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Visible degrees in Italian Sign Language

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Abstract Data from Italian Sign Language provide evidence in favor of a degree-based analysis over a non-degree based analysis for gradable adjectives and comparative constructions. Morphological and phonological constraints identify a class of gradable adjectives in which degree variables can be overtly represented as ordered points established in the signing space by an iconic mapping. When this happens the visible degree becomes available as an antecedent for a later pronoun, as in the nominal, temporal and modal domain, showing that the same anaphoric system is at work.

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1 Introduction

Sign languages systematically make visible some abstract properties of human language that are not immediately visible in spoken languages (Wilbur 2008). For example, *loci*, which are positions in signing space associated with nominal elements, have been claimed to be overt realization of indices, i.e. of variables (Sandler and Lillo-Martin 2006). Schlenker (2013) uses sign language data to prove the existence of time and world variables. He shows that in American Sign Language (ASL) temporal and modal constructions can be anaphorically retrieved by a pronoun, realized as a pointing sign toward a *locus* thereby supporting the existence of time and world variables. The example in (1) taken from Schlenker (2013:6) shows that the two spatial locations associated with the temporal constructions TOMORROW and DAY-AFTER-TOMORROW can be singled out by the pointing pronoun IX.

(1) $_a$[TOMORROW WILL RAIN] $_b$[DAY-AFTER-TOMORROW WILL SNOW].
         $\overline{\text{IX}_b}^{\text{re}}$ IX-1 HAPPY. $\overline{\text{IX}_a}^{\text{re}}$ IX-1 WON'T HAPPY.
         'Tomorrow it will rain and the day after tomorrow it will snow. Then [= the day after tomorrow] I will be happy but then [= tomorrow] I won't be happy.'

Our work fits into the context of these studies. We look at gradable adjectives and comparative constructions in Italian Sign Language (LIS). Specifically, we argue that locations in space associated with gradable adjectives are *loci* and correspond to overt realizations of degree variables. Our proposal is in part reminiscent of Wilbur et al. (2012), where intensification in gradable adjectives in ASL is discussed. In that paper the authors propose that phonological boundaries of gradable adjectives iconically represent the boundaries of degree scales. By looking into LIS, we will show that the scale itself is visible and not just its extremes and that LIS phonological boundaries mark the standard and the reference degree.

Formal approaches to the semantics of gradable adjectives are distinguished between those that make explicit reference to degrees in the ontology, and those that do not. The data we present in this short paper support a degree-based approach. We describe how gradable adjectives and comparatives are expressed in LIS, showing that degrees can be overtly realized as points in the signing space (i.e. *loci*). When this happens, anaphoric relations between the visible degree and a pronoun become accessible. Similarly to temporal and modal anaphora in ASL, anaphoric constructions can involve singular, dual or trial pronouns, showing that in these domains the same pronominal system is at work (Schlenker 2013).

The rest of the paper is organized as follows: Sect. 2 briefly introduces the two main accounts of gradability. In Sect. 3, we present the empirical part of our work describing new data on gradable adjectives and comparative constructions in LIS. We also show how the pronominal system interacts with gradable adjectives. Section 4 contains the analysis, while Sect. 5 concludes the paper.

2 Two theories of gradability

There are two main approaches to the semantics of gradable adjectives and gradability: the degree-based approach or Scalar Analysis (Cresswell 1976; Heim

1985; Kennedy 1997, 2007:etc.), and Delineation Semantics (Klein 1980; Burnett 2015:etc.). For a general overview on the semantics of adjectives and comparatives see Demonte (2011) and Beck (2011), respectively. The Scalar Analysis treats gradable adjectives as relations between individuals and degrees, which are abstract representations of measurements. To do so, degrees and scales are introduced into the ontology and adjectives are treated as expressions that relate individuals to degrees on a scale. For instance, the denotation of the adjective *tall* is stated as in (2), where the measure function **height** maps an individual to its degree of height:[1]

(2) $[\![\text{tall}]\!] = \lambda d.\lambda x.\textbf{height}(x) = d$

As for the semantics of comparative constructions, the degree morpheme *-er* is analyzed as a quantifier over the degree variable introduced by the gradable adjective. It denotes a relation between two sets of degrees and compares the maximal degree of each of them (Heim 2001; von Stechow 1984:among others). The formal denotation is given in (3):

(3) $[\![\text{-er}]\!] = \lambda D1_{<d,t>} \lambda D2_{<d,t>}.\max(D2) \succ \max(D1)$

The logical representation of the comparative sentence in (4) is stated in (5).

(4)   John is taller than Mary.

(5) $\max(\lambda d.\textbf{height}(j) \succeq d) \succ \max(\lambda d'.\textbf{height}(m) \succeq d')$

In Delineation Semantics, degrees and scales are not part of the ontology. The interpretation of gradable adjectives is derived by looking at comparison classes which are sets of ⟨individual, adjective⟩ pairs pertinent to the context. For instance, in order to give the semantics of explicit comparatives like the English example in (4), Burnett (2015:240) adds the expression ER to the logical language, which compares two ⟨individual, adjective⟩ pairs with respect to a strict order definable from the comparison classes. The sentence in (4), then, is true if there is some way of dividing the set of individuals into two sets like 'tall' and 'not tall,' obeying certain logical constraints[2] such that John is in the set 'tall' and Mary is in the set 'not tall.' Notably, under this analysis, gradability is captured indirectly. The logical form of the sentence in (4) is given in (6):

(6) ER^{+} (John, tall, Mary, tall)

Both approaches correctly derive the truth conditions of gradable adjectives and comparatives. However, they differ in how these are derived. Specifically, the existence of degrees in the ontology opens the possibility to anaphorically refer back to them, an option that is not available in Delineation Semantics. To put it in terms of Quine (1948:7): "[...] to be is to be in the range of reference of a pronoun. Pronouns

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[1] This analysis is identical to that of Cresswell (1976), but this is not the only option. Other analyses assume a partial ordering relation (Heim 1985).

[2] These constraints include the following: (i) for a given comparison class X, an individual cannot be both tall and not tall in X; (ii) for two comparison classes X1 and X2, it can't be the case that John is tall and Mary is not tall in X1, but Mary is tall and John is not tall in X2 (Burnett 2015).

are the basic media of reference [...]." In this respect, at a first glance, evidence from English and other spoken languages seems to point toward Delineation Semantics. Indeed, in sentences like (7) and (8) the pronoun *it* cannot refer to the degree of John's tallness.

(7)   # John is taller than Bill. It is 1.70 meters.
         Intended meaning: 'John is taller than Bill and his height is 1.70 meters.'

(8)   # John is tall. It is 1.70 meters.
         Intended meaning: 'John is tall and his height is 1.70 meters.'

However, the reason why pronouns cannot anaphorically refer to degrees in English may be due to factors other than the fact that degrees are not part of the ontology. One possibility could be that degrees are part of the ontology, but when they remain covert they are not a suitable antecedent for pronouns (we come back to this issue at the end of Sect. 3.3).[3] If this is the case, then there should be languages in which overt pronouns can refer back to degrees. Here, we argue that this is indeed the case of LIS, where degree variables are visible under iconic uses of signing space, as we will show in Sect. 3. Our line of argument follows Schlenker (2013), who shows that ASL pointing pronouns can single out *loci* to refer back to temporal and modal constructions, hence supporting the existence of time and world variables (see example (1), above). We provide empirical evidence supporting a scalar analysis of gradable adjectives by looking at the anaphoric dependency between a visible/overt degree introduced by positive and comparative markers and a pronoun referring to it.

3 LIS data

The basic facts about gradable adjectives and comparative constructions in LIS are provided in this section. We also offer empirical evidence supporting a scalar analysis of gradable adjectives by looking at the anaphoric dependency between a *locus* introduced by positive and comparative markers and a pronoun referring to it. Data comes from two LIS signers (Mirko Santoro and Lorenzo Laudo) who regularly collaborate with our group. During elicitation we used LIS as the exclusive means of communication. All LIS productions by the informants were recorded and played back to collect acceptability and felicity judgments.

     To help the reader, we provide here a small guide to assess the LIS examples. Glosses for signs are reported in small capital letters, Roman subscripts indicate *loci* that correspond to locations of nominal referents, Greek subscripts indicate *loci* that correspond to locations of degrees. To illustrate, consider the example in (9), where the nominal element PIETRO is associated with a single *locus a*, while the adjective TALL is associated with two *loci* α and β which correspond to the standard and reference degrees. Pointing pronouns are glossed as IX. Therefore, the subscript in IX_a

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[3]Another possibility could be that the English pronominal system lacks a pronominal form that refers to degrees altogether. This situation would be similar to the one described for parasitic gaps targeting prepositional phrases in English (Engdahl 2001, but see Levine et al. 2001 for counter arguments). Specifically, Engdahl (2001) argues that differently from Swedish, English does not have parasitic gaps on prepositional phrases because English lacks proforms that are able to refer to prepositional phrases.

indicates a pronoun that points toward *locus a*. Following the standard practice in semantics, we use the gloss *pos* for the positive degree morpheme. We extend this practice to *neg* which indicates the negative degree morpheme and *iconic-more* and *iconic-less* which indicate the iconic version of comparative degree morphemes instantiated in LIS.

(9) **Word by word images of a LIS sentence**

PIETRO$_a$ IX$_a$ TALL$_\alpha$-pos$_\beta$
'Pietro is tall.'

3.1 Gradable adjectives in LIS: The positive form

The adjectives discussed in this paper are all open scale gradable adjectives. They are gradable because they are compatible with the degree adverb *very* as in (10a) and they are open scale adjectives because they are not compatible with adverbs like *completely* as in (10b) (see Kennedy and McNally 2005 for an illustration of these diagnostics):

(10) a. GIANNI TALL-$_\alpha$pos$_\beta$ VERY
          'Gianni is very tall.'
      b. *GIANNI TALL-$_\alpha$pos$_\beta$ COMPLETELY

We classify LIS gradable adjectives in two groups: adjectives in which the amount of the property *is* iconically encoded, and adjectives in which the amount of the property is *not* iconically encoded. Adjectives that belong to the first class, like those shown in (11)[4] need to meet two crucial requirements: i) they are all classifier signs of the Size and Shape type, ii) the movement is always perpendicular to the plane of articulation.
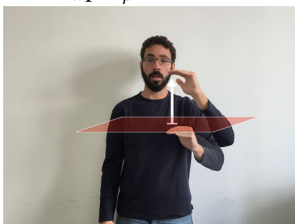
(11) a. TALL-$_\alpha$pos$_\beta$ b. DEEP-CL-$_\alpha$pos$_\beta$

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[4]The sign for *deep* is glossed DEEP-CL rather than DEEP because in the lexicon of LIS there are two signs for *deep*. One is a classifier sign while the other is not (see also the discussion around the example (14a) in the text).

c.   CULTURED-αpos$_\beta$ d.   BIG-αpos$_\beta$

First, a morphological constraint is at work. Adjectives of the first group are all classifier signs, although some of them like those in the examples in (11) and (12) may have become lexicalized signs, i.e. part of the core lexicon of LIS. More specifically, they are Size and Shape Specifiers (Supalla 1982). What distinguishes these classifiers from other types of classifiers, like handling or entity classifiers, is that they depict the size and/or the shape of the concept they describe by representing the contour of the object. For instance, the handshape of TALL classifies the area on top of the subject of predication, the handshape of DEEP-cl is a point-size classifier normally used for round/cylindrical cavities (like holes, wells, etc.) and the handshape of BIG classifies the shape of the object of the predication, etc. Differently from Size and Shape Specifiers, handling classifiers identify objects by the way they are handled, for example a closed fist handshape is used in many sign languages to represent hammers, tennis rackets and pans; while in entity classifiers, the handshape itself represents the entire object/concept, for example a flat open hand is used in LIS to refer to (non-flying) vehicles (car, trucks, boats, etc.).

Second, a phonological constraint is also active. The movement of the sign has to be perpendicular with respect to the plane of articulation. The movement component of signs is normally described as being parallel with respect to the plane of articulation or as perpendicular to it (Brentari 1998). To illustrate, consider the signs LONG and CULTURED in (12) and (11c). Both are articulated on some body location, LONG is articulated on the chest, while CULTURED is articulated on the forehead. However, in the case of LONG the movement is parallel to the body (i.e. the hand moves vertically along the chest, which is the plane of articulation), while in the case of CULTURED the movement (finger aperture) is perpendicular with respect to the plane that contains the forehead. The same phonological distinction is available for signs produced in the area in front of the signer. Specifically, the signs in (11) all instantiate a movement that is vertical with respect to their plane of articulation, as indicated in the still images. As we will shortly see, the grammar of LIS (and possibly of other sign languages) capitalizes on this fact to make the scale iconically visible, i.e. only movements that are perpendicular to the relevant plane of articulation may make the scale iconically visible.

The second class of adjectives is negatively defined as adjectives that cannot iconically map the amount of the property onto the signing space. This is so because they violate either the first (they are not Size and Shape Specifiers) or the second (the movement is not perpendicular) requirement. The relevant examples are given in (12)–(14). LONG is a Size and Shape Specifier with no perpendicular movement (cf. (12)). TALL-entity is not a Size and Shape Specifier (cf. (13)). DEEP and SMART are non-classifier gradable adjectives with perpendicular movement (cf. (14)).

(12) LONG

(13) TALL-entity

(14) a. DEEP

b. SMART

Notice that adjectives that are intuitively 'iconic' may fail to meet one or both of these morpho-phonological requirements. For example, DEEP is an 'iconic' sign because in its articulation the dominant hand goes down beyond the non-dominant hand representing the idea of depth. However, it is not a Size and Shape Specifier because it does not depict the contour of any object or concept. It is normally used to indicate the depth in wide spaces. On the other hand DEEP-cl is a Size and Shape Specifier because it describes the contour of the object, which in the case of cavities, is the interior. Therefore it can only be used to indicate the depth of cavities, like holes, wells, the interior of pipes etc. In these latter cases, DEEP cannot be used. Thus, iconicity alone is not a sufficient condition to encode a visible degree and is a separate property from iconically encoded scales.

In the next sections, we provide independent evidence for this classification by showing that only adjectives that belong to the first class can express comparative constructions by using the synthetic form (Sect. 3.2), and that only for these adjectives, anaphoric reference to degrees is possible (Sect. 3.3). In Sect. 4, we argue that when these morpho-phonological properties are met, the amount of the property is iconically encoded by the movement component which marks two points in the signing space.

3.2 Gradable adjectives in LIS: The comparative form

The sentences in (15a) and (15b) exemplify the two main strategies to convey *more*-comparatives:

(15)   a.   MAN TALL-$_\alpha$pos$_\beta$ WOMAN MORE

       b.   MAN TALL-$_\alpha$pos$_\beta$ WOMAN TALL-$_\beta$iconic-more$_\gamma$

          'The woman is taller than the man.'[5]

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[5]For convenience we translate the meaning of the sentence with an English *than*-clause even if the syntactic structure of the LIS sentence is different from the *than*-clause.

In (15a) the comparison is expressed by an analytic form using the lexical comparative marker MORE shown in (16), while in (15b) the comparison is expressed by a synthetic form that we glossed *iconic-more*. Since this is a simultaneous bound morpheme, we exemplify it in (17) with the adjective TALL.[6]

(16) MORE

(17) a. TALL-αposβ b. TALL-βiconic-moreγ

Both classes of adjectives allow comparatives to be expressed with the analytic form (as in (15a) and (18a)/(19a)). Crucially, only the adjectives in the first class allow the synthetic form, as shown by the ungrammaticality of (18a) and (19a):

(18) a. ADRIATIC DEEP, AEGEAN MORE
      b. *ADRIATIC DEEP AEGEAN DEEP-αiconic-moreβ
          'The Aegean sea is deeper than the Adriatic sea.'

(19) a. MAN SMART, WOMAN MORE
      b. *MAN SMART WOMAN SMART-αiconic-moreβ
          'The woman is smarter than the man.'

Less-comparatives behave similarly: they can be expressed by the analytic form using the lexical sign LESS or by a synthetic form glossed *iconic-less* as shown in (20).[7]

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[6]*Iconic-more* behaves like the positive morpheme *pos*, it iconically maps the amount of the property denoted by the subject (the man and the woman in the case of (15b)). Specifically, the iconic mapping of the comparative morpheme *iconic-more* needs to be the same as that of the positive morpheme *pos* (a vertical line in the case of TALL, a horizontal in the case of BIG, etc.)

[7]The main difference between *iconic-more* and *iconic-less* is that the movement of the latter goes in the opposite direction. More generally, in *more*-comparatives the movement of *iconic-more* goes in the same direction as that of the positive form. Hence, if the movement of the positive form is directed downward, as in DEEP-cl, then *iconic-more* is also directed downward.

(20) a.   MAN TALL-$_\alpha$pos$_\gamma$ WOMAN LESS
    b.   MAN TALL-$_\alpha$pos$_\gamma$ WOMAN TALL-$_\gamma$iconic-less$_\beta$
      'The woman is less tall than the man.'

Like in *more*-comparatives, the synthetic form *iconic-less* cannot be used with adjectives that belong to the second class as shown by the contrast in (21b) and (22b).

(21) a.   ADRIATIC DEEP, AEGEAN LESS
    b.   *ADRIATIC DEEP AEGEAN DEEP-$_\beta$iconic-less$_\alpha$
      'The Aegean sea is less deep than the Adriatic sea.'

(22) a.   MAN SMART, WOMAN LESS
    b.   *MAN SMART WOMAN SMART-$_\alpha$iconic-less$_\beta$
      'The woman is less smart than the man.'

LIS data show a clear connection between *loci* in signing space and the amount or degree expressed by gradable adjectives. It bears noting, though, that they do not mark the exact absolute degree predicated by the adjective as in a 1:1 scale. Rather, the iconic mapping is proportionally adjusted to the size of the signing space. For example, LARGE-$_\alpha$pos$_\beta$ can be used to describe both houses and microbes. In these cases, large dimensions like the size of a house are downscaled, while small dimensions are magnified, as in the case of microbes.

3.3 Anaphoric properties of visible degrees

In this section, we show that it is possible to anaphorically refer back to the visible/overt degree by means of a pronoun that points to the *locus* in which the degree was previously established. This is shown by the examples in (23)–(25). In (23) and (24), the pronoun IX$_\beta$ refers to the degree of GIANNI's height, while in (24) IX$_\gamma$ refers to the degree of MARIA's height. The sentence in (25) shows that the anaphoric relation can be established even with gradable adjectives denoting abstract properties, like being cultured.
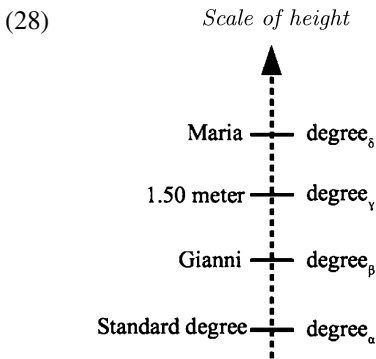
(23) GIANNI TALL-$_\alpha$pos$_\beta$ IX$_\beta$ 1 METER 70
    'Gianni is tall. This one (Gianni's degree) is 1.70 meters.'

(24) 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.'

(25) GIANNI CULTURED-$_\alpha$pos$_\beta$ MARIA CULTURED-$_\beta$iconic-more$_\gamma$. CULTURED$_\alpha$pos$_\beta$ CULTURED$_\alpha$pos$_\gamma$. IX$_\beta$ IX$_\gamma$ DIFFERENCE A-LOT.
    'Maria is more cultured than Gianni. The difference between this one (Maria degree of culture) and that one (Gianni's degree of culture) is a lot.'

LIS signers can also use dual or trial pronouns to refer to two or three degrees when they are established vertically into two or three different *loci* as shown by the sentences in (26a) and (26b):

(26) a. GIANNI$_a$ TALL-$_\alpha$pos$_\beta$ MARIA$_b$ TALL-$_\beta$iconic-more$_\gamma$. THE-TWO$_{\beta-\gamma}$ DIFFERENCE A-LOT
'Maria is taller than Gianni. The difference between these two (Gianni's and Maria's degree of tallness) is a lot.'

b. GIANNI$_a$ TALL-$_\alpha$pos$_\beta$ MARIA$_b$ TALL-$_\beta$iconic-more$_\gamma$ MATTEO$_c$ TALL-$_\gamma$iconic-more$_\delta$. THE-THREE$_{\delta-\gamma-\beta}$ DIFFERENCE A-LOT
'Maria is taller than Gianni and Matteo is taller than Maria. The difference between these three (Gianni's, Maria's and Matteo's degree of tallness) is a lot.'

Furthermore, once the scale becomes available, any point/degree on the scale can be used to establish a new *locus* that becomes an antecedent for a possible anaphoric relation. This is shown by the example in (27) where it is possible to refer to a degree between Gianni's greatest degree of height and Maria's greatest degree of height. The representation of the scale is illustrated in the figure in (28) where γ represents the crucial degree above which passengers must pay the fare.

(27) **Scenario:** All passengers who are below 1.50 meter travel free on public buses.
GIANNI TALL-$_\alpha$pos$_\beta$ MARIA TALL-$_\beta$iconic-more$_\delta$ 1 METER 50 IX$_\gamma$ MEANS MARIA TICKET PAY MUST
'Maria is taller than Gianni. This point (IX$_\gamma$) is 1 meter 50, therefore Maria has to pay the fare.'

(28)

Scale of height

Maria — degree$_\delta$

1.50 meter — degree$_\gamma$

Gianni — degree$_\beta$

Standard degree — degree$_\alpha$

Notice that in all these cases the pronouns are not referring to the nominal elements. This is shown by the contrast in (29)–(30). The pronoun in (29) anaphorically refers to the degree of height of GIANNI and MARIA, therefore it is semantically incompatible with the adjective BEAUTIFUL. In (30), the pronoun anaphorically refers to the nominal elements and therefore it is compatible with the adjective BEAUTIFUL.

(29) a. # GIANNI$_a$ TALL-$_\alpha$pos$_\beta$ MARIA$_b$ TALL-$_\beta$iconic-more$_\gamma$.
THE-TWO$_{\gamma-\beta}$ BEAUTIFUL
Intended meaning: 'Maria is taller than Gianni but both (degrees of tallness) are beautiful.'

    b.   # GIANNI$_a$ TALL-$_\alpha$pos$_\beta$ MARIA$_b$ TALL-$_\beta$iconic-more$_\gamma$ MATTEO$_c$
        TALL-$_\gamma$iconic-more$_\delta$. THE-THREE$_{\delta-\gamma-\beta}$ BEAUTIFUL
        Intended meaning: 'Maria is taller than Gianni and Matteo is taller than
        Maria but all the three (degrees of tallness) are beautiful.'

(30) a.   GIANNI$_a$ TALL-$_\alpha$pos$_\beta$ MARIA$_b$ TALL-$_\beta$iconic-more$_\gamma$.
        THE-TWO$_{a-b}$ BEAUTIFUL
        'Maria is taller than Gianni but both are beautiful.'

    b.   GIANNI$_a$ TALL-$_\alpha$pos$_\beta$ MARIA$_b$ TALL-$_\beta$iconic-more$_\gamma$ MATTEO$_c$ TALL-
        $_\gamma$iconic-more$_\delta$. THE-THREE$_{c-b-a}$ BEAUTIFUL
        'Maria is taller than Gianni and Matteo is taller than Maria but all the
        three are beautiful.'

However, if the adjective does not respect the morphological or/and the phonological requirements, anaphoric relations cannot be established. This is so, because no location in the signing space has been established as a *locus*. The relevant example is provided by the adjective LONG shown (12) and repeated here in (31). Although it is a Size and Shape Specifier, this adjective does not meet the phonological requirement: its movement is not perpendicular to the plane of articulation. Hence, the starting and end points of the sign are not morphologically associated with *loci*, and they cannot be overt realizations of degrees.[8] Indeed, comparatives with LONG are instantiated by the analytic form only, as shown by the contrast in (32). The sentence in (33) shows that a pointing pronoun cannot single out a *locus* for anaphoric reference.

(31)   LONG

(32) a.   WORKSHOP LONG SEMINAR MORE
    b.   *WORKSHOP LONG SEMINAR LONG-$_\alpha$iconic-more$_\beta$
        'The seminar is longer than the workshop.'

(33)   *WORKSHOP LONG. IX$_\beta$ TWO HOUR
    Intended meaning: 'The workshop was long. Its duration (IX$_\beta$) was two
    hours.'

We suggest that the ungrammaticality of the sentence in (33) reflects what usually happens in spoken languages, where degrees are not overtly represented. The ungrammaticality of (33) is comparable to that of the English examples in (7) and (8) repeated in (34). Crucially, visible iconic degrees allow those readings as shown in the examples in (23)–(26).

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[8]An anonymous reviewer asked whether forcing the presence of boundaries at the edges of gradable adjectives makes degree scales visible as an effect of coercion, as reported for ASL (Wilbur et al. 2012:198). We tested this with some adjectives including THIN and LONG and the degrees are never accessible.

(34)   a.   # John is taller than Bill. It is 1.70 meter.
               Intended meaning: 'John is taller than Bill and his high is 1.70 meter.'
        b.   # John is tall. It is 1.70 meter.
               Intended meaning: 'John is tall and his high is 1.70 meter.'

If this is the case then the issue of what counts as 'overtly visible' in spoken languages becomes immediately relevant. We follow Kennedy (1997) in assuming that measure-phrases denote overt degrees. Interestingly, pronominal reference to measure-phrases is possible in spoken languages too, as shown by the example in (35):

(35)   Mary is 2 meters tall. John is taller than that.

Finally, the availability of dual and trial pronouns in degree constructions exemplified in (26) above is reminiscent of the similar pattern obtained with modal and temporal anaphora in Schlenker (2013) (see Example (1)). We take this as evidence suggesting that the same anaphoric system is at work in both domains and in the nominal domain as well.

4 Iconic scales and scalar analysis

Some gradable adjectives in LIS iconically represent degree variables, which can also be anaphorically retrieved by pronouns. Specifically, if a gradable adjective meets both the morphological and phonological requirements illustrated in Sect. 3, an iconic mapping is realized between the two loci singled out by the movement component of the sign and semantic degrees. The movement marks two meaningful points in the signing space (the starting and the end point of the sign). Intuitively, the iconic representation of the adjective looks very similar to the concept of scale in which points are ordered along a line in which the starting point corresponds to the standard degree while the end point corresponds to the reference degree (see Wilbur et al. 2012 for a similar observation for ASL).[9] The direction of the movement marks the (positive or negative) relation between them. Notice that the two points can be marked in different ways at the morpho-phonological level. Specifically, TALL-$_\alpha$pos$_\beta$ and DEEP-CL-$_\alpha$pos$_\beta$ iconically map the two points along a vertical line, while BIG$_\alpha$pos$_\beta$ and CULTURED-$_\alpha$pos$_\beta$ map the two points along a horizontal line (see the examples in (11) above). In the case of BIG-$_\alpha$pos$_\beta$ the points in space are marked by the movement of the arm, while in the case of CULTURED the points are identified by the aperture of the fingers.

Degree variables are realized as *loci* in the signing space, while the direction of the movement of the hand marks the degree relation. These two pieces are the building blocks of the degree morphology of sign language. The visibility of degree variables can be taken as evidence in favor of the *Scalar Analysis*. Specifically, we argue that *Loci* crucially mark degrees; the facts from LIS thus cannot be immediately explained

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[9]One crucial difference between our proposal and that of Wilbur et al. (2012) is that in our proposal neither of the two points represents any of the scale boundaries but just two of its degrees along a scale which is itself visible, see the discussion in Sect. 3.3. Furthermore, Wilbur et al. (2012) do not discuss comparatives or anaphoric relations.

within the *Delineation Semantics* approach, where no reference is made to degree variables.

Following the scalar approach, we provide an explicit definition of iconic degree scale, which is modeled after the Kennedy and McNally (2005) definition of scales:[10]

(36)   *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.
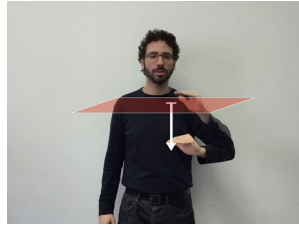
Kennedy (1997) argues that gradable adjectives have three semantic constituents: a reference value (the degree of the property denoted by the adjective), a standard value (some other degree to which the reference value is compared to) and a degree relation (the relation between the reference and the standard value). In comparatives, the comparative clause (the complement of *than*) introduces the standard value that the reference value (introduced by the main clause) is compared to. Degree morphemes denote relations between the reference value and the standard value. LIS overtly shows each of these components in both positive and comparative forms: the standard value is provided by the first *locus* marked by the movement, the reference value is marked by the second *locus* and the degree relation is marked by the directionality of the movement.

Furthermore, Rullmann (1995) and Kennedy (2001) propose that degrees of antonymous adjectives map identical arguments (degrees) onto the same scale, but in the opposite ordering relations. LIS offers iconic evidence for this mapping. The difference between antonymous adjectives that iconically map degrees is given by the direction of the movement. This is exemplified by the case of TALL/SHORT in (37) (see also fn. 7). The only difference between them is the opposite direction of the movement. This holds for all the adjectives in which degrees are overtly represented. We take this as evidence of an inverse ordering relation between degrees on the same scale.

(37)   a.   TALL   b.   SHORT

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[10]Kennedy and McNally (2005:349): "Gradable adjectives are those adjectives that map their arguments onto abstract representations of measurement, or degrees, which are formalized as points or intervals partially ordered along some dimension (i.e. Tall is ordered by a measure of height). A scale is a set of ordered degrees."

5 Conclusion

In this short paper, we showed that LIS gradable adjectives are divided in two groups: adjectives with iconic degree mapping and adjectives without iconic degree mapping. We also showed that there are two strategies that instantiate comparative constructions: the first is expressed by using the analytic forms MORE or LESS, the second is expressed by using the synthetic forms *iconic-more* or *iconic-less* which iconically map degrees. Gradable adjectives with iconic mapping can use both strategies, gradable adjectives without iconic mapping can use the analytic form only. The iconic mapping provides empirical support for a degree-based approach of gradable adjectives through the fact that *loci* in signing space are associated with degrees and these *loci* become antecedents for later pronouns. To account for these facts, we introduced iconic scales and iconic degrees as the overt counterparts of scales and degree variables. An iconic scale is the order-preserving mapping of a set of ordered degrees onto a set of ordered points in the signing space. Iconic degrees are points along these lines.

The treatment of gradable adjectives and comparative constructions is an active debate in the semantic literature. The empirical evidence coming from LIS (and possibly other sign languages) nicely fits within a scalar approach and raises non-trivial problems for formal approaches that do not contain degrees as part of the ontology. In the spirit of reaching both descriptive and explanatory adequacy, our work scores a significant point in favor of the scalar analysis.

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