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Version 1.7 June 27, 2016

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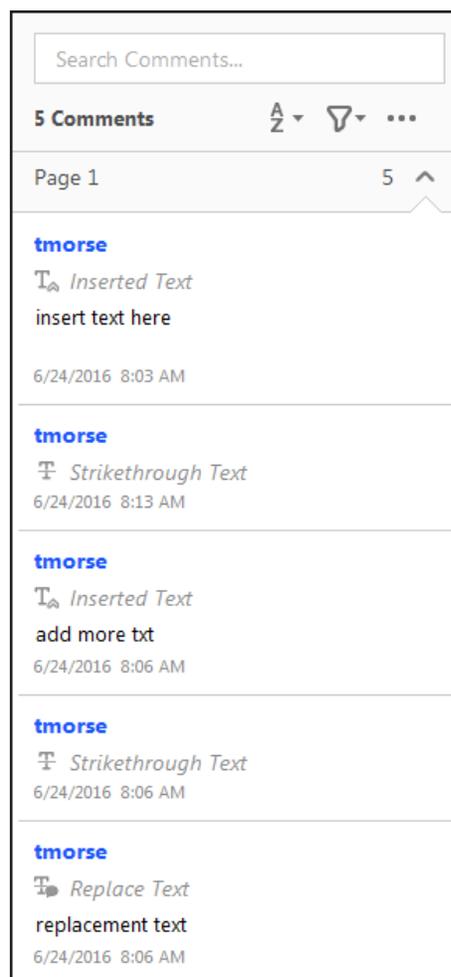
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INFLUENCE OF PREDICATE SENSE ON WORD ORDER IN SIGN LANGUAGES: INTENSIONAL AND EXTENSIONAL VERBS



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We present evidence for the influence of semantics on the order of subject, object, and verb in Brazilian Sign Language (Libras) sentences. While some have argued for a prevailing pattern of SVO in Libras, we find a strong tendency for this order in sentences that do not presuppose the existence of the verb's object, but not in sentences that do, which instead favor SOV. These findings are coherent with those of a recent study on gesture. We argue that the variable influence of the relevant predicates is particularly salient in sign languages, due to the iconic nature of the visual modality.*

Keywords: sign languages, Libras, Brazilian Sign Language, syntax, word order, sign order, semantic verb types

1. GENERAL BACKGROUND. The work described here explores the relationship between verb meaning and word order in sign languages. Specifically, we consider the possibility that word order in sign languages, as exemplified by Brazilian Sign Language (Libras), is sensitive to the difference between extensional and intensional verbs.

A given language is frequently expected to have a basic way of ordering the subject (S) and object (O) in relation to each other and to the verb (V). Basic word orders are often unambiguously claimed for particular languages (as in the seminal work of Greenberg 1963 and much work thereafter). Languages that use morphological markers to indicate the grammatical functions of the participants in an action may use a freer order, but even these languages are expected to have a preferred basic order. Of the six possible linear permutations of S, O, and V, it is widely reported that most of the world's languages prefer either SOV or SVO (about 76%; Dryer 2005).

The determination of the order of these elements in any given language can be tricky, and it is complicated for sign languages by the fact that the relevant literature often labels the agent as S and any other argument of the verb as O. Further complications are that the verb's arguments are often integrated into the phonological parameters of that verb (as with agreement verbs, classifier predicates, and others; Padden 1988), and the subject can be embodied by the signer (Meir et al. 2007). Napoli and Sutton-Spence (2014) reviewed as much published research data as they could find concerning the order of elements in forty-two national sign languages. By collecting from the published studies of others only sentences in which all arguments of the verb are expressed manually and independently of the verb (via lexical signs or manual pointing to a spatial index or a real-world entity, labeled MNPs for 'manually expressed noun phrases'), they identify six generalizations about possible word orders. One generalization is that

* We thank Marieke Schouwstra for discussing the experiment methodology used here and for giving us her kind permission to use the materials she had used in her gesture experiment. We thank all of our linguistic participants in this study. We thank Irina Sekerina for extensive help on the statistical analyses and for discussion of the design of empirical studies in general. We thank Byron Ahn for discussions with one of us about pseudo noun incorporation. We thank the faculty, staff, and students at the New York-St. Petersburg Institute of Linguistics, Cognition and Culture in summer 2016 for comments on a presentation of this work, especially John Bailyn, Ilya Kuryanova, and Dmitrii Zelenskii. We thank Greg Carlson and the anonymous referees for a multitude of comments, all of which guided our presentation and discussion. The data collection was conducted with support from CAPES, BEX 17881/12-9.

SOV is grammatical in all sign languages (in contrast to spoken languages), their eventual account of which hinged on iconicity. Another is that the O and V are typically immediately adjacent (VO or OV), which is no surprise given the existence of a VP (left- or right-headed).

Napoli and Sutton-Spence also considered the relevance of the articulation of the V to word order in a given sentence. They make the generalization that if an argument affects the phonological shape of the V, it precedes the V. So classifier predicates of a range of types, as well as agreement verbs, tend to come last in the sentence, as many others had previously noted. Napoli and Sutton-Spence offer this account: because the relevant verbal parameters are iconic of visual characteristics of the relevant arguments (including location in space) they most naturally follow the establishment of those visual characteristics. Liddell (1980:90–91) offers another account of the fact that certain sentences are V-final—one that is also iconic and is compatible with what Napoli and Sutton-Spence say. He talks about the chronology of events for a proposition such as ‘woman put pie in oven’, which he found rendered in ASL as WOMAN PIE PUT-IN-OVEN. According to Liddell, the V is final because the sentence order conveys a ‘spatial, pictorial sense’ (1980:91) of the activity; in other words, it is mimetic. Chen Pichler (2001) follows up on Liddell, noting that the nondominant hand with such verbs is like a base—similar in ways to a classifier.



In addition to such iconic approaches are morphosyntactic accounts involving movement from an SVO base, only some of which are compatible with an iconic approach. Some derive sentences with SOV order in ASL via O-fronting triggered by agreement (Fischer 1975) and sentences with OSV order in ASL via topicalization (Fischer 1975, Liddell 1980, Aarons 1994). Others note that OSV order in a given sentence is often not accompanied by the nonmanuals expected with initial topics, and they derive these instances of OSV order as well as SOV in ASL via O-fronting triggered by classifier verbs (including ones with instrumental and locational information), particularly handling verbs (Chen Pichler 2001:Ch. 2 gives an extensive overview plus an in-depth discussion of handling verbs). These approaches can be seen as compatible with iconic approaches.

However, some note additionally that verbs marked with aspect often come last (whether the order in a given sentence is OSV or SOV), which they account for with rightward V-raising, sometimes accompanied by O-fronting (Fischer & Janis 1990, Matsuoka 1997, Braze 2004). Such data do not lend themselves to an iconic account since the articulatory shape of the V is not affected by the arguments. O-fronting and/or V-raising are likewise appealed to in accounts of sentences with OSV and SOV orders in Libras, where both the type of verb and whether it is marked for aspect are again relevant (Brito 1995, Quadros 1999, Quadros & Karnopp 2004, Pizzio 2006, Quadros & Lillo-Martin 2008, Souza & Duarte 2014). What ties together most of these accounts of both SOV and OSV order is that the proposed movement is triggered by a morpho-phonologically heavy V (regardless of iconicity).

Napoli and Sutton-Spence (2014), in their survey of studies on forty-two sign languages, also touch on the effect of a verb’s meaning on word order in a given sentence with respect to locational sentences and so-called reversible sentences—effects that had been reported by many before them. With respect to locational sentences, they come to the generalization that ‘[w]hen two manually expressed noun phrases occur in a locational expression that forms a single clause, NPs that refer to larger more immobile objects tend to precede NPs that refer to smaller more mobile ones, regardless of theta role or grammatical function’ (Napoli & Sutton-Spence 2014:5). Some argue that this fact is an effect of the visual modality, since larger objects are perceptually more important

(Volterra et al. 1984:35, 38, among others). Although animacy of the objects can override size in determining word order in a given sentence (Coerts 1994, Kristoffersen 2003), it is clear that order in sentences with locational verbs is sensitive to different factors from those operative in other types of sentences.

Further, as Liddell (1980:91–100) observes, often verbs that are not considered locative or presentational themselves will occur with an initial locative NP and without the nonmanuals associated with a topic. For example, for ‘the cat sleeps on the fence’, one might sign FENCE CAT SLEEP. He says the predicates here are internally complex, involving both an action and a location, with a discussion that has similarities to the discussion of complex events with regard to the English so-called *spray-load* verbs (Rappaport-Hovav & Levin 1998). We suggest that the theta-role of the NP FENCE here is comparable to that of the locative with *spray/load* verbs, which can occur either as the object of a preposition or, perhaps more ‘affected’, as the object of the verb: *They loaded hay onto the wagon/They loaded the wagon with hay*.

Turning to reversible sentences, let us first clarify what we mean: in these sentences the S and the O both meet the selectional restrictions that the verb imposes on its S and on its O, such as *Lucia kissed Valeria* (in which the O and S could easily switch roles, yielding the grammatical *Valeria kissed Lucia*), but not *Lucia kissed the photograph* (which contrasts with the anomalous **The photograph kissed Lucia*). In their survey, Napoli and Sutton-Spence find that in reversible sentences in which both S and O are human and the verbs do not change morphological shape in accordance with their arguments (termed ‘plain verbs’), SVO is favored, and many of the sources they cite explicitly note this fact.

We know of no work that examined any other aspect of a verb’s meaning as being a relevant factor for word order with respect to S, O, and V. However, the gesture studies of Schouwstra (2012) and of Schouwstra and de Swart (2014) show that sentential word order is sensitive to verb meaning, in particular, to the difference between extensional and intensional verbs. Since Napoli and Sutton-Spence (2014) argue that their generalizations as a totality are a consequence of pressures on visual communication in general (as in Gershkoff-Stowe & Goldin-Meadow 2002, So et al. 2005, Goldin-Meadow et al. 2008, Gibson et al. 2013), gesture studies like this raise the question of whether sign languages are similarly sensitive to this distinction in verb meaning. Hence, the present work.

The goal here was to replicate the study of Schouwstra (2012) with Libras signers and see if her findings hold. We show that they do, and we offer a unitary account for both findings. Signers and gesturers introduce onto the visual scene arguments whose existence is independent of the action of the verb before they introduce those verbs. And they introduce arguments whose existence comes about via action of the verb after they introduce those verbs. In this way, the order of visual presentation corresponds to the chronology of the unfolding of the event; it is thus iconic in a way that is natural to sign languages and to gesture. We expand on this idea in the discussion section (§3), where we consider alternative ways of accounting for the data.

Before proceeding, we must note that in work in the gesture field, the semantic labels *agent*, *predicate* (or *action*), and *patient* appear to be almost interchangeable in many instances with the syntactic labels *subject*, *verb*, and *object* (an interchangeability explicitly defended in Schouwstra 2012, but see her comments about the label *patient* on p. 92). And, of course, the fundamental notion of ‘sentence’ is at issue. However, while sign languages have grammars with the full range of components that spoken languages do and thus differ significantly from gestures made by nonsigners (Armstrong et al. 1995, Em-

morey & Reilly 1995, Goldin-Meadow & Mylander 1998, Goldin-Meadow 2005, McNeill 2008, among many others), these same issues also arise in comparing studies of various sign languages, where explicit criteria for fundamental notions are often lacking or inconsistent (for discussions of the notions ‘clause’ and ‘sentence’, see Crasborn 2007, Jantunen 2008). Linguists have managed to make valuable comparisons among sign language studies despite these issues, and we extend these comparisons to those between gesture and mime studies, on the one hand, and sign language studies, on the other, particularly with regard to phenomena in which iconicity potentially plays a significant role. We defend this methodological approach further in §3.

2. EXPERIMENTS STUDYING INTENSIONAL VERSUS EXTENSIONAL EVENTS. Schouwstra (2012:143) defines extensional events as those in which ‘someone does something to someone or something else’, for which, logically, the direct object needs to exist. That is, certain verbs typically set up an event in which the existence of the object is presupposed (we talk about extensional events and extensional verbs interchangeably here). For an intensional event, by contrast, the direct object does not need to exist (that is, it is not presupposed to exist). Schouwstra offers ‘girl cover box’ as an example of an extensional event and ‘princess want apple’ as an example of an intensional event. In the former case, the box must exist in order for the girl to cover it, but in the latter, there is no requirement for any apple to exist in order for the princess to want one (indeed, we might be in a world where there has been a terrible blight that wiped out all apple trees for  Schouwstra and de Swart (2014:432), continuing this line of study, note that ‘[d]  objects that are arguments of extensional verbs refer to concrete objects that are identified as existing independently of the event, but intensional verbs take direct objects that are possibly non-specific or non-existent’. Both studies conclude that in gesture, people (here speakers of Turkish and speakers of Dutch who have no signing experience) strongly prefer to place O before V in an extensional event, but O after V (though less strongly) in an intensional event—where the labels O and V in the gesture data are loose at best, corresponding to what might be the patient and the predicate in a corresponding sentence (see §1).

The predicate role in these gesture studies is also tied to the concrete or abstract nature of the patient. For extensional events, the predicate often requires movement and the patient is often concrete. But in intensional events, patients are ‘more abstract and more dependent on the action than those in extensional events’ (Schouwstra & de Swart 2014:432). (We return to this observation in the discussion section, when we consider alternative accounts of the data.) Schouwstra (2012) concludes that the outcome of the event type and the nature of the object determine the order in which S, O, and V occur.

She suggests that a paraphrase of an extensional event such as ‘pirate throw guitar’ can be ‘You know the pirate? You know the guitar? He throws it’. This would be realized by an SOV order in gestures. A paraphrase of an intensional event like ‘pirate think of guitar’ is unlikely to be ‘You know the pirate? You know a guitar? He thinks of one’. It is more likely to be ‘You know the pirate? He is thinking about something. It is a guitar’. This would be realized by an SVO order. While Schouwstra’s argument is not based on empirical evidence, we find it helpful here, just as imagining what someone might be thinking and how someone might be visualizing an event can help sign language interpreters to communicate better (Wilcox & Shaffer 2005). Indeed, visualization is key to understanding what is going on in both the gesture data and the Libras data, as we argue below.

The distinction between extensional and intensional events is not captured solely by looking at verbs, and there are multiple complications (see Pustejovsky 1991, for ex-

ample). A given verb can be used with an object that exists prior to the verb action or not (*She is writing her name* vs. *She is writing a poem*), and a given sentence can be ambiguous between an extensional and an intensional reading (*She's looking for her perfect bike ... you wouldn't believe how much it costs!*; *She's looking for her perfect bike, but no one has built it yet*). But for the sake of expediency, we follow the literature we are citing and speak of verbs.

The findings of these studies strongly suggest that verb meaning affects order in gesture sentences. Neither these findings nor Schouwstra's account of them surprised us; instead, given our experience with sign languages, the results felt decidedly familiar. Does the same meaning contrast affect order in sign sentences? We have found no previously published research on sign languages that addresses potential contrasts between the grammatical behavior of extensional and intensional verbs. However, Sutton-Spence and Woll (1999) give constructed examples to support an intriguing claim that in British Sign Language O precedes V with affective verbs, but O follows V with effective verbs—a claim similar to the gesture findings. We therefore conducted our own study, a modified version of Schouwstra's (2012).

We collected material from fluent Libras users to see if their productions showed a pattern similar to those of gesturers in Schouwstra's (2012) study. While Quadros (2003) has argued that the basic word order for Libras is SVO, she notes that SOV is likely to occur when there are handling or classifier verbs (and see Quadros 2004), an important observation that we return to in the discussion section. Her study is based on a range of transitive sentences, some reversible and some not, and it does not consider a distinction between intensional and extensional verbs (as we have noted, no studies we know of have done so). With the present work, then, we hope to extend knowledge on word order in Libras, and, since we know of no peculiarity of Libras in this regard that would prejudice our findings, also on order in sign languages in general.

2.1. METHOD. From this point on we use semantic terminology to describe the images we presented to our consultants, and syntactic terminology to describe the sentences they produced (regardless of the terminology used in Schouwstra 2012 and Schouwstra & de Swart 2014).

CONSULTANTS. We prepared two sets of stimulus materials (described under 'Procedure' below) and gave each set to ten potential consultants (for a total of twenty). Only eleven people chose to participate. All are fluent, native signers of Libras. Ten are deaf and consider themselves L1 users of Libras. The final consultant, a child of deaf parents, is a hearing active member of the Brazilian Deaf community. Although she is not deaf, Libras is her maternal language (and see Johnston 2006 for arguments concerning the native-signing status of many hearing children of deaf parents). Comparison of her responses to those of our deaf consultants revealed no aberrant behavior.

All of the consultants were postgraduate students at the Federal University of Santa Catarina, enrolled in either master's or doctoral degree courses specializing in areas relating to sign languages or deaf studies. They were all in their twenties and thirties and their home cities are distributed across the whole of Brazil. In summary, the consultants were highly educated, mature L1 users of Libras with advanced levels of linguistic awareness.

We did not collect further information on the language backgrounds of our consultants, because this is not the accepted protocol in that community and was not necessary for our study. We did not ask at what age they learned Libras or Portuguese, nor in which language they were educated at school. With the exception of the hearing daughter of deaf parents, we do not know whether they grew up with other deaf family mem-

bers. Their self-identification as L1 users of Libras is taken to be enough for them to be consultants in a study such as the present one. One of the authors of this article is a native signer of Libras, and she judges their signing to be native, agreeing with their own assessment.

MATERIALS. The stimulus materials used in Schouwstra 2012 and again in Schouwstra & de Swart 2014 are illustrations designed to represent the verb type with two levels: extensional or intensional. Each of a series of forty illustrations shows a single image in which an agent is engaged in either an intensional or an extensional event, with the patient clearly identified in the illustration. The use of a thought bubble in the illustrations makes it possible to show the intended patient for some of these events without implying that it exists. With Marieke Schouwstra's kind permission, we used these same materials for this study, allowing us to make a close comparison to the gesture studies.

In these illustrations verbs of perception are included among intensional verbs. One might find that surprising, given that if a person sees or hears something, under ordinary circumstances that something exists. However, extensive discussion in the semantics literature about the range of possible interpretations of the objects of perception verbs, including clausal objects (Asher & Bonevac 1985), shows that the issue is complex; Fodor and Pylyshyn (1981:194) conclude that '[e]ven if all you want is to construct a theory of perception, you cannot do much without encountering problems about intentionality'. Schouwstra (2012:133) points out that we can even find the odd sentence like: *When John listened to a cello, he heard a violin*. She concludes that perception verbs have 'at least an intentional flavor'. Moltmann (2004:26–27) explains it this way:

The complements of perception verbs ... do not describe the external object that may be perceived, but rather the way the perceived object appears (allowing for perceptual illusion) or perhaps describe a mere appearance (perceptual hallucination). ... in a number of ways sense data do not behave like ordinary objects with respect to the properties they may be attributed (sense data may be underdetermined and underspecified with respect to properties normally attributed to objects and may have contradictory properties).

Indeed, there is a way in which the perception of something brings it into existence with respect to the person who is perceiving it at that moment—which need not mean that it does not exist before that person perceives it (pace Bishop Berkeley); rather, awareness of existence is what is at issue here. If you enter a dark room and turn on the lights, for example, the existence of much that you did not hear, smell, touch, or taste in the dark will suddenly become apparent.

For these reasons, we followed Schouwstra (2012) and Schouwstra and de Swart (2014) here in maintaining the perception verbs among the intensional ones, and we kept note of any ways in which perception verbs stand apart.

Twenty illustrations show ten extensional events with two different agents and patients (such as 'gnome eat pizza' and 'witch eat banana'), and twenty show ten intensional events with, again, two different agents and patients (such as 'gnome want pizza' and 'witch want banana'). The extensional events include the predicates 'swing', 'throw', 'climb', 'eat', 'carry', 'drop', 'paint' (that is, apply paint to a surface, rather than depict by painting), 'hang' (on a washing line), 'cut' (with scissors), and 'slice' (with knife or pizza wheel). The intensional events include the actions 'knit', 'want', 'look for', 'build', 'dream of', 'hear', 'sculpt', 'think of', 'see', and 'draw'. There are five agents engaged in the events: a witch, a gnome, a pirate, a cook, and a princess. There are ten patients: a sock, a saxophone, a tower, a pizza, a ball, a guitar, a vase, a

scarf, a house, and a banana. The same agent and patient engage in an intensional event and in an extensional event (for example, ‘cook knit sock’ and ‘cook cut sock’).

Figure 1 shows a subsection of the stimulus materials depicting the cook as the agent. In the illustrations showing intensional events he dreams of a saxophone, hears a saxophone, thinks of a sock, and knits a sock. In the illustrations showing extensional events he swings a saxophone, throws a saxophone, cuts a sock, and hangs up a sock.



FIGURE 1. Stimulus materials showing intensional and extensional events.

Although Schouwstra had already pretested these illustrations for clarity, we found that some of our consultants misinterpreted the illustration of ‘pirate sculpt ball’ as being of him pumping up the ball (the chisel in his hands interpreted as a pump). This was possibly driven by daily experience in that we are more likely to pump up a ball than we are to sculpt one. Others were not at all sure what was happening to the ball, so they gave long answers that reflected confusion. Since their confusion made it impossible for us to determine whether they were giving an extensional or an intensional interpretation to the verb, we removed this item from our results.

Two consultants signed ‘see’ instead of ‘hear’ in response to hearing the guitar and the saxophone, making the point to us that the research materials were not entirely appropriate for a deaf discourse. In any related studies in the future, we would remedy this. Since they remained intensional events, however, we retained the items in our results.

A general word of caution is in order. Using images as a prompt may result in unnatural responses, since context is not supplied. People may wind up simply describing what they see, rather than trying to convey the information on the page in the way they might in a conversation, or each person may supply their own personal context. We found that some consultants focused on details of the image (such as whether someone has a belt on) that they probably would not have focused on in conversation where they were simply delivering information about who did what. Nevertheless, visual prompts are useful in eliciting sign language data (Hong et al. 2009, Padden 2015). And since the same prompts were used in the gesture studies, we hope that the results of both taken as a whole are comparable.

PROCEDURE. The consultants were divided into two groups. Following the procedure in the gesture studies, the materials were divided so that each group saw a given set of illustrations (one set for group A and a different set for group B) depicting all ten extensional verbs and all ten intensional verbs. Each particular verb appeared only once for each group (for example, if they saw ‘gnome eat pizza’ they did not see ‘witch eat banana’). Each group also saw the same agent and patient engaged in an intensional event and in an extensional event (for example, they might have seen both ‘cook knit sock’ and ‘cook cut sock’). The materials were initially randomized so that each person within a group saw them in a different order. However, as it was desirable to ensure that the same agent, predicate, or patient did not occur in immediate sequence (following the design of Schouwstra 2012), it was necessary to make minimal adjustments. The materials, then, were semi-randomized. There were four initial practice items for each set that were not included in the results.

The illustrations were printed on A4-sized pieces of paper and stapled to ensure the consultant followed the predetermined order. We distributed them to a meeting of all the volunteers, explaining to them that our interest was in how they, as fluent Libras signers, would sign what they saw in the pictures, as we wished to compare their production with work that had already been done on the way hearing nonsigners gestured them. We did not explicitly mention word order. We asked them to imagine they were signing these to a fluent signer as part of normal, everyday conversation and not particularly to aim for a full detailed visual construction of the whole image. Although all of the consultants were on a friendly basis with the researcher who ran the experiment and thus entirely comfortable with her, and although all understood the nature of linguistic fieldwork, we took them through the practice items until they were all confident that they understood the task and felt no stress.

The consultants took the illustration sheets away and filmed themselves signing the answers to their own webcams, before uploading the video to YouTube and sending us an ‘unlisted’ link. This procedure of sharing video information is standard among staff and students at UFSC and was familiar to all of them. We asked them to hold the relevant picture up to the camera first so we knew which event they were referring to and then to sign what they saw. This method worked extremely well, and none of the consultants who returned the material reported any difficulty with the procedure. Six deaf signers from group A returned a video but only four from group B did so. However, the hearing signer mentioned above returned a video, and she was in group B. So the groups are as nearly equal as possible, given that we have an uneven number of consultants.

2.2. ANALYSIS. After we had removed the responses to the problematic image of the pirate sculpting the ball, and taking into account that one consultant inadvertently skipped two illustrations, 216 responses from the eleven consultants were usable. Other adjustments needed to be made, however.

In general in sign languages, when a signer first introduces an argument of a verb, it is usually expressed manually and independently of all other elements in the sentence—that is, it is an MNP (a manually expressed NP). However, on later mentions within the same discourse the referent of that argument might not be articulated at all (Lillo-Martin 1986) or might be embodied in the signer or encoded into a phonological parameter of the V (as mentioned earlier). Embodied or otherwise incorporated arguments of a V cannot be teased apart from the V with respect to linear ordering. We therefore follow Napoli and Sutton-Spence in focusing on arguments expressed as MNPs. However, since our main interest is on the linear order of O with respect to V (OV or VO), we include all data

in which the O is an MNP even if the S is not. We eliminated five responses because they do not include an O that is an MNP; details are given in Appendix A.

Additionally, some images produced complex responses that consisted of more than one sentence. Most often only one of those sentences had an O that was an MNP, so only one was pertinent to our study, but four responses consisted of multiple sentences where two were relevant to our study (details found in Appendix A). Thus, four more responses are added to our total. This led to a running total of 215 usable responses, of which 107 are extensional and 108 are intensional.

One more set of responses needed to be excluded: those with a form of verb doubling known as VERB SANDWICHES (Fischer & Janis 1990, Kegl 1990, Matsuoka 1997). Appendix C describes the data we collected and why it should be set aside in this study. Our corpus of verb sandwiches consists of fourteen extensional examples and thirteen intensional examples. We thus delete these twenty-seven responses.

The grand total of our usable responses is then 188, of which ninety-three are extensional and ninety-five are intensional.

CODING. For each signed response from our consultants, we analyzed it into a string of S, O, and V, not considering modifying phrases. With respect to modifying phrases, they were scattered throughout both extensional and intensional responses, but they often piled up the first time an agent or patient appeared in an illustration. For example, the first time the cook appeared, the signer might describe the person in a number of ways, talking about the hat and apron, for example, but for later appearances of the cook, the signer might just give the simple sign with no modifiers. In both types of utterances, the subject was coded simply as S, even though the noun phrase in one might be simple and in another complex. Other modifiers involved details of an action such as precisely where something was done. Examples include the easel on which the subject is drawing something and the line on which something is hung. While some of our signers did not consider it necessary to mention where the gnome drew the pizza or where the cook hung out his sock, it was a priority for others.

Sixty-three responses contained more than one V.¹ The immediate question is whether such strings consist of multiple sentences or one sentence with multiple clauses or even one sentence with only one clause. We discuss this issue and the standards for analysis that led to our decisions in Appendix B.

PROCEDURE OF ANALYSIS. All three authors coded the responses from three signers separately, and then compared and discussed our results. When we had reached agreement on the way we would code the sentences, two of us familiar with Libras coded three more together. The remaining interviews were divided between these two, who met subsequently to check the coding and make any amendments necessary. Additionally, the analysis of all responses with more than one V was coded and checked by all three authors.

2.3. RESULTS. We present our results of the raw data in Table 1 and of the percentages in Figure 2. Within these, we give the compilation of data (for all 188 responses), then

¹ Additionally, four single-verb responses for extensional events had repeated Os. Three were OSVO, where two of these ('gnome paint tower' and 'pirate throw guitar') elicited responses from one other signer that were OSV, and the third ('witch paint house') elicited responses from three other signers that were OSV. Because there are so few examples, we ignore the second O and fold these into the OSV responses. The fourth has the form SOVO (again for 'pirate throw guitar'). For consistency's sake, we ignore the second O and fold this into the SOV responses.

the data on strings with one V (125), then two Vs (thirty-eight), then more than two Vs (twenty-five).

	EXTENSIONAL	INTENSIONAL		EXTENSIONAL	INTENSIONAL
(S)VO	17	87	SVO	12	43
(S)OV	60	2	SOV	48	2
OSV	16	6	OSV	15	5
a. Compilation of data.			b. Responses with one V.		
	EXTENSIONAL	INTENSIONAL		EXTENSIONAL	INTENSIONAL
(S)VO	2	27	(S)VO	3	17
(S)OV	8	0	(S)OV	4	0
OSV	1	0	OSV	0	1
c. Responses with two Vs.			d. Responses with more than two Vs.		

TABLE 1. Raw data.

In Table 1, the cell for responses that have only one V lists the three orders SVO, SOV, and OSV; both S and O are realized by MNPs in all of these responses. In the other cells, we find (S)VO, (S)OV, and OSV, since multiple-verb responses often included clauses that did not have an MNP for S.

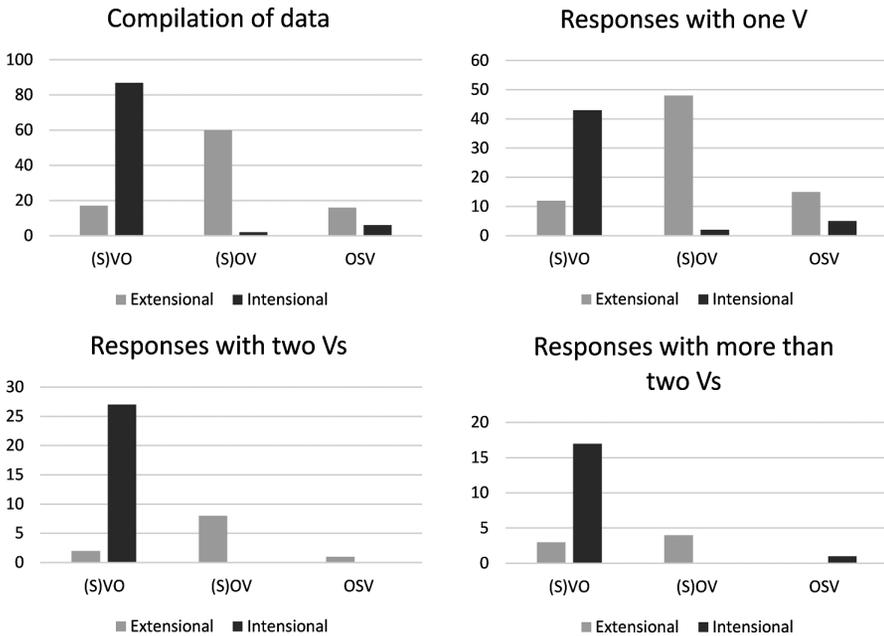


FIGURE 2. Percentages.

A chi-square test of independence for the compilation of all responses was performed to examine the relation between verb type (extensional vs. intensional) and word order. The relation between these two variables was significant: $\chi^2(2) = 105.9096, p < 0.001$. Intensional verbs favor SVO structures and disfavor SOV structures. Extensional verbs favor SOV and disfavor SVO structures.

Additional chi-square tests were performed to examine the relation between verb type and word order for each individual type of response: with one V, two Vs, or more than two Vs. These statistical results are presented in Table 2. All indicate that word

order critically depends on verb type. This dependence is highly telling, given that SVO has been argued to be the basic order for Libras.

VERB TYPE	ONE V RESPONSE		TWO V RESPONSE		> TWO V RESPONSE	
	χ^2	<i>p</i>	χ^2	<i>p</i>	χ^2	<i>p</i>
	62.2841	< 0.001	28.9467	< 0.001	12.3512	< 0.001

TABLE 2. Chi-square results by number of verbs in the response.

Of the 188 total responses, 125 (66%) have only one V. All of these responses include not just an O, but an S expressed as an MNP. Seventy-five of these are extensional, and fifty are intensional. So 81% (75/93) of the extensionals are rendered with a simple clause, while only 53% (50/95) of the intensionals are. This fact alone leads us to suggest that rendering an extensional event visually is a more straightforward job (relatively easily done with a single clause) than rendering an intensional event visually (which more often calls for multiple clauses) (see relevant remarks in Dennett 1969:§IV and Karl 1994). That is, there is something about an intensional event that makes it more complex for sign language rendering.

We here pursue this idea a little further. Several of our consultants opened up their hands and signed the creation of a thought bubble in their intensional responses, which we here indicate with THOUGHT-BUBBLE. For example, for ‘cook dream sax’, consultants produced responses with a variety of structures. Only two produced the simple SVO structure COOK DREAM SAX. One produced COOK DREAM THOUGHT-BUBBLE SAX, which we analyze as SV followed by another VO clause (perhaps embedded, perhaps not). The images our consultants were describing had thought bubbles in them, so the signers could simply have been describing the image they were looking at. In that case, the sign THOUGHT-BUBBLE indicates a place in the air where the sax, for example, is located. Alternatively, they might have been using THOUGHT-BUBBLE as a predicate indicating the existence of an intensional world in which something exists or in which an action takes place. Importantly, in either possibility, THOUGHT-BUBBLE is a (locational) predicate. Many other times THOUGHT-BUBBLE is not used, but intensional responses still have multiple Vs in them. We find it unsurprising that signers would choose to use additional predicates to render intensional events given the prevalence of iconicity in sign languages (as explained in §3 below). There is the possibility of a straightforward mapping from the visualization of concrete items to visual presentation in a sign language (or in gesture), but no such transparent mapping can occur with respect to abstractions, such as dreams, thoughts, wants, or perceptions, particularly if the thing dreamed about, thought about, wanted, or perceived is indefinite.

In support of that account, we note that the multiple-verb responses to the intensional images were fairly evenly distributed across all of the verbs. In contrast, multiple-verb responses to extensional images have uneven distribution. The responses to the images involving ‘carry’, ‘drop’, and ‘hang’ accounted for fifteen out of the eighteen multiple-verb extensional responses, with ‘slice’, ‘climb’, and ‘eat’ (one of the added-in examples that came from the image ‘gnome draw pizza’, discussed in Appendix A) eliciting only one multiple-verb response each. The three actions of carrying, dropping, and hanging are complex in that our consultants often chose to express picking something up before walking with it (‘carry’), holding something before dropping it (‘drop’), and shaking out or lifting something before hanging it on a line (‘hang’). That is, complex actions that can be expressed with what looks like a single action in gesture or mime (and, indeed, with a single verb in English and many other spoken languages) lead to multiple verbs in a sign language.

Before leaving this section, we consider the twenty-two responses with OSV order. (Details on these responses are found in Appendix A.) Of these, sixteen are open to an analysis as locational sentences. That is, the O is of an appropriate meaning and large enough that it can be considered a location for an action (see remarks in §1). For example, ‘gnome climb tower’ can be viewed as locating a tower and then locating a gnome climbing on it. Locational sentences present a different pattern for word order: a larger, more immobile object tends to precede a smaller, more mobile object, regardless of theta-role or grammatical function, hence OSV.

Of the remaining six OSV responses, five of them were produced by a single signer—we call her signer A. Signer A also produced two of the locational sentences. Clearly, this particular signer has a penchant for fronting Os. This does not mean that her signing is in any way aberrant. In fact, she is a beautifully clear signer. The one remaining OSV was produced by a consultant we call signer B, for ‘pirate throw guitar’. Signer B also produced three of the locational sentences. She may also favor OSV, though less strongly than signer A.

Given that there are sensible accounts of the OSV order that do not concern verb type, we wonder if it is advisable to simply set these data aside and discuss them no further with respect to verb type. To test this, we wanted to see if the data on OSV responses varied significantly from the rest of the data. Given the small number of OSV responses compared to the much greater numbers of SVO and SOV responses, we ran a chi-square test of independence for OSV (sixteen extensional plus six intensional) compared to SVO (seventeen extensional plus eighty-seven intensional) as a function of verb type and a second chi-square test of independence for OSV (sixteen plus six) compared to SOV (sixty extensional plus two intensional) as a function of verb type. The difference between these two variables was significant. For OSV compared to SVO, $\chi^2(1) = 29.8605$, $p < 0.001$. For OSV compared to SOV, $\chi^2(1) = 10.8971$, $p < 0.001$. Thus the OSV responses should not be folded into either the SVO or SOV responses. Rather, we maintain our account of these responses as being instances of locational sentences or reflections of individual consultants’ preferences.

3. DISCUSSION. Our interpretation of the data in this study is that they show that intensional verbs favor SVO and extensional verbs favor SOV, but the data clearly are open to other explanations. We now consider two competing explanations, one that attributes orders other than SVO to the relative youth of sign languages—which turns out to be unsupported—and one that attributes orders other than SVO to syntactic movement of the O—which turns out to present a serious challenge. We opt for the original analysis, however, on the basis that it generalizes across gesture and language data.

3.1. A YOUNG LANGUAGE ACCOUNT. Some have argued that SOV is the default basic word order for all human languages (such as Givón 1979, Newmeyer 2000a). Newmeyer (2000b) goes further, claiming that SOV was the order in proto-language. Meir and colleagues (2010) note that emerging sign languages strongly favor SOV. Given all this, one might claim that the appearance of SOV in a language like Libras, which has SVO as its basic order, is simply evidence that Libras has not yet fully evolved to a state of full language maturity.

Although there is little work on the history of Libras (Bacellar 1925, Diniz 2010, Schmitt 2013), it is clear that the development of Libras, like that of many other sign languages of the Americas and Europe, was strongly influenced by French Sign Language (LSF; Quadros & Campello 2010). Eduard Huet, a deaf teacher from the National Institute of the Deaf of Paris (Institution Nationale des Sourds-Muets à Paris)

immigrated to Brazil in 1855, and in 1857 he founded the Imperial Institute of Deaf Mutes (Instituto Imperial de Surdos Mudos) in Rio de Janeiro (Rocha 2010). Again, like for so many other sign languages of these areas, LSF was not the only source for Libras. Campello (2011) studied entries in an early dictionary of Libras (that of Gama 1875) and concluded that LSF was integrated into an already existing indigenous sign language of Brazil.

The roots of Libras therefore probably go back at least 200 years, considering the indigenous side. Even if we took 1857 as the birth date for the language, it would not qualify as a young sign language; rather, it is among the most established national sign languages in the world. How long does it take for a sign language to become mature? Evidence from the development of Nicaraguan Sign Language suggests that a full grammar evolves quickly, within a couple of decades (Senghas & Coppola 2001). In any case, Libras should not be considered an ‘emerging’ sign language.

Nevertheless, even if one were to push the idea that the appearance of SOV sentences is a hangover from some earlier stage in the history of Libras, such an account could not explain the contrast in word order between extensional and intensional sentences. There is no obvious reason why extensional sentences should hang on to SOV word order longer than intensional sentences do.

A young-language account, then, is not only unlikely; it is also unexplanatory.

3.2. A SYNTACTIC ACCOUNT. Since there is evidence that SVO is the basic order in Libras, one might propose that all instances of OSV and SOV are produced via fronting of the O.

In Libras, O-fronting is often due to focus or topicalization (and see Quadros 2003, particularly pp. 4–6). However, the discourse contexts one would expect for focus or topicalization structures (Padden 1988, Lillo-Martin 1991, Petronio 1993) are absent in our data, given that these responses were elicited in isolation. Thus, our consultants would have had to supply an appropriate discourse context for focus/topicalization consistently and precisely in the instance of extensional verbs, a highly suspect conjecture. Further, the special characteristics associated with this kind of O-fronting in Libras (such as agreement, eye gaze, raised brows, head tilted slightly back followed by a nod of affirmation or negation; Quadros 2003:2) are absent in our data. Thus these data do not appear to be the result of movement due to focus or topicalization.

As noted in §1, however, some have posited O-fronting when the verb is morphologically or prosodically complex (including when the articulation is shaped in any way by the arguments, as well as the presence of aspect or even a prolonged articulation; see Chen Pichler 2001). Here, then, we reconsider the entire data set (that is, the 188 useful tokens), separating out what we call ‘heavy’ verbs from ‘nonheavy’ verbs.²

The extensional predicates in our data set (all ninety-three tokens) elicited heavy verbs. This fact, in itself, may seem startling. However, in all of our extensional materials, a person interacts with a concrete object—as Schouwstra pointed out—and many times the person moves that object (‘swing’, ‘throw’, ‘carry’, ‘drop’, ‘hang’)—as Schouwstra also pointed out—which means that the verb is typically realized as a handling classifier. And even when the object is not moved, as with ‘climb’ in ‘gnome climb tower’, the verb is realized as a handling classifier since the hands curl to grasp the bricks in the tower. Also, with these extensional verbs the person usually affects that object (‘eat’, ‘cut’, ‘slice’, ‘paint’), which again means that a classifier will typically

² The term ‘heavy’ is accepted in the sign literature with this morphological or prosodic sense and is distinct from its use in syntax, for example, for phrases with particular characteristics.

appear. In many of these instances, the nondominant hand is a classifier for the O, and the dominant hand acts on it. So, for example, the witch will paint a wall, where, after signing both WITCH and WALL, the signer will articulate the predicate, and now the nondominant hand will be a classifier for the wall and the dominant hand will act on it (making the up-down movement of painting).

Among the intensional predicates, ‘knit’, ‘build’, ‘sculpt’, and ‘draw’ also elicited heavy verbs (details are in Appendix A). The total number of tokens for these predicates was thirty-four. The total number of tokens with a heavy verb, then, is 127, as shown in Table 3.

	(S)VO	(S)OV	OSV
extensional	17	60	16
intensional	31	1	2
TOTAL	48	61	18

TABLE 3. Word order for heavy verbs.

Only the intensional verbs ‘want’, ‘look for’, ‘dream of’, ‘hear’, ‘think of’, and ‘see’ did not elicit heavy verbs. We must add into this group one intensional verb elicited by the extensional image ‘gnome paint tower’ (which gave two sentences, the first of which had the intensional verb ‘look for’). There were a total of sixty-one tokens for these verbs, fifty-five being (S)VO, one SOV, and five OSV (details are again in Appendix A).

The compilation of raw data on heavy versus nonheavy verbs and the graphs of percentages are shown in Table 4 and Figure 3.

	HEAVY V	NONHEAVY V
(S)VO	48	55
(S)OV	61	1
OSV	18	5

TABLE 4. Compilation of data by verb type: heavy vs. nonheavy.

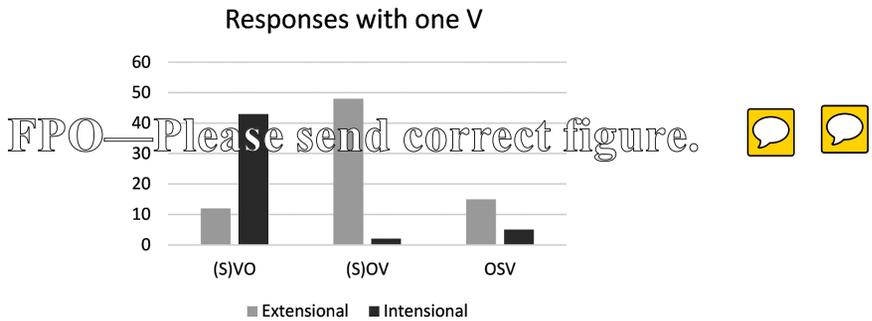


FIGURE 3. Graph of results in Table 4 by percentages.

It is not statistically justifiable to do a chi-square test of independence on these data, since heavy versus nonheavy was not set up as a verb type to begin with. That is, we did not choose ten verbs that are reliably heavy and ten verbs that are reliably nonheavy as our independent variable to start with and then look for a dependency of the other variable (word order). Rather, we gathered the responses our consultants produced and judged in each instance whether the verb was heavy or nonheavy—and those data (qualitative, rather than quantitative) are represented in Table 4 and Fig. 3. Although we are unable to manipulate those dependent variables, we can see that the relationships in

Fig. 3 are not random: nonheavy verbs favor SVO structures and disfavor SOV structures. Heavy verbs favor SOV and disfavor SVO structures.³

Based on these data, therefore, we do not discount the syntactic approach (which involves O-movement).

3.3. CLOSER COMPARISON OF THE EXTENSIONAL/INTENSIONAL AND HEAVY/NON-HEAVY ACCOUNTS. The central finding from this small study is clear: the order of the three elements S, O, and V in Libras varies in a systematic way. In particular, with extensional verbs, just as with heavy verbs, OV is favored and VO is disfavored, while with intensional verbs, just as with nonheavy verbs, VO is favored and OV is disfavored. We therefore have two accounts of the data. And both turn out, in fact, to be based on iconicity. We have already seen this for the extensional/intensional account, but let us now discuss it for the heavy/nonheavy account.

If we take a closer look at the notion of heaviness, we can see that it circumscribes quite different phenomena. Heaviness due to aspectual markers on the verb may be determined completely without regard to the arguments of the verb. In contrast, heaviness due to parameters of the verb that give information about the verb's arguments (as with agreement and with many types of classifier constructions, including handling verbs) concerns articulation that is iconic with regard to those arguments (as in slicing with a pizza wheel—that is, an instrument appropriate for the theme argument—or climbing a wall with hands cupped—again appropriate for grasping the bricks of the theme argument). In our corpus, aspectual markers did not occur on verbs that were not already heavy. So, in fact, with respect to our corpus, factors concerning the verb's arguments—that is, iconic factors—were the determinants in the choice between (S)OV and (S)VO for all verbs, both extensional and intensional.

Why should iconic factors affect order in sign languages? The simple answer is perhaps 'Because they can'. As Woll (2009:150) says:

Since the visual medium affords the identification of objects and their spatial locations as a function of their forms and locations on the retina and sensory cortex, it is not surprising that cortical systems specialised for such mappings are utilised when sign languages capture these relationships.

If a language has the ability to make its articulation align with parts of an event, then it would be contrary to the overall goal of communication not to avail itself of that possibility. We are reminded again of Liddell's (1980:91) insight (see §1) about sentence order conveying a 'spatial, pictorial sense'. Signing space may be likened to a canvas, with time as an added dimension. This iconicity is fundamental to understanding how sign languages work.

The relationship of a sign's articulatory form to its meaning is not entirely arbitrary; further, while sign languages vary in many ways in how they encode space (Perniss et al. 2015), classifier predicates and agreement systems are based on iconic use of space (Sandler & Lillo-Martin 2006). In a series of studies of British Sign Language (BSL), we find that iconicity is predominant in the lexicon and plays a role in language processing (Thompson et al. 2009) and in language acquisition for both comprehension and production, not so much in the very youngest child, but more and more strongly as the child enters the third year of life (Thompson et al. 2012). The influence of iconicity is so strong that even in a phonological decision task (determining whether a sign has

³ And if one were (against all advice of statisticians) to do a chi-square test of independence for the compilation of all responses in Fig. 3 in order to examine the relation between verb type (heavy vs. nonheavy) and word order, they would find that the relation between these two variables was significant: $\chi^2(2) = 48.7227$, $p < 0.001$.

straight or curved fingers) adult BSL signers' reaction times slowed and errors increased when judging iconic signs; thus meaning is activated automatically for highly iconic signs and this interferes with being able to judge form quickly and accurately (Thompson et al. 2010). In other words, iconicity effects permeate the entire grammar, not just the semantics component. BSL is not unique: multiple studies of iconicity in many other sign languages are coherent with the evidence from BSL (discussions are abundant; for ASL, Tolar et al. 2008; for Australian Sign Language (Auslan), Schembri 2002; for French Sign Language (LSF), Sallandre & Cuxac 2002; for German Sign Language (DGS), Perniss 2007; for Japanese Sign Language (Nihon Shuwa), Herlofsky 2010; for Russian Sign Language, Kimmelman 2009; note that multiple citations could have been given for these and many other languages could have been added). Indeed, some have argued that iconicity is a general property of language (Perniss et al. 2010), which just happens to be more obvious in a sign language because the visual modality allows for rich and varied iconic mappings, while the oral modality is more limited, if not impoverished, in this regard.

Importantly, the pictorial nature of signing does not in any way threaten the status of sign languages as *bona fide* languages. A simplified representation of denotation can, at the same time, be a formal variable in semantics, as, for example, Schlenker, Lamber-ton, and Santoro (2013) have shown for discourse referents. Further, sign languages can impose different linguistic and discourse constraints on how they map event space onto sign space (Perniss & Özyürek 2008), showing a range of variation among them just as we find among spoken languages. As Taub (2012:388) observes, '[i]conicity motivates but does not determine the form of iconic signs'.

With respect to verbs, in particular, recognition of iconicity allows explanations for movement in classifier predicates and for agreement facts (including otherwise unexpected movement parameters; see, for example, Meir 1998, 2002, Quadros & Quer 2008), and for the multitude of ways articulatory forms are related to event structure (Wilbur 2003, 2008, 2010, Grose et al. 2007, Malaia & Wilbur 2012). Considering classifier predicates and agreeing verbs, for example, Napoli and Sutton-Spence's (2014) survey of the literature on forty-two sign languages resulted in the generalization that if an argument affects the phonological shape of the V, it precedes the V, precisely because the relevant semantic factors of the given argument are realized articulatorily in an iconic way (in strong contrast to spoken language agreement phenomena).

The extensional/intensional distinction is also spelled out in an iconic way. Arguments that are present on the scene before an action takes place precede the V; those that are not follow the V. This is not a vision issue *per se*, but a visualization issue. The pre-existing arguments of an extensional event are already somewhere in our mental picture before the predicate is articulated. But in intensional events, arguments are brought into our mental picture only after the predicate is articulated because their existence depends upon that predicate. This is as true in spoken language as in sign language. But spoken languages, because they do not use the visual modality for expression, have much less pressure on them to align articulation with mental visualization and much less ability to do so.

Given all this, we are encouraged that the two accounts of our data are iconic, and we suspect that the two accounts might not be in competition, but in collusion. To see if heaviness enhances the effect of extensionality or, alternatively, if extensionality enhances the effect of heaviness, we could design an experiment in which ten verbs are extensional for which we can reliably expect five to be realized as heavy and five to be realized as non-heavy, and ten verbs are intensional for which we can reliably expect five to be realized

as heavy and five to be realized as nonheavy. Then we could look at the three levels (the three word orders) and see whether heaviness, for example, contributed to making an extensional or intensional verb have a certain word order. However, given the design of our present experiment—which was adopted in order to make a comparison to the gesture studies—we have come as far as we can go with the statistics.

Still, though the two accounts are both iconic, they are not equivalent. We now argue for the extensional/intensional account on the grounds that the extensional/intensional one is coherent with the gesture studies in Schouwstra 2012 and Schouwstra & de Swart 2014, but the heavy/nonheavy one is not. We therefore discuss the pertinence of gesture studies to sign language studies.

First, it is to be expected that clauses in sign languages might have much in common with strings of gestures in gesture studies, given that strings of gestures aim to be visually iconic. This is not to say that the results of gesture studies can be taken as evidence for the structure of sign languages but only as presenting areas that might lead to fruitful investigations in sign languages. The strings produced in gesture studies are systematic in some ways, to be sure, but unsystematic in other ways. And the ways in which they are systematic may not carry over to sign languages. Similarly, sign language studies may shed light on the nature of gesture—again with caveats (Wilbur & Malaia 2008).

For example, just as Napoli and Sutton-Spence (2014) found that SVO is favored with plain verbs in reversible sentences in which both S and O are human, similar findings appear in a gesture study (Gibson et al. 2013) and an elicited pantomime study (Hall et al. 2013). Hall and colleagues (2013) introduce the notion of ‘role conflict’ as an influence on order in visual communication, which they pursue in Hall et al. 2015. In the latter study they note that people producing gestures to describe events that involve a human agent and a nonhuman patient (for example, MAN BOX PUSH⁴) are more likely to use SOV order than any other option. However, they report that SOV was actively avoided when people gestured events involving a human agent and a human patient (for example, MAN WOMAN PUSH). They suggest that role conflict could account for the difference between the order of elements in the two sentence types in the following way. When people describe an event with gestures, they sometimes take on roles of participants in the event, but generally only of human participants; thus they may take the role of the human agent or the human patient, but they do not take the role of the nonhuman patient. For example, they found that in MAN BOX PUSH the gesturer does not take the role of the box. Hall and colleagues (2015:18) explain that, as

action gestures are almost always produced from the perspective of the agent, producers seem compelled to avoid the sequence O-V when the object is human. This account can explain the observed decreases in SOV as well as the increases in both OSV and SVO.

Importantly, however, this account of gesture order is unlikely to carry over strongly to word order; while events involving nonhuman patients are not expected to generate role conflict in gesture, they could in sign languages, since signers frequently assume non-human roles (Peters 2000, Sutton-Spence & Napoli 2010).

Proceeding with caution, then, one can turn to visual communication (gesture and pantomime) studies for comparisons to sign languages and even for enlightenment about sign languages, based on recognition of the shared articulators and of the role that iconicity plays in both, as much research has, in fact, done (Emmorey & Reilly 1995, among much work since). The study here aims to do exactly that.

⁴ Hall et al. 2015 uses small capitals to indicate gestures, similarly to how all capitals or small capitals indicate signs in the literature on sign languages.

And, importantly, the examples of extensional and intensional predicates that Schouwstra provides in her gesture study all involve nonhuman patients, which made it easier for us to look at true, conventionalized language and determine the impact of the influence of the corresponding verbs on word order. Despite the fact that signers can take the role of nonhumans, the consultants in our study did not avail themselves of this possibility. Perhaps it is more likely to occur in longer stretches of discourse than in the short sequences we generated here, or perhaps it is more likely to occur in more creative genres than these purely informative sequences. Thus, we find no evidence to support or contradict any hypothesis of role conflict that could influence the order of signs here.

The extensional/intensional account is adequate for both the sign language data we gathered in our study and the gestural data Schouwstra gathered in her study. That is, it applies to both types of visual communication.

The heavy/nonheavy account, however, has no pertinence to the Schouwstra study. It relies crucially on recognition of a basic word order, of a movement of the O, and of internal morphological structure of the V—all things that are anathema to gesture. Thus, with this account, the fact that the same Vs show the same preference for a particular word order in Libras and in the gestures studies is a coincidence—without explanation.

Coincidence, while it does happen, is unexplanatory and hence regrettable if an equally empirically adequate account exists that does not involve coincidence, as is the case here. We therefore prefer a single account for the results of the sign language and the gesture studies—the extensional/intensional account. As Brazilian Portuguese does not mark the order of words in intensional and extensional sentences differently, there is no suggestion that our Libras consultants (who are bilingual in Libras and Brazilian Portuguese) have been influenced in this way. Indeed, although the wide range of options available to the signers shows that they are working with complex linguistic rules rather than simple gestural rules, it is more likely that the differences between the verb types is driven by the visual aspects of the language that are shared with gesture.

Additionally, with the extensional/intensional account, but not with the heavy/nonheavy account, one might expect to find other instances in which word order in sign languages depends on semantic distinctions having to do with a phrase's timeliness of appearance on the visual scene. What do we mean by that? Objects of extensional verbs are present on the scene before the action takes place, but objects of intensional verbs are not; hence the order SOV is natural for extensional predicates, and the order SVO is natural for intensional ones. Thus the study here shows a phenomenon in which space and time are aligned.

If we look around for other ways in which being on the scene at a particular time might be coherent with interpretation, we can find at least two phenomena of interest. The first is complex sentences that contain conditional clauses. In the sign languages that have been studied in this regard thus far, the default position for a conditional clause is sentence-initial (Pfau & Quer 2010). Iconic motivation for this ordering is not hard to come by: the condition must be established—it must be present on the scene—before the action dependent upon it can take place.

The second phenomenon likewise involves complex sentences, where the event of one clause is chronologically ordered with respect to the event of the other clause. Taub (2001:25–26) claims that if we want to convey 'I took off my shoes before I jumped into the pool', a sign language will employ a default order that matches the ordering of the visualization of the events; we 'see' someone taking off shoes before we 'see' them jumping into the pool. But in a spoken language, while there might be an unmarked preference, we could have as easily ordered the events differently: *Before I jumped into the pool, I took off my shoes.*

There has been very little research on temporal clauses in sign languages since Taub's remarks. And the research that has been done shows the situation to be more complex. Baker and colleagues (2016), for example, report that in Flemish Sign Language and German Sign Language an embedded temporal clause must be sentence-initial, whether the event of the clause occurs before or after the event of the main clause. We note, however, that Flemish Sign Language has clear markers to indicate which clausal event preceded the other (an aspectual marker at the end of the embedded clause, a brief pause between the two clauses often accompanied by a head nod, and an optional lexical sign THEN in the main clause), and German Sign Language employs both the temporal conjunction BEFORE and a nonmanual marker (raised eyebrows). Many sign languages need not employ conjunctions—such as ASL, BSL, and Libras—and instead rely on Taub's default: the order of presentation of the clauses is taken to match chronological order unless someone specifically gives information to the contrary.

Finally, the analysis of our results that is based on the extensional/intensional distinction offers evidence about investigations into areas outside sign languages. For example, much has been written about the relationship between time and space with regard to how we think and how we talk. Casasanto and Boroditsky (2008:579), for example, ask: 'Do people ... think about time using spatial representations, even when they are not using language?'. They ran experiments from which they conclude that the answer is yes, and they suggest that mental representations may be built 'in part, out of representations of physical experiences in perception and motor action'. An examination of such phenomena as the extensional/intensional verb distinction and its effect on word order in sign languages offers overt evidence for their contention, in a way that spoken languages cannot.

4. CONCLUSION. Extensional verbs tend to follow their object in Libras, while intensional verbs tend to precede their object. The reported basic word order of SVO for Libras, argued for in other works cited earlier, was not especially evident in the data collected here. We suggest this is due to the deliberate selection of verb types. The majority of the extensional verbs were signed as spatial verbs in nonreversible sentences—exactly the situation in which Schouwstra (2012) claims we should expect to see SOV order. The fact that, despite this particular selection of data, 18.3% of the extensional verbs appeared in SVO responses can be taken as supporting evidence that SVO is indeed the basic word order of Libras. What we have shown in this study, then, is that semantic factors that have a strong iconic effect may interfere with ordinary word order.

Taking all of these findings into consideration, we suggest that studies of word order need to ferret out potential interfering factors, particularly iconic factors, if they are to truly shed light on the basic order of a given language. In particular, since our findings are consistent with those of gesture studies, we suggest that sensitivity to the distinction between intensional and extensional predicates is characteristic of the visual modality in general; thus other sign languages should exhibit similar data, regardless of their basic order.

So far as we know, there have been no studies of the potential influence of extensional versus intensional verbs on the relative order of V and O in spoken languages, although some work on pseudo noun incorporation in a variety of languages across the globe notes that the nominal must be interpreted as existentially quantified, which might well be relevant since the nominal always precedes the verb (Bittner 1994, van Geenhoven 1998, Massam 2001, Farkas & de Swart 2003, Dobrovie-Sorin et al. 2006, Dayal 2011, Baker 2014). More to the point, many studies of word order note that indefinite NPs obey different constraints from definite ones (see Tomlin 1986), with def-

inite ones being able to move leftward (Chung 1976 for Indonesian; Byarushengo & Tenenbaum 1976 for Haya (a Bantu language); Givón 1975, 1976 for Rwanda and Swahili (also Bantu); Mould 1974 for Lugunda; Horton 1949 for Luvale; among others). Since extensional verbs are more likely to have definite objects and intensional verbs are more likely to have indefinite objects, these studies are intriguing. Most languages (not just sign languages) favor SOV, with SVO as the closest second, and since both SOV and SVO sentences are attested in many of those languages, we encourage such investigation in the hope that this initial study may have impact beyond understanding word order. The growing knowledge of linguistic distinctions and universals has recently been augmented through initial examination of the visual modality (as in Strickland et al. 2015 and works cited there). This study might be a small contribution in the same direction.

APPENDIX A: RESULTS: INDIVIDUAL RESPONSES

A1. HOW WE ARRIVED AT OUR TALLY OF 188 RESPONSES. Of our 216 initial responses, all but five include an O that is an MNP. Three of these five responses have only one V, and they are of the form SV. One of these is an instance of ‘witch eat banana’ in which the classifier predicate includes information about the O that suggests its shape (including a curve) and indicates that it is eaten by being held in the hand. Thus, the banana essentially appears in the V (via the handling classifier and the shape of the movement path). The other two of these are both instances of ‘princess knit scarf’. The signers prolong the knitting action in comparison to the duration of the Vs in their other responses, indicating that something long was knitted. Since our study is restricted to sentences that include MNPs for the O, we conclude nothing about word order from these three examples.

A fourth example consists of the string VSV. It is a response to ‘witch build wall’. It begins with MAKE WITCH. Then it has a classifier predicate in which we see the building of a wall. While this example is ultimately unusable for our study (lacking an O that is expressed as an MNP), the word order here calls for comment. As Napoli and Sutton-Spence (2014) note, V-initial sentences in sign languages are rare and quite generally occur only when a V functions to present or introduce a new argument, like with existential ‘seem’ or presentational ‘happen’. But building a wall is certainly bringing it into existence, and this string emphasizes that by using the verb MAKE perhaps the creational nature of the action influenced the placement of that initial V.

Further, one participant interpreted the image of ‘princess drop vase’ as the princess standing there with a vase attached to her sash (a perfectly understandable interpretation of the particular image). So he simply describes the princess—producing only one (very complex) NP.

These five responses, then, are eliminated from our study. However, four others were added due to responses that consisted of more than one sentence. The image ‘gnome draw pizza’ elicited the response GNOME DRAW PIZZA. EAT PIZZA. The first sentence has an intensional verb and the second an extensional verb. Since both have an O that is an MNP, this one image produced two usable responses. Likewise, ‘princess sculpt vase’ elicited the response PRINCESS SCULPT VASE. THINK VASE. The one verb is physical and the other is mental, both are intensional verbs and both sentences have an O that is an MNP, so both are usable responses. That same image elicited the response PRINCESS SCULPT-WITH-HAMMER VASE. SCULPT + IMAGINE VASE. The second sentence here has two verbs expressed simultaneously, which we have indicated here with the + (for a discussion of simultaneity see Vermeerbergen et al. 2007, Napoli & Sutton-Spence 2010). Both sentences have only intensional verbs and have an O that is an MNP. So both sentences are usable for our study. Finally, ‘pirate look for ball’ elicited the response PIRATE PONDER + SEARCH-FOR BALL. THINK BALL. IMAGINE BALL. We treated this as four sentences, where the second and third are both usable in our study. In sum, then, these four images result in eight sentences for our study, rather than four.

Another adjustment needed to be made. The image of ‘gnome paint tower’ produced a complex response from one participant, who signed GNOME LOOK-FOR TOWER. PAINT TOWER. The first sentence, then, involves an intensional verb, and since the O is an MNP, it is useful for our study. (The second sentence is not useful since it has no MNPs.) Since all other participants produced only an extensional verb for this image, we maintained it in our study and simply moved that one response to the set of intensional data.

Altogether, then, after additionally removing the twenty-seven responses with verb sandwiches (see Appendix C), we had 188 usable sentences for our study.

A2. DETAILS ON OSV SENTENCES. Of the sixteen OSV responses that lend themselves to a locational-sentence analysis, twelve involve extensional events: ‘gnome paint tower’ (two instances), ‘gnome climb

tower' (three instances), 'witch climb house' (three instances), and 'witch paint house' (four instances). The remaining four are intensional: 'gnome see tower' (two instances), 'witch build wall' (one instance), and 'witch see house' (one instance). We note that in three of these intensional responses, we have a verb of perception, which calls into question whether our signers interpreted the illustrations as 'see' or instead as the extensional 'look at'. Either reading, however, allows for a locational viewing.

The five responses that reflect signer A's favoring of OSV were for the intensional event 'cook hear sax' and for the extensional events 'gnome slice pizza', 'pirate drop ball', 'pirate swing guitar', and 'pirate throw guitar'. Notice again that a verb of perception is involved in the intensional event, calling into question whether this signer interpreted the illustration as 'hear' or instead as the extensional 'listen to'.

A3. DETAILS ON HEAVY VERSUS NONHEAVY VERBS. Table A1 shows the intensional heavy Vs.

	(S)VO	(S)OV	OSV
'princess sculpt vase'	8		
'gnome build wall'	6		
'cook knit sock'	5		
'gnome draw pizza'	4		
'witch draw banana'	4	1	1
'princess knit scarf'	2		
'witch build wall'	2		1
TOTAL	31	1	2

TABLE A1. Word orders for heavy verbs, all intensional.

Considering the heavy Vs of both extensional and intensional responses, all but one is a handling verb, where often the thing handled is an instrument appropriate to the theme (as with 'cut' and 'slice', where we might have scissors, a knife, or a pizza wheel). The only nonhandling heavy verb is the extensional 'climb', which our consultants made heavy by shaping their hands as though the S was clinging to bricks (a part of the theme argument) during climbing.

The individual results of intensional responses with nonheavy verbs are given in Table A2.

	(S)VO	(S)OV	OSV
'cook dream sax'	4		
'pirate dream guitar'	6		
'cook hear sax'	4		1
'pirate hear guitar'	4	1	
'cook think of sock'	5		
'witch want banana'	4		
'gnome want pizza'	6		
'princess think of scarf'	5		
'gnome see tower'	3		2
'witch see house'	4		1
'pirate look for ball'	7		
'princess look for vase'	2		1
Addition of 'look for tower' from the image 'gnome paint tower'	1		
TOTAL	55	1	5

Table A2. Word orders for nonheavy verbs, all intensional.

APPENDIX B: ANALYSIS OF RESPONSES WITH MORE THAN ONE V

When a response has more than one V, it is not immediately obvious how many clauses we have. Counting verbs is not enough (Crasborn 2007, Jantunen 2008). That is partly because sign languages have structures similar to those of serial verbs in spoken languages and because of verb sandwiches (discussed in Appendix C), which can be open to a one-clause or multiple-clause analysis (see discussion in Johnston et al. 2007:190–93). Thus semantics carries us only so far in determining sentence and clause breaks. Examination of the nonmanuals can help (except in the instance of simultaneous Vs) (Fenlon et al. 2007), however, since, with respect to Libras, several works have noted that nonmanuals tend to occur at major syntactic breaks and pile up at clause boundaries (Quadros 2003, Quadros & Karnopp 2004, Quadros & Lillo-Martin 2007, 2008, Nunes & Quadros 2008).

When determining whether two Vs were ‘the same lexical item’, we relied on the phonological parameters: they were considered the same only if they had the same parameters or modifications on those parameters that had to do with morphology (such as aspect or agreement) or prosody (such as intensity or manner). For each V we noted whether it incorporates arguments into its parameters, just in case that information should turn out to be enlightening.

We found multiple-verb responses that we analyzed as containing three different kinds of relationships between Vs.

(i) We note serial verbs or a control construction, indicated below by V&V. Here, the Vs are different lexical items, the S is the external argument of both Vs, and the O is the internal argument either of the string of Vs or of the second V. For example, ‘gnome climb tower’ elicited one response of TOWER GNOME DECIDE CLIMB, which we analyze as OSV&V.

(ii) We note clause breaks, indicated below by a dot (.). The Vs in these responses are different lexical items, and they denote entirely separate actions. Usually the dot indicates a sentence break, but for our purposes it is immaterial whether it is a clause break or a sentence break, since we found no difference in word order between clauses open to an embedded analysis versus those open only to an unembedded analysis. Further, we know of no claims in the literature that there might be a different word order in embedded clauses in a sign language.

An example for SOV.V was in response to ‘princess hang scarf’. The signer produced PRINCESS SCARF FLAP (to straighten it out, which O is expressed by an MNP that precedes the V and is incorporated into the V as well) followed by PEC that incorporates both S and O. The first V, since it is extensional (though not the V we had been trying to elicit), is in an SOV clause, so that clause is relevant to our study.

(iii) We note simultaneous articulation of two Vs, indicated below by V+V. The two Vs are different lexical items; typically the first V is articulated and held and the second V’s articulation begins and continues during the hold of the first V. An example of SOV+V was in response to ‘pirate carry ball’. The signer produced PIRATE BALL TUCK-UNDER-ARM + WALK.

We now discuss all examples with more than one V.

EXAMPLES WITH PRECISELY TWO VS.

Order OSV: The single OSV token is extensional (‘gnome climb tower’) and has the structure OSV&V.

Order (S)OV: The eight (S)OV tokens are all extensional, with the three structures shown in Table A3.

	SOV.V	SV.OV	SOV+V
‘princess drop vase’	1	1	
‘pirate carry ball’	1		1
‘princess hang scarf’	2		
‘witch slice banana’	1		
‘princess carry vase’	1		
TOTAL	6	1	1

TABLE A3. Extensional examples with two Vs that offer (S)OV tokens.

Order (S)VO: Twenty-three of the twenty-nine (S)VO tokens are intensional and consist of the four structures seen in Table A4. Additionally, one extensional response (‘cook hang sock’) had the structure SVO.V.

	SVO.V	SV&VO	SV+VO	SV.VO
‘cook knit sock’		3		
‘gnome build wall’		2		2
‘pirate dream guitar’		2		1
‘pirate look for ball’	2	1		
‘gnome draw pizza’		1		
‘pirate hear guitar’	1		1	
‘princess look for vase’	1			
‘cook dream sax’			1	1
‘princess sculpt vase’				1
‘princess think scarf’				1
‘witch draw banana’				1
‘witch look at house’				1
TOTAL	4	9	2	8

TABLE A4. Intensional examples with two Vs that offer (S)VO tokens.

Four more tokens in the (S)VO row in Table 1 in the main text came from two strings with the structure SVO.VO, both elicited by an intensional image. One of those strings (‘princess sculpt vase’) yielded two ex-

amples, both of which have intensional Vs and an O that is an MNP. Another (‘gnome draw pizza’) yielded a first sentence that is intensional and a second that is extensional (both usable since both have an O that is an MNP, as discussed in Appendix A).

Another token in the (S)VVO row came from the string SVO.V, elicited by ‘gnome paint tower’, where the first V is intensional (as discussed in Appendix A).

EXAMPLES WITH MORE THAN TWO VS. The single response that yielded an OSV token is intensional and has the structure OSV&V&V (‘princess look for vase’).

The four (S)OV tokens are all extensional, with the structures seen in Table A5.

	SOV.V.V	SV.OV.V	SV.V.OV
‘pirate carry ball’		1	1
‘princess carry vase’	1		
‘princess drop vase’		1	
TOTAL	1	2	1

TABLE A5. Extensional examples with more than two Vs that offer (S)OV tokens.

We now go through the first example in detail, to help clarify how we went about analyzing this kind of response.

This structure was elicited by ‘princess carry vase’, and while we notate it here with SOV.V.V, in our annotated notes it is SOV₁.Ve₂.V₃. The first V shows constructed action on the part of the princess in picking up the vase and tucking it under her arm (which we termed ‘Vi’ as a ‘verb of incorporation’ since the signer embodies the S and uses a handling classifier, even though there is an MNP subject and an MNP object present as well). The second V shows an entity classifier (for the subject) taking multiple steps (which we termed ‘Ve’). The third V is simply the lexical sign GO-FORWARD, where the subject is understood to be the same as in the preceding sentences. (We again stress that all of these Vs are distinct lexical items, judging by their phonological parameters.) We count this as a token of extensional SOV, since the only two MNPs are the initial S and O, and since the first V in the string is extensional.

The twenty (S)VO tokens occur in twelve structures, as shown in Table A6, where intensional and extensional are listed together.

ORDER	TYPE	#	EXAMPLES
1. SVO.VV	ext	2	‘cook hang sock’, ‘princess carry vase’
	int	2	‘gnome think pizza’, ‘witch draw banana’
2. SVO.V+V	ext	1	‘pirate carry ball’
3. SV&V&VO	int	4	‘gnome build wall’, ‘gnome think pizza’, ‘pirate dream guitar’, ‘princess sculpt vase’
4. SV&V&V&VO.V.V	int	1	‘princess sculpt vase’
5. SV+VO.V.V	int	1	‘princess sculpt vase’
6. SV+V&VO	int	1	‘pirate dream guitar’
7. SV.V.VO	ext	1	‘witch build wall’
8. SV&V.VO	int	1	‘gnome think pizza’
9. SV.V&VO.V	int	1	‘princess think scarf’
10. SV.V&VO.O	int	1	‘pirate look for ball’
11. SVO.V+VO	int	2	‘princess sculpt vase’—double, so this yields two usable responses
12. SV+VO.VO.V	int	2	‘pirate look for ball’—double, so this yields two usable responses

TABLE A6. Examples with more than two Vs that offer (S)VO tokens.

In the first six structures, the S and O are in the same clause, where we have a single V or a series of Vs and/or simultaneous Vs. In the next four examples, the S is in the initial clause, but the O is in some later clause. Since the V of the later clause is an intensional one, these offered usable tokens for our study. Notice that the tenth example has a repeated O, which stands on its own after a clear syntactic break. The final two examples have two Os expressed as MNPs, each of which goes with a different V, both Vs being intensional. So these strings offer two tokens each for our study (indicated here by ‘double’).

APPENDIX C: VERB SANDWICHES

Strings with verb sandwiches (hereafter V-sandwiches) have the structure SVOV, where the two Vs denote the same action; thus there is only one event. Typically, the second V has additional information. For example, it might add aspect or it might have a handshape that makes it a classifier predicate, or it might be marked

for agreement (Fischer & Janis 1990), or its dynamics might incorporate manner (as in the sense of Harley 2012). That is, the second V is typically heavy.

We distinguish two types of V-sandwiches. One has the form SVOV, where it is easy to recognize the second V as being the same lexical item as the first V. An example for Libras might be ‘knit’ versus ‘knit for a long time’, where the lexical sign KNIT is recognizable in both, but elements of the movement parameter are modified for the second instance. We call this TYPE-SAME. The other type of V-sandwich also has the form SVOV, but the verbs are not the same lexical item—witness a difference in handshape, orientation, location, and/or a difference in the movement parameter that is not simply due to aspectual morphology or degree of intensity. Instead, the two Vs in the construction share (part of) their sense. An example for Libras might be ‘build’ versus ‘build with bricks’, where the handshapes, movement, orientation, and location are distinct for the two Vs. We call this TYPE-DIFFERENT.

In our data twenty-seven V-sandwiches occur. Fourteen V-sandwiches involve extensional events, twelve of type-same and two of type-different. Among the twelve type-same V-sandwiches we include one response that repeats the O (giving the sequence SVOOV): ‘gnome draws tower’. Following the procedure discussed in n. 1 for other instances of repeated Os, we discount the second instance of O and consider this string to be equivalent to SVOV. (The absence of nonmanual markers between the two Os led us to this analysis. However, the alternative analysis of SVO.OV would have resulted in one more instance of SVO and one more instance of (S)OV in Table 1d.)

Thirteen V-sandwiches involve intensional events, all of type-same. Among these we include one example that has an initial extra V (a separate lexical item). To be specific, in response to ‘cook dream saxophone’, one participant produced an initial V that was a classifier predicate of someone holding a bedsheet up to his chin (as in the image). This was followed by SVOV. We analyzed the initial V as a modifying relative clause of the head ‘cook’ (the S), so the structure was simply SVOV.

Logically, V-sandwiches might be two clauses or one clause, and both have been posited in the literature. If V-sandwiches consist of two clauses where the first has the structure SVO and the second simply V (as treated by Liddell (2003:64), who stipulates this ‘treatment’ here but does not argue for it), the first clause should give data consistent with data in responses that contain only one V. Considering the results in Table 1b for responses with one V, then, we expect V-sandwiches to be more common among intensional responses than among extensional responses since the order of the first clause is SVO. Yet the number of responses for each type of verb is almost equal (thirteen versus fourteen; in fact, there is one more extensional example than intensional).

As a logical alternative (one no one has posited, so far as we know), we could analyze the V-sandwich with a clause boundary before the O (that is, the first clause being SV and the second being OV). Remember that the important point for us is whether the O precedes or follows the V. With this second analysis we expect V-sandwiches to be more common among extensional responses than among intensional responses since the order of the second clause is OV. Again, the fact that the two groups are nearly equal thwarts our expectations. Further, the analysis of the first clause as consisting of only SV is unjustified, given that the V is transitive.

We conclude that, regardless of whether the V-sandwich construction consists of one clause or two, whatever factors influence the choice of using a V-sandwich are not sensitive to the extensional versus intensional contrast in verbs. For this reason, we set V-sandwiches aside and consider them no further in this article.

An analysis of V-sandwiches as being one clause with two V positions, one higher than the other, might posit only the lower one being filled underlyingly. That V could then raise into the higher V position, yielding SVOV. This is in essence the analysis of Matsuoka (1997), where he raises the V rightward, but one could as easily raise the V leftward, depending on one’s overall analysis of the particular language. At this point, the grammar determines which V will be realized (spelled out). The V-sandwich would represent the instance in which, for a reason that would need to be determined, both Vs are realized. Tricky questions come up for both types of sandwiches, where the type-different might benefit from a decompositional approach to lexical items (like that of GENERATIVE SEMANTICS, as in Jackendoff 1972, or MINIMALISM, as in Harley 2012), and both would face the question of why direction of raising affects which of the two Vs has more morphological information in it. Further, such an analysis raises the question of why the intensional versus extensional distinction in the higher phrase should correlate with the spell-out choices in the way that it does. Finally, we do not see a way to connect the stipulated spell-out choices to the effects noted in the gestural responses to stimuli in Schouwstra & de Swart 2014.

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