SIMULTANEITY IN SIGN LANGUAGE:
SOME OBSERVATIONS FROM JAPANESE SIGN LANGUAGE[*]

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1 Introduction

Sign languages, unlike spoken languages, use more than one articulator, two hands and non-manual markers (NMM) such as a head shake and eye movements, which are physiologically independent. Therefore, multiple articulators can be used to sign words and phrases simultaneously as illustrated by the example in (1) from Hong Kong Sign Language (HKSL).

(1) *Hong Kong Sign Language*
Right hand: CL: PLANE-FLY- -
Left hand: HAVE MANY BIRD CL: MANY-BIRDS-FLY-BY
                                                                                (CL: classifier)
'The plane flew (in the sky). Many birds flew together with the plane.'
                                                                        (Tang *et al*. 2007: 290)

In this example, the right hand perseverates the sign 'plane,' a classifier morpheme, while the left hand simultaneously continues signing to describe the event.[1]

However, simultaneous articulations are not always permitted. It has been pointed out that the independent and simultaneous movement to produce two lexically distinct signs is cross-linguistically less common than the cases of perseveration as in (1), where one hand holds the end state of a sign without moving, while the other continues signing (cf. Miller 1994; Vermeerbergen *et al*. 2007; Kimmelman 2015; Kimmelman *et al*. 2016). For example, two hands

[1] See Emmorey (2003) for a collection of articles on classifier constructions.

never express two propositions at the same time (Kimmelman 2015). That is, although the human body is a "bilaterally symmetrical object" (Battison 1978), signers tend to use only one side of their body to produce words and phrases.

Asymmetry between the two hands in simultaneous movements is also observed in their functional qualities. Miller (1994) argues that in bimanual simultaneity, a division of labor exists between the signer's H1 and H2 as carriers of foreground and background information, respectively. Other functions for bimanual simultaneity described in the literature include topic-comment structures (Perniss 2012), locative-relationships between two or more referents (Engberg-Pedersen 1994), and independent meaning signs that help guide discourse (Liddell 2003).

If these descriptions concerning simultaneity in sign language are correct, several questions arise: Why is simultaneity in sign language constrained in this specific way? If simultaneous movements are only permitted in the case of perseveration and it involves asymmetrical semantic roles such as topic and comment, then why are other types of simultaneity not permitted? And, why do the observed instances of simultaneity carry these specific functions?

This paper explores a novel approach to address these questions. I propose that modality-specific constraints on simultaneity in sign language can be derived from a general, modality-independent linguistic principle, providing evidence from Japanese Sign Language (hereafter, JSL). The article is organized as follows. Section 2 reviews previous works on simultaneity in sign language and introduces the generalization concerning formal properties of simultaneous constructions. Section 3 presents functional accounts of simultaneity proposed in the literature. Section 4 proposes a modality-independent, syntactic account of the distribution of simultaneous constructions in sign language. Section 5 provides evidence from JSL to support the presented proposal. Finally, section 6 concludes the discussion.

2   Formal Properties of Simultaneity

The visual-spatial modality of sign language (Sander & Lillo-Martin 2006) allows for multiple articulators to be used simultaneously. Thus, several types of co-articulation involving two hands and NMM are possible. Some illustrative examples are given in (2)−(4) from JSL, following the three-way classification of simultaneity proposed by Vermeerbergen *et al*. (2007: 2): (i) bimanual simultaneity, (ii) manual-oral simultaneity, and (iii) simultaneous use of other (manual or non-manual) articulators.

(2) *Bimanual simultaneity*
    Right hand: TV   EAT - - - - - -
    Left hand: TV- - - - - - - - - -
    '(I was) eating while watching TV.'

(3) *Manual-oral simultaneity*

                                    th
    Right hand: STUDY - - -
    Left hand: STUDY - - -
    'study without thinking'   (Ichida 2005: 95)

(4) *Simultaneous use of other (manual or non-manual) articulators*

<div style="text-align:center">tensed mm/body lean/head down</div>

Right hand: STUDY - - - - - - - - - - - - - - - - -
Left hand: STUDY - - - - - - - - - - - - - - - - -
'(I was) studying very hard.'

Figure 1   'study very hard'

Bimanual simultaneity is used in (2), where both hands start producing the sign 'TV,' and the end state of this sign is held by the signer's left hand (i.e., the non-dominant hand, henceforth H2), while the right hand (the dominant hand, H1) changes to produce the sign that describes the eating event. In (3), the verb 'study' is signed manually and at the same time, an adverbial expression 'with no intention, without thinking' is performed by extending the tongue tip between the teeth (notated as *th*).[2] In (4), manual, facial, and body articulators are simultaneously used. The adverbial expression 'very hard' that modifies the verb is made by leaning the body forward, with head down and mouth tensed (mm), as shown in Figure 1.

     Crucially therefore, in examples (1) and (2) above, which are instances of bimanual simultaneity, the movements of the two articulators do not continuously overlap. In contrast, in examples (3) and (4), the movements of two or more articulators coincide simultaneously. In what follows, I refer to the latter type of simultaneity, in which two or more articulators act independently of each other to produce lexically distinct signs, as 'full simultaneity' (Miller 1994; Vermeerbergen *et al*. 2007), distinguishing it from bimanual simultaneity as in (1) and (2), which are cases of 'perseveration,' where one of the hands is maintained *in situ*.[3]

     Bimanual full simultaneity in sign language, as mentioned above, is rarely attested cross-linguistically (see Miller 1994; Vermeerbergen *et al*. 2007; Kimmelman *et al*. 2016). It is argued that the simultaneous production of words and phrases by the two manual articulators is quite restricted. For example, Hendriks (2007), based on her work on Jordanian Sign Language, proposes the phonological condition in (6), which basically rules out bimanual full simultaneity.

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[2] In addition to the 'mouth gesture' described here, Ichida (1998) specifies that in this example, a signer's head should be in a "low" position (see e.g. Liddell 1980; Kimura & Ichida 1991 for discussion of nonmanual adverbs).

[3] Some researchers refer to examples such as (1) and (2) as "weak hand holds" (Kimmelman 2015; Kimmelman *et al*. 2016). I instead use the term 'perseveration' in this paper, which encompasses cases like (1), in which a signer's strong/dominant hand is maintained in the hold position.

(5) *Phonological rule for simultaneity (Jordanian Sign Language)*
Manual simultaneity can only take place when at least one of the hands makes no lexically specified movement, or when the movement of the two hands is symmetrical.

(Hendriks 2007: 240)

Kimmelman (2015), more generally, formalizes constraints on manual simultaneity as in (6a), arguing that the full realization of two independent signs by two hands almost never occurs, and that what we see instead is (6b).

(6) a.   H1:   X
           H2:   Y
    b.   H1:   X - - - - - - -
           H2:   Y   (Kimmelman 2015: 228)

In this paper, following Kimmelman, I adopt the generalization in (7), which states that bimanual articulation with lexically specified distinct movements, i.e. full simultaneity, is not permitted.[4]

(7) *Ban on bimanual full simultaneity*
    * H1: X
       H2: Y   (X and Y are lexical items or phrases)

Unfortunately, while this generalization appears to hold, counter-examples are also reported in the literature. Consider (8) from HKSL.

(8) *HKSL*
    H1:   DRINK- - - - - - - - - - - - -
    H2:   DRIVE- - - - - - - - - - - - -
    '(The man) was drinking while driving.'   (Tang *et al*. 2007: 192)

In this example, two hands actively move to produce two lexically distinct signs, hence violating the generalization in (7). Another violation case is found in a British Sign Language (BSL) poem, where a signer expresses three propositions using two hands and an NMM, each of which encode a different word and phrase.

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[4] Interestingly, a similar phonological condition is proposed in the literature, namely, the well-known Battison's (1978) Dominance Condition. Just as our generalization in (7) bans the use of two hands that are specified for lexically different words and phrases, the Dominance Condition bans the use of two hands that are specified for different handshapes and movements to express a mono-morphemic word. This suggests that a unified analysis of two phonological conditions may be possible. Whether or not these conditions arise from the same cognitive constraint or should be treated independently should be investigated in future research. See Kita *et al.* (2014) for an interesting avenue for the former direction. I thank Daisuke Hara (p.c.) for pointing this out to me.

(9) *BSL*
    NMM: The signer puts her head back and opens and closes her mouth.
        SNORING HUMAN
    H1:   DOG
    H2:   BIRD
    'Dog dozes, I doze, bird dozes.'   (Napoli & Sutton-Spence 2010: 651)

How can we account for the grammaticality of these "exceptions"? To help explain these exceptions, in the next section, we turn to another aspect of bimanual simultaneity that is discussed in the literature.

3   Functional Properties of Simultaneity

In addition to the formal properties described above, researchers have proposed functional descriptions of manual simultaneity. For example, based on the corpus data from Quebec Sign Language, Miller (1994) proposed one important function of manual simultaneity: encoding the distinction between foregrounded and backgrounded information, expressed by H1 and H2 respectively, as illustrated in (10).

(10)   *Quebec Sign Language*
        H1:   AIRPLANE Y TO (location x)   (arc movement)
        H2:   GO TO (location x)   (straight line movement)
        'I flew there.'   (Miller 1994: 105)

This example, in which distinct movements occur independently by using two hands, is an instance of full simultaneity, hence violating the generalization in (7). Yet, the example fits into Miller's semantic dichotomy in manual simultaneity: H1 expresses the foreground information, while H2 expresses the background information.

    In the works following Miller (1994), other functions for manual simultaneity have been identified. Engberg-Pedersen (1994) examined Danish Sign Language and argued that two hands in simultaneous constructions establish locative relationships between two or more referents. Liddell (2003) investigated various discourse functions of an H2 held in a stational configuration in perseveration that he called 'buoys,' which were distinguished into four types: list, THEME, POINTER, and fragment buoys (see also Liddell *et al*. 2007).

    Reviewing these works, Perniss (2007) provided a list of functions of bimanual simultaneous constructions as in (11).

(11)   *Functions of bimanual simultaneous constructions*
        i)   to express locative information
        ii)   to express the temporal and locative simultaneity of events
        iii)   to express temporal simultaneity of events or states
        iv)   topic-comment structure
        v)   enumeration
        vi)   an index sign and its related signs   (cf. Perniss 2007: 28)

Interestingly, the functional qualities described here accurately capture the example in (4)–(5) discussed above. Recall that these examples are instances of full simultaneity, thereby violating the generalization in (7). However, the two examples, which both depict temporally simultaneous events, neatly fall into the functional description of manual simultaneity in (7iii) above.

On a related note, Tang *et al.* (2007) presented a similar line of argument for their example (8). Considering that the example does not conform to Battison's (1978) Symmetry and Dominance Conditions (see Footnote 4), they suggested that "conjoined or temporal embedding of clauses" as in (8), where different predicates are subsumed under the same event, are sites for "potential violations." (2007: Footnote 5). Note that this suggestion also applies to example (9) from British Sign Language, another case of violation to the generalization in (7), which is an instance of conjoined clauses.

Now, suppose that such function-based account is descriptively accurate. We are then left with the following questions: Why do the observed instances of simultaneity carry these specific functions? Furthermore, why is only this type of manual simultaneity allowed, not others? In the next section, I propose a novel approach to address these questions.

4 Proposal

From our discussion so far, an overarching property emerges that encompasses both formal and functional qualities of manual simultaneity: asymmetry between two manual articulators. Although the two articulators are equally available, one is used more actively than the other, and their semantic roles invoke a "central-peripheral" dichotomy (Miller 1994).

One way to encode such asymmetry in terms of form and meaning is to represent it in syntax. On a closer inspection, functional qualities of simultaneous constructions described in Perniss' (2007) list are typically represented by temporal, locative, and topic adverbial phrases/clauses. Enumeration and indexing morphemes can be analyzed as modifiers of their associated words. Syntactically, such elements all involve adjunct structures. In the recent theory of syntactic labeling, adjuncts are assumed to have a special status. While syntactic objects must be labeled to be interpreted at the interfaces (Chomsky 2013), it is argued that adjuncts are licensed without the need to resort to labeling (Hornstein & Nunes 2008; Hornstein 2009). To illustrate this line of analysis, let us consider (12) in English.

(12)   The man reads while eating.

The example has a structure as in (13), where the embedded predicate is adjoined to the matrix predicate.

(13)   VP

    the man   read   eat $[_{vP}$ [the man] ^ [read]]
                                                    ^ [eat]
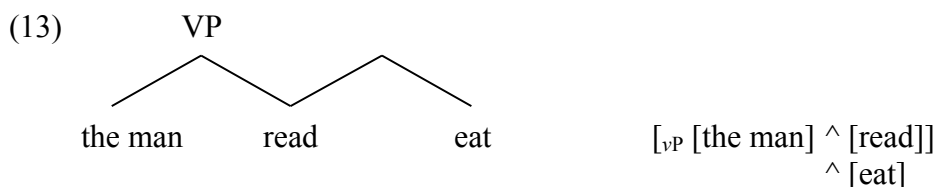
In this structure, the two predicates are simply concatenated (notated with ^) without being labeled.

I propose that this absence of syntactic labels explains the availability of simultaneous constructions in sign language, assuming that the constituents of an unlabeled syntactic object lack a fixed ordering relationship in syntax, and hence, may be realized simultaneously at the phonology if a language permits this type of articulation. This proposal correctly explains the availability of full simultaneity in the data presented above.[5] First, let us consider the examples in (3) and (4) from JSL, which involve non-manual articulators, repeated here:

(14) *Manual-oral simultaneity*

                   <u>   th</u>

       H1:   STUDY - - -

       H2:   STUDY - - -

       'study without thinking'

(15) *Simultaneous use of other (manual or non-manual) articulators*

                 <u>tensed mm/body lean/head down</u>

       H1:   STUDY - - - - - - - - - - - - - - - - -

       H2:   STUDY - - - - - - - - - - - - - - - -

       '(I was) studying very hard.'

In both examples, an adjunct adverbial that occurs as an NMM is produced simultaneously with the manually signed predicate that it modifies. This fact naturally follows from the presented analysis, where the adjunct and the predicate in these examples form an unlabeled constituent, hence, lacking a fixed order, as shown in (16).[6]

(16) *Structure of (14)-(15)*

```
              VP
         ___/  \__/\__
        /        \     \
      DP          V      Adv
      I         study
```
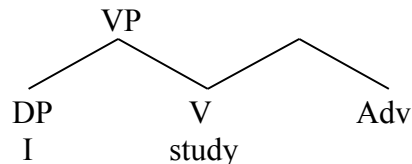
Next, let us revisit the examples that do not follow the generalization in (7). My proposal correctly accounts for the grammaticality of these exceptions. The relevant examples are repeated here:

(17) *HKSL*

       H1: DRINK- - - - - - - - - - - - -

       H2: DRIVE- - - - - - - - - - - - -

       '(The man) was drinking while driving.'

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[5] In the present work, I leave open the question of how best to analyze the cases of perseveration and weak-hand holds (Kimmelman 2015) and how exactly they differ from the cases of full simultaneity. Clearly, this area needs to be further investigated in future research.

[6] Harmon (2016) presents a similar argument concerning adjuncts in ASL. She proposes that non-manual manner adverbs in this language that occur simultaneously with manually signed verbs are unlabeled adjuncts.

(18)   *BSL*
  NMM: The signer puts her head back and opens and closes her mouth.
        SNORING HUMAN
  H1:   DOG
 H2:   BIRD
  'Dog dozes, I doze, bird dozes.'

First, let us consider the example in (17) from HKSL, which contains a secondary verbal predicate. The example is analyzed as in (19), where the embedded predicate is adjoined to the matrix predicate.

(19)   *Structure of (17)*

$$[_{VP} \; [\text{the man}] \wedge [\text{drink}]] \wedge [\text{drive}]$$
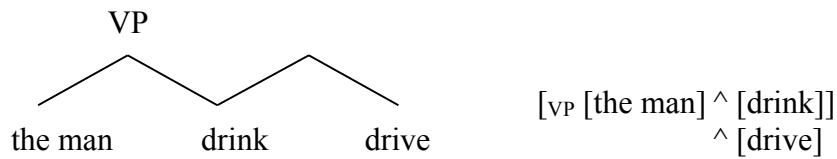
In this structure, the two predicates are simply concatenated without being labeled, thus, unordered in syntax. This is why the simultaneous articulation of the two signs in (17) is permitted in this language. Second, we saw that the example in (18) from BSL, in which three propositions are signed simultaneously, is well-formed. This fact also follows from my proposal. In this example, the three clauses are simply juxtaposed at the discourse level, without being labeled, as in (20).

(20)   *Structure of (18)*

Dog dozes I doze Bird dozes
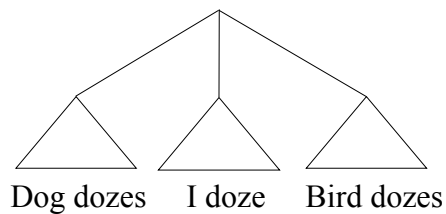
The conjoined three clauses, therefore, just like adjuncts, lack a fixed linear order. This explains the possibility of expressing the three propositions simultaneously.

  The current proposal neatly captures the relative absence of simultaneous constructions described in the literature. Simultaneous articulations of syntactic items are permitted when the precedence relation between the items is unspecified, as I have assumed. However, such instances are not generally allowed. For example, consider (21a) and (21b), where the constituent formed by merging two heads [H^H] and that formed by merging two phrases [XP^YP] occur as compliments of a head.

(21)   a. $[\ldots [_Z Z \wedge [\text{H}^\wedge\text{H}]]]$ b. $[\ldots [_Z Z \wedge [\text{XP}^\wedge\text{YP}]]]$

The two heads in (21a) and the two phrases in (21b) are simply concatenated, and hence, unordered in syntax. They can thus potentially exhibit co-articulation. However, the two constituents, without a label, are problematic because they are invisible to the labeling algorithm

(Chomsky 2013). This accounts for a limited distribution of simultaneous constructions as described in previous research.[7]

5 Japanese Sign Language

5.1 DP-coordination

JSL provides a piece of evidence to support this proposal. Consider the example of DP-coordination in (22) in English.

(22)   He and I came.

In research on coordination, traditionally, a coordinate structure as in (22) is analyzed as in (23), where conjuncts are concatenated in a hierarchically flat manner (cf. Kuroda 1960; Goodall 1987; de Vries 2005).

(23)   [$_{vP}$ [he^and^I] ^ come]

In our current terms, the coordinate structure in (23) corresponds to an unlabeled "non-adjunct" structure, such as [XP^YP] in (21b) above, in which concatenated items are not specified for linear ordering.

Interestingly, JSL can substantiate this structure. It is known that this language employs an NMM, a head nod (hn), to represent the coordinator (cf. Ichida 1998; Kimura 2007; Kotani 2009), as shown in (24).

(24)   a.   ___hn___
                  H1: HE   I   COME
                  'He and I came.'

         b.   ___hn___
                  H1: I   HE   COME
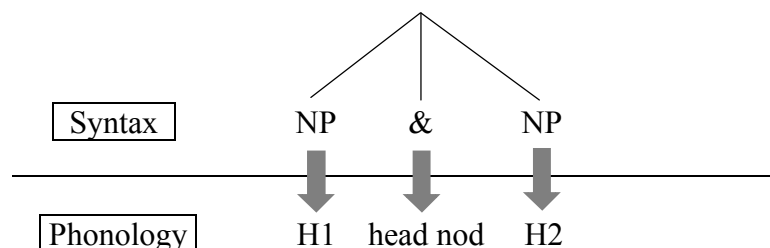   'I and he came.'

Figure 2   'he and I'

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[7] If the current analysis is correct, we can expect that other types of adjuncts such as adjectival modifiers and relative clauses can also appear in simultaneous constructions. This indeed appears to be the case (see Nyst 2007 for discussion on manual-oral simultaneous constructions involving size, shape, and color adjectives in Adamorobe Sign Language). I leave this topic for future work and thank Hiroaki Saito (p.c.) for bringing this to my attention.

Therefore, the two coordinated DPs and the coordinator in (23), for which linear order in syntax is unspecified, are potentially possibly signed by three independent articulators — two hands and the head — simultaneously in the phonology as schematically shown in (25), if such a structure is indeed available:

(25)

$$
\begin{array}{ccc}
\boxed{\text{Syntax}} & \text{NP} \quad \& \quad \text{NP} \\
\hline
\boxed{\text{Phonology}} & \text{H1} \quad \text{head nod} \quad \text{H2}
\end{array}
$$

However, this expectation is not met, as shown in (26).
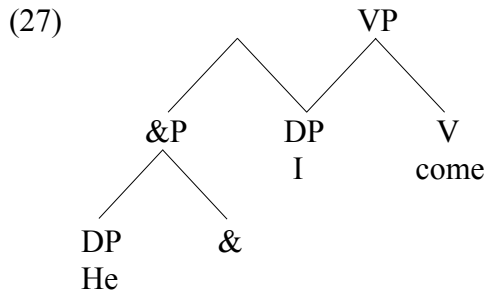
(26) a. * (hn)
    H1: HE COME
    H2: I
    'intended: He and I came.'

  b. * (hn)
    H1: I COME
    H2: HE
    'intended: I and he came.'

Figure 3 'he and I' (ungrammatical)

In these examples, the two conjuncts and the coordinator are signed independently by two hands and the head at the same time, and my informants concurred that the examples are both ungrammatical. This is expected under my proposal, since the coordinate structure in (23) is unlabeled, thus invisible to the labeling algorithm, creating an interpretation problem.
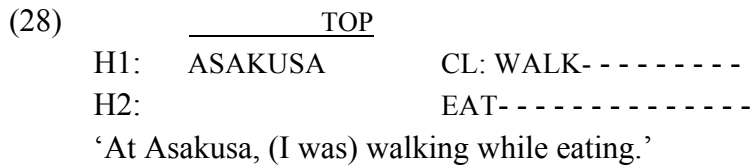
  At this point, one may ask why the examples of coordination in (24), which involve sequential representation, are grammatical. The grammaticality of these examples is accounted for, if we assume the asymmetrical analysis for coordination in which the coordinator phrase (&P) headed by the coordinator is adjoined to the second conjunct as shown in (27) (see e.g. Munn 1993 for the adjunct analysis of coordination).

(27)

```
                              VP
                  _____/_____
                 /          \      \
               &P          DP      V
             __/\__         I     come
            /      \
          DP        &
          He
```

In this structure, &P is an adjunct that is licensed without being labeled. The grammaticality of the examples in (24) is therefore not a problem for the proposal I presented above.

5.2   VP-adjunction

Another piece of evidence from JSL supports the present proposal. Recall that in example (17) from HKSL, the co-articulated two predicates express two events that temporarily overlap. A similar construction is available in JSL.

(28)
```
                    _____TOP
H1:    ASAKUSA          CL: WALK- - - - - - - - -
H2:                     EAT- - - - - - - - - - - - -
```
    'At Asakusa, (I was) walking while eating.'

In this example, just as in (17), both H1 and H2 move actively simultaneously to describe two verbal predicates, i.e., 'walk' and 'eat,' which temporarily overlap (Figure 4).


Figure 4   'walk while eating'

Crucially, while the example induces this interpretation, my informants agreed that from this example, it is not possible to get a lexically more conflated, co-event interpretation in which there is no temporal dependency between the two events (as in the Japanese V-V compound *tabe-aruku* 'to make an eating tour'). This contrast follows from my proposal. The available, temporally simultaneous event reading comes from an adjunct structure as in (29), which is licensed without resort to labeling.[8,9]

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[8] Note that the sign 'walk' is reserved for the signer's dominant hand, not vice versa, which suggests that it denotes the matrix predicate.

(29) *Structure of (28)*

```
                    VP
            /\        /\
           /  \      /  \
          I   walk      eat
```
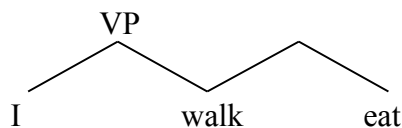
By contrast, the co-event reading under which the two events do not temporarily coincide is assumed to arise from a structurally lower, non-adjunct V-level concatenate [walk^eat] as in (30), which is unlabeled.

(30)   VP
```
           /\
          /  \
         I    /\  ←  unlabeled
             /  \
          walk  eat
```
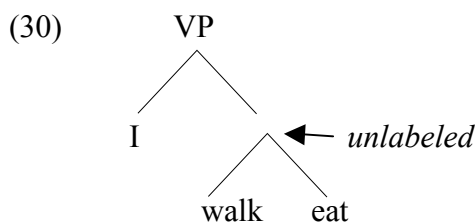
We therefore expect that the example creates a problem of interpretation, and this is indeed what we observe.

6 Conclusion

In this paper, I first introduced formal and functional properties of simultaneous constructions in sign language, formulating the generalization concerning the ban on manual full simultaneity. Second, as an account of this generalization, I proposed that simultaneous constructions involve unlabeled constituents, which lack specification in linear ordering. Finally, I provided two types of evidence from JSL to support the proposed analysis: DP-coordination and VP-adjunction. Further research is obviously needed to examine this proposal and for cross-linguistic comparison (see e.g. Sáfár & Kimmelman 2015 for the difference between Russian Sign Language and Sign Language of Netherlands in terms of the frequency of weak hand holds).

The present work is an attempt to derive modality-specific, phonological conditions concerning simultaneity in sign language from a modality-independent, general requirement on

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[9] Alternatively, as pointed out by an anonymous reviewer, it may be possible to analyze this example as an instance of two independent clauses conjoined at the discourse level, similarly to example (18) from BSL. I assume, however, that the example is mono-clausal, based on the fact that the sentence can be further embedded under negation (i) and inside a question (ii).

```
     (i)                    TOP
              H1:   ASAKUSA       CL: WALK- - - - - -   NOT
              H2:                 EAT- - - - - - - - - - -
              'At Asakusa, (I) was not walking while eating.'
     (ii)                   TOP                      Q
              H1:   ASAKUSA       CL: WALK- - - - - -
              H2:                 EAT- - - - - - - - - -
              'At Asakusa, are you walking while eating?'
```

labeling. While much work has been done in the investigations of linearization and syntactic labeling, relatively less attention has been given to research on sign language in this area (but see Kimmelman 2015; Harmon 2016). I have shown in this paper that sign language, with its visual modality, can offer a new perspective, not readily available in spoken languages, to address such topics.

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