositional semantics

In this section, we provide a compositional analysis of pluractional markers in LSF. After introducing further data that dictates formal choices in the semantic analysis, we turn to a compositional puzzle, in which it seems like the contribution of the pluractional marker is trivially redundant. Although an analogous puzzle has been observed in the nominal domain of 'dependent indefinites,' the present work is the first case in which an analogous pattern has been reported for the verbal domain. We model a solution on Henderson's (2014) analysis of dependent indefinites.

3.1 Operator or filter?

As described in the previous section, both /-rep/ and /-alt/ yield sentential truth conditions that entail that there are a plurality of events. However, as highlighted by a range of recent literature on plurality (e.g. Henderson 2014, among others), the entailment of an event plurality may arise from a variety of different compositional mechanisms. In English, this can be illustrated with the sentences in (29). Although both (29a) and (29b) entail that John coughed several times, the two sentences seem to arrive at this entailment in very different ways: (29a) quantifies over intervals of time that each contain a single event; (29b) checks that there is a single interval of time that contains a plurality of events.

(29) a. Every three seconds, John coughed once.
b. John coughed repeatedly for several minutes.

This intuition can be made more concrete by observing how the constructions interact with other operators in the sentence. Specifically, as observed by van Geenhoven (2004), constructions that result in a plurality of events may differ with respect to whether they allow plain indefinites to vary with respect to those events. For example, the two English sentences in (30) both contain the singular indefinite *one book*. In (30a), variation is possible — each reading subevent may be associated with a distinct book; in contrast, in (30b), no variation is possible — all the subevents must involve the same book. This contrast becomes more pronounced in (31), where the implausibility of eating a single strawberry more than once yields degraded acceptability of (31b).

(30)	a.	John read one book every week.	✓many books	✓one book
	b.	John read one book repeatedly.	*many books	✓one book

(31) a. Every three seconds, John ate one strawberry.
b. # John ate one strawberry repeatedly.

Cross-linguistically, the inability to induce variation in a plain indefinite has been observed for a wide range of pluractional markers across many languages, including Chechen (Yu 2003), West Greenlandic (van Geenhoven 2004), Spanish (Laca 2006), and Kaqchikel Mayan (Henderson 2014). For example, the Kaqchikel pattern in (32) replicates the English contrast in (30). In (32a), the distributive operator *q'ij qij* ('every day') can scope over the indefinite *jun wuj* ('a book') allowing the books to vary day by day. In contrast, although the pluractional suffix *la'* may also indicate an event recurring over time, these events must involve the same book on each occasion.

(32) **Kaqchikel** (Henderson 2014)

a. Q'ij qij xukanöj jun wuj.
day day search a book
'Every day she looked for a (different) book.'

b. Xukano-la' jun wuj.
search-LA' a book
'She looked for a (particular) book many times.'

Based on these contrasts, an analytical distinction can be made between two kinds of constructions that generate 'pluractional' meanings. The first category consists of distributive operators, like English *every week* or Kaqchikel *q'ij qij*; these operators pluralize the meaning of an event predicate by summing distinct events that appear in the predicate. For example, if e is an event in which John read *The Left Hand of Darkness* on Week 1, e' is an event in which John read *Catch-22* on Week 2, and e'' is an event in which John read *American Gods* on Week 3, the sum of these three events would be in the denotation of (30a). Of note, the resulting meaning includes some events that were not included in the original event predicate: although e, e', and e'' are all events contained in ⟦John read one book⟧, the sum of them is not, since three books are involved.

In the second category, pluractional markers like English *repeatedly* and Kaqchikel *-la'* check that an event consists of a plurality of sub-events, but do not themselves sum together the constituent sub-events. For example, assuming that ⟦John read one book⟧ consists of both events in which a particular book was read a single time, and also those in which it was read several times, the contribution of the adverb *repeatedly* in (30b) will be to filter out only those events with multiple subevents that are distributed over time.

Turning to LSF, we can use these diagnostics to characterize the pluractional morphemes /-alt/ and /-rep/. We show that these cannot make plain indefinites dependent, so fall into the category of plurality *filters* (along with English *repeatedly* and Kaqchikel *-la'*). In contrast, we argue that the LSF quantifiers EACH, 'each (one),' and EVERY-DAY, 'every day,' are distributivity operators, like their English translations.

First, looking at distribution across the temporal dimension, we observe a semantic contrast between the lexical item EVERY-DAY, and the verbal inflection /-rep/: the former allows variation of a plain indefinite; the latter does not. For example, the sentence in (33a) is true if a different word was forgotten each day, but (33b) entails that the same word was forgotten more than once.

(33) a. EVERY-DAY JEAN ONE WORD FORGET. ✓many words ✓one word
'Every day, Jean forgot one word.'

b. JEAN ONE WORD FORGET-rep. *many words ✓one word
'Jean forgot one word repeatedly.'

Turning to distribution across the participant dimension, we see a similar contrast between the lexical item EACH, and the verbal inflection /-alt/. Like EVERY-DAY, the quantifier EACH may induce variation in a plain indefinite; this can be seen in (34a), which admits a reading in which each individual forgot a different word. In contrast, /-alt/ cannot introduce any such variation: the only situations described by (34b) are those in which the same word was forgotten by each student.

(34) a. STUDENT EACH FORGOT ONE WORD. ✓many words ✓one word
'Each student forgot one word.'

b. STUDENT IX-arc FORGOT-alt ONE WORD. *many words ✓one word
'The students forgot (the same) one word.'

We thus conclude that, like pluractional markers in many other languages, the verbal inflections /-rep/ and /-alt/ filter the meaning of an event predicate for plurality, but are not themselves distributive operators. In contrast, the quantifiers EACH and EVERY-DAY are distributive operators that return sums of the events in an event predicate. This distinction is orthogonal to the dimension across which there is distribution. These findings are summarized in (35).

(35)

	operator	filter
participants	EACH	-alt
time	EVERY-DAY	-rep

3.2 Definitions and examples

We will adopt a neo-Davidsonian event semantics, where verbs denote sets of events (e.g., Davidson 1967, Carlson 1984). Both events and individuals form a mereological structure; $\preceq$ indicates mereological parthood ($e' \preceq e$ is read "e' is part of e"). The sum of two objects, $x \oplus y$, is defined as the smallest object z such that $x \preceq z$ and $y \preceq z$. The generalized summation operator $\bigoplus P$ takes the sum of all the elements of a set P, defined when $P \neq \emptyset$.

Algebraic closure of a set under sum-formation is defined as the star-operator in (36). Following Krifka (1992) and Kratzer (2008), among others, lexical predicates are inherently pluralized via the star operator. Thus, *arrive* denotes the set of all singular or plural arriving events.

(36) For every set P, ${}^*P = \{x\colon\ \exists P'[P' \subseteq P \ \wedge\ P' \neq \emptyset \ \wedge\ x = \bigoplus P']\}$
'${}^*P$ is the set of all objects that can be made by summing non-empty subsets of P.'

A definite plural denotes a sum individual.

(37) $[\![\text{the boys}]\!] = \bigoplus [\![\text{boy}]\!]$

Verbal arguments are related to events through thematic role functions; thus if e is an event witnessing the fact that John coughed, then $\text{agent}(e) = \text{John}$. Following Krifka (1986) among others, we assume cumulativity of thematic roles; that is, for all events e, e', $\text{agent}(e \oplus e') = \text{agent}(e) \oplus \text{agent}(e')$.

These arguments are introduced by thematic role operators, which we will represent syntactically as [ag] and [th]. Following Champollion (2015), we will assume that a thematic role operator forms a constituent with a noun phrase. Because the particular details of this composition are irrelevant here, we will simplify by providing denotations for the full noun phrases, after combination with the thematic role operator. Two definitions that we will use are provided in (38) and (39).

(38) $[\![\text{the boys [ag]}]\!] = \lambda V \lambda e[V(e) \wedge \text{agent}(e) = \bigoplus [\![\text{boy}]\!]]$

(39) $[\![\text{one word [th]}]\!] = \lambda V \lambda e[V(e) \wedge \text{theme}(e) \in [\![\text{word}]\!] \wedge |\text{theme}(e)| = 1]$

We are now equipped to provide definitions for the pluractional morphemes in LSF. The meanings of /-alt/ and /-rep/ are provided in (40) and (41), adapted from a similar analysis in Lasersohn (1995). Here, the function τ returns the runtime of an event — the sum of contiguous points in time over which it occurs. We let $\theta(e)$ be the tuple of the arguments of an event: $\langle \text{agent}(e), \text{theme}(e), \ldots \rangle$.

(40) $[\![\text{-alt}]\!] = \lambda V \lambda e[V(e) \wedge \exists e', e'' \preceq e[\theta(e') \neq \theta(e'')]]$
'/-alt/ takes a verb denotation V and gives the set of V-ing events that have at least two subparts with different thematic arguments.'

(41) $[\![\text{-rep}]\!] = \lambda V \lambda e[V(e) \wedge \exists e', e'' \preceq e[\tau(e') \neq \tau(e'')]]$
'/-rep/ takes a verb denotation V and gives the set of V-ing events that have at least two subparts with different runtimes.'

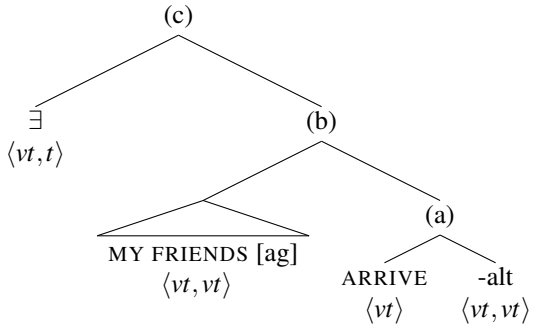
The critical difference between the two morphemes is that /-alt/ requires that the event has sub-events with different thematic arguments; /-rep/ requires that the event

has sub-events with different runtimes. In either case, the existence of two non-identical sub-events entails that there is more than one event — that is to say, the inflected verb is pluractional.

In the remainder of Section 3.2, we illustrate the system with several examples. The tree in (43) provides an example derivation for sentence (42). The verb ARRIVE is number-neutral, including both singular and plural events; at node (a), it combines with /-alt/, which restricts this denotation to plural events, and further imposes the condition of thematic variation over these events. At node (b), an agent argument position has been introduced and filled by the sum of the speaker's friends. Because 'MY FRIENDS' is plural, it provides a thematic argument that can satisfy the condition of thematic variation imposed by /-alt/. Finally, the event argument is existentially closed.

(42) MY FRIENDS ARRIVE-alt.

(43)



(44) a. $\lambda e[{}^{*}\text{arrive}'(e) \wedge \exists e', e'' \preceq e[\theta(e') \neq \theta(e'')]]$

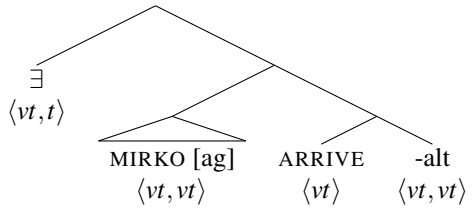
b. $\lambda e[{}^{*}\text{arrive}'(e) \wedge \exists e', e'' \preceq e[\theta(e') \neq \theta(e'')] \wedge {}^{*}\text{agent}(e) = \bigoplus(\text{my friends}')]$

c. $\exists e[{}^{*}\text{arrive}'(e) \wedge \exists e', e'' \preceq e[\theta(e') \neq \theta(e'')] \wedge {}^{*}\text{agent}(e) = \bigoplus(\text{my friends}')]$

The sentence in (45) is ungrammatical; the tree in (46) shows where this goes wrong. The derivation proceeds as before; the difference here is that the subject of the sentence is a singular individual, thereby guaranteeing that the sentence be a contradiction. Specifically, /-alt/ imposes the condition of thematic variation. Since the only thematic role is the agent, this amounts to the constraint that $\exists e', e'' \preceq e[\text{agent}(e') \neq \text{agent}(e'')]$, which entails that $|\text{agent}(e)| \geq 2$. This contradicts the condition that $\text{agent}(e) = \text{mirko}'$.

(45) * MIRKO ARRIVE-alt.

(46)

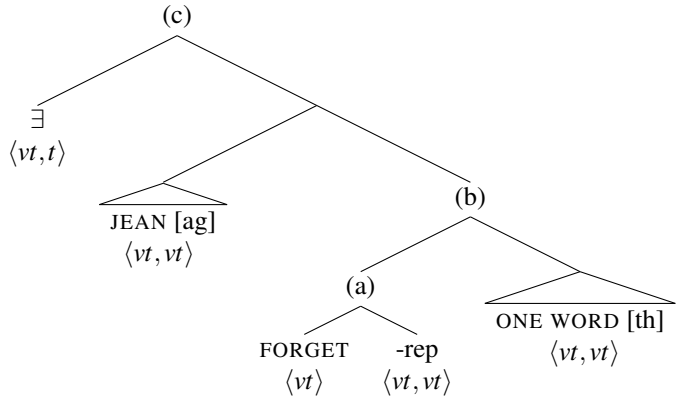


(47) $\exists e[^{*}\text{arrive}(e) \wedge \exists e', e'' \preceq e[\theta(e') \neq \theta(e'')] \wedge {}^{*}\text{agent}(e) = \text{mirko}']$

As shown in Section 3.1, /-alt/ and /-rep/ cannot induce variation in plain indefinites. The example in (48) illustrates how this result is derived, using an example with /-rep/. As before, the verb FORGET is number-neutral, including both singular and plural events; at node (a), it combines with /-alt/, which restricts this denotation to plural events that are distributed over time. At node (b), this denotation is again restricted to those (plural) events that have a single word as theme. By cumulativity of thematic roles, this entails that the same word was forgotten in each subevent. The sentential truth conditions involve a total of one book, as attested.

(48) JEAN ONE WORD FORGET-rep.

(49)



(50) a. $\lambda e[^{*}\text{forget}(e) \wedge \exists e', e'' \preceq e[\tau(e') \neq \tau(e'')]]$

b. $\lambda e[^{*}\text{forget}(e) \wedge \exists e', e'' \preceq e[\tau(e') \neq \tau(e'')] \wedge \text{theme}(e) \in \text{word}' \wedge |\text{theme}(e)| = 1]$

c. $\exists e[^{*}\text{forget}(e) \wedge \exists e', e'' \preceq e[\tau(e') \neq \tau(e'')] \wedge \text{theme}(e) \in \text{word}' \wedge |\text{theme}(e)| = 1 \wedge \text{agent}(e) = \text{jean}']$

For comparison, let us look at the action of a distributive operator; here we focus on EACH. Above, we showed that EACH takes an event predicate, and returns the sum of events in that predicate. A version of this is implemented in (51): applying 'EACH [ag]' to a predicate returns a set of events that can be obtained by summing subevents with atomic agents.

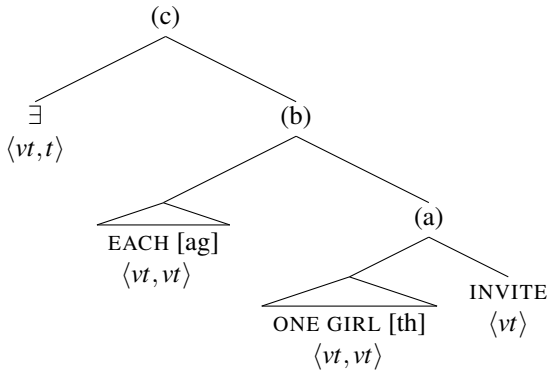
(51) $[\![\text{EACH [ag]}]\!] = \lambda V \lambda e[\exists E[e = \bigoplus E \wedge \forall x[\textbf{atom}(x) \rightarrow \exists! e'[e' \in E \wedge V(e') \wedge \text{agent}(e') = x]] \wedge \forall e'[e' \in E \rightarrow \exists x[\textbf{atom}(x) \wedge V(e') \wedge \text{agent}(e') = x]]]]$

'Given an event predicate V, return the set of events $e = \bigoplus E$ such that each atomic individual is the agent of exactly one V-ing event in E, and, conversely, every element of E is a V-ing event with an atomic agent.'

As an example, (53) provides the derivation of (52). At node (a), the subtree denotes a set of events in which one girl was invited. At node (b), the distributive operator is applied, returning sums of events in which each atomic individual invited one girl. At (c), existential closure asserts that such an event exists. Critically, although any atomic subpart of this event is guaranteed to involve a single girl, the sum of these subevents, i.e., the event itself, may involve more than girl, as attested.

(52) EACH ONE GIRL INVITE.

(53)



(54) a. $\lambda e[{}^{*}\text{invite}(e) \wedge \text{theme}(e) \in \text{girl}' \wedge |\text{theme}(e)| = 1]$

b. $\lambda e[\exists E[e = \bigoplus E \wedge \forall x[\mathbf{atom}(x) \rightarrow \exists! e'[e' \in E \wedge {}^{*}\text{invite}(e') \wedge \text{theme}(e') \in \text{girl}' \wedge |\text{theme}(e')| = 1 \wedge \text{agent}(e') = x]] \wedge \forall e'[e' \in E \rightarrow \exists x[\mathbf{atom}(x) \wedge {}^{*}\text{invite}(e') \wedge \text{theme}(e') \in \text{girl}' \wedge |\text{theme}(e')| = 1 \wedge \text{agent}(e') = x]]]]$

c. $\exists e[\exists E[e = \bigoplus E \wedge \forall x[\mathbf{atom}(x) \rightarrow \exists! e'[e' \in E \wedge {}^{*}\text{invite}(e') \wedge \text{theme}(e') \in \text{girl}' \wedge |\text{theme}(e')| = 1 \wedge \text{agent}(e') = x]] \wedge \forall e'[e' \in E \rightarrow \exists x[\mathbf{atom}(x) \wedge {}^{*}\text{invite}(e') \wedge \text{theme}(e') \in \text{girl}' \wedge |\text{theme}(e')| = 1 \wedge \text{agent}(e') = x]]]]$

Some notes are warranted about this definition of the universal quantifier. In particular, we note that the meaning that we have assigned the DP 'EACH (BOY)' is not a generalized quantifier (type $\langle et,t\rangle$), but rather an event modifier (type $\langle vt,vt\rangle$); in this sense, the definition is perhaps somewhat nonstandard. On the other hand, in making this choice, we follow a tradition of other work on quantification within event semantics. For example, Taylor (1985) and Davies (1991) observe that when adverbial expressions appear with a universal quantifier, they can target either the subevents involving atomic participants, or an event that is generated by summing these subevents, depending on the syntax. For example, in (55), the temporal modifier '*for sixteen measures*' must apply to each of the subevents in which a single note was played, but the adverb '*unharmoniously*' must apply to the plural event involving a chord.

(55) Unharmoniously, every organ student sustained a note on the Wurlitzer for sixteen measures. (via Schein 1993)

Schein (1993) and Kratzer (2000) employ a similar strategy to analyze sentences in which distributive operators receive cumulative readings, such as in (56) on a reading in which there are two plays per quarterback, but three video games in total. Analogously to (55), here '*two new plays*' counts objects in the subevents, and '*three video games*' counts objects in the sum of these events.

(56) Three video games taught every quarterback two new plays. (Schein 1993)

The treatment of universal quantification as a summation operator is also adopted in recent theories of dynamic semantics with plural information states (Dynamic Plural Logic: van den Berg 1996, Nouwen 2003; Plural Compositional DRT: Brasoveanu 2006, Henderson 2014). Within this tradition, Henderson (2014) uses the fact that distributive operators introduce sums in order to explain the appearance of dependent indefinites (which require a plural licensor) in the scope distributive quantifiers. As we will see in the Section 3.4, it is exactly the same architectural decision that allows us to explain the licensing of pluractional markers by distributive operators.

3.3 A compositional puzzle

In our descriptive generalizations thus far, there is a similarity between a verb inflected with /-alt/ and a collective predicate like GATHER: both require a plurality to be introduced in some thematic role. The parallel is illustrated in (57) and (58), where the form with a singular argument is ungrammatical in both.

(57) a. * MIRKO GATHER.
b. BOYS IX-arc GATHER.
'{The boys/*Mirko} gathered'

(58) a. * ONE PERSON FORGET-alt ONE WORD.
b. SEVERAL PEOPLE FORGET-alt SEVERAL WORDS.
'Many people forgot many words'

However, it turns out that the behavior of /-alt/ diverges from collective predicates under distributive operators like EACH. The collective predicate GATHER is ungrammatical under EACH, indicating that EACH distributes down to atomic individuals, yielding the same deviance in (59) as in (57a). On the other hand, a verb inflected with /-alt/ is fine under EACH, as seen in (60). Given that EACH entails that a given predicate holds of atomic individuals, it is puzzling that /-alt/, which generally needs a plural licensor, can apparently happily reside below it.

(59) * EACH BOY GATHER.

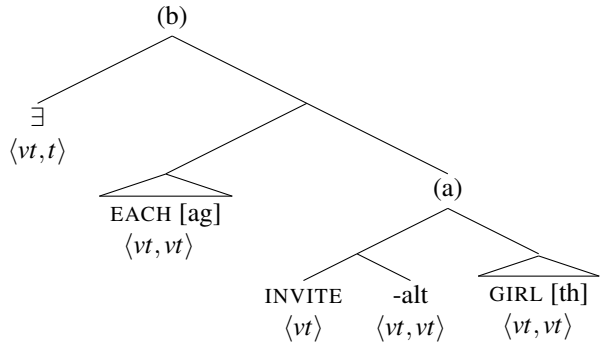
(60) a. BOY EACH FORGET-alt BRING CAMERA.
'Each boy forgot to bring a camera.'

b. EACH INVITE-alt GIRL.
'Each one invited girls.'

We can make this puzzle formally precise with the definitions provided above. As we saw in the derivation of (45) (i.e., 'MIRKO ARRIVE-alt.'), the thematic variation condition of /-alt/ generates a contradictory meaning when combined with singular arguments. An exactly parallel situation occurs if (61) is given the structure in (62). Specifically, in the meaning in (63b), observe that the agent of e' is an atomic individual. As in (45), this means that it is impossible to satisfy the requirement that there be $e'', e''' \preceq e'$ with different agents. Thus, the meaning in (63b), derived through the tree in (62), incorrectly predicts sentence (61) to be ungrammatical.

(61) EACH INVITE-alt GIRL.

(62)



(63) a. $\lambda e[{}^*\text{invite}(e) \wedge \exists e', e'' \preceq e[\theta(e') \neq \theta(e'')] \wedge \text{theme}(e) \in \text{girl}']$

b. $\exists e[\exists E[e = \bigoplus E \wedge \forall x[\textbf{atom}(x) \rightarrow \exists! e'[e' \in E \wedge {}^*\text{invite}(e') \wedge \text{theme}(e') \in \text{girl}' \wedge \text{agent}(e') = x \wedge \exists e'', e''' \preceq e'[\theta(e'') \neq \theta(e''')]]] \wedge \forall e'[e' \in E \rightarrow \exists x[\textbf{atom}(x) \wedge {}^*\text{invite}(e') \wedge \text{theme}(e') \in \text{girl}' \wedge \text{agent}(e') = x \wedge \exists e'', e''' \preceq e'[\theta(e'') \neq \theta(e''')]]]]]$

As it turns out, an analogous situation also occurs in the temporal domain. Because /-rep/ does not generally need a licensor, the puzzle is seen not in the unexpected grammaticality of a particular sentence (as in (60)), but rather, in the unexpected availability of a particular reading of a sentence. Specifically, in Section 3.1, we showed that the temporal quantifier EVERY-DAY is a distributive operator; thus, the result of applying EVERY-DAY to an event predicate V is the sum of subevents (across each of several days) in which V took place. If the structure of (64) is that in (65), then the relevant event predicate is the meaning of the subtree under (a). Because this subtree contains /-rep/, it denotes a set of events with temporally distributed sub-events. Applying EVERY-DAY to this predicate thus predicts sentential

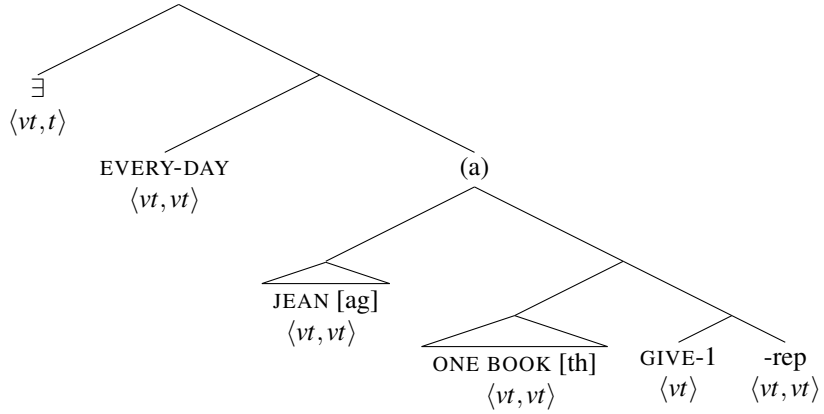
truth conditions with a 'doubly distributive' meaning, in which there are multiple giving events on each day. However, although this is reported as one possible reading of the sentence, it is critically not the only reading, nor even the most salient reading. Additionally, (64) is reported to have a preferred reading — (64a) — in which a single giving event occurs on each day. On this reading, the contribution of /-rep/ seems to be mysteriously vacuous.

(64) EVERY-DAY ONE BOOK JEAN GIVE-1-rep.

a. 'Every day, Jean gave me one book.' *(preferred reading)*

b. 'Every day, Jean gave me one book repeatedly.'

(65)



To summarize, both /-alt/ and /-rep/ show an unexpected interaction in the presence of distributive operators. Whereas the two verbal inflections normally impose a pluractional constraint on the meaning of a verb, this constraint doesn't seem to surface in the compositional derivation when the verb appears under a distributive operator that performs the same action.

3.4 Scopable pluractionality

To the best of our knowledge, the LSF pattern laid out above is the first systematic documentation of this compositional puzzle in the verbal domain. On the other hand, the present state of affairs turns out to be formally identical to a puzzle involving 'dependent indefinites' in the nominal domain (Balusu 2005, Henderson 2014). The situation can be illustrated using data from Kaqchikel Mayan (Henderson 2014). In Kaqchikel, reduplicating a numeral (e.g. *ju-jun*, 'one-one'; *ox-ox*, 'three-three') yields the meaning that the indefinite varies with respect to another argument in the sentence; as such, it is licensed by a plural (as in (66b)) and is ungrammatical if all other arguments are singular (as in (66a)). But, just like /-alt/ in LSF, reduplicated numerals in Kaqchikel can also be licensed by quantifiers which distribute to atoms,

as in (66c). (Like EACH in LSF, Kaqchikel *chikijujunal* is ungrammatical with collective predicates (Henderson 2014, f.n. 14).)

(66) Kaqchikel Mayan (data from Henderson 2014)

a. * Xe'inchäp ox-ox wäy.
I-handle three-three tortilla
Desired reading: 'I took (groups of) three tortillas.'

b. Xeqatij ox-ox wäy.
we-eat three-three tortilla
'We each ate three tortillas.'

c. Chikijujunal ri tijoxela' xkiq'etej ju-jun tz'i'.
each the students hugged one-one dog
'Each of the students hugged a dog.'

In the literature on dependent indefinites, a variety of different solutions have been proposed for this problem. For example, in one class of analysis, dependent indefinites are posited to have no built-in variation condition; rather, dependency marking is the expression of syntactic agreement with a higher operator that introduces pluractionality. This operator is the overt distributivity operator in the case of (66c), and is posited to be covert in the case of (66b). Analyses that exemplify this theory of 'distributive concord' include Oh (2001, 2006) and Kimmelman (2015).

Here, we will argue for an alternative proposal in which a pluractional marker is a *scope-taking predicate*. Following Lasersohn (1995), among others, we have proposed that the meaning of a pluractional marker is a predicate, or a filter, that checks for a plurality of events. However, departing from these authors, we will argue that this predicate can take scope at different levels with a non-trivial semantic effect; in particular, when a pluractional marker takes scope above a distributive operator, it may be satisfied by properties of the event plurality that is introduced by that operator. In this proposal, we follow the spirit of Brasoveanu & Henderson's (2009) analysis of English '*one by one*' and Henderson's (2014) analysis of dependent indefinites, also exemplified in Kuhn (to appear).

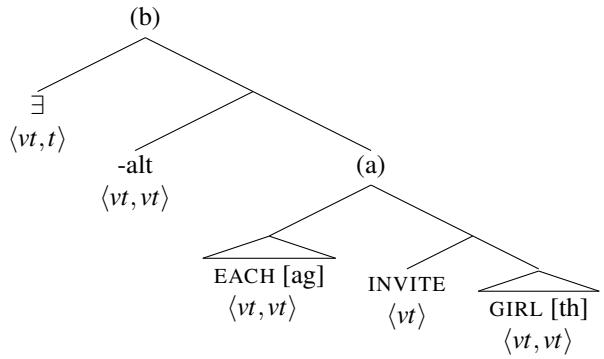
Formally, there are a number of ways in which this proposal can be implemented, including standard mechanisms of scope-taking (quantifier raising and associates; see Kuhn to appear) and analyses employing 'postsuppositions,' propositions that are dynamically passed through the derivation of a sentence to be evaluated at a later point (see Henderson 2014 for discussion). Henderson (2014) observes that the effect of a postsupposition can be emulated by evaluating a conjunct as though it attaches to a given tree at a higher node. Thus, for relative simplicity, here we will approximate the process of scope-taking as an attachment ambiguity.

The derivation below illustrates how this analysis works. Sentence (67) repeats the example from (61), in which /-alt/ co-occurs with a distributive operator. The

proposed tree in (68), however, differs from the earlier logical form in the position at which /-alt/ is evaluated; here, it appears at a higher node than EACH, generating the truth conditions in (69b). Critically, although the subevents e' still have atomic agents, the condition of thematic variation now applies to the global event e. The variation introduced under 'BOY EACH' can thus also satisfy the entailments of /-alt/, and there is no contradiction.

(67) EACH INVITE-alt GIRL.

(68)

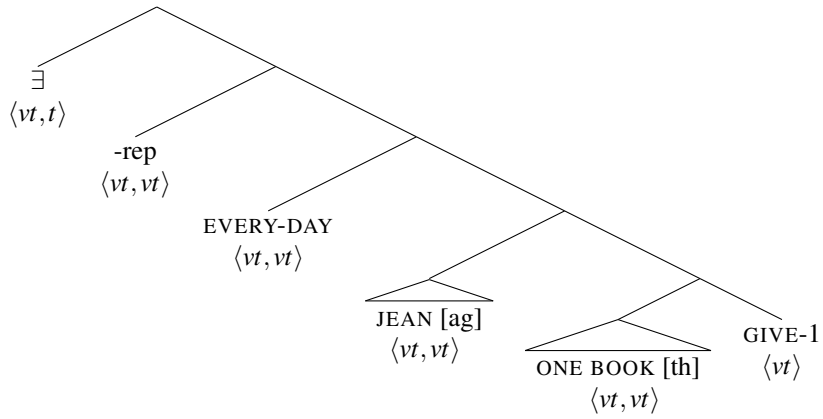


(69) a. $\lambda e[\exists E[e = \bigoplus E \wedge \forall x[\mathbf{atom}(x) \rightarrow \exists! e'[e' \in E \wedge {}^*\text{invite}(e') \wedge \text{theme}(e') \in \text{girl}' \wedge \text{agent}(e') = x]] \wedge \forall e'[e' \in E \rightarrow \exists x[\mathbf{atom}(x) \wedge {}^*\text{invite}(e') \wedge \text{theme}(e') \in \text{girl}' \wedge \text{agent}(e') = x]]]]$

b. $\exists e[\exists E[e = \bigoplus E \wedge \forall x[\mathbf{atom}(x) \rightarrow \exists! e'[e' \in E \wedge {}^*\text{invite}(e') \wedge \text{theme}(e') \in \text{girl}' \wedge \text{agent}(e') = x]] \wedge \forall e'[e' \in E \rightarrow \exists x[\mathbf{atom}(x) \wedge {}^*\text{invite}(e') \wedge \text{theme}(e') \in \text{girl}' \wedge \text{agent}(e') = x]]] \wedge \exists e', e'' \preceq e[\theta(e') \neq \theta(e'')]]$

An analysis of /-rep/ under a temporal quantifier is exactly parallel; when the pluractional morpheme is evaluated at a higher position than the distributive operator, as in (70), the temporal distribution introduced by EVERY-DAY can satisfy the pluractional entailments of /-rep/.

(70)



The analysis of pluractional morphemes as scope-taking predicates thus successfully predicts the grammaticality and interpretation of sentences in which /-alt/ and /-rep/ co-occur with with distributivity operators.

Following the discussion of iconicity in Section 4, we will give a new argument in favor of this kind of analysis, based on the interaction of iconicity with the compositional semantics. In particular, we will see that iconic manipulations are incorporated as part of the at-issue meaning of pluractional forms in LSF; when /-alt/ is licensed by EACH, we will observe that this iconic enrichment must be evaluated from a global perspective, demonstrating that the iconic predicate (as part of the pluractional morpheme) is taking scope above the distributive operator.

3.5 Summary: pluractionality

Up to this point, the pattern of pluractional verbs in French Sign Language fits perfectly into a broader typology of pluractionality in spoken languages: verbal inflection, through reduplication, indicates a plurality of events, whose distribution over various dimensions may be specified by the morpheme in question. We observed a compositional puzzle that was formally identical to the puzzle of licensing dependent indefinites in nominal domain, which we analyzed through a mechanism of scope-taking.

The following section, however, shows that the patterns in LSF go beyond this basic typology: specifically, LSF may additionally communicate information about an event through an iconic mapping. We will argue that this iconic mapping must be integrated throughout the course of semantic composition.

4 Iconicity

4.1 Iconicity in the grammar?

Sign languages, cross-linguistically, are well known for having productive and pervasive iconicity (Cuxac 2001, Liddell 2003, Emmorey 2003). In loose terms, iconicity means that the form of the sign 'looks like' the meaning of the sign. Iconic phenomena have been shown be productive and interpretable. For example, in ASL, an 'F' handshape (as shown in Figure 6) denotes a small disk; Emmorey & Herzig (2003) show that the aperture between the index finger and thumb can be gradiently modified to iconically indicate the size of this disk.

The fact that interlocutors are able to communicate such meanings shows that sign language is able to communicate both logical meaning (generated via grammatical composition) and iconic meaning (generated via pictorial demonstration). On the other hand, it is perhaps not surprising that humans are able to integrate

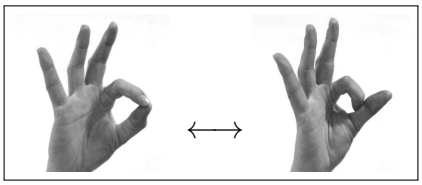


Figure 6 Aperture iconically interpreted in ASL

two kinds of meaning; after all, we make inferences all the time about how people look, sound, and behave. Of particular note, even in spoken language, interlocutors may accompany speech with gesture; the inferences drawn from these utterances incorporate both linguistic meaning and pictorial, gestural content. For example, when an ascending spiral gesture accompanies the utterance in (71), we infer that the way up to the roof is a spiral staircase.

(71) John $\overset{\text{spiral gesture}}{\overline{\text{went up to the roof}}}$.

Ebert & Ebert (2014) argue that, without the presence of a lexical demonstrative, co-speech gesture is never at-issue, so is systematically projected. Schlenker (2016) refines Ebert & Ebert's proposal with systematic investigation of gestures embedded under various logical operators; he shows that empirically, gestural meaning projects like a special kind of presupposition.[3] For example, in (72), the meaning of the co-speech gesture is projected to be evaluated above *if*; empirically, we infer that John may or may not go up to the roof, but that, if he does, the only way to get there is via a spiral staircase.

(72) If John $\overset{\text{spiral gesture}}{\overline{\text{goes up to the roof}}}$, he'll get vertigo.

Turning to sign language, we take the null hypothesis to be that the iconic component of meaning is similarly non-interactive. Instantiating this hypothesis, for example, Goldin-Meadow & Brentari (2015) advance the proposal that iconicity in sign language is exactly analogous to co-speech gesture in spoken language. In light of the work on co-speech gesture, such an analysis would thus predict that iconic meaning should not be at-issue, and thus that it should project. To date, though, the status of iconic meaning in sign language has for the most part not been investigated. The one exception is Schlenker, Lamberton & Santoro (2013), who examine the

3 More specifically, Schlenker (2016) argues that co-speech gesture triggers a 'cosupposition,' a presupposition conditionalized on the meaning of the cooccuring speech: if g is the meaning of a gesture and p is the meaning of the speech with which it cooccurs, the utterance generates a presupposition of the form $p \rightarrow g$.

iconic properties of pronouns in ASL and LSF. In both languages, a pronoun can be directed at a high location in space if the associated referent is tall or powerful; Schlenker et al. show that this height specification is a presupposition that projects out of negation, analogous to phi-features on spoken language pronouns. At this point, though, it is still up in the air whether this projective behavior arises from the iconic (or gestural) nature of the signal, or from the fact that pronominal features, such as gender, are presupposed in general.

Here, we advocate for a hypothesis on which iconic meaning can interact with logical meaning throughout the composition of a sentence, and, like logical meaning, may be either at-issue or presupposed. In Section 4.4, we will show that, unlike the interpretation of co-speech gesture, iconic meaning on pluractional verbs in sign language *is* at-issue, taking scope below other logical operators. In Section 4.5, we will further argue that the iconic component of pluractionals in LSF is incorporated into the same, scopable morpheme that checks for a plurality of events. The upshot of this is that the iconic component may 'take scope,' with the result of generating different readings. In order to be descriptively adequate, the system must integrate the calculation of iconic meaning throughout grammatical composition.

4.2 Iconicity in LSF verbal forms

We will claim that the rate of reduplication in LSF pluractional verb forms is iconically mapped to the rate of event repetition over time. Roughly speaking, GIVE-rep, when signed slowly, means that the giving events happened slowly; GIVE-rep, when signed quickly, means that the giving events happened quickly. Formally, we use the following definition of iconicity:

(73) A structure is *iconic* if there is a non-arbitrary structure-preserving mapping from the form of a sign to its meaning.

Critically, if *geometric* structure (i.e. measurement) is preserved, then analog phonetic differences produce analog semantic effects. This is in contrast to the discrete, combinatorial system that is generally assumed for generative grammar, which is not able to generate patterns of gradient interpretation. Following Emmorey & Herzig (2003), we can thus use the gradient interpretation of gradient phonetic changes as a diagnostic for iconicity.

For LSF, we claim that the phonetic form of a pluractional verb includes gradient temporal information that is preserved in its interpretation. That being said, it's immediately clear that it is not *absolute* speed that is preserved — for example, GIVE-rep, signed slowly, can refer to an event which transpires of the course of several days, even though it clearly doesn't take several days to pronounce the verb.

(74) BOOK 1-GIVE-a-rep-slow.
Compatible with: 'I gave books over the course of several days.'

We will argue that what the sign preserves, then, is *relative* speed. But, if only relative speed is preserved, then in order to find gradient effects, we need to look at comparative examples, since a single speed can't be evaluated without a frame of reference.

Here, we present two such cases. First, we will look at comparative paradigms, where multiple levels of speed are interpreted in comparison. Second, we will look at examples with acceleration or deceleration: change of speed within a single verb form. We will show that both of these kinds of cases are interpreted as expected from an iconic mapping, with gradience in the phonetic form interpreted as gradience in the meaning.

Example (75) presents a comparative paradigm. The verb GIVE-rep appears at three speeds: slow, fast, and medium.

(75) a. BOOK 1-GIVE-a-rep-slow.
b. BOOK 1-GIVE-a-rep-fast.
c. BOOK 1-GIVE-a-rep-medium.
'Again and again, I gave a book to him.'

Figure 7 provides graphs that show the speed of repetition in each of these three forms. In the graphs below, time appears along the x-axis; forward motion of the hand is indicated by a black bar; pauses and reset motions are indicated with white space.

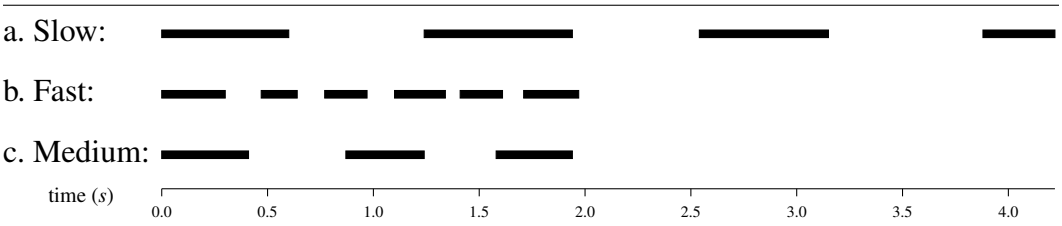


Figure 7 Graphs of forms at three different speeds in a comparative paradigm.

When each form was judged independently (with a simple interpretation question: 'What does this mean?'), two signers showed slightly different patterns: one consultant reported a different meaning for each of the forms, but the other only reported a binary distinction between the three. For the second signer, GIVE-rep-slow, was interpreted as slower than some default rate; in a neutral context, (75a) was interpreted as denoting giving events that occurred over the course of several days. (75b) and (75c) were judged to be true in essentially the same scenarios, denoting

giving events that occurred multiple times in the same day. In fact, though, this vagueness of meaning is exactly what we expect if an iconic mapping only preserves relative speed; in isolation, iconic forms must be evaluated with respect to a default rate; as such, a standard of comparison must come from context, with a resulting vague interpretation (c.f. Kennedy 2007 for vagueness of context-sensitive adjectives in English). Without comparison to another form, there is thus no way to get crisp differences in meaning from gradient phonetic manipulations.

On the other hand, when the consultants were asked to *compare* the meanings of forms, gradient judgments emerged for both signers between all three forms. In the words of the second signer (translated from LSF), "Of the three, for the second and the third, the situations are the same, *but* the timing is different: fast or slow. [. . .] The level of degree is different. The idea's the same." Thus, gradient effects appear in comparative paradigms.

Second, we can see gradient effects in a single verb if we allow change in speed: acceleration or deceleration. In such examples, the form of the verb provides a standard for comparison for itself, since the rate of repetition at the start of the inflected verb is compared to the the rate of repetition at the end.

The following paradigms are replicated both in LSF and in ASL. The importance of this replication is to emphasize the stability of the iconic component across sign languages; we have no empirical findings so far to show that the iconic component is at all different between the two languages, and, indeed, there are theoretical reasons why we expect this to be the same among sign languages (Goldin-Meadow & Brentari 2015). Additionally, since much of the literature on verbal inflection has described ASL, we want to make the point that these arguments carry over to ASL as well.[4]

Example (76) provides two forms of the verb GIVE in LSF: accelerating and decelerating. As before, Figure 8 provides a graph of the motion, with black lines indicating the forward component of each repetition.

(76) **LSF**

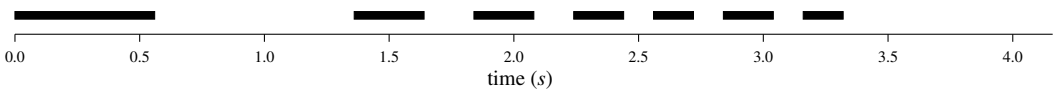
a. MIRKO CHILD BOOK GAVE-rep-accelerating.
'Mirko gave the child a book at an accelerating pace.'

b. MIRKO CHILD BOOK GAVE-rep-deceleration.
'Mirko gave the child a book at decelerating pace.'

The first of these forms is interpreted as denoting an event which accelerates in rate; the second is interpreted as denoting an event which decelerates in rate.

4 On the other hand, the grammaticalized component of pluractional morphemes does seem to show variation between the two languages. ASL is also able inflect verbs with either /-rep/ or /-alt/; however, the conditions for /-alt/ seem to be less strict: thematic participants don't need to vary, as long as the events are inferred to be different *kinds* of events.

a. Acceleration



b. Deceleration

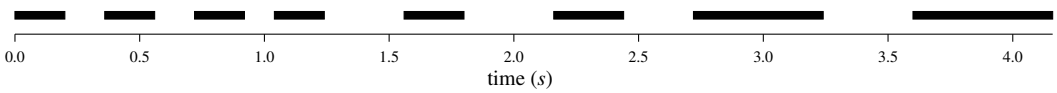


Figure 8 Time-course diagrams of accelerating and decelerating GIVE-rep (LSF)

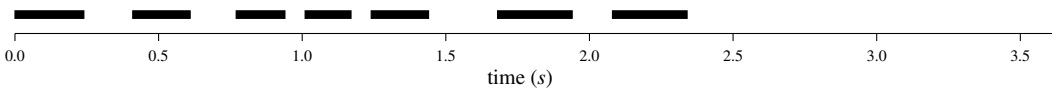
In fact, it's possible to preserve quite a lot of information in the iconic mapping. Figure 9 shows the phonetic time-course graphs for two forms of GIVE-rep in ASL, as seen in (77): the interpretation is that the giving events increase in frequency to a plateau that lasts for a short or long period of time before the rate of events decreases again.

(77) **ASL**

a. ME SECRETARY PAPERS GIVE-rep-slow/fast[short]/slow.

b. ME SECRETARY PAPERS GIVE-rep-slow/fast[long]/slow.
'I gave the secretary papers at a rate that sped up to a {short/long} plateau before slowing down again'

a. Short plateau



b. Long plateau

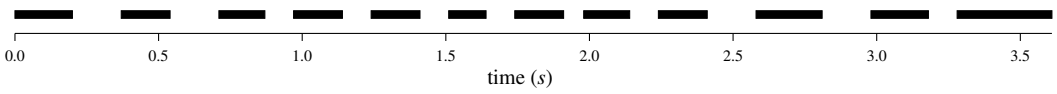


Figure 9 Time-course diagram of 'plateau' inflection of GIVE-rep (ASL)

4.3 Sketch of the iconic mapping

With all the structure that is preserved, what is notably *not* preserved is the exact number of repetitions. For example, in (76b), there is no inference that there the speaker gave something exactly eight times, even though this was the number of times the signer's hands moved (as depicted by the eight black bars in Figure 8b).

In fact, this is no surprise; there is a general finding in the sign language literature that "three means plural (and sometimes two is enough)," which goes hand-in-hand with the more general cognitive finding (Carey 2009) that relative cardinality judgments are much easier than absolute cardinality judgments. Yet, there is a challenge in the formalization; on one hand, a huge amount of information is preserved by the iconic mapping, but it critically doesn't maintain a one-to-one correspondence with the phonetic repetitions. Thus, we need a mechanism to innocently 'add points' to a sequence without altering important global properties of the sequence (like acceleration, etc.).

Our answer to this puzzle is to associate an iconic sequence not with a discrete set of points, but with a continuous of distribution of events over time. Roughly speaking, then, the accelerating sequence in Figure 10a would be associated with the positively-sloped red line that appears above it. We can now formalize what it means to be insensitive to 'absolute rate' and 'absolute number:' the iconic mapping can innocently stretch a coutour by multiplying by a constant along the x-axis or y-axis. Stretching or compressing along the x-axis allows us to ignore absolute speed, as in Figure 10b; stretching along the y-axis allows us to add more points to the sequence, as in Figure 10c.

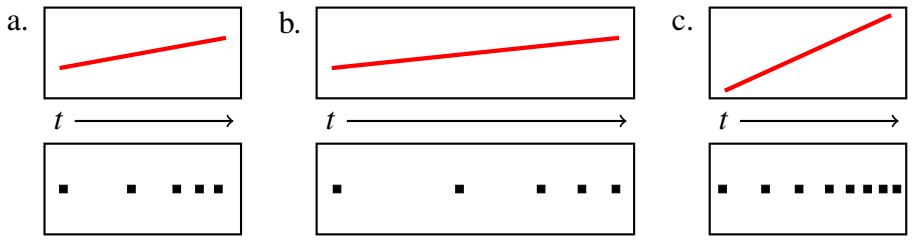


Figure 10 Stretching along the axes yields timing and number insensitivity

Technically, there are a number of different options for how to map a set of discrete points to a continuous contour. A standard strategy in statistics is to use a kernel density estimation (see Silverman 1986 for an overview). Essentially, this is a way of estimating the rate of events at a given point in the sequence by counting the number of events within a fixed-size window centered around that point. The graph created by allowing the window to move along the x-axis (time) will be the contour associated with the sequence of points. Figure 11 demonstrates this idea using a

bell-curve-shaped window: the estimated rate at $t = 25$ is the sum of the values of the red lines.

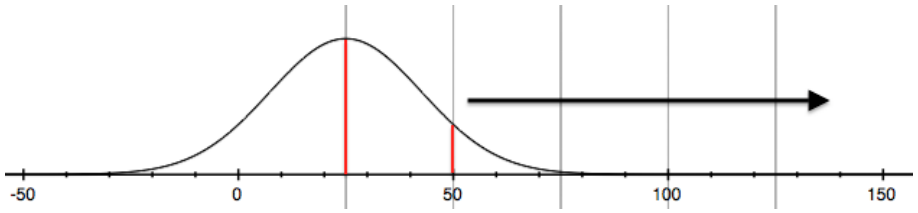


Figure 11 Illustration of a kernel density estimation calculation

An example is given in Figure 12. Here, a decelerating sequence of events is mapped to the contour that is layered on top of it. Formally, the resulting representation is very similar to a histogram, but the smoothed technique here escapes from several pathologies that arises from the chunking properties of histograms.

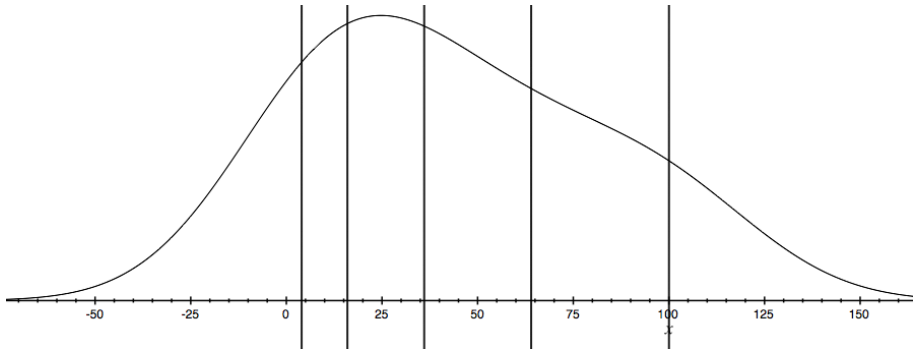


Figure 12 Output of a kernel density estimation. The downward slope of the line indicates that event occurrences become less frequent over time.

Since this is a general algorithm for estimating contours from an initial set of points, observe that it immediately captures the complex timing information contained in the phonetic forms shown in Figure 9, which not only encode information about rate, but also information about the amount of time for which a given rate was maintained. This is in contrast to a theory that relies on primitive features like [+acceleration], which would have to stipulate further mechanisms to preserve the durational information that is necessary to capture the contrast between (77a) and (77b).

At this point, there are certainly many more refinements that could be made regarding the mapping above; and, indeed, linguistic truth value judgements can only bring us so far, since they rely on categorical judgements of an inherently gradient

phenomenon. On the other hand, as the processes involved in this iconic mapping are presumably cognitively domain-general mechanisms of pattern-matching, they could in principle be experimentally tested using completely non-linguistic methodologies. Having sketched an initial mapping that is finely sensitive to event contour but not absolute number, we leave such further refinements to future work.

Generally speaking, though, our iconic mapping will associate a sequence of phonetic movements with a continuous contour (like the curve in Figure 12) that represents the rate of events — the number of events over time. This contour is subject to optional transformations, as in Figure 10. We say the verb is true of any sequence of events which matches the resulting set of contours.

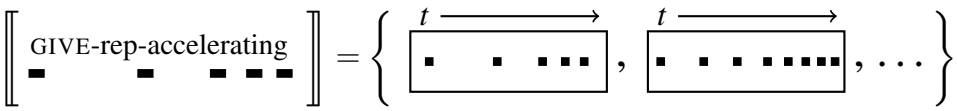


Figure 13 Semantic interpretation of a phonetic form

In Figure 13, the phonetic form appears in semantic interpretation brackets; the meaning is the set of event sequences on the right, all of which match the same contour (modulo stretching). But now, notice that what we've done is simply to associate a phonetic form with a set of plural events: in other words, we have defined a predicate of type $\langle v,t \rangle$. For a phonetic form Φ, call this predicate $\textbf{Icon}^{\Phi}$. The predicate $\textbf{Icon}^{\Phi}$ is a formal object of exactly the same type as any other event predicate.[5]

5 We might well ask whether iconic mappings of this kind occur in spoken language as well. One promising place to look for such iconic effects is in the domain of *ideophones*, a morphological class of onomatopoetic words that communicate eventive meaning in part through demonstration (e.g., Dingemanse 2012). Indeed, Henderson (2016) has recently proposed that in some languages, ideophones are sensitive to a structure-preserving interpretation function that maps repetition of a phonological form to repetition of an event meaning.

Strikingly, these mappings seem to display some of the same properties as the pattern of pluractionality in LSF. Considering the English ideophone *snip*, for example, the pattern in (i) shows a similar insensitivity to exact number. From the sentence in (ia), we infer that the ponytail was cut off by a single cut by the scissors. By contrast, (ib) entails that multiple cuts were needed, but does *not* entail that there were exactly three cuts.

(i) a. Graham went to the barber and snip, no more ponytail.
b. Graham went to the barber and snip snip snip, no more ponytail.

The phenomenon of ideophones in spoken language thus seems to be subject to similar principles of interpretation as the pattern of pluractional verbs in LSF. Further work is needed to test the extent of these parallels, but we expect that aspects of the present analysis should be able to carry over to the spoken language domain.

4.4 At-issue iconicity

As established in Section 4.1, the next question is to ask how the iconic meaning provided by **Icon**$^{\Phi}$ interacts with the logical meaning provided by syntactic composition. In particular, can it take scope under logical operators, or does it obligatorily project, combining with logical meaning only when syntactic composition is complete?

Here, we argue that the iconic meaning must be calculated as part of syntactic composition. In particular, in both LSF and ASL, the iconic inferences about the rate of the event are *at-issue entailments*, that can scope low under negation, conditionals, and distributive quantifiers. Sentences (78) and (79) demonstrate this with negation; these pairs of sentences are not contradictory; the meaning is that the subject gave books at a decelerating pace.

(78) **LSF**
MIRKO BOOK GIVE-rep-speeding-up NOT. IX BOOK GIVE-rep-slowing-down DOWN.
'Mirko didn't give books at an accelerating rate. He gave books at a decelerating rate.'

(79) **ASL**
'JOHN NOT PAPERS GIVE-alt-speeding-up. IX PAPERS GIVE-alt-slowing-down.'
'John didn't give papers at an accelerating rate. He gave papers at a decelerating rate.'

Sentences (80) and (81) show the behavior in the antecedent of a conditional (i.e., under IF); here, signers infer that the secretary will only be happy if the subject gives papers at an accelerating rate.

(80) **LSF**
IF MIRKO PAPERS GIVE-rep-speeding-up, IX SECRETARY HAPPY.
'If Mirko gives papers at an accelerating rate, the secretary will be happy.'

(81) **ASL**
IF JOHN PAPERS GIVE-alt-speeding-up, SECRETARY WILL HAPPY.
'If John gives papers at an accelerating rate, the secretary will be happy.'

Finally, we observe that iconic meanings can scope below distributive operators. In particular, note that a large number of slowly repeating events, when summed together, can yield a sequence of events that occur at a fast rate, as illustrated in Figure 14.

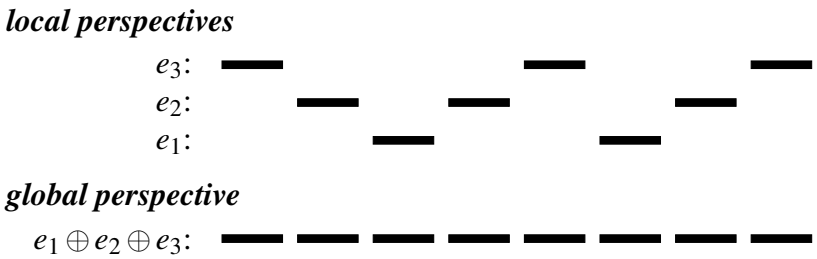


Figure 14 Local vs. global perspective of a plural event

In the English sentence 'Each worker gave the secretary papers slowly,' the adverb *slowly* takes scope below the distributive operator *each*; the result is that the sentence is compatible with a situation in which there are so many workers that the (solitary) secretary ended up receiving papers at a very fast rate. In LSF and ASL, we see the analogous result that the iconically-encoded information about the rate of the event may scope below a distributive operator; thus, the ASL discourse in (82) is judged as non-contradictory, parallel to the English gloss.

(82) **ASL**
EACH WORKER SECRETARY PAPER GIVE-rep-slow. BUT, MANY WORKER NUMEROUS, ONE SECRETARY. SO SECRETARY RECEIVE-alt-fast FAST.
'Each worker gave the secretary papers *at a slow rate*. But there are many workers and one secretary. So the secretary received papers *at a fast rate*.'

The discourse in (83) provides a more complex example that makes the same point. Here, from the point of view any given worker, the giving events accelerate; however, the total number of workers is not constant since workers leave throughout the day, so from the point of view of the secretary, the giving events decelerate. The ASL discourse in (83) is judged as non-contradictory.

(83) a. **Context (ASL)**
ALL WORKER IX-ARC ARRIVE TIME NINE. IX-ARC EACH GOAL FINISH TEN FORM FILL-IN-rep; FINISH FILL-IN, LEAVE HOME. SOME FINISH FAST FILL-IN-rep TIME TEN; SOME ALL-DAY. BEGIN FILL-IN DIFFICULT; PROGRESSING, GET-USED SPEED-UP FILL-IN-rep.
'All the workers arrive at 9:00. Each has to finish ten forms; when they finish, they head home. Some finish quickly and are done at 10:00; others take all day. At first it's difficult, but they get used to it and get faster.'

b. **Target (ASL)**
EACH WORKER SECRETARY PAPER GIVE-rep-accelerating. BUT, WORKER GIVE-rep FINISH, LEAVE. SO, SECRETARY PAPER RECEIVE-alt-decelerating.

> ‘Each worker gives papers to the secretary at an accelerating rate. But, when the workers finish, they leave. So, the secretary receives papers at a decelerating rate.’

Altogether, these examples show that the iconic meaning introduced by the predicate is an at-issue entailment, which may scope below other operators in the sentence.

At this point, we may observe a further parallel between iconic meaning and logical meaning. In Schlenker et al.’s case of iconic height on pronouns, the iconic meaning was presupposed, just like gender and number features on English pronouns. In the case of rate of repetition on pluractional verbs, the iconic meaning is at-issue, just like manner adverbs (*slowly*, *quickly*, etc.) that modify verbs in English. These observations suggest an attractive hypothesis — namely, that the semantic status of iconic meaning is determined by the same linguistic principles (e.g. semantic type, syntactic position) as those that determine the semantic status of logical meaning.[6] In this respect, we note that iconicity in sign language differs from co-speech gesture, which we saw was always presupposed (in the absence of a demonstrative), even when the gestural meaning expressed a manner modification (as in (72)).

In order to get the correct truth conditions for the sign language sentences, the iconic condition must be evaluated in the course of syntactic composition. We therefore propose that the iconic meaning $\mathbf{Icon}^{\Phi}$ is directly incorporated into the definitions for /-alt/ and /-rep/. The definitions in (84) and (85) are exactly equivalent to those in (40) and (41), but with the iconic predicate added as a conjunct.

(84) $[\![\text{-alt}]\!] = \lambda V \lambda e[V(e) \wedge \exists e', e'' \preceq e[\theta(e') \neq \theta(e'')] \wedge \mathbf{Icon}^{\Phi}(e)]$
‘/-alt/ takes a verb denotation V and gives the set of V-ing events that have at least two subparts with different thematic arguments and that have the temporal distribution shown.’

(85) $[\![\text{-rep}]\!] = \lambda V \lambda e[V(e) \wedge \exists e', e'' \preceq e[\tau(e') \neq \tau(e'')] \wedge \mathbf{Icon}^{\Phi}(e)]$
‘/-rep/ takes a verb denotation V and gives the set of V-ing events that have at least two subparts with different runtimes and that have the temporal distribution shown.’

This theoretical move follows Schlenker et al. (2013), who observe that there is no fundamental opposition between iconic properties and formal properties; there’s no problem in allowing an iconically defined predicate to be incorporated directly into a logical definition.

6 On the other hand, Aristodemo et al. (2016) provide a potential counterexample involving an iconic modification of the absolute adjective FULL in Italian Sign Language; here the iconic meaning is roughly equivalent to the degree modifier *completely*, yet it projects like a presupposition, unlike the English expression ‘*completely full*.’ We leave further investigation of this hypothesis to future research.

4.5 Scopable iconicity

The proposal that the iconic and logical components are incorporated into a single morpheme turns out to make specific predictions in the context of the compositional system that we have built thus far. In particular, in Section 3.4, we observed that /-alt/ and /-rep/ appear to be semantically vacuous when they appear under an operator that distributes over the relevant dimension. We proposed a solution whereby the pluractional morphemes can be evaluated at a hierarchical level higher than the distributive operator. This proposal contrasted with analyses on which the morphemes take scope *in situ*, but display syntactic agreement with a higher node.

When we incorporate an iconic predicate into the definition of a pluractional morpheme, however, the two approaches make different predictions regarding the semantic contribution of the iconic predicate to the global truth conditions. In particular, we observed in at the end of Section 4.2 that when an iconic predicate is interpreted below a distributive operator, the time-course of the global event may differ in significant ways from the time-course of the local events. (For example, a set of sequences that have a slow rate may sum to a single event sequence that has a fast rate.) Because the iconic predicate is incorporated into the meaning of /-rep/ and /-alt/, we thus expect the iconic component to be interpreted differently depending on where /-rep/ and /-alt/ attach to the tree. Specifically, if /-alt/ is forced to scope above a distributive operator in order to license the variation condition, we predict that the iconic component must also be interpreted above the distributive operator.

This prediction appears to be borne out. For example, in the ASL sentences in (86), the speed of repetition in the phonological form must match the speed of the event from a global perspective. Specifically, the sentence in (86a) *cannot* be used to describe a scenario with a slow local perspective and a fast global perspective (c.f. the interpretation of /-rep/ in (82)). In contrast, the sentence in (86b) *is* compatible with such a scenario (although it's pragmatically dispreferred, not being a particularly clear way to communicate this meaning).

(86) **ASL**

a. EACH-a BOY BOOK a-GIVE-1-alt-slow.
'Each boy gave me books, which happened slowly from a global perspective.'

b. EACH-a BOY BOOK a-GIVE-1-alt-fast.
'Each boy gave me books, which happened quickly from a global perspective.'

In LSF, when such sentences are presented without context, judgements are slightly less clear, likely due to pragmatic factors ruling out complicated meanings. In (87a), the giving events are interpreted as happening at a slow rate from both a

local and global perspective; in (87b), the giving events are interpreted as happening at a fast rate from both a local and global perspective. (Neither are reported to be compatible with a scenario with a mismatch between the local and global speeds.)

(87) **LSF**

a. BOY EACH-a BOOK a-GIVE-1-alt-slow DOWN.
'Each boy gave me books, which happened slowly from a global perspective.'

b. BOY EACH-a BOOK a-GIVE-1-alt-fast MORE.
'Each boy gave me books, which happened quickly from a global perspective.'

Nevertheless, mismatch scenarios become more accessible in LSF with additional context. In the first sentence in (88b), the pluractional inflection /-alt/ is licensed by the plural direct object, 'OBJECTS VARIOUS'; iconic manipulation indicates that the event plurality decelerates over time. The following two sentences make similar assertions for other givers — Mirko and several other people. In the final sentence, however, /-alt/ is licensed by the distributive quantifier EACH-abc; here, even though the accelerating iconic manipulation contrasts with that of the previous sentences, the sentence is nevertheless compatible with the previous discourse, because the accelerating inflection is interpreted above the distributive quantifier.

(88) a. **Context (LSF):**
JEREMY OBJECTS VARIOUS a-GIVE-1-alt-decelerating. NEXT MIRKO VARIOUS OBJECTS b-GIVE-1-alt-decelerating. SEVERAL c-GIVE-1-alt-decelerating.
'Jeremy gave me various objects at a decelerating rate; next, Mirko gave me various objects at a decelerating rate. Several other people gave me stuff at a decelerating rate.

b. **Target (LSF):**
EACH-abc abc-GIVE-1-alt-accelerating MORE FULL-UP ALONE.
'Each of them gave me objects, which happened at a globally accelerating rate; being alone, I was overwhelmed.'

Although pragmatic constraints introduce complications to these judgements, what holds between both languages is that when /-alt/ is licensed by a distributive operator, the iconic component must be interpreted as holding (at least) at a level above that distributive operator.

5 Summary

Here, we focused on two reduplicative verbal forms in LSF. First, we positioned the semantics of these forms within a broader linguistic context; we saw that the meanings fit into a more general typology of cross-linguistic pluractionality. The specific finding was that exact repetition (/-rep/) means distribution over time; two-handed alternating repetition (/-alt/) means distribution over participants. We then discussed the compositional semantics, focusing on a puzzle about the licensing of /-alt/ and /-rep/ under distributive operators, familiar from the literature on dependent indefinites. We provided a solution to this puzzle in terms of scope.

We then argued that sign language forms go beyond what has been described to date for spoken language forms — in particular, both forms are sensitive to an iconic mapping, sensitive to gradient manipulations, that preserves information about the rate of repetition. In contrast to paralinguistic signals like co-speech gesture, we showed that this iconic meaning is an at-issue component of meaning. For descriptive adequacy, the system thus needed to allow an iconic predicate to be evaluated in the course of syntactic combination.

We advanced a proposal in which logical and iconic components are built into a single pluractional morpheme. In the context of the compositional system hypothesized earlier, this proposal ended up making the prediction of 'scopable iconicity,' in which the hierarchical position of the pluractional morpheme determines the interpretation of iconicity. These predictions were borne out; in particular, we observed mandatory global evaluation of an iconic predicate in cases where /-alt/ is licensed by EACH, providing new evidence for the scopal analysis.

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