Positive gradable adjective ascriptions without positive morphemes[1]

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Abstract. A long-standing tension in semantic theory concerns the reconciliation of positive gradable adjective (GA) ascriptions and comparative GA ascriptions. Vagueness-based approaches derive the comparative from the positive, and face non-trivial challenges with incommensurability and non-GA comparatives. Classic degree-based approaches effectively derive the positive from the comparative, out of sync with the direction of evidence from morphology, and create some difficulties in accounting for GA scale-mates with differing thresholds (e.g., *cold* $\sim$ *warm* $\sim$ *hot*). We propose a new reconciliation that capitalizes on recent proposals analyzing GAs as predicates of states. On our account, GAs lexically involve both a threshold property and a background state structure. Positive occurrences of GAs make use of the threshold property, while comparative occurrences make use of degrees representing elements of the background structure. Our approach preserves the virtues of classic degree-based approaches while offering a natural account of scale-mates, and without appeal to covert morphemes like POS or related devices. As we show, it is possible to inject our solution back into the classic degree-based approach, but we find reasons to prefer our states-based account.

Keywords: comparatives, vague adjectives, thresholds, state structures

1. Introduction

How should we understand gradable adjective (GA) ascriptions as they occur in the positive, (1-a), and comparative forms, (1-b), neither of which entails the other?

(1) a. Miami is hot. [positive]
b. Miami is hotter than Barcelona. [comparative]

Ultimately, how one answers this question depends upon one's assumptions about the lexical semantics of GAs. In 'classic' degree-theoretic approaches, GAs are interpreted directly as measure functions—mappings from individuals to degrees representing their measure along some dimension—as in (2-a) (e.g. Kennedy 1999), or as relations between individuals and degrees that invoke a measure function indirectly, (2-b) (e.g. Heim 2000).

(2) a. $[\![\text{hot}]\!]_K = \lambda x.\mu_{\textbf{heat}}(x)$ $\langle e,d\rangle$
b. $[\![\text{hot}]\!]_H = \lambda d.\lambda x.\mu_{\textbf{heat}}(x) \geq d$ $\langle d,\langle e,t\rangle\rangle$

In what follows, we present and discuss a version of the classic degree semantics picture for GAs that assumes they are interpreted on the model in (2-a). Everything we say applies equally well to the model in (2-b), however, since the issues we highlight flow from the central assumption that the lexical semantics of GAs incorporates degrees *simpliciter*.

Given a degree semantics of this stripe, the relevant positive form is interpreted as in (3-a), and the relevant comparative form as in (3-b). (3-a) indicates that (1-a) is true whenever the

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heat-measure of Miami (i.e., Miami's degree of heat) meets or exceeds the standard for such measures in context c (i.e., the contextual standard for heat). (3-b) indicates that (1-b) is true whenever Miami's degree of heat strictly exceeds that of Barcelona.

(3) a. $[\![\text{Miami is POS hot}]\!]_K = \mu_{\textbf{heat}}(m) \geq \textbf{std}_c(\mu_{\textbf{heat}})$ [positive]

b. $[\![\text{Miami is hot ER than Barcelona}]\!]_K = \mu_{\textbf{heat}}(m) > \mu_{\textbf{heat}}(b)$ [comparative]

These interpretations get the (lack of) entailments right. To see this, consider a context in which we understand the standard for heat to be 100°F, while Miami measures 95°F and Barcelona measures 87°F. In this context, (3-a) is false but (3-b) is true. Next, consider a context in which the standard is again 100°F, but Miami measures 105°F and Barcelona measures 110°F. Here, (3-a) is true but (3-b) is false.

This way of reconciling the positive and comparative forms gets the truth conditions right. But considerations of other kinds can be marshalled against this account. Here are a few.

First, analyses like (3) exhibit a mismatch with the direction of morphology (Klein 1982): they associate positive and comparative occurrences of GAs with underlying forms of equal complexity—i.e., the positive goes with POS, the comparative goes with -ER—in spite of the plausible linguistic universal that comparative forms are strictly more complex than positive forms in terms of their overt morphological realizations (Bobaljik 2012).[2]

Moreover, there is no surface evidence for POS (or anything like it that can discharge a GA's lexical degree semantics), despite the initial promise of some candidate languages (e.g. Grano 2012, Grano and Davis 2018). Finally, these analyses run into difficulties if we assume that some pairs of GAs like *warm* and *hot* exploit the same degree scale. Certain entailment facts involving these GAs in the comparative form can be taken to suggest that they are interpreted as the same measure function. But then it would be mysterious why they have different thresholds in the positive form (cf. Lassiter 2011).

We should like, then, an approach which gets the truth conditions right, and which is also concordant with the wider distribution of form-meaning mappings, and supportive of a plausible analysis of scale-mates. Our approach will do this, by combining the pieces in (i)-(iii):

(i) GAs express properties of states (e.g. Fults 2006; Wellwood 2012; Baglini 2015);

(ii) These states are ordered into a background 'state structure' (Wellwood 2015, 2019; cf. Bale 2006, 2008); and

(iii) GAs contribute two properties—a threshold property and a background property—of which the positive and comparative forms make differential use. Roughly, the threshold property is the property of having enough of the relevant quantity (or quality) to warrant ascription of the positive form. The background property is the property of having some amount of the relevant quantity (or quality). For example, this is the distinction between *being hot* and *having (some) heat*.

[2] Whether because there is a covert morpheme POS as in (3-a) or not, it will be necessary that something intervene between the degree-involving lexical semantics of the GA, and the lack of overt use to which its degree argument is put in the positive form.

In particular, we propose that the lexical semantics of a GA like *hot* looks as in (4),[3] with the threshold property indicated as $\mathbf{hot}_c$, and the background property indicated as the functional restriction to states in an ordering of heat states.[4]

(4) $[\![\text{hot}]\!] = \lambda s : s \in \mathbf{domain}(\langle D_{\mathbf{heat}}, \succcurlyeq_{\mathbf{heat}} \rangle) \,.\, \mathbf{hot}_c(s)$ $\langle v,t \rangle$

With this lexical semantics in hand, we develop a novel account of the relationship between positive and comparative as follows. Uses of the positive form assert that a threshold property holds of a state that the subject is in; that is, the positive form relates states, and so its uses are true whenever, e.g., Miami's heat-state is ordered higher than some contextually-determined cut-off point in the background ordering on such states. Uses of the comparative form, in contrast, assert that the background property holds of a state *s* that the subject is in, and moreover that the measure of *s* exceeds the measure of some other state; a use of the comparative form is true, then, whenever, e.g., the measure of a heat-state of Miami exceeds that of any heat-state of Barcelona. Our compositional analysis will derive such interpretations as in (5-a) and (5-b).

(5) a. $[\![\text{Miami is hot}]\!]^{c,\sigma}$ [positive]
$= (\exists s : s \in \mathbf{domain}(\langle D_{\mathbf{heat}}, \succcurlyeq_{\mathbf{heat}} \rangle))(\mathbf{holder}(s,m) \ \&\ \mathbf{hot}_c(s))$
b. $[\![\text{Miami is hot ER than Barcelona}]\!]^{c,\sigma}$ [comparative]
$= (\exists s : s \in \mathbf{domain}(\mathbf{background}(\mathbf{hot}_c)))(\mathbf{holder}(s,m) \ \&\ \sigma(\mu)(s) > d_b)$

(5-a) says that the positive form is true just in case Miami is in a state of heat that has the contextually-determined property of being hot. (5-b) says that the comparative form is true just in case Miami is in a state of heat *s* whose measure—i.e., the value of an appropriate measure function, supplied by the assignment function σ applied to *s*—is greater than the same for any such state of Barcelona.

In what follows, we discuss the challenges for standard executions of the degree-based analysis in more detail, and show how our proposal addresses those challenges. At least at first, it will appear critical that we have eliminated reference to degrees within the lexical semantics of GAs. However, our solution can be injected back into the classic degree-based framework, as we show. Playing out this possibility, we find that such an approach does well with the basic truth-conditional and scale-mates facts, without appeal to POS or POS-like elements. However, it plausibly lacks the resources to illuminate other important phenomena.

The account that we advocate brings the classic degree analysis of positive GA ascriptions closer to that of its major competing framework, that which interprets the positive form using mechanisms designed for the resolution of vagueness, at least insofar as that approach and ours posit lexical associations with non–degree-based ordering relations. Before diving into our proposal, then, we should like to briefly note why we do not pursue an account that more explicitly aligns itself with the vagueness-based alternative. We hope to show that, as we see it, our approach captures the very best of both worlds, while avoiding the real pitfalls of either.

[3]N.B.: $\mathbf{domain}(\langle D, \succcurlyeq \rangle) = D$.
[4]N.B.: Accessing the background structure from the threshold property: $\mathbf{background}(\mathbf{hot}_c) = \langle D_{\mathbf{heat}}, \succcurlyeq_{\mathbf{heat}} \rangle$.

2. Challenges for vagueness-based approaches

Our proposal will understand comparative constructions to express relations between degrees, but not degrees that are lexically introduced by a GA. Why not simply adopt existing non-degree-based theories as offered by vagueness-based approaches? As we briefly review, such accounts face challenges which can generally be avoided on degree-based approaches. The net result is that we should prefer a degree-theoretic approach, if some version of it can meet these challenges.

Vagueness-based approaches (e.g., McConnell-Ginet 1973, Klein 1980) take as their starting point mechanisms for the resolution of GA vagueness, and build a comparative semantics on top of that. (This contrasts, of course, with supposing that the GA starts out lexically 'crisp', e.g., by denoting a measure function.) The central formal idea is that the positive form is evaluated relative to a background ordering contributed by the GA. Specifically, it is evaluated relative to a partitioning on the domain of that ordering into positive, negative, and neutral regions. So, for example, *tall* associates with an ordering of individuals according to their height, and a positive attribution like *Ann is tall* in context *c* is TRUE just in case Ann is in the positive extension of *tall* in *c*, FALSE if she is in the negative extension in *c*, and undefined otherwise. The comparative form, in turn, can be analyzed in terms of quantification over 'delineators' that hard-wire such partitioning effects; a comparative attribution like *Ann is taller than Betty*, then, would come out true just in case there is a delineator which partitions the domain of the ordering associated with *tall* in such a way that Ann is in its positive extension but Betty isn't.[5]

Such proposals are interesting, and, indeed, our proposal maintains the idea that GAs lexically associate with an ordering relation that is not based on degrees. As on vagueness-based approaches, such a formal move supports positing lexical entries for GAs that do not require POS or POS-like elements in the positive form, for a better alignment with the direction of morphological exponence across languages. We are not comfortable simply adopting existing accounts in this vein, however, as we believe there are good use cases for degrees.

One such challenge for vagueness-based approaches that Kennedy (1999) points to are patterns of (in)felicitous composition in 'subcomparatives', i.e., comparatives with distinct adjectives in each of their matrix and *than*-clauses. First, notice that such combinations can be perfectly fine, (6-a), but they can also be odd, (6-b). The question is, why is (6-b), and indefinitely many examples like it that could be constructed, anomalous?

(6) a. The ladder is longer than the doorway is high.
b. ?The hallway is longer than the carpet is green.

According to vagueness-based approaches, (6-b) should simply say that there is a way of dividing up the GAs' domains such that the hallway is in the positive extension of *long* but the carpet is not in the positive extension of *green*; that could be false, of course, but no anomaly is predicted (though see Doetjes 2011). In contrast, in a degree-based framework, one can say that failure to locate a common ordering relation between degrees of different types leads to a sense of semantic anomaly.

[5]This analysis is bolstered by a meaning postulate (e.g., the 'Consistency Postulate' of Klein 1980), which stipulates that if there is such a delineator, then there is no other delineator that could establish the opposite partitioning. This in effect codes the realistic assumption that the background ordering itself is unaffected by delineators.

The broader typology of degree constructions presents a different sort of issue. Vagueness-based approaches place the properties of lexical GAs at the center of their proposals for how comparatives work. As such, they are not straightforwardly extensible to, for example, nominal (7-a) and verbal comparatives (7-b) whose target lexical items do not appear to be vague, at least not in the same ways (though see Burnett 2015 for an approach to nominal comparatives).

(7) a. Mary drank more coffee than John did.
    b. John works in Barcelona more than he does in Miami.

In contrast, approaches to cross-categorial verbal comparatives have been successfully carried out in degree semantics, e.g., supplemented by incorporation of a 'universal measurer' contributed by the comparative morphology itself (e.g., Wellwood 2012).

Finally, vagueness-based approaches build the mechanism of comparative semantics off of the threshold-fixing action otherwise used to delineate the positive and negative extensions of a GA in the positive form. Given this, it is not clear why we should see differences in 'crisp' judgments for sentences that, at least superficially, express the same comparisons.[6] For example, Kennedy (2007) describes contexts like that in (8), to which people respond differently with *-er* comparatives and those based on modification of a positive predication: (8-a) is just 'true' in the context, but (8-b) is 'weird' or even 'false'.

(8) **Context**: Al has an almost imperceptible difference in height over Bill.
    a. Al is taller than Bill. [comparative]
    b. Compared to Bill, Al is tall. [positive]

As it stands, neither vagueness-based approaches nor the classic degree-based framework clearly have the representational power to treat (8-a) and (8-b) differently. But a framework that distinguishes lexical orderings and degree orderings has, in principle, the resource to treat (8-a) and (8-b) differently. (8-a) involves calculations relative to a lexical GA ordering, while (8-b) involves calculations relative to an ordering on degrees.

3. Challenges for degree-based approaches

We pursue an analysis of the positive and comparative forms which not only gets the truth conditions and patterns of entailment right, but also meets additional challenges posed by the relationship between these forms in English and across languages. Here, we discuss three such outstanding challenges.

The first has been long-acknowledged: the apparent mismatch between the compositional pieces posited in a degree-based analysis, and the observed direction of morphological complexity. Bobaljik (2012) concluded his study of morphological patterns across hundreds of languages suggesting that the patterns there observed demand explanation involving the universal derivation of comparative forms from positive forms. Yet, under standard executions of the degree framework, a covert morpheme like POS necessarily co-occurs with the GA in the positive form, (9-a). If so, then the positive and the comparative, (9-b), are equally complex.

[6] See Castillo-Gamboa et al. (2021) for experimental evidence of contrasts like that in (8). They propose that the semantics of (8-b) involves comparison with standards for differences.

(9) a. [GA POS]
b. [GA -ER]

Ideally, the structural analysis of positive and comparative forms would deliver a formulation such that the GA occurs alone in positive ascriptions, and along with a degree relation just when comparative morphology is explicitly indicated.

The second challenge is more subtle. This is the problem of capturing differences in meaning between putative scale-mates like *hot* and *warm*. We assume that a necessary (but probably not sufficient) condition for two gradable adjectives to be considered scale-mates is that their comparative forms are mutually entailing. For instance, plainly it is the case that if (10-a) is true, so is (10-b); and, if (10-b) is true, so is (10-a).[7]

(10) a. Miami is hotter than Barcelona.
b. Miami is warmer than Barcelona.

In the classic degree-based framework, such instances of mutual entailment may be captured by positing that the relevant GAs lexically express the same measure function (cf. Lassiter 2011 on epistemic adjectives). (11) does this, and, if correct, it would obviously guarantee logical equivalence between (10-a) and (10-b).

(11) a. $[\![\text{hot}]\!]^c = \lambda x.\mu_{\mathbf{heat}}(x)$
b. $[\![\text{warm}]\!]^c = \lambda x.\mu_{\mathbf{heat}}(x)$

However, such an analysis runs into serious trouble with the positive form, where differences in lexical form tend to go along with differences in contextual threshold. This leads to a general lack of mutual entailment between just about any putative scale-mates, e.g., while (12-a) being true guarantees the truth of (12-b), the reverse isn't so.

(12) a. Miami is hot.
b. Miami is warm.

Combined with standard assumptions about how POS (or a relevant POS-like mechanism) works, we have no obvious explanation for this difference in threshold sensitivity. Any function like **std** applies to lexical meanings/interpretations, not to the lexical items themselves (cf. Kennedy and McNally 2005); so, if *hot* and *warm* express the same measure function, they are predicted to have the same standards in every context, cf. (13).

(13) a. $[\![\text{POS hot}]\!]^c = \lambda x.\mu_{\mathbf{heat}}(x) \geq \mathbf{std}_c(\mu_{\mathbf{heat}})$
b. $[\![\text{POS warm}]\!]^c = \lambda x.\mu_{\mathbf{heat}}(x) \geq \mathbf{std}_c(\mu_{\mathbf{heat}})$

[7] Some speakers feel that (10-a) and (10-b) are not equivalent, even while agreeing that they're mutually entailing. These speakers get the sense that (10-a) entails or implicates the positive attribution of *hot* at least to Miami. However, our point in the text is not that the two are synonymous, only that they are mutually-entailing.

The issue, then, is that the same assumption that would guarantee patterns of mutual entailment in the comparative form—interpreting scale-mates as encoding the same measure function—blocks any ability to see why they should have different thresholds in the positive form.

An alternative—positing multiple distinct POS-like elements to account for differing thresholds—faces its own challenges, the first being that there simply is no surface evidence for any POS-like elements in the first place. It had seemed at one point that Mandarin *hen* would be a good candidate, however Grano (2012) has argued convincingly that it is not. Certain templatic alternations between the positive and comparative forms in Arabic had seemed a good candidate, but subsequent analysis by Grano and Davis (2018) suggests that they aren't either.[8]

We now turn to see whether a different style of framework can account for the patterns of universal markedness, mutual entailment, and scale mates, without positing POS or any POS-like elements.

4. Our analysis

Our analysis combines elements of both degree-based and vagueness-based approaches with an elaboration of the states-based approach. Like degree-based approaches, we treat comparatives (superlatives, excessives, ...) as involving relations between degrees. Like vagueness-based approaches, we posit that GAs do not lexically involve relations between degrees. In our implementation, though, the ordering associated with a GA is an ordering on states.

Our formal analysis revolves around five main claims. (i) GAs lexically contribute a contextually-determined property of states (i.e., the 'threshold' property). (ii) Those states are part of a 'background' ordering, information about which is encoded in the non-at-issue component of the GA's lexical meaning. (iii) This background ordering includes states that meet the threshold property, but also ones that do not: for example, in the case of *hot*, the background property includes states measuring any degree of temperature (i.e., even states properly called *cold*). (iv) The positive form uses the threshold property, and indicates that this property holds of its subject. (v) The comparative form uses the background ordering, and indicates that some element *s* in the domain of that background ordering holds of its subject, and that a relevant measure function maps *s* to a degree greater than that of any state described in the *than*-clause.

With respect to the idea that GAs lexically contribute a property of something other than individuals, a wealth of evidence has been presented to support the idea that GAs express properties of states. For that reason, we do not see this article as the place to argue this point; instead, the reader is directed to Fults (2006), Moltmann (2009) (where the entities are 'tropes'), Wellwood (2012, 2015, 2016, 2019), Husband (2012), and Baglini (2015). As a sample, we flag some of the more immediately compelling data points that motivate the analysis: GAs may be modified by prepositional phrases that otherwise combine with predicates of eventualities (e.g., *hot/run in the kitchen*); such modifiers must figure into what degrees are compared (e.g., *Ann is more patient in the kitchen than in the den*); GA ascriptions can figure in descriptions of cause and effect (e.g., *Ann burned her hand because the pot was hot*); they contribute something to descriptive and anaphoric reference (e.g., *The pot's heat/it burned her hand*); and so on.

Our second claim is that the states that GAs are true of are ordered. This is a natural assump-

[8]Notice, too, that if those analyses had gone the other way, we would also have found some convincing exceptions to Bobaljik's generalization of the universal markedness of comparatives over positives.

$$\overbrace{\ldots s_1 \quad s_2 \quad \begin{matrix}s_{3.a}\\ s_{3.b}\end{matrix} \quad s_4 \quad s_5 \quad s_6 \quad \underbrace{\begin{matrix}s_{7.a}\\ s_{7.b}\end{matrix} \quad s_8 \quad s_9 \quad \begin{matrix}s_{10.a}\\ s_{10.b}\\ s_{10.c}\end{matrix} \quad \begin{matrix}s_{11.a}\\ s_{11.b}\end{matrix} \quad s_{12}\ldots}_{\text{states of being hot}}}^{\text{states of having some heat}}$$

Figure 1: States of being hot, as a sub-ordering of states of having some heat.

tion. Vagueness-based approaches posit as much. And within degree semantics, at least since Cresswell 1976, it has been assumed that a unique background ordering of individuals precedes the mapping from those individuals to degrees representing their measure (see also Bale 2006, 2008). The relation represented in (14) simply has some subset of D_e as its domain. Wellwood (2015), in contrast, posits that GAs associate with orderings between states, with a domain like in (15-a) and an ordering relation that may be read as in (15-b).

(14) $\{\langle x, x' \rangle \mid x \text{ has as much heat as } x' \}$

(15) a. $D_{\textbf{heat}} = \{s \mid s \text{ is some quantity of heat} \}$
b. $\succcurlyeq_{\textbf{heat}} = \{\langle s, s' \rangle \mid s \text{ is as much heat as } s' \}$

Following Wellwood, we say that the GA *hot* associates with $\langle D_{\textbf{heat}}, \succcurlyeq_{\textbf{heat}} \rangle$, understood as in (15). This move is warranted, if nothing else, by the standard assumption in event semantics that thematic relationships—like the one which holds between states and their bearers, or between events and their agents, etc—is one-to-one; $\textbf{holder}(s,m)$, then, is read 'm is the holder/bearer of s'.[9] Cresswell's individual orderings, then, can be recovered by means of the function **holder** (see e.g., Kratzer 1996, Husband 2012).

Let us turn now to claims (iii) and (iv). As anticipated, the subject of a positive GA ascription combines with the GA via the compositional assumptions standard in event semantics. For example, we interpret θ-marked syntactic arguments as properties of eventualities (Champollion 2015), as in (16), so that the subject is of the same type as the predicate and the two combine by the (appropriately generalized) rule of Predicate Modification (Heim and Kratzer 1998).

(16) $[\![\text{Miami}_{[\text{ho}]}]\!]^{c,\sigma} = \lambda s \,.\, \textbf{holder}(s,m)$

At this point, we introduce the first novel element of our proposal. We hold that the orderings of states invoked by the lexical semantics of GAs are part of a broader, 'background' ordering of states. For illustration, let us stick to the case of *hot*. We assume that the ordering of states of being hot is part of a broader ordering of states of having some heat—the relevant intuition being that all states of being hot are states of having heat, but not vice versa. The structure consisting of states of being hot may be viewed as a substructure of overall ordering of states of heat—those states that lie above a certain threshold in the background ordering. This is illustrated in Figure 1. We assume that the 'threshold' indicating which states of heat count as states of being hot is fixed by context.

[9]For background, discussion, and references, see 'Role Exhaustion' in Williams (2015).

As the figure shows, we do not generally assume that state structures must be linearly ordered Here it is instructive to consider how we would characterize the case in which two cities—say, Miami and Barcelona—are said to have exactly the same temperature; i.e., that Miami is exactly as hot as Barcelona. The assumption that states are unique to their bearers entails that these are two non-identical states of heat—call them s_m and s_b—neither of which instantiates more heat than the other. Instead, s_m and s_b are equivalent only in the sense that having the same temperature means having the same value under the appropriate measure. In other words, $s_m \neq s_b$ because $\mathbf{holder}(s_m) \neq \mathbf{holder}(s_b)$ but nevertheless $\mu_{\mathbf{heat}}(s_m) = \mu_{\mathbf{heat}}(s_b)$.[10] So, the background ordering has at least two states which are non-identical, and which are not ordered with respect to one another; thus, this background structure is non-linear. We assume this is probably the case for all GAs.

Compositionally, we encode the information that the relevant state is drawn from the domain of a particular ordering in a not-at-issue component of the GA's lexical entry. For concreteness, we think of this component as a presupposition. Consider, for example, the entry in (17). *hot* denotes a function that maps a state s to true only if s meets the relevant threshold in context c; moreover, a presupposition requires that the relevant state be in the domain of the heat ordering.

(17) $[\![\text{hot}]\!]^{c,\sigma} = \lambda s : s \in \mathbf{domain}(\langle D_{\mathbf{heat}}, \succcurlyeq_{\mathbf{heat}}\rangle)\ .\ \mathbf{hot}_c(s)$

In addition to the information encoded in lexical entries like (17), we stipulate monotonicity properties as in (18).[11] These help guarantee the validity of certain inference patterns, including that exemplified in (19).

(18) If $\mathbf{hot}_c(s)$ and $s' \succcurlyeq_{\mathbf{heat}} s$, then $\mathbf{hot}_c(s')$

(19) a. Barcelona is hot.
b. Miami is hotter than Barcelona.
c. Therefore, Miami is hot.

Given these ingredients, the sentential truth conditions for the positive form on our account look as in (20): this says that Miami is hot just in case it bears/is the holder of a state of heat that counts as hot in the context c.

(20) $[\![\text{Miami}_{[\text{ho}]} \text{ is hot}]\!]^{c,\sigma} = (\exists s : s \in \mathbf{domain}(\langle D_{\mathbf{heat}}, \succcurlyeq_{\mathbf{heat}}\rangle))(\mathbf{holder}(s,m)\ \&\ \mathbf{hot}_c(s))$

Finally, let us move on to our claim (v), which concerns GAs in the comparative form. Our first goal is to ensure that our interpretation of a sentence like (21) does not entail that in (20); the comparative semantics must not say, e.g., of Miami that it bears a state of being hot.

[10] One can think of the degree structures that are output by measure functions as recording the values of equivalence classes of states in background structures, which remedies precisely this failure of inequality; this appears rather in accord with how Cresswell (1976) was thinking about it, though the mapping from base orderings of individuals to degree orderings was all fixed before one could comprehended the GA at all. Bale (2006) makes transitions between base individual orderings and degree structures yet more explicit and compositionally relevant.

[11] This parallels the 'Consistency Postulate' noted in fn. 5 for vagueness-based approaches.

(21) Miami is hotter than Barcelona.

To accomplish this, we propose that the comparative morphology bypasses the GA's threshold property and accesses directly the background ordering. For (21), the effect of this is that Miami is said to be the bearer/holder of a state of heat (i.e., a state in the background structure of *hot*), the measure of which exceeds any such state described in the *than*-clause.

We build on elements of the semantics of comparative morphology from Wellwood (2015, 2019). On her account, *-er/more* introduces the measure function via the assignment function σ, regardless of whether the target of the comparison is a GA, noun, or verb phrase.[12] The comparative is felicitous with a given XP just in case XP is 'measurable', where a measurable predicate is simply understood to be one that lexically associates with an ordering. This requirement, for us, will be reflected in a not-at-issue component of -ER that its 'contentful' target—whether A, N, or V—specifies an ordering on its domain.

Our novel compositional move is to have the comparative take the GA as an argument and use its background structure. When the comparative combines with *hot*, for example, it uses $\mathbf{hot}_c$ to specify a property of states-of-heat. The matrix subject is merely said to be in one of those states, *s*; the measure function introduced by the comparative morphology maps *s* to a degree.

We propose the entry in (22) for the comparative morpheme, then, assuming: the argument of type *d* is contributed by the *than*-clause;[13] f is the property targeted for measurement; **background**(f) is the unique background ordering associated with f; and $\sigma(\mu)$ is the measure function assigned by σ (with restrictions[14]). Given such a degree d, property f, and state s, *more* indicates that the σ-measure of s is greater than d.

(22) $[\![\text{-er/more}_\mu]\!]^{c,\sigma} = \lambda d.\lambda f.\lambda s : s \in \mathbf{domain}(\mathbf{background}(f)) \;.\; \sigma(\mu)(s) > d$

Putting the pieces together, we deliver the interpretation for the comparative form in (21) as in (23): this says that Miami is in a state in the domain of the background structure associated with the (contextually-determined) property of being hot, the measure of which exceeds any such state for Barcelona.

(23) $[\![\text{Miami}_{[\text{Ho}]} \text{ is hotter (than Barcelona)}]\!]^{c,\sigma}$
$= (\exists s : s \in \mathbf{domain}(\mathbf{background}(\mathbf{hot}_c)))(\mathbf{holder}(s,m) \;\&\; \sigma(\mu)(s) > d_b)$

[12]Strictly speaking, on her account a covert MUCH_μ introduces the measure function. We needn't specify the decomposition here since, for our purposes, it could as well be that -ER bundles together the measure function and the degree relation.

[13]The composition of these clauses is rather complex, involving abstraction over degrees using covert (at least in standard American English) HOW (MUCH); maximization of that derived degree predicate by **max**; etc. See Wellwood (2019: pp. 25-29) for a characterization of the representational and compositional assumptions for *than*-clauses on the classic degree-theoretic approach, and her pp. 78-79 for adaptations related to the comparative morphology introducing measure functions as we assume here.

[14]Some specific restrictions include simple structure preservation/monotonicity (Schwarzschild 2002), and perhaps stronger forms of structure preservation like invariance under automorphism (Wellwood 2018), etc.

5. Solutions

We opened with three challenges for classic degree-theoretic approaches: the mismatch between the patterning of overt morphology across languages with the compositional pieces required for the positive and comparative forms; capturing the compositional semantics of the positive form without appeal to a dubious POS or POS-like element; and, for scale-mates, guaranteeing patterns of mutual entailment of the comparative forms but asymmetric entailment in the positive form. We now show how our account addresses these challenges.

Where the classic degree-theoretic account has GAs introduce a degree variable that needs to be bound in some fashion in the positive form, our GAs express properties of states. Since GAs do not introduce degree arguments, nothing is required to bind them. Instead, the property expressed by the GA is compositionally integrated with the other elements in the clause in the standard neo-davidsonian fashion. The GA's threshold-sensitivity, accordingly, is not viewed as a matter of some external element introducing a **std** function, or the inclusion of a free degree variable, etc; rather, it arises simply due to the context-sensitivity involved in fixing the GA's threshold property itself, much like on vagueness-based approaches.

The meaning of the comparative depends on (and builds off of) the meaning of the lexical GA, albeit through the mechanism of not-at-issue content. The GA lexically provides a context-sensitive property of states—that which we have called the 'threshold property'—and a background ordering on states against which thresholds are computed. The comparative morphology inputs such an interpretation and uses it to access the background ordering; then, it says that an element of the domain of that background ordering holds of the subject, etc. Just as positive occurrences of GAs are interpretable without need of POS or any POS-like element, the comparative meaning is straightforwardly a function of the GA's meaning.

Clearly, then, our compositional analysis aligns with the direction of evidence from overt morphological realization. This result crucially fellows from our account's ability to dispense with any dependence on POS or any POS-like element.

To address the data on putative scale-mates, we must say more about how GA thresholds are fixed. Here, too, our analysis avoids challenges threatening the classic degree-based account. That GAs specify both a background property and a threshold property supports a simple pathway to saying how scale-mates are similar, and how they are different.

Scale-mates are similar, we say, in that they relate to the same background property, e.g., (24) for *hot* and *warm*; these GAs are related in that states of being hot and states of being warm are both ineluctably states of heat; this contrasts with the view on which they merely represent degrees of heat via lexically-determined measure functions.

(24) $\textbf{background}(\textbf{hot}_c) = \textbf{background}(\textbf{warm}_c) = \langle D_{\textbf{heat}}, \succcurlyeq_{\textbf{heat}} \rangle$

Given this identity of background structures, we can immediately capture facts about mutual entailment between scale-mates in the comparative form. We have already seen the interpretation that our analysis assigns to the comparative with *hotter*; this is given again in (25-a), with the corresponding interpretation for the *warmer* comparative in (25-b).

$$\overbrace{\ldots s_1 \quad s_2 \quad \begin{matrix} s_{3.a}\\ s_{3.b}\end{matrix} \quad s_4 \quad s_5 \quad s_6 \quad \underbrace{\begin{matrix}s_{7.a}\\ s_{7.b}\end{matrix} \quad s_8 \quad s_9 \quad \overbrace{\begin{matrix}s_{10.a}\\ s_{10.b}\\ s_{10.c}\end{matrix} \quad \begin{matrix}s_{11.a}\\ s_{11.b}\end{matrix}}^{\text{positive region for } \textit{hot}} \quad s_{12}\ldots}_{\text{positive region for } \textit{warm}}}^{\text{states of having some heat}}$$

Figure 2: Sample background ordering and thresholds for *warm* and *hot*.

(25) a. $[\![\text{Miami is hotter than Barcelona}]\!]^{c,\sigma}$
$= (\exists s : s \in \textbf{domain}(\textbf{background}(\textbf{hot}_c)))(\textbf{holder}(s,m)\ \&\ \sigma(\mu)(s) > d_b)$
b. $[\![\text{Miami is warmer than Barcelona}]\!]^{c,\sigma}$
$= (\exists s : s \in \textbf{domain}(\textbf{background}(\textbf{warm}_c)))(\textbf{holder}(s,m)\ \&\ \sigma(\mu)(s) > d_b)$

Given (25) and the identity in (24), it is clear that any state which satisfies (25-a) will satisfy (25-b) and vice versa, thus guaranteeing mutual entailment for comparatives with scale-mates.

Scale-mates differ, of course, in labeling different threshold properties. Being warm isn't the same as being hot; indeed, different standards for determining whether a state instantiates one or the other property will be in play both within and across contexts. Yet, certain relationships must be maintained. Consider the sample background structure with thresholds fixed for *hot* and *warm* in Figure 2. Here, the left boundary of the positive region for *hot* is higher in the ordering than the boundary for the positive region for *warm*. This must be so, it seems, for any context *c*. How should we code such standard-setting relationships?

One option would be to stipulate meaning postulates forcing the threshold for one of the scale-mates to be higher than the threshold for states belonging to the other. Another option would be to add indices to the meanings of scale-mates that are used to recover regular, distinct thresholds from the background ordering. Applied to the case of orderings on heat states, for example, we can suppose that the background ordering comes tagged with an upper threshold and a lower threshold. Then, it would be enough for the semantic values of *hot* and *warm* to provide indices that direct semantic evaluation to the relevant upper or lower threshold.[15]

Assuming some sufficient coding along these lines, here is how we can capture the asymmetric entailment from positive forms centered on an 'upper' scale-mate (e.g., *hot*) to those centered on a 'lower' scale-mate (e.g., *warm*). Consider (26-a) and (26-b). Any state satisfying (26-a) will be a state of heat *s*, and one which reaches above the upper threshold defined for the given ordering of heat states. That very same *s* will meet the domain restriction for (26-b) and, by stipulation that upper thresholds exceed lower thresholds on the background ordering, *s* will also satisfy (26-b). The reverse, of course, will not be guaranteed.

(26) a. $[\![\text{Miami is hot}]\!]^{c,\sigma}$
$= (\exists s : s \in \textbf{domain}(\langle D_{\textbf{heat}}, \succcurlyeq_{\textbf{heat}}\rangle))(\textbf{holder}(s,m)\ \&\ \textbf{hot}_c(s))$

[15] In some cases, however, thresholds might be fixed in more complicated ways: in Cariani et al. (shed), we propose a states-based theory of confidence reports in which confidence thresholds are set in part on the basis of 'contrast' states.

b. $[\![\text{Miami is warm}]\!]^{c,\sigma}$
$= (\exists s : s \in \mathbf{domain}(\langle D_{\mathbf{heat}}, \succcurlyeq_{\mathbf{heat}}\rangle))(\mathbf{holder}(s,m)\ \&\ \mathbf{warm}_c(s))$

6. Injecting our solution into the classic account

The core element of the approach we have offered is the idea that the lexical entries of GAs carry two important types of information: one is information about a background ordering, and the other is information about which subset of the domain of that ordering they denote in a given context. The first kind of information is relevant for the interpretation of a GA comparative form, and the second kind is relevant for that of a GA positive form.

We have implemented this proposal within a states-based framework, for the purposes of simplicity and its extensibility to other puzzles. However, the core element as just described can, in fact, be implemented within something closer to the classic degree-based account which posits lexical measure functions to the GA.[16] Here is how it can be done. The lexical entry for the GA introduces its own standard degree, as POS would do on the classic degree-based accounts. The comparative morphology bypasses the information about the standard to access a background scale. So, the GA has the relevant 'background structure' as on our states-based proposal, but this structure is a set of degrees and an ordering relation on it.

Here, just as in §4, our first step is to adapt the lexical entries of GAs. In the Kennedy-style classic degree-based theory discussed at the top, GAs just denote functions from individuals to degrees (type $\langle e,d\rangle$). For ease of reference, an example of such a function is repeated in (28).

(27) $[\![\text{hot}]\!]^c_K = \lambda x.\mu_{\mathbf{heat}}(x)$

The adaptation we explore here departs from this in three critical respects. (i) We render explicit, as a presupposition, the information about the background ordering on degrees. For example, *hot* includes a map from individuals to degrees of heat, and presupposes that those degrees form an ordering. This ordering is distinct from but intimately related to the ordering of states that we used in §4: the background ontology is different—degrees are not states—and orderings of degrees are presumed to be linearly ordered. While these differences are not relevant for current purposes, we will keep track of them by using the notation '$\langle D_{\mathbf{temp}}, \geq_{\mathbf{temp}}\rangle$' for an ordering on degrees representing temperature. (ii) We build the comparison with a contextual degree standard directly in the at-issue component of the GA's meaning, thereby interpreting *hot* so that it is equivalent to ⌜POS *hot*⌝, modulo the above-noted presupposition. And finally (iii), in order to accommodate the scale-mates problem, we hard-code lexical standards as in $\theta_{\mathbf{hot}}$, for reasons that will become clear shortly.

(28) $[\![\text{hot}]\!]^c_A = \lambda x : \mu(x) \in \mathbf{domain}(\langle D_{\mathbf{temp}}, \geq_{\mathbf{temp}}\rangle).\ \mu(x) \geq \theta_{\mathbf{hot}}$

[16]There is a terminological debate at the margin of this discussion that is worth highlighting even though we cannot wade too deeply into it. Whether the semantics in this section would count as a degree semantics depends in part on what we take to be the essential features of degree semantics. One idea would be to think of degree semantics as a theory on which measure functions are involved in the denotations of GAs. In this sense, the semantics would count as a degree semantics. In another sense, a degree semantics is a theory on which GAs have semantic values in the type d or in its derivative types. This isn't true here, for reasons that will become clear.

$$\overbrace{\ldots d_1\quad d_2\quad d_3\quad d_4\quad d_5\quad d_6\quad \underbrace{d_7\quad d_8\quad d_9\quad \overbrace{d_{10}\quad d_{11}\quad d_{12}\ldots}^{\text{degrees that count as hot}}}_{\text{degrees that count as warm}}}^{\text{degrees representing temperature (‘background’ ordering)}}$$

Figure 3: *Hot* and *warm* picking out subsets of the scale of temperature.

This predicts acceptable truth conditions for the positive form, as illustrated with (29): this says, simply, that Miami's degree of temperature is greater than the contextual standard for being hot on the temperature scale. The sentence does not include a positive morpheme or any element like it, since the standard-relativity is incorporated in the lexical meaning of the GA just as on our states-based account (and on vagueness-based approaches generally).

(29) $[\![\text{Miami is hot}]\!]^c_A$ is defined iff $\mu(m) \in \mathbf{domain}(\langle D_{\mathbf{temp}}, \geq_{\mathbf{temp}}\rangle)$
if defined, it is true iff $\mu(m) \geq \theta_{\mathbf{hot}}$

Let us consider how this implementation would apply to the patterns with scale-mates, continuing on with the example of *warm* and *hot*. Here, as in the states-based implementation, one has to stipulate that the lexical entry for the GA includes a context-sensitive threshold. In the present case in which GAs reference only the degree ordering, the idea will be that these thresholds pick out particular, and different, degrees in a shared background scale. This is illustrated in Figure (30).[17] It is not possible here, as on the classic degree-based approach, to make use of a $\mathbf{std}_c$ function to invoke the threshold, because that function would apply to an identical measure function both with *hot* and *warm*; cf. (29) and (30).

(30) $[\![\text{Barcelona is warm}]\!]^c_A$ is defined iff $\mu(b) \in \mathbf{domain}(\langle D_{\mathbf{temp}}, \geq_{\mathbf{temp}}\rangle)$
if defined, it is true iff $\mu(b) \geq \theta_{\mathbf{warm}}$

The interpretation of the comparative must also differ, following again the playbook in §4. The comparative morphology still extracts a background ordering from the GA's interpretation, though in this case that background is a scale (i.e., an ordered set of degrees). Just as before (modulo the types), this account assumes that, for each adjective denotation g, the function **background** maps g to its unique background ordering $\mathbf{background}(g)$. Unlike the states-based approach, the GA introduces the measure function (albeit via a slightly more tortuous path than it did on the classic degree-based account[18]).

(31) $[\![\text{-er/more}]\!]^c_A = \lambda d.\ \lambda g.\ \lambda x : \mu(x) \in \mathbf{domain}(\mathbf{background}(f)).\ \mu(x) > d$

[17]In this diagram, the objects appearing on a line is meant to indicate that the background ordering is a linear ordering. We assume along with the literature that scales, i.e., orderings on sets of degrees, are all linearly ordered.
[18]Consider that, while the g in (31) is of type $\langle e,t\rangle$ rather than of type $\langle v,t\rangle$, the comparative morphology does not introduce a measure on the individual predicate while it did so for the eventuality predicate. On the neodavidsonian approach we advocate, the comparative morphology includes an index, μ, which is provided a value of the measure function type by the assignment function, σ, in accordance with various constraints. On the present alternative, the value of $\mu(x)$ has to be determined on the basis of what is actually found in $\mathbf{domain}(\mathbf{background}(f))$; if this is a set of degrees representing temperature, μ must resolve to $\mu_{\mathbf{temp}}$.

This gets the truth conditions for the comparative form as follows. Again assuming that the *than*-clause straightforwardly contributes a degree (see fn.13), we continue to abbreviate the contribution of, e.g., *than Barcelona is hot*—the maximal degree of temperature measured by Barcelona—as d_b, for simplicity. Given this, the semantics of the comparative works did on much like it the states-based semantics in §4: the property expressed by the GA is used to access a background scale (which also serves to fix the value of μ), so that the sentence, e.g., (32), says that this μ applied to Miami is greater than d_b.

(32) $[\![\text{Miami is hotter than Barcelona}]\!]^c_A$
is defined iff $\mu(m) \in \mathbf{domain}(\mathbf{background}(\langle D_{\mathbf{temp}}, \succeq_{\mathbf{temp}}\rangle))$
if defined, it is true iff $\mu(m) > d_b$

This account also meets the challenges that we have discussed. The first challenge was the mismatch between the classic degree-based theory and the direction of morphology: the positive form surfaces as morphologically simpler than the comparative form. Here, by design, the positive form is syntactically simpler than the comparative form. The second challenge was the necessity of postulating (something like) POS, despite little surface evidence to support its existence; there is no such need here. And the third challenge concerned getting the right entailment relations between putative scale-mates; this, too, has been accomplished.

In light of this, we won't claim that the core element of our novel proposal couldn't be captured with the resources of the classic degree-based theory. Further and wider study—some of which we sketch in the next section—is required to adjudicate between these approaches.

7. Coda: advantages of our analysis over the degree-based theory

Our proposal for eliminating POS was initially formulated within a state-based framework. But we have managed to export it to a version of the degree-based framework. Nevertheless, we think there may be additional benefits to a states-based account.

Our analysis shares with Bale's (2008) a differentiation between the ordering lexically associated with the GA, and that in terms of which the comparative relation is stated.[19] However, the difference between positing a base ordering between individuals vs states may provide some purchase on challenges that have been raised for his approach to sentences like (33). Specifically, his account has the *for*-phrase restrict the underlying individual ordering prior to the mapping to degrees. So for example, *tall* restricted by *for a 5-year old* would have a threshold relative to the average tallness of a 5-year old.

(33) Ann is tall for a 5-year-old.

A problem with this style of account was brought to the fore by Schwarz (2010), who pointed out that (34) clearly would not involve restricting the individual ordering of *expensive* with the

[19] Cresswell's (1976) did so as well, differentiating conceptually between an ordering of individuals according to, e.g., height and degrees as names for equivalence classes of individuals under the relevant ordering. Bale's account, uniquely, makes compositionally explicit use of the base orderings and a mapping to degrees, in such a way so as to allow for, e.g., *Ann is taller than Bill* to be true while *Ann is taller for a 20 year old than Bill is for a 5 year old* can be false.

set of 5-year olds—for one thing, such a calculation would exclude the hats, which is what the sentence (on the classic lexical degree analysis) says is being measured for its expensiveness.

(34) Ann bought an expensive hat for a 5-year-old.

In our terms, it seems rather that the *for*-phrase would restrict the threshold property such that the GA's contextual threshold is calculated relative to a property of states instantiated by a 5-year-old, in (33), but by states instantiated by a hat bearing some *R* to a 5-year-old, in (34), where *R* could resolve in relational terms like 'possessed by', 'having bought', or 'being given', etc.[20] A plausible avenue for exploration, then, would consider these different restricting properties relative to attachment height and possible levels of resolution of ellipsis or a predicative anaphor inside the *for*-phrase.

One issue that has not been finally resolved and which may, alone, make the difference for distinguishing between our preferred states-based approach and its lexical degree-based counterpart in section 6, concerns differences in 'crispness'. Recall this was the label Kennedy assigned to the observation that, given only a very minimal difference in ADJ between two individuals, B and C, the comparative form *B is* ADJ*-er than C* is always felicitous, but its putatively positive counterpart like *Compared to B, C is* ADJ need not be. It is potentially significant to emphasize here that, of the options discussed in any detail in this paper, only the states-based account makes different ordering relations available to these two constructions.

But how should we think about the recruitment of these different ordering relations in order to make the relevant predictions? Some thoughts might be usefully suggestive. Combined with a positive GA ascription, a phrase like *compared to B* may introduce an equivalence relation, and contribute that B and the matrix subject are in different classes under that relation. Now, it is true that, strictly speaking, any ADJ-difference with respect to B and C means that some equivalence relation will order them so. However, not all such relations may be equally relevant or salient (cf. Schmidt et al. 2009 on 'indifference'). In contrast, the very point of degree orderings is that they represent any measurable difference.

8. Conclusion

We provided a new account of the relationship between positive and comparative GA ascriptions which preserves insights from both the vagueness- and degree-based approaches to GAs. We first assumed, following recent work, that GAs express properties of (ordered) states, and that comparative morphology introduces a mapping to degrees in a way that respects such lexical orderings. Our novel idea separates out one part of the GA meaning for use in the positive form—i.e., the contextually-determined threshold property—and a different part for use in the comparative form—i.e., the background property against which contextual thresholds are set.

This account avoids problematic aspects of prior approaches. We have the expressive capacity, finally, to capture the semantic patterning of scale-mates like *hot* and *warm*, while remaining faithful to the direction of morphological evidence, and avoiding questions about the realization of POS or any POS-like element. As we saw, it is not at all impossible to reverse engineer our proposal in something like the classic degree-based theory, but we think there may be additional benefits to our states-based account, some of which we have briefly reviewed.

[20] Schwarz (2010) opts for a 'scope of POS'-based analysis that is unavailable to us for the obvious reasons.

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