Degrees and depiction- gradability in sign languages[1]

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Abstract. Based on variation in spoken languages, the Degree Semantics Parameter (DSP) proposes a split between languages that use a degree based system and those that use a delineation system (Beck et al., 2009; Bochnak, 2015). When it comes to sign languages, it has recently been proposed that the phonological form of gradable predicates can iconically represent the boundaries and points on a degree scale, as in Italian Sign Language [LIS] (Aristodemo and Geraci, 2018). From this perspective, sign languages seem to offer visible evidence of abstract linguistic objects like degree scales which have been theoretically motivated in spoken languages but whose existence has been inferred through certain syntactic and semantic cues. However, evidence for a degreeless semantics for American Sign Language [ASL] (Kouli-dobrova et al., 2023) suggests that sign languages could vary as much as spoken languages within this domain.We argue for an alternative semantics for comparative constructions in sign languages with a iconic component in them. Rather than assuming that that sign languages vary with respect to whether this iconicity encodes degrees, we suggest a unified view of all these constructions where the iconicity is analysed as gestures or demonstrations in the sense of Davidson (2015). Under this view, iconicity is insufficient to motivate a degree ontology in a sign language because the linguistic parts of sign languages, being languages, are built around abstraction, and what may appear to be iconic/visible pieces of the grammar are more accurately viewed as gestural depiction, just like spoken language gestures.

Keywords: semantics, sign language, gesture, gradability, degrees, iconicity

1. Introduction

Formal semantic analyses of natural language phenomena have typically focused on descriptive symbolic meaning. In contrast, recent work on meaning in the visual modality has sparked the need for an updated approach to meaning that can also capture the semantic contribution of depictive or 'iconic' elements that are produced as part of an utterance but are often left unanalysed. Within the domain of spoken languages, this has led to sometimes analogous proposals for the semantic contribution of co-speech gestures in the context of spoken language expressions (Schlenker, 2021; Ebert et al., 2020; Esipova, 2019). The question of how to approach iconic content within formal semantics is particularly salient when modelling natural language phenomena in sign languages where both the depictive and symbolic elements of communication are expressed in the visual modality, where categorizing "gestures" is not a simple matter of modality (even if it were in spoken languages). Although formal semantic work on sign languages in role shift, anaphora, quantification etc. have provided valuable insight, one area that has remained comparatively understudied are gradable expressions in sign languages.

We typically encounter the notion of gradability in the meanings of predicates such as *tall, heavy* or *expensive*. The meaning of a sentence like *the textbook is heavy* seems to be dependent on what exactly classifies as heavy in a particular context. While a weight of 2kgs might be heavy in the context of books, it might not be heavy in the context of furniture. Adding degree variables to our semantic ontology captures this intuition by defining these gradable predicates

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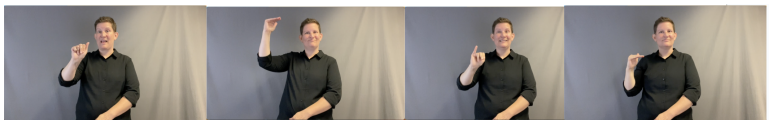
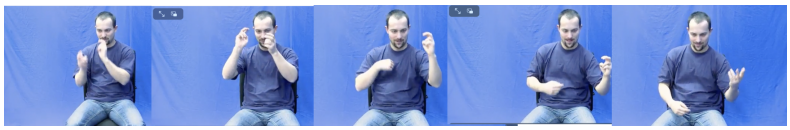
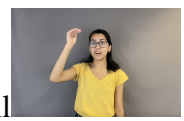
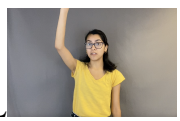
as a relation between the argument of the predicate and the degree to which the gradable predicate holds of the argument, relative to a contextually determined standard of what classifies as *tall* or *heavy* or *expensive*. Natural language contains a wide range of expressions that make use of the concept of gradability such as comparatives, superlatives, measure phrases, etc. Although well studied in spoken language (Kennedy and McNally, 2005; Kennedy, 2007a), the semantics of gradability in the visual modality is much less well understood. As this paper will argue, sign languages offer a valuable insight into how these concepts of gradability are expressed in the visual modality, and in doing so provide new insight into modeling iconic content in sign languages and gestures. To see why, consider the following sentences in (1)-(4) which are all comparative constructions involving the predicate *tall*. Not only do they all express essentially the same meaning, i.e, *A is taller than B* but they also involve an iconic component that seems to contribute this meaning. The iconic element in question here is the position of the hand in the signing space which depicts the height of the referent and seems to be almost identical in all four cases. In LIS in (1), the position of the hand is represented by the subscripts α, β and γ which refer to vertically ordered loci in the signing space, following the glossing scheme in Aristodemo and Geraci (2018). The DGS example in (3) shows multiple occurrences of the hand-shape TALL2A* high in the signing space to refer to many tall individuals, and the same hand-shape low in the signing space to refer to a short individual.

(1) MAN TALL-$_\alpha$POS$_\beta$ WOMAN TALL-$_\beta$ICONIC-MORE$_\gamma$. IX$_\beta$ 1 METER 70. IX$_\gamma$ 1 METER 80
'Maria is taller that Gianni. This one (Gianni's degree) is 1 meter 70 and that one is 1 meter 80.' (LIS, Aristodemo and Geraci (2018))

(2) 
MARY TALL$_{(at-signer'-head)}$ GIANNI TALL$_{(neutral-space)}$
Lit. 'Mary is this tall, Gianni is this tall.' ('Mary is taller than Gianni.')
(ASL, adaptation from Koulidobrova et al. (2023))

(3) 
TALL2A* TALL2A* I2 SMALL 3 GEST-OFF*
'All the others were taller than me; I'm just too short' (DGS ,(Konrad et al., 2020))

(4) Alex is tall  but Jo is like TALL 
Interpretation: Both Alex and Jo are tall, but Jo is very tall. (English w co-speech gesture)

This paper aims to answer two questions that arise from the data above. The first concerns how sign languages encode the semantic concept of gradability and the role they play with respect to the Degree Semantics Parameter. The second is about how sign languages use iconicity, and how to model iconicity within our formal semantic analysis. As seen in (1)-(4), iconic depic-

tions of certain gradable predicates seems to be a common strategy in expressions of gradability in the visual modality, both sign and gesture, and a theory of gradability for sign language should include a proposal for the exact semantic contribution of these iconic expressions. This of course raises the broader question of the semantics of iconic expressions across multiple phenomena in both the visual and spoken modality. We argue for a account that uniformly models the iconicity across all of these gradable expressions as demonstrations.

2. Gradability in natural language

The semantics of gradability remains a relatively understudied phenomenon in sign languages compared to spoken languages. While the conceptual notion of gradability seems to be expressed in every language, the syntax and semantics of expressions such as comparatives, superlatives, measure phrases, degree questions, etc. that encode gradability are subject to a high degree of cross-linguistic variation (Bobaljik, 2012; Bochnak, 2015; Beck et al., 2009). One influential idea in this literature comes from Beck et al. (2009) who propose that the ontology of a degree variable is a point of parametric variation. This is the spelled out as the Degree Semantics Parameter (DSP) in (5).

(5) Degree Semantics Parameter (DSP):
A language does/does not have gradable predicates (type $\langle d, \langle e, t \rangle \rangle$ and related), i.e. lexical items that introduce degree arguments. (Beck et al., 2009)

This proposal challenges the assumption that the concept of a degree is a semantic universal, and that some semantic categories might be subject to parametric variation. The DSP proposes a split between languages that employ a Delineation style semantics (Klein, 1980; Burnett, 2015), and those that use a Degree semantics (Kennedy and McNally, 2005; Kennedy, 2007b; Wellwood, 2015). While the nature of this parameter is an interesting discussion in its own right, for the purposes of this paper, we will assume that the DSP causes languages to pattern differently with respect to whether the ontological category of a degree exists in that language. Note however, that this is not to say that languages without degrees do not express concepts of gradability but rather that they employ a different syntactic and semantic inventory, and thus do so in a different way. We can see this by comparing English, which is a +DSP language according to this proposal, to Washo which has been argued to be a -DSP language (Bochnak, 2015). In the case of comparative expressions, the presence of a lexical item *-er* or its analytic counterpart *more*, as in English, is typically analysed as an operator over degrees, and is often indicative of the presence of a degree ontology in a language. In contrast, the main strategy of comparison in Washo is a conjunction construction which does not have any comparative morphology on the gradable predicate or the standard of comparison (6a). These constructions are not felicitous in crisp judgement contexts i.e cases where there are fine grained differences between two entities with respect to some gradable property. For such cases where the English *-er* comparative is reported to be permitted, Washo uses modifiers like the intensifier šemu ('really') or wewš ('almost') rather than the conjoined comparative as in (6b).

(6) a. *Conjoined comparative*
mé:hu delkáykayiʔ k'éʔi šáwlamhu ʔilkúškuši ʔaš
mé:hu de-ʔil-kaykay-iʔ k'-eʔ-i šawlamhu ʔil-kuškuš-iʔ-aʔ-š
boy NMLZ-ATTR-tall-ATTR 3-COP-IPFV girl ATTR-short-ATTR-AOR-SR
'The boy is taller than the girl'

b. *Comparatives with modifiers*
wíːdiʔ behezinaš lákʾaʔ wíːdiʔ tʾíːyeliʔ **wéwši**
wiːdiʔ behezin-aʔ-š lakʾaʔ wiːdiʔ tʾiːyeliʔ **wewš-i**
this small-AOR-SR one this big almost-IPFV
this one is bigger than that one
(lit: this one is small, that one is almost big) (Bochnak, 2015)

This is in contrast to a +DSP language like English where the main strategy of comparison is a construction with overt comparative morphology on the gradable predicate which is also the preferred construction in crisp judgement contexts. While English also has expressions for comparison that use a coordination structure (7c) or an intensifier (7b), they seem to have a more restricted usage than the *-er* comparative (7a).

(7) a. John is taller than Mary.
b. John is tall, but Mary is really tall.
c. John is tall but Mary is not.

3. Gradability in sign languages- LIS and ASL

We turn to similar data in the visual modality from two different sign languages that have been argued to be on opposite sides of the DSP, just like English and Washo. As we will see, unlike with spoken languages, these proposals crucially need to capture what seem to be additional iconic components of these gradable predicates. Intriguingly, Aristodemo and Geraci (2018) propose to account for this iconicity in LIS by analyzing the iconic component as a visual representation of the underlying degree component proposed to be covert in spoken languages. However, as Koulidobrova et al. (2023) argue, this analysis seems to make incorrect predictions for ASL, a sign language that has similar iconic expressions of comparison as in LIS, but seems to differ in terms of other expressions of gradability, which point to ASL as falling on the Washo side of the DSP. Crucially, it seems that other expressions of gradability in ASL are best analysed without degrees, in which case a degree-based analysis of iconicity would be incompatible with broader facts of ASL, yet they acknowledge they lack a formal semantic analysis of these iconic comparatives that is compatible with the degree-less semantics suggested for ASL.

3.1. Degrees in LIS

This section reviews the proposal in Aristodemo and Geraci (2018) for visible degrees in LIS, which originated the discussion of degree semantics in sign languages and raised an intruiging case of 'visibility' of logical form. While LIS is essentially supposed to be like other +DSP languages, the authors highlight two unique aspects of this phenomenon in LIS. The first is that the phonological form of certain gradable predicates seems to encode an 'iconic scale'. This means that the movement of the hand in signing space depicts an abstract scale (vertical or horizontal) with points or loci along that scale representing overt degree arguments. A consequence of this is the second important aspect of gradability in LIS. Overt expression of degree arguments in the language allows for the possibility of anaphoric reference to degrees. As we know, languages with a degree semantics like LIS are fairly common among spoken languages. However, as the authors note, English allows anaphoric reference to individuals but not to the degree itself.

While a degree semantics does not explain why such reference is not possible in all +DSP

languages, it does seem to be available in LIS. So one of the pieces of evidence for a degree semantics in LIS is the anaphoric potential of degrees in this sign language. The authors are primarily concerned with open scale gradable adjectives like *tall, deep, expensive, etc*. All of these adjectives employ scales of some dimension of measurement along which a set of degrees is ordered. Their proposal for an Iconic Degree Scale in (8) is a modification of this idea.

(8) Iconic Degree Scale
An iconic scale is the order-preserving mapping of a set of ordered degrees onto a set of ordered points in the signing space (i.e. a line on the horizontal, vertical or lateral plane). Each degree of the scale is represented as a point along a line. (Aristodemo and Geraci, 2018)

Access to this iconic scale however, is subject to certain morpho-phonological constraints. Crucially, the signs for the gradable predicates must be size and shape classifiers, and the movement of the sign must be perpendicular to the plane of articulation. So the LIS sign for DEEP which is semantically the same kind of open scale gradable predicate as TALL, does not have access to this iconic scale. The movement of the sign DEEP is iconic, perpendicular to the plane of articulation with the non-dominant hand moving downward to indicate depth, but it is not a size and shape classifier and so will not express degrees iconically. But for a predicate like TALL, which does satisfy these constraints, the positive form of the predicate, and the comparative form of the predicate are in (1). α,β, and γ refer ordered points on the iconic scale where $\alpha \prec \beta \prec \gamma$. The movement of the hand from one locus to the next is analysed as a morpheme within this analysis. So the movement $\alpha \rightarrow \beta$ is assumed to be the bound *pos* operator and the movement $\beta \rightarrow \gamma$ is the bound morpheme which represents the comparative operator, like the English *-er*. Moreover, in (1), β is the degree to which the man is tall, and γ is the degree to which the woman is tall along the Iconic Degree Scale.

(9) ADRIATIC DEEP AEGEAN MORE
'The Aegean sea is deeper than the Adriatic sea' (Aristodemo and Geraci, 2018)

Other gradable predicates in LIS which do not meet these constraints are not compatible with the bound morpheme. Instead, in these cases the analytic form of the comparative morpheme, glossed as MORE as in (9) is used, and there seems to be no overt morpheme for the *pos* operator in these cases. Moreover, all the adjectives which can use the iconic scale are also compatible with the analytic form. This seems to be indicative of some element of optionality in making use of the iconic scale. Both the analytic MORE and the synthetic ${}_{\beta}$ICONIC-MORE$_{\gamma}$ have been argued to encode the same semantics of a clausal comparative *-er* operator (10).

(10) a. $[[-er_{clausal}]] = \lambda P_{\langle d,t\rangle}.\lambda Q_{\langle d,t\rangle}.Max(Q) > Max(P)$

However, note that even though the two may be different morphological realisations of the same operator, it is only ${}_{\beta}$ICONIC-MORE$_{\gamma}$ which also includes overt realisations of degree arguments as loci (locations in signing space) ordered along the iconic scale. This would mean that gradable predicates which do not have access to the iconic scale presumably do not allow anaphoric reference to degrees since it would not be possible to assign them to visible loci. In sum, the morphology that makes overt reference to degrees is restricted to a certain class of predicates, and is always optional. In particular, it seems to depend in part on how 'iconic' a particular sign is, with iconicity in this context being defined by certain morphophonological

constraints i.e, they must be classifiers with a specific direction of hand movement.

Aristodemo and Geraci (2018) argue for a degree ontology in LIS on the basis of the fact that certain gradable predicates in this language allow an overt realisation of degree arguments. Perhaps not surprisingly, the existing typology of comparatives in spoken languages in Beck et al. (2009) does not discuss overt realisation of degree arguments as a diagnostic for a degree ontology in a language, so the argument is based on entirely disjoint diagnostics. Moreover, the possibility of anaphoric reference to degrees in LIS discussed by Aristodemo and Geraci (2018) is a novel observation since as the authors note, this sort of anaphoric reference has not been observed in +DSP spoken languages like English, but it remains unclear whether this sort of reference to degrees is not possible in English by virtue of its modality, or whether there are other factors at play. If LIS as a +DSP language allows anaphoric reference to degrees, then it would certainly be interesting to understand whether other + DSP languages pattern similar to LIS, and particularly whether other sign languages also allow this property. As the facts stand, it would seem that any sign language where gradable predicates can make use of the iconic degree scale should allow anaphoric reference.

This brings us to a broader question about the theory of iconicity being assumed for LIS. It is very likely that gradable predicates whose morphophonological form satisfies the constraints outlined in Aristodemo and Geraci (2018) can be found across sign languages. Does this proposal then predict the possibility of visible degrees in all those cases in different sign languages? If so, one would assume that all sign languages employ a degree semantics. However, as we will in see in the next section, Koulidobrova et al. (2023) argue that ASL differs from LIS in this regard, and may be best analyzing using a delineation or degree-less semantics instead.

3.2. A degree-less semantics in ASL

Contrary to previous work on gradability in ASL (Wilbur et al., 2012; Kentner, 2020) which assumes the presence of degrees in ASL, Koulidobrova et al. (2023) argue that a degree-less analysis along the lines of Washo better explains the data from ASL. According to their findings, differential measure comparatives across a wide range of gradable predicates are strictly ungrammatical in ASL (11a). It is also not possible to construct a measure phrase with an overt degree in the attributive position as in (11b).

(11) a. *ALEX a-IX TALL$_{(neutral-space)}$ JO b-IX TALL$_{(at-signer'-head)}$ 4 INCH
'Jo is 4 inches taller than Alex'

b. *BOOK (IX) 4 KILO HEAVY NOT 1-POSS
That 4 kilo heavy book- not mine (Koulidobrova et al., 2023)

If this is right, then according to the diagnostics in Beck et al. (2009), ASL does not seem to have the kind of expressions that refer to degrees. When it comes to expressing comparison, there are multiple strategies in ASL; a juxtaposition construction like in Washo without an overt comparative marker; comparison using a non-manual intensification marker; an overt lexical item such as MORE, BEAT, BETTER, SAME,etc. A further strategy which the authors note as being the most common and intuitive one is comparative depiction, shown (2). This expression has exactly the same components as the explicit comparative in LIS, with the same gradable predicate TALL which seems to have the same form as its LIS counterpart.

The argumentation for ASL essentially goes in the opposite direction to what has been proposed

for LIS, which leads us to radically different analyses for a construction which in fact looks very similar in the two languages. Koulidobrova et al. (2023) argue that ASL systematically lacks constructions one might expect to see in a +DSP language and hence it reasonable to propose that it is a -DSP language, so the sentence in (2) cannot contain degrees. Meanwhile, the proposal for LIS argues that similar constructions like (1) contain overt reference to degrees, and hence provide a unique form of evidence for a degree ontology in LIS.

Clearly, we need a resolution. We agree with Koulidobrova et al. (2023) that a degree-less story for ASL is appealing in light of several empirical patterns in the language, but in order for the degree-less analysis of ASL to stand, there needs to be a formal semantic analysis that explains the constructions in (12) without reference to degrees. Koulidobrova et al. (2023) allude to two possible directions for these cases. For (12a), they suggest that this could be a case of comparative depiction or demonstration in the sense of Davidson (2015) rather than visible degrees. And in (12b), the intensification of the sign FAST is a kind of predicate modifier which results in an intensification interpretation like the modifier *šemu* in Washo (Beltrama and Bochnak, 2015), running contrary to the claim in Wilbur et al. (2012) which analyses intensification in ASL as a form degree modification.

(12) a. a-IX a-HEAVY b-IX HEAVY (*minimal downward movement*)
'B is a little heavier than A'
b. a-IX a-FAST b-IX $\overline{\text{FAST}}^{intens}$
' A is fast, B is a little faster' (Koulidobrova et al., 2023)

Note that both expressions involve some modification of the phonological form of the sign, although the intensification strategy is not strictly restricted to 'iconic' signs. The existing literature on constructions of this form has assumed a degree-based analysis, crucially relying on the iconicity as evidence for degrees in these constructions. Both in the extension of the Event Visibility Hypothesis in Wilbur et al. (2012), as well as the Iconic Degree Scale in Aristodemo and Geraci (2018), the claim has been that the phonological form expresses the semantic scales that are a part of the lexical semantics of these gradable predicates.

This paper will put aside the question of intensification, which is best examined in the context of intensification cross-linguistically. In the next section we focus on the non-intensification examples, and argue in agreement with Koulidobrova et al. (2023) that cases such as (12a) are best suited to a demonstration based account. Taking on the challenge they note for semantics, we propose an degree-less analysis for comparative depiction in ASL where the iconic component of the sign for the gradable predicate is analysed as a demonstration, providing a degree-less analysis for this data. Moreover, given the similarity between the constructions in LIS and ASL in (3) and (2), we also argue that such an analysis significantly weakens the claim in Aristodemo and Geraci (2018) for a degree ontology in LIS which is based solely on the iconicity in these constructions

4. Iconicity via demonstration

4.1. The semantics of demonstrations

The original argument for the concept of a demonstration in Clark and Gerrig (1990) takes on the question of the 'iconicity' in quotations, namely the fact that a quote has to report a speech event in roughly (although not always exactly) the form that it was originally made, and thus analyses quotations (in written and spoken language) as a performance or a demonstration.

Davidson (2015) builds on this idea to propose a compositional analysis for demonstration in language in quotations and in other iconic gestural phenomena, both spoken and signed. Under this view, in order to compose a demonstration d_v (a communicative event of type v) with a natural language expression, an operator establishes a relation between a demonstration and the event denoted by the expression. It could be a covert operator, or it could be denoted by a lexical item as in the English '*like*' quotations in (13d). Existing implementations of this approach to iconicity have been proposed for spoken language quotations and sign language classifiers (Davidson, 2015; Zucchi, 2017), as well as role shift (Davidson, 2015; Maier, 2018; Steinbach, 2023).

(13) a. A demonstration d is a demonstration of e (i.e. demonstration(d,e) holds) if d reproduces properties of e and those properties are relevant in the context of speech.
b. $[[demonstration]] = \lambda d.\lambda e[demonstration(d,e)]$
c. d_1 = Chloe's utterance "that's a huuuge dog"
d. [[Chloe was like "that's a huuuge dog"]] $= \exists e[Agent(e,Chloe) \wedge demonstration(d_1,e)]$ based on (Davidson, 2015)

Sign language classifier predicates can be decomposed into a linguistic component (contributed by the handshape), and a gestural component which is expressed with iconic uses of the classifier sign's location and movement. The demonstration tool in (16b) allows us to model the semantic contribution of the non-linguistic component of the classifier. In an event semantics framework, the classifier takes as its arguments a demonstration and an event (this can be an agent and/or a theme depending on the type of classifier). This is illustrated in the denotation of the size and shape classifier for BOOK in ASL from Davidson (2015).

(14) $[[\text{CL-B MOVE}]] = \lambda d.\lambda x.\lambda e.[theme(e,x) \wedge flat-object(x) \wedge moving(e) \wedge demonstration(d,e)]$

The resulting expression has an interpretation along the lines of *'the book moved in a manner that resembles demonstration d'*. The next section illustrates how this analysis of size and shape classifiers in ASL can be straightforwardly extended to iconic gradable predicates in ASL.

4.2. Comparative depiction as demonstration

The examples of comparative depiction in Koulidobrova et al. (2023) all involve adjectives which have a strong iconic component in the form of the sign.[2] For these adjectives we propose a similar split between the linguistic component and the demonstration component of the sign. The linguistic component in this case is a gradable predicate whose denotation is determined by the contextually specified comparison class which is encoded by the handshape, i.e. the linguistic aspect of the sign TALL can simply mean roughly 'tall for the context'. The demonstration component is expressed by the movement and location of the hand in the signing space, exactly as in the case of the classifiers. In this way, we assume that iconic movements are integrated into the form of the sign as demonstrations of type δ. So when we think of a sentence like ALEX TALL(signed in neutral space) *'Alex is tall'* in ASL, the location of the hand in the signing space is the demonstration. Just as in the case of the classifiers, the demonstration

[2]Koulidobrova et al. (2023) note that all the gradable predicates they tested which employ a comparative depiction strategy are also compatible with a different strategy of comparison which involves the use of MORE or BEAT, similar to the optionality between the synthetic and analytic forms in LIS

composes with TALL by means of a covert *demonstration* predicate.

In order to capture the semantics of gradable predicates within this framework, we assume that gradable adjectives represent states, not events. This is in some sense a natural extension of Davidson (2015), which focuses on manner classifiers which are eventive. Since sign languages also have classifiers (e.g. size and shape predicates) that denote states, this approach can be extended to a broader range of classifiers not just those that are relevant to gradability. Consider the spoken language example in (15) where the demonstration event depicts the state of exhaustion that the person is in.

(15) [[Chloe was like exhausted$_{drooping\ shoulders}$]] =
$[\exists s.(Exhausted(s) \wedge Holder(s, Chloe) \wedge Demonstration(d, s))]$
(Interpretation: Chloe was really tired and the demonstration event depicts her physical state.)

We now have the first component of our analysis, which is an analysis of demonstrations that express states. Next, we turn to other pieces of formal machinery that are required to make the semantics of gradable predicates compatible with the account of iconicity above. Within an event semantics framework, gradable predicates can be predicates of events or states, and an additional functional head v_S introduces the thematic role of the Holder of the state (16f). Since we are primarily concerned with gradable adjectives in this paper, we adopt a semantics of gradable adjectives from Cariani et al. (2023). Within this approach, gradable adjectives like TALL and HOT do not encode a relation between degrees and individuals in their lexical semantics. Instead, they are defined as properties of states. A contextually determined comparison class (Klein, 1980) is encoded here as a background ordering of states which is part of the the lexical semantics of the gradable adjective. Thus, TALL is a predicate of states, with a contextually determined threshold property of being tall that maps a state s to true if the state meets the relevant threshold in context c and if the state is a relevant state in the domain of height ordering (16a).

(16) a. $[[tall]] = \lambda s : s \in domain(D_{height} \succeq_{height}).tall_c(s)$ [based on Cariani et al. (2023)]

b. $[[demonstration]] = \lambda d.\lambda s, demonstration(d, s)$

c. [[]] $= \delta_1$

d. $[[demonstration([[$  $]])]] = \lambda s.demonstration(\delta_1, s)$

e. [[TALL ]] $= \lambda s(s \in domain(\langle D_{height}, \succeq_{height} \rangle)).Tall_c(s)$
$\wedge Demonstration(\delta_1, s))]$

f. $[[V_S]] = \lambda x.\lambda s.Holder(s)(x)$

g. [[ALEXa-IX TALL ]]^c
$= [\exists s(s \in domain(D_{height}, \succeq_{height})).Tall_c(s) \wedge (Holder(s, Alex)$
$\wedge Demonstration(\delta_1, s))]$
'Alex is in a state of being tall (relative to the context c) and δ_1 demonstrates that state.'

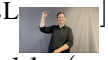
The implicit *demonstration* predicate (16b) first takes as an argument the iconic component

of the sign δ_1, which is the position of the hand in neutral space and returns a predicate of states. It then combines with the gradable adjective and the holder of the state via Predicate Modification to give us the truth conditions in (16g). This is the positive form of the gradable adjective, produced in a way to iconically express Alex's height.

For the comparative form of the gradable adjective in a language like English, Cariani et al. (2023) introduce degrees through the denotation of *-er* which introduces a measure function and combines with any adjective phrase, NP or VP if they are measurable. It imposes a condition on the background ordering of states and requires that the measure function maps s to a degree greater than any denoted by the *than-* clause. However, since we are assuming a degree-less semantics for ASL, there is no comparative operator like *-er* in the ASL cases of comparative depiction. For the example in (2) we simply see two instances of the positive form of the gradable adjective combining with two different demonstration arguments δ_1 and δ_2. Combining all these elements, we can the following truth conditions for a comparative depiction in ASL (simplifying the information structural features of having the proper name followed by a pronoun).

(17) a. ALEX a-IX TALL  JO b-IX TALL 

Lit. 'Alex is this tall, Jo is this tall.' ('Jo is taller than Alex.')

b. $[[\text{ALEX}a\text{-IX TALL}$  $]]^c[[\text{JOE}b\text{-IX TALL}$  $]]^c$

$= [\exists s(s \in domain(\langle D_{height}, \succeq_{height}\rangle))(Holder(s, Alex) \wedge Tall_c(s)$
$\wedge Demonstration(\delta_1, s))][\exists s(s \in domain(\langle D_{height}, \succeq_{height}\rangle))(Holder(s, Joe)$
$\wedge Tall_c(s) \wedge Demonstration(\delta_2, s))]$

'Alex is in a state of being tall (relative to the context c) and δ_1 demonstrates that state. 'Joe is in a state of being tall (relative to the context c) and δ_2 demonstrates that state.'

Crucially, in this analysis the demonstration is *not a degree*. Rather, gradable adjectives denote properties of states: there is a state of being tall that is true of an individual, and the demonstration is a reproduction of that state or property. As we can see from the example above, we infer that Joe is taller than Alex since δ_2 demonstrates a greater height than δ_1. Koulidobrova et al. (2023) argue that these constructions are felicitous in crisp judgement contexts (e.g. where they are both tall but one is minimally taller than the other), so the demonstration argument can be used to express fine grained distinctions in height.

These comparative depiction cases are distinct from the juxtaposition constructions in ASL which, like the Washo juxtaposition constructions as in (18b) are only felictious in contexts where the predicate is true of one entity and not of the other. It is predicted that a sentence like (18a) is only possible in contexts where Mary's hair is curly and Paul's hair is straight, but not when both Mary and Paul have curly hair.

(18) a. HAIR left hand-a-MARY-CURLY right hand-PAUL STRAIGHT
'Mary's hair is curly, Paul's hair is straight.' ASL,(Koulidobrova et al., 2023)

b. mé꞉hu delkáykayiʔ k'éʔi šáwlamhu ʔilkúškuši ʔaš
mé꞉hu de-ʔil-kaykay-iʔ k'-eʔ-i šawlamhu ʔil-kuškuš-iʔ-aʔ-š
boy NMLZ-ATTR-tall-ATTR 3-COP-IPFV girl ATTR-short-ATTR-AOR-SR
'The boy is taller than the girl' Washo, (Bochnak, 2015)

By including the ontology of a demonstration in our semantics; an account of gradability in ASL without degrees becomes possible. As discussed earlier, demonstrations are not modality specific. They can be quotations in spoken or sign language, but they can also be iconic elements of classifiers and gradable predicates. It is also possible that there are predicates that do not have as close an integration with demonstration as the cases discussed above. A gradable predicate like SMART in ASL might not have the same sort of iconicity as predicates like TALL. In such a case, ASL presumably employs a different strategy of comparison like a BEAT construction or intensification. Now that we have seen how demonstrations integrate with the lexical semantics of signs, next we revisit the case of gradability in LIS.

4.3. A reanalysis of LIS

On one hand, assuming an overt comparative operator makes it fairly straightforward to model LIS as a language with a standard degree semantics. However, as we have seen in this section, LIS is different from other spoken languages with a degree semantics in a number of ways. Not only does the iconicity seem to offer evidence for an overt *pos* morpheme, as proposed by Aristodemo and Geraci (2018), but the iconic movement in the signing space also motivates the presence of an overt measure function. This also seems to allow another unusual property of LIS which is the possibility of anaphoric reference to degrees. It is also worth noting that in a typical clausal comparative like (19a), the comparative operator does not take overt degree arguments but involves abstraction over degrees, and under this view the LIS *-er* operator has the same denotation as the English clausal comparative operator. However, the LIS comparative constructions seem to involve a direct comparison between two degree arguments δ_β and δ_γ.

(19) a. #John is taller than Mary. It is 6ft tall.
b. John is taller than Mary. He is 6ft tall. (Aristodemo and Geraci, 2018)

Such an analysis of LIS as a +DSP language seems to involve overt evidence of several components of grammar that had previously only been analyzed as covert in spoken language. Moreover, the presence of these components is very clearly linked to the iconicity in this languages. One reason for this difference could be that we do not see overt expressions of these elements in other spoken languages because they lack they same level of iconic potential that LIS has. As Aristodemo and Geraci (2018) note, the data in LIS supports a degree semantics *because* of the overwhelming evidence of overt degrees in the language. In their view, the degrees exist because we can 'see' them. An analysis using overt degrees provides the truth conditions in (20) for the LIS comparatives. If gradable adjectives themselves do not encode a relation between degrees and individual, but rather a predicate of ordered states as in Cariani et al. (2023), the iconic *pos* in LIS would encode a measure function $A(\mu)$ that introduce degree arguments ordered along a contextually relevant scale.

(20) $[[\text{MAN TALL }_\alpha\text{POS}_\beta\text{WOMAN TALL}_\beta\text{ICONIC-MORE}_\gamma]] = (\exists s[Holder(s)(Man) \wedge Tall(s) \wedge A(\mu)(s)(= \delta_\beta) \succ \delta_\alpha])(\exists s[Holder(s)(Woman) \wedge A(\mu)(s)(= \delta_\gamma) \succ \delta_\beta])$
'The woman is in a state such that her degree δ_γ, the man is in a state such that his degree of tallness δ_β and it is the case that δ_γ exceeds δ_β

Since spoken languages haven't been argued to use overt degrees, a standard degree semantics for comparatives does not include argument slots for overt degree variables; the positive and comparative operators in (20) are a modification of the proposal in Cariani et al. (2023) in order

to include the overt degree arguments. The truth conditions in (20) state that the height of the man is of a degree δ_β which exceeds the standard degree δ_α, and the height of the woman is of a degree δ_γ which exceeds the standard degree δ_α. In this framework, (20) differs from the English clausal comparative since it explicitly encodes a relation between two over degree variables rather than a comparison relation between two sets of degrees.

5. Extending the DSP to sign languages

5.1. Situating LIS and ASL in the typology

On the face of it, we have two new languages to add to our typology. According to Aristodemo and Geraci (2018), LIS has been analyzed as a +DSP language like English, with some constructions that seem to make use of degree arguments, and apparent operators such as the comparative *-er* operator that manipulates degree arguments. On the other hand, Koulidobrova et al. (2023) argue that, ASL patterns empirically like Washo with respect to several tests for a degree ontology. Constructions such as differential measure phrase comparatives and degree questions which target the degree argument slot are not available in ASL, and so we provided a delineation semantics that incorporates demonstrations to model their iconic component. However, perhaps these languages are themselves not so empirically different. Here, we consider more closely the case of the comparative constructions in crisp judgement contexts. Recall that English and Washo pattern in opposite ways with respect to the DSP, and have vastly different constructions to express comparison between two individuals in such cases. English employs the familiar comparative operator lexicalised as *-er* or *more* which establishes a greater than relation between two predicates of degrees. Washo, which lacks such comparative operators uses a conjuctive strategy along with modifiers such as *šemu* (really) or *wewš*(almost).

When we examine the constructions used by LIS and ASL to express comparison in crisp judgement contexts, one would expect to see a similar difference between the two languages given the existing claims about the DSP. But strikingly both sign languages seem to make use of essentially the same strategy of comparison. This is completely at odds with the predictions of the DSP. The presence of a degree ontology in a language is supposed to result in significant differences in the strategies used to express comparison. So how can a +DSP and a -DSP language employ what seem to be identical constructions? Taking the existing analyses of these languages on their face, this conflict makes it difficult to predict how other sign languages will potentially fit into the gradability typology. What can we say about a sign language that uses the same strategy of comparison that seems to be available in both LIS (1) and ASL (2)?

To consider this problem in more detail, we turn next to a third sign language which remains unstudied in this domain. The third data point from our initial puzzle is an example of a comparative construction in German Sign Language (DGS) from the DGS corpus (Konrad et al., 2020). Given the similarities (3) has to the LIS and ASL examples, if those two languages really are different then a question arises whether to analyze it as a clausal comparative or a comparative depiction construction; alternatively, if sign languages generally show the same kind of comparative, this may push us further to use a unified story for all.

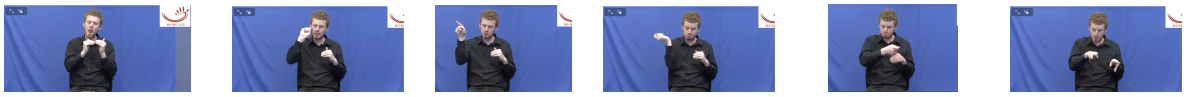
5.2. Gradability in DGS: evidence from corpus data

Beyond the iconic comparative in DGS[3] in (3), we see a lot of constructions that express comparison similar to ASL as reported by Koulidobrova et al. (2023), including BEAT comparatives

[3]The DGS data presented here follows the glosses in the Hamburg DGS corpus (Konrad et al., 2020)

and intensification. Where does this put DGS in terms of the DSP?

(21) BEAT comparative



COMPARISON BERLIN1C* THERE1* BERLIN1C* TO-BEAT-7* PARIS
”But Berlin is bigger than Paris in comparison.

(22) Intensifier comparative

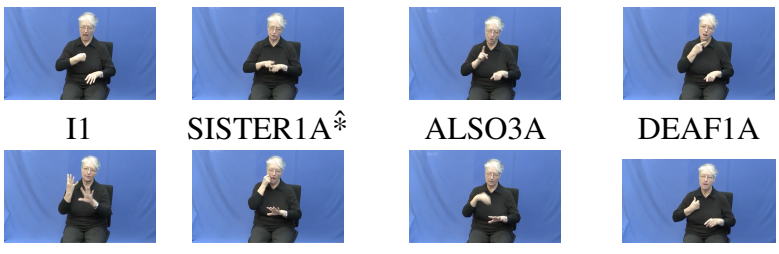
LOUD1C OUTDOORS2* $INDEX1
‘(‘Speak louder!’) the people outside were supposed to hear me say it ’ Konrad et al. (2020)

As Koulidobrova et al. (2023) argue, other comparison strategies such as intensifier comparatives as well as BEAT comparatives need not encode a degree semantics in ASL. From that perspective, it seems like DGS might pattern like ASL with respect to the DSP.[4] Of course, the case for a degree semantics (or lack thereof) in DGS must be based on a systematic investigtion into an entire family of expressions that is indicative of a degree ontology in a language. (23) lists diagnostics for the DSP in a language.

(23)
- •Differential degree comparative.
  A is 5 cm taller than B.
- •Degree comparative
  A is taller than 5 cm
- •Superlative
  A is the tallest person in the room
- •Measure phrase construction
  A is 10 cm tall.
- •Equative
  A is as tall as B is
- •Degree question
  How tall is A? (Beck et al., 2009)

That said, there is some evidence that there might be an English style differential comparatives in DGS, such as (24). This finding was somewhat serendipitous; further empirical corpus and/or elicitation work may more clearly help determine the role of differential degree comparatives, degree comparatives, measure phrases, etc.

(24)



I1 SISTER1A$\hat{*}$ ALSO3A DEAF1A
YEAR1B$\hat{*}$ OLD2C AS-OR-THAN3 I2
‘my sister is deaf as well and she’s nine years older than me’

Although a complete analysis of DGS is beyond the scope of this paper, we hope that this comparison of the three languages highlights the tension in existing proposals for gradability in

[4]For a degree-less anaylsis of intensification see Beltrama and Bochnak (2015).

sign languages. It is clear that the choice between the two analyses may not be entirely informed by existing tests, but also depends on whether one assumes that iconicity represents a linguistic concept like a degree, or something extra-linguistic like a demonstration. On the whole, the ASL proposal leans towards a degree-less semantics, while the LIS proposal leans towards a degree semantics, and focusing primarily on these iconic comparatives cannot settle the debate. This is also in line with what we know about the predictions of DSP in spoken languages, where the comparative construction might be indicative of a degree ontology in a given language, but should be considered in light of the rest of the relevant degree constructions. Moreover, the comparative constructions in these three sign languages show a clear uniformity in their use of iconicity that neither the prior proposal for LIS nor the one for ASL captures; their iconicity seems to be coincidental if both are taken at face value. Without a theory that explains the very salient commonality in these cases, it is difficult to investigate the potential-crosslinguistic variation in this domain among sign languages.

We suggest, in an effort towards taking the iconicity to be from a common source, that this difference between the two proposals regarding the comparatives in (1) and (2) is not because LIS has degrees while ASL does not, but rather it is a result of modelling the iconicity in these constructions in two different ways. In the next section, we will argue for a cohesive theory of iconicity that can be generalised over multiple phenomena including co-speech gesture. We follow an extension of Davidson (2015) where iconic elements of language are classified as demonstrations, a distinct ontological category. This clearly draws distinctions between iconic and abstract elements of language while still allowing both to be integrated into the logical form of the utterance.

6. Towards a unified theory of iconicity

While (Koulidobrova et al., 2023) argue for a degree-less semantics for ASL, this stance is complicated by the fact that BEAT, *intes*, and iconic comparatives have been used to argue for a degree analysis of ASL (Wilbur et al., 2018; Kentner, 2020). However, the absence of constructions like differential degree comparatives and degree questions strengthen the case for a degree-less semantics. Moreover, the demonstration based account for comparative depiction constructions involving gradable predicates completes the picture of ASL as a degree-less language. Analysing iconicity as demonstration also weakens the claims of a degree semantics in LIS which is argued *on the basis of the iconicity* in such comparative expressions.

In order to confirm a degree semantics for LIS, we'd want to look for further evidence independent of iconicity in the form of other degree constructions. As it is, the demonstration account is equally compatible with the LIS data which has essentially the same elements as the ASL case. In fact, the demonstration account is further supported by the fact that iconic gradable predicates in LIS *must* be size and shape classifiers, which makes them perfectly compatible with the semantics of classifiers proposed in Davidson (2015), as well as the extension of the proposal to gradable predicates which was laid out in the previous section. In contrast, a degree-based analysis seems potentially more problematic in ASL where there is less evidence for degrees in non-iconic expressions of gradability.

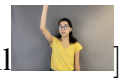
The demonstration based account can also be clearly extended to the DGS example in (3) . The sign for tall (token label TALL2A*), has the same form as the sign for adult (token label (ADULTS1A)). Just as in the ASL case, there is nothing (3) that strictly requires a degree semantics (given our analysis of its iconicity), but like ASL, the argument in favor of a degree-

less semantics is merely based on the absence of constructions we expect to find if a language makes use of degrees in this way. Not finding this evidence, either in ASL or in DGS, could be due either to cross-linguistic parametrization, or to the data not happening to contain one (especially in the case of corpus work). Certainly, though, a demonstration account takes away the iconic examples as a focus of this debate, and is a promising direction towards a unified analysis of all such expressions of comparison across sign languages which involve iconic gradable predicates, however they fall on this particular semantic parameter.

The final part of this puzzle is the English comparative accompanied by a co-speech gesture in (4). English is classified as a +DSP language which allows clausal comparatives of the form *A is taller than B is*. The *-er* morpheme is typically analysed as a comparative operator that encodes a greater than relation between two sets of degrees. This is also the analysis initially proposed by Aristodemo and Geraci (2018) for comparatives in LIS. However, the construction in (4) is quite different from the standard clausal comparative. It uses a conjunctive strategy of comparison resembling the cases in -DSP languages like Washo. Rather than a degree operator, we see two independent clauses connected by the conjunction *but* and the gradable predicate in each conjunct is accompanied by a co-speech gesture.

Once again, this construction is remarkably similar to the comparative constructions in ASL and LIS that we have seen so far. Just as in the earlier cases, the co-speech gesture is analysed as a demonstration that combines with the English gradable predicate *tall*. Unlike in the sign language expressions, this case also has the overt *demonstration* predicate which is denoted by the English *like*. If we assume a delineation style semantics, the truth conditions in (25) are identical to the comparative depiction case in ASL that was discussed earlier .

(25) a. $[[\text{tall}]] = \lambda s : s \in domain(D_{height} \succeq_{height}).tall_c(s)$

b. [[Alex is tall ]]^c[[Jo is like tall ]]^c
$= [\exists s(s \in domain(\langle D_{height}, \succeq_{height}\rangle))(Holder(s,Alex) \wedge Tall_c(s)$
$\wedge Demonstration(\delta_1,s))][\exists s(s \in domain(\langle D_{height}, \succeq_{height}\rangle))(Holder(s,Joe)$
$\wedge Tall_c(s) \wedge Demonstration(\delta_2,s))]$
'Alex is in a state of being tall (relative to the context c) and δ_1 demonstrates that state. 'Joe is in a state of being tall (relative to the context c) and δ_2 demonstrates that state."

If we follow Aristodemo and Geraci (2018) in assuming that the co-speech gestures are overt representations of degree variables, we may be tempted to implement a degree semantics with the co-speech gesture combining with the positive form of the gradable predicate in each conjunct, and the gesture encoding the iconic degree scale. However, it is important to note that (4) is truth conditionally distinct from the explicit comparative without the co-speech gesture in English.

Within a standard Montague semantics, the *-er* operator typically denotes a relation between two sets of degrees. Within an event semantics framework, this denotation must be modified, since gradable predicates denote a predicate of states rather than a relation between degrees and individuals. Instead, an *-er* operator in Wellwood (2015) assumes that the *-er* takes a measure function g, a degree argument d (contributed by the comparative clause), and a state or event of type α (26c). In this case, an explicit clausal comparative without a co-speech gesture would

have the truth conditions in (26d).

(26) a. Jo is taller than Alex is
b. $[[-er_{clausal}]] = \lambda P_{\langle d,t\rangle}.\lambda Q_{\langle d,t\rangle}.Max(Q) > Max(P)$
c. $[[-er_{event}]] = \lambda g.\lambda d.\lambda \alpha.g(\alpha) \succ d$
d. True iff $\exists s[Holder(s)(Joe) \wedge Tall(s) \wedge A(\mu)(s) \succ max(\lambda d.\exists s'[Holder(s')(Alex) \wedge Tall(s') \wedge A(\mu)(s') \succeq d])]$
'The degree of the state of tallness of Joe exceeds the degree of tallness of Alex'

Crisp judgement contexts are a crucial diagnostic for explicit comparatives i.e cases where there are fine grained distinctions between two entities with respect to the property of the gradable predicate (Kennedy, 2007a). Consider a case where Joe is 6ft tall and Alex is 5'11 ft tall. The English clausal comparative is felicitous in this context, while (4) is predicted to be degraded or infelicitous here. (26d) is acceptable in a context where both Jo and Alex are tall but there is a minimal difference in their heights. It is also felicitous in a context where both Jo and Alex are short, but Jo is still slightly taller than Alex.

However, comparatives like (4) are not possible in crisp judgement contexts. The assertion in the implicit comparative is that relative to a context c, the gradable predicate is true of one individual and false of the other. So we can imagine a context where Jo is 7ft tall and ALex is still 5'8 ft tall. Now the truth conditions in (4) entail that in this context, Jo is tall while Alex is not. Moreover, it also entails that both individuals are tall. It is infelicitous in a context where one of them is tall and the other one is short, or in a context where both of them are short.

We predict that all of the instances with an iconic demonstration of height in LIS, ASL, DGS, and English are more like implicit comparatives accompanied by a demonstration rather than explicit comparatives. A further complicating factor in the sign language data is that the signs for the gradable adjectives TALL and SHORT are identical except for the location of the hand in the signing space. While the hand moves up from the neutral space for TALL, it moves down from the neutral space for SHORT. So it is not clear whether the demonstration is combining with the gradable predicate *tall* or whether this is a pure demonstration of height. Crucially, these are all cases of an indirect form of comparison. In the cases like the English clausal comparative, the meaning *A is taller than B* is encoded in the truth conditions of the sentence. However, with the implicit comparatives discussed here, the meaning *A is taller than B* is an inference from the demonstrations. The addressee infers that Jo is taller than Alex due to the fact that the demonstration δ_2 (mapped to Joe) shows a height that is greater than δ_1 (mapped to Alex).

7. Conclusion

This paper presents a demonstration-based account for comparative depiction in ASL which strengthens the case for a degree-less semantics in this sign language. The iconic component of gradable predicates such as TALL can be understood as demonstrations which compose with the predicate via a *demonstration* operator. This is a departure from the analysis proposed for very similar expressions in LIS where it has been claimed that the iconicity in these constructions are components of the logical form such as degrees and scales, opening up room for investigation for the best analyses of each of these languages, and the empirical bases for these choices. We have also shown how this approach can account for comparatives in LIS, DGS, as well as conjoined comparatives in English with co-speech gestures. Analysing iconic elements as

demonstrations as shown in this paper allows for a more generalised theory of iconicity that cuts across languages and modalities. We also know from the existing literature that this approach can be extended to other sign language phenomena like role shift and classifiers.

We began with two sign languages that seem to pattern on opposite sides of the Degree Semantics Parameter. Whether this is truly the case remains a question for further research; one would certainly expect to find a similar manner of cross-linguistic variation in sign languages as we find in spoken languages. It may well be the case that ASL patterns like Washo, while LIS and DGS pattern like English and other +DSP languages. However, we make the case that these highly iconic comparative constructions are insufficient to make that claim. A case for degrees in these languages would involve an investigation into classes of expressions, with a wider range of gradable predicates do not encode a demonstration in their form in the manner that TALL does. This would reveal more about the underlying architecture of these constructions in each of these sign languages. More specifically within the class of expressions of comparison, there remains an intriguing question of the finer grained distinctions between BEAT, and intensification and the depictive strategy discussed here, as well as their cross-linguistic distribution among other sign languages.

The proposal for modelling iconicity presented here does not predict that all sign languages are fundamentally the same when it comes to expressing comparison of gradable concepts. Nor does it argue that iconicity does not have a semantic contribution in these cases. It aims to present a unified approach to iconicity which captures the distinction between the depictive and descriptive elements of utterances. While demonstrations do contribute semantic content via the predicate created by combining the demonstration operator and the language-external demonstration, they are also distinct in several ways from elements that combine compositionally in the abstract linguistic structure of these expressions. We argue that the visual modality does not include the interpretation of iconic components in its core grammar. Instead, demonstrations as a separate module of meaning can, and often do co-occur with linguistic structure.

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