MOTION EVENTS AND EVENT SEGMENTATION IN AMERICAN SIGN LANGUAGE

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To Dr. Lee Etta Powell. May I live up to her praise.

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ABSTRACT

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As we may understand it, space-time is some ambient, homogeneous, and non-discrete phenomenon. However, we as human beings are able to segment space-time into chunks, or events, based on perceived start and end points (Zacks & Tversky, 2001). While event segmentation of this sort is a cognitive, species-wide ability, how events are then encoded into language is typological. Some languages focus on certain aspects of events, while other languages focus on others. Motion events have been of particular interest, specifically which elements from Talmy's catalog are encoded within a single event or sentence, or across a narrative. To that end, Bohnemeyer et al. (2007) (= B. et al.) aim to figure out how much information can be packaged within a single motion event in a given language. Their work covers a range of genetically unrelated languages, but does not take sign languages into consideration. Here I intend to extend B. et al.'s diagnostics to ASL.

For want of an Event Phrase, B et al. propose the Macro Event Property (MEP), which carves out events from a range of syntactic structures. Formally, the MEP contains any number of subevents that can be 'located' by a single time adverbial. B. et al. show that there are a number of unrelated grammatical constraints whose domain of application is the MEP. Namely, within a single macro event, a language may NOT:

a. assign two of the same θ-roles to Ground DPs,
(Argument Uniqueness Constraint, AUC)

b. assign a particular Ground-denoting DP two θ-roles, or
(Referential Uniqueness Constraint, RUC)

c. encode and entail a change of direction in the path a Figure takes.
(Unique Vector Constraint, UVC)

Next, consider that motion events come in two flavors in ASL: there are those that are expressed by 'fossilized' verbs (such as GO-TO, GO-OUT, and ZOOM) and those that are expressed by classifier constructions (e.g. w/e-CL:3-$GO_{[drive]}$). While these two signing modes are differentiated by a host of syntactic, morphological and phonological characteristics, of interest here is their differing semantics: The former are time-anchored (despite being motion events), while the latter are space-anchored.

As B. et al.'s constraints concern the amount of spatial information allowed within a single macro-event expression, there are grounds here to wonder whether the constraints are respected in both signing modes; in one, but not the other; or in neither. We might predict already, though, that classifiers–with their focus on space–may be allowed to express more spatial information than what B. et al.'s constraints can handle.

1. INTRODUCTION

As we may understand it, human beings physically perceive time as some ambient, homogeneous, and non-discrete phenomenon. However, we are able to segment time into chunks, or events, based on perceived start and end points (Zacks and Tversky (2001)). While event segmentation of this sort is a cognitive, species-wide ability, how events are then encoded into language is typological. Some languages focus on certain aspects of events, while other languages focus on others. Motion events have been of particular interest, specifically which elements from Talmy's catalog are encoded within a single event or sentence, or across a narrative. To that end, Bohnemeyer et al. (2007) aim to figure out how much information about a single motion event can be packaged within a single "macro event" in a given language. Their work covers a range of genetically unrelated languages, but does not take sign languages into consideration. Here I intend to extend Bohnemeyer et al.'s work to ASL.

The basis of Bohnemeyer et al.'s work is the Macro Event Property (MEP). The MEP is defined by temporal locators (such as time adverbs/ adverbials and tense), such that all subevents of a macro event are bound by the same locator. So defined, the MEP is not necessarily isomorphic with any syntactic category; rather, it is a semantic domain. Further, the MEP serves as the domain of application for a number of unrelated, independently motivated constraints.

In this thesis, I will examine three of Bohnemeyer et al.'s event segmenting diagnostics, the Argument Uniqueness Constraint (AUC), the Referential Uniqueness Constraint (RUC), and the Unique Vector Constraint (UVC). The AUC deals with how many semantic roles and of which type can be encoded within a single event. There are typological implications here, with some languages encoding more semantic roles per event than others. The RUC, similarly, prohibits languages from assigning

one given ground DP two semantic roles. The last constraint puts a limit on how much spatial information human language may encode within a single clause.

There is one very important fact that separates ASL and other sign languages from spoken language: the verbal system of sign languages patterns in two distinct ways, depending on the function of the signing space. Sometimes the signing space means space (topographic) and sometimes it's referential (relational). It is worthwhile to ask, then, whether this split will present itself in the application of the AUC/RUC and UVC.

With respect to the AUC/RUC, I will show that relational space and topographic space pattern differently. Relational space does not appear to (readily) encode certain semantic roles, while those same semantic roles are easily found in topographic space. What's more, topographic space is shown to violate the AUC and RUC in the number and type of semantic roles that can be encoded within a single macro-event. As for the UVC, it is not a question of a typological split, but rather how well each use of space or fits with the constraint. I will show that relational space is more or less unproblematic, while topographic space presents a challenge unique to visual languages.

In the discussion of topographic space and the UVC, it will also be necessary to tackle the issue of *what is encoded vs. what is entailed*, as these questions have a special significance to Bohnemeyer et al.'s diagnostics. What's more, the reality of semantic roles in topographic space (w.r.t. the AUC and RUC) are similarly in question: why should such violations occur here and not in relational verbs or spoken languages?

The organization of this thesis is as follows: in the next section (§2.1) I overview Bohnemeyer et al.'s conception of a macro-event and the three constraints that are active within it. Next, I outline how phonological criteria can aid in deciding when one macro-event ends and the next begins (§2.2). In Chapter (3), I discuss certain phenomena relevant to this thesis that are unique to sign languages. Here, I lay out the differences between the relational and topographic space (§3.2 - §3.3) as well as

cases where they overlap (§3.4). In Chapters (4 & 5) I outline my predictions and the methodology I used in eliciting data, reporting my findings in Chapter (6), and discussing them in Chapter (7).

2. BACKGROUND

2.1 Bohnemeyer et al.

2.1.1 The Macro Event Property

The Macro-Event Property (MEP) is a measure of how 'tightly packaged' information about an event is. For instance, each example in (2.1) faithfully describes the same event, albeit in different ways. (2.1a) represents the event in a single CP, (b) in two, and (c) in three. Intuitively, then, (a) is more 'tightly packaged' than (b), and (b) more so than (c).

(2.1) a. Chuck cracked the piñata in two
b. Chuck hit the piñata and it cracked in two
c. Chuck hit the piñata and it cracked and it is now in two pieces

To capture this intuition, Bohnemeyer et al. (2007) (henceforth *B. et al.*) use 'temporal locators' as a heuristic. Temporal locators may be temporal clauses (e.g., *while it was still raining*), time adverbs, or tense. If a temporal locator scopes over, or 'locates,' all subevents in a clause, then the clause is said to be a macro-event expression.

If we look at the same sentences in (2.1) again in (2.2), it becomes clear the extent to which (a) is more tightly packaged than (b) and (c). In (2.2a), the temporal clause, *as the children watched*, takes scope over all subevents, such that the children must have seen both the causing and 'cracking' subevents. However, in (2.2b), it is only necessarily the case that the children saw the 'hitting' event (and, i.e., remain naïve of the fate of the piñata), whereas the reverse is true for (2.2b′). Notice also that each subevent in (b, b′) can be modified by separate temporal locators, so they escape the definition of a macro-event expression (MEE; or, variably, *macro-event*). Similarly,

additional meanings arise in (2.2c), where the temporal clause can scope over one of the three subevents, or the entire clause.

(2.2) a. Chuck cracked the piñata in two as the children watched

b. Chuck hit the piñata as the children watched and it cracked in two (after the children left)

b′ Chuck hit the piñata (before the children arrived) and it cracked in two as the children watched

c. Chuck hit the piñata $_{\wedge}$ and it cracked $_{\wedge}$ and it's now in two pieces $_{\wedge}$

B. et al. claim that the MEP is not isomorphic with or predicted by any syntactic constituent. VPs, for instance, generally have the MEP (2.3a). However in cases where VPs also contain event nominals (2.3b) or gerunds (2.3c), they do not. That is, event nominals and gerunds contribute their own event variable which may be bound by their own time positional adverb. Logically, then, CPs are also not always isomorphic with the MEP. In cases where a VP contains more than one macro-event expression, the containing CP will have more than one MEP, too.

(2.3) a. Caesar [inspected his troops from head to toe]$_{\text{MEP/ VP}}$

b. Charlie [sped [from his daughter's performance at 9]$_{\text{MEP}}$ [to his appointment at 9:30.]$_{\text{MEP}}$]$_{\text{VP}}$

c. Alfred [went [from being a nerd in his adolescence]$_{\text{MEP}}$ [to becoming quite a catch in his 20's.]$_{\text{MEP}}$]$_{\text{VP}}$

This is not to say, however, that whenever one encounters an event variable, one encounters another MEP. The MEP is a measure of 'conceptual events,' and not event variables. Serial verb constructions (SVCs), for example, contain multiple predicates (2.5), each of which can stand alone in its own main clause (2.4; Zheng, 2012). As stand alone verbs, they each contribute their own event variable. So, in SVCs each also contributes its own 'subevent' variable. If all of the subevents are located by the same time positional element, then they together make up a single macro-event (and not three).

(2.4) *gai*^{5}*lao*^{2}*se*^{1} [*ke*^{3} *suah*^{4}*sia*^{3}]$_{VP/\ MEP}$
Cl-teacher go dormitory
'The teacher went to the dormitory.'

(2.5) *gai*^{5}*lao*^{2}*se*^{1} [[*ki*^{2} [*ke*^{3} [*gao*^{3} *suah*^{4}*sia*^{3}]$_{VP}$]$_{VP}$]$_{VP}$]$_{MEP}$
Cl-teacher go-up go arrive dormitory
'The teacher went up to the dormitory.'

[Suan^{1}tao^{5}Uê^{7}]

Although B. et al. claim that there is no MEP-syntactic isomorphism, they do claim that the MEP may not span a CP boundary. That is, if an utterance can be argued to contain two CPs, it has at least two macro-event expressions. For instance, (2.6a,b) both contain two CPs, with (a) being a subordination structure and (b) being a case of adjunction. Notice that in each CP, a separate time adverbial scopes over each event variable. The sentence in (2.6c) is a special case: it may or may not have the MEP, depending on how it is parsed. If (c) is parsed as a coordination of NPs (a collective reading), then it does have the MEP (2.6c′). Otherwise, (c) can be parsed as a coordination of CPs with elided material.

(2.6) a. [Miles knew yesterday]$_{\text{MEP}}$ |$_{\text{CP}}$ [that Kenny had swept the floor the day before]$_{\text{MEP}}$

b. [Arthur peeled the potatoes in the morning]$_{\text{MEP}}$ |$_{\text{CP}}$ [before Kenny scrubbed them that night]$_{\text{MEP}}$

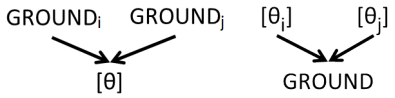
c. Mary read the NY Times and Chicago Tribune

c′ [Mary read the NY Times and Chicago Tribune in one sitting]$_{\text{MEP}}$

c″ [Mary read the NY Times in the morning and]$_{\text{MEP}}$ |$_{\text{CP}}$ [(Mary read) the Chicago Tribune in the evening]$_{\text{MEP}}$

Finally, while I have been saying that examples like (2.1c; repeated below as 2.7) have more than one macro-event expression, this turns out to be a stronger claim than what B et al. put forward. Instead, the authors simply say that such utterances do not have the MEP (and not that they have multiple). However, there is no immediate reason not to commit to the stronger claim. As we will see at the

Figure 2.1. AUC & RUC



(a) AUC (b) RUC

conclusion of (§2.1.3), the constraints whose domain of application is the MEP are still active even in (e.g., conjoined) sentences which 'lack the MEP,' like in (2.7).

(2.7) Chuck hit the piñata and it cracked and it is now in two pieces

2.1.2 The Argument & Referential Uniqueness Constraints

As mentioned above, B. et al. propose three constraints on event-packaging: the AUC[1] RUC, and the UVC. The AUC has two facets. In one capacity, it lays out the absolute human maximum for how many semantic roles may be expressed in a single event. Similar to the Biuniqueness Constraint of LFG (e.g., Kaplan & Bresnan, 1982) and the Theta Criterion of Generative Grammar (e.g., Chomsky, 1993), the AUC requires that no two ground denoting DPs bear the same semantic role (2.8; see schema in Fig. 2.1a).[2] However, again, the AUC differs from its predecessors in claiming that this constraint is active at the level of the MEP and not the clause.[3]

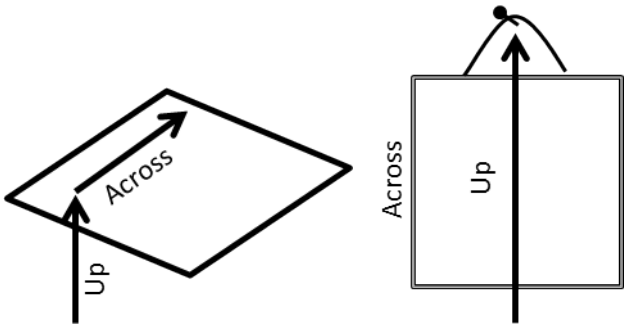
In its other capacity, the AUC divides languages by what their particular maxima are. Some languages will be able to encode source, goal, and via in a single clause (Type I; 2.9a); some will be able to express only source and goal within a single macro

[1]The label 'Argument Uniqueness Constraint' was used in Bohnemeyer (2003), however, in (Bohnemeyer et al., 2007) the authors refer to this constraint as the 'Biuniqueness Constraint.' However, I will continue to use the label AUC (a) because its domain of application is the MEP and not the CP and (b) for convenience.

[2]B. et al. base their set of semantic roles on Jackendoff, 1983's path functions: TOWARDS, AWAY-FROM, and VIA.

[3]B. et al. follow Carlson (1998), who claimed that the 'event,' however delimited, was the domain of the theta criterion.

Figure 2.2. AUC & RUC



(a) Up across table (b) Up across picture

event, expressing via in a separate macro event (Type II; 2.9b); and yet others will only be able to encode one semantic role per macro event (Type III; 2.9c).[4]

(2.8) *I walked out of the house [SOURCE] from the store [SOURCE]

(2.9) a. I walked from my house [SOURCE] to school [GOAL] via the bridge [VIA]

b. I walked from my house [SOURCE] to school [GOAL] $|_{CP}$ using the bridge [VIA]

c. I walked from my house [SOURCE] and $|_{CP}$ I walked to school [GOAL] $|_{CP}$ using the bridge [VIA]

(2.10) *I walked from the tree_i [SOURCE] to the tree_i [GOAL]

Similarly, the RUC rules out cases like (2.10), where *tree* has received a source and goal semantic role (see Fig. 2.1b). Note that two coreferential DPs may receive different semantic roles (2.11a.), but that motion events cross-linguistically do not seem to have suitable reflexives (2.11b.).

[4]It should be noted that languages are classified only by their maxima. That is, for example, it is because English CAN encode all three subevents within a single macro event, even though it is free to segment events in other ways, that English is a Type I language.

(2.11) a. I_i [AGENT] shaved $myself_i$ [PATIENT]
b. *I walked from the $tree_i$ [SOURCE] to $itself_i$ [GOAL]

One last thing to note is how quantification is handled in B. et al.'s system. Carlson (1998) provides the following example. The sentence in (2.12) is ambiguous between a group and distributive reading. In one (represented by 2.12a), the five boys are understood to have carried the piano up the stairs together. In the other (2.12b), it is understood that each of the five boys carried a/ the piano up the stairs. In the (a) case, we have one event with a collective agent, so the sentence has the MEP. On the other hand, in the (b) case, we have five events with five agents. Conceptually, though, (b) is still treated as a single macro-event (witness the ungrammaticality of 2.13). As B. et al. do not go into much detail about such sentences, I expand a bit on how 'multiple' roles of the same type may appear to be assigned in quantificational expressions in (§6.1.1).

(2.12) Five boys carried a piano up the stairs.
a. ∃e [carrying(e) & Agent(e, five boys) & Theme (e, piano)]
b. Five x [∃e [carrying(e) & Agent (e, x) & Theme (e, piano)]]

(2.13) Five boys carried a piano up the stairs at one-o'clock, two-o'clock, ..., *(and) five-o'clock

2.1.3 The Unique Vector Constraint

The UVC requires that motion events unfold along a single global direction vector, with just a single direction specification or polarity (witness the ungrammaticality of 2.14). This requirement is not completely stringent, in that languages are free to entail a change of direction (2.15a) or encode a change of direction (2.15b); just not both within one macro event.

(2.14) *The ant crawled up down the table.
Change of direction encoded and entailed

(2.15) a. The ant crawled up across the table/ the picture.
Change of direction encoded but not entailed

b. The show dog zigzagged through the poles from the starting line to the podium.
Change of direction entailed but not encoded

Specifically, (2.15a) encodes a change of direction, using the prepositions *up* and *across*. However, the same prepositions may be used to describe an event where an ant crawled across a flat picture all the while climbing up a wall. In this situation, the ant is understood to be traversing a straight path. To put it another way, *up* and *across* each select a set of vectors (Zwarts, 2005). The intersection of these two sets is non-empty, such that there are some 'upwards' vectors that are also 'across' relative to some ground. So, it is ambiguous, then, whether one is selecting vectors from *up*, from *across*, or from the intersection of the two. The selection ambiguity is resolved by real-world knowledge. It is only what we know about tables (that they have both a vertical and horizontal component; Fig. 2.2a) that forces the change of direction reading. On the other hand, we know that pictures are roughly 2-dimensional, only having a horizontal component (Fig. 2.2b). The easiest interpretation is that there is no change of direction.[5] Thus, this is a matter of real-world knowledge or pragmatics, not entailment.

Conversely, with *zigzag* (2.15b), it cannot be the case that the show dog is moving in a straight line. The lexical semantics of the verb prohibit such an interpretation. However, zigzagging only entails that the figure is moving in a particular repeated pattern. It cannot encode that the show dog wove left first, then right, and then left again to obstacle A, and then right to obstacle B within a single macro-event. Notice also that although the local path movement of the dog in (2.15b) is non-linear, one

[5]Of course, *up across the picture* could also mean that the ant is crawling up away from the picture (towards the sky) and then across the space immediately above the picture. Clearly, though, this is not the most felicitous interpretation and is therefore not selected.

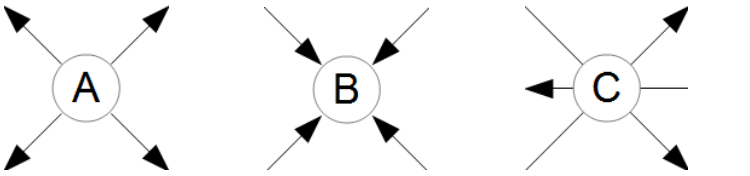
still assumes by default from the prepositional phrases that the dog's ultimate path–encoded by *to* and *from*–is globally straight (van der Zee, Nikanne, & Sassenberg, 2012).

Next consider what exactly is entailed by prepositions and directionals. Prepositions do not entail a particular direction vector. For instance, consider *to B*, as represented in (Fig. 2.3b). So long as the head of the vector is directed at location B, the preposition *to* is satisfied no matter where its tail originated. This underspecification allows for paths to be selected from the intersection of the denotations of several prepositions. That is, none of the prepositions in *Clark goes from A to B by way of C* require a particular direction vector, so the intersection will be relatively large.

On the other hand, directionals like *North* (Fig. 2.4a), *up*, and *left* require that the head and tail of a vector be oriented towards a particular direction, and are therefore more limited. For example, the set of vectors described by *North* and the one described by *West* may intersect: there exist vectors that can be described by both terms (i.e. those that belong to the set *Northwest*; Fig. 2.4b). However, the set of *North* vectors does not intersect with the set of *South* vectors (i.e. **Northsouth*).

Also note that the intersection of, for example, two sets cannot entail *X and then Y*. *Northwest* entails that the direction of movement is ultimately in a Northwesterly way. It does not entail that there was a movement North followed by a movement West and vice versa (what's more, there is no such word **Westnorth*). In SVCs, too, the ordering of verbs in motion events does not entail the extensional movement in that order. For example, the default interpretation of (2.16a) is that the dog followed a straight path, and not that it moved horizontally (cross) before coming towards the speaker (come; Zheng, 2012). What's more, reversal of verb ordering is not possible (2.16b; with the intention to specify that the dog first moved vertically and then horizontally).

Figure 2.3. Vector Selection in English Prepositions

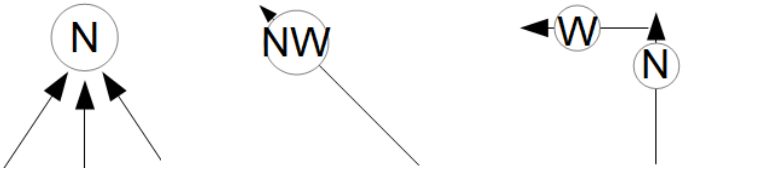


(a) *from A*: multiple directions

(b) *to B*: multiple directions

(c) *via C*: multiple directions

Figure 2.4. Vector Selection in English Directionals



(a) *North*: one direction

(b) *Northwest*: intersection of sets North and East; mono-eventive

(c) *North, then West*: adjunction of sets North and East; multiple events

(2.16) a. *ziah⁴-gao²* *guê³* *lai⁵* *bhê²lou⁷* *zio³* *boin⁵*
Cl-dog cross come road this side
'The dog crossed toward this side of the road'

b. **ziah⁴-gao²* *lai⁵* *guê³* *bhê²lou⁷* *zio³* *boin⁵*
Cl-dog come cross road this side
'The dog crossed toward this side of the road'

[Suan¹tao⁵Uê⁷]

The UVC can be reinterpreted, then, as a requirement that (a) in simplex cases, the vector denoted by a single preposition or directional must be linear or (b) there exists an intersection of the sets of vectors denoted by two or more prepositions/ directionals (with the understanding that vectors from intersections are necessarily linear). Simple adjunction of two sets will not result in a single vector, but two vectors, and so the UVC is violated or the MEP is lifted (Fig. 2.4c).

Lastly, let us revisit quantification, but this time from the perspective of the UVC. In (2.17), the event quantifier *twice* multiplies the event, such that the path is

multiplied. This path-multiplication does not play into the UVC, as the core path (the one stretching from Sacramento to Las Vegas) is still singular and linear. Notice that the core event is 'impenetrable' to time-positional adverbs. (2.17) cannot mean that one flight occured on Monday and the other on Tuesday. Instead, both commuting events happened on Monday and again on Tuesday.

(2.17) Jerry commuted from Sacramento to Las Vegas twice on Monday and Tuesday

In sum, Bohnemeyer et al. (2007) argue for the Macro-Event Property, a semantic domain active within, yet not determined by, syntax, which serves as the domain of application of three event-sensitive constraints (summarized in 2.1). These constraints are active universally, that is, in all languages. So, then, the remainder of this thesis will be concerned with how ASL fits with or is principally excluded from these constraints.

2.1.4 Revisi(ti)ng the MEP

Before moving on, however, I'd like to return briefly to the definition of the MEP. We are now in a position to test whether sentences like (2.1a) and (2.7a,b; repeated below as 2.18a,b) (a) do not have the MEP or (b) have not one, but two macro-event expressions. B. et al. claim that the AUC, RUC, and UVC take the MEP as their domain of application, so the authors do not predict, then, the ungrammaticality of (2.18b). Here, even though (2.18b) does not have the MEP, all of the constraints are still respected. This remains a mystery, unless one concludes that (b) has two macro-event expressions. Going forward, then, I will assume that macro-event expressions are strictly delimited by temporal locators. Macro-event expressions may be chained in a single utterance, such that the utterance itself doesn't have the MEP, but that its component clauses *are*, in fact, macro-event expressions.

Table 2.1
MEP and Event-segmenting Constraints

MEP
All subevents of a macro-event are bound by the same temporal locator

Summary of Constraints	
AUC	TWO ground-denoting DPs may not receive the same ONE semantic role
RUC	ONE ground-denoting DP may not be assigned TWO semantic roles
UVC	The path of movement must not entail AND encode a change of direction

(2.18) a. Chuck hit the piñata and it cracked and it is now in two pieces

b. Chuck hit the piñata and, in unrelated news,...

a squirrel chased another squirrel out of the $\text{tree}_{[\text{source}]}$ from the $\text{yard}_{*[\text{source}]}$
AUC violation
a $\text{squirrel}_{\text{i}}$ chased a $\text{squirrel}_{*\text{i/j}}$ from the tree_{k} to the $\text{tree}_{*\text{k/l}}$
RUC violation
a squirrel chased another squirrel up the tree (*down again)
UVC violation

2.2 Phonological Event Segmentation

As discussed in §2.1.1, Bohnemeyer et al. propose that the CP is a syntactic domain relevant for event segmentation in as much as two CPs necessarily mean (at least) two macro-event expressions. Research has shown that large, phonological constituents (i.e. Intonational Phrases) are generally isomorphic with syntactic CPs (Selkirk, 2011). In ASL (and others SLs), there are a host of phonological phenomena that occur at the level of the intonational phrase that can be exploited to segment events. What's more, there are cues that span smaller phonological/ syntactic constituents that correlate to subparts of events. First, though, I illustrate how IPs can be used to segment events in spoken language.

2.2.1 Clause-level segmentation

Spoken Languages

Bohnemeyer et al. discuss a previous study on event segmentation that uses intonational units as a heuristic. Givón (1991) uses the distribution of pauses of a certain length to show that verbs in SVCs are more tightly packaged than clause-chaining constructions and sequences of independent clauses (cf. Basu, 2010, who measures pauses in verbal complexes and SVCs). He concludes that SVCs, in contrast to the other two constructions, are mono-eventive. While Bohnemeyer et al. argue that prosody is not a reliable test on its own (that, e.g., how languages build prosodic domains is variable), they recognize that there are cases where prosodic cues need to be considered.

(2.19) a. *Man²* *lèèn¹* *(qòòk⁵)* *caak⁵* *hùan²* *taam³* *thaang²* *hòòt⁴*
[[3 run exit from house]$_{VP}$ [follow path]$_{VP}$ [reach
kòòn⁴-hiin³
cl-rock]$_{VP}$]$_{CP/IP}$
'He ran (exited) from the house followed the path reached the rock.'

b. *Man²* ***nùng¹*** ***moong²*** *lèèn¹* *(qòòk⁵)* *caak⁵* *hùan²* *taam³*
[[3 one hour run exit from house]$_{VP}$ [follow
thaang² $|_{IP}$ ***sòòng³*** ***moong²*** *hòòt⁴* *kòòn⁴-hiin³*
path]$_{VP}$]$_{CP}$ $|_{IP}$ [[two hour reach cl-rock]$_{VP}$]$_{CP}$
'At one he ran exited from the house followed the path, (and) at two he reached the rock.'

[Lao]

For example, consider the minimal pair in (2.19). In the (a) case, we have a simple SVC. While there are three VPs in (a), the entire construction is mono-eventive and has the MEP. (2.19b) is nearly string identical to (a), except that it has two temporal locators (bolded). At face value, this seems to contradict the assertion that (a) is mono-eventive, but instead suggests that SVCs in Lao may be bound by more than one temporal locator and would thus not have the MEP. However, Bohnemeyer et al. note that intonational breaks (which are represented by $|_{IP}$) are necessary for

(2.19b)'s grammaticality. Thus, assuming an isomorphism between the IPs in (b) and underlying CPs, we see that (b) is not truly mono-clausal. And, as always, more than one CP entails more than one macro-event expression.

What's more, it is not possible to negate singular VPs within an SVC or V-V compound structure. However, B. et al. note that the addition of these breaks in (b) license the independent negation of each VP. The fact that a pause licenses individual VP negation further shows that sentences like (2.19b) are actually multi-clausal and thus lack the MEP.

Of course, though, IPs often span constituents that are smaller than a clause. For instance, in (2.20) the IP spans a fronted prepositional phrase. We would not want to conclude that *into the soup* is its own clause or its own event, so one should be cautious in concluding what syntactic constituent lines up with IPs.

(2.20) [Into the soup $_{PP}]_i$ $|_{IP}$ the tofu plopped t_i

Sign Languages

The IP in sign languages (at least in ASL, Wilbur, 2000; and ISL, Sandler, 2010) is demarcated by a host of non-manual markers. Blinks, for instance, optionally occur at IP boundaries (Wilbur, 1994). Other non-manual markers are themselves not entirely predictive of IP boundaries, but a wholesale reset of all these markers do. That is, for example, a dramatic change in body posture, head position, eyebrow position, and/ or other markers will all line up at an IP boundary. As in spoken languages, IP boundaries may also be singled out by pauses and concomitant prepausal lengthening.

(2.21) IF GOALKEEPER IX3 h-CL:5-CATCH$_{[ball]}$ $|_{IP}$ WIN GAME WIN

brow raise
squint
head forward
head up
head back

'If the goalkeeper had caught the ball, (the team) would have won the game'

[ISL]

If we consider the example in (2.21; from Dachkovsky & Sandler, 2009, p. 292), there are two clauses separated by an IP boundary. Before the boundary, there's brow raise, squinted eyes, and the head moves forward during the articulation of the verb. At the boundary, the brows and eyes return to a neutral position, and the head moves upwards and backwards. In this more or less clear-cut case, the IP boundary lines up exactly between two CPs. However, ASL and ISL (at least) topicalize regularly, so we run into the same issue as in (2.20): IPs may span over constituents smaller than a CP (2.22).

(2.22) [$\overset{\text{top}}{\overline{\text{VEGETABLES}}}$ $_{DP}]_i$ $|_{IP}$ IX1 LIKE t_i
'Vegetables, I like'

2.2.2 VP-level segmentation

Mouth Morphemes

In sign languages there are also VP-spanning and VP-delimiting non-manuals, Posture Nonmanuals (PNMs) and Transition Nonmanuals (TNMs) (Schalber & Grose, 2006). These morphemes are articulated by the mouth, but are distinct from mouthing words from the ambient hearing community. Because the domain of these nonmanuals is the VP/ predicate, which usually contributes the event variable(s), it will be beneficial to use them to help determine event boundaries, should other prosodic or syntactic tests be unclear.

That is, Pustejovsky (1991) decomposes events into the primitives, State (S) and Process (P). Atelic predicates are simplex, consisting of a single S or P. Telic predicates are complex, having an initial S or P and a final S (i.e. $P/S_1 \rightarrow S_{(2)}$). This categorization (minus a possible initiation event, S $\rightarrow$ P) is exhaustive, such that complexes like $P_1 \rightarrow P_2$ ($\rightarrow$ S, etc.) are empirically unattested. So, we can map predicates–simple verbs or whole VPs–to one Pustejovskian template, using phonological cues to help decide.[6]

PNMs are a set of nonmanuals, which may take on a number of forms. Some are articulated with flattened, tense lips, while others involve a wide open mouth. These nonmanuals serve as adverbial modifiers, which encode meanings such as carelessness ('th') and effort ('sta-sta') (mouthing labels from Baker & Cokely, 1980). PNMs scope over the dynamic or non-changing parts of events. That is, they may co-occur with atelic processes (2.23a), statives (2.23b), and the dynamic portion of accomplishments (2.23c).[7]

(2.23) a. CHILDREN [$\overset{\text{th}}{\overline{\text{V}_\text{D}\text{P PLAY}}}$]

'The children are playing carelessly'

b. POSS1 HUSBAND [$\overset{\text{halflip}}{\overline{\text{V}_\text{D}\text{P SICK}_{[+\text{dur}]}}}$]

'My husband is always sick'

c. HOT WATER [$\overset{\text{ahh}}{\overline{\text{V}_\text{D}\text{P RUN-OUT}}}$ [$\overset{\text{closed}}{\overline{\text{V}_\text{S}\text{P}\,(\text{V}_\text{S})}}$]]

'The hot water eventually ran out' (It took a long time for the water to run out)

[6]It is also possible to chain a series of telic, atelic, or telic and atelic predicates together in SVCs (e.g. Basu, 2010). However, SVCs in ASL studied so far always seem to consist of an atelic, manner predicate followed by an optionally telic path verb (Supalla, 1990). As this is predictable, using VP spanning or delimiting phonological cues should still be informative.

[7]I assume that VPs may be broken down into component parts (Ramchand, 2008). Here I have chosen the category labels V_DP, for Dynamic Verb Phrase, and V_SP, for Stative Verb Phrase. These categories are relatively neutral, since they do not comment further on the semantics of their heads.

As for TNMs, they involve a rapid change in aperture of the mouth: either closed to open (e.g., EXPLODE; 2.24a) or open to closed (e.g., DISAPPEAR; 2.24b). This change in aperture of the mouth mirrors a change of state entailed by the predicate. That is, both EXPLODE and DISAPPEAR are telic, consisting of a final state (i.e. $P/S_1 \rightarrow S_{(2)}$).

(2.24) a. $[\ \overline{{}_{V_S P}\,\text{EXPLODE}}^{\text{closed}}\ [\ \overline{{}_{V_S P}\,(V_S)}^{\text{open}}]\ ]$

b. $[\ \overline{{}_{V_S P}\,\text{DISAPPEAR}}^{\text{open}}[\ \overline{{}_{V_S P}\,(V_S)}^{\text{closed}}\ ]\ ]$

TNMs are also found on compositionally telic predicates. For example, in an unrelated study, signers retold a story where a man, Homer, is accidentally set in motion on a skateboard down an incline. At the bottom of the incline, Homer soars off a ramp over a gorge. The verb $\text{GO}_{[\text{downhill}]}$ in (2.25a) is inherently atelic[8], but the VP can be made telic by the addition of an endpoint. This endpoint is signaled by a TNM, in this case the mouth snapping shut when Homer reaches the bottom of the incline. Exploiting this, it is evident that the utterance in (2.25a,a′) consists of two events, even though (a) the two events share the same subject (it being phonologically null in the second), and (b) the handshape of the classifier does not change and is not rearticulated at the event boundary.

(2.25) a. FATHER [balancing] $[\ \overline{{}_{V_D P}\,\text{w/e-CL: V-GO}_{[\text{downhill}]}}^{\text{open}}[\ \overline{{}_{V_S P}\,(V_S)}^{\text{closed}}\ ]\ ]\,|_{EV}$

a′ $[\ \overline{{}_{V_S P}\,\text{w/e-CL: V-GO}_{[\text{launch-off-ramp}]}}^{\text{closed}}\ [\ \overline{{}_{V_D P}\,(V_D)}^{\text{open}}]\ ]$

'Father (=Homer) skateboarded down the slope, balancing, (and) launched off the ramp'

Summing up, B. et al. propose semantic criteria for defining and segmenting macro-events. However, they concede that information from phonological processes is useful or even needed to determine macro-event boundaries. Within these macro-

[8]For example, one test for telicity is the *for/in*-adverbial test, with telic predicates being incompatible with *for*-adverbials (**Ben reached the bottom of the hill for an hour*) and *in*-adverbials with atelic (**Ben went downhill in an hour*).

events, B. et al.'s semantic constraints are active. Again, the Argument and Referential Uniqueness Constraints dictate how many semantic roles may occur within a macro-event: maximally one of each type per event, and no more than one of each type. The UVC, by contrast, states that the motion event described must unfold along a single, unidirectional vector. In the next chapter, I give a brief introduction to sign language (specific) issues relevant to this study, including the two modes of signing that will be under investigation.

3. DEFINITIONS

In this chapter, I briefly cover certain phenomena relevant to this study and unique to sign languages. First, I discuss the five components that make up signs, which are similar in certain ways to phonemes in spoken languages (§3.1). Next, in (§3.2), I discuss two distinct signing modes: a temporally-oriented mode and a spatially-oriented mode. The last two sections, (§3.3 & §3.4), are devoted to how to distinguish between these two modes.

3.1 Sign Parameters

Signs are composed of five parameters: handshape, orientation of the pamls/ fingers, movement, location, and non-manual markers. Along these five parameters we find minimal pairs in lexical signs. For example, the sign CHINA is signed with a 1-handshape at the corner of the eye with a twisting motion of the wrist (Fig. 3.1a). CANDY is signed in exactly the same way, except at the corner of the lips (Fig. 3.1b). The following table provides examples of signs that are distinguished by a single parameter.

Figure 3.1. Parametric Differences in Lexical Items

(a) CHINESE: signed at corner of eye

(b) CANDY: signed at corner of lips

HS	Orientation	Movement	Loc	NM markers
APPLE	THINGS	TAPE	ONION	LATE
CANDY	CHILDREN	TRAIN	APPLE	NOT-YET
COOL		EGG	KEY	

Some parameters are highly complex and consist of many different subtypes. For the purpose of this work, it will be necessary to define certain aspects of the movement parameter specifically. There are many different movement types. Some movements distinguish two lexical signs from each other. For instance, EGG, TRAIN, CHAIR/ SIT, and TAPE are all made in the same location (neutral space), and involve the same orientation (downward), handshape (H), and non-manual marker (none). Further, movement has morphological properties and is used in deriving nouns from verbs (reduplication; e.g. SIT 'sit' > SIT++ 'chair'). Certain circular movements add aspectual information to verbs (Klima & Bellugi, 1979; e.g. $\text{SICK}_{[\text{cont}]}$, 'Sick continuously'). What's more, Malaia and Wilbur (2012) have found experimentally that rapid deceleration towards a point signals a telic event.

One last property of movement is that it conveys path in motion events. Path is the space between where the verb starts and where it ends. It may be linear or it may not be. It may simply denote motion, or it may encode specific twists, turns, and directions. What it means to have a linear or non-linear path is one of the questions discussed in this thesis. This thesis, then, is not concerned with the other uses of movement just discussed. Going forward, I will use the term 'movement' to refer specifically to path movement, unless otherwise noted.

3.2 Spatial Functions

In ASL, along with other sign languages, there are two functions of space, relational and topographic.[1] (Going forward, 'a relational use of space' = 'relational space,' 'relational verb,' or 'relational semantics' and likewise for 'topographic space.') There are a number of ways to distinguish between each function, though not all are

[1]Using the term 'function' to describe how space is interpreted dates back to Poizner, Klima, and Bellugi (1987).

uncontroversial. First, in relational space, non-present referents are set up in locations as arguments of the verb or antecedents of pronominals. If these referents are physically present, the choice of location is determined by the physical location of the referent. The relocation of these referents do not affect the truth conditions of the expression (Barberà, 2012). By contrast, the location of referents in topographic space is truth conditional, since the movement of a figure with respect to a ground represents extensional movement (e.g. 'John was there, but now is here').

Relatedly, the movement of a verb from the location of one referent to another does not imply the movement of that referent to the other in relational space. What's more, if the verb does not leave from the exact location of Referent A and arrive at the exact location of Referent B, the truth conditions of the expression are not affected. For instance, if the verb GIVE does not originate or end at exact loci of its arguments, the meaning is not *A almost give B*, but simply *A give B* (Janis, 1995). Unlike relational space, then, if the verb leaves from the location of Referent A and moves towards Referent B in topographic space, whether the verb arrives at Referent B's location affects meaning. That is, *A almost moved to B* and *A moved to B* are distinctive.[2] Further, it is this possible distinction that has led some authors (e.g. Liddell, 2003) to posit that topographic space is gradient, and a reflection of the signers' mental space. Movement of a verb in mental space, then, more or less mirrors the extensional movement of the referent.[3]

Third, Rathmann and Mathur (2008) give the following two distinctions: (1) The distribution of source arguments differs in relation space and topographic space. Source arguments are available in ditransitive topographic verbs, where they are not so in relational verbs (3.1a, cf. b). (2) Goal arguments in sentences with relational

[2]de Quadros and Quer (2008), however, argues that 'A almost give B' is a possible interpretation (unrealized inceptive).

[3]That is, Cogill-Koez (2000b) discusses cases where path is more abstract and schematic, and cases where path is more literal and analog.

verbs can only be questioned by 'who' and not 'what,' (3.2a) while the opposite is true of topographic verbs (3.2b).[4]

(3.1) a. *PAPER JOHN$_{i}$ BILL$_{j}$ MARY$_{k}$ $_{j}$GIVE$_{k}$
'John gave paper from Bill to Mary.' **relational**

b. PAPER JOHN$_{i}$ HOME$_{a}$ SCHOOL$_{b}$ $_{a}$BRING$_{b}$
'John brought paper from home to school.' **topographic**

(3.2) WHO/*WHERE JOHN$_{i}$ $_{i}$GIVE PAPER
'Who/*where did John give paper to?' **relational**

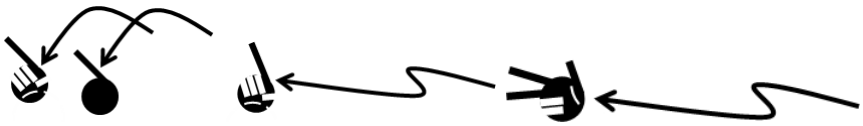
*WHO/WHERE JOHN$_{i}$ BRING$_{a}$ PAPER
'*Who/where did John bring paper to?' **topographic**

Turning now to verbs of motion specifically, path in relational space–to my knowledge–is always linear. Also, relational space makes exclusive use of the event timeline, which spans from left to right in front of the signer (called 'sequence timeline' in Emmorey, 2001). Here, signers locate events or referents along this line to show sequence or quantification. Paths may be multiplied in relational space to show event or object quantification (e.g., Wilbur, 2009). In both cases, there is no implied spatial or temporal contiguity between going events. So, for example, in conveying an event about a woman, Robin, going to three workshops, the signer does not imply and cannot mean that Robin went to each workshop one after the other (i.e. leaving one workshop and immediately going to another workshop). Instead, it could mean that over the course of a year, Robin went to each workshop, with months of time in between going events. This phenomenon, then, seems to be related solely to time and not space.

On the other hand, path in topographic space is not confined to linearity. To my knowledge, in fact, there is no limit to path-shape productivity (provided, of course, signs are made within the signing space). There is no path multiplication in topographic space, so goal or event quantification cannot be achieved in the same

[4]Note that in (3.1a), the subscripts, *i, j,* and *k* indicate the discourse referents, 'John,' 'Bill,' and 'Mary' (respectively), while in (3.1b) the subscripts *a* and *b* indicate locations in the signing space. Going forward, subscript letters from the beginning of the alphabet will symbolize locations in the signing space, and subscript letters starting from *i* will represent discourse referents.

Figure 3.2. Motion Verbs



(a) GO-TO (b) w/e-CL:1-GO (c) w/e-CL:3-GO$_{[drive]}$

way as in relational space. Another important distinction is that motion events in topographic space are spatially and temporally contiguous.

3.3 Phonological Characteristics of GO-TO & w/e-CL:1-GO, our Target Verbs

The forms of the motion verbs in the two functions of space are different, too. The verb GO-TO (Fig. 3.2a) appears only in relational space. It can be one- or two-handed (1-handshape) and is characterized by a lax, always linear movement towards spatial locations. Importantly, this verb may combine with aspect. On the other hand, the verb w/e-CL:1-GO (Fig. 3.2b) only shows up in topographic space. While GO-TO is arguably an unanalyzable whole morphologically, w/e-CL:1-GO can be teased apart into separate morphemes. The 'w/e-CL:1' part represents a classifier used for humans/ upright things. There are many other classifiers, falling into a few distinct categories, that correspond to other types of referents. For example, w/e-CL:3 is used to represent vehicles (Fig 3.2c). These classifiers combine with a verbal primitive, GO (Jackendoff, 1983; Shepard-Kegl, 1985), whose meaning and form are gradient. Visually, GO-TO and w/e-CL:1-GO are both made with the 1 handshape, so care was taken to distinguish the two.

3.4 Delimitation of Spatial Functions

It is important to be clear about what aspects are and are not a part of each function of space. I assume that topographic space is invoked only when a classifier verb, pronominal, or verb agreement is used (in the latter two, only to link up points in space with their referents). That is, topographic space may be embedded into relational space.

Take (3.3) for example. Here, the only form that is making use of topographic space is the classifier (bolded). Specifically, it is the verbal primitive, GO, that brings along with it the meaning *this is spatial*, not some other lexical item (including the CL handshape; as first articulated by Shepard-Kegl, 1985). What's more, GO also has a syntactic frame, taking both an internal and external argument (Benedicto & Brentari, 2004). Verbal primitives also take optional locative arguments (3.4).

(3.3) $\overline{\text{SCHOOL}_{\text{a}}\ \text{HOME}_{\text{b}}}^{\text{top}}$ IX_{c} HAVE BRIDGE. JOHN $_{\text{a}}$**bp-CL:bentV-GO**$_{\textbf{[walk]}\text{c,b}}$
'There's a bridge between school and home. John walked across it.'

(3.4) ($\overline{\text{MOUNTAIN}}^{\text{top}}$) JOHN w/e-CL:1-$\text{GO}_{[\text{up}]}$
'John went up (the mountain)'

It may also be the case that–across agreement verbs, pronominals and verbal primitives–sources, goals, and other semantic roles are assigned to phonologically null morphemes, whose spell-outs are governed topographically. Certainly, one similarity between the pronominal/ agreement system and the classifier system is the fact that loci are assigned arbitrarily and non-arbitrarily in the same contexts.

That is, discourse referents are set up at locations, or loci, in the signing space. Referents are set up non-arbitrarily if they appear in the immediate environment of the signer (=known spatial locations). If the signer is referring to non-present referents, an arbitrary location is set up. Similarly, when specific spatial information is known (for instance, relative positions of cities on a map), non/less-arbitrary loci

are selected. When spatial relations between referents are not known or fully specified, more or less arbitrary loci are selected (see §6.3 for illustrations).

In sum, then, the phenomena in topographic space are few in number. Specifically, it is the verbal primitive, GO, which adds path, and possibly referential loci, which influence the direction of the path and the facing of the classifier handshape, that are handled topographically. All other elements are predicted to occur in referential space.

4. PREDICTIONS

Given the split between relational and topographic uses of space, where the latter (but not the former) is anchored in space, we might expect that both functions behave differently with respect to the AUC, RUC, and UVC. Specifically, I predict that relational space will obey all three constraints. This would entail that no more than one source, goal, or route may be expressed within a single event, and that ground DPs may not be assigned more than one semantic role. However, there is no indication from what we already know about relational space how many distinct semantic roles may appear within the same clause. As for the UVC, vectors contained within an event in relational space are expected to be linear and without changes of direction.

On the other hand, the verbal primitives found in topographic space may have more gradient properties. Other researchers (e.g. Liddell, 2003; Cogill-Koez, 2000b, inter alia) have argued for an extra-linguistic treatment of path and location features, specifically. So, if these features are truly extra-linguistic, they is therefore not bound by the same rules as verbs in relational space. The null hypothesis, then, would be that classifier constructions do not forcibly follow any of the rules. As far as the AUC/ RUC are concerned, this would mean that multiple source grounds, for example, may appear within the same macro-event. It would also mean that the same ground may act as both the source and the goal. What's more, we would expect that a change of direction can indeed be encoded and entailed.

Alternatively, it could also be the case that Bohnemeyer et al.'s constraints are too narrow to include ASL (and other SLs by extension). If it is found that the constraints do not apply to either spatial function, there are grounds to suspect that this is the case. However, should the constraints apply to one function to the exclusion of the other, a more cautious conclusion must be reached. If the constraints may be violated in topographic space, but not relational space, the same predictions as above hold. If,

Table 4.1
Predictions, divided by space type

	Relational	**Topographic**
AUC/ RUC	1. Max one source, one goal, one route per event 2. No ground DP may receive more than one semantic role 3. No telling how many/ which roles show up within an event	5. Any number of sources, goals, and routes 6. Grounds may receive more than one semantic role
UVC	4. Linear path movement; no encoded or entailed changes of direction	7. Changes of direction encoded and entailed

Table 4.2
Implications for where violations are found

	Where Violations Found		
Relational	X	X	
Topographic	X		X
	8. Redefine B. et al.'s constraints	9. Mischaracterization of spatial functions	10. Enriched spatial information clashes with constraints; implications for gradience

however, violations are found in relational space, but not topographic space, I have perhaps mischaracterized the spatial functions.

Predictions are summarized and enumerated in Tab. 4.1 & 4.2.

5. METHODOLOGY

5.1 Participants

I consulted two signers for this thesis. Participant A is a CODA, bilingual in English and ASL. Participant A signs with a Hoosier dialect. Participant A is a graduate student at Purdue University and is naïve to linguistics. Participant B is a native ASL signer (Deaf), who signs with a Pittsburgh dialect. Participant B is an instructor of ASL at the college level and has a Masters in linguistics. However, Participant B was kept unaware of the of the specific purpose of the study.

5.2 Sessions

For this thesis, I conducted three elicitation sessions. Session I (§5.2.1), with Participant A, tested motion events in ASL in a broader sense, and was thus more exploratory: I tested quantification of motion events in relational space and I tested all three constraints on event packaging in topographic space. Further, as a result of this session, I uncovered additional tests for distinguishing spatial functions (i.e. topographic vs. relational; see again §3.2). Session II (§5.2.2) was designed to confirm data elicited in Session I. Session II also aimed to test how many distinct semantic roles can be encoded within a single macro-event (AUC) and, similarly, how much spatial (specifically, path) information can be encoded in that domain (UVC). Both spatial functions were explored. Finally, Session III (§5.2.3) sought negative evidence in support of my findings from Sessions I and II.

5.2.1 Session I: Interview

For Session I, Participant A and I sat across from each other in the Sign Language Linguistics lab at Purdue University. A video camera recorded our session. During the session, I signed test sentences to Participant A and asked him to judge the acceptability of what I had just signed. If the sentence was unacceptable, Participant A would sign back a semantically equivalent sentence that was syntactically well-formed. If the sentence was acceptable, yet somewhat odd, Participant A would sign back a more acceptable, semantically equivalent sentence.

This session tested motion events in a broader sense, but was designed with two specific ideas in mind: the first, quantification of motion events (16 items; Tab. A.1 in Append. A), and the second, Bohnemeyer at al. and their constraints on event packaging (11 items; Tab. A.2). Accordingly, the session was divided into two halves. While only the content of the second half of the session speaks directly to the purpose of this thesis, some relevant data and methodological considerations came from the first. For instance, as will be elaborated more below, only verbs with relational semantics were elicited in the quantification half, while the Bohnemeyer et al. half only elicited verbs with spatial semantics. I take this split to be nonaccidental. Finally, within the Bohnemeyer et al. half of this session, only the UVC was explicitly tested.

Materials and Tasks to Ensure Spatial Function

The main hypothesis of this thesis is that Bohnemeyer et al.'s constraints will only apply to a subset of verbs in ASL: namely, verbs with relational semantics should obey the constraints, while those with spatial semantics will not necessarily play ball. So, care was taken to properly differentiate verbs of both semantic types. First, handshapes were considered, such that relational verbs and spatial verbs used

different handshapes. Second, certain spatial information was added to goal referents in relational space, to confirm that such information is incompatible. [1]

The two case verbs I studied were GO-TO and w/e-CL:x-GO.[2] These verbs were identified as having relational semantics and topographic semantics, respectively (§3.2). GO-TO only selects arguments with human referents (and possibly non-human companions), so Figures in relational space were always human. In contrast, whole entity classifiers may refer to a number of different referents, depending on the classifier (handshape) chosen. That is, the 1-handshape (w/e-CL:1-GO) may refer human referents, or non-human referents where length and thinness are salient characteristics. Because GO-TO and w/e-CL:1-GO are phonologically similar, to avoid confusion of the two, a non-human, vehicle referent was used in the classifier condition, such that the handshape was different (i.e. w/e-CL:**3**-GO). To my knowledge, there is no motion verb with relational semantics that uses the 3-handshape.[3]

The quantificational half of the session tested quantification by reduplication of goals and GO-TO. Only one verb was used in this part of the session, GO-TO, which has relational semantics. In addition to quantification, though, I also tested the spatio-temporal properties of GO-TO by adding either spatial or temporal information. That is, I elicited sentences akin to 'I went to three workshops, one after the other' (temporal contiguity) and 'At the office, I went to/from the bathroom, to/from the break room, and to the copy room' (spatial contiguity). This was to test how much time and space, hallmarks of topographic space, could be included in relational space. If such rich information is permitted within relational space, there is an additional avenue for exploration of constraint violations.

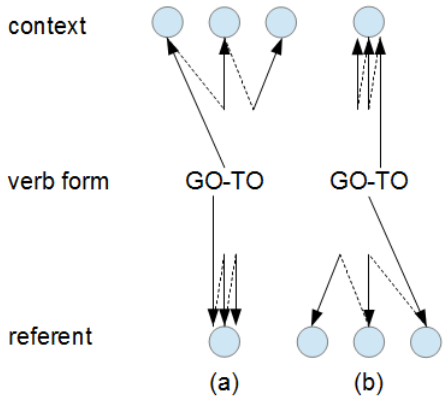
Specifically, context was supplied such that the inflection of the verb could have (a) matched the number of distinct referents or (b) matched the number of distinct

[1]That is, relational space only assumes time, while topographic space assumes both space *and* time (Wilbur, 2010)

[2]Where 'x' in w/e-CL:x-GO stands in for a handshape. For instance, the 1-handshape is used (generally) for human referents, and the 3-handshape for vehicle referents.

[3]The w/e-CL:3 classifier was also used for pragmatic reasons. For many of the test items, which involve traveling over the length and breadth of the United States, using the w/e-CL:1 classifier would have been pragmatically odd, since it is less likely that such a distanced is traveled by foot.

Figure 5.1. Do reduplicated verb forms, ++ and [distr], agree with context or referents?



(a) “There’s a workshop going on all month. Everyday the location of the workshop changes...”
(b) “There’re three workshops going on all month. Each is held in the same room...”

locations of the referent(s). For example, in one test item, a workshop was established contextually to change its physical location every day (e.g. it's in a gym one day, in an auditorium the next, and so on), with the Figure going to that same workshop over and over. If it is the case that it is the number referents that matters for the inflection of the verb, then the verb should be reduplicated towards a single locus representing the single workshop. If, on the other hand, it is the case that it is the spatial location of the referent (which changes daily) that matters, then the verb would be articulated towards loci referring to, e.g., the gym, the auditorium, and so on (i.e. more than one locus). This choice is schematized in (Fig. 5.1a).

Along these lines, it was also tested whether three different workshops, whose locations were identical (e.g. in the same conference room), would be set up in a single locus (consistent with a spatial interpretation) or in three different loci (consistent with a referential interpretation).[4] This option is schematized in (Fig. 5.1b).

Next, it should be the case that spatial relationships *between* goals are not specifically encoded in relational verbs, or at least with GO-TO$_{[\text{distr}]}$ (although real-world knowledge may supply this information). To test this, spatial information about the relative locations of goal referents was given (e.g. 'The office, here, is next to the (location of the) meeting'). That is, these grounds were established 'off of' the event timeline with the verb GO-TO$_{[\text{distr}]}$ directed towards their loci. Here, then, spatial information could be said to 'creep' into relational space, should the construction be well-formed. If so, extra precautions for ensuring spatial function would be needed.

Lastly, I explored the temporal quality of GO-TO. As defined in (§3.2), GO-TO$_{[\text{distr}]}$ does not imply any sort of specific temporal relationship between goals, only a sequence order. That is, in *3 WS, JOHN GO-TO$_{[distr]}$*, the time between the first workshop and the second may have been a few hours, while the time between the second and third could be a number of days. To test this, I established the three workshops in the signing space (along the event timeline). In one example, I specified

[4]Of course, it is reasonably assumed that the three workshops were not happening in the same place *and* at the same time, in which case time/ event could be quantified. In such a case, the verb would be directed towards three distinct points in space, one for each event-time.

in context that the three workshops were happening one beginning immediately after the other and directed GO-TO$_{[distr]}$ across the event timeline. In another example, the preceding context was the same, but GO-TO instead was articulated to the locus of the first, from that locus to the locus of the second, and so on to the third, such that the goal of Event A was the source of Event B (that is, the verb was not reduplicated or otherwise 'reset' to the neutral, non-source, signing space in front of the signer).[5]

Materials and Tasks to Test MEP and Constraints

I used two topographic schemes in my exploration of Bohnemeyer et al.'s constraints. The first, and more local of the two, involved a crudely-drawn, partial map of (West) Lafayette, including several major streets and a salient landmark (a movie theater). The second scheme involved an 'imagined map' (that is, a 'map' projected into mental space), as opposed to a physical map. This map included all of the continental United States and adjacent areas of Canada. I will discuss each in turn.

The local scheme was used to elicit naturalistic data: I asked Participant A to give directions to a movie theater in West Lafayette, using several major streets. The particular configuration of the starting location and the ending location require a nonlinear path (i.e. there's a river that runs between them). Since the extensional path did not fall on a straight line, Participant A could have chosen to represent the path with turns. Noting that 'giving directions' in general involve stepwise descriptions (in my experience, at least), it was expected that a sequence of source-goal event would be produced (AUC). In order, however, to elicit a single, non-linear vector/ verb (UVC), I asked Participant A on occasion to assume unfamiliarity with the area (and thus avoid using specific directions). Instead, because the starting point, ending point, and logical path between the two are contained within the same field of view, I expected rudimentary, path-tracing directions under this provision.

[5]Note also that this is also applicable to the AUC, in that a source and goal would appear within the same macro-event expression. More on this below.

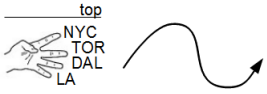
While the local scheme was used primarily to elicit forms without much prompting (i.e. for naturalistic data), I elicited data from the non-local scheme in a more direct way, targeting the AUC and UVC. First, context was established that a character, John from New York City, was going on a road trip to visit his friend in Los Angeles during spring break. John then took a series of direct or indirect routes to L.A. The AUC was tested by adding cities to John's tour, such that more than one intermediate ground (=via role) was articulated using a single path contour (=single event). If this form is possible, we would have an AUC violation. The UVC was tested at the same time, by selecting cities that are dramatically Northern or Southern (e.g. NYC to Toronto to Dallas to L.A.). Here, an uninterrupted weaving movement of the verb, paired with the non-neutral establishment of ground loci, would mean a UVC violation.

Using a single contour was motivated by the following: By hypothesis, a single movement contour in topographic space (without any abrupt stops or sharp changes in direction; Wilbur, 2003 and subsequent work) means a single verb, and thus single (macro-) event. Discontinuous movement, however, might imply a "verb x and then verb y" interpretation, even when there is only one overt time adverbial (i.e. the gapping/ deletion of already asserted information; Zwitserlood, 2003).

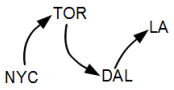
For the purpose of eliciting a continuous movement contour, ground DPs and time adverbials can be fronted, resulting in a verb-final construction (Fig. 5.2a, cf. b). For example, in (Fig. 5.2a), all of the ground DPs are listed on the hand with brow raise (and not localized in the signing space). Then, the verb can be articulated, without interruption, weaving to locations in the signing space in accordance with the grounds' geographical positions relative to each other. I signed sentences in this format to Participant A, and asked for the same in his productions.

Finally, the RUC was tested separately, in an event about a boy walking away from and back to a single tree. As this was more of a spur-of-the-moment addition, this example was not supported by context and was the only one of its kind.

Figure 5.2. Aiming for a single path



(a) Ground DPs, verb



(b) Ground DP, verb, Ground DP, verb ...

Discussion of Session I

As mentioned at the onset of this subsection, this session was more exploratory: exploring both quantificational and event-packaging properties of motion events. However, as alluded to, I noticed at least two other potential differences between spatial functions, apart from handshape selection: (a) the referent of the ground DPs or how much spatial information about the ground DPs was available, and (b) quantificational properties of the event, including use of the event timeline. I go over each in turn.

First, it might be the case that enriched knowledge about spatial locations (and perhaps time between events) is partly determinant of what function of space is used. That is, with less information known about a location (or locations relative to each other), the less likely a motion or locative classifier construction will be used.[6] Conversely, the more spatial information known about particular ground DPs might prompt the signer to include that information. This information might come from the referent of the DP itself, or from the overt establishment of these DPs in the signing space (e.g., 'The library is behind the union, here').

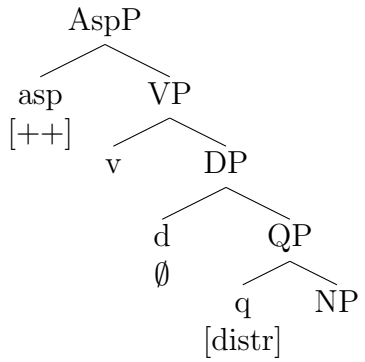
That is, all sentences in the relational group (quantification section) used grounds that are common to many scenes. For example, in JOHN GO-TO++ WS++ ('John went to [several] workshops'), no specific real-world set of workshops is intended. In addition, there was no spatial information provided about these workshops (e.g. 'Workshop A is located here, Workshop B there, ...').[7] On the other hand, all sentences in the spatial group contained a list of cities in the US and Canada, or a list of locations around (West) Lafayette, Indiana. It was assumed that Participant A had previous knowledge of the rough topographic relations between each city (at least North-South-East-West distinctions) and Lafayette landmarks.

[6]I make no claim about other classifier constructions, specifically those which may have relational semantics and/ or do not entail movement or location.
[7]Further, when such information was supplied, topographic space was produced. To be elucidated in (§6.3).

Figure 5.3. Reduplication in Relational Space

(a) Goal quantification; $\text{VERB}_{[\text{distr}]}$

(b) Event quantification; VERB++



(c) Goal Quantification

e.g. [$_{\text{AspP}}$ GO-$\text{TO}_{\text{i,[distr]j,++}}$ [$_{\text{VP}}$ $\text{t}_{\text{i,j}}$ [$_{\text{DP}}$ [$_{\text{QP}}$ t_{j} [$_{\text{NP}}$ STORE]]]]
'Go to each store repeatedly'
(a) $\exists e, x, y[GO - TO(e) \wedge Theme(e, x) \wedge Goal(e, y) \wedge Quant(y, many)]$
(b) $\exists e, x, y[GO - TO(e) \wedge Theme(e, x) \wedge Goal(e, y) \wedge Quant(e, many)]$

Next, each test item in the relational space condition used some form of reduplication: either quantification of goals (Fig. 5.3a) or quantification over the event (Fig. 5.3b). While it seems controversial whether classifier constructions may be reduplicated, no reduplication was found in the topographic condition (pro: examples in Fischer & Janis, 1990; con: Brentari & Padden, 2001). It may be the case, then, that only verbs (including classifiers constructions) with relational semantics may be reduplicated. On the other hand, verbs (here, whole entity classifier constructions) with spatial semantics may not combine readily with reduplicative morphemes, if at all. Going forward, then, I will use these observations in the construction of test items for Sessions IIa,b and III.

5.2.2 Sessions IIa & b: Elicitation

As for Participant B, I designed two sessions (Sessions IIa and IIb) (a) to verify the Session I data with another signer and (b) to expand on the initial findings. Here, face-to-face interaction was not possible. For the first elicitation, I sent Participant B a list of test sentences written in English for her to translate. The sentences, while not identical to the set used with Participant A, were similar in spirit and presented in the same order. Participant B filmed herself and sent me the video files.

Specifically, Session IIa was a continuation of Session I. Session IIa aimed to test how many semantic roles can be included in a single macro-event (one facet of the AUC) and how much path information can be included across both spatial functions (UVC). (Session I had only explicitly tested the AUC and UVC in topographic space). Session IIb presented selected test items from Session IIa with diagrams depicting desired topicalizations and paths. First, however, I will discuss how I used the results of Session I to create materials for Session II, such that spatial functions were sure to be distinct.

Materials to Ensure Spatial Function

Based on the materials used for Session I with Participant A, I created a list of 33 English sentences. The sentences were divided into two large sections: with one targeting relational space, and the other topographic space. Specifically, there were 16 test items targeting relational space, and 17 targeting topographic space (see Tab. B.1 in Append. B). The test items here were informed by what was learned from Session I, namely: the relational space items were controlled for using (a) a human referent, (b) limited spatial information about grounds DPs (encyclopedic or relative to other grounds), and (c) quantification by reduplication. Reduplicated forms were targeted by including English phrases like "everyday" (event quantification) and "each workshop" (goal quantification).

(5.1) a. This month there are three different workshops. Everyday John goes to each of them.
No spatial information given

b. Teddy went on a second trip. First he went to Santa's workshop, then to the south pole, then to Neverland, then to the moon, and finally back to Lafayette, IN.
Some spatial information assumed

c. John decided to take a road trip. He drove from NYC, to Toronto, to Dallas, and finally to L.A.
Most or all spatial information assumed

I assumed that the amount of spatial information about ground DPs would influence the use of the signing space. To test this, I designed sentences for Participant B where none, some, or all of the spatial relationships between ground DPs was known (5.1a,b,c, respectively). That is, (5.1a) involved three made-up workshops, whose locations were not specified. In (b)'s case, only some spatial information was known about the ground DPs, namely: *Santa's workshop* is at the North Pole, the South Pole is on the opposite end of the planet from the North Pole, *Neverland* is somewhere up and away from Earth ("second star on the right," where ever that may be), and so on. Finally, the (relative) geographic positions of each ground DP should be easily

retrievable in (c). For example, New York's relative position to Toronto (South and East) was expected to be known.

Materials to Test MEP and Constraints

Keeping these factors in mind, test items varied with respect to how many semantic roles were included. In the relational space condition, I assumed that out of source, goal, and via, goal is the most basic in ASL, so the test items started with only goal information (5.2a), then progressively added source (5.2b) and (then) via roles (5.2c). It is widely cited that object agreement is obligatory in verbs that agree, while subject marking is optional. All of the items in these Sessions 'agreed' in some way with referential loci.[8] Because source and goal are generally mapped to subject and object, respectively, (noting 'backwards verbs') I assumed that goal marking would be privileged in motion verbs, although source-only verbs (e.g. GO-OUT and ESCAPE) do exist.[9] I additionally assumed that via was more marked than source, given that source and goal have been found to be privileged over via in Bohnemeyer et al. (2007)'s AUC typology.[10]

(5.2) a. John keeps going and going to that workshop.
Goal Only

b. Everyday, John leaves school and goes to that workshop.
Source and Goal

c. Everyday, John goes from school to the workshop via the pedestrian bridge.
Source, Goal, and Via

As for topographic space, all test items had one source and one goal. Then, intermediary grounds were added. As I was trying to elicit a single continuous vector (again, to ensure the most information possible within one VP), I varied the context

[8]Here, I intend 'agreement' to be whatever (possibly unified) process that is responsible for matching a discourse referent–human, ground, or otherwise–to a location in the signing space.
[9]Incidentally, goal was also the only role found in Session I.
[10]That is, Type I languages encode all three semantic roles in a single macro-event expression, Type III languages can only encode one, and Type II, interestingly, can encode source and goal *to the exclusion of* via.

and prepositions used.[11] For example, I contrasted goal-denoting prepositions (e.g., 'to Toronto'; 5.3b) with via-denoting prepositions (e.g., 'through Toronto'), additionally noting that intermediate grounds were not themselves destinations (5.3c). That is, supposing that the (b) case elicits multiple movement contours (=multiple events), the idea was that the (c) case, to be distinguished from the (b) case, should be signed with one continuous movement.

(5.3) a. John drove from NYC straight to L.A. in 2 days.

b. John decided to take a road trip. He drove from NYC, to Toronto, to Dallas, and finally to L.A.

c. John decided to take a road trip. He drove from NYC, through Toronto, through Dallas, and arrived in L.A. He didn't have time to stop in Toronto or Dallas.

Movement Diagrams

A major limitation of Session IIa was that English, as a spoken language, represents spatial information in a fundamentally different way from visual languages. Additionally, English tends to encode information sequentially, while the same informational content may be conveyed simultaneously in ASL in a great many cases.[12] I aimed to avoid these issues in Session IIb.

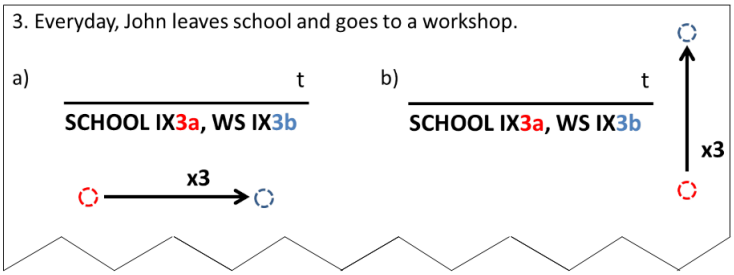
For Session IIb, I selected 14 sentences from Session IIa to solicit again (8 targeting relational verbs, 6 targeting topographic verbs). To these I added partial ASL transcriptions and spatial diagrams.[13] Together, the transcriptions and diagrams were intended to influence Participant B's responses. Some items had only one diagram, while others had up to four. Altogether, there were 26 diagrams (16 for relational verbs, 10 for topographic).

[11] That is, since English is not a visual language, especially when written, eliciting particular path movements and event segmentation was indirect.

[12] Naturally, there are a number of other differences between spoken and signed languages, although I do not discuss them here.

[13] Participant B is familiar with ASL transcriptions.

Figure 5.4. Sample sentence and diagram presented to Participant B



Topics and subjects were given in transcription, while path movements and agreement markers/ referential loci were schematized in the diagrams. Fig. 5.4 shows a sample stimulus. Here, the English sentence is given at the top to establish a global meaning. That is, the English was not intended to influence the form of the elicited sentence. Then, below, the spatial referents were listed in a topic phrase (demarcated by $\underline{\text{t}}$).

Finally, path movements were schematized as arrows. The arrows point in different directions as to elicit path movements using different planes. The diagrams were intended to be seen from a signer's perspective (e.g., such that the arrow in Fig. 5.4a. would represent verb movement from the contralateral side of the signer to the ipsilateral side; from proximal to distal locations w.r.t the signer in Fig. 5.4b). However, as long as some sort of contrast was made between different diagrams for the same sentence, it should not matter if signer's perspective was understood. Additionally, '3x' (for 'three times') was intended to elicit reduplication. All examples were color coded such that spatial referents listed in topics matched referential loci at each end of the arrow. Instructions explaining the sentences, transcriptions, and diagrams were given before the task.

5.2.3 Session III

As the first session was exploratory (and partly not specifically targeting the research question) and the second sessions did not contain any negative evidence (by nature of the task), a third session was needed. This session was an interview-style elicitation with Participant B.

Materials

This session was divided again into two sections: the first targeting relational space, the second spatial. All of the same procedures for ensuring spatial function were followed.

MEP

As a brief reminder, the MEP is a semantic domain, delimited by temporal adverbials, in which the AUC, RUC, and UVC apply. These constraints are not predicted to apply outside of a macro-event expression (whatever that might look like)[14] or across macro-event expressions. This session, then, is to test two things: (1) whether either or both semantic classes (relational, topographic) disallow more than one time adverbial per expression (here, clause/ CP[15]) and thus form macro-event expressions and (2) once a macro-event expression is established, whether the constraints apply within it.

In testing the constraints active within a macro-expression, I inserted two time adverbials within a single clause. In most cases, one was placed before the subject and one after the object, in accordance with the positions of sentential adverbs identified

[14]Recall from (§2.1.4) that I argue that it is trivial or misleading to say an expression does not have the MEP, at least in those cases that B. et al. have flagged. Instead, such expressions may contain *more than one* macro-event expressions.

[15]Again, the MEP is not necessarily isomorphic with any syntactic constituent. However, more than one CP entails more than one macro-event expression. So, then, the CP is the largest possible syntactic container for a singular MEP.

by Braze (2004) and sources therein (5.4). The decision to use these positions was largely arbitrary. In stimuli where there is more than one VP, adverbs will also be tested between VP (e.g. Top ADV Subj Verb goal ADV verb goal)

(5.4) a. Top **ADV** Subj Verb Obj/goal
b. Top Subj **ADV** (modal) Verb Obj/ goal
c. Top Subj Verb Obj/ goal **ADV**

In addition to time adverbials, ASL locates events using FINISH. FINISH indicates perfect, perfective, or narrative advancement (as a 'conjunction'), depending on its position (Fischer & Gough, 1999; Rathmann, 2005). For the purposes of this thesis, the last function, narrative advancement (which I will refer to as FINISH_3 for convenience), will be used as a diagnostic for multi-eventivity. FINISH_3 serves to sequence events, such that one event is understood to have culminated before the start of the second.[16] I imagine there will be some cases where time adverbs do not gracefully combine with scenarios taking place over a short period of time (e.g. 'I went to the cupboard at 9:00 and returned to the living room at 9:05'). FINISH, then, provides a semantically appropriate alternate diagnostic.

[16]But this fact alone does not preclude a mono-eventive interpretation, as SVCs in, e.g., Bangla (ii) show (Basu, 2010). In (ii), cf. (i), the perfective, *ye*, signals the culmination of the *eating* event before the start of the *going* event, however the sentence (as argued for all SVCs) is mono-eventive. Nevertheless, Fischer and Gough (1999) argue (indirectly) for the multi-eventivity of event-FINISH-event constructions, citing non-manual behavior. They posit the structure in (iii). Again, two CPs necessarily means (at least) two macro-event expressions.

i. $[\text{YOU EAT FINISH}_3]_{\text{MEP}}$ $[\text{WE GO SHOPPING}]_{\text{MEP}}$
'After you finish eating, we'll go shopping.' (from Fischer & Gough, 1999)

	Ami	khabar	khe-ye	bari	ash-chi
ii.	[I.NOM	food	eat-PERF	home	come-BE.1PRSN]$_{\text{MEP}}$
	'I will eat and the come home'				[**Bangla**]

iii.

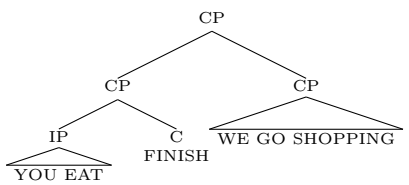


Table 5.1
Possible Combinations of AUC Violations

	source	**goal**	**via**
source	√	-	-
goal	-	√	-
via	-	-	√

AUC

For the AUC, we are looking for duplicates of semantic roles. As such, there are three possible combinations of AUC violations: two sources, two goals, and two routes (Tab. 5.1).

Grounds may receive their semantic roles in at least two ways in ASL. What have traditionally been termed 'agreement markers' may be affixed to verbs, such that the verb begins in the referential locus of the source and ends at the locus of the goal. In ASL, grounds may also receive their interpretation through prepositions.[17,18]

The three possible combinations, then, are two verbs, two prepositions, or one verb and one preposition (Tab. 5.2; 5.5/5.6b,c,d). However, the establishment of referential loci and the directionality of verbs are two different processes, which contributes additional possibilities. For instance, it is theoretically possible (yet, infelicitous; Quer, 2011) to set up two grounds at the same locus, directing a single verb to that

[17]While prepositions may be infrequently expressed in ASL (e.g. Emmorey, 2001), they are nevertheless present. Some may argue that prepositions are borrowed into ASL from English, and as such are not part of the core lexicon (and this may have been true at some point). However, ASL's prepositions have a different distribution, and may be semantically distinct from prepositions in English (among other distinctions). For instance, Emmorey (1996) found that English and ASL have different criteria for what constitutes an 'in' relationship (ASL: IN, cf. English: *in*). While ASL requires absolute containment of a figure within a ground, English is less restrictive.

[18]I should also clarify here that the verb GO-TO is simply a verb, and not the conjunction of the verb GO and the (overt) preposition TO. More accurately, GO-TO reflects the conceptual structure of the verb, as it encodes the Event function, GO, and Path function, TO (á la Jackendoff, 1992; Shepard-Kegl, 1985). For example, consider the English verb *reach* and construction *go to*, as in *Jack reached the goal* and *Mark went to the store*. Ignoring any nuanced meaning, both basically have the same underlying conceptual structure (i.e. $[_{\text{Event}}$ GO $[_{\text{Path}}$ TO $]]$), yet one is realized as two morphemes in *go to* and the other is realized as only one in *reach*. GO-TO in ASL is conceptually structured in the same way as 'reach.'

Table 5.2
Lexical/ Syntactic Sources of AUC Violations

Letters in table correspond to item numbers in (5.5) and (5.6)

		locus	**preposition**	**verb**
Goal	**verb**	(a,a′)	(b)	(c,c′)
	preposition	-	(d)	-

locus (5.5/5.6a). It is also possible to set up two grounds at different loci and then direct (1) a single, reduplicated verb (5.5/5.6a′; where (a′) represents a dual form, phonologically similar to [distr]) or (2) two verbs towards those loci (5.5/5.6c′).

There are a few further comments to make. First, in items where two verbs are signed, the posture nonmanual, 'mm,' was used to force an interpretation of a single, larger VP (and, by hypothesis, a single event). This applies to both relational and spatial test items. Secondly, again across both groups of test items, only one type of thematic role was tested at a time, such that in the goal set, no sources appeared and vice versa, wherever possible.[19] Lastly, the cities Washington, DC and Baltimore were chosen for the topographic condition because of their geographical proximity. This allows for the establishment of their referential loci in the same (perhaps overlapping) area of the signing space. That is, if the signing space is mapped in such a way to respect near-far information, then two relatively far apart cities (e.g. New York and Los Angeles) would not be felicitously set up in the same locus in the signing space anyway.

Altogether, then, three violation types (double source, double goal, and double via) and six construction types make 18 test items per spatial function. Six are printed below, the rest listed in Appendix C.1.

[19]It may not be possible for classifier motion events to omit goals in favor of sources.

(5.5) **Relational Space (Goal)** - See Tab. 5.2

a. $\overline{\text{SCHOOL}_\text{a}\ \text{WORK}_\text{a}}^{\text{top}}$ MAN GO-TO$_\text{a}$
Verb - Locus

a′ $\overline{\text{SCHOOL}_\text{a}\ \text{WORK}_\text{b}}^{\text{top}}$ MAN GO-TO$_{\text{a,b/ [dual]}}$
Verb - Locus

b. MAN GO-TO$_\text{a}$ SCHOOL$_\text{a}$ TO CHURCH
Verb - Prep

c. MAN $\overline{\text{GO-TO}_\text{a}\ \text{SCHOOL}_\text{a}\ \text{GO-TO}_\text{a}\ \text{CHURCH}_\text{a}}^{\text{`mm'}}$
Verb - Verb

c′ MAN $\overline{\text{GO-TO}_\text{a}\ \text{SCHOOL}_\text{a}\ \text{GO-TO}_\text{b}\ \text{CHURCH}_\text{b}}^{\text{`mm'}}$
Verb - Verb

d. MAN GO-OUT HOME TO SCHOOL TO CHURCH
Prep - Prep

(5.6) **Topographic Space (Goal)** - See Tab. 5.2

[A man, John, is going on a short trip from Indianapolis...]

a. $\overline{\text{DC}_\text{a}\text{BALTIMORE}_\text{a}}^{\text{top}}$ IX3 DRIVE w/e-CL:3-GO$_\text{a}$
Verb - Locus

a′ $\overline{\text{DC}_\text{a}\ \text{BALTIMORE}_\text{b}}^{\text{top}}$ IX3 DRIVE w/e-CL:3-GO$_{\text{a,b / [dual]?}}$
Verb - Locus

b. IX3 DRIVE w/e-CL:3-GO$_\text{a}$ DC$_\text{a}$ TO BALTIMORE
Verb - Prep

c. IX3 DRIVE $\overline{\text{w/e-CL: 3-GO}_\text{a}\ \text{DC}_\text{a}\ \text{w/e-CL: 3-GO}_\text{a}\ \text{BALTIMORE}_\text{a}}^{\text{`mm'}}$
Verb - Verb

c′ IX3 DRIVE $\overline{\text{w/e-CL: 3-GO}_\text{a}\ \text{DC}_\text{a}\ \text{w/e-CL: 3-GO}_\text{b}\ \text{BALTIMORE}_\text{b}}^{\text{`mm'}}$
Verb - Verb

d. IX3 DRIVE w/e-CL:3-GO$_\text{a}$ TO DC TO BALTIMORE
Prep - Prep

Table 5.3
Possible Combinations of RUC Violations

	source	goal	via
source	AUC	√	*√
goal	-	AUC	*√
via	-	-	AUC

* = not tested

Table 5.4
Lexical/ Syntactic Sources of RUC Violations

		locus	**preposition**	**verb**
Source - Goal	**verb**	(a,a′)	(b)	(c,c′)
	preposition	-	(d)	-

RUC

As for the RUC, there are logically six possible, distinct violations. A single ground can receive a source role and a goal role, a source and a via role, and so on. Of these six possible violations, three are already ruled out by the AUC, leaving just three.

Next, as outlined for the AUC, there are six combinations of verbs, loci, and prepositions, yielding six different constructions. Altogether, six constructions for each of three violation pairs totals 18 items per spatial function (see Appendix C.1). Not all possible combinations were tested due to time constraints. Those left for future research are marked with an asterisk in Tab. 5.3.

(5.7) **Relational Space: Source - Goal** - See Tab. 5.4

a. $\overline{\text{SCHOOL}_\text{a}\ \text{SCHOOL}_\text{b}}^{\text{top}}$ BILL $_\text{a}$#BACK$_\text{b}$
Verb - Locus

a′ $\overline{\text{SCHOOL}_\text{a}\ \text{SCHOOL}_\text{a}}^{\text{top}}$ BILL $_\text{a}$GO-TO$_{\text{[loop path],a}}$
Verb - Locus

b. BILL GO-TO$_\text{a}$ SCHOOL FROM SCHOOL
Verb - Prep

c. BILL $\overline{\text{GO-OUT}_\text{a}\ \text{SCHOOL}_\text{a}\ \text{GO-TO}_\text{a}\ \text{SCHOOL}_\text{a}}^{\text{`mm'}}$
Verb - Verb

c′ BILL $\overline{\text{GO-OUT}_\text{a}\ \text{SCHOOL}_\text{a}\ \text{GO-TO}_\text{b}\ \text{SCHOOL}_\text{b}}^{\text{`mm'}}$
Verb - Verb

d. BILL GO-OUT FROM SCHOOL TO SCHOOL
Prep - Prep

(5.8) **Topographic Space: Source - Goal** - See Tab. 5.4

a. $\overline{\text{SCHOOL}_\text{a}\ \text{SCHOOL}_\text{b}}^{\text{top}}$ BILL WALK $_\text{a}$w/e-CL:1-GOb
Verb - Locus

a′ $\overline{\text{SCHOOL}_\text{a}\ (\text{SCHOOL}_\text{a})}^{\text{top}}$ BILL WALK $_\text{a}$w/e-CL:1-GO$_{\text{[loop path]a}}$
Verb - Locus

b. BILL WALK w/e-CL:1-GO$_\text{a}$ SCHOOL FROM SCHOOL
Verb - Prep

c. BILL $\overline{\text{WALK w/e-CL: 1-GO}_\text{a}\ \text{SCHOOL}_\text{a}\ \text{w/e-CL: 1-GO}_\text{a}\ \text{SCHOOL}_\text{a}}^{\text{`mm'}}$
Verb - Verb

c′ BILL $\overline{\text{WALK w/e-CL: 1-GO}_\text{a}\ \text{SCHOOL}_\text{a}\ \text{w/e-CL: 1-GO}_\text{b}\ \text{SCHOOL}_\text{b}}^{\text{`mm'}}$
Verb - Verb

d. BILL WALK w/e-CL:1-GO FROM SCHOOL TO SCHOOL
Prep - Prep

UVC

From the description given in (§3.3), motion verbs in relational space have a lexically specified linear movement. Modifying that movement to express path information, to my knowledge, is not possible. Nevertheless, (5.7a′) checks for non-linear

movement in GO-TO, so creating additional test items was unnecessary. However, if one bundles two motion verbs under a single, larger VP, an encoded and entailed change of direction may be possible (5.9; where the notation, $\rightarrow \uparrow$, is intended to mean that each instance of GO-TO is directed at a distinct locus). So that the verbs were interpreted as belonging to the same VP, the nonmanual marker 'mm' scoped over both of them.

(5.9) a. $\overset{\text{top}}{\overline{\text{BANK}_\text{a}\ \text{BILL}}}\ \overset{\text{'mm'}}{\overline{\text{GO-TO GO-TO}_\text{a}}}\ (\rightarrow \uparrow)$

b. $\overset{\text{top}}{\overline{\text{BANK}_\text{a}\ \text{RESTAURANT}_\text{b}\ \text{BILL}}}\ \overset{\text{'mm'}}{\overline{{}_\text{a}\text{GO-OUT GO-TO}_\text{b}}}\ (\rightarrow \uparrow)$

Lastly, I added time adverbials to the previous test items to see if those examples were macro-event expressions. For example, I took (5.10a), a test item from Session I, and added temporal adverbs (5.10b,c). In (b), I added temporal adverbs in the topic phrase, and in (c) I added them after the topic and after the verb.

(5.10) a. $\overset{\text{top}}{\overline{\text{NYC}_\text{a}\ \text{TORONTO}_\text{b}\ \text{DALLAS}_\text{c}\ \text{L. A.}_\text{d}}}$ JOHN DRIVE
w/e-CL:3-$_\text{a}$GO$_{\text{[drive], b, c, d}}$

b. $\overset{\text{top}}{\overline{\text{NYC}_\text{a}\ \text{MON}\ \text{TOR}_\text{b}\ \text{TUES}\ \text{DAL}_\text{c}\ \text{WEDNES}\ \text{L. A.}_\text{d}\ \text{THURS}}}$ JOHN DRIVE
w/e-CL:3-$_\text{a}$GO$_{\text{[drive], b, c, d}}$

c. $\overset{\text{top}}{\overline{\text{NYC}_\text{a}\ \text{TORONTO}_\text{b}\ \text{DALLAS}_\text{c}\ \text{L. A.}_\text{d}}}$ MONDAY JOHN DRIVE
w/e-CL:3-$_\text{a}$GO$_{\text{[drive], b, c, d}}$ FRIDAY

5.3 Summary

The choice of spatial function (and thus relational or topographic verb) was controlled for manipulating three factors: (1) The referent of the figure of the motion event (human for relational verbs and vehicle for topographic verbs); (2) how much spatial information about ground DPs was supplied or assumed (minimal for relational space, enriched for topographic space); and (3) quantification over events or goal-denoting ground DPs (quantification for relational verbs, none for topographic).

With spatial functions controlled for, I first tested path shapes in topographic space (Session I). Here, I manipulated how many grounds were included in an event. Furthermore, each ground was a North American city, such that the establishment of each city in the signing space reflected real-world topographic information. I additionally manipulated how many intermediate grounds were included. To ensure that path shapes were not interrupted, all grounds were set up in a topic.

Second, I tested how many semantic roles of distinct types could be included within a single macro-event in relational space (Sessions IIa,b). This was achieved by adding grounds to the stimuli one by one. These two sessions additionally tested macro-event boundaries across both functions of space: I included time positional adverbials. As for topographic space, Sessions IIa,b also aimed to elicit and corroborate the responses from Session I.

Finally, Session III provided direct negative evidence for constraint violations. This was achieved by manipulating the type of violation (e.g., an AUC violation with two offending source roles versus, for example, an RUC violation with source and goal roles) and construction type (whether the violation occurred due to spatial loci, prepositions, or the lexical specification of the verb). Session III also thoroughly tested whether each suspected violation (or non-violation) occurred within a single macro-event expression.

6. FINDINGS

6.1 Relational Space

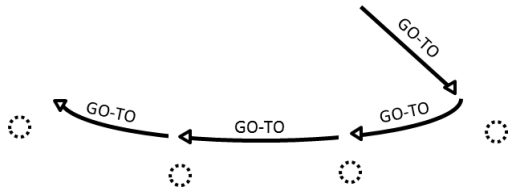
6.1.1 AUC & RUC

As a brief reminder, the AUC and RUC deal with the number and types of semantic roles within a single macro-event expression. The AUC states that maximally one semantic role of each type may be encoded, while the RUC requires that each ground only receive one semantic role. Both constraints are active within a macro-event domain, which is delimited by temporal adverbs.

Expression of semantic roles in ASL comes in two sorts. The first is through overt lexical realization. The second is through cliticization or affixation (depending on who you ask), whereby (source and) goal referential indices are matched with referential loci. There is potentially a third method: an abstract region or locus in space between source and goal loci that represents an intermediary ground (although, this may be an instance of topographic space bleeding into relational space). The interpretation of the latter two types is dependent on the former, though they need not be contained within the same clause.

In the quantificational half of Session I with Participant A, I only elicited examples where the verb was reduplicated. It was predicted that reduplication is not compatible with classifier constructions with spatial semantics, so using reduplication controlled for space usage. In all of the responses I elicited, goal was present: either a singular goal or a three-goal collective. However, no source was present in any of the data in any instantiation (i.e. as a full-fledged lexical item, marker on the verb, or abstract region in space).

Figure 6.1. Verb GO-TO Signed across Event Timeline



When following up with Participant B, I again targeted reduplication in order to ensure a relational use of space, but specifically looked for source roles. As such, source did appear, although never in the same event as goal (either as a lexical item or verb marker). For example, in (6.1), the source (SCHOOL) and the goal (WS) are separated by the completive aspect marker, FINISH (Rathmann, 2005). In this case, FINISH marks the boundary between events. Lastly, note that in this example goal was expressed as an overt lexical item, WS, and as a marker on the verb, GO-TO$_{\mathbf{a}}$. It appears, then, that source-marking is not available with reduplicated forms.

(6.1) a. SCHOOL FINISH $|_{\text{EV}}$ $\overset{\text{top}}{\overline{\text{WS}_{\text{a}}}}$ EVERYDAY IX1 GO-TO$_{\text{a}}$++
'After school, I would go to the workshop everyday'
= ' I would go from school to the workshop everyday'

It was revealed in the second consultation with Participant B that source and goal do appear within the same event, but only in the absence of goal/event quantification. In one example (6.2), a source (SCHOOL$_{\text{a}}$) and goal (HOME$_{\text{b}}$) were set up in space. The sign GO-TO moved from the location of the source to the location of the goal. In addition, body lean marked the source location.

(6.2) a. $\overset{\text{top}}{\overline{\text{SCHOOL}_{\text{a}}\ \text{IX3}_{\text{a}}\ \text{HOME}_{\text{b}}\ \text{IX3}_{\text{b}}}}$ IX1 $_{\text{a}}$GO-TO$_{\text{b}}$
'I went home from school'
b. $\overset{\text{top}}{\overline{\text{SCHOOL}_{\text{a}}\ \text{IX3}_{\text{a}}\ \text{HOME}_{\text{b}}\ \text{IX3}_{\text{b}}}}$ MONDAY IX1 $_{\text{a}}$GO-TO$_{\text{b}}$ (*TUESDAY)

In another example, grounds were set up along the event timeline. The verb first moved from the neutral signing space in front of the signer to the location of the

first goal. The verb then left the locus of the first goal and arrived at the locus of the second. Here, what was the goal of the first movement became the source of the second (that is, none of the loci had a route interpretation; 6.3). This is shown schematically in (Fig. 6.1).

(6.3) FIRST #TEDDY GO-TO SANTA #WORKSHOP FINISH, GO-TO #WONDERLAND FINISH, GO-TO #MT-OLYMPUS, LAST GO-TO #NEVERLAND

'Teddy first went to Santa's workshop, then to Wonderland, on to Mt. Olympus, and finally to Neverland'

Finally, routes were rare in the data.[1] When presented with stimuli including via roles, Participant B only produced source-goal chains across the events (6.3; 6.4). That is, in response to (6.4a), a macro-event expression with all three ground types, Participant B produced three macro-event expressions, each with one source and one goal (6.4b).

(6.4) a. 'Everyday, John goes from school to the workshop via the pedestrian bridge'

b. $\overset{\text{top}}{\overline{\text{EVERDAY}}}$ JOHN SCHOOL FINISH $|_{\text{EV}}$ bp-CL:bentV-WALK$_{\text{[over bridge]}}$ $|_{\text{EV}}$ GO-TO WS

'John walks over the bridge and goes to a workshop everyday after school.'

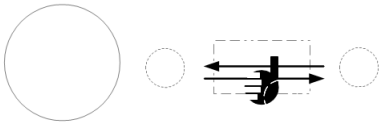
What's more, routes were conspicuously absent from reduplicated forms. In (6.5), a locus is set up for West Lafayette and another for Lafayette. Then the bridge is set up at a location between loci of the two cities. The sign GO-TO$_{\text{[distr]}}$ is directed towards each locus. Here, the interpretation is not that the subject went from West Lafayette to Lafayette via the bridge, but rather that the subject went to each place.

(6.5) ? $\overset{\text{top}}{\overline{\text{WEST \#LAF IX3}_{\text{a}} \text{ \#LAF IX3}_{\text{b}}}}$ IX3$_{\text{c}}$ HAVE BRIDGE. EVERYDAY IX1 GO-TO$_{\text{[distr]}}$

'There is a bridge that connects W. Lafayette and Lafayette. Everyday I go to W. Lafayette, the bridge, and Lafayette'

[1]Session I did not check for routes in relational space at all.

Figure 6.2. Crossing Events in relational Space



Nevertheless via did occur, albeit only surfacing in two constructions (one of which is suspect). In the first, loci for West Lafayette and Lafayette were established as well as an intermediary locus representing a bridge that connects the two cities (in an identical set up to 6.5). Next, the verb COMMUTE was signed such that it oscillated between the loci for West Lafayette and Lafayette, over the space representing the bridge (schematized in 6.2). Here, unlike (6.5), a route interpretation is achieved (6.6).

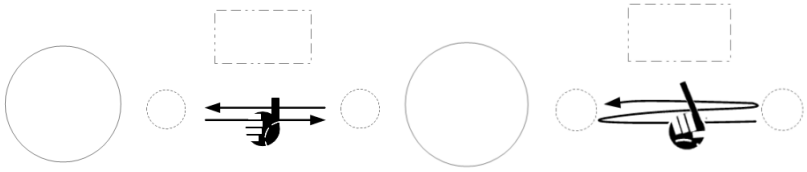
(6.6) $\overline{\text{WEST \#LAF IX3}_{\text{a}} \text{ \#LAF IX3}_{\text{b}}}^{\text{top}}$ IX3$_{\text{c}}$ HAVE BRIDGE. EVERYDAY IX1 $_{\text{a}}$COMMUTE$_{\text{b}}$
'There is a bridge that connects W. Lafayette and Lafayette. Everyday commute between W. Lafayette and Lafayette via the bridge'

The expression of routes in this way seems rather limited, however. (Figs. 6.3a,b) correspond to an event where the Figure goes between two points past some intermediary ground. The (a) case, which uses a frozen form (COMMUTE, GO-TO) is questionable[2], while the (b) case, which uses a classifier construction, is acceptable. Whether the verb passes over the locus of the intermediate ground or simply passing by it, then, seems to be the minimal difference between (Fig. 6.2) and (Fig. 6.3).

The other mechanism for encoding route information is the use of prepositions. In (6.7a), route information is expressed by the prepositional phrase THROUGH TREE++. However, here too there seems to be an arbitrary restriction on what types of route information can be expressed. Using the prepositional phrase ACROSS

[2]In an informal follow-up to Session II, Participant B rejected (a), but in Session III—a few months later (at least 3)–she found (a) acceptable (albeit not perfect).

Figure 6.3. Passing Events in relational Space



(a) Non-occurring: relational space

(b) Occurring: topographic space

top
BUILDING-A$_a$ BUILDING-B$_b$ IX3$_c$ #BELL ext-CL:C-C-EXTEND$_{[tower],c}$…
(a) ?? IX1 $_a$COMMUTE$_b$ / $_a$GO-TO$_b$
(b) OK: IX1 w/e-CL:1-$_a$GO$_b$++
'I pass by the bell tower from Building A to Building B again and again.'

BRIDGE (6.7) is unacceptable.[3] Instead a separate verb, USE, is needed to express a crossing event and, thus, the MEP is lifted.[4]

(6.7) a. $\overset{\text{top}}{\overline{\text{SCHOOL}_\text{a}\ \text{HOME}_\text{b}}}$ IX1 $_\text{b}$GO-TO$_\text{a}$ THROUGH TREE++
'I went from home to school through the woods'

a′ $\overset{\text{top}}{\overline{\text{SCHOOL}_\text{a}\ \text{HOME}_\text{b}}}$ MONDAY IX1 $_\text{b}$GO-TO$_\text{a}$ THROUGH TREE++ (*TUESDAY)
'On Monday I went from home to school through the woods (*on Tuesday)'

b. * $\overset{\text{top}}{\overline{\text{SCHOOL}_\text{a}\ \text{HOME}_\text{b}}}$ IX1 $_\text{b}$GO-TO$_\text{a}$ ACROSS BRIDGE
'I went to school across the bridge'

b′ OK: $\overset{\text{top}}{\overline{\text{SCHOOL}_\text{a}\ \text{HOME}_\text{b}}}$ IX1 $_\text{b}$GO-TO$_\text{a}$ USE BRIDGE
'I went to school using the bridge'

In sum, the expression of source, goal, and via was present within a single event in relational space. There are certain cases where only goal appears, some where source and goal appear, and fewer where source, goal, and via appear. Because all three roles may be expressed within a single event, relational space in ASL patterns like a Type I language.[5]

As for the other facet of the AUC, that only one role of each type may be assigned within a macro-event, there were a number of ways to test this. Certain relational verbs always encode a particular semantic role (e.g. GO-TO, goal; GO-OUT, source), and likewise with prepositions (e.g., TO, goal; FROM, source). It was found that two

[3]I did not test whether a simpler sentence, like IX GO-TO SCHOOL ACROSS BRIDGE, is possible. However, the focus of this work is how many different roles may be expressed within a single event (three: source, goal, and via), and not the peculiarities of certain combinations.

[4]I assume, without direct evidence, that USE is a verb. Further testing may show that it may be used as a preposition.

[5]B et al. do not elaborate on how typological the AUC is. That is, to my understanding, a typology concerns a constellation of inter-related or unrelated phenomena that are common to a group of languages, which themselves may or may not be genetically related. B et al. have proposed a loose correlation between AUC Types and Talmy's Motion Event typology, but also note that the availability of certain syntactic structures (outside of lexicalization) also account for variability between types. Thus, it is not exactly clear what we gain from the fact that ASL patterns like a Type I language in relational space (and nor will it really matter much how topographic space patterns in ASL or any other sign language for that matter).

verbs encoding the same semantic role were not permissible within a single macro event (6.8a). Similarly, two prepositions encoding the same semantic role were also unacceptable within the same macro event (6.8c).

Next, combining verbs and prepositions which assign the same role should result in unacceptability. As expected, then, (6.8b) is unacceptable. Lastly, if two different grounds are set up in the same spatial locus, it might be the case that both grounds receive the same role from the same verb (i.e. via directionality). This, too, results in unacceptability (6.8d).

(6.8) a. *JOHN $\overline{\text{GO-TO SCHOOL GO-TO WORK}}^{\text{mm}}$
Verb + Verb

b. *JOHN GO-OUT/LEAVE$_a$ HOME$_a$ FROM WORK
Verb + Preposition

c. *JOHN GO-TO WORK FROM HOME FROM SCHOOL
Preposition + Preposition

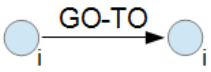
d. * $\overline{\text{SCHOOL}_a \text{ WORK}_a}^{\text{top}}$ JOHN GO-TO$_a$[6]
Verb Locus

Before moving on, I'll mention a few limitations of the RUC data just reported: one the fault of the researcher, the other an accident of the language. First, it was discovered only after the elicitation that at least one via-denoting verb exists in ASL: PASS. As this verb was not part of the elicitation, combinations of PASS with other verbs and prepositions are left for future research. Second, there are certain restrictions in ASL on which prepositions show up and where. For instance, in all cases TO or its fingerspelled variant, #TO, were illicit, no matter what (motion event) context was provided.

Turning now to the RUC, there was evidence to suggest that it may not be violated in relational space. As noted before, the form GO-TO has a lexically specified, linear path movement, which may only be modified by a closed-class of inflectional morphemes (e.g., aspectual modification, Klima & Bellugi, 1979; [Extra], Wilbur,

[6]Under the understanding that John does not work at the school.

Figure 6.4. Two loci representing a single ground, with GO-TO



2010). Importantly, the morpheme [tracing] (Brentari, 1998) is not included in this set.

Because path movement cannot be modified such that GO-TO is articulated away from and back toward a single locus in space, a singular ground referent was established at two distinct loci instead (6.9a; Fig. 6.4). This strategy, however, was also found to be unacceptable. Finally, it was also unacceptable to sign multiple (frozen) verbs, such that one leaves from the locus of the source and the other returns to the locus of the source all within one macro-event (6.9b,c).[7] The (b) and (c) examples, however, are fine so long as they are multi-eventive (b′,c′). Here, no posture nonmanual scopes over both verbs, and an optional event sequencer (FINISH) can be inserted between them.

(6.9) a. With the understanding that the schools are identical
* $\overline{\text{SCHOOL}_i\ \text{IX3}_a\ \text{SCHOOL}_i\ \text{IX3}_b}^{\text{top}}$ IX1 $_{i,a}$GO-TO$_{i,b}$
'I went from school to school'

b. BATHROOM$_a$. $\overline{\text{GO COME-BACK}_a}^{\text{mm(?)}}$

b′ [I forgot something at home]
IX1 GO-TO$_a$ (GRAB PAPER) (FINISH) $_a$COME-BACK

c. * $\overline{\text{BATHROOM}_a}^{\text{top}}$ $\overline{\text{GO-TO}_a\ {}_a\#\text{BACK}}^{\text{mm}}$

c′ $\overline{\text{BATHROOM}_a}^{\text{top}}$ GO-TO$_a$ (FINISH) $_a$#BACK

The last thing to consider is whether multiple roles can be assigned to a single ground by a verb and preposition, or two prepositions. As just mentioned, TO and

[7]Note, too, that these would be in violation of the UVC, since there is an encoded and entailed change of direction. AWAY-FROM and TOWARDS. See below, (§6.1.2 & 6.2.2).

its variant, #TO, were independently not acceptable in motion event contexts. Additionally, the verb PASS coupled with a via-denoting preposition (e.g., THROUGH, ACROSS) was not tested. What's left, then, is the preposition FROM: it was found that FROM cannot be coupled with a source-denoting verb (e.g. GO-OUT; 6.10a) or with another source PP (6.10b).

(6.10) a. MAN GO-TO$_{a}$ SCHOOL$_{i,a}$ FROM SCHOOL$_{i}$
Verb + Preposition

b. MAN GO-TO$_{a}$ SCHOOL$_{a}$ FROM HOME FROM WORK
Preposition + Preposition

Summing up, then, relational space does not encode more than one source, goal, or via role per event, although all three roles may appear together. As for the RUC, with exception for via-denoting verbs and preposition–which were not tested–a single ground may only receive one semantic role. As expected, then, verbs with relational semantics do not violate either the AUC or RUC.

6.1.2 UVC

The UVC requires that all events unfold along a singular, unidirectional vector. That is, if an expression denotes more than one vector, the UVC is violated. If an expression's singular vector is non-linear (i.e. there is a direction change), and this non-linearity is both encoded and entailed, then the UVC is similarly violated.

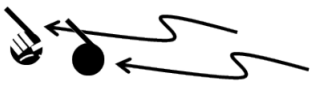
As relational space was characterized in (§3.2; and just now in §6.1.1), path shape is always linear. The data that I collected confirmed this: for one, all forms elicited had linear path movement, and secondly, adding non-linear path movement to GO-TO was unacceptable (Fig. 6.6). As such, the first requirement of the UVC is satisfied. However, on the face of it, clauses with quantification contain more than one path: In cases of goal quantification (e.g. 6.11a; Fig. 5.3a repeated as Fig. 6.5a), there are three separate vectors, each pointed in a different directions. As for event quantification, the path of the verb is repeated (6.11b; Fig.6.5b). To be sure, expressions like these are macro-eventive (6.12).

Figure 6.5. Reduplication in Relational Space

(a) Goal quantification; $\text{VERB}_{[\text{distr}]}$

(b) Event quantification; VERB++

Figure 6.6. Illicit Path Modification in GO-TO



(6.11) a. $\overset{\text{top}}{\overline{\text{3 WS}}}$ IX1 GO-TO$_{\text{[distr]}}$
'I went to each workshop'

b. $\overset{\text{top}}{\overline{\text{WS}}}$ IX1 GO-TO++
'I went to the workshop several times'

(6.12) $\overset{\text{top}}{\overline{\text{SCHOOL BANK STORE}}}$ MONDAY IX1 GO-TO$_{\text{[distr]}}$ (*TUESDAY)
'On Monday I went to school, the bank, and the store (*on Tuesday)'

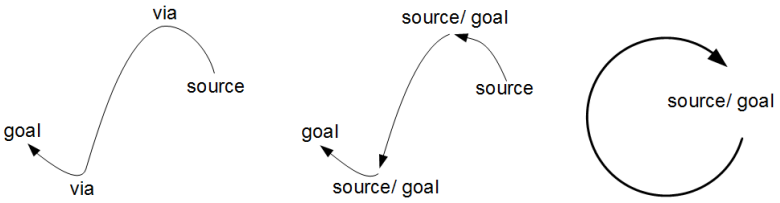
Another thing to consider is that ASL is a serializing language: Supalla (1990) discusses manner + path SVCs, where the manner verb is always a frozen form (e.g., WALK, RUN; at least in his data) and the path verb is always some classifier construction. To my knowledge, no one has documented the serialization (or chaining) of frozen forms (e.g., GO-TO + GO-TO).[8] This part is already partially explained in the discussion of the RUC results. There it was discussed that multiple instances of GO-TO, #BACK, or other directional motion verbs, with each verb pointing in a different direction, are unacceptable (for reasons of multiple semantic role assignment). Here, too, we might ascribe this to a UVC violation.

To be sure though, one example showed that the UVC is respected even in cases where these verbs are directed towards separate points (i.e. $\rightarrow\uparrow$; 6.13). In (6.13), the first instance of GO-TO is directed towards locus *a*, away from and to the left of the signer's body. The second instance is articulated from locus *a* parallel to the signer's body towards locus *b*. If (6.13) is mono-eventive, then the two differently-directed instances of GO-TO would be in violation of the UVC. However, it turns out that each verb may be located by a separate time adverbial, so the expression is not mono-eventive. In no way, then, was relational space found to be in violation of the UVC.

(6.13) (TIME^9) JOHN GO-TO$_{\text{a}}\uparrow$ SCHOOL$_{\text{a}}$ (TIME^10) $_{\text{a}}$GO-TO$_{\text{b}}\rightarrow$ WORK$_{\text{b}}$

[8]Benedicto, Cvejanov, and Quer (2008) discuss cases in LSC and LSA where motion SVCs form sandwiches, but do not show if these verbs may be directed towards different referential or spatial loci.

Figure 6.7. AUC in Topographic Space



(a) Routes in Topographic Space

(b) Source/ Goal in Topographic Space

(c) RUC violation

Taken all together, relational space abides by the AUC, RUC, and UVC as predicted. Once again, no more than one type of semantic role can be encoded within a single macro-event expression in ASL, and similarly, no one ground may receive more than one semantic role. As far as the number of different types of roles that can be encoded within a single macro-event expression, ASL patterns with Type I languages, allowing source, goal, and via roles (although routes were rare and only truly showed up as prepositions). Finally, it appears that two motion verbs with relational semantics are never within the same macro-event, but span across (at least) two. As such, the UVC is respected. However, there are further complexities with the AUC and UVC with respect to quantification. These issues will be discussed in the next chapter (§7.1.1).

6.2 Topographic Space

6.2.1 AUC & RUC

Source and goal were readily found in topographic space, both in topics and as markers on the verb. In addition, via was also present in topographic space, though its status is not clearly defined.[9] Lexically, via is introduced in a topic phrase much

[9]This is the same via-denoting strategy as reported in 6.1.1, whereby a ground set up in a region in space, which itself is not associated with any theorized argument slots, is nevertheless interpreted as being an intermediary ground.

like source and goal. Logically, the via-denoting ground is signed after the source and before the goal grounds (this ordering, in fact, is the only one attested), however, the extent to which the ordering of the lexical items corresponds with the interpretation of source, via, and goal is unknown.

There were two constructions that I elicited: In the first, via was not expressed. Instead a series of events containing sources and goals was signed (6.14; see Fig. 6.7b). Pauses and blinks occurred between sources and goals, suggesting multiple events. That is, the verb moved from a source locus to a goal locus. The goal locus of the first event would then become the source locus in the following event. Breaking up a larger motion event into smaller events in this manner was strongly preferred.[10]

(6.14) JOHN DECIDE GO-OUT SHORT TRIP DRIVE++. FROM NYC w/e-CL:3-$_{a}$GO$_{[drive],b}$ TORONTO. w/e-CL:3-$_{b}$GO$_{[drive],c}$ DALLAS. w/e-CL:3-$_{s}$GO$_{[drive],d}$ L.A.
'John decided to go on a sort trip. He drove from NYC to Toronto, from Toronto to Dallas, and from Dallas to LA.'

In the other, the verb itself moves from the locus of the source, to the location of the intermediate ground(s), and moves to the locus of the goal without stopping. The location of the intermediate ground has an effect on the shape of the path (6.15; see Fig. 6.7a), suggesting that path modification is used to 'encode' via roles. This construction was monoeventive, in that there were no pauses or blinks while the predicate was signed.[11] What's more, a PNM scoped over the entire predicate, suggesting that all three verbs are located within the same VP. In addition, the distribution of temporal locators (here time adverbs) indicates that these expressions are monoeventive (6.15b). Because source, goal, and via can all be encoded within one clause, ASL behaves like a Type I language in topographic space.

[10]Participant A said that the smaller event chunk form was more clear. Participant B did not produce the larger event contour on her own, but accepted the form when presented with it on another occasion.
[11]A slight pause and a blink did sometimes occur between the topic and assertion, however.

(6.15) a. $\overline{\text{NYC}_\text{a}\ \text{TORONTO}_\text{b}\ \text{DALLAS}_\text{c}\ \text{L. A.}_\text{d}}^{\text{list}}$ JOHN
$\overline{\text{DRIVE w/e-CL: 3-}_\text{a}\text{GO}_{\text{[drive], b, c}}\ \text{ARRIVE}_\text{d}}^{\text{mm}}$.
'John drove from NYC through Toronto through Dallas to LA.'

b $\overline{\text{NYC}_\text{a}\ \text{TORONTO}_\text{b}\ \text{DALLAS}_\text{c}\ \text{L. A.}_\text{d}}^{\text{list}}$ TUESDAY JOHN DRIVE w/e-CL:3-$_\text{a}$GO$_{\text{[drive], b, c, d}}$ (*NEXT TUESDAY)

b′ $\overline{\text{NYC}_\text{a}\ \text{TORONTO}_\text{b}\ \text{DALLAS}_\text{c}\ \text{L. A.}_\text{d}}^{\text{list}}$ TUESDAY JOHN DRIVE w/e-CL:3-$_\text{a}$GO$_{\text{[drive], b, c, d}}$ $|_{\text{EV}}$ ARRIVE$_\text{d}$ NEXT TUESDAY

The presence of two via-roles (or intermediary grounds, at least) suggests already, then, that topographic space is not bound by the same constraints as relational space. On the other hand, more than one via role may be assigned in topographic space, although it does not seem possible to assign a third (at least in the road trip scenario). It could be the case that ASL may assign two via roles. However, for reasons that will be outlined in the next sections, it may be more harmonious to think of this restriction (i.e. 'no more than two via roles') as being one from an extra-linguistic source (e.g. memory, cultural conventions, etc.), rather than a formal linguistic constraint.

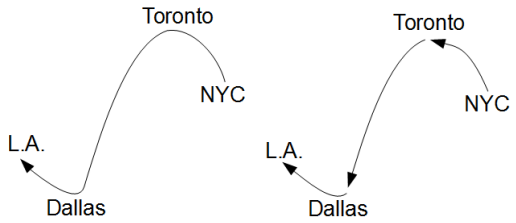
Lastly, one (possibly two) data points show that the RUC may be violated. In this example, the figure (a boy) leaves a tree and returns to that same tree in one fluid movement (6.16a,b; schematized in Fig. 6.7c). The tree, then, is both the source and the goal of the event. (6.16a,b) appear to be monoeventive (and not a sequence of two classifier verbs) due to their smooth, uninterrupted path movements, and–in (a)–the fact that a posture nonmanual scopes over the entire predicate.

(6.16) a. $\overline{\text{TREE}}^{\text{top}}$ BOY WALK $\overline{\text{w/e-CL: 1-}_\text{a}\text{GO}_\text{a}}^{\text{mm}}$

b. $\overline{\text{TREE}}^{\text{top}}$ BOY WALK [trace circle]
'The boy walked from the tree$_\text{i}$ to the tree$_\text{i}$'

To sum up, because source, goal, and via roles may be assigned within a single macro-event, topographic space patterns like a Type I language, just like relational space. Additionally, via roles were dispreferred or otherwise scare in both spatial functions. Despite this, multiple via roles were found in topographic space, which is

Figure 6.8. Path curvatures for *I went from NY to L.A. via Toronto (and) Dallas*



(a) Single event contour

(b) Multi-event contours

in violation of the AUC. What's more, the ability for the same ground to receive two thematic roles (here, source and goal) violates the RUC.

6.2.2 UVC

As was outlined above (§3.2), paths in topographic verbs may theoretically take on an infinite number of forms. Because of this, it is expected that topographic constructions do not obey the UVC. This hypothesis was supported. To take an example from the data, Participant A described an event of going from New York City to Los Angeles by way of Toronto and Dallas. Here, the verb began at the locus of NYC and traveled up in the signing space to the locus of Toronto. Then the verb travelled downwards to the locus of Dallas, and finally arrived at the locus of LA.

The entire construction was monoeventive as evidenced by the singular, continuous movement of the verb (6.15, reproduced below as 6.17; see also Fig. 6.8a). That is, no pauses, blinks, or other nonmanuals were inserted at pivot points. What's more, a PNM ('mm') scoped over the entire predicate, indicating further that it was conceived of as a single event. Lastly, only one temporal locator could be used in this construction. Specifying on which days the driver reached each city was unacceptable (6.17b). So, it seems, then, that changes in direction are possible within an event in topographic space. However, as outlined in (§2.1.3), B. et al. claim that the UVC

is only violated when a change of direction is encoded (e.g., *up across*) and entailed (e.g., *zigzag*). I'll explore what these criteria might mean for topographic verbs in the next section.

(6.17) a. $\overline{\text{NYC}_\text{a}\ \text{TORONTO}_\text{b}\ \text{DALLAS}_\text{c}\ \text{L. A.}_\text{d}}^{\text{list}}$ JOHN DRIVE
$\overline{\text{w/e-CL: 3-}_\text{a}\text{GO}_{\text{[drive], b, c}}\ \text{ARRIVE}_\text{d}}^{\text{mm}}$.
'John drove from NYC through Toronto through Dallas to LA.'

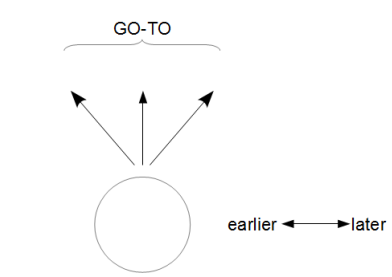
b. * $\overline{\text{NYC}_\text{a}\ \text{TORONTO}_\text{b}\ \text{MON DALLAS}_\text{c}\ \text{WED L. A.}_\text{d}\ \text{FRI}}^{\text{list}}$ JOHN DRIVE...
'John drove from NYC through Toronto Monday through Dallas Wednesday to LA Friday.'

Despite the fact that a continuous curvilinear path may be signed, there appeared to be a preference to break up the larger event into component events. For instance, Participant A felt that it was "more clear" if the L.A. trip was broken down into individual events: the NYC to Toronto leg, the Toronto to Dallas leg, and finally the Dallas to L.A. leg. Component legs could each be bound by a singular temporal locator. Participant B, despite being presented with schematics that showed single, curvilinear paths, always broke the trips up into several events. Note, too, that the English stimuli she was given were written in such a way as to encourage a mono-eventive reading, even if they were ill-formed English sentences (e.g. *I drove from NYC through Toronto through Dallas to LA*). Component events nominally obeyed the UVC.

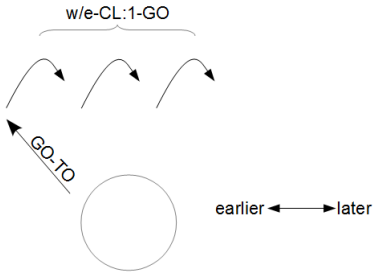
Taking stock, topographic verbs do not strictly adhere to the linguistic constraints on event encoding laid out by Bohnemeyer et al. The AUC may be violated, in that two identical via roles may appear within the same event. The RUC is violated since one ground may receive two different semantic roles. Finally, the UVC is violated, in as much as path shapes are not linear (again, I will discuss what this may mean in the next section).

However, there did appear to be certain limits: via, and not source or goal, was the only semantic role to be assigned twice (and more than two was unacceptable).

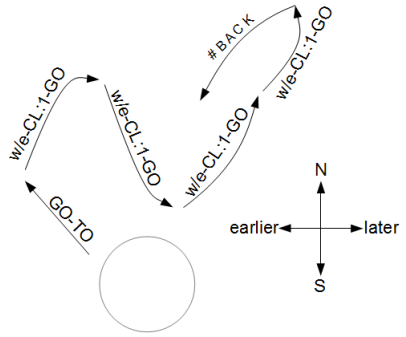
Figure 6.9. From left to right: less spatial/ temporal information → more spatial/ temporal information



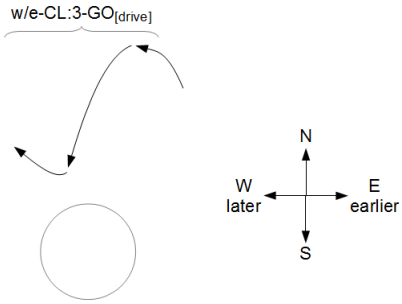
(a) No spatial/ temporal contiguity



(b) Temporal contiguity



(c) Temporal contiguity, some spatial relations



(d) Spatial/ temporal contiguity

In addition, the traveling events were most easily segmented into separate chunks, with roughly linear movements between sources and goal.

In the next section, I return to the apparent separation of spatial functions, and how well the methodological considerations observed (see again §5.2.1) predicted the use of each function. This section will also set up the groundwork for discussion of the status of paths and referential loci as linguistic elements in each spatial function.

6.3 Functions of Space Driven by Encyclopedic/ Real-World Knowledge

As previously mentioned, I used three factors to control which spatial function was used: handshape, the amount of available spatial information, and quantification

of goals or events. It happened to be that in all of the test items, all three factors were present or absent. That is, Items A used a particular handshape, x, used a reduplicated verb form, and were noncommittal about space or temporal contiguity (and vice versa for Items B). It was not the case that any A item used an x handshape, used a reduplicated verb form, but was nevertheless spatially/ temporally enriched. As such, there is no way of knowing which factor was the most influential or influential at all (as this was not the focus of this thesis).

In my data, the choice of spatial function was partially dependent on real-world knowledge. In situations where the spatial arrangement of each location was unknown, both signers used relational space (6.18a,b; Fig. 6.9a). For instance, Participants A and B sign an event, in which the Figure travels to three different places: a series of three workshops, and a school, a bank, and a store, respectively. No particular school, bank, or store, or suite of workshops were assumed, so the spatial relationship between these locations was not retrievable. Both signers set up each location from left to right at a locus along the event time-line in sequential order (e.g., first, the Figure went to school, then to a bank, and finally to a store). Then, both signers used the form GO-TO$_{[\text{distr}]}$ (and not a classifier).

(6.18) a. $\overline{\text{\#WS}_\text{a}\ \text{\#WS}_\text{b}\ \text{\#WS}_\text{c}}^{\text{top}}$ TEACHER GO-TO$_{[\text{distr}]}$
'The teacher went to each workshop'

b. $\overline{\text{SCHOOL}_\text{a}\ \text{BANK}_\text{b}\ \text{STORE}_\text{c}}^{\text{top}}$ IX1 GO-TO$_{[\text{distr}]}$
'I went to school, the bank, (and) the store.'

In addition to not specifying the spatial relationships between locations, it appears that temporal contiguity is also not entailed (however, sequence order *is* entailed). Both signers insisted on using a classifier construction when it was understood that the figure immediately went from one location directly to the next, a point to which I'll return shortly below (6.20).[12]

[12]In many instances, the signers used different classifier handshapes. In this instance, Participant A used the 1-handshape, while Participant B used the bent-V-handshape.

Conversely, when the spatial arrangement of the grounds was known to the signers, topographic space was used. In one example where the signers were asked to describe a road trip across the United States and Canada, locations of the major cities visited were set up from *right to left* (i.e. not left-to-right, as on the event timeline) and as if on a map (6.19; Fig. 6.9d). For instance, Toronto was set up at some locus 'north' and 'west' (or, neutrally up and to the left of) the locus of New York City. The locus of Dallas was then set up 'south' and 'west' of Toronto and so on. Only a classifier construction (specifically, w/e-CL:3-$GO_{[drive]}$) was used. Lastly, this construction forces an interpretation where time and space are understood to be contiguous.

(6.19) READY GO-OUT #TRIP. EXCITED. NYC_a $_a$w/e-CL:3-$DRIVE_b$
$CANADA_b$. $_b$w/e-CL:3-$DRIVE_c$ #$DALLAS_c$. $_c$w/e-CL:3-$DRIVE_d$ #LA_d.
$_c$w/e-CL:3-$DRIVE_d$ $ARRIVE_d$
'[I'm] excited to go on a trip. I drove from NYC to Canada, then from Canada to Dallas, then from Dallas to L.A.'

In the two above cases, only one spatial function was used (relational only for the workshop-going event, and topographic only for the road-trip event). However, there were additionally two in-between cases, where it seems that both functions of space were used simultaneously. The first is when a signer wants to indicate temporal contiguity without explicit knowledge of (or desire to express) the geographical relations between locations. Here, both participants used the event timeline with a classifier construction (6.20), as schematized in (Fig. 6.9b). In this example, an event is described where a teacher must go to three different workshops, one immediately after the other. GO-TO is articulated towards the locus of the first workshop, but w/e-CL:1-GO (Part. A) or bp-CL:bentV-HOP (Part. B) is articulated from the locus of the first workshop to the locus of the second, and then from the second to the third. While the classifier construction is needed to force the temporal contiguity of each *going to a workshop* event, the locations of the workshops relative to each other remains unknown.

(6.20) $\overline{\text{\#WS}_\text{a}\ \text{\#WS}_\text{b}\ \text{\#WS}_\text{c}}^{\text{top}}$ 3 IX-3$_{\text{a-c}}$. w/e-CL:1-GO$_\text{a}$. w/e-CL:1-GO$_\text{b}$. w/e-CL:1-GO$_\text{c}$
'[The teacher] went to each workshop, one after the other'

The other in-between case also involves classifiers and the event time-line, such that locations we set up along the time-line, but additionally used the vertical plane (6.21a; Fig. 6.9c). In this case, some (but not all) spatial relationships were known between each location: Santa's Workshop is traditionally at the North Pole, the South Pole is on the opposite end of the planet from the North Pole, Neverland is somewhere up and away from Earth, and so is the moon. Here only basic information (North-of or South-of relations) is known. So, Participant B signed GO-TO to the locus assigned to the first location, then used a classifier to show that the second location was North of the first.[13] Then, she used another classifier to show that the third location was south of the second, and so on.

(6.21) a. #TEDDY GO-OUT SECOND TRIP. FIRST GO-TO$_\text{a}$ SANTA #WORKSHOP$_\text{a}$ FINISH, $_\text{a}$w/e-CL:1-GO$_{\text{[down],b}}$ SOUTH #POLE$_\text{b}$ FINISH, $_\text{b}$w/e-CL:1-GO$_{\text{[up],c}}$ #NEVERLAND$_\text{c}$ FINISH...

'Teddy went on a short trip. First he went up to Santa's workshop, then down to the S. pole, then up to Neverland, then...'

b. FIRST #TEDDY GO-TO SANTA #WORKSHOP FINISH, GO-TO #WONDERLAND FINISH, GO-TO #MT-OLYMPUS, LAST GO-TO #NEVERLAND

'Teddy first went to Santa's workshop, then to Wonderland, on to Mt. Olympus, and finally to Neverland'

I'll mention again that the (total?) lack of spatial information about goal referents predicts choice of spatial function, by contrasting (6.21a) and (b). Both were responses given by Participant B to adjacent test items. In the (a) case, Participant

[13]It is interesting to note that GO-TO was articulated towards the first locus, instead of w/e-CL:1-GO (as with all the other *going* events in this example). In addition, this first locus was at a neutral height. However, Santa's workshop *does* have an associated semi-exact geographical location (i.e. the North Pole), so the choice not to articulate GO-TO or w/e-CL:1-GO towards a locus 'up' (i.e. at a non-neutral height) in the signing space is mysterious. It awaits to be seen if this choice is possible and, if so, whether it has a different meaning from (6.21a). Potentially, though, the first point in a series of motion events may serve as a reference point and is thus set up at a neutral height.

B could retrieve partial spatial relationships between ground referents. However, she could not in the (b) case, which differs minimally in the grounds chosen. As such, Participant B used a classifier construction in the (a) case and the less informative GO-TO in the (b) case.

Finally, there was more direct evidence that enriched spatial or temporal information is incompatible with relational verbs: In an example where a single goal referent (a workshop) was understood to occur in three different locations (say, a classroom, a gymnasium, and an auditorium), neither signer *accepted* GO-TO$_{[\text{distr}]}$, or the articulation of the verb towards three loci in space, one locus representing a real-world location change (6.22a). Conversely, when three goals were understood to occur in the room (auditorium), neither signer accepted GO-TO++, which, again, would have agreed with the number of spatial locations in lieu of the number of referents (6.22b).

(6.22) a. [There's a big conference going on in the Stewart Center with many different workshops happening concurrently.]

$\overline{3\,\text{WS}}^{\text{top}}$ TEACHER *GO-TO++/ GO-TO$_{[\text{distr}]}$

'The teacher went to three workshops'

b. [There's a workshop going on all month. Its location changes everyday. Sometimes it's in the auditorium, sometimes in the gym,...]

$\overline{\text{WS}}^{\text{top}}$ TEACHER GO-TO++/ *GO-TO$_{[\text{distr}]}$

'The teacher went to the workshop again and again'

When goals were set up off of the event timeline, GO-TO could not be used to show movement to these locations. That is, in one example, where a teacher is going between rooms in a building, these rooms were established in the signing space in accordance with a building plan. As such, the office was located down the hall from a conference room and so on. Only a classifier construction (here, w/e-CL:1-GO) could be used to describe movement to and from these rooms.

(6.23) [Where the grounds are set up off of the event timeline]
*WS_a $MEETING_b$ $CLASSROOM_c$ $OFFICE_d$ TEACHER GO-TO_a, GO-TO_b, GO-TO_c, GO-TO_d
'The teacher went to the workshop, meeting (room), the classroom, and the office'

There are a few interesting things to conclude from this little excursion: (1) There is no hard line between spatial functions. It seems that topographic and relational space may be used sequentially (6.18a,b; 6.19) or simultaneously (6.20; 6.21a). (2) The assignment of spatial loci can be dependent on encyclopedic knowledge (6.21a cf. b). (3) Relational space, or at least GO-TO, has grammaticalized in such a way as to be noncommittal about temporal or spatial contiguity: to achieve temporal contiguity between events, a classifier is needed (6.20). Further GO-TO is directed at and agrees in number with referents, and not the spatial location of those referents (6.22a,b). Adding spatial information to non-specific, everyday grounds (e.g., the office is here, the conference room is here...) required the use of a classifier instead of GO-TO (6.23).

7. DISCUSSION

7.1 Relational Verbs

7.1.1 AUC/ RUC

Multiple Goals

Recall from earlier (§6.1.1) that semantic roles come in two, possibly three, flavors. First, they may be assigned to full-fledged DPs by some verb or preposition. Second, they may appear as markers on the verb, both in cases where they co-occur with DPs and in cases where they occur alone (i.e. in those cases where a referent has been set up in space previously in the discourse, and the verb moves from, to, or by that locus). These first two methods will be discussed directly below. Lastly, semantic roles may (potentially) be conveyed by loci in space directly. This last option seems to only be available for via, as will be discussed in (§7.1.1; see also the discussion of via in topographic space, §7.2.1).

In §6.1.1 I reported that source was initially not found within the same macro-event expression (MEE) in relational space. However, it was also the case that these initial items all contained a reduplicated verb (i.e. event or goal quantification). As soon as quantification was dropped, source and goal both readily appeared within the same MEE. This patterning is not unique to GO-TO, as other verbs that make use of relational space (= agreement verbs/ directional verbs) show source and goal (7.1a). However, as soon as the verb is reduplicated, source drops out (7.1b) (examples from Matsuoka, 1997 and Braze, 2004). The morphological facts discussed above all indicate that GO-TO is formalized within the linguistic system at least as much as agreement verbs are.

(7.1) a. DOG_{a} CAT_{b} $_{a}\text{BITE}_{b}$
'The dog bit the cat'

b. DOG_{a} CAT_{b} $\emptyset\text{BITE}_{b[\text{iter(ative)}]}$
'The dog kept biting the cat'

(7.2) a. $\overline{\text{SCHOOL BANK STORE}}^{\text{top}}$ IX1 GO-TO++

b. I went to school, the bank, *(and) the store.

b′ I ate an apple and (then) an orange (all at once)

c.

hok⁶haau⁶	*ngan⁴hong⁴*	*jau⁴guk⁶*	*ngo⁵*	*dou¹*	*heoi³*
school	bank	post-office	I	distributive	go

gwo³
Asp.experiential
'The school, the bank and the post office, I went to each of them.'
[Cantonese]

Along these same lines, both GO-TO and BITE, as members of the set of relational verbs, are able to express multiple goals, in a sense (7.2a), and do so without overt conjunction (as is required in English; 7.2b). B. et al. note that the presence of overt conjunction may be grounds for a multi-macro-eventive interpretation (along the lines of *I went to school and I went to the bank and...*), which certainly works for the English example. They also note collective readings, as in (b′), where the utterance is ambiguous between a multi-eventive expression (*apple and then orange*) and a collective, mono-eventive expression (*apple and orange all at once*). However, they do not explicitly discuss distributive readings (although Bohnemeyer, 2003 does discuss aspect briefly). So then, again, at first blush the utterance in (a) seems to violate the RUC, by allowing three goals within a single macro-event expression.

But notice that among ASL (7.2a) and Cantonese (7.2c; and Mandarin, among others, I'm sure), English is the odd one out, in that it cannot express the distributive over non-identical DPs. (That is, *I went to three stores* cf. **I went to the store, the bank, the post office*). Or, more precisely, English syntax does not allow for multiple DPs without conjunction. So, the English examples (b,b′) are ambiguous between a

macro-event reading and a multi-macro-event reading, while the ASL and Cantonese examples are not.

However, the underlying semantics should be common among the three languages. Universally, (7.3a) should be disallowed (by the definition of the AUC), since there are multiple goal functions within a single MEE, each of which is potentially bound by a separate temporal locator. (7.3b), on the other hand, takes a list of grounds as the argument of a single goal function, yielding the unambiguously mono-eventive ASL and Cantonese examples (7.2a,c) and one of the two interpretations of the English example in (7.2b). Finally, (7.3c) represents the other interpretation of (7.2b), in which there are multiple MEEs.

(7.3) a. $*\exists e, x, y, z[GO(e, John) \wedge Goal(e, x) \wedge Goal(e, y) \wedge Goal(e, z)]$
= go to x to y to z within same time interval

b. $\exists e, x, y[Eat(e, John, [x, y])]$
= eat x and y at the same time/ within same time interval

$\exists e, x, y, z[GO(e, John) \wedge Goal(e, [x, y, z])]$
= go to x, y, and z within the same time interval

c. $\exists e_1, x[Eat(e_1, John, x)] \wedge \exists e_2, y[Eat(e_2, John, y)]$
= eat x and y at different times

$\exists e_1, x[GO(e_1, John) \wedge Goal(e_1, x)] \wedge \exists e_2, y[GO(e_2, John) \wedge Goal(e_2, y)]...$
= go to each location at a different time

Lastly, recall that semantic roles are expressed as full DPs (as just discussed) and also as markers attached to verbs.[1] So, what of these verb markers? In an event with a singular goal, GO-TO (for example) is directed towards the referential locus of that goal. The referential locus is related, through some (possibly gestural/ extra-linguistic; Mathur, 2000; Lillo-Martin & Meier, 2011) process, to a referential index (linguistic) that attaches to the end of the verb. In case the verb is directed towards more than one locus in space, it is conceivable that there are multiple goal markers, which might–again–open the door to an AUC violation.

[1]Noting again that the nature of the attachment process–affixation, cliticization, or other–is not itself uncontroversial. See *Theoretical Linguistics* 2011, Vol 37.:3–4. I stay neutral by referring to this process as "attachment."

However, Benedicto and Brentari (2004) claim that this reduplication is morphological. Specifically, there is a morpheme [distr] (for 'distributive') that multiplies the verb root and accounts for its varying directionalities. In support of a morphological treatment of this phenomenon, they claim that locations the $\text{VERB}_{[\text{distr}]}$ is directed to cannot be referenced by indexicals/ pronouns (7.4a). What's more, even in form, the number of repetitions–or copies–is indeterminate (Wilbur, 2009), such that there can be a mismatch between the number of grounds and the number of copies.

On the other hand, if three instances of the verb GO-TO are signed, a signer can refer to each point separately (b). Ultimately, Benedicto & Brentari take this to mean that (a) is mono-eventive.[2]

(7.4) a. $\overset{\text{top}}{\overline{\text{STORE 3}}}$ IX1 $\text{GO-TO}_{[\text{distr}]}$. $\text{IX3}_{?}$ HAVE #SALE
= 'I went to three stores. One of the three had a sale (and I don't know which).'
= 'I went to three stores. Each had a sale'

b. $\overset{\text{top}}{\overline{\text{STORE 3}}}$ IX1 GO-TO_{a} FINISH ${}_{\text{a}}\text{GO-TO}_{\text{b}}$ FINISH ${}_{\text{b}}\text{GO-TO}_{\text{c}}$. IX3_{b} HAVE #SALE
'I went to three stores. The second one had a sale.'

In sum then, although it appears on the surface that multiple goals exist within the same macro-event in ASL, this is indeed just a surface phenomenon. I have argued for a distinction between multiple instances of a particular path function (here, GOAL) and a single instance of that path function taking a list (of sub-goals) as an argument. The former may not occur within a single macro-event, but the latter may. While this distinction is important support for the upholding of the AUC, it is independently motivated by the anaphoric properties of the path function arguments. A singular

[2]Further: phonologically, (b) differs from (a) in that the predicate in (a) is reduced while those (b) are not. In (a) the verb is articulated from the neutral location in front of the signer, then the verb resets to a location nearer to the signer, yet not back to the point where it originated from (Wilbur, 2009). Each successive iteration may involve further truncation of the path movement, much like a bouncing ball coming to rest. In the (b) case, however, the form of the predicates are less reduced, with each verb originating from the same signing region, and there are noticeable pauses between verbs as well as optional blinks. These pauses and blinks are indicative of IP boundaries, which predict clause boundaries (see again §2.2.1).

argument (e.g. [...GOAL(e,x)...]; 7.4b) is available for unique reference, while an individual in a list argument (e.g. [...GOAL(e,[x,y,z])...]; 7.4a) is not.

Status of Via

In (§6.1.1), I reported that via roles are (potentially) present in relational space. In the example elicited (6.6; repeated below as 7.5), the loci for two cities (Lafayette and W. Lafayette) were established first, followed by the locus representing a bridge that connects them. All three loci were set up such that they formed a straight line. Then, the verb COMMUTE was articulated such that it oscillated between the locus representing one city and the location of the other, over the location of the locus referring to the bridge.

(7.5) $\overline{\text{WEST \#LAF IX3}_{\text{a}} \text{ \#LAF IX3}_{\text{b}} \text{ IX3}_{\text{c}} \text{ HAVE BRIDGE. EVERYDAY IX1}}^{\text{top}}$
$_{\text{a}}\text{COMMUTE}_{\text{b}}$
'There is a bridge that connects W. Lafayette and Lafayette. I commute between W. Lafayette and Lafayette via the bridge everyday'

Here, route information is conveyed by a locus in space that is not associated with the beginning or ending of the verb. This is unlike source and goal, which have been argued elsewhere (e.g., Glück & Pfau, 1999; Mathur, 2000, inter alia) to be prefixed and suffixed to the verb. From the data I've collected, it is unclear how to handle this example. As reported in §6.3, relational and topographic uses of space may be used simultaneously, so it is at least conceivable–and to the author, likely– that via is conveyed topographically.[3]

Perhaps more puzzling is that this strategy does not seem to be commonly allowed. In another example, two buildings are set up and an intermediary ground is placed off of the line connecting the buildings, such that the figure would be understood to pass the intermediate ground as opposed to crossing it (as in the previous example). This example, however, was found unacceptable. One possible answer comes in B. et al.'s

[3]One possible way to test this is to see if two intermediary grounds may be expressed in this way. If so, this would entail two via semantic roles, which–as was shown in §6.2.2–topographic space allows.

finding that Jackendoff's singular VIA function can actually be split into different (sub-)functions (i.e. a separate passing, crossing, etc. function; to be elaborated in §7.2.1). Here, then, one function is found acceptable, while the other is not. However, this is purely speculative, and the separating of VIA functions in this way doesn't tell us much (why should *crossing* be favored over *passing*?). What's more, these are only two (nuanced!) examples, both from only one signer, so drawing concrete conclusions here seems premature.

Despite this, ASL behaves like a Type I language–allowing source, goal, and via to all be expressed within a single MEE–since via can be expressed through prepositions. As mentioned before (§5.2.3), I assume that prepositions are a part of ASL's grammar, though some might protest that they historically were introduced via English. Although not the focus of this work, I will add that if it were true that ASL prepositions are identical borrowings from English, they should have the same distribution, which is not what was found (6.7; repeated below as 7.6). Here, the two ASL expressions are identical in structure, but use different prepositional phrases. It is possibly on semantic or lexical/distributional grounds that THROUGH TREE++ is acceptable, while ACROSS BRIDGE is not. And while it remains a puzzle (for now) why one should be acceptable while the other not, (7.6a) shows that source, goal, and via may all be encoded within the same MEE.

(7.6) a. $\overline{\text{SCHOOL}_a\ \text{HOME}_b}^{\text{top}}$ IX1 $_b$GO-TO$_a$ THROUGH TREE++
'I went to school through the woods'

b. * $\overline{\text{SCHOOL}_a\ \text{HOME}_b}^{\text{top}}$ IX1 $_b$GO-TO$_a$ ACROSS BRIDGE
'I went to school across the bridge'

RUC violations

Considering the data collected here, only one example clearly and unequivocally demonstrated that the RUC is not violable in ASL (*verb + preposition* case). In all other cases (*verb + verb*, *locus + verb*), there were no direct indications of RUC

effects. Instead, for those cases, other factors could equally explain the pattern of acceptability.

First, the RUC can be shown to be active in ASL by the use of a verb + preposition construction. Even here, though, there appear to be certain restrictions on what prepositions may be used: TO (or preferably #TO) was dispreferred in every context (7.7b; note the location of the violation, cf. b′).

(7.7) a. *JOHN GO-TO$_{a}$ WORK$_{i,a}$ FROM WORK$_{i,a}$
RUC violation

b. *JOHN GO-OUT$_{a}$ HOUSE$_{i,a}$ *TO/#TO HOUSE$_{i,a}$
RUC violation OR illicit usage of preposition

b′ JOHN GO-OUT$_{a}$ HOUSE$_{a}$ *TO/#TO WORK$_{b}$
Illicit usage of preposition

Next, although it was reported that a singular ground may not receive more than one semantic role, it should be qualified that this observation may be excluded by three unrelated facts about ASL. The first is this: the same referent may not be set up in space in two distinct locations (7.8a).[4] Second, the phonological specification of the path movement of GO-TO and DRIVE-TO is fixed (a straight line), such that adding bends or looping the verb back towards the location of the ground referent is independently impossible (7.8b,c). Finally, Supalla (1990) shows that ASL is a serializing language, in as much as it allows sequences of motion verbs (i.e. I am not aware of any analyses of non-motion event serialization in ASL). These serial constructions, however, are always of the form manner verb (with relational semantics) followed by a path verb (with spatial semantics). The combination of two motion verbs with relational semantics or two verbs with spatial semantics is not attested within a single

[4]There may be cases involving a unique ground, or referent in general, being set up in two different loci in space. This comes with the understanding, however, that such a ground is set up in regions of space referring to different times. That is, Emmorey (2001) discusses what she calls an 'deictic' timeline that runs forward from the dominant shoulder perpendicularly to the body. Referents set up along this timeline gain temporal meaning, such that–for example–MONTH signed directly in front of the signer means 'this month' and MONTH signed forward of the neutral signing space means 'next month.' It may be possible to set up the same referent at different points along this timeline (or potentially other timelines) within a single discourse. Naturally, though, since each referent is anchored in a different time, the MEP can be hardly argued to stand in such cases.

clause.[5] So, although ASL is a serializing language, it appears to be impossible to put two uniquely oriented verbs within the same clause (7.8d,d′). Finally, I'll also mention that GO-TO always requires a goal. The form in (d) is additionally bad in that there is no goal specified for GO-TO; the signer repeatedly asked where the figure went in addition to rejecting the sentence in its entirety.

(7.8) a. *SCHOOL$_{i,a}$ SCHOOL$_{i,b}$ JOHN $_a$GO-TO$_b$
b. *SCHOOL$_a$ JOHN $_a$GO-TO-COME-BACK$_a$
c. *HOME$_a$ STORE$_b$ JOHN $_a$DRIVE-TO$_{b,a}$
d. *SCHOOL$_a$ JOHN $_a$GO-TO$_{\neg a}$ #BACK$_a$
d′ *SCHOOL$_a$ HOME$_b$ JOHN $_a$GO-TO$_b$ #BACK$_a$

(7.9) a. OK: CLASS$_a$ BATHROOM$_b$ IX1 $_a$GO-TO$_b$ (FINISH) $_b$#BACK$_a$
b. OK: HOME$_a$ STORE$_b$ JOHN $_a$DRIVE-TO$_b$ PICK-UP FOOD (FINISH) $_b$DRIVE-TO$_a$

For those examples in (7.8) that were disqualified only by an illicit sequence of differently directed vectors (i.e. c & d), the addition of the perfective marker, FINISH, makes them acceptable. Of course, the addition of FINISH also lifts the MEP, as each event in an event-FINISH-event construction may be independently bound by a temporal locator (7.10).

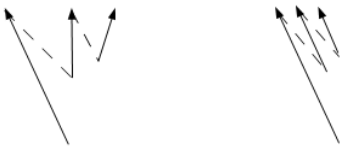
(7.10) TIME^9 JOHN GO-TO$_a$ SCHOOL$_a$ (FINISH) TIME^10 GO-TO$_b$ WORK$_b$

7.1.2 UVC

As with event and goal quantification, discussed above, a similar problem presents itself with reduplicated forms and the UVC: reduplication involves the copying of path, in apparent violation of the UVC's *singular*, unidirectional vector requirement. What's more, in the case of goal quantification, each path copy is directed at a different point in space, meaning that the event is not strictly speaking unidirectional (see Fig. 5.3, repeated here as Fig. 7.1, for illustrations).

[5] Although Zwitserlood (2003) shows that sequences of classifier verbs of motion may be articulated, but that these sequences are distinct CPs without overt (re)articulation of the figure/ subject.

Figure 7.1. Reduplication in Relational Space



(a) Goal quantification; $\text{VERB}_{[\text{distr}]}$

(b) Event quantification; VERB++

With regard to the first objection, that reduplication produces multiple paths, this is not unlike aspect in, e.g., English, as B. et al. claim. Take *I flew from Lafayette to San Francisco three times*. Here, there is only one, unique path: the one the lies between Lafayette and San Francisco.[6,7] *Single*, then, refers to the uniqueness of the path (irrespective of aspectual multiplication; e.g. $\overrightarrow{\text{3x}}$) and, to be sure, that a separate (distinct) vector is illicit within a single MEE (e.g. pointing in a different direction: *The geese migrated West *(and then) South*, $\leftarrow\downarrow$; or in the same direction: *Nick went to Davenport *(and/ $|_{IP}$) on to Moline*, $\rightarrow\rightarrow$).

Finally, no specific extensional path is encoded, such that in $\overline{\text{WS}}^{\text{top}}$ JOHN GO-TO$_{[++]}$ it could be true that John took a different route to the workshop each time (or the same one; we don't know!). The path of the verb does not refer to a specific, extensional path. In all, then, at least in terms of event quantification, where there are multiple instances of the same vector/path, all directed at the same locus, there seems to be no conflict with the UVC.

The second objection, that reduplication can produce multiple paths, each directed at a different locus, stills needs further comment. That is, is it the case that there is a single path that has multiple direction specifications (over time?), or that there are three (or indiscernibly more) distinct paths, or something else? It is here that the most crucial distinction between phonological vectors and semantic vectors must be made: the multiple, multi-directional vectors are the phonological description of the morpheme, [distr]. Semantically, there's not much different between, e.g. $\overline{\overline{3\#\text{WS}}}^{\text{top}}$ JOHN GO-TO$_{[\text{distr}]}$ and its English translation *John went to three workshops*. Neither expression is committed to referring to any extensional paths. It could be the case that all of the workshops form a straight line and that John went to each in a row,

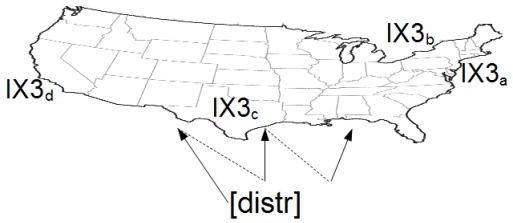
[6]Further, I may add that this path is underspecified, in that it leaves out any and all extensional flight paths the flight may have used.

[7]I'll also add that, as mentioned above, each copy of the path in [++] and [distr] is progressively shorter and shorter. Naturally, this does not imply that the actual, semantic (or extensional) path shortens. The mapping between form and meaning is not iconically motivated in this way, as will be discussed further below.

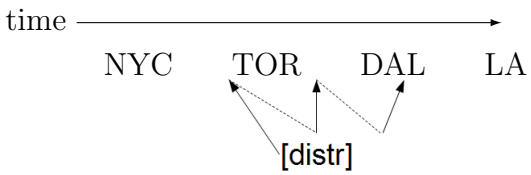
or in various places across town (i.e. such that John actually traces triangular path). That is, in no case is a unique direction encoded or entailed.

There is some further evidence in support of this claim: signers wishing to show spatial relationships between ground referents and how a figure moves between those grounds do not (generally) choose the less informative $\text{VERB}_{[\text{distr}]}$. Further, referents that have been located in non-arbitrary loci in space, such that the spatial relations between referents are understood to be approximately accurate, are not (always) compatible with [distr] (7.11a). Here, the loci for the four cities are established first, according to their approximate real-world locations (from a map-viewing perspective). Then, the form $\text{GO-TO}_{[\text{distr}]}$ was articulated from left-to-right. Although Signer II did not completely reject (a), she much preferred (b), where cities were set up along the event timeline in the order in which the figure traveled to them. I take this to show further that $\text{GO-TO}_{[\text{distr}]}$ is incompatible within a topographic context, and as such has purely relational semantics (which, again, focuses on time, sequencing, and similar concepts).

(7.11) a. ?NYC IX3_a TOR IX3_b DAL IX3_c LA IX3_d. IX1 $\text{GO-TO}_{[\text{distr}]}$
Intended: 'I went to each of four places: NYC, Toronto, Dallas, and L.A.'



b. OK: $\overline{\text{NYC TOR DAL LA}}^{\text{list}}$ IX1 $\text{GO-TO}_{[\text{distr}]}$
'I went to each of four places: NYC, Toronto, Dallas, and L.A.'



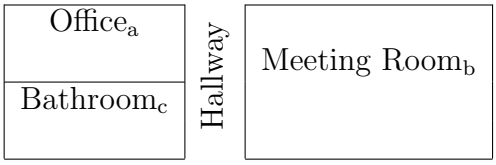
However, this line of reasoning is muddled by another data point, for which my two informants provided opposite judgments. While Signer II found (7.11a) questionable,

she found a similar example, (7.12), acceptable. In the latter, a series of rooms within an office building were established in the signing space, off of the timeline, such that it was understood, e.g., that the office was across the hall from the meeting room. That is, here again we have an example where the topographic relations between grounds are known, just like (7.11a), but GO-TO$_{[distr]}$ may be used to describe John going to each of the rooms. In contrast, Signer I dispreferred (7.12a) and instead produced (7.12b), using a classifier construction.

(7.12) OFFICE IX3$_a$ MEETING IX3$_b$ BATHROOM IX3$_c$.

a. JOHN GO-TO$_{[distr]}$
'John went to each of three places: the office, the meeting room, and the bathroom.'

b. JOHN bp-cl:bentV-$_a$HOP$_b$. bp-cl:bentV-$_b$HOP$_c$
'John went from the office, on to the meeting, and then to the bathroom'



So while it is not yet clear the extent to which [distr] may be used in topographic contexts, we may at the very least tentatively assume that when the focus is time, [distr] is used, and when the focus is space, a classifier construction is used. The establishment of grounds in space-literal loci might shift the focus from time to space, without necessarily precluding the use of a time-focused, relational verb.

Independently, Wilbur (2010) argues that the default interpretation for non-spatial verbs is temporal.[8] In support of this, she posits a feature [extent], which is realized phonologically as path movement and interpreted semantically as event time. Looking at just telic verbs, [extent] is present in accomplishments (HIT), while absent in achievements (FIND, SEND).[9] Here, then, this path movement is not related to space, but to time, as it is not clear how a spatial interpretation could account for the

[8]I understand 'non-spatial' here to refer to what I've been calling relational verbs, including certain motion-denoting verbs (like GO-TO, ARRIVE, and DRIVE-TO).

[9]Achievements, instead, are characterized by a change in handshape aperture, orientation change, or a 'setting' change.

punctuality of signs that do not have [extent] and the durational properties of those that do.[10]

Extending this to relational motion verbs (excluding HIT, for a more obvious example), this [extent] feature dominates a [path] feature, which is responsible for giving verbs their motion event interpretation. [extent]/ [path] can similarly explain the difference between accomplishments like FLY-TO and DRIVE-TO,[11] and achievements like ARRIVE and EXIT. The former have these features, while the latter do not. Here, then, the path movement of DRIVE/FLY-TO is not related to space, per se, but to time, since the lack of path in ARRIVE and EXIT does not disqualify them from being motion events.[12]

Further,Wilbur (2009) argues that when a verb is reduplicated, the phonologically specified movement of a verb constitutes an event and the reset to base position is the time between events (see Fig. 7.2). The form of the reset tells you that the core event occurs frequently, every once in a while, continually, and the like. Here, then, there is a visual interpretation of, e.g., *I went to Las Vegas twice*, *I went to three places*, or even *Every year I go to three places twice.* Although you can see the vectors in ASL, the entailments match English equivalents. Wilbur also claims that these return paths are temporal and not spatial. All together, then, since the UVC is a constraint on spatial (and not temporal) information packaged within a macro-event, such reduplicative forms in ASL are unproblematic.

[10]However, Wilbur (2010) claims that, e.g., HIT has a morpheme called [path] which *does* have a spatial interpretation. This use of the word *spatial* is slightly different from my own: in her words, Wilbur describes [path] as the morpheme responsible for a sign's status as a motion event (although it is not obvious to me how HIT is a motion verb). However, for me, verbs like HIT do not have truly spatial semantics, where the movement of the verb is closer to a one-to-one mapping with a referent event's extensional path.

[11]DRIVE-TO and FLY-TO are surely both within the 'core lexicon,' which excludes classifier constructions (Brentari & Padden, 2001). To be clear, DRIVE-TO is a two-handed sign made with two s-handshapes and not the classifier, w/e-CL:3-GO$_{[drive]}$. Likewise, although identical in most respects, FLY-TO is distinct from w/e-CL:ILU-GO$_{[fly]}$, as argued by Brentari & Padden.

[12]Naturally, verbs of location, like STAND and BE-AT, are under under the umbrella of motion events, and I do not mean to exclude them. However, the semantics of ARRIVE and EXIT both entail movement.

Figure 7.2. Aspectual Modification: Events and Time Between

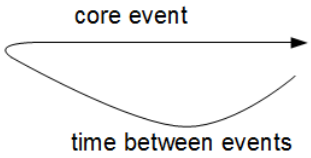
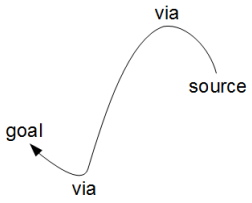


Figure 7.3. AUC in Topographic Space



(a) Routes in Topographic Space

7.2 Topographic Verbs

7.2.1 AUC/ RUC

Turning now to motion events in topographic space, it was reported above that only one source and one goal were found per MEE. However, it appears that via may occur (at least) twice within a single MEE in violation of the AUC (6.15, repeated as 7.13; see Fig. 6.7a., or Fig. 7.3).

(7.13) $\overline{\overline{\text{NYC}_{\text{a}}\ \text{TORONTO}_{\text{b}}\ \text{DALLAS}_{\text{c}}\ \text{L. A.}_{\text{d}}}^{\text{list}}\ \text{JOHN}}^{\text{mm}}$
$\overline{\text{DRIVE w/e-CL: 3-}_{\text{a}}\text{GO}_{\text{[drive], b, c}}\ \text{ARRIVE}_{\text{d}}}$.
'John drove from NYC through Toronto through Dallas to LA.'

Bohnemeyer (2003) notes, however, that via (as conceived by Jackendoff, 1983) may be split into slightly more specific roles. For instance, (7.14) shows that English may encode two routes, so long as the right prepositions are used: (7.14a) includes a crossing event and a passing event, while (7.14b) illicitly includes two crossing events.[13]

[13]The judgments on the examples in 7.14 are my own. Should it turn out that both are unacceptable, it does not hurt the argument presented here, but rather supports it further: two via roles, no matter what particular nuance of the preposition, would be illicit within the same macro-event. Also, both sentences are more comfortably pronounced with a slight pause (=IP break) between prepositional phrases, indicating that these examples may not truly be macro-event expressions.

(7.14) a. ?Charlotte walked across the tracks [$\text{VIA}_{\text{crossing}}$] past the ticket counter [$\text{VIA}_{\text{passing}}$] to the bench

b. *Charlotte walked across the tracks [$\text{VIA}_{\text{crossing}}$] over the bridge [$\text{VIA}_{\text{crossing}}$] to the bench

In order for (7.13) to abide by the AUC, then, it must be the case that ASL may encode more than one via role, in a similar way to English. However, there are no morphophonological clues that these via roles represent two different types (e.g. an upwards bend represents a passing event, while a downward bend represents a crossing/ etc. event). What's more, from the interpretation of such events, both intermediary grounds are understood as being traveled *through* (i.e. [$\text{VIA}_{\text{through}}$]).

Lastly, as I pointed out in (§7.1.1), multiple goal roles in relational space are available if they are collective or distributive. It was argued above that the GOAL function takes a list of subgoals as its arguments. Likewise, it could be the case that the VIA function may also take a list as an arguments, yielding (7.15).

(7.15) $\exists e, x, y[...VIA(e, [x, y])...]$

Indeed, (7.13) can only be bound by one temporal locator. In order to probe its structure, then, we might (in the future) try to scope over one intermediary ground to the exclusion of the other. For example, *almost* in English can scope over one of three verbal subevents: an initiation subevent, a process subevent, or a resultant subevent, which–naturally–yields three different interpretations (7.16; Smith, 2007; Ramchand, 2008). Here, *almost* targets the *from/* initiator subevent in the (a) case, the *running/* process subevent in (b), and the *to/* resultant subevent in the (c) case, but importantly not all three at the same time (d).

(7.16) Joan almost ran from her home to the the base of the mountain...

a. but never made it out the door *almost + initiation*

b. but ended up walking the whole way

c. but it was too much for her and she quit

$\neq$ a $\wedge$ b $\wedge$ c

As for the RUC, two data points together show that the same ground may receive two different semantic roles (6.16, repeated as 7.17). Here, a boy walks from a tree and back to that tree in a loop. The examples below are mono-eventive as evidenced by a single posture non-manual scoping over the entire predicate and the impossibility of two temporal locators within the clause. Thus, it appears that these examples violate the RUC.

(7.17) a. $\overline{\text{TREE}}^{\text{top}}$ BOY WALK $\overline{\text{w/e-CL: 1-}_{\text{a}}\text{GO}_{\text{[nonchalantly],a}}}^{\text{mm}}$

b. $\overline{\text{TREE}}^{\text{top}}$ BOY WALK [trace circle]
'The boy walked from the tree$_{\text{i}}$ to the tree$_{\text{i}}$'

However, on closer inspection, the data become murky: are thematic roles truly assigned in structures like those in (7.17a,b), and do we have evidence either way? The answer hinges on what type of path movement is involved. Brentari (1998) posits two relevant path features, the first of which–[tracing]–is realized as (straight) lines, arcs, and circles.[14] [tracing] is found in both lexical signs (such as the circular path shape of the sign FACE) and in classifier constructions (e.g. the tracing of a triangle, using an extension classifier). In the former, this feature is totally lexical, and subject to certain phonological processes (such as modification in compounding). As such, it is taken to be completely within the grammar of ASL.[15] In addition, this tracing feature is common to atelic verbs, like SWIM and PLAY, which are homogenous (and thus inherently lack, e.g., sources and goals). What's important to the discussion of the RUC, then, is that the start and end points of this tracing do not refer to any stop or start point, a point which may prove problematic for the interpretation of path movement in classifier constructions.

The second feature Brentari posits is [direction]. The direction feature differs from the tracing feature in that, phonologically, there's (initial or final) contact of

[14]Definition: "A line with an arc, straight, or circle shape articulated with respect to a single point within a plane," Brentari (1998, pg. 136).

[15] For example, the signs BLACK and FACE are very similar phonologically. They are both made with the 1-handshape and are produced at the face, albeit in contrasting locations (BLACK on the forehead, FACE over the entire face). BLACK's tracing feature is a convex arc, while FACE's is a circle. Swapping their tracing features, for example, makes both signs ill-formed.

the hand with a reference point or plane perpendicular to the direction of movement. This point of contact has semantic status, serving as a marker of telicity (Wilbur, 2010) and/ or a source-goal location (in that path + goal yields a telic construction). Further, Wilbur (2003, 2004) (and subsequent work) observes that, at least in lexical signs, there is a rapid deceleration towards this point.

Returning now to the discussion of (7.17), it seems clear that the example in (b) is an example of [tracing]: in this case, the signer sets up the location of the tree with his left hand. Then, with his index finger, the signer traces a circular path leaving from the tree and returning to the tree. There is no apparent[16] deceleration of this tracing motion towards the tree, although there is contact with the tree both at the head and tail of the path. Thus, it remains unclear whether there are source and goal roles assigned.

Similarly, the classifier construction in the (a) case does not appear to have the [direction] feature, but rather [tracing]. That is, (a) was signed just as in (b), except with a classifier handshape instead of a simple path tracing. The classifier left the location of the tree, articulated simultaneously with the left hand, and returned to the location of the tree. Again, no sharp deceleration was observed, which would have been indicative of a goal. However, in both the (a) and (b) examples, the interpretation was that the figure left from and arrived at the tree.[17]

There are two lines of thought, immediately obvious to me anyway, that one could follow: (a) that these examples are truly instances of [tracing], with the result that source and goal are not encoded in the expressions, or (b) that despite not having all of the right phonological cues, the initial and final contact of both the traced path and the classifier construction are indicative of the [direction] feature.

In reference to the first possibility, we might ask how, then, does this interpretation of the tree being the source of the movement and also the goal of the movement come

[16]That is, apparent to the naked eye of a beginning signer.

[17]That is, goals are still present in atelic motion events, using TOWARD and AWAY-FROM path functions (e.g., Jonah sailed away from the whale's mouth). While the author does not know how TOWARD and AWAY-FROM are coded in ASL, this was nevertheless *not* the interpretation observed.

about? It could be the case that semantic roles are inferred or 'read off' of the path movement, or–more puzzling–it could be a case of entailment (although we would want some formalism to show how these entailments are governed).

Perhaps one argument in favor of the inference analysis is the English preposition *around*, which is ambiguous between a telic and atelic interpretation (cf. *Scott finished running around the lake* and *Scott stopped running around the lake*). In its telic interpretation, it is entailed that Scott at least reached the point where he started running around the lake, though there's no entailment that that is his final stopping point. In certain contexts, though–say Scott is fulfilling a high school gym requirement–it could be inferred that the starting point is also the stopping point (as it is on a track). But this is not a perfect fit with the ASL data, in that the latter seems to mean that the starting point is also necessarily the stopping point (i.e. the tree). However, the fallout of this line of reasoning is admitting that source and goal are not coded linguistically, but instead inferred, which one might find hard to swallow (and hard to prove independently).

The other option, then, is to assume that end-marking (i.e. a sharp deceleration towards a point) is optional in classifier constructions. I'll note briefly here, before going much further, that in the road trip example, for instance, there was clear end-marking–both in the individuated going events (i.e. where travel to each city constituted its own event) and in the larger, uninterrupted event (i.e. where all grounds were mentioned in a single large event). The absence of end-marking in the to-and-from-tree example, then, is a bit puzzling. However, there was initial and final contact, so we might consider that enough of an indication for the [direction] feature.[18] However, the [direction] feature is specified for only initial *or* final contact (schematized as $[|>]$ and $[>|]$, respectively), and not *both*, as we see in this example

[18]In its original formulation, Brentari says that the [direction] feature is always a straight line ("A [direction] feature at the path node can only be realized as a straight movement," pg. 130). However, I take it that–as with [tracing]–the path specification of [direction] can be any shape in classifier constructions.

(which might be schematized as [| > |]). So, on a more general level, and on this more specific, featural level, we seem to run into issues with the AUC.

Lastly–and also in support of semantic role assignment–Liddell (2003) discusses contexts in which the signer's non-dominant hand acts as a 'buoy,' standing in as some semantic entity, be it concrete (e.g. a person) or abstract (e.g. Deaf culture). Liddell discusses several types of buoys, but the two I'll mention here are List Buoys and Fragment Buoys. The first type involves the establishment of each referent onto a finger on the non-dominant hand, forming a list. The signer may then refer back to these referents by pointing to the corresponding finger. What's more, the signer may use directional verbs to show a relationship between two referents in a list. Liddell provides an example where a woman is explaining how one aspect of Deaf culture influences another and articulates the sign, ADVISE, such that it is oriented away from the finger representing the influencer towards the one representing the influencee. We might argue, then, that semantic roles are available to be assigned to referents in List Buoys. Likewise, from my data, once a referent city (in the road-trip example) is set up on a List Buoy, establishing it in space or otherwise including it again within the same MEP is illicit (per the AUC; 7.18).

(7.18) * $\overline{\text{NYC TOR DAL LA}}^{\text{list}}$ NYC_{a} LA_{b} IX1 DRIVE++ w/e-CL:3-$_{\text{a}}$GO$_{\text{[drive],b}}$
'I drove from NYC, through Toronto, through Dallas to LA.'

The other type, Fragment Buoy, appears to be functionally equivalent to list buoys, but is created 'on the fly.' That is, fragment buoys arise in two-handed signs when (generally) the non-dominant hand is held past the off-set of the sign (perseveration). As such, the concept expressed by the non-dominant hand becomes discourse-salient and the dominant hand is free to make reference to it. Liddell provides the following example: a woman is again discussing aspect of Deaf culture. She signs CULTURE (two-handed) but holds her dominant hand in the C configuration. This C handshape now refers to 'culture' as a concept. The woman then refers back to the C-handshape/

'culture' indexically, and presumably, could have chosen to direct agreement verbs towards it, as is possible with list buoys.

In the case at hand, then, TREE is signed with the non-dominant hand, in what we might gloss as a separate locative clause. The non-dominant hand persists into the next clause, but still serves as a salient discourse referent. The verb, then, is articulated from the locus of the non-dominant hand/ tree back to the same locus, making contact both times. If, again, we assume that semantic roles can be assigned to list buoys and also to fragment buoys, the tree here receives both source and goal roles, in violation of the RUC.

(7.19) H1 BOY WALK $\overline{\text{w/e-CL: 1-}_{a}\text{GO}_{[\text{nonchalantly}],a}}^{\text{mm}}$
H2 TREE_{a} $\longrightarrow$
'There is a tree_{i}. The boy walked from it_{i} to it_{i}.

Either way, then–whether we consider (7.17) as having semantic roles or being devoid of semantic roles–there are issues. In the former case, the RUC is violated in that the same ground has both a source and a goal role (i.e. more than one), and in the latter, the lack of encoded semantic roles leaves an explanation for the interpretation of source and goal to be desired.

7.2.2 UVC

Wilbur (2010) and Brentari argue that [tracing] may take on any number of shapes. Although not specifically mentioned in Wilbur's analysis, I assume that [direction] may also take on any shape, so long as there's initial or final contact with a plane. So, then, if these features do indeed combine with classifier constructions, then here there is clear potential for UVC violations.

Wilbur (2010) discusses an example in her data where a signer is relating a story about a car swerving off of the road and hitting a tree. During the swerving portion of the event a single PNM is articulated, indicating that each apparent change of direction should be considered as part of the same event. However, these changes in

direction, Wilbur claims, are not violations of the UVC. Instead, she claims that as long as the 'type' of movement (i.e. *zigzag*, *circle*, etc.) does not change, a singular type of movement is allowed to have whatever shape.

This line of reasoning is comparable to manner+path verbs in English. Take, *zigzag*, for instance. The verb itself brings along with it the entailment that path movement is not linear. However, in and of itself, *zigzag* does not encode a direction. To this end, manner verbs instead combine with prepositions (e.g. *Zack zigzagged FROM one end of the soccer field TO the other*). The swerving event in Wilbur's analysis, then, points in a singular direction, with unspecified direction changes along the way.

To complete the analogy with English (which serves only as a representative of all spoken languages[19]), one question we might ask, then, is whether users of ASL–a language which theoretically has the ability to produce an infinite number of path shapes–actually produce infinitely variable path shapes and/or whether these path shapes are categorical. But, raw data is perceived categorically such that perceived motion falls into movement categories. Here, we wouldn't be able to tell whether path shapes are categorical from a linguistic point of view, or are just conceived categorically.

However, the examples elicited in this thesis paint a different picture. Consider again (6.15; repeated as 7.20; see also Fig. 7.3, not repeated here). In this example, it is not just entailed that John drove along a non-linear path, but also encoded.

[19]That is, van der Zee et al. (2012) discuss possible grain levels when referring to path shape. There's a level of specificity that they observe to be a maximum in the languages they studied (English, Dutch, Finnish, and Bulgarian). They posit that all languages have three grains of path specification in verbs (or V-PPs): the first is comprised of motion verbs that only specify movement, and not path (e.g. *to arrive, to go, to leave*). The second denote a global path (e.g. *to curve, to arc*). The last denote local path movement (e.g. *to slalom, to zigzag*). Concerning this last type, path is always some repeated local change of direction, which is not exactly what we see in sign languages. Instead, in sign languages, there are occasions where signers choose to be more analog in their descriptions of location and movement, where the movement or location of the classifier closely mirrors the movement or location of their real world referents. In such cases, signers break from (potentially) categorical movement schema/ morphemes in favor of a more (hyper-)realistic description (Cogill-Koez, 2000b; Emmorey & Herzig, 2003).

(7.20) $\overline{\text{NYC}_\text{a}\ \text{TORONTO}_\text{b}\ \text{DALLAS}_\text{c}\ \text{L. A.}_\text{d}}^{\text{list}}\ \text{JOHN}$
$\overline{\text{DRIVE w/e-CL: 3-}_\text{a}\text{GO}_{\text{[drive], b, c}}\ \text{ARRIVE}_\text{d}}^{\text{mm}}$.
'John drove from NYC through Toronto through Dallas to LA.'

Since topographic space is a reflection of the signer's real-world knowledge (§6.3), spatial relations between points, and so also the movement between points, are entailed. However, what does *encoded* mean for classifier constructions? For the sake of argument, if we believe that path movements are lexical (Engberg-Pedersen, 1993), then there are four possibilities, the first two of which I will discuss and quickly dismiss in favor of the latter two.

The first is that this up-down-up path is itself lexical. However, there are no other signs (that the author can think of) that use this particular movement (in contrast other [tracing] shapes, like lines and arc, which are found in a multitude of signs). What's more, this approach misses the generalization that real-world knowledge affects path shape, as demonstrated in (§6.3).

The second possibility is that this complex movement is composed of smaller movements; in this case, three arc morphemes. Engberg-Pedersen (1993) provides an analogous example from Danish SL, in which a signer is describing a Figure's journey around a track. The signer produces a track-shaped path movement, which Engberg-Pedersen argues to be a sequence of path morphemes, *move-line + move-arc + move-line + move-arc*. She supports her claim by showing that individual legs of the journey around the track, each of the path morphemes, can be independently modified by manner morphemes (e.g. speed). Taking the data collected for this thesis into consideration, one would need to show that each leg of the journey can be modified by such a manner morpheme.

There is some evidence to show that, at least in the road-trip example, the path is considered whole. ASL has a trilled manner morpheme, in which the classifier handshape shakes rapidly, that appears to have the meaning 'take a long time' (roughly speaking). In addition, ASL has a path-modifying morpheme, which adds indiscernibly many twists and turns. This morpheme may serve as some kind of indefinite

marker (i.e. which might mean ‘Between cities, I drove all over the place’; see Fig. 7.4d). Both of these morphemes were articulated over the whole path of (7.20), and not just a portion. What’s more, it was not the case that these morphemes were rearticulated at would-be path morpheme boundaries.

Lastly, still under the assumption that larger paths are composed of smaller ones, we would then be in want of principled rules of combination, including rules for meaningful rotation (unless upwards, downwards, concave, convex, etc. arcs are stored separately). At first glance, it seems that any path morpheme may freely combine with any other path morpheme and in any order, suggesting that these morphemes are not organized hierarchically. For example, Engberg-Pedersen’s race-track example above implies (7.21), but no cartographic or minimalist analysis I know have argued (a) for specific path shape projections (e.g. LineP), (b) for the projection of more than one of the same XP, (b′) including multiple, generic path projections (e.g., $[_{\text{PathP}}\ [_{\text{PathP}}\ \ldots\ ]\ ]$).

(7.21) ?$[_{\text{VP}}$ GO $[_{\text{LineP}}$ line $[_{\text{ArcP}}$ arc $[_{\text{LineP}}$ line [...]]]]]

So, from the discussion so far, it seems that this up-down-up path is a whole unit, but that this unit is likely not itself stored in the lexicon. Instead path morphemes seem to be created de novo according to the positions of loci in space. The third possibility, then, is that there are a set of finite path movements, but that these path movements may be modified by an automatic phonological process. In this case, the phonological process that is responsible for the verb’s final path shape is abstract, and without a fixed phonological form. An analysis along these lines has been applied to directionality (=‘agreement’ or ‘concord’ in some analyses) in sign languages. Specifically, Aronoff, Meir, and Sandler (2005) compare sign language agreement to literal alliterative concord (or agreement) in Bainouk, and other languages with this particular phenomenon.[20]

[20]In Bainouk, roughly speaking, concord is achieved by copying a noun’s class prefix onto demonstratives, pronouns, and adjectives. In cases where the noun does not fall into a particular class, or that class has a phonologically null prefix (whatever the case may be), it is the first CV of the

The gist of their argument is this: there are abstract phonological processes that (by definition) take in phonological content, modify it, and return a new string (other examples of context-dependent phonological processes include the obligatory contour principle, stress clashes, and tone sandhi; or even Mathur (2000)'s conception of 'alignment'). For sign language agreement, then, there is an abstract process whose function is roughly 'take two points and connect them.' The direction (and length) of the resulting line thus varies with every two points fed to this process. Even if one buys this argument–and there are reasons not to[21]–this analysis does not apply to path modification, as the latter seems to add content-based lexical and not functional meaning.[22]

But there are at least two further drawbacks to this analogy. First, and most obviously, reduplicative morphemes (like in Bainouk) and other processes/ process

noun root that is copied (i,ii). Here, since the first CV can be any combination of consonant and vowel (as permitted by the phonology of the language), it would be inelegant to posit that there are ((C × V) - phonotactics) phonological versions of this same morpheme.

i. **ka**ta:ma-ã ka-nak-ã
river-PL CV-two-PL
'two rivers'

ii. **ka**ta:ma-ngo in-**ka**
river-DEF this-CV
'this river' [Bainouk]

[21]For example, the morpheme in Bainouk operates on linguistic material, here phonological content. Applying such an analysis to sign languages would entail forcing referential loci into the linguistic system proper, a controversial move and subject of a whole special issue of *Theoretical Linguistics* (Vol 37.:3–4.)

[22]There are, however, abstract morphemes of this sort that do add content-based meaning: For example, McCarthy and Prince (1993) (and earlier and later works) discuss a reduplicative morpheme, RED, in Timugon Murut. Without getting into the specifics of the analysis, RED takes two segments (also a C + V) from the base, copies them, and then affixes to the base. As such, again, it would be theoretically inelegant (and incorrect) to posit that for each word in the language, there is a morpheme that is a partial copy of that word. What's more, these morphemes would be identical in meaning, which offers an additional ugliness to this line of reasoning. Instead, this RED morpheme is argued to be void of phonetic content. The latter is contributed by a phonological process. As will be argued in the text, this reduplicative process adds predictable semantic content (i.e. what appears to be aspectual information/ frequency).

i. /RED+a.ba.lan/ → [a.**ba**.ba.lan]
'bathe' → 'often bathes'

ii. /RED+om.po.don/ → [om.**po**.po.don]
'flatter' → 'always flatter' [Timugon Murut]

morphemes (Aronoff et al.'s conception of SL agreement) take phonological content and modify or copy it, but in ways that are predictable without taking extra-linguistic factors into consideration. However, the process that is responsible for the path movement in the road-trip event (i.e. the bending up towards to locus of Toronto, down to the locus of Dallas, etc.) is only predictable once the signer's real-world knowledge is assessed.

The second, and more problematic objection is a semantic one: process morphemes/ processes have predictable semantics (or no semantics at all!), while this path-completion process does not. That is, taking the New York to L.A. road trip as an example (as always), the up-down-up movement means 'North, then South, then North, all the while going West.' A straight path in this case would not be an accurate description, as it would only encode/ entail West, and assumes that all cities visited along the way lie along this path. Adding or deleting bends, rotating arcs, among other (potentially) meaningful modifications suggest that the meaning is not contributed by a (single) morpheme–process or typical, but a gradient path modification process, as I will now argue.

The final possibility that I'll consider here, and the one I believe holds water, is that, again, there is a finite set of discrete path movements, or–as I'll assume–there is a single morpheme, GO. GO interacts syntactically, optionally taking grounds arguments, and obligatorily taking an internal argument. However, GO may be defined gradiently and in part according to real-world semantic knowledge.[23] Note that this analysis further assumes that there is a visible interface between semantics

[23]In part, the final form of these constructions is also subject to phonological constraints. For instance, there appear by the constraints–at least from my data–on using the vehicle classifier articulated from the left of the signing space to the right (i.e. if signed with the right hand, the classifier handshape is oriented outwards, away from the signer's body, which appears to be illicit on phonological grounds. If articulated with the left hand, the orientation is correct, but the form is ruled out by some other principle). Independently, Liddell and Johnson (1987) observe that whole-entity classifiers may not be stacked on top of each other, such that showing, e.g., 'There is a man standing on top of a car' using w/e-CL:1 and w/e-CL:3 is ill-formed. Although it appears (anecdotally, to my knowledge) that some demographic of signers may 'stack' classifiers in this way, I am confident that there is another (appropriate) example in which topographic space is arbitrarily constrained.

and phonology and that both, in turn, may be found to have access to more general human (spatial) reasoning capacities.

When considering the data that I collected, most of the path shapes in topographic space were roughly linear (if not flattened arcs). These linear path shapes combined in such a way as to yield an overall non-linear trajectory (see again Fig. 6.8b). Likewise, as reported in Taub and Galvan (2001), larger trajectories were often composed of lines and arcs.

At junctures between one path shape and another, it was possible to add a temporal locator (such as NEXT DAY). Thus, each semi-linear path shape was contained within a macro-event. What's more, even though the physical shape of the path was non-linear in all cases, it is not the case that the path shape was interpreted as the literal, extensional path of the figure. For instance, the semi-arcing line traced between the locus of New York City and Toronto in one example, did not mean that the figure followed a strictly linear path between the two cities (in fact, there is no one road/ path that connects the cities in the real world; Fig. 7.4a). As such, these path movements are spatially uninformative with respect to how the figure moved (of course, the establishment of the loci of NYC and Toronto with respect to each other is indeed informative). This is all to say, then, that constructions with individuated path components–these lines and arcs–obey the UVC.

However, while this semi-arcing line can be categorized, is UVC-abiding, and may be stored lexically, it may also be meaningfully deformed. If the arc of the path is increased, it gains the meaning 'the figure moved more Northward then Westward such that the figure approached Toronto from the East' (Fig. 7.4b). Likewise, if the arc is flipped, the meaning changes to 'the figure moved Westward then Northward such that the figure approached Toronto from the South' (Fig. 7.4c). Still, in both examples, no extensional path is entailed, but particular absolute directions are. Recall from the brief discussion of vector semantics in (§2.1.3) that a linguistic expression may at most select a single directional vector. Two selections–either from the same set or from distinct sets–must be spread across two macro-event expressions. Expressions

Figure 7.4. CL Path Shapes and their Interpretations

(a) List form: Neutral

(b) Deformed: North, then West

(c) Deformed: West, then North

(d) Deformed: All over New England

are free to choose vectors from the intersection of two sets, should that intersection exist. In the case at hand, ASL may encode {North ∪ West} and {West ∪ North}, both in violation of this general rule. That is, topographic verbs are able to 'conjoin' vector sets in ways that are not available in spoken languages, or in the domain of relational verbs.

Finally, I want to mention again that here, too, 'what you see' is not always 'what you get' with phonological vectors. There was one seemingly extreme example where Signer A produced a path movement with indiscernibly many twists and turns. It was not the case that he was tracing some extensional movement of the figure (here, a car) up and throughout the Northeast (Fig. 7.4d), but rather that the figure traveled along some unspecific or indefinite path. As such, it is likely that this path modification is morphemic and not this 'extra' path modification previously discussed.[24] The lesson, then, is that the identification of path morphemes versus path modifications needs careful semantic analysis.

[24]Similarly, Liddell (2003) & Supalla (1986) inter alia discuss certain path morphemes in classifier constructions that are not to be interpreted as literal, among which is a small bouncing movement meaning roughly 'in an unhurried manner.'

8. CONCLUSIONS

Bohnemeyer et al. (2007) propose a semantic measure of event packaging, the Macro-Event Property (MEP). The MEP is delimited by temporal locators, such that all subevents within a macro-event fall under the same locator's scope. The MEP serves as the domain of application for three constraints: the Argument Uniqueness Constraint (AUC), the Referential Uniqueness Constraint (RUC), and the Unique Vector Constraint (UVC). The AUC dictates that no two semantic roles may appear within a macro-event expression (e.g. **Laurie went from the library out of the stairwell*). Similarly, the RUC requires that no one ground may receive more than one semantic role (e.g., **Daryl walked from home back to home*). Lastly, the UVC requires that all vectors within a macro-event expression are singular and unchanging in direction (e.g. **James dribbled up down the court*). This thesis asked how well the two modes of signing, topographic and relational, fit these event-segmenting constraints.

Topographic and relational functions of space are distinguished by a host of syntactic, morphological, and phonological phenomena, including (but not limited to) the types of morphemes that appear and the type of path shapes that are used. One of the most important characteristic differences between the two modes, however, is the interpretation of the motion of the verb, or the locations of the referents of its arguments. In relational space, the location of referents is arbitrary (unless physically present) and the movement of the verb between referents is to express the relationship of the referents to one another (i.e. who is the subject and who is the [in]direct object; whether a ground should interpreted as a source or goal; etc.). The identification of event participants is achieved in the same way in topographic space, but the movement of the verb itself entails the real-world movement, or movement in some imagined/mental space–an interpretation unique to topographic space. The location

of the referents in topographic space are similarly interpreted spatially (i.e. *Sam is here, not here*). As such, a lot more spatial information is expressed.

As B. et al.'s constraints concern how much spatial information can be packaged into a single macro-event expression, the two signing functions were predicted to behave differently: relational verbs, being anchored in time, were predicted not to violate any of the constraints. On the other hand, topographic verbs were predicted to violate the constraints, due to increased and, in some cases, detailed spatial information.

Indeed, it was shown in this thesis that the two modes of space differ with respect to their conformity to B et al.'s constraints, precisely based on this (semi-)literal or relational interpretation of space. Relational space conformed to all of the constraints, even in cases with multiple goals and multiple, multiply directed vectors. With respect to the number of goals, it seems that within a single macro-event languages may not encode multiple path functions, like TO or FROM (e.g., [...TO(x) $\wedge$ TO(y)...]; as predicted by the AUC), but nevertheless can encode a list of goals, e.g. TO([x,y,z]), with distributive readings. With respect to the number and direction of vectors exhibited by relational verbs, it was argued that vectors visible in the phonology are nevertheless distinct from semantic ones. The vectors you see are related to time and to the number of ground referents, and remain agnostic to any spatial relationship held between ground referents or the figure in relation to ground referents. Again, as B. et al.'s constraints are on the packaging of spatial information, relational verbs–as expected–play by the rules.

Conversely, topographic verbs violated each of the constraints. Specifically, more than one via role may appear, the same ground may receive more than one semantic role, and paths in topographic space may entail and (nominally) encode a change in direction. Ignoring via-assigning prepositions, via presents a particular challenge: it has, to my knowledge, yet to be associated with a fixed syntactic slot (as have source and goal) in any analysis (aside from possibly Supalla, 1982's base grid analysis), and there's no real indication from the data gathered here that it should be. Instead,

we are left with two knee-jerk possibilities: via is understood analogically or more than one via role (and, strangely, only the via role) may be assigned per macro-event expression. This naturally leads into the discussion of the RUC violation, which poses two very similar questions.

The RUC appeared to be violated in that at face value, source and goal may be assigned to a single ground referent. There were two issues raised here. One, the RUC could truly be violated, in which case we would ask what this means for the universality of Bohnemeyer et al.'s tests or the exceptionality of this particular mode of signing in ASL. Two, we might ask whether these roles are assigned at all (since path in these cases seem to be instances of [tracing]), in which case the RUC is not called into question, but leaves unexplained how source and goal are interpreted.

Finally, verbs in topographic space are not necessarily bound by the UVC either. As in relational space, vectors seen in topographic space could still have linear semantics, despite curvy phonological forms. However, as the signing space is a representation of the signer's real-world knowledge, movement in direction x of the signing space is mapped directly to a representation of the figure moving in the corresponding direction y. Thus, for example, an up-left movement in the signing space can represent Northwest directly.

Leaving aside the function responsible for assigning points in space in accordance with real-world knowledge, the movement between these points was mostly spatially uninformative. In most cases, path was encoded by listable, linear or semi-linear movements, which did not take into account specific directions (i.e. it was the establishment of loci relative to each other that forces the interpretation of direction). However, path morphemes can be modified gradiently to add more specific spatial information (e.g. to make a contrast between Northwest and Westnorth). So–in theory–while the underlying base morphemes are UVC-compliant, it is this extra modificational process that breaks the rules.

In sum, the division between signing functions was further supported by applying Bohnemeyer et al.'s constraints to each. Relational verbs behaved; topographic verbs

did not. What's needed now, then, is a proper way to explain the exceptionality of topographic verbs. While this thesis cannot weigh in directly on such approaches, those put forward by Cogill-Koez (2000a, 2000b) and Liddell (2003) may be promising places to look. Both analyses, in a nutshell, argue that there are some (and only some) components of topographic verbs that resist a purely linguistic description (from a narrow perspective, anyway). Instead, they posit that movement and locations in topographic space are products of a separate, yet intimately interwoven cognitive module. Perhaps there, in this line of thought, can the anomaly of dual via, silent source and goal, and variable path be explained.

LIST OF REFERENCES

LIST OF REFERENCES

Aronoff, M., Meir, I., & Sandler, W. (2005). The paradox of sign language morphology. *Language*, *81*(2), 301.

Baker, C., & Cokely, D. (1980). *American Sign Language: A teacher's resource text on grammar and culture*. Silver Spring, MD: TJ Publishers.

Barberà, G. (2012). *The meaning of space in Catalan Sign Language (LSC): Reference, specificity and structure in signed discourse*. Unpublished doctoral dissertation, PhD dissertation, Universitat Pompeu Fabra, Barcelona.

Basu, D. (2010). *Syntax-semantics issues for multiple event clauses in Bangla*. Unpublished doctoral dissertation.

Benedicto, E., & Brentari, D. (2004). Where did all the arguments go?: Argument-changing properties of classifiers in ASL. *Natural Language & Linguistic Theory*, *22*(4), 743–810.

Bohnemeyer, J. (2003). The unique vector constraint. *Representing Direction in Language and Space*, 86–110.

Bohnemeyer, J., Enfield, N., Essegbey, J., Ibarretxe-Antuñano, I., Kita, S., Lupke, F., & Ameka, F. (2007). Principles of event segmentation in language: The case of motion events. *Language*, *83*(3), 495.

Braze, D. (2004). Aspectual inflection, verb raising and object fronting in American Sign Language. *Lingua*, *114*(1), 29–58.

Brentari, D. (1998). *Prosodic model of sign language phonology*. MIT Press.

Brentari, D., & Padden, C. (2001). Native and foreign vocabulary in American Sign Language: A lexicon with multiple origins. *Foreign vocabulary in sign languages: A cross-linguistic investigation of word formation*, 49–85.

Carlson, G. (1998). Thematic roles and the individuation of events. In S. Rothstein (Ed.), *Events and grammar* (pp. 35–52). Kluwer Academic Publishers.

Chomsky, N. (1993). *Lectures on government and binding*. Mouton De Gruyter.

Cogill-Koez, D. (2000a). A model of signed language classifier predicates as templated visual representation. *Sign language & linguistics*, *3*(2), 209–236.

Cogill-Koez, D. (2000b). Signed language classifier predicates: Linguistic structures or schematic visual representation? *Sign language & linguistics*, *3*(2), 153–207.

Dachkovsky, S., & Sandler, W. (2009). Visual intonation in the prosody of a sign language. *Language and Speech*, *52*(2-3), 287–314.

de Quadros, R. M., & Quer, J. (2008). Back to back(wards) and moving on: On agreement, auxiliaries and verb classes in sign languages. *Sign Languages: spinning and unraveling the past, present and future. TISLR9, forty five papers and three posters from the 9th. Theoretical Issues in Sign Language Research Conference, Florianópolis, Brazil, December 2006, 530-551*.

Emmorey, K. (1996). The confluence of space and language in signed languages. In P. Bloom, M. Peterson, L. Nadel, & M. Garrett (Eds.), *Language and space* (pp. 171–209). Cambridge, Mass: MIT Press.

Emmorey, K. (2001). Space on hand: The exploitation of signing space to illustrate abstract thought. In *Spatial schemas abstract thought.* The MIT Press.

Emmorey, K., & Herzig, M. (2003). Categorical versus gradient properties of classifier constructions in ASL. *Perspectives on Classifier Constructions in Signed Languages*, 222–246.

Engberg-Pedersen, E. (1993). *Space in Danish Sign Language: The semantics and morphosyntax of the use of space in a visual language.* Hamburg: Signum.

Fischer, S., & Gough, B. (1999). Some unfinished thoughts on FINISH. *Sign language & linguistics*, *2*(1), 67–77.

Fischer, S., & Janis, W. (1990). Verb sandwiches in American Sign Language. *Current trends in European sign language research*, 279–294.

Givón, T. (1991). Serial verbs and the mental reality of 'event': Grammatical vs. cognitive packaging. *Approaches to grammaticalization*, *1*, 81–127.

Glück, S., & Pfau, R. (1999). A distributed morphology account of verbal inflection in German Sign Language. In *Proceeding of console vii* (pp. 65–80).

Jackendoff, R. S. (1983). *Semantics and cognition.* MIT Press, Cambridge, Mass.

Jackendoff, R. S. (1992). *Semantic structures* (Vol. 18). The MIT Press.

Janis, W. (1995). A crosslinguistic perspective on ASL verb areement. *Language, Gesture, and Space*, 195–223.

Kaplan, R., & Bresnan, J. (1982). Lexical-functional grammar: A formal system for grammatical representation. In J. Bresnan (Ed.), *The mental representation of grammatical relations* (pp. 173–281). Massachusetts Institute of Technology, Center for Cognitive Science.

Klima, E. S., & Bellugi, U. (1979). *The signs of language.* Harvard University Press.

Liddell, S. (2003). *Grammar, gesture, and meaning in American Sign Language.* Cambridge University Press.

Liddell, S., & Johnson, R. E. (1987). An analysis of spatial-locative predicates in American Sign Language. In *4th international symposium on sign language research, lappeenranta, finland.*

Lillo-Martin, D., & Meier, R. (2011). On the linguistic status of 'agreement' in sign language. *Theoretical Linguistics*, *37*(3-4), 95–141.

Malaia, E., & Wilbur, R. (2012). Kinematic signatures of telic and atelic events in ASL predicates. *Language and Speech*, *55*(3), 407–421.

Mathur, G. (2000). *Verb agreement as alignment in signed languages*. Unpublished doctoral dissertation, MIT, Department of Linguistics.

Matsuoka, K. (1997). Verb raising in American Sign Language. *Lingua*, *103*(2), 127–149.

McCarthy, J. J., & Prince, A. (1993). *Prosodic morphology I: Constraint interaction and satisfaction* (Tech. Rep.). Piscataway, NJ: Rutgers University Center for Cognitive Science.

Poizner, H., Klima, E., & Bellugi, U. (1987). *What the hands reveal about the brain*. Cambridge, MA: MIT press.

Pustejovsky, J. (1991). The syntax of event structure. *Cognition*, *41*(1), 47–81.

Quer, J. (2011). When agreeing to disagree is not enough: Further arguments for the linguistic status of sign language agreement. *Theoretical Linguistics*, *37*(3-4), 189–196.

Ramchand, G. (2008). *Verb meaning and the lexicon: A first phase syntax* (Vol. 116). Cambridge University Press.

Rathmann, C. (2005). *Event structure in American Sign Language*. Unpublished doctoral dissertation, The University of Texas at Austin.

Rathmann, C., & Mathur, G. (2008). Verb agreement as a linguistic innovation in signed languages. *Signs of the time. Signum Verlag*.

Sandler, W. (2010). Prosody and syntax in sign languages. *Transactions of the Philological Society*, *108*(3), 298–328.

Schalber, K., & Grose, D. (2006). The semantics, syntax and phonology of adverbial nonmanuals in Austrian and American Sign Language. *Sign Languages: Spinning and unraveling the past, present and future-Theoretical Issues in Sign Language Research*, *9*, 552–565.

Selkirk, E. (2011). The syntax-phonology interface. In J. Goldsmith, J. Riggle, & A. Yu (Eds.), *The handbook of phonological theory, 2nd edition.* Oxford: Blackwell.

Shepard-Kegl, J. A. (1985). *Locative relations in American Sign Language word formation, syntax and discourse*. Unpublished doctoral dissertation, Massachusetts Institute of Technology.

Smith, C. (2007). *'ALMOST' in ASL: Insights into event structure*. Unpublished master's thesis, Purdue University.

Supalla, T. (1982). *Structure and acquisition of verbs of motion and location in American Sign Language*. Unpublished doctoral dissertation, University of California, San Diego.

Supalla, T. (1986). The classifier system in American Sign Language. *Noun classes and categorization*, 181–214.

Supalla, T. (1990). Serial verbs of motion in ASL. *Theoretical issues in sign language research*, *1*, 127–152.

Taub, S. F., & Galvan, D. (2001). Patterns of conceptual encoding in ASL motion descriptions. *Sign Language Studies*, *1*(2), 175–200.

van der Zee, E., Nikanne, U., & Sassenberg, U. (2012). Grain levels in English path curvature descriptions and accompanying iconic gestures. *Journal of Spatial Information Science*(1), 95–113.

Wilbur, R. (1994). Eyeblinks & ASL phrase structure. *Sign Language Studies 88*, *88*, 221–240.

Wilbur, R. (2000). Phonological and prosodic layering of non-manuals in American Sign Language. In H. Lane & K. Emmorey (Eds.), *The signs of language revisited: Festschrift for ursula bellugi and edward klima* (pp. 213–241). Hillsdale, NJ: Lawrence Erlbaum.

Wilbur, R. (2003). Representations of telicity in ASL. In *Proceedings from the annual meeting of the chicago linguistic society* (Vol. 39, pp. 354–368).

Wilbur, R. (2004). Complex predicates involving events, time and aspect: Is this why sign languages look so similar. *Theoretical issues in sign language research*.

Wilbur, R. (2009). Productive reduplication in a fundamentally monosyllabic language. *Language Sciences*, *31*(2), 325–342.

Wilbur, R. (2010). The semantics–phonology interface. *Sign Languages: A Cambridge Language Survey*, 355–380.

Zacks, J., & Tversky, B. (2001). Event structure in perception and conception. *Psychological bulletin*, *127*(1), 3.

Zheng, C. (2012). *Path verbs of motion in SwaTawWe serial verb constructions*. Unpublished master's thesis, Purdue University.

Zwarts, J. (2005). Prepositional aspect and the algebra of paths. *Linguistics and Philosophy*, *28*(6), 739–779.

Zwitserlood, I. (2003). *Classifying hand configurations in Nederlandse Gebarentaal (Sign Language of the Netherlands)*. Unpublished doctoral dissertation, Utrecht University.

APPENDICES

APPENDICES

Appendix A: Session I

Again, Session I was a larger investigation of motion events in ASL. The first part did test some information about the inclusion or exclusion of (relatively) enriched spatial/ temporal information in relational space, as will be described below, and was thus pertinent to this thesis. But, many items were crafted specifically for quantification, and can be treated, then, as fillers.

Items in **Part 1** were all goal-oriented and involved some form of reduplication: ++ for event quantification and [distr] for goal quantification. For the purposes of this thesis, the interesting items have been tagged with either 'Space' or 'Time.' Items with 'space' ticked included more rich spatial information relative to other test items. For instance, (A.1, 4.) includes context where the same room in a particular building is used for different workshops. Here, there are two possibilities: if this spatial context is taken into consideration, all three workshops would be articulated in the same area of the signing space. If, however, the space is used referentially, each workshop would be articulated in a different part of the signing space.

Conversely, (A.1, 8.) adds additional spatial and temporal information. That is, if we take (7.) as the neutral case ('The teacher went to workshops'), then (8.) could be 'The teacher went from each workshop to the next' or further 'The teacher went immediately from one to the other.'

All other test items may be considered fillers. However, all test items trivially relate to the AUC, in that all included goals (and not source or via).

Table A.1
Session I Test Items

Part 1	#	Item	Space Enriched	Time Enriched
	1.	TEACHER GO-TO WORKSHOP		
	2.	EVERYDAY TEACHER GO-TO WORKSHOP		
	3.	TEACHER GO-TO WORKSHOP$_{[distr]}$		
	4.	[There's a big conference going on in the Stewart Center. Everyday there's a workshop on a different topic in the same room.] TEACHER GO-TO++ WORKSHOP	X	
	5.	3 WS TEACHER GO-TO++		
	6.	TEACHER GO-TO WS++		
	7.	WS$_{[distr]}$ TEACHER GO-TO$_{[distr]}$		
	8.	WS$_{[distr]}$ TEACHER w/e-CL:1-GO$_{a,b,c}$	X	X
	9.	WS MEETING CLASSROOM OFFICE TEACHER GO-TO$_{[distr]}$		
	10.	'I know that the teacher went to a workshop, meeting, class, and office, but I'm not sure when' WS MEETING CLASSROOM OFFICE TEACHER GO-TO$_{[distr]}$		X
	11.	WS MEETING CLASSROOM OFFICE TEACHER GO-TO$_{a,b,c,d}$	X	
	12.	TEACHER GO-TO WS$_{[plural]}$		
	13.	TEACHER GO-TO WS IX-3$_{[plural]}$		
	14.	WS IX-3$_{[plural]}$ TEACHER GO-TO(++)		
	15.	WHOLE WS TEACHER GO-TO		
	16.	20 WS TEACHER GO-TO++(or distr)		

Table A.2
Session I Test Items

s = source, v = via, g = goal; context in *italics*

Part 2	#	Item	Constraint AUC	RUC	UVC
	1.	Imagine: it's spring break, I live in NYC, my friend lives in LA, I'm visiting him. $\overline{\text{NYC}_a\ \text{LA}_b}^{\text{top}}$ IX1 DRIVE w/e-CL:3-$_a$GO$_b$	s/g		
	2.	Spring break is 2 weeks long. That's a long time. I decided to visit Canada on my way from NYC to LA, but I'm not sure just where I was. CANADA AREA$_a$. $\overline{\text{NYC}_b\ \text{LA}_c}^{\text{top}}$ IX1 DRIVE w/e-CL:3-$_b$GO$_{a,c}$	s/v/g		X
	3.	I didn't stop there and I didn't visit any place in Canada, I just went through it.	s/v/g		X
	4.	How about a specific city, Toronto$_c$ $\overline{\text{NYC}_b\ \text{LA}_c}^{\text{top}}$ IX1 DRIVE w/e-CL:3-$_b$GO$_{a,c}$	X		X
	5.	Suppose there's a fourth city, Dallas $\overline{\text{NYC TOR DALLAS LA}}^{\text{top}}$ NYC$_a$ LA$_b$ IX1 w/e-CL:3-$_a$GO$_{b,c,d}$	s/v*2/g		X
	6.	$\overline{\text{NYC TOR DALLAS LA}}^{\text{top}}$ IX1 w/e-CL:3-$_a$GO$_{b,c,d}$	s/v/g		X
	7.	TREE, BOY w/e-CL:1-GO	s/g	X	
	8.	TREE, BOY WALK w/e-CL:1-GO	s/g	X	
	9.	same as 8 but with a go-there-come-back motion	s-g	X	
	10.	Context: Maybe the boy was mulling something over, pacing	s/g	X	
	11.	TREE, BOY (WALK) trace-path from tree to tree	s/g	X	

Appendix B: Session II

Table B.1: Session IIa; Test Sentences for Participant B

Cond.	#	Item	AUC (Goal)	AUC (Source)	AUC (Via)	UVC	MEP
Quantification/ Reduplication ↓	1.	There's a teacher's workshop happening all month. My friend John has been going to that workshop everyday.	X				
	2.	John keeps going and going to that workshop.	X				
	3.	Everyday, John leaves school and goes to that workshop.	X	X			
	4.	The location of the workshop changes everyday. Sometimes it's in the auditorium, sometimes it's in the gymnasium, and sometimes it's in a classroom. Everyday John goes to the workshop.	X				
	5.	The location of the workshop changes everyday. Sometimes it's in the auditorium, sometimes it's in the gymnasium, and sometimes it's in a classroom. Everyday John goes from school to the workshop.	X				
	6.	John usually goes over the pedestrian bridge to get from school to the workshop. Everyday, John goes from school to the workshop via the pedestrian bridge.	X	X	X		
	7.	This month there are three different workshops. Everyday John goes to each of them.	X				
	8.	All this week, John keeps going and going to those three workshops	X				
	9.	Everyday John goes from school to each of these workshops.	X	X			
	10.	Using the pedestrian bridge, John goes from school to each of the workshops	X	X	X		
	11.	The workshops are scheduled such that one begins after another ends. John has to rush to get to each one. John went to each workshop right after the other.	X				

Quant./ Redup.	12.	One day John started feeling sick. John went to the first two workshops, but did not goes to the third one.	X				
	13.	The first workshop is at 9am, the second at 10am, and the third one is at 11am. John went to each of them.	X				
	14.	Every morning, John left his house at 8:30am		X			
	15.	One of the workshops was really terrible. All during the workshop, people kept leaving.		X			
	16.	However, one of the workshops was really popular. All throughout the workshop people kept coming and coming.	X				
Topographic	17.	John lives in New York City and my friend lives in L.A. For Spring break, John have two weeks off from school. John decided to visit my friend in L.A. John drove from NYC straight to L.A. in 2 days.	X	X		X	
	18.	Many things kept happening on John's trip. He got a flat tire; He got lost; and he ran out of gas. It took him a really long time to get from NYC to L.A.	X	X		X	
	19.	John decided to take a road trip. He drove from NYC, to Toronto, to Dallas, and finally to L.A.	X	X	X	X	
	20.	John decided to take a road trip. He drove from NYC, through Toronto, through Dallas, and arrived in L.A. He didn't have time to stop in Toronto or Dallas.	X	X	X	X	
	21.	John decided to take a road trip. He drove from NYC to Toronto on Monday, and to Dallas and L.A on Tuesday.	X	X	X	X	X
	22.	John decided to take a road trip. He drove from NYC through Toronto on Monday, and to L.A. by way of Dallas on Wednesday. He didn't have time to stop in Toronto or Dallas. The whole trip, from NYC to LA, took him 5 days.	X	X	X	X	X

Topographic

23.	John took a road trip to Toronto, Dallas, and L.A. He arrived in Toronto on Monday. John went to Dallas on Wednesday and John arrived in L.A. on Friday.	X	X	X	X	X	
24.	John is not familiar with the geography of Canada. John knows that he passed through Canada somewhere on his trip. So, he drove from NYC, through Canada, through Dallas, to L.A.	X	X	X	X		
25.	In L.A. John visited his friend, he visited Brad Pitt's house, he visited the Chinese Theater, and he visited Venice Beach	X					
26.	John returned home using the exact same route: John went from L.A., through Dallas, through Toronto, to NYC	X	X	X	X		
27.	John started driving towards L.A., but John forgot that he left the stove on and had to turn back.	X	X				
28.	Fortunately, John was driving away from NYC when the big storm hit		X		X		
29.	John likes playing with his young niece. She is a good story-teller. Last week she was telling him a story about a vacation that her teddy bear went on. Her teddy bear went to a number of different places. Her teddy bear went to: Neverland, Wonderland, Santa's Workshop, and Mt. Olympus	X			X		
30.	First, teddy went to Santa's workshop, then to Wonderland, then to Mt. Olympus and finally to Neverland	X			X		
31.	Teddy went on a second trip. First he went to Santa's workshop, then to the south pole, then to Neverland, then to the moon, and finally back to Lafayette, IN.	X			X		
32.	When the family arrived at the beach, the children ran from the car into the ocean	X	X		X		

33.	The dog stuck its head into every hole looking for rabbits	X	X	

Appendix C: Session III

C.1 AUC Violations

(C.1) **Relational Space (Goal)**

a. $\overline{\text{SCHOOL}_a\ \text{WORK}_a}^{\text{top}}$ MAN GO-TO$_a$
Verb - Locus

a′ $\overline{\text{SCHOOL}_a\ \text{WORK}_b}^{\text{top}}$ MAN GO-TO$_{a,b/\ [dual]}$
Verb - Locus

b. MAN GO-TO$_a$ SCHOOL$_a$ TO CHURCH
Verb - Prep

c. MAN $\overline{\text{GO-TO}_a\ \text{SCHOOL}_a\ \text{GO-TO}_a\ \text{CHURCH}_a}^{\text{`mm'}}$
Verb - Verb

c′ MAN $\overline{\text{GO-TO}_a\ \text{SCHOOL}_a\ \text{GO-TO}_b\ \text{CHURCH}_b}^{\text{`mm'}}$
Verb - Verb

d. MAN GO-OUT HOME TO SCHOOL TO CHURCH
Prep - Prep

(C.2) **Relational Space (Source)**

a. $\overline{\text{SCHOOL}_a\ \text{WORK}_a}^{\text{top}}$ MAN GO-OUT$_a$
Verb - Locus

a′ $\overline{\text{SCHOOL}_a\ \text{WORK}_b}^{\text{top}}$ MAN GO-OUT$_{a,b/\ [dual]}$
Verb - Locus

b. MAN GO-OUT$_a$ SCHOOL$_a$ FROM CHURCH
Verb - Prep

c. MAN $\overline{\text{GO-OUT}_a\ \text{SCHOOL}_a\ \text{GO-OUT}_a\ \text{CHURCH}_a}^{\text{`mm'}}$
Verb - Verb

c′ MAN $\overline{\text{GO-OUT}_a\ \text{SCHOOL}_a\ \text{GO-OUT}_b\ \text{CHURCH}_b}^{\text{`mm'}}$
Verb - Verb

d. MAN GO-TO HOME FROM SCHOOL FROM CHURCH
Prep - Prep

(C.3) **Topographic Space (Goal)**

[A man, John, is going on a short trip from Indianapolis...]

a. $\overline{\text{DC}_\text{a}\text{BALTIMORE}_\text{a}}^{\text{top}}$ IX3 DRIVE w/e-CL:3-GO$_\text{a}$
Verb - Locus

a′ $\overline{\text{DC}_\text{a}\ \text{BALTIMORE}_\text{b}}^{\text{top}}$ IX3 DRIVE w/e-CL:3-GO$_{\text{a,b / [dual]?}}$
Verb - Locus

b. IX3 DRIVE w/e-CL:3-GO$_\text{a}$ DC$_\text{a}$ TO BALTIMORE
Verb - Prep

c. IX3 DRIVE $\overline{\text{w/e-CL: 3-GO}_\text{a}\ \text{DC}_\text{a}\ \text{w/e-CL: 3-GO}_\text{a}\ \text{BALTIMORE}_\text{a}}^{\text{‘mm’}}$
Verb - Verb

c′ IX3 DRIVE $\overline{\text{w/e-CL: 3-GO}_\text{a}\ \text{DC}_\text{a}\ \text{w/e-CL: 3-GO}_\text{b}\ \text{BALTIMORE}_\text{b}}^{\text{‘mm’}}$
Verb - Verb

d. IX3 DRIVE w/e-CL:3-GO$_\text{a}$ TO DC TO BALTIMORE
Prep - Prep

(C.4) **Topographic Space (Source)**

[A man, John, is returning to Indianapolis...]

a. $\overline{\text{DC}_\text{a}\text{BALTIMORE}_\text{a}}^{\text{top}}$ IX3 DRIVE $_\text{a}$w/e-CL:3-GO$_\text{b}$ INDIANAPOLIS$_\text{b}$
Verb - Locus

a′ $\overline{\text{DC}_\text{a}\text{BALTIMORE}_\text{a}}^{\text{top}}$ IX3 DRIVE $_{\text{a,b / [dual]?}}$w/e-CL:3-GO$_\text{c}$ INDIANAPOLIS$_\text{c}$
Verb - Locus

b. IX3 DRIVE DC$_\text{a}$ $_\text{a}$w/e-CL:3-GO$_\text{b}$ INDIANAPOLIS$_\text{b}$ FROM BALTIMORE
Verb - Prep

c. $\overline{\text{INDIANAPOLIS}_\text{a}}^{\text{top}}$ IX3 DRIVE
$\overline{\text{DC}_\text{b}\ _\text{b}\text{w/e-CL: 3-GO}_\text{a}\ \text{BALTIMORE}_\text{b}\ _\text{b}\text{w/e-CL: 3-GO}_\text{a}}^{\text{‘mm’}}$
Verb - Verb

c′ $\overline{\text{INDIANAPOLIS}_\text{a}}^{\text{top}}$ IX3 DRIVE
$\overline{\text{DC}_\text{b}\ _\text{b}\text{w/e-CL: 3-GO}_\text{a}\ \text{BALTIMORE}_\text{c}\ _\text{c}\text{w/e-CL: 3-GO}_\text{a}}^{\text{‘mm’}}$
Verb - Verb

d. IX3 DRIVE w/e-CL:3-GO$_\text{a}$ INDIANAPOLIS$_\text{a}$ FROM DC FROM BALTIMORE
Prep - Prep

C.1 RUC Violations

(C.5) **Relational Space: Source - Goal**

a. $\overline{\text{SCHOOL}_a\ \text{SCHOOL}_b}^{\text{top}}$ BILL $_a$#BACK$_b$
Verb - Locus

a′ $\overline{\text{SCHOOL}_a\ \text{SCHOOL}_a}^{\text{top}}$ BILL $_a$GO-TO$_{\text{[loop path],a}}$
Verb - Locus

b. BILL GO-TO$_a$ SCHOOL FROM SCHOOL
Verb - Prep

c. BILL $\overline{\text{GO-OUT}_a\ \text{SCHOOL}_a\ \text{GO-TO}_a\ \text{SCHOOL}_a}^{\text{`mm'}}$
Verb - Verb

c′ BILL $\overline{\text{GO-OUT}_a\ \text{SCHOOL}_a\ \text{GO-TO}_b\ \text{SCHOOL}_b}^{\text{`mm'}}$

d. BILL GO-OUT FROM SCHOOL TO SCHOOL
Prep - Prep

(C.6) **Topographic Space: Source - Goal**

a. $\overline{\text{SCHOOL}_a\ \text{SCHOOL}_b}^{\text{top}}$ BILL WALK $_a$w/e-CL:1-GOb
Verb - Locus

a′ $\overline{\text{SCHOOL}_a\ (\text{SCHOOL}_a)}^{\text{top}}$ BILL WALK $_a$w/e-CL:1-GO$_{\text{[loop path]a}}$
Verb - Locus

b. BILL WALK w/e-CL:1-GO$_a$ SCHOOL FROM SCHOOL
Verb - Prep

c. BILL $\overline{\text{WALK w/e-CL: 1-GO}_a\ \text{SCHOOL}_a\ \text{w/e-CL: 1-GO}_a\ \text{SCHOOL}_a}^{\text{`mm'}}$
Verb - Verb

c′ BILL $\overline{\text{WALK w/e-CL: 1-GO}_a\ \text{SCHOOL}_a\ \text{w/e-CL: 1-GO}_b\ \text{SCHOOL}_b}^{\text{`mm'}}$
Verb - Verb

d. BILL WALK w/e-CL:1-GO FROM SCHOOL TO SCHOOL
Prep - Prep