

The relationship between verbal form and event structure in sign languages

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Abstract

Whether predicates describe events as inherently bounded (telic) or unbounded (atelic) is usually understood to be an emergent property that depends on several factors, including lexical semantics of the verb and semantic properties of their arguments; few, if any, spoken languages have dedicated morphology for marking a telic/atelic distinction. It is thus surprising that sign languages have been recently proposed to have dedicated morphology to mark telicity, and moreover that this telic morphology takes a form which iconically reflects the underlying event structure - this is known as the “Event Visibility Hypothesis” (EVH) (Wilbur 2008). The EVH has been extended with claims about its universality in sign languages (Wilbur 2008, Wilbur and Malaia 2011), its gradient nature (Kuhn 2017), and its iconic transparency (Strickland et al. 2015). However, in this paper we argue that so far the foundational claim has not been investigated with the full rigors needed to meet linguistic standards of evidence. Critically, we note that despite some compelling correlations between interpretation of predicates with regard to events structure and their forms, the status of this relationship remains an open question due to (a) lack of independent tests for telicity in sign languages that do not depend on translation assumptions, (b) lack of lexical coverage, (c) lack of demonstration that formal expressions of telicity are morphological in nature, rather than a lexical property, and (d) inability so far to dissociate telicity and perfectivity. We propose new tests and provide new data bearing on each of these points and conclude that while some evidence points in the direction of a morphological marker related to telicity in ASL, the full set of facts suggests that the proposed form and telicity are not isomorphic in their distribution. Moreover, we suggest that much of the iconicity in this domain is the result of several independent factors also found in spoken languages, so that ASL may be much more similar to spoken languages than implied by recent work on this domain in sign languages.

1. Introduction

Sign languages have been argued, in several different semantic domains, to overtly instantiate levels of structure for which there has previously been only covert evidence from spoken languages (Lillo-Martin and Klima 1991, Zucchi 2004, Schlenker 2011, Kuhn and Aristodemo 2017, etc.). One case that has received much recent attention in formal semantics (Wilbur 2008,

Kuhn 2017) and in cognitive science more generally (Strickland et al. 2015) is the claim that sign languages encode their underlying event structure (namely, the telic/atelic distinction) overtly in the phonological form of verbs (which appear in bounded/unbounded forms), known as the Event Visibility Hypothesis (EVH) (Wilbur 2008).

For example, in its original formulation, Wilbur noted that verbs like STEAL appear in telic predicates and are produced with an abrupt boundary marker (a rapid deceleration in movement and sometimes other abrupt changes), while verbs like PLAY appear in atelic predicates and are produced without an abrupt boundary marker in their form. (Note: small caps are used to discuss signs in ASL, using a close English glossing equivalent.) The Event Visibility Hypothesis claims that the abrupt boundary marker in the form reflects the presence/absence of an encoded boundary point in their semantics. Wilbur has analyzed this pattern as resulting from the addition of an iconic “EndState” morpheme that instantiates a boundary point both in form and in meaning (Wilbur 2008), making the EVH a claim about morphology, semantics, and iconicity. Subsequent works have followed up on this hypothesis in several ways. Strickland, Geraci, Chemla, Schlenker, Kelepir, and Pfau 2015 (2015) brought wider attention to this claim by arguing that this “event visibility” is transparent even to non-signers, who are able to “see” the event structure: presented with a possible (sometimes even incorrect) translation and two signs, non-signers in their study match the telicity value of verbs in several different sign languages and nonce signs at above chance levels. Kuhn (2017) uses this iconicity as the centerpiece of his analysis of telicity in sign languages, reducing the role of morphological contrast but maintaining the view that sign languages are special in directly encoding their semantic event structure in their form.

In what follows, we will instead argue that the strongest versions of this generalization at each level (semantic, morphological, and iconic) are seriously lacking in empirical support, while weaker versions may be maintained but in the end lead to patterns that are not unlike those reported for spoken languages. In the remainder of the introduction we go into greater detail on notions of telicity, using the somewhat more familiar notion of mass/count as a comparison point (1.1), before describing claims about telicity in sign languages (1.2). In section 2, we argue that discussions surrounding the EVH have been significantly lacking in independent tests of telicity that work in ASL (2.1), and instead highlight an existing possible telicity test (2.2) and suggest another new one (2.3) and apply these to ASL (2.4-2.5). In section 3 we discuss a second major issue concerning proposals of event visibility, namely the focus on only a very small number of verbs (3.1); we add new data from a wider variety of verbs both in terms of possible forms with and without boundary markers (3.2) and their associated meanings (3.3-3.4). As we will discuss, the EVH comes in several flavors, varying in the dimension that is considered iconic and with respect to the morphological status of the iconic component. We will focus on the question of the morphological status of the EVH marking in Section 4. Because telicity is intimately connected with aspect across languages, we will discuss the relationship between telicity and aspect in ASL

in Section 5, and argue that there is currently no reason to favor telicity as a morphological marker in ASL over aspect, which is more commonly marked across languages. Finally, in Section 6 we focus on issues related to the claim of iconicity and event “visibility” more generally, and in Section 7 we conclude that ASL may be much more similar to spoken languages than recent work on event structure in sign language implies.

1.1. Telicity

Natural languages are known to be sensitive to semantic differences between atomic (“count”) versus nonatomic (“mass”) reference in the nominal domain (Link 1983), and, analogously, between bounded (“telic”) versus unbounded (“atelic”) events in the verbal domain (Bach 1986), in ways which are both language dependent and also reflect general properties of the world we inhabit. Consider the nominal case first: for a felled tree on the back of a truck, a speaker of English can talk about the tree itself (atomic reference: *tree* is a count noun), or the wood that makes up the tree (nonatomic reference: *wood* is a mass noun). This choice will also affect the grammaticality of other morpho-syntactic elements. For example, English has several structures that are restricted to count reference (1) (including the plural suffix and count quantifiers like *many*), and others for mass reference (2) (including lack of plural morphology and mass quantifiers like *much*).

- (1) There are many trees on the truck.
 #There are many woods on the truck.
- (2) There was not much wood on the truck.
 #There was not much tree on the truck.

Since Bach (1986), the nominal domain has been analogized to the verbal domain through the notion of telicity, or boundedness of an event. Consider an hour-long event in which Mary carried the wood to a lumber yard in the back of her truck. This can be conceptualized either as an action of transportation with a clear goal (the lumber yard), and expressed with a clear boundary point in the telic predicate *drive the wood to the lumber yard*, or as an unbounded action of wood-carrying, expressed without a clear boundary point in the atelic predicate *carry the wood in her truck*. Again parallel with the nominal domain, elements of linguistic composition are sensitive to properties of telicity: for example, in English, verb phrase modifiers like *in an hour* can co-occur naturally with telic but not atelic predicates to describe how long the event lasted (3), while others like *for an hour* modify atelic predicates naturally but not telic predicates to the same semantic effect (4).

- (3) Mary drove the wood to the lumber yard in an hour.
 #Mary carried the wood in her truck in an hour.

- (4) Mary carried the wood in her truck for an hour.
 #Mary drove the wood to the lumber yard for an hour.

Across both the nominal domain and the verbal domain, several nonlinguistic and linguistic factors conspire to result in either mass vs. count status, or telic vs. atelic status. For example, while languages tend to categorize some nouns similarly (e.g. most languages classify *water* as mass and *cat* as count), other nouns vary from language to language (e.g. *hair* is mass in English and count in Italian). In addition, languages vary in what kind of structures are sensitive to these categories: in English plural marking and quantifiers distinguish mass/count, while in Mandarin different nominal classifiers are used for many of these same distinctions, and some languages seem to make little or no distinctions between them at all (Lima 2014, but see Deal 2017, Scontras et al. 2017). In the verbal domain, telicity is similarly based on several complex factors, including verbal lexical semantics and argument structure. For example, directed motion events in which the destination of an action is specified in the predicate generally lead to telic structures but the specific nature of the prepositional semantics matters: in English, *Mary ran to the store* is telic while *Mary ran towards the store* is atelic. In other languages, partitive case and conative particles preserve the general directionality of an action while removing the specificity of the ending, as in Finnish (I shot *karhu-a* [bear-partitive] means I shot in the direction of the bear, but I shot *karhu-n* [bear-accusative] means I shot the bear dead; Kiparsky 1998) or Dutch (She wrote *aan haar proeschrift* [conative her thesis] means she worked on her dissertation but without the conative *aan* marker, she finished it; Van Hout 2013). Identifying the telicity of a predicate, therefore, depends on a thorough understanding of many semantic details of a specific language.

While several morphological markers track with mass/count and telic/atelic distinctions, another parallelism between these two domains is that typically neither property is one that is marked directly with dedicated morphology. For example, English is not analyzed as having a morphological marker specifically for count noun status, despite generally finding plural morphology (-s) on count but not mass nouns, because singular count nouns (*cat*) lack the morpheme just as mass nouns do and some mass nouns even have count interpretations without allowing plural morphology, like *furniture* (Barner and Bale 2011). For the telic/atelic distinction, there is similarly a trend for telic predicates to appear with perfective marking (*Mary read the book*) and for atelic predicates to appear with imperfective marking (*Mary was playing*) in both adult language and child language (Shirai and Andersen 1995). However, morphological aspect marking is clearly independent of the telicity of the predicate and all combinations of aspect and telicity are acceptable (5).

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| (5) | a. Mary was reading a book. | (telic, imperfective) |
| | b. Mary read a book. | (telic, perfective) |
| | c. Mary was playing. | (atelic, imperfective) |
| | d. Mary played. | (atelic, perfective) |

In fact, the differing interpretations of telic and atelic predicates with perfective and imperfective morphology constitute a classic linguistic test of telicity for English, the so-called Imperfective Paradox (Dowty, 1979; Vendler, 1967). This test notes that for atelic predicates, the imperfective version (5c) entails the perfective version (5d) but for telic predicates, it does not. It is possible to continue (5a) with an explicit statement that the event's culmination was not reached (*but she left it at the airport and never found out how it ended*) but such an explicit denial of the ending leads to a contradiction after perfective (5b). Thus, differential behavior of telic and atelic predicates under aspect morphology is one way that the predicate types can be identified.

A few cases of dedicated telic morphology have been claimed to occur in spoken languages. Most notably, Travis (2005a) explores the properties of three Malagasy (iso 639-3: mlg) verbal prefixes, *tafa-*, *voa-*, and *(m)aha-*,¹ which she argues realize telic meaning, based on comparisons like (6) and (7) (Travis (2005a: 395-6), drawn originally from Phillips (2000:87)).

- (6) a. Nisambotra ny alika ny zaza
 PST.captive DET dog DET child
 'The child caught the dog.'
- b. ... nefa faingana loatra ilay alika.
 ... but quick too that dog
 '... but that dog was too quick.'
- (7) a. Nahasambotra ny alika ny zaza.
 PST.AHA.captive DET dog DET child
 'The child was able to catch the dog.'
- b.#... nefa faingana loatra ilay alika.
 ... but quick too that dog
 '... but that dog was too quick.'

Travis's claim of morphologically marked telicity rests on the observation that in accomplishment verb constructions without these prefixes, the existence of a natural endpoint that is reached is implicated but defeasible (6). However, when one of the target prefixes is added, it is entailed that the endpoint has been reached (7). From examples of this sort she concludes that the relevant prefixes are telic morphemes: they change an atelic predicate into a telic one. However, the data leave room for interpretation. The structure of Travis's examples is

¹ Travis (2005b:180) makes clear that she in fact analyzes *maha-* as a sequence of three morphemes *m-a-ha-*, with *ha-* being the telic morpheme. However, she seems to treat the facts related to defeasibility of the endpoint, shown in (6) and (7), as a function of *maha-*, not only *ha-*. There are some morpheme deletion facts that create complications for interpretation of surface forms.

the same as the Imperfective Paradox (see example 5) and hinges on the fact that an explicit statement that the event's culmination was not reached is allowed in (6) but is a contradiction in (7). The Imperfective Paradox, though, relies on the interaction of both telicity and perfectivity. The contradiction that arises in (7b) shows that the predicate in (7a) is both telic and perfective, but the acceptability of (6b) only requires one of those two values to be different. As presented, the defeasibility test in Malagasy could be evidence of a telic vs. atelic distinction (if the verb is consistently perfective), but also of an imperfective vs. perfective distinction (if the predicate is consistently telic). It is just as possible that (*m*)*aha-* and the other prefixes are perfective markers and their absence signals neutral, or even imperfective, marking for the sentence. This example highlights and foreshadows one problem that we also encounter in our investigation in this paper of ASL -- while aspect and telicity are conceptually independent, it can be difficult to separate telicity from aspect. Nonetheless, even if we accept Travis's argument, Malagasy is notable for its rarity. Together perhaps with the related language Tagalog (iso 639-3: tgl),² it is one of only a very few examples of (possibly) dedicated telic morphology that we are aware of as occurring in spoken languages.³ This is striking, considering the pervasiveness of boundedness in event conceptualization.

One final analogy between the nominal and verbal domains that we will see is relevant to our investigation in ASL is the possibility of semantic coercion: in the nominal domain, the presence of some morphological elements can coerce the opposite interpretation of the standard one; similarly, use of some modifiers coerce a telic interpretation from an otherwise atelic predicate, and vice versa. For example, (8) and (9) illustrate the typical uses (a) and atypical uses (b) of mass/count morphology. Turning to the verbal domain, we see the same kind of pattern: one continuation is natural while the other one is an unusual interpretation, forced by the predicates in

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| | (10) | and | (11). |
| (8) | a. She ate many sandwiches. | (count noun <i>sandwich</i> , count quantifier <i>many</i>) | |
| | b. She ate many peanut butters. | → Infer perhaps different types of peanut butters | |
| (9) | a. She ate too much peanut butter. | (mass noun <i>peanut butter</i> , mass quantifier <i>much</i>) | |

² Dell (1983) notes a similar pattern for the Tagalog prefixes *maka-* and *ma-*, which he describes in terms of a resultative meaning. (Tagalog *maka-* is cognate to Malagasy *maha-* (Phillips 2000:91).) A Tagalog verb form without these prefixes implicates but does not entail that a result is achieved; verbs with the *maka-* or *ma-* prefixes entail a result. He does not claim that *maka-* and *ma-* are telic morphemes in Tagalog (he instead treats them as resultative), but the parallels to Travis's logic are striking. Travis (2005b) analyzes Tagalog *maka-* as multiple morphemes, including a telic morpheme *ka-*.

³ Also on this short list is Camling (also spelled Chamling), a moribund Sino-Tibetan > Kiranti language of Eastern Nepal (iso 639-3: rab). In her grammar of the language, Ebert (1997:34-37) identifies a number of compounding elements as telicizers. These all can be used as full verbs, in which case they have lexical meanings (*chud-* 'arrive', *chungs-/chod-* 'send to', *dha-/dhas-* 'fall/descend', *pak-* 'put', etc.), but according to Ebert's description, when used as postverb compounding elements they are grammaticalized as telicizers, sometimes with restrictions on their distribution (e.g. *chud-* occurs only with motion verbs) or with additional meanings beyond being telic. She also records an atelicizing compounding element *ngas-/ngaid-* which, as a free verb, means 'stay, remain / keep'.

- b. She ate too much sandwich. → Infer a sandwich substance
- (10) a. Mary ate a sandwich in an hour. (telic predicate *eat a sandwich*)
 b. Mary ate a sandwich for an hour. → Infer odd lengthened eating event
- (11) a. Mary ate peanut butter for an hour. (atelic predicate *eat peanut butter*)
 b. Mary ate peanut butter in an hour. → Infer a goal of finishing some amount

The possibility of coercing both possible interpretations foreshadows another one of the problems we run into when diagnosing telicity properties of predicates in a new language: the boundary between forced and natural is not always such a stark one, and it is often quite possible to reconceptualize events in different ways depending on surrounding linguistic context. In this paper, we argue that, for several reasons, the relationship between verbal forms and telicity values in sign languages is much less straightforward than has been suggested so far in several papers arguing for a unique status of telicity in sign languages. In the next section, we turn to a discussion about telicity in sign languages in more detail.

1.2. Telicity in sign languages

Given that the telic/atelic distinction is rarely if at all expressed via dedicated morphology in spoken languages, it is a striking exception, then, to encounter the claim that all sign languages encode abstract event structure universally, morphologically, and iconically - this is known as the Event Visibility Hypothesis (EVH) (Wilbur 2003, Wilbur 2008, Wilbur and Malaia 2011). The observation that underlies the EVH is that many signs that describe events with distinctive boundary points (e.g. *die*, *steal*) involve a distinctive change in the sign across two prosodically based timing slots (which Wilbur defines as a change in: handshape aperture, orientation, “setting change”, or “change of location with contact”). By contrast, many signs that describe unbounded events (e.g. *play*, *work*) keep the hands constant along these dimensions through both timing slots (Wilbur, 2008: p. 232). The intuition behind the semantics of the EVH is that these distinctive prosodic changes iconically represent the semantic boundary of the event and the lack of such changes implies a lack of boundary in the semantics.



Figure 1. Video stills from ASL-LEX project, Caselli et al. (2017)

Wilbur (2003, 2008) categorizes this change across the prosodic timing slots as an EndState *marker* and proposes that it has morphological status: its presence reflects the presence of a boundary point in the conceptualization of the event as it is expressed by a predicate, an overt manifestation of Ramchand's (2008) *res* head marking the boundary (result) point. In other words, the EndState morpheme signals that the predicate is telic.

The Event Visibility Hypothesis is, in this formulation, stronger than the claim that there is a regular form-meaning link between the shift across prosodic timing slots and the conceptual structure. Wilbur explicitly argues that the EndState marker is an "affix morpheme" that specifically signals the inherent lexical/phrasal property of telicity (example 14, p. 232), as above, and is not any kind of marker of perfectivity. As such, she distinguishes it from, for example, Rathmann's (2005) proposal for the HOLD marker in ASL, which he suggests indicates an event was interrupted, or the sign FINISH analyzed as a marker of perfectivity. Under Wilbur's account of EndState as a telicity morpheme, it manifests as several allomorphs (since many different kinds of changes across the prosodic timing slots count as the EndState marker) and it is further subject to morpho/phonological constraints – most notably, it does not co-occur with spatial verbs. Crucially, she notes that few (possibly no) spoken languages have an explicit morphological marker of telicity (iconic or not) and that this is one point of difference between sign languages (as a class) and spoken languages, and further that this is "what makes sign languages look so similar" (Wilbur 2008).

Since the status of this EndState marker as an iconic morpheme puts sign languages in a unique typological class, there have been several extensions of this work to investigate the boundaries of both the morphemic and iconic components. Some of these extensions focus on the iconicity and its *transparency*, namely whether some regularity related to the EndState marker is available to both signers and nonsigners alike when perceiving sign language structure. For example, Malaia and Wilbur (2011) argue that there are physical characteristics of EndState that can be quantified – rapid deceleration, for instance, seems to be a regular feature that separates the kinds of verbs that are claimed to have the EndState Marker from ones that do not.

In a further investigation of this iconic component through a behavioral test of the transparency of EndState's meaning, when adults who have had no exposure to a sign language were asked to guess a given sign's meaning (in Italian (LIS), Dutch (NGT), and Turkish (TID) sign languages), they guessed at above chance levels to signs that matched the given sign's telicity value (Strickland et al. 2015). In this study, nonsigners continued to pick meanings that matched based on telicity value even when the signs themselves were "nonce signs" that followed the phonological patterns of the sign languages (including presence/absence of an EndState allomorph) but did not actually have any meaning. Strickland et al. interpret their finding to point toward a possible encoding of telicity in "core cognition", the kind of building blocks for

cognition available for use in the languages of all humans (as well as pre-linguistic children and other animals). Under this view of telicity, it is thus unsurprising that unrelated sign languages throughout the world would make use of the same kind of telicity marking, and rather what is then quite surprising is that spoken languages do not do the same.

Kuhn (2017) focuses on another aspect of the EVH: its discrete nature. He argues that sign languages use an iconic mapping between their form and the expressed event structure that goes beyond the simple presence or absence of the EndState marker (in form) and boundary point (in meaning) to something that measures out the proportion of an event that occurs and matches it to the proportion of the movement performed in a sign. For example, the sign DIE can be produced without the realization of the EndState marker, and the interpretation is that the subject came close to dying, but did not yet die. Wilbur (2008) notes this as well, but Kuhn argues that the scopal properties of the structure proposed in the EVH do not predict readings that are available in ASL (12) and moreover, that the EVH does not capture further mappings between form and interpretation as seen in changes in acceleration and deceleration which ASL signers interpret as reflecting the speed and frequency of the events that they describe (13).

- (12) a. DIE(with small movement, missing endpoint and most of the arc) ‘start to die’
b. DIE(with fuller movement, missing endpoint) ‘almost/close to dying’
(13) GIVE(fast)-GIVE(slower)-GIVE(slowest) ‘give repeatedly, while decelerating’

Kuhn proposes that the data can be better captured by an iconicity function which is present in the lexical entry for iconic predicates in ASL. For example, his semantic denotation for the verb CLOSE is shown in (14), and we extrapolate that his denotation for DIE is as in (15).

- (14) $[[\text{CLOSE}]] = \lambda x \lambda e. \text{pos}_v(\text{closure})(x)(e) \wedge \text{Icon}_\phi(\text{closure})(x)(e)$
‘There was an increase in closure, and the closure progressed in the manner shown.’
(Kuhn 2017, ex. (29))
(15) $[[\text{DIE}]] = \lambda x \lambda e. \text{pos}_v(\text{death})(x)(e) \wedge \text{Icon}_\phi(\text{death})(x)(e)$
‘There was movement toward death, and the movement toward death progressed in the manner shown.’

This function Icon_ϕ requires that the distance that the phonetic form has traveled at a given time corresponds to the degree that a measure (of closure, of death, etc.) has changed in the event at the corresponding time, and moreover, that if the maximum of the distance is reached (Wilbur’s EndState), the corresponding maximum/endpoint of the degree of the event has been reached (Kuhn 2017, p. 19-20). This has an advantage in accounting better than the original EVH for meaningful differences expressed by both the intermediate forms of verbs (12) and variation in speed (13). It does, however, leave open the question of which verbs have Icon_ϕ in their semantic denotation, leaving this as simply a constraint present in (some number of) sign language verbs.

Under this view, why some verbs, and why all and only sign languages, make use of such a function remains a puzzle, and it emphatically does not predict the existence of discrete morphological categories reflecting event structure.

Finally, Wright (2014) proposes yet a third linguistic mechanism by which sign languages are proposed to iconically encode telicity: through the repetition of movements within a sign that correspond to repeated atomic stages of processes. For example, events of drinking involve bringing a container to the mouth and events of eating involve bringing food to the mouth. In these cases, there is a minimal atomic unit that is a necessary condition on the event: the affected object needs to be brought to the mouth. The signs for these events iconically represent this minimal unit of the event; moreover, just as in the real world the events may include multiple instances of the minimal units (multiple sips from a cup, for example) so too can the sign be repeated. Wright argues that it is in fact the presence of these iconic signs for the atomic units that allows for persistent process -- that is, atelic -- interpretations on these predicates.

All of the above works take for granted that telicity is what is iconically reflected in the forms of verbs in sign languages, either due to an iconic boundary marker, an iconic function that portions out movements in the sign to correspond to progress of an event, or iconic repetition of stages in a process. We argue that while the observation of a relationship between event structure and form in sign languages seems to be supported in many ways, there is reason to doubt that telicity is always what is being reflected, and also that the relationship in sign languages between verb form and event structure is more similar to spoken languages than has been claimed so far. In Section 2 we argue that strong claims of “event visibility” have included limited tests of telicity as separate from, for example, grammatical aspect, and in Section 3 argue that these same claims have been focused on a very limited set of verbs, minimizing generalizability. We follow these observations with new data bearing on each point and then propose that these shortcomings have led to exaggerated differences between sign and spoken languages in both the morphological and iconic aspects of the Event Visibility Hypothesis. By providing new tests and data bearing on several points we add some needed nuance to the topic. We end by arguing that several factors have conspired to make event structure appear iconic in ASL, but when they are teased apart there are fewer surprising differences based on language modality than have been claimed so far.

2. Independent tests for Telicity

2.1 Tests of telicity that depend on other languages

We begin by noting that in the current literature on telicity in sign languages, there is a critical lack of an independent test of telicity. The Event Visibility Hypothesis and work based on it have all taken as given the set of verbs that are telic, in most cases based off of their English glosses, using linguistic tests in English. For example, Wilbur (2008: 221) discusses several tests

proposed by Rothstein (2008) for states vs. dynamic events based on English, such as the *in an hour/for an hour* test that we discussed above, and implies that this should inform categorization in ASL but generally does not apply these tests within ASL or discuss which tests make sense in ASL and which do not. The paper provides a short list of verbs in ASL in each category based on Rathmann (2004), but they are not those used in discussion in the rest of that paper.

Strickland et al. do not discuss how they identified the signs they used as being telic or atelic, but rather seem to determine category membership in a circular manner: if a sign has the EndState marker, then it is “telic”, and if a sign does not, they say it is “atelic”. They do show that non-signers can successfully infer two categories and link them to English words which align with English tests of telicity, but whether the signs themselves are best (or solely) distinguished along the dimension of telicity is not determined in any independent way.

Kuhn uses translated interpretations of the same tests in English, while in fact showing that they are *not* the same as in English. For example, Kuhn uses (16) to demonstrate a contrast between one production of the verb SLEEP which he argues lacks the iconic function Icon_φ (16a) and another that expresses it (16b).

- (16) a. IX-1 SLEEP ONE HOUR. (Kuhn 2017, ex. (39))
 ‘I slept for one hour.’
 a. IX-1 SLEEP-slow ONE HOUR.
 ‘I fell asleep in one hour.’

Interestingly, this example also illustrates that in ASL, ONE HOUR may either mean ‘for one hour’ or ‘in one hour’, whichever is more consistent with the interpretation of the verb. In English, the forms for those interpretations are different (*for an hour* or *in an hour*), but because they are the same in ASL, the use of ONE HOUR on its own does not work as a test of telicity in the same way the parallel phrases do in English. Rathmann (2005) suggests that there is a form of ONE-HOUR that unambiguously specifies duration, but no difference in form is suggested in (16), and Rathmann notes that the overlap between forms means that it does not provide a good test of telicity in ASL.

A much stronger form of evidence for various forms of the EVH would be to develop a test of telicity that is independent of the form of the verb and is either specific to ASL or is language independent, so that it is possible to ask whether this test does or does not necessarily track the EndState morpheme. Here we will first discuss some ASL specific tests (Section 2.2), and then discuss a test that is language independent (Section 2.3), and is consistent with Wilbur’s (2008) distinction of telicity/atelicity as one of hetero- vs. homogeneity in semantics.

2.2 ASL tests of telicity

Rather than assuming that ASL signs have the same semantic properties as their typical English glosses, or that the tests work the same way, it would be preferable to develop ASL-specific tests (and so on for other (sign) languages). In his dissertation, Rathmann (2005, Chapter 3) proposes precisely this, after noting the difficulty of transferring linguistic tests of telicity to ASL. He analyzes two constructions (NEED X TIME vs. STILL Y) which, parallel to the English “in an hour/for an hour” tests, can each be used naturally with only one telicity value.

The NEED X TIME construction specifies the time needed to complete an event and it is felicitous with telic predicates which have a designated boundary point (17a) but not with atelic predicates that contain no designated ending (17b). Rathmann notes that this construction is a close equivalent to English “take X time”, which is also restricted to telic predicates (18). Thus, we can consider the ability to felicitously appear as a complement of NEED X TIME as a test of telicity: telic predicates can do it but atelic predicates cannot.

- (17) a. BOY_i IX_i NEED 45 MIN WALK THREE ROUND (Rathmann 2005, ex. (35))
 ‘A boy there needs 45 minutes to walk three laps.’
 b. #BOY_i IX_i NEED 45 MIN WALK
 ‘A boy there needs 45 minutes to walk.’

- (18) The boy took 45 minutes to walk three laps.

The STILL Y construction indicates that an event is ongoing and Rathmann argues that only atelic predicates (19a) and not telic predicates (19b) can felicitously be complements of STILL Y. The equivalent verb in English selects for an imperfective form, regardless of its telicity value (20).

- (19) a. STILL RUN? (Rathmann 2005, ex. (36))
 ‘Is he still running?’
 b. #STILL PUBLISH?
 ‘Is he still publishing it?’

- (20) a. Mary is still carrying wood in her truck. (atelic)
 b. Mary is still driving the wood to the lumber yard. (telic)

As Rathmann himself notes, these tests are not bulletproof in that, like other linguistic tests for telicity/atelicity (and as we saw above, similar to linguistic tests for mass/count), they are susceptible to coercion effects. For example, he notes that (17b) can be well-formed, but it also implies that events of walking always take 45 minutes, which is counteracted by our real world knowledge. As far as we know, Rathmann’s telicity tests are the closest proposal so far for telicity in ASL independent of verb form, and form a small part of a much richer investigation

into event structure in sign languages (Rathmann 2005). His work also highlights the importance of not using apparent translation equivalents across languages, as even very similar words (like *STILL/still*) may work differently (but see section 5 below). More generally, given the vigor with which the EVH and related notions have been investigated recently, we want to add further, ideally converging, evidence for telicity values in ASL, one which does not draw from English-specific tests and works on a wide spectrum of predicates.

2.3 Language independent conceptual test

We suggest a test that focuses on a conceptual distinction between bounded and unbounded events -- the homogeneity distinction -- and that may allow us to distinguish between telic and atelic predicates across languages. To start, we return to our original analogy, comparing the telicity distinction in the verbal domain with the mass/count distinction in the nominal domain. Consider *wood* and *tree*. If we take some amount of wood in a truck, and then look at some arbitrary subpart of that wood, can we still describe it as *wood*? In this case, we can. Mass nouns like *wood* have the property of being *divisive*, namely, they can be increasingly divided and still the overall term applies. This contrasts with *tree*: if we have something which we can describe as *a tree*, and we take some arbitrary subpart of that tree, is it still possible to call it *a tree*? Probably not - count nouns are not divisive/homogeneous (Link 1984, Chierchia 1998).

The same notions hold in the verbal domain (Bach 1986): if we take an arbitrary subpart of the event described with the telic predicate in (21) *drove the wood to the lumber yard*, the same description would not accurately describe any arbitrary subpart of the event - for any subpart of the event that does not include the endpoint, the event requires a different description. This contrasts with the atelic predicate in (22) - any subpart of the event described by *carried the wood in her truck* can also be accurately described by that same predicate. In other words, the structure of the described events for atelic predicates, but not telic predicates, is *homogeneous*.

(21) Mary drove the wood to the lumber yard.

(22) Mary carried the wood in her truck.

So, let us consider how to test homogeneity first with the English verb *write* in different predicate forms. Imagine a world in which Mary is very busy and ambitious, but she has one hour free each day to work on her writing. She joins a writing group to help her use this time wisely. This week she is working on an essay, which she started on Monday and finished on Friday (23). If we ask what Mary did during this whole week in the writing group, you can truthfully say, *She wrote*. If you ask what she did on Tuesday in the writing group, it is also truthful to say, *She wrote*. In the case of the simple predicate *wrote* (perfective form, no direct object), a subpart of the event still counts as the same kind of event, so we can say that *wrote* passes the homogeneity test, and thus by this diagnostic, is atelic. By contrast, in the same context, if you ask what Mary did in her writing group that week, one can say, *She wrote her*

essay, but it is not truthful to say during her Tuesday writing time that, *She wrote her essay*. With the addition of the direct object, in the same aspectual form, *wrote an essay* becomes telic, specifying its endpoint. Any arbitrary sub-part of the event that does not include the endpoint of the event, therefore, cannot be described with that predicate. In other words, whether a predicate that describes the whole can also describe the subparts is a diagnostic of whether the event is conceptualized as having a boundary point (telic) or not (atelic).

(23) Context: Mary is very busy and ambitious, but she has one hour free each day to work on her writing. She joins a writing group to help her use this time wisely. This week she is working on an essay, which she started on Monday and finished on Friday.

(a) Question: What did Mary do this week in the writing period?

Answer: (i) She wrote. (ii) She wrote her essay.

(b) Question: What did Mary do on Tuesday in the writing period?

Answer: (i) She wrote. (ii) #She wrote her essay.

The homogeneity test itself is conceptual inasmuch as it depends on our understanding of the structure of the event being described and not merely the grammaticality of an added linguistic element/phrase. However, what makes a particular predicate and context evoke one kind of event structure over another is still very much dependent on linguistic properties. For example, the contrast between *wrote* and *wrote an essay* relies on two language-specific dimensions of English to evoke the telic/atelic distinction: the addition of a direct object and the use of perfective aspect.

Regarding direct objects in English, the intransitive verb *write* is atelic but adding a direct object *her essay* creates a telic predicate. The presence/absence of a direct object is highly correlated with whether an event is telic/atelic, but specific linguistic properties of both the verb and the object also play an important role. For example, in English, a direct object that is a mass noun rarely makes a predicate telic (*Mary wrote stuff* is still atelic) and not all verbs are as flexible with their argument structure as *write*. The verb *construct* for example requires a direct object and there is no intransitive *construct* in English that is atelic. Part of knowing English (or any specific language) is knowing which verbs permit/require/refuse direct objects and what the grammatical signals are (if any) of mass and count nouns. But learning any language requires learning the nuances of specific lexical items. One of the critical reasons to use a conceptual/linguistic test like homogeneity is that it allows these differences to emerge across languages and does not require assumptions about them to start.

The second language-specific element invoked in the homogeneity test in English is that the tested examples were all in perfective aspect (i.e. the simple past tense). As was noted for the sentences in (5), telic predicates in perfective aspect entail their completion point. This makes them non-homogeneous: telic predicates in perfective aspect will “fail” our homogeneity test

because arbitrary subparts of the event do not include the ending point which the perfective aspect requires be part of the predicate's interpretation. However, if a telic predicate appears with imperfective aspect (*Mary was writing an essay*) then the entailment of completion is removed and it is possible to describe an arbitrary subpart with the same predicate. If one is interested in the event structure properties of the predicate itself, then at least in English it is critical not to test the predicate using imperfective aspect. In the next section we apply the homogeneity test to various predicates in ASL, and in doing so attempt to use aspectually neutral forms, staying away from any markers of imperfectivity. However, we will return to precisely this issue later in the paper in Section 5, where we will ultimately argue that what initially looks very much like a "telicity" distinction in some predicates in ASL is difficult to separate from markers of aspect, which are still themselves under investigation in ASL.

2.4 Homogeneity test applied to predicates in ASL

In this section, we discuss applying the homogeneity test in ASL as another independent test of telicity. For this data, we met with three Deaf signers of ASL, one a multi-generational native Deaf signer and two Deaf signers from hearing families who learned ASL at very young ages. In each interview, we investigated whether the given predicates are interpreted as homogeneous, defined in the same way as we did for English in the previous section: that is, can the same description be used to describe an entire event as well as an arbitrary subpart of the event? For each predicate, we established a context for evaluation (as in the week-long essay writing scenario for *wrote*), which we discussed with each signer.

We will first discuss two predicates that seem to fall into the extreme categories that have been the focus of most previous work on the Event Visibility Hypothesis, PLAY and STEAL. PLAY has no EndState marker in its form (e.g. no abrupt deceleration) and has been assumed to be atelic (24), while STEAL has an EndState marker (an abrupt end to the single internal movement) and has been assumed to be telic (25); neither can appear in a form with the opposite EndState value. In the case of PLAY, we considered a context presented as in sentence (24). We asked whether if we take any subpart of this girl-in-room event, whether it is possible to describe it in the same way, and all three signers reported that it was.

- (24). GIRL ROOM DO-DO? PLAY 'What the girl did in her room was she played.'
 → Also holds as a true description of any subpart of this event

For STEAL, we considered a situation described as in sentence (26). We take a subpart of that event, the part before the flag is stolen, and ask whether the description holds of that event, and all signers report that it does not.

- (25) GIRL FLAG SEE, STEAL. 'The girl captured the flag.'
 → Subparts of this process cannot be accurately described with this sentence

These examples show that when applied to STEAL and PLAY, the homogeneity test is able to diagnose the verbs' predicates as telic and atelic, respectively. They thus serve as a proof-of-concept illustration of the usefulness of the test. Notably, STEAL has the EndState form as defined by Wilbur (2008) and PLAY lacks it, so they are consistent with what is expected based on the EVH. But this form-meaning correspondence is hardly surprising: these are precisely the kind of verbs that have been the focus of most of the literature on the EVH. We note that these verbs are also particularly extreme cases: PLAY describes a process that is difficult, if not impossible, to conceive of as telic even with a different argument structure, while STEAL is a punctual event, and possibly just as difficult to conceptualize as atelic. More generally, PLAY and STEAL differ along a wide variety of semantic dimensions, making it especially challenging to be sure what the specific contribution of EndState is across these cases. Additionally, since these verbs do not have both EndState and non-EndState forms, it is not possible to determine whether EndState is a true morphological marker, or something inherent in the lexical properties, or something similar to a phonaestheme (e.g. English *glisten*, *glitter*, *gleam*, *glimmer*), in which there is some relationship between form and meaning, but the shared element (e.g. *gl-*) is not quite fully a morpheme. A more informative test would be to find a single verb that allows for the creation of a minimal pair -- with and without EndState -- and for tracking the homogeneity inferences across both halves of the pair. The next section focuses on precisely these types of verbs.

2.5 Homogeneity test applied to alternating predicates in ASL

One example of such an alternating verb is WRITE (Figure 2). In one form of this verb, which we will call WRITE_1, the movement involves one sideways movement/single swipe across the nondominant hand. Because this movement has a clear rapid deceleration to an endpoint, Wilbur (2008) would analyze this morphologically as having the morpheme EndState. We can ask whether predicates containing WRITE_1 pass or fail the homogeneity test, following the reasoning outlined above for *write* in English. If WRITE_1 contains a morpheme (EndState) that expresses telicity, we should expect it to fail this test of homogeneity.

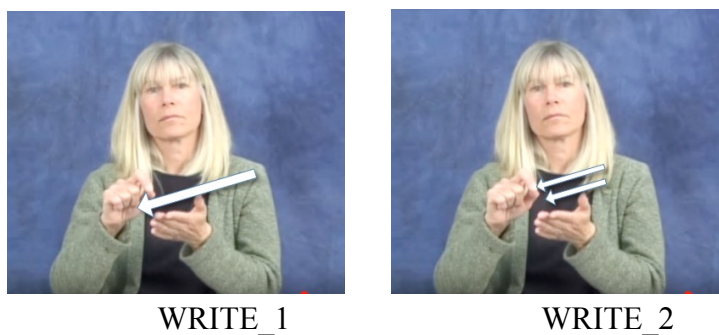


Figure 2. Video stills from ASL-LEX project, Caselli et al. (2017)

This predicate indeed fails the conceptual homogeneity test (26): while IX-Mary WRITE_1 ESSAY describes the entire week-long writing event accurately, a subpart of that event (namely, Mary's writing on Tuesday) is not accurately described by the same string. We thus conclude that the form WRITE_1 can be used to express a telic predicate, which is consistent with EndState being a morphological marker of telicity and thus consistent with the EVH. In addition, because WRITE_1 fails homogeneity, we can also be confident that it is not in an imperfective form (see section 5 for further discussion).

(26) Context: Mary is very busy and ambitious, but she has one hour free each day to work on her writing. She joins a writing group to help her use this time wisely. This week she is working on an essay, which she started on Monday and finished on Friday.

(a) Question: What did Mary do this week in the writing period?

Answer: (i) IX-Mary WRITE_1 (ESSAY).

(b) Question: What did Mary do on Tuesday in the writing period?

Answer: (ii) #IX-Mary WRITE_1 (ESSAY).

Note that in ASL, the addition of the direct object (ESSAY) is optional and does not seem to affect the value for this test, differing in this way from English, as we might expect given that ASL is well known for null arguments, both subjects and objects (Lillo-Martin 1986).

Now, we consider a different form, WRITE_2. By any account this sign is morphologically related to WRITE_1 in that it has the same lexically-specified handshape for both hands, orientation, and location, and a closely related meaning. The only difference is that now the movement involves multiple smaller sideways swipes of the dominant over the nondominant hand. Although as far as we are aware Wilbur does not focus any attention on verbs like WRITE which seem to have two forms, nevertheless when we apply her description of EndState form, this sign would clearly not be categorized as having the morpheme EndState. Just as with WRITE_1, we can ask whether WRITE_2 passes the homogeneity test, as it is predicted to be atelic and thus interpreted as homogeneous. As (27) illustrates, this predicate indeed passes the test for homogeneity because it is possible to use the same predicate to describe both the entire time period (27a), and a subset of that time period (27b), consistent with the EVH.

(27) Context: Mary is very busy and ambitious, but she has one hour free each day to work on her writing. She joins a writing group to help her use this time wisely. This week she is working on an essay, which she started on Monday and finished on Friday.

(a) Question: What did Mary do this week in the writing period?

Answer: (i) IX-Mary WRITE_2 (ESSAY)

(b) Question: What did Mary do on Tuesday in the writing period?

Answer: (ii) IX-Mary WRITE_2 (ESSAY)

Since WRITE_1 and WRITE_2 differ in whether they have the EndState marker and the semantic distinction tracks this difference of form, we find a new piece of preliminary evidence to support the EVH. Alternating verbs of this sort are crucial evidence for the claim that telicity marking is morphological: verbs that have only the form with EndState (e.g. STEAL), or only the form without EndState (e.g. PLAY), offer only weak evidence of morphological status -- *even if* the form always corresponds to the expected telicity value. As we argue further below (Section 4), true morphological structure is characterized by substitutional relations, known as paradigmatic contrast, and examples like WRITE_1 and WRITE_2 provide a demonstration of paradigmatic contrast as it relates to the status of the EndState form.

To sum up our discussion of homogeneity, we have so far applied this test to only a couple of verbs of the sort used by Wilbur (2003, 2008), Strickland et al. (2005), and Kuhn (2017) (PLAY and STEAL), as well as to a type of verb not previously discussed in the literature -- WRITE, which has alternating, paired forms. In both cases we find a mapping consistent with the EVH between the presence of the EndState marker on the verb and categorization of a predicate as telic. Conversely, and just as importantly, we also find a one-to-one mapping between absence of the EndState marker on the verb and categorization of a predicate as atelic (an example of ‘significative absence’ in the sense of Stump 1997). However, the surprising claim that ASL provides a morphological marker of telicity should be put to further tests, both with more lexical coverage and addressing the possibility of alternative interpretations of the form, specifically aspect marking. In order to really conclude that EndState is a morpheme expressing telicity, we would need to establish that the form-meaning relationship found in WRITE_1 and WRITE_2 is in fact a pattern repeated in other verbs, and that the difference in meaning is really one of telicity and not of aspect. In addition, since previous work has focused on a narrow set of verbs, exploration of a wider set of verbs allows us to test whether the EVH holds of most (if not all) verbs, as previously claimed, or only in certain subparts of the lexicon. Lexical coverage helps to establish the extent to which a telicity (or aspect) contrast is a pervasive and central organizing principle of the verbal system. We turn to lexical coverage in the next section (Section 3), and return to the issue of morphological marking generally in Section 4, followed by a return to aspect in Section 5.

3. Lexical coverage

3.1. Need for lexical coverage

Evidence both from extreme verbs like PLAY and STEAL and from alternating verbs like WRITE does seem to suggest that a change in form tracks changes in meaning, and we have provided no evidence so far that does not support the EVH. However, there is reason to think that precisely on a topic like telicity that combines world knowledge and language specific properties, increased lexical coverage is important. Recall our original analogy, between telicity in the

verbal domain and mass/count in the nominal domain. For most nouns in English, application of plural number marking like *-s* signals a count noun, and inability to take plural morphology signals a mass noun. However, not only do we not analyze the plural morpheme as the instantiation of underlying atomicity (count semantics), we also know that a few extreme examples like *cat* and *milk* do not exhaust the possible categories of interest within the mass/count domain; for example, there are nouns like *stone* which alternate between mass and count depending on linguistic markers like number morphology (*how much stone* vs. *how many stones*). These may recall verbs like ASL WRITE, which can take two forms with interpretative differences. Moreover, if telicity is really a grammatical marker it should appear on enough verbs to suggest that it has reached some level of generality, even if some exceptions exist. It is important then for investigating claims of morphological “event visibility” to increase lexical coverage by investigating several more verbs and asking two questions: (1) what forms can the verb take (with and/or without EndState)? and (b) what interpretations can its predicates have (telic and/or atelic)? We will focus first on our method for testing robustness of possible forms (Section 3.2), and then discuss possible meanings for these forms (Section 3.3).

3.2. Testing for available forms in ASL

To ask what possible meanings each form of a verb might take, we first needed to generate an inventory of verbs and document which can appear in which possible forms. Can all verbs take both forms? Clearly not - PLAY and STEAL are prime examples. Can no verbs take both forms? Also clearly not - we already saw that the verb WRITE could appear both with and without EndState. Moreover, in Wilbur’s description, EndState has a wide variety of allomorphs that are seemingly phonologically conditioned. To test the range of possible forms in ASL, we created a list of 23 verbs in ASL, based on intuitions that some may vary more than others:

READ	WRITE	STEAL	DIE	PAINT	LEARN
DRINK	SLEEP	IMAGINE	THINK	SWIM	SKATE
DRIVE	TYPE	SKI	LECTURE	DESTROY	BUILD
PLAY	STORYTELL	STUDY	BREATHE	DANCE	

We then asked the same three Deaf signers in the same interviews about homogeneity discussed above whether each verb was available in a form with EndState, and a form without it. The signers did not know each other prior to the testing session and interacted with each other for only a short time prior to participation. Thus, we are confident each gave independent judgments that were not influenced by long-term accommodation to the other participants. In addition, one challenge with the question of form is that a verb may superficially appear not to have an EndState marker (abrupt deceleration) by virtue of marking pluractionality, which is done via repetition (Klima and Bellugi 1979, Rathmann 2005, Kuhn and Aristodemo 2017). In other words, by defining EndState as rapid deceleration, descriptions involving multiple events will look like they are lacking EndState, even if perhaps the linguistic encoding of each individual event is telic. Therefore, for these tests of forms we advised signers to consider only cases with

single arguments (subject, objects, and indirect objects), at one point in time, in order to minimize pluractionality marking.

Our results showed robust agreement in form judgments across all three signers. Verbs were categorized as shown in Table 1, with 8 verbs judged to have only a form consistent with EndState, 10 verbs judged to have only a form that is inconsistent with EndState, and 5 alternating verbs that could appear both with and without the EndState form. Even before we consider the semantic contexts in which the verbs can appear, the fact that the verbs fall into three form classes (including several alternators) already suggests that the distributional facts for EndState are more complicated than has been recognized in previous work.

ENDSTATE	STEAL, DIE, DESTROY, LEARN DRINK, SLEEP, IMAGINE, THINK	READ, WRITE, DRIVE, TYPE, SKI
No ENDSTATE	PLAY, STORYTELL, STUDY, BREATHE, SWIM, SKATE, LECTURE, PAINT, BUILD, DANCE	

Table 1. Verb form distribution of 23 verbs based on agreement by 3 Deaf ASL signers.

We are not yet aware of any large database of verbs in ASL that includes semantic properties, but we chose a variety of verbs that seemed to have the potential to show a variety of patterns. However, because we drew our small sample with the intention of identifying verbs of various types, it would be premature to draw any conclusions about the distribution of these three classes of verbs within in the wider language. That said, it is notable that signers' judgements on forms were generally consistent and robust: while there was some discussion about whether certain forms could exist independent of other marks of aspect (e.g. followed by a perfective marker FINISH), in general most verbs had clear judgments about what possible forms they could take.

3.3. Testing for Available Meanings in ASL across several verbs

After determining the range of possible forms for each verb, we then asked about each allowable form, whether it can appear in a predicate with a telic interpretation, and whether it can appear in a predicate with an atelic interpretation, with the telicity value determined by the homogeneity test. These semantic judgments were somewhat less robust than the form judgments (both in terms of consistency and confidence by signers) as might be expected of semantic judgments in an area with potential for coercion, but nevertheless several categories emerged after clarifying discussions, several of which began to break the one-to-one correspondence we have seen so far between EndState forms and telic interpretations. A summary of these judgments are shown in Table 2; the next sections discuss each subcategory in turn.

	TELIC	ATELIC
ENDSTATE	STEAL, DIE, DESTROY, LEARN, READ, WRITE, DRIVE, TYPE, SKI, DRINK	DRINK, SLEEP, IMAGINE, THINK
No ENDSTATE	SWIM, SKATE, LECTURE, PAINT, DANCE BUILD	SWIM, SKATE, LECTURE, PAINT, DANCE, PLAY, STORYTELL, STUDY, BREATHE, READ, WRITE, DRIVE, TYPE, SKI

Table 2. Verb form/meaning distribution of 23 verbs

3.3.1 Supportive Evidence for the EVH: form-meaning matches

In addition to the small number of verbs described earlier in Section 2, we identified several more that patterned in a way that was predicted by the EVH. These included some additional verbs that patterned like PLAY in that they were unacceptable with EndState and also consistently received atelic interpretations (they passed the homogeneity test): STORYTELL, STUDY, BREATHE. Attempts to identify telic interpretations containing these verbs failed; in other words, we could not identify any combination of sentence with supportive context in which the verb did not pass the homogeneity test. We also identified more verbs like STEAL, which require the EndState form and which consistently received telic interpretations: DIE, DESTROY, LEARN. These all “failed” the homogeneity test even when we identified potentially supportive context/sentence pairs, leading us to conclude their interpretations must be telic. Crucially, we also discovered that all of the verbs identified as allowing both an EndState and a non-EndState form also alternated their meanings accordingly, as happened with WRITE. In other words, all of the verbs in this alternating class consistently failed the homogeneity test when EndState was included in the form and passed when it was not: READ, DRIVE, TYPE, SKI. It appears, therefore, that the EVH is not narrowly restricted to just a few verbs within ASL, but extends to a range of different verbs across the language. This is consistent with the universality claimed by Wilbur (2008) and implied by the generalization that lead to correct judgments for even ‘nonce’ vocabulary in Strickland et al. (2015). Moreover, the alternating verbs in particular offer evidence in support of an analysis of EndState as a morpheme, and not simply a loose relationship between the phonological form of the stem and the lexical meaning of the verb.

3.3.2 Lack of form-meaning match

However, the picture gets more complex as we investigate other verbs, and we find several pieces of evidence which are not consistent with the EVH as it is currently stated. The first category of verb that breaks the correspondence between EndState and telicity consists of verbs that allow only a single form but seem to allow both telic and atelic interpretations. One such example is DRINK, which can be used in a linguistic context with a clearly telic interpretation (28a) and also one with a clearly atelic interpretation (28b), but in both cases the sign clearly takes the EndState form. Another example is DANCE. Like DRINK, this verb also allows both atelic and telic interpretations (29a-b) but in contrast to DRINK, it always appears without the EndState marker. Thus, semantic flexibility is possible with a single form, and this can involve the presence or absence of EndState.

(28) (a) Context: Discussion about how much caffeine one has consumed, so as to help stay awake (with the understanding that a lot is contained in a full cup of coffee). Mary started drinking her beverage at 1pm and finished at 2pm.

Question: What did Mary drink between 1-2pm?

Answer: (i) IX-Mary DRINK CUP COFFEE.

Question: What did Mary drink between 1-1:30pm?

Answer: (ii) #IX-Mary DRINK CUP COFFEE

(b) Context: Mary has a severe allergy to caffeine; any small amount is dangerous. Mary started drinking her beverage at 1pm and finished at 2pm.

Question: What did Mary drink between 1-2pm?

Answer: (i) IX-Mary DRINK COFFEE.

Question: What did Mary drink between 1-1:30pm?

Answer: (ii) IX-Mary DRINK COFFEE

(29) (a) Context: Mary is on the TV dance competition *Dancing With The Stars*. Mary started her waltz at 1pm and ended it at 1:10pm.

Question: What did Mary do between 1:00-1:10pm?

Answer: (i) IX-Mary DANCE WALTZ.

Question: What did Mary drink between 1:00-1:05pm?

Answer: (ii) #IX-Mary DANCE WALTZ

(b) Context: Mary is a habitual dancer of waltzes; she'll often just dance and dance without any particular end goal. Mary started dancing at 1pm and ended at 1:10pm.

Question: What did Mary do between 1:00-1:10pm?

Answer: (i) IX-Mary DANCE.

Question: What did Mary drink between 1:00-1:05pm?

Answer: (ii) #IX-Mary DANCE.

These types of verbs do not on their own invalidate EndState as a morpheme -- syncretism is extremely common cross-linguistically, and we can entertain the hypothesis that DANCE,

DRINK, and other verbs of this type belong to syncretic classes.⁴ Moreover, there have even been argued to be (rare) languages with inflectional patterns showing exactly the type of syncretism just described, where one class of lexemes takes form A (e.g. EndState) and another class of lexemes takes form B (e.g. non-EndState) (Baerman et al. 2005). More investigation is needed to substantiate this hypothesis, but the key point is that the existence of verbs that break the correspondence between EndState and telicity are not inherently problematic for the claim that EndState is a morpheme. Such cases, however, do raise significant problems for the part of the EVH that posits that EndState is a universal *iconic* reflection of the underlying event structure. More generally, these cases suggest that if EndState is in fact a morpheme, the relationship between form and meaning that it instantiates is significantly more complicated than what has been postulated in the EVH.

The second category of verbs which break the correspondence between EndState and telicity is even more problematic with regard to iconicity, and introduces additional complexity with regard to morphological status. Some verbs appear in only one form, but consistently receive the opposite telicity interpretation to that predicted by the EVH. For example, SLEEP takes only a form with EndState but only allows an atelic interpretation (30); moreover, BUILD only allows a form without EndState, but patterns with telic verbs in failing the homogeneity test (31).

- (30) Context: The children were playing outside all day. At night they were very tired, and decided they needed to sleep past 7am. Mary went to bed at 10pm and woke up at 8am.

Question: What did Mary do between 10pm-8am?

Answer: (i) IX-Mary SLEEP.

Question: What did Mary do between 10pm-2am?

Answer: (ii) IX-Mary SLEEP

- (31) Context: The students were each given a box of Legos and instructions for how to make an airplane with them. Mary started putting together the pieces at 1pm and finished the airplane at 2pm.

Question: What did Mary do between 1pm-2pm?

Answer: (i) IX-Mary BUILD (AIRPLANE).

Question: What did Mary do between 1pm-1:30pm?

Answer: (ii) #IX-Mary BUILD (AIRPLANE)

These verbs constitute clear counter-examples to the iconicity claims of the EVH. With respect to morphological status, there are attested parallel patterns found in the inflectional systems of spoken languages (e.g. deponency) so verbs of this sort do not inherently preclude an analysis of

⁴ Syncretism is a mismatch between inflectional form and morphosyntactic or morphosemantic meaning such that a single inflected word-form is used for more than one licensed meaning. It is a situation in which, for some subpart of the lexicon, the morphology is insensitive to a distinction that is relevant at the level of syntax.

EndState as a morpheme. However, verbs of the types SLEEP and BUILD certainly complicate the relationship between form and meaning in a way that is not consistent with the EVH.

3.4 *Summary of the Judgment Data*

Our goal of gathering data from a range of verbs was to determine if the EVH held widely across ASL. With respect to the EndState form, the data are quite clear: signers are able to make consistent and clear judgments about which verbs do and do not require EndState, as well as which verbs can appear both with and without the form. However, in asking whether the forms were linked to the predicted telicity value, the results were far more mixed. While we found many verbs in ASL that were consistent with the EVH, we also found some notable counter-examples. At a minimum, these counter-examples demonstrate that EndState is not the only means within ASL to signal telicity, and likewise, that EndState does not always signal telicity. In fact, some of the examples violate the EVH wholesale. ‘Mismatches’ between morphological form and meaning (e.g. syncretism, deponency) are not uncommon to see within a language, although if there are enough such cases, they raise doubts about whether one has the right characterization of the pattern. Moreover, they speak to the additional component of “event visibility”, namely that EndState is iconic. To the extent that the marker is supposed to be transparently available to users of the language, the examples that we found which have non-isomorphic form-meaning relations are even less expected.

4. The morphological status of EndState

In its original formulation by Wilbur (2008), the Event Visibility Hypothesis makes a clear claim that EndState is a morpheme, and that the expression of telicity in ASL verbs (and in other sign languages) is therefore morphological in nature. While we have focused so far primarily on the semantic properties of EndState, in this section we turn to look at the logic underlying the analysis of its formal properties. As with other aspects of the EVH, the claim that EndState is a morpheme requires more rigorous testing than it has received so far. The question, fundamentally, is whether telicity is morphologically expressed in ASL verbs or is instead an inherent lexical-conceptual property, as implied by Kuhn (2017). Extreme examples of the STEAL and PLAY type -- the kinds of examples that previous work has focused on -- are consistent with either conclusion. We must therefore develop the evidence and reasoning further.

It is unclear whether Wilbur views EndState as an inflectional or a derivational morpheme. However, fundamentally the same standard of evidence applies for both inflection and derivation, so this is not a crucially important issue. Inflectional and derivational morphology both involve *paradigmatic contrast*. To illustrate the issues involved, we use the relatively well-understood issue of noun gender as a reference point. As is well known, in some languages the grammatical category of gender is a pervasive dimension of the grammatical system. In these

languages, gender always has a semantic core (Corbett 1991:9), in the sense that assignment of gender to nouns is based on semantic properties of the noun. In a subset of these languages, formal assignment (i.e. based on phonological or morphological properties) also occurs and is relevant when gender cannot be assigned on semantic grounds. For example, Russian nouns whose referents are biologically male are assigned masculine grammatical gender and those whose referents are biologically female are assigned feminine gender. Nouns that do not refer to biologically sexed entities are assigned gender according to their declension class, i.e. based on a morphological property (Fraser and Corbett 1995).

The question here is: Is gender morphologically expressed in Russian nouns? There is a good correlation between a noun's inflected word-forms and the semantic property of gender, since a noun's inflection class determines, on the one hand, the set of allomorphs that convey case and number for that noun, and on the other hand, the grammatical gender for non-sexed entities. However, morphological structure is defined by the covariation of form and meaning. This is a stricter standard than simply correlation between form and meaning. In the context of inflection, 'covariation' means that we expect to find pairs of word-forms *a* and *b*, belonging to the same lexeme, that semantically differ only in gender value, such that *a* occurs in the context of gender value *X* and *b* occurs in the context of gender value *Y*, where $X \neq Y$ and $a \neq b$. Thus, in this scenario there is not just a correlation between *a* and *X*, but in fact the *same lexeme* is combinable with both *X* and *Y*, and in those minimally different contexts, the form varies accordingly. This covariation of form and meaning is sometimes called 'paradigmatic contrast'. When this same paradigmatic contrast extends to a class of items, thus defining a pattern, we identify it as morphological in nature. See Spencer (2002) for a careful explication of this analytic logic. Paradigmatic contrast is likewise a defining empirical property of derivational morphology. In derivation we expect to find two lexemes *c* and *d* (e.g. English *teach* -- *teacher*) that share a root, semantically differ only in some meaning *Z* (e.g. 'agent noun'), and also exhibit a difference in form (e.g. *-er*). In such cases the same root occurs both in the context of *Z*, and in its absence, and the relevant form element varies accordingly, so we again have paradigmatic contrast. When this same form-meaning relationship is repeated across other lexeme pairs, we identify it as (derivational) morphology.

Gender in Russian nouns does not satisfy the paradigmatic contrast criterion. Since any given noun in Russian only ever has one gender, there is no covariation of form and gender value in the way outlined. Stated differently, the key issue is that nouns do not have inflectional 'gender pairs'. In fact, while nouns determine the gender of adjectives and other agreement targets (and gender is morphologically expressed in these agreement targets), nouns themselves do not inflect for gender (Corbett 1991:39-40). Gender is an inherent, classificatory property of Russian nouns, but not a morphological one. This despite the fact that in Russian there is a correlation between the inflected forms of a noun and its gender, because both gender and form are properties derived from inflection class membership.

Applying this logic to the EndState form in ASL, the implication is that even if we had found that verbs with EndState were always telic and ones without EndState were always atelic, this would still not be sufficient by itself to clearly establish that the EndState form is a morpheme. If all of the ASL examples were like PLAY and STEAL, this would be like gender in Russian nouns in the sense that there would be a correlation between a form (EndState) and a meaning (telic), but not paradigmatic contrast. (The examples would be different in that the correlation in Russian nouns results from both gender and form being derived from inflection class membership, whereas in ASL verbs, the correlation may be a direct or indirect reflection of iconicity in the emergence of new forms. But this difference is not relevant in the present context.) In the absence of covariation of form and meaning in the context of the same lexeme and/or stem, the best conclusion would be that there is an inherent, lexical-conceptual property of telicity that has some relationship to form, but does not rise to the level of being morphological expression. This is why alternating predicates of the sort investigated in section 2.5 (WRITE, READ, DRIVE, TYPE, SKI) are so important. WRITE_1 and WRITE_2 (and parallel pairs in other lexemes) are the crucial evidence of paradigmatic contrast, going beyond what Wilbur herself provides, towards the conclusion that EndState is a morphological marker and not just an inherent, lexical-conceptual property of verbs that has some correlation to form. The alternating predicates meet the standard of having paradigmatic contrast in a way that examples like PLAY and STEAL do not.

It is notoriously difficult to establish where the boundary between inflection and derivation is, to the point that many morphologists reject the possibility of a principled distinction (for a review, see Booij 1998 and Haspelmath and Sims 2010). Moreover, even if we want to make such a distinction, it is not fully clear to us whether examples like WRITE_1 and WRITE_2 should be considered to be derivationally or inflectionally related. However, for the question of whether the EndState marker is morphological this is immaterial, since the paradigmatic contrast criterion is applied in fundamentally the same way in both inflection and derivation. We leave for future research the question of whether to analyze the alternating verbs as belonging to the same lexeme or different lexemes.

In the end, in the alternating verbs we find some evidence that EndState is a morpheme. At the same time, the verbs with a ‘mismatch’ between form and meaning, discussed in 3.3.2 above, show that to the extent that such a morpheme expresses the semantic feature probed in this test (telicity, or perhaps aspect), it fails to apply exhaustively to the lexicon, in the sense of Corbett (2012). This leaves questions about the status of such a value as an organizing principle of verb morphology in ASL. Speculating, we may be observing an incipient morphological distinction, one that is in the process of shifting from being a lexical-conceptual property of verbs to being a grammatical (i.e. morphosemantic) feature. Across languages, new morphosyntactic and morphosyntactic features frequently (perhaps always?) develop in a piecemeal way (Joseph

2011:405). We return to this issue in our discussion in section 7 below. But first, we turn our attention to discussion of another area where the data present particular challenges for our understanding of the interpretation of Endstate marking: the relationship between aspect and telicity.

5. Relationship between aspect and telicity

In Section 2, we argued that the EVH was not yet well supported because there was no independent test of telicity of new verbs in sign languages. We then proposed the homogeneity test as one potential way to do just that, complemented by tests specific for the language (e.g. ASL). In Section 3, we argued that the EVH is not yet well developed in terms of lexical coverage, and that especially in a semantic domain like telicity, a focus on a small number of verbs may miss important larger generalizations. We then investigated a larger set (23 verbs) than previous papers, and showed that they provide several different types of counterexamples to the EVH. This already seems to pose a challenge to the notion that verbal forms in American Sign Language always wear their predicate's event structure on their sleeve. However, there is a yet another major reason to raise significant doubt about the EVH: it remains difficult at the current stage of research on sign languages to separate telicity from (grammatical) aspect.

As we noted in Section 1, telicity and aspect are independent but there are also co-occurrence patterns in their usage: telicity tends to track with perfectivity and atelicity with imperfectivity. Theoretical accounts differ on the origin of this relationship: some argue that these pairings are more natural or perhaps it is easier to compute the truth conditions in the natural pairings (e.g. Bohnemeyer and Swift, 2004; Comrie, 1976; Lie and Shirai, 2000; Wagner, 2009). Is it possible that the presence or absence of EndState is really tracking perfectivity and not telicity? One reason to be concerned about this possibility is that telic predicates can pass the homogeneity test (appear to be interpreted homogeneously) if they are in the imperfective aspect. For example, in the English version of our homogeneity test for *write*, if we change *wrote* to the imperfective *was writing*, it passes the homogeneity test even with the presence of a direct object (32).

(32) Context: Mary is very busy and ambitious, but she has one hour free each day to work on her writing. She joins a writing group to help her use this time wisely. This week she is working on an essay, which she started on Monday and finished on Friday.

(a) Question: What did Mary do this week in the writing period?

Answer: (i) She was writing. (ii) She was writing her essay.

(b) Question: What did Mary do on Tuesday in the writing period?

Answer: (i) She was writing. (ii) She was writing her essay.

In ASL, we can be confident that at least some of the forms that we used are not imperfective since we had several examples of predicates failing homogeneity, something that requires both a telic and a perfective interpretation. However, the behavior of alternating verbs like WRITE becomes more suspicious: if the presence/absence of EndState really signals the perfective/imperfective division, then we might be finding predicates to pass homogeneity for the wrong reason, namely aspect. That is both WRITE_1 and WRITE_2 could be telic but the internal repetitive movements in the sign for WRITE_2 may be marking the predicate as imperfective, allowing it to pass the homogeneity test on aspectual, not telicity, grounds.

There are actually several reasons to consider that the presence/absence of EndState might be marking aspect. First, ASL is known to have many aspect markers, so it would be consistent with what we already know is a rich area for semantic marking in the language (Klima and Bellugi 1979, Rathmann 2005). Second, many spoken languages (about half according to the WALS database) have perfective/imperfective marking, while morphological marking of telicity is at best, extremely rare, as we noted in Section 2.

There are also attested examples where aspect marking can create interpretative shifts that interact directly with telicity (Smith and Rappaport, 1991). For example, in some contexts, Russian does not overtly indicate if an NP has specific reference or not; however, specific direct objects (e.g. *the meat*) create stronger boundary points and are linked to telic interpretations while non-specific direct objects (e.g. *meat*) are linked to generic and atelic interpretations. In the absence of explicit specificity marking, aspect can shift the interpretation, with perfective marking leading to a specific (and telic) interpretation (33-a) and imperfective marking leading to a non-specific (and generic) interpretation (33-b).

- (33) a. Ja sʹel mjaso (Smith & Rappaport, 1991; ex 40)
 I eat.PFV meat
 ‘I ate the meat.’
- b. Ja el mjaso
 I eat.IPFV meat
 ‘I ate the meat/some meat.’

Thus, it is possible for EndState to mark aspect and still have a regular influence on the telicity interpretation of predicates.

That said, the claims that either EndState is a perfective marker, or that the absence of EndState marks imperfectivity, both fall short of fully supported conclusions. For one thing, just as this work has argued that we need to investigate telicity using valid linguistic tests over a range of lexical items, similarly, any claims about EndState contributing aspect meaning would require

rigorous linguistic testing. However, as ASL has no obligatory tense marking, even for future tense (Rathmann 2005), many straightforward tests of aspect marking are complicated to implement. Moreover, there is no reason to expect that EndState would mark simply perfective aspect as opposed to something with richer semantics: ASL is known to have several aspect markers so a more unusual aspect would not be especially surprising. We would also have to explain why so many verbs (all of the non-alternators) can only appear with one or the other form (presence or absence of EndState): while many languages show a strong correlation between aspect and telicity with perfective marking appearing disproportionately often with telic predicates and imperfective marking appearing more frequently with atelic predicates, it is nonetheless the case that the less frequent combinations are typically grammatical. ASL would be unusual in having grammaticized a restriction that in most other languages is simply a preference.

Finally, it is worth noting that EndState interacts with established resultative and perfective markers in ways that are not consistent with it being telicity marker (or a marker of aspect, either). Wright (2014) marshals both experimental and consultant-based data on this point. Experimentally, Wright shows that several EndState-marked verbs do not entail a completion point: signers judge them to be true even when the endpoint is not reached (and in which the English translation is often taken to be telic, although he notes that English speakers vary on this as well). Two such examples showing these interpretations are below in (34-a) and (35-a), both EndState marked forms. Additionally, Wright notes that in ASL, the most natural way to ensure that the endpoint is interpreted as part of a predicate is to include an overt result-state marker, such as DRAIN (34-b) and END (35-b). DRINK does not alternate in form, but READ does, and it is worth noting that the form of READ that appears in (35-b) and receives a completed interpretation is actually the one *without* EndState marking (he uses the notational variant READ++, which would be READ_2 in our notation: this form involves internal repetition, lacking rapid deceleration).

- (34) a. _____ t _____
 COCA-COLA, BOTTLE CL_{medium-height}, #RAY DRINK
 Ray drank (from) the bottle of Coca-Cola.
- b. _____ t _____ t
 COCA-COLA, BOTTLE CL_{medium-height}, #RAY DRINK DRAIN
 Ray drank the whole bottle of Coca-Cola.
- (35) a. _____ t
 BOOK, #RAY READ
 Ray read (part of) the book.
- b. _____ t
 BOOK, #RAY READ++ END
 Ray read the book to the end.

Wright's data converges in several encouraging ways with ours. First, both of these examples (DRINK and READ) are verbs that we have classified as allowing both telic and atelic interpretations based on the homogeneity test, and that classification is also reflected in the judgements in (34) and (35). Second, the above examples are also consistent with our form classifications: we classified some verbs as having a constant form regardless of their telicity form (DRINK) and some verbs as alternating their form depending on their telicity value (READ). Finally, in our interviews we had precisely the same experience as Wright that the most natural way to get telic entailments in ASL was by adding a result-state markers (in our case, almost always the particle FINISH). Wright calls FINISH a "general-purpose perfective marker", and proposes that the addition of FINISH or one of these other result state markers creates endpoint entailments that (he claims) the predicates otherwise lack. In our data, all three signers initially wanted to add FINISH in telic contexts that we set up via the homogeneity test. For example, whether or not the direct object of DRINK was quantized or not, signers preferred adding FINISH in cases where it needed to be clear that the endpoint was reached (36).

- (36) MARY DRINK COFFEE/CAPPUCCINO FINISH.
Mary drank (all of) the coffee/cappuccino.

Moreover, also as reported by Wright, an additional nuance of our data for the EVH is that for signs that allow both forms (e.g. WRITE), signers generally judged the non-EndState form (e.g. WRITE_2) as being telic (failing the homogeneity test) if FINISH was included (e.g. MARY WRITE_2 ESSAY FINISH). In our work, the clearest differentiation between the two forms (with and without EndState) emerged only after we convinced signers not to use FINISH at all (after a discussion/explanation of our intent to differentiate the alternating forms). While clearly more work should be done to understand the entailments of the combination of Non-EndState form with the result-state marker, there seems to be evidence that WRITE_2 is at least not incompatible with a telic interpretation of the full predicate (with FINISH) and thus that Non-EndState marking (as in WRITE_2) is probably not an atelicity marker. An analysis of EndState as marking telicity is still on the table but seems less likely given both judgments reported from Rathmann (2005) and signers' preferences for adding FINISH; an analysis of EndState as perfectivity also remains on the table, and we suspect will require more nuanced work on the entire tense-aspect-mood system in ASL more generally.

6. On Iconicity

We finally turn to a topic which for many who encounter the EVH is the most intriguing aspect: the iconic component. Iconicity was a central part of the original hypothesis discussed by Wilbur (2003, 2008) and by Wilbur and Malaia (2011), it is the basis for Strickland et al.'s (2015) study

of the transparency of these forms for non-signers, and it is the core of Kuhn's (2017) analysis of telicity in ASL. However, given the many exceptions that have come to light with larger lexical coverage and the difficulty in disentangling aspect from telicity at the current stage of this research, we find the focus on iconicity in this domain to be misplaced. The exceptions identified in section 3 show that predicates in ASL can have a telicity value that does not match the EndState form of their verb, and therefore that the event structure of predicates is not always "visible". Moreover, while our data found many examples supporting the EVH, suggesting some regularity in the language, the difficulty of determining aspectual marking versus telicity means that we cannot be sure that one or both forms do not involve aspectual inflectional morphology, making it unclear what exactly is supposed to be iconic.

We suggest that iconicity in this domain may be the result of several factors that have conspired to make sign languages initially appear more exceptional than they really are. One way to approach this is to separate the effects of (a) historical iconicity in the lexicon based on the grammaticalization of some signs from gestures; (b) availability to interpret some spatio-temporal modulations as gestures, in both sign and speech; and (c) grammatical forms that have only tenuous links to iconicity, such as the use of reduplication for marking pluractionality and/or progressive or imperfective aspect.

Regarding the effects of historical iconicity, we know that several signs are iconic in a way that does not connect to the semantic component. For example, the sign VOTE looks like someone stuffing a ballot. However, this sign is used even for voting that happens in other ways, such as electronic voting. We can imagine that similar iconic/gestural beginnings have led to differences across the lexicon, as in the signs used for words like STEAL or PLAY, without committing to these playing an active role in a synchronic semantic analysis. This is not to say that iconic properties of lexical items must play no role at all in interpretation in sign languages: Meir (2010) discusses some interesting ways in which this iconicity can affect interpretations, most notably through the possible uses of signs in metaphors: the iconic ASL sign EAT seems to be restricted in metaphors in some ways based on its iconic properties in a way that the English word *eat* is not. Analogously, in the domain of event structure, we can imagine that there may be some restrictions on interpretations arising from iconic origins, or perhaps conditioning which lexemes certain morphemes may combine with. This is certainly worth investigating further, but our suggestion is that this need not be a primary organizing principle of the verbal lexicon and/or event structure in sign languages, but rather an effect that arises on occasion as it does in other domains in the language (e.g. in metaphor).

A second factor that may be conspiring to create an overall effect of iconicity is language users' ability to interpret spatio-temporal modification as meaningful, which is present in both spoken and signed languages. These modifications are often analyzed as (spoken or signed) gesture. For example, Kuhn's (2017) focus on the analog iconicity, as in the signed forms of "almost die"

and “give repeatedly”, is probably the strongest evidence of interpreted iconicity in this domain, and indeed, he uses it to motivate an entirely iconic function within the semantics. In the end, this may be the best analysis of such iconicity, especially as it can be lexically specified (accounting for lexical variation and exceptions) and takes telicity as a result of the function and not as a primitive. However, we urge caution on this account as well, given how amenable this type of iconicity is to a gestural analysis. It is well known that it is possible to use elements of language to depict as well as (or instead of) to describe, and that this option is available both in the spoken and in the sign modalities. For example, in the spoken modality we can say someone’s words *in the manner they said them*, depicting their use instead of using them to describe (and occasionally doing both). As Davidson (2015) notes, many categories of iconicity in sign languages, including classifiers and role shift, can be productively considered in this way, as a simultaneous depiction/demonstration that affects the truth conditions only in so far as demonstrations do in speech (e.g. *loooooong*). In the case of sign language verb forms and their underlying event structure, we need more research to determine whether these can also be thought of productively as depictions of a metalinguistic sort, or whether they should be put into the basic semantic denotations for each verb.

Finally, alternators like WRITE_1/WRITE_2 represent the last case of iconicity that is not naturally covered by appealing to either gestural origins of the lexicon or the possibility of demonstrating using sign or speech. Here, we note that this alternation is of a form regularly seen in spoken languages as well: it involves reduplication. The WRITE_1 form (and all of the other EndState marked alternators) involves a single large movement, while the WRITE_2 form (and all of the other non-EndState marked alternators) involves multiple smaller movements, with the rest of the parameters (location and handshape) held constant. To the extent that this is iconic in sign languages, we suggest it may be iconic in precisely the way that we see in spoken languages with reduplication. As a form, reduplication is dispreferred as a phonological marker but preferred as a morphological marker, and shows similar iconic and interpretive properties in both sign and speech (Berent et al. 2016, Berent et al. 2017). For example, reduplication frequently marks plurality in both the nominal and verbal domain, and this is true in sign languages as well (see Aristodemo and Kuhn 2017 for detailed discussion of semantic properties of some reduplicative pluractionality markers in French Sign Language (LSF)). Of course, plurality does not exhaust the uses for reduplication by a long shot, and in fact reduplication of verbs is known to be frequently used for several things within the aspectual domain, especially frequentative, repetitive, continuation, and progressive aspect (Inkelas 2014). To the extent that the alternation seen in WRITE_1/WRITE_2 and similar verbs is iconic and follows the EVH, it may be due to similar processes that mark imperfective and/or progressive aspects in spoken languages, which as we noted in Section 5 is difficult to disentangle from telicity for several reasons.

In general, the properties of the human mind that make reduplication have similar linguistics properties across modes (Behrent et al. 2016), allow us to interpret gestures, and allow for

depiction at the same time as description across sign and speech may well account for the pattern reported by Strickland et al. (2015) in which nonsigners appear to follow the EVH in guessing meanings for nonce signs. A strong test case for this analysis would be to test for similar patterns (using reduplication, elongated vowels, etc.) of spoken language nonce words as well. Clearly more work deserves to be done on all of these hypotheses about iconicity, both fieldwork and experimental. We hope that in any case such an endeavour would take care with taking an independent test of telicity and larger lexical coverage, and consider that an emergent pattern of iconicity may be due to several underlying factors that we are already familiar with from spoken languages.

7. Conclusions

We conclude that there is not sufficient evidence to support the claim that sign languages are radically different than spoken languages in the morphological expression of telicity. We suggest that the best evidence so far for Wilbur's original formulation of the Event Visibility Hypothesis as morphological comes from verbs that alternate in forms, with those forms corresponding to different meanings which seem to have a different event structure. We argued that this provides a richness to the argument that was missing in the original work and in its successors which has focused almost completely on verbs that occurred at the most extreme ends of a spectrum of properties that track together, including the telic/atelic distinction. Alternating pairs like WRITE_1 and WRITE_2, and at least a handful of other verbs with the same pattern, may offer evidence that there is morphological expression of telicity in ASL, at least to some degree.

At the same time, the claim of event visibility is a claim that expression of telicity via the EndState morpheme is both iconic and a universal property of sign languages. The most straightforward prediction is that all verbs that are semantically compatible with both telic and atelic interpretations should exhibit the formal contrast. We showed that some verbs can occur in both telic and atelic predicates, but lack the corresponding formal contrast (e.g. DRINK, SWIM, SKATE, LECTURE, PAINT, DANCE), leading to the conclusion that the EVH is too strong of a claim. Even if alternating pairs offer some evidence that EndState is a telic morpheme, it is equally clear that the telicity contrast is not a pervasive organizing principle of verbal morphology in ASL. This is an important point in and of itself, since it speaks to the need to investigate the foundational claim of the EVH more rigorously, meeting traditional standards of evidence used in linguistics. While the data are in need of further investigation, even the preliminary investigation that we have offered here is sufficient to show that the distribution of EndState, and the corresponding semantic facts, are significantly more complex than the picture presented by Wilbur's EVH and widely assumed by subsequent work.

This returns us to another aspect of the EVH: the claim that morphological marking of telicity, as a universal property of sign languages, differentiates sign languages from spoken languages in a fundamental way. We have not attempted to investigate in this paper the question of whether the EVH holds across other sign languages; the evidence available thus far for ASL is not wholly convincing that it holds for even a single sign language. But the larger question is whether a dedicated telicity marker would make ASL and other sign languages fundamentally different from spoken languages. Indeed, although a few examples of telicity markers have been posited in spoken language (see section 1), they are not completely clear; at the very least, it is fair to say that the morphological expression of telicity is extremely rare in spoken languages. Considering how central boundedness is to event semantics, the rarity of such marking is quite notable and its presence in ASL would be equally remarkable. But as we have argued, it might be worthwhile to consider some alternatives, such as marking aspect, or some intermediate ground -- there are other possibilities related to the EVH that are available than simply saying that Endstate is a morphological marker of telicity or that it simply is not.

We can draw some lessons from the ways that languages change to identify other ways that EndState might be partially fulfilling some of the claims of the EVH. Looking beyond the occurrence of telicity morphology in particular, we can observe that the emergence of new grammatical categories occurs gradually. Deo (2015) explores the development of privative semantic oppositions, noting that they often exhibit a period of free variation before becoming fully categorical in their use. For example, in Hindi, distinct markers of progressive and imperfective have only recently come to be used categorically, in separate contexts. Based on game-theoretic modeling of the grammaticalization of a progressive-imperfective distinction (and then generalization of progressive), she emphasizes the dynamical interplay of speaker-hearer strategies and language states in grammaticalization. In the present context, the important issue is that the availability of two forms (presence/absence of EndState) does not entail a categorical semantic contrast, although this can be a step along the way to such a state.

Likewise, morphological form also does not suddenly appear wholesale and fully developed. Here we draw a parallel between EndState and phonaesthemes, such as the *gl-* group in English: *glitter*, *glimmer*, *gleam*, *glow*, etc. The consonant cluster *gl-* corresponds to a semantic property, loosely glossed as ‘shining in a bright or sparkly manner’, yet *gl-* is at best a quasi-morpheme. Most notably, it lacks paradigmatic contrast, since the ‘remnant’ parts of each verb (*-itter*, *-immer*, *-eam*, *-ow*, etc.) cannot be recombined with other prefixes to form other inflectionally or derivationally related words, and have no identifiable meaning on their own. Examples like the *gl-* cluster therefore do not meet the criteria for having internal morphological structure under the strict definition that we outlined in section 4, and in this respect are in fact further from meeting the standard of evidence than ASL verbs like *WRITE_1* and *WRITE_2* are. Phonaesthemes are in fact roughly parallel to the situation that we would find in ASL if there were *only* forms of the *PLAY* and *STEAL* type that shown no alternation. At the same time, phonaesthemes represent a

situation in which speakers have latched onto a form-meaning correspondence and extended it to new lexemes. For example, an English *-ag* phonaestheme cluster meaning ‘in a slow or tired fashion’ (e.g. *drag*, *flag*, *lag*, *sag*, etc.) can be identified. However, *flag*, *lag* and *sag* all had a final /k/ in an earlier state of the language. The shift from /k/ to /g/ was analogical in nature -- a result of speakers latching onto and extending the form-meaning correspondence, strengthening the pattern in the process (Samuels 1972:45-48). Other phonaesthemes arise in a similarly piecemeal way from words that fit the phonological structure shifting their semantics, or some combination of the two.

If there is a difference between sign languages and spoken languages in the extent to which they have dedicated telic morphology, we suggest that this may derive from the relatively greater iconicity of signs in the lexicon compared to spoken words, and an interplay of the conspiracy of iconic factors mentioned in section 6. For example, we would find it not at all surprising if the iconicity that is the historical source of many ASL lexical signs gave rise to a form-meaning correspondence in a way that parallels the *gl-* or *-ag* clusters in English. Iconically-rooted lexical signs may have created “minor, coincidental identifications” (Samuels 1972:47) between form and meaning from the perspective of the grammatical system. But in extending these form-meaning correspondences in such a way as to create alternating verb pairs, the meaning shifts from the domain of being lexical-conceptual to being morphological. In this view iconicity can be a seed from which dedicated event related morphology can grow, but crucially, it is in an indirect relationship to any morphological pattern that ultimately develops. This is significant because under this view, we should fully expect the emergence of potential telic morphology in ASL to operate through a series of small-scale generalizations that extend the pattern through the lexicon in a piecemeal way -- i.e., through the exact same processes that we find routinely in the development of spoken language morphology. The somewhat chaotic mix of form-meaning relations that we documented in sections 2 and 3 above is exactly what we would expect from a pattern that is still in the process of being grammaticalized, and in which iconicity shapes the grammar in similar ways as in spoken languages (e.g. reduplication, demonstration, etc.). In this respect, ASL may be much more similar to spoken languages than recent work on event structure in sign language implies.

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Appendix: Contexts for Judgments on 23 verbs

Note 1:

Verbs were tested on each form that was judged grammatical, i.e. both Endstate and Non-Endstate marked forms for alternators.

Note 2:

Verbs reported as possible to appear with telic interpretations meant that there was a context such that they were judged to not be true of the character who participated in a sub-part of the event. Verb judged possible to appear with atelic interpretations meant that they could be true of both characters, including the character who only participated in a subpart of the event.

Verb (Verbs in bold have two forms, EndState and nonEndState)	Context	
STEAL	<i>Both of these people were playing Capture the Flag, a game where you need to find + take the other team's flag to win.</i>	
	Whole	He came across the flag easily. He grabbed it when no one was looking.
	Subpart	She looked very hard. She walked close to the flag but didn't see it.
	Question: WHO STEAL?	
DIE	<i>Both of these people got a very rare disease and went to the hospital.</i>	
	Whole	He had a very bad case of the disease. Unfortunately, he didn't survive.
	Subpart	She is still in the hospital and very ill. We're very worried about her!
	Question: WHO DIE?	
LEARN	<i>These children are at school. Today's lesson is about how a bill becomes a law. The students have a difficult test on this lesson at the end of class.</i>	
	Whole	He understood the teacher very well and he got an A on the exam.
	Subpart	She tried very hard during class but she flunked the exam.
	Question: WHO LEARN?	

DESTROY	<i>There is a very old building that needs to be removed so that they can build new apartments instead.</i>	
	Whole	Using dynamite and construction vehicles, he tore down the building in 1 hour.
	Subpart	Using construction vehicles, she tore down part of the building in ½ hour.
	Question: WHO DESTROY BUILDING?	
READ	<i>Today’s test is on Pres. Obama’s biography, especially about what happened in the last chapter!</i>	
	Whole	She finished the book!
	Subpart	He started the book but never finished the last chapter.
	Question: WHO READ?	
READ	<i>Research suggest that one easy way to learn new words is to start each day with a newspaper.</i>	
	Whole	She looked at the newspaper for 20 minutes this morning.
	Subpart	He looked at the newspaper for 10 minutes this morning.
	Question: WHO READ?	
WRITE	<i>Today’s assignment was to turn in to the teacher at the end of class a poem with 10 lines.</i>	
	Whole	Her 10 lines were all about winter.
	Subpart	He turned in just 5 lines about summer, didn’t have time to finish.
	Question: WHO WRITE?	
WRITE	<i>To help the students improve their handwriting, the teacher had them spend some time each day practicing ABCs.</i>	
	Whole	She practiced for 20 minutes this morning.
	Subpart	He practiced for 10 minutes this morning.
	Question: WHO WRITE?	

DRIVE	These students love to go to the beach and on the last day of classes, they both got in their cars and were ready to go!	
	Whole	He had an easy trip and arrived in just 20 minutes.
	Subpart	She started out but got a flat tire on the highway and never arrived.
	Question: WHO DRIVE?	
DRIVE	These students are crazy about cars and just like to take them out on the road, feeling the wind in their hair.	
	Whole	She took the car on a winding road for 2 hours.
	Subpart	He took the car on a winding road for 1 hour.
	Question: WHO DRIVE?	
TYPE	For their history class in school, these students need to turn in a paper and they can't handwrite it.	
	Whole	She has a computer and completed the whole term paper on it.
	Subpart	His computer died while he was working and the last section of his paper was handwritten.
	Question: WHO TYPE?	
TYPE	These students are taking a class on how to use a computer, starting with practicing making a list in MS Word.	
	Whole	She was very fast and practiced entering all the words on the list.
	Subpart	He worked very hard and entered many of the words on the list.
	Question: WHO TYPE?	
SKI	These students are on the ski team and are entered into a race that starts at the top of the mountain and ends at the red flag at the bottom.	
	Whole	She reached the red flag in 2 minutes!
	Subpart	He fell part way down and never got to the final flag.
	Question: WHO SKI?	

SKI	These students both got new skis and they are looking forward to using them at the mountains.	
	Whole	She started at the top of the mountain and went all the way down.
	Subpart	He started at the top and fell half-way, so then he needed to be carried.
	Question: WHO SKI?	
DRINK	These students went to a café with some friends.	
	Whole	He could not sleep last night at all and really wanted some coffee. He finished his whole cup in 3 gulps.
	Subpart	She is allergic to caffeine and it makes her ill. The waitress accidentally gave her coffee. She had one sip then noticed and stopped.
	Question: WHO DRINK CUP COFFEE?	
DRINK	These students went to a café with some friends.	
	Whole	He could not sleep last night at all and really wanted some coffee. He finished his whole cup in 3 gulps.
	Subpart	She is allergic to caffeine and it makes her ill. The waitress accidentally gave her coffee. She had one sip then noticed and stopped.
	Question: WHO DRINK COFFEE?	
SLEEP	The children were playing outside all day. At night they were very tired.	
	Whole	She went to bed early and woke up late, very rested.
	Subpart	He went to bed early and woke up early.
	Question: WHO SLEEP?	
IMAGINE	These two are looking for a new house. They visit one that is very ugly and in need of a lot of repairs.	
	Whole	He spent 5 minutes thinking about how it could be improved, including fixing the yard and new paint.
	Subpart	She spent 2 minutes thinking about how it could be

		improved, especially new paint.
	Question: WHO IMAGINE HOUSE?	
IMAGINE	<i>These two are looking for a new house. They visit one that is very ugly and in need of a lot of repairs.</i>	
	Whole	He spent 5 minutes thinking about how it could be improved, including fixing the yard and new paint.
	Subpart	She spent 2 minutes thinking about how it could be improved, especially new paint.
	Question: WHO IMAGINE?	
SWIM	<i>The students were trying out for the Olympic swim team and have to beat a set time in the 50-meter race.</i>	
	Whole	He was very fast and completed the race with a terrific time!
	Subpart	She dove into the pool but got a cramp right away and almost drowned.
	Question: WHO SWIM RACE?	
SWIM	<i>The students were trying out for the Olympic swim team and have to beat a set time in the 50-meter race.</i>	
	Whole	He was very fast and completed the race with a terrific time!
	Subpart	She dove into the pool but got a cramp right away and almost drowned.
	Question: WHO SWIM?	
SKATE	<i>The students were trying out for the Olympic speed skating team and have to beat a set time in the 50-meter race.</i>	
	Whole	He was very fast and completed the race with a terrific time!
	Subpart	She started out strong, but slipped on the ice and never finished.
	Question: WHO SKATE RACE?	
SKATE	<i>The students were trying out for the Olympic speed skating team and have to beat a set time in the 50-meter race.</i>	
	Whole	She started at the top of the mountain and went all

		the way down.
	Subpart	He started at the top and fell half-way, so then he needed to be carried.
	Question: WHO SKATE?	
LECTURE (PRESENT)	<i>The students were in a history class where they had to perform Pres. Obama’s acceptance speech.</i>	
	Whole	He was very formal and finished his presentation.
	Subpart	She started but she had to stop halfway through.
	Question: WHO LECTURE ACCEPTANCE SPEECH?	
LECTURE (PRESENT)	<i>The students were in a history class where they had to perform Pres. Obama’s acceptance speech.</i>	
	Whole	She started at the top of the mountain and went all the way down.
	Subpart	He started at the top and fell half-way, so then he needed to be carried.
	Question: WHO LECTURE?	
PAINT	<i>The students are taking an art class. Today’s lesson is about making flowers.</i>	
	Whole	He was a great artist and he used his paints to make a very realistic flower.
	Subpart	She liked to use lots of colors of paint, but she got bored before she finished anything.
	Question: WHO PAINT FLOWER?	
PAINT	<i>The students are taking an art class. Today’s lesson is about making flowers.</i>	
	Whole	She started at the top of the mountain and went all the way down.
	Subpart	He started at the top and fell half-way, so then he needed to be carried.
	Question: WHO PAINT?	
DANCE	<i>They are contestants on Dancing With The Stars.</i>	
	Whole	She did a great job on her entire piece, a waltz.

	Subpart	He did a great job on the first half of his piece, a waltz, but then had to stop.
	Question: WHO DANCE WALTZ?	
DANCE	They are contestants on Dancing With The Stars.	
	Whole	She started at the top of the mountain and went all the way down.
	Subpart	He started at the top and fell half-way, so then he needed to be carried.
	Question: WHO DANCE?	
BUILD	The students were each given a box of Legos and instructions for how to make something specific with them.	
	Whole	He was very focused on followed the directions for an airplane to the end.
	Subpart	She didn't like to use instructions and just put Legos together the way she liked.
	Question: WHO BUILD AIRPLANE?	
BUILD	The students were each given a box of Legos and instructions for how to make something specific with them.	
	Whole	She started at the top of the mountain and went all the way down.
	Subpart	He started at the top and fell half-way, so then he needed to be carried.
	Question: WHO BUILD?	
THINK	The Department of Linguistics is in Building B, not Building A.	
	Whole	She thought (wrongly) all year that Linguistics was in Building A.
	Subpart	He thought (wrongly) up until March that Linguistics was in Building A, but realized in April that it was in Building B.
	Question: MARCH, WHO THINK LINGUISTICS DEPARTMENT [in] BUILDING A?	
PLAY	Research shows that petting cute puppies reduces stress, makes people more happy. The teacher brought her puppy to school one day.	

	Whole	She was the last child to have a turn. She got to spend 30 minutes with the puppy.
	Subpart	He was the first child to have a turn. He got to spend 15 minutes with the puppy.
	Question: WHO PLAY WITH DOG?	
STORYTELL	Research shows that children learn best by doing things themselves, not just passively watching their teachers. These children have to practice their presentation skills.	
	Whole	She likes to talk in front of the teacher and she took 20 minutes.
	Subpart	He is very shy and he took just 10 minutes.
	Question: WHO STORYTELL?	
STUDY	These children go to a hard school. At the beginning of every week, the teacher gives them a list of words. On Friday they have a spelling test.	
	Whole	Thursday night, he practiced spelling for 2 hours.
	Subpart	Thursday night, she practiced spelling for 1 hour.
	Question: WHO STUDY LIST?	
STUDY	These children go to a hard school. At the beginning of every week, the teacher gives them a list of words. On Friday they have a spelling test.	
	Whole	She breathed in and out for 5 minutes.
	Subpart	He breathed in and out for 2 minutes.
	Question: WHO STUDY?	
BREATHE	These children go to the doctor, who asks them to breath in and out so they she can check their lung capacity.	
	Whole	She breathed in and out for 5 minutes.
	Subpart	He breathed in and out for 2 minutes.
	Question: WHO BREATHE?	