ON THE SEMANTICS OF COMPARISON ACROSS CATEGORIES

ABSTRACT. This paper explores the hypothesis that all comparative sentences—nominal, verbal, and adjectival—contain instances of a single morpheme that compositionally introduces degrees. This morpheme, sometimes pronounced *much*, semantically contributes a structure-preserving map from entities, events, or states, to their measures along various dimensions. A major goal of the paper is to argue that the differences in dimensionality observed across domains are a consequence of *what is measured*, as opposed to *which expression* introduces the measurement. The resulting theory has a number of interesting properties. It characterizes the notion of 'measurement' uniformly across comparative constructions, in terms of non-trivial structure preservation. It unifies the distinctions between mass/count nouns and atelic/telic verb phrases with that between gradable and non-gradable adjectives. Finally, it affords a uniform characterization of semantically anomalous comparisons across categories.

1. Introduction

This paper explores the hypothesis that all comparative sentences—adjectival, nominal, and verbal—contain a morpheme that compositionally introduces degrees. This morpheme, sometimes pronounced *much*, contributes a structure-preserving map from entities, events, or states, to their measures along some dimension.

Canonical comparatives feature adjectives like *hot* as in (1). In the tradition beginning with Cresswell (1976), such gradable adjectives (GAs) are analyzed as expressing relations between individuals and degrees—names for measures of temperature, height, etc. Morphemes like *-er* and *as*, in turn, express relations between degrees: one may be greater than (1a) or (at least) equal to another (1b).[1] Gradable adverbs pattern much like gradable adjectives, (2).

(1) a. Al's soup is hott**er** than Bill's is.
b. Al's soup is **as** hot as Bill's is.

(2) a. Al ran fast**er** than Bill did.
b. Al ran **as** fast as Bill did.

Non-canonical comparatives contain nouns like *coffee* (3) and verbs like *run* (4). These sentences show the same range of degree-relational interpretations (greater-than, at-least-equal-to, etc.), but differ in their morphosyntax: here the form *more* is obligatory (cp. **coffee-er*), and *as* is followed not directly by the noun but by *much* (cp. **as coffee*).

(3) a. Al bought **more** coffee than Bill did.
b. Al bought **as much** coffee as Bill did.

(4) a. Al ran **more** than Bill did.
b. Al ran **as much** as Bill did.

[1] I focus on comparatives with *-er* and *as*, though the account extends to those with *too*, *enough*, etc.

Comparatives with nouns and verbs have interesting semantic properties that appear to distinguish them (Schwarzschild 2002, 2006, Nakanishi 2007, Wellwood et al. 2012). The sentences in (5) each allow multiple dimensions for comparison, but only those that respect strict part-whole relations. Larger portions of soup have greater measures by volume or weight than smaller portions, which is not generally the case with measures by temperature, (5a). The same, mutatis mutandis, for running events, (5b).

(5) a. Al bought **as much soup** as Bill did. VOL,WEIGHT,*TEMP
b. Al **ran as much** as Bill did. TIME,DIST,*SPEED

These properties can be captured by positing a variable in nominal and verbal comparatives that ranges over measure functions, restricted to just those that are homomorphic to the measured domain (Schwarzschild 2002, 2006). This meaning has been attributed to *much*, overtly with *as*, less so with *more* (Nakanishi 2007, Wellwood et al. 2012; cf. Solt 2014).

That *much* allows for a variety of dimensions raises the question of whether it couldn't introduce measure functions in GA comparatives as well. I argue, in effect, for just this: a unified account of comparative constructions in which (i) degrees are introduced compositionally, (ii) by *much*, and (iii) not by an other expression. The theory contrasts primarily with contemporary degree-theoretic approaches in which GAs lexically specify measure functions (while nouns and verbs typically don't). On my view, which dimensions are possible across domains is a consequence of *what is measured*, rather than *which expressions* measure.

In short, different things are measured in sentences like (1) than we might have thought. I will propose the interpretations for *coffee*, *run*, and *hot* as in (6), where x, y range over elements of the domain of individuals D_e, and e, e', ..., s, s', ... range over elements of the eventive and stative subsets of the domain of eventualities D_v. A noun like *coffee* introduces individuals that can be measured, a verb like *run* introduces events, and an adjective like *hot* introduces states.

(6) a. $[\![\text{coffee}]\!]^A = \lambda x.\mathbf{coffee}(x)$
b. $[\![\text{run}]\!]^A = \lambda e.\mathbf{run}(e)$
c. $[\![\text{hot}]\!]^A = \lambda s.\mathbf{hot}(s)$

The interpretation for *much* that I will propose is as in (7), relative to any assignment of values to variables, A. Here, μ ranges over measure functions of type $\langle e, d\rangle$ or $\langle v, d\rangle$, with d the type of degrees. Potential values for μ are given in (8), on various assignments.

(7) $[\![\text{much}_\mu]\!]^A = A(\mu)$

(8) a. $A(\mu) = $ VOLUME
b. $A'(\mu) = $ TEMPORAL DURATION
c. $A''(\mu) = $ TEMPERATURE

The theory has a number of interesting properties. It characterizes the notion of 'measurement' uniformly in terms of structure-preservation (cf. Berka's 1983 definition), across comparative constructions. It unifies the distinction between gradable and non-gradable adjectives with that between mass and count nouns, and between atelic and telic verb phrases. And, it maintains a single cause for semantic anomaly in comparatives across categories: it arises whenever the domain for measurement fails to be non-trivially structured.

I present a semantics for nominal and verbal comparatives in §2, emphasizing the role of *much*. §3 extends this account to adjectival comparatives, and compares it to contemporary degree-based approaches. §4 revisits earlier alternatives (Reichenbach 1947, Cresswell 1976), and suggests how the present account improves on them. §5 discusses familiar and novel data that, while not impossible to capture on previous approaches, is expected on the theory advanced here. §6 addresses some potential objections, and §7 concludes.

2. Nominal and verbal comparatives

2.1. Noun phrases

Intuitively, the sentences in (9) express that the amount of coffee Al bought (meets or) exceeds that of Bill's coffee, and (10) that Al's amount of rock (meets or) exceeds Bill's amount. Whether comparing with *rock* or *coffee*, 'amount' may be understood in terms of volume or weight. Despite this variability, there are innumerably many other dimensions that such examples cannot be understood in terms of: for example, (9) cannot express comparisons by temperature, nor can (10) express comparisons by density.

(9) a. Al bought **more coffee** than Bill did.
b. Al bought **as much coffee** as Bill did.

(10) a. Al found **more rock** than Bill did.
b. Al found **as much rock** as Bill did.

This pattern contrasts with that of comparatives with nouns like *idea* and *cup*. While *more idea* could in principle express something like 'an idea of greater profundity', such readings are not available to (11). And, this is not just a problem of abstract nouns: the examples in (12) are sensical only to the extent that *cup* can be understood as denoting a kind of stuff, as opposed to merely a sort of object. The comparative construction disallows characteristically 'count noun' interpretations.

(11) a. ? Al has **more idea** than Bill does.
b. ? Al has **as much idea** as Bill does.

(12) a. ? This table has **more cup** than that one does.
b. ? This table has **as much cup** as that one does.

Schwarzschild (2002, 2006) captures data similar to that in (9)-(12) by positing a "monotonicity" condition on constructions involving measurement.[2] Among these, he considered *much* with a partitive NP (13a) and the excessive *too* with mass nouns (13b). These data show a similar pattern to the above: while (13) can express comparisons of amounts of coffee by weight or volume, neither can express a comparison by temperature, and (14) are odd or coercive at best.

(13) a. Al didn't buy **much of our coffee**.
b. Al bought **too much coffee**.

[2]He mainly focuses on pseudopartitives (*20 ounces of water*) and attributive measure phrase constructions (*20 degree water*), which I do not discuss here.

(14) a. ? Al didn't buy **much of our cup**.
b. ? Al bought **too much cup**.

Schwarzschild suggests that part of the meaning of nominal phrases like those in (13) is a contextually-determined measure function, selected from among those whose dimensions respect the part-whole structure of the measured domain. Moreover, only domains that are so structured are measurable. I first review the appeal to ontology in the semantics of mass and count nouns, and then return to this analysis.

The felt difference between mass and count nouns is often modeled by positing structural differences in their domains of application (Cartwright 1975, Link 1983, Chierchia 1998, among many others). Mass nouns tend to show cumulative reference: if *coffee* applies to two portions of matter, then it also applies to the mereological sum of those portions.[3] In contrast, (singularly-interpreted) count nouns tend to show non-cumulative reference: if *a cup* applies to a given object, it fails to apply to any of its (relevant) proper parts.[4] The semantics of a noun like *coffee* is thus often modeled in terms of a domain structured by the part-of relation, while that of a noun like *cup* lacks such structure.

A given measure function is monotonic in Schwarzschild's sense just in case, for any two things that are properly ordered in a part-of relation, their measurements are similarly ordered. Krifka (1989) discusses similar patterns in terms of 'extensive' measures, and Higginbotham (1994) in terms of 'additive' measures; Nakanishi (2007) follows Schwarzschild's formulation, as I do here (cf. Champollion 2010). Reference to binary relations (monotonicity) or operations (extensivity, additivity) is ultimately important for how we formalize measurement in semantics, however (see Klein 1991).

Schwarzschild's condition can be stated as in (15). Monotonicity requires that the relation to be preserved is the strict ordering, $\prec$; if we required only that $\preccurlyeq$ was preserved, mappings from portions of coffee to degrees representing temperature would be incorrectly permitted (e.g., for two portions, a and b, it may be that $a \preccurlyeq b$ and $a \neq b$, while nonetheless $\textsc{temperature}(a) = \textsc{temperature}(b)$).

(15) **Monotonicity** [first version]
A measure function $\mu : D_{\preccurlyeq^{Part}} \mapsto D_{\leq^{Deg}}$ is **monotonic** iff:
for all $x, y \in D_{\preccurlyeq^{Part}}$, if $x \prec^{Part} y$, then $\mu(x) \prec^{Deg} \mu(y)$.

To see what this amounts to, consider a portion of coffee, a, and two of its proper subparts, a', a''. All of a, a' and a'' necessarily measure some degree e.g. by volume, weight, and temperature, but only measures of volume or weight can be invoked by (16). Importantly, the sum a necessarily measures a greater degree by volume or weight than that of the parts a' and a''; they (normally) have the same degree of temperature. To express a comparison of portions of coffee along such a dimension, one must use a GA like *hot* as in (17).

(16) a. Al has **more coffee** than Bill does. *TEMP,VOL
b. Al has **as much coffee** as Bill does. *TEMP,VOL

[3]They also tend to show the property of *divisiveness/homogeneity*: if *coffee* applies to a portion of stuff, it also applies to a proper part of that stuff. See Zucchi and White 2001 for critical discussion and counterexamples like *twig*, *sequence*, etc.

[4]It is imperative for these tests that nouns be presented in a mass or count *context*, since otherwise coercive effects intrude on the judgments. Further, certain idealizations are necessary: for example, we have to imagine a "normal" cup, since a cup made out of cups would fail quantization.

(17) a. Al has **hotter coffee** than Bill does. TEMP,*VOL
b. Al has **as hot (of) coffee** as Bill does. TEMP,*VOL

Part of the meaning of nominal comparatives is something that ensures only monotonic dimensions for measurement are available for interpretation. This constraint can be naturally captured on accounts that appeal to mereology in the domain of application for expressions like *coffee*, as they provide just the structures that monotonicity can be stated over. Furthermore, nominal comparatives are not compatible with (singularly-interpreted) count nouns, whose domains are often thought to lack such structure.

2.2. Verb phrases

The comparatives in (18) express that the amount of running Al did (meets or) exceeds that of Bill, and in (19) express that Al's amount of sleeping (meets or) exceeds Bill's amount. In both, 'amount' may be understood in terms of temporal duration; (18) also permit an interpretation comparing spatial distances. There are many more dimensions that are not permitted, however: (18) cannot be understood in terms of speed, nor can (19) be understood in terms of the fitfulness of the sleeping.

(18) a. Al **ran more** than Bill did.
b. Al **ran as much** as Bill did.

(19) a. Al **slept more** than Bill did.
b. Al **slept as much** as Bill did.

This pattern contrasts with that of verb phrases like *graduate high school* and *eat one's first cupcake*. One could imagine using a sentence like (20) to express something about how long the ceremonies lasted, or the relevant students' GPAs; yet, such readings are not available. The sentences in (20) and (21) are only interpretable if understood in terms of counts of pluralities of events, which is odd given what we normally think about events like eating one's first cupcake. More generally, while (18)-(19) can express comparisons between single events, (20)-(21) cannot.

(20) a. ? Al **graduated high school more** than Bill did.
b. ? Al **graduated high school as much** as Bill did.

(21) a. ? Al **ate her first cupcake more** than Bill did.
b. ? Al **ate her first cupcake as much** as Bill did.

The relevant difference between the predicates in (18)-(19) and (20)-(21) manifests in other, more familiar linguistic contexts. A *for*-phrase can be used with *run* or *sleep* to express that an event of a certain type occurred over the course of 5 minutes, (22). With *run to the park* or *graduate high school*, such an interpretation is odd: (23) seem to express, instead, that an event of a certain type iterated over 5 minutes. Verb phrases that show the interpretive pattern in (22) are called 'atelic', and those that show the pattern in (23), 'telic'.

(22) a. Al **ran in the park** for 5 minutes.
b. Al **slept** for 5 minutes.

(23) a. ? Al **ran to the park** for 5 minutes.
b. ? Al **graduated high school** for 5 minutes.

The felt difference between atelic and telic predicates, like that between mass and count nouns, is often located in their domains of application—except here the predicates apply to events (Taylor 1977, Mourelatos 1978, Hoepelman and Rohrer 1980, Bach 1986, Link 1987, Krifka 1989, Landman 2000, Rothstein 2004, Borer 2005a, a.o.).[5] Like mass nouns, atelic predicates tend to show cumulative reference: if *run in the park* applies to two stretches of activity, it also applies to their sum. In contrast, (singularly-interpreted) telic predicates tend to show quantized reference: if *run to the park* applies to an event, it fails to apply to any of its (relevant) subparts. Such observations suggest that atelic verb phrases have domains structured by the part-of relation on events, while those of telic predicates lack such structure.

In this light, that verbal comparatives display their own version of Schwarzschild's monotonicity restriction is interesting. Consider some running event, e, and two of its proper subparts, e' and e''. All of e, e', and e'' necessarily measure some degree by e.g. temporal duration, spatial distance, and speed, yet the sentences in (24) invoke only measures by duration or distance (Nakanishi 2007, Wellwood et al. 2012). Along such dimensions, the sum e necessarily measures a greater degree than that of the parts e' and e''; however, arbitrary subparts of e may measure the same, a lesser, or even a greater degree by speed. To express a comparison in those terms one must use an adverb like *fast*, (25).

(24) a. Al **ran more** than Bill did. *SPEED,DUR
b. Al **ran as much** as Bill did. *SPEED,DUR

(25) a. Al **ran faster** than Bill did. SPEED,*DUR
b. Al **ran as fast** as Bill did. SPEED,*DUR

A restriction to monotonic measures in the verbal domain means that, for any two events that are (properly) ordered in a part-of relation, their measurements are similarly ordered. We can thus generalize the statement of the monotonicity condition so that it is neutral with respect to the type of (at least) individuals and events: in (26), α ranges over entities of type e or v.

(26) **Monotonicity** [final version]
A measure function $\mu : D_{\preccurlyeq^{Part}} \mapsto D_{\leq^{Deg}}$ is **monotonic** iff:
for all $\alpha, \beta \in D_{\preccurlyeq^{Part}}$, if $\alpha \prec^{Part} \beta$, then $\mu(\alpha) \prec^{Deg} \mu(\beta)$.

Part of the meaning of (verbal) comparatives is something that ensures only monotonic dimensions for measurement are available. Further, these constructions are not compatible with singularly-interpreted telic VPs. As with nominal comparatives, this pattern can be naturally captured on accounts that appeal to mereological structure or lack thereof in the domains of application for verbal predicates.

[5]See Ryle 1949, Kenny 1963, Vendler 1957, Verkuyl 1972, Mourelatos 1978, Dowty 1979, Parsons 1990, Filip 2004, 2011 for discussion of telicity. Borer 1998, 2005b, Ritter and Rosen 1998, Ramchand 1997, 2003, van Hout 2000, and Kratzer 2004 discuss structural factors in determining telicity.

2.3. Measuring individuals and events

Compositionally, I assign *-er* and *as* the interpretations in (27) (Bartsch and Vennemann 1972, Kennedy 1999, Bale 2006, 2008, among others), where g ranges over measure functions, d is provided by the *than* or *as* clause, and α may be of type e or v (ν indicates neutrality). These morphemes are thus not interpreted as quantifiers (Heim 2000, Bhatt and Pancheva 2004, among others), but that approach could be adopted, making the requisite changes below.

(27) i. $[\![\text{-er}]\!]^A = \lambda g \lambda d \lambda \alpha . g(\alpha) \succ d$ $\langle\langle \nu, d\rangle, \langle d, \langle \nu, t\rangle\rangle$

ii. $[\![\text{as}]\!]^A = \lambda g \lambda d \lambda \alpha . g(\alpha) \succcurlyeq d$

The semantics of *much* is as in (28), with μ an object language variable assigned a measure function type by the assignment function A. This proposal is similar to that of Wellwood et al. (2012) and Solt (2014) (for her covert expression $Meas$), but differs in that μ is an object language rather than metalanguage variable. Example values of such variables are given in (29), on various assignments.[6]

(28) $[\![\text{much}_\mu]\!]^A = A(\mu)$ $\langle \nu, d\rangle$

(29) i. $A(\mu) = \textsc{volume}$

ii. $A'(\mu) = \textsc{temperature}$

iii. $A''(\mu) = \textsc{temporal duration}$

To capture the interpretive patterns of nominal and verbal comparatives, in any context and on any assignment A, $A(\mu)$ is understood to be restricted as follows: it only allows measure functions that apply to non-trivially structured domains, and the mapping must be monotonic in Schwarzschild's sense.

Requiring that any α predicated of by $A(\mu)$ be in the domain of a non-trivial ordering ensures that (relevantly singular) count nouns and telic verb phrases will be uninterpretable here. I assume that the domains of *rock* and *run* have mereological structure, while, following primarily Link (1983), the satisfiers of expressions like *a cup* or *a rock* do not; where correspondences exist between the mass and count domains, they are captured by a material constitution relation $\rhd$. A similar relation can be defined for events (see Wellwood 2014).

Requiring that the mapping be monotonic ensures three things: that it is homomorphic to the structure of the measured domain (such functions can be defined relative to relations $\preccurlyeq$ or operations $\vee$ in the usual way); that it is part-whole structure that is preserved; and moreover, that this preservation is non-trivial. These conditions prevent, for example, TEMPERATURE as a possible value for $A(\mu)$ when α is a portion of coffee.

Lastly, the value of $A(\mu)$ understood in a given context of use depends not only on how the measured entities are ordered, but also on what sort of entity they are. Presumably, *more coffee* can't involve measurement by TEMPORAL DURATION, since this function does not have portions of coffee in its domain, (30i). Similarly, *run more* cannot express measurement by VOLUME, since that function does not have events in its domain, (30ii).

(30) i. $\textsc{temporal duration} : D_v \mapsto D_d$

ii. $\textsc{volume} : D_e \mapsto D_d$

[6]Wellwood 2014 offers some skepticism of index-based approaches like this. Applying tests primarily from Gillon 2004, *much* often patterns like a polysemous or general expression, rather than a type of pro-form.

It is crucial for this account that nouns like *coffee* and verbs like *run* appearing in comparatives are predicates of individuals and events, respectively. This gives $A(\mu)$ access to the individual and event mereologies against which the conditions on admissible measure functions can be checked.

Thus, I assume that bare nouns like *coffee* express predicates of type $\langle e, t\rangle$ (cf. Krifka 2003). These combine with a silent indefinite determiner e, that I interpret using Hilbert's ϵ operator in (32), the indefinite counterpart of ι that doesn't presuppose uniqueness (see von Heusinger 1997, Bierwisch 1989). The present account could be recast in terms where e is interpreted as a generalized quantifier like *some*, in which case nominals containing it would undergo Quantifier Raising; I adopt the present approach mainly to simplify the derivations.

(31) i. $[\![\text{coffee}]\!]^A = \lambda x.\mathbf{coffee}(x)$ $\langle e, t\rangle$

ii. $[\![\text{rock}]\!]^A = \lambda x.\mathbf{rock}(x)$ $\langle e, t\rangle$

(32) $[\![e]\!]^A = \lambda P.\epsilon x[P(x)]$ $\langle\langle e, t\rangle, e\rangle$

I assume that intransitive verbs like *run* express one-place predicates of events (cf. Parsons 1990), and transitive verbs like *eat* express two-place predicates, with both an event and individual argument. Again, the account can easily be recast assuming that all verbs are one-place predicates of events (Schein 2003, Pietroski 2005, among others). Verbs are linked with their external arguments by the functional head, v (Marantz 1984, Chomsky 1995), using the rule of Event Identification (Kratzer 1996), and with their internal arguments, when applicable, by Functional Application.[7]

(33) i. $[\![\text{run}]\!]^A = \lambda e.\mathbf{run}(e)$ $\langle v, t\rangle$

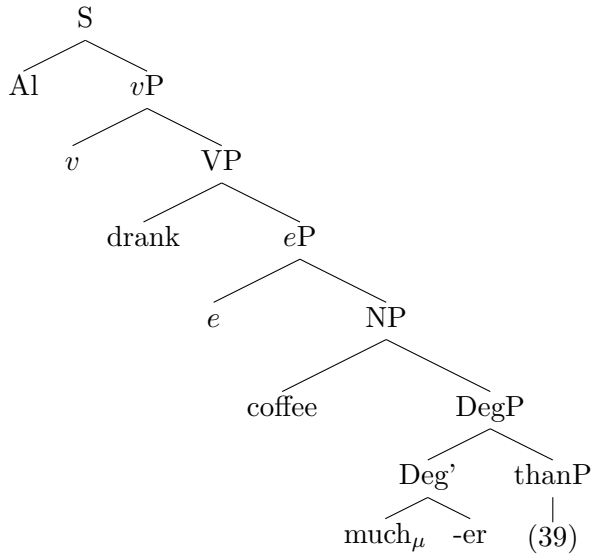
ii. $[\![\text{drink}]\!]^A = \lambda x\lambda e.\mathbf{drink}(e)(x)$ $\langle e, \langle v, t\rangle\rangle$

(34) $[\![v]\!]^A = \lambda x\lambda e.P(e)$ & $\text{Agent}(e)(x)$ $\langle e, \langle v, t\rangle\rangle$

With these assumptions in place, consider the nominal comparative in (35), which I assume has the (simplified) structure in (36).

(35) Al drank **more coffee** than Bill did.

(36)



[7]Except where noted, I assume the compositional toolkit presented in Heim and Kratzer 1998.

Abbreviating the interpretation of the *than*-clause as δ for now, the truth conditions of (36) are derived as in (37). 'IE' stands for 'Indexed Expression', a more general label for the Traces and Pronouns Rule. PM is Predicate Modification, which I assume can compose two nodes of type $\langle e,t\rangle$ or of type $\langle v,t\rangle$. $\exists$ marks existential closure of the event variable at the top of the sentence; I abstract away from what introduces this. The result is an existential statement about events e involving Al drinking some coffee, the measure of which is greater than δ.

(37)
i. $[\![\text{Deg'}]\!]^A = \lambda d\lambda\alpha.A(\mu)(\alpha) \succ d$ IE,FA
ii. $[\![\text{DegP}]\!]^A = \lambda\alpha.A(\mu)(\alpha) \succ \delta$ i,FA
iii. $[\![\text{NP}]\!]^A = \lambda y.\mathbf{coffee}(y)\ \&\ A(\mu)(y) \succ \delta$ ii,PM
iv. $[\![e\text{P}]\!]^A = \epsilon y[\mathbf{coffee}(y)\ \&\ A(\mu)(y) \succ \delta]$ iii,FA
v. $[\![\text{VP}]\!]^A = \lambda e.\mathbf{drink}(e)(\epsilon y[\mathbf{coffee}(y)\ \&\ A(\mu)(y) \succ \delta])$ iv,FA
vi. $[\![v\text{P}]\!]^A = \lambda y\lambda e.\text{Agent}(e)(y)\ \&\ \mathbf{drink}(e)(\epsilon y[\mathbf{coffee}(y)\ \&\ A(\mu)(y) \succ \delta])$ v,EI
vii. $[\![\text{S}]\!]^A = \lambda e.\text{Agent}(e)(a)\ \&\ \mathbf{drink}(e)(\epsilon y[\mathbf{coffee}(y)\ \&\ A(\mu)(y) \succ \delta])$ vi,FA
viii. $= \top$ iff $\exists e[\text{Agent}(e)(a)\ \&\ \mathbf{drink}(e)(\epsilon y[\mathbf{coffee}(y)\ \&\ A(\mu)(y) \succ \delta])]$ vii,$\exists$

As for the *than*-clause, the head of this phrase has the interpretation in (38i): it takes the characteristic function of a set of degrees D, and outputs the maximal degree that D takes to the value $\top$ (von Stechow 1984, Rullmann 1995; cf. Schwarzschild and Wilkinson 2002). The syntax and composition that I assume internal to the *than*-clause follows the basic outline of Kennedy (1999; cf. Bale 2006), wherein an expression of type $\langle \nu, d\rangle$ is linked to an overt degree variable by the morpheme ABS, (38ii).

(38)
i. $[\![\text{than}]\!]^A = \lambda D.max(D)$ $\langle\langle d,t\rangle, d\rangle$
ii. $[\![\text{ABS}]\!]^A = \lambda g\lambda d\lambda\alpha.g(\alpha) \succcurlyeq d$ $\langle\langle \nu, d\rangle, \langle d, \langle \nu, t\rangle\rangle\rangle$

The structure of the *than*-clause of (35) is given schematically in (39). Here and below, I assume that the same index is assigned to the matrix and *than*-clause occurrences of *much*, though so far nothing I have said prohibits them from differing. ABS links the interpretation of *much* to the trace of an operator, OP, whose *wh*-movement is interpreted as a λ-abstract over degrees, (40), by Predicate Abstraction.

(39) [$_{thanP}$ than OP$_i$ [Bill v drank e coffee [t_i [much$_\mu$ ABS]]]]

(40) $[\![$OP$_i$ [Bill v drank e coffee [t_i [much$_\mu$ ABS]]] $]\!]^A =$
$\lambda d.\exists e[\text{Agent}(e)(b)\ \&\ \mathbf{drink}(e)(\epsilon x[\mathbf{coffee}(x)\ \&\ A(\mu)(x) \succcurlyeq d])]$ PA

Given these assumptions, the interpretation of (39) is as in (41): it is the maximal degree d such that d is the $A(\mu)$-measure of some coffee Bill drank.

(41) $[\![[_{thanP}\ldots]]\!]^A =$
$max(\lambda d.\exists e[\text{Agent}(e)(b)\ \&\ \mathbf{drink}(e)(\epsilon x[\mathbf{coffee}(x)\ \&\ A(\mu)(x) \succcurlyeq d])])$ FA

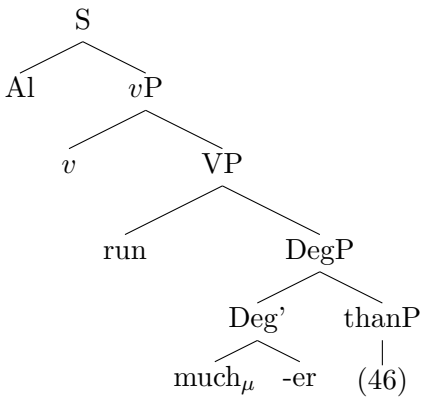
Putting everything together, (35) has the logical form in (42). This interpretation is true just in case Al was the agent of a drinking event involving some coffee, the $A(\mu)$-measure of which is greater than that of some coffee Bill drank. In the context of *drink*, $A(\mu)$ will likely be VOLUME, though WEIGHT is in principle possible. TEMPERATURE, for the reasons discussed above, is not.

(42) $[\![\text{Al drank } \textbf{more coffee} \text{ than Bill did}]\!]^A = \top$ iff
$\exists e[\text{Agent}(e)(a)\ \&\ \textbf{drink}(e)(\epsilon x[\textbf{coffee}(x)\ \&\ A(\mu)(x) \succ$
$max(\lambda d.\exists e'[\text{Agent}(e')(b)\ \&\ \textbf{drink}(e')(\epsilon y[\textbf{coffee}(y)\ \&\ A(\mu)(y) \succcurlyeq d])])]$

The verbal comparative in (43) is derived in much the same fashion. Assuming the matrix clause of (43) has the structure in (44), its interpretation is derived as in (45), again abbreviating the *than*-clause with δ for now.

(43) Al **ran more** than Bill did.

(44)



(45) i. $[\![\text{Deg'}]\!]^A = \lambda d\lambda\alpha.A(\mu)(\alpha) \succ d$ IE,FA
ii. $[\![\text{DegP}]\!]^A = \lambda\alpha.A(\mu)(\alpha) \succ \delta$ i,FA
iii. $[\![\text{VP}]\!]^A = \lambda e.\textbf{run}(e)\ \&\ A(\mu)(e) \succ \delta$ ii,PM
iv. $[\![v\text{P}]\!]^A = \lambda x\lambda e.\text{Agent}(e)(x)\ \&\ \textbf{run}(e)\ \&\ A(\mu)(e) \succ \delta$ iii,EI
v. $[\![\text{S}]\!]^A = \lambda e.\text{Agent}(e)(a)\ \&\ \textbf{run}(e)\ \&\ A(\mu)(e) \succ \delta$ iv,FA
vi. $= \top$ iff $\exists e[\text{Agent}(e)(a)\ \&\ \textbf{run}(e)\ \&\ A(\mu)(e) \succ \delta]$ v,$\exists$

The structure of the *than*-clause is as in (46), and its interpretation is given in (47).

(46) $[_{thanP}$ than OP$_i$ [Bill v ran [t_i [much$_\mu$ ABS]]]]

(47) $[\![[_{thanP}\ldots]]\!]^A = max(\lambda d.\exists e[\text{Agent}(e)(b)\ \&\ \textbf{run}(e)\ \&\ A(\mu)(e) \succcurlyeq d])$

Putting these pieces together, the interpretation of (43) in (48) is true just in case Al is the agent of a running event, the $A(\mu)$-measure of which is greater than that of a running event by Bill. If $A(\mu)$ is TEMPORAL DURATION or DISTANCE, the result will be interpretable, and in those terms. If it is SPEED, it will not be.

(48) $[\![\text{Al } \textbf{ran more} \text{ than Bill did}]\!]^A = \top$ iff
$\exists e'[\text{Agent}(e')(a)\ \&\ \textbf{run}(e')\ \&\ A(\mu)(e') \succ$
$max(\lambda d.\exists e[\text{Agent}(e)(b)\ \&\ \textbf{run}(e)\ \&\ A(\mu)(e) \succcurlyeq d])]$

2.4. Looking ahead

On the account I have offered, *much* does not express a particular measure function, but any drawn from among a class that are monotonic with respect to the (non-trivial) ordering relations on its input argument. So far, I have said that this expression introduces measures of individuals and events.

Turning to GAs, traditional degree-theoretic approaches hold that gradable adjectives themselves introduce measure functions into the compositional semantics (Bartsch and Vennemann 1972, Cresswell 1976, Kennedy 1999, among many others). Combining such an approach with that I have offered for nominal and verbal comparatives would suggest a fundamental split in how comparatives are interpreted across categories.

That is, (49) and (50) would represent measurement of coffee and running events, respectively, but each would differ internally in which expressions introduce degrees, and to what extent the mapping to degrees is constrained. In (49a) and (50a), degrees are introduced compositionally, in a manner constrained by monotonicity. In (49b) and (50b), degrees are introduced lexically, and the choice of dimension is otherwise unconstrained.

(49) a. Al drank **more coffee** than Bill did. VOL,*TEMP
b. Al drank **hotter coffee** than Bill did. *VOL,TEMP

(50) a. Al **ran more** than Bill did. DUR,*SPEED
b. Al **ran faster** than Bill did. *DUR,SPEED

I propose to capture the observed differences in dimensionality between pairs like these not by appeal to which expressions introduce the measures, but to differences in what is measured; *much* introduces measure functions even in GA comparatives. (49a) and (50a) involve measurement of coffee and running events that can only be mapped to scales that respect their mereologies; sentences like (49b) and (50b) involve measurement of states.

3. Adjectival comparatives

3.1. Adjectives

Intuitively, the sentences in (51) express comparisons between the temperature of Al's coffee, and that of Bill's coffee, such that the first is greater than the second. The sentences in (52) express comparisons between how much skill this man and that man have, the measure of which might depend on whether e.g. skill with a scalpel or a sledgehammer is intended.

(51) a. Al's hot coffee is **hotter** than Bill's is.
b. Al's hot coffee is **as hot** as Bill's is.

(52) a. This skillful man is **more skillful** than that one is.
b. This skillful man is **as skillful** as that one is.

Comparatives with adjectives like *wooden* and *triangular* are more restricted. Once it is acknowledged that two things are made of wood, it makes no sense to say that one is *more wooden* than another, and the same for two triangles.[8]

(53) a. ? This piece of wood is **more wooden** than that one is.
b. ? This piece of wood is **as wooden** as that one is.

(54) a. ? This triangle is **more triangular** than that one is.
b. ? This triangle is **as triangular** as that one is.

[8]I set aside examples that give rise to interpretations like 'this table is more comprised of wood than that table is' or 'this shape is closer to being triangular than that shape', as I see them as separate phenomena.

I propose to capture this contrast in terms of the domains of application of the two types of adjective. Both GAs and non-GAs express predicates of states (Landman 2000, Fults 2006), entities which, I assume, are ontologically distinct from the individuals that bear or instantiate them, and that are unique to those individuals. The difference between the two classes is that GAs predicate of ordered states, unlike non-gradable adjectives.

On degree-based theories of their lexical semantics, GAs associate directly with sets of ordered degrees, or scales. Cresswell (1976) understands degrees to be names for equivalence classes of objects based on antecedent ordering relations, where that relevant to *hot* might be represented (equivalently) as $\{\langle x, x'\rangle \mid x \text{ is as hot as } x'\}$ or $\{\langle x, x'\rangle \mid x \text{ has as much heat as } x'\}$ (cf. Engel 1989). The collapsing of these relations into equivalence orders is also extralinguistic, and the mapping to degrees is internal to the adjective (see also Bale 2008).

The present account differs from Cresswell's conception in two ways. The binary relation associated with *hot* is an ordering on states, rather than on the individuals that bear them. The ordering on individuals can be recovered via the thematic relation that, in a neodavidsonian semantics, links states with their bearers in the syntax. And, degrees are introduced compositionally: states are mapped to degrees when they are arguments to $[\![much_{\mu}]\!]^{A}$.[9]

The states predicated of by GAs are quantities that there may be more or less of: states satisfying $[\![hot]\!]$ are in the domain of an ordering by 'how much' heat they represent. In contrast, the states predicated of by non-gradable adjectives are quantities that either exist, or they do not: a thing is either wooden, or it's not. I propose to model this difference such that non-gradable adjectives are formally parallel to (singular) count nouns and telic VPs: the states that satisfy them are atomic, unordered objects.

Finally, even if the domain of a GA is ordered, this is not yet enough for it to combine with *much*, given the semantics and conditions of use offered for that expression in the previous section. There must be a way of seeing that the measure functions introduced with GAs are monotonic: that is, that they are not only homomorphic to the ordering relations on the measured domain, but to non-trivial part-whole relations. Such a semantics is only applicable here if it is possible to see the state-satisfiers of $[\![hot]\!]$ as ordered by a part-of relation.

There is some linguistic evidence that such states form a mereology. Recall Schwarzschild's (2006) explanation for why sentences like (55) are ungrammatical: the pseudopartitive requires monotonic measurement, which TEMPERATURE (apparently) does not involve. Yet, Champollion (2010) provides the naturally-occurring examples in (56) that contain pseudopartitives, yet temperature is the only grammatical dimension for their interpretation. How could this be?

(55) * Al drank **30 degrees Celsius of water**.

(56) a. Emilia was lying on her bed, **with 41 degrees Celsius of fever**.

b. The scientists from Princeton and Harvard universities say just **two degrees Celsius of global warming**, which is widely expected to occur in the coming decades, could be enough to inundate the planet.

The solution, Champollion points out, requires recognizing that monotonicity is calculated relative to a system: change what is measured (from water, to fever) and the available

[9]Moltmann 2009 analyzes adjectives as predicates of states so as to eliminate degrees, which is not the course I pursue; some reasons to think degrees are still theoretically desirable are given in §4, when I discuss Reichenbach's 1947 logic for comparatives.

measures can change. Indeed, a smaller amount of heat will have a smaller temperature than a larger amount; to see temperature as monotonic with respect to amounts of heat requires only the further step of thinking that the smaller amount is a mereological part of the larger amount (Champollion, p.c.).

Herein lie metaphysical (or psychological) questions that are beyond the scope of this work. Yet, Schwarzschild's generalization for data like (55) can be maintained in the face of apparent counterexamples like (56), if we hold that TEMPERATURE is monotonic with respect to heat states. I thus assume that the domains of GAs form mereologies of states.

3.2. Measuring states

I assign adjectives like *hot* and *wooden* the interpretations in (57). Both are one-place predicates of states, entities of type v. The difference between GAs like *hot* and non-gradable adjectives like *wooden* is not in their types, but in their domains of application: that of $[\![hot]\!]$ forms a mereology, but that of $[\![wooden]\!]$ does not.

(57) a. $[\![\text{hot}]\!]^A = \lambda s.\mathbf{hot}(s)$ $\langle v, t\rangle$

b. $[\![\text{wooden}]\!]^A = \lambda s.\mathbf{wooden}(s)$ $\langle v, t\rangle$

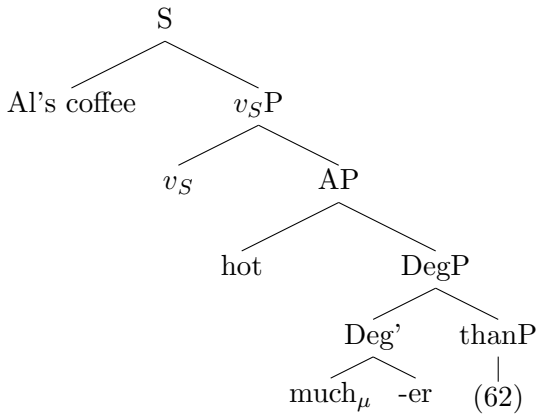
States, like other eventualities, are linked to individuals by thematic relations: for example, x is in a state of heat s only if x bears the right thematic relationship to s, and no other y is also in s. I assume that the morpheme v_S introduces what I will call the Holder relation that links states with their bearers ((58); Kratzer 1996, Husband 2012). Nothing hinges on this choice of label; the specific content of thematic relations generally is a yet unresolved issue (Kratzer 1996; cf. Dowty 1989).

(58) $[\![v_S]\!]^A = \lambda x \lambda s.\text{Holder}(s)(x)$ $\langle x, \langle v, t\rangle\rangle$

To see how the composition proceeds, consider the GA comparative in (59). I posit that the underlying syntax of (59) is very similar to that underlying nominal and verbal comparatives: *-er* first combines with *much*, which then combines with the *than*-clause, and the resultant complex combines with the GA. The simplified syntax I assume is as in (60), ignoring the copular verb.

(59) Al's coffee is **hotter** than Bill's is.

(60)



The interpretation of this sentence is derived as in (61), abbreviating the *than*-clause as δ, and $[\![Al's\ coffee]\!]$ as *ac*. The result is an existential statement about states of heat that Al's coffee is in, whose $A(\mu)$-measure is greater than δ.

(61) i. $[\![\text{Deg'}]\!]^A = \lambda d \lambda \alpha . A(\mu)(\alpha) \succ d$ IE,FA
ii. $[\![\text{DegP}]\!]^A = \lambda \alpha . A(\mu)(\alpha) \succ \delta$ i,FA
iii. $[\![\text{AP}]\!]^A = \lambda s . \mathbf{hot}(s)\ \&\ A(\mu)(s) \succ \delta$ ii,PM
iv. $[\![v_S\text{P}]\!]^A = \lambda x \lambda s . \text{Holder}(s)(x)\ \&\ \mathbf{hot}(s)\ \&\ A(\mu)(s) \succ \delta$ iii,EI
v. $[\![\text{S}]\!]^A = \lambda s . \text{Holder}(s)(ac)\ \&\ \mathbf{hot}(s)\ \&\ A(\mu)(s) \succ \delta$ iv,FA
vi. $= \top$ iff $\exists s[\text{Holder}(s)(ac)\ \&\ \mathbf{hot}(s)\ \&\ A(\mu)(s) \succ \delta]$ v,$\exists$

The structure of the *than*-clause of (59) is given schematically in (62). The internals of such clauses are exactly as presented in the previous section, except that the complex of *much* and ABS combine with a GA. The λ-abstraction by OP_i is given in (63), abbreviating $[\![\textit{Bill's coffee}]\!]$ as *bc*. Combining (63) with the interpretation of *than* is as in (64): it is the maximal degree that $A(\mu)$-measures a state of heat that Bill's coffee is in.

(62) [$_{thanP}$ than OP_i [Bill's coffee v_S hot [t_i [much$_\mu$ ABS]]]]

(63) $[\![\text{OP}_i\ [\text{ Bill's coffee } v_S \text{ hot } [\ t_i\ [\ \text{much}_\mu\ \text{ABS }]\ ]\ ]]\!]^A =$
$\lambda d . \exists s'[\text{Holder}(s')(bc)\ \&\ \mathbf{hot}(s')\ \&\ A(\mu)(s') \succcurlyeq d]$ PA

(64) $[\![[_{thanP} ...]]\!]^A = max(\lambda d . \exists s'[\text{Holder}(s')(bc)\ \&\ \mathbf{hot}(s')\ \&\ A(\mu)(s') \succcurlyeq d])$

Combining the two clauses delivers the truth conditions in (65), which says that (59) is true just in case there is a state of heat that Al's coffee is in, the $A(\mu)$-measure of which is greater than the maximal degree $A(\mu)$-measured by Bill's coffee. Since the measured entities are heat-states, measurement by TEMPERATURE is understood.

(65) $[\![\text{Al's coffee is } \mathbf{hotter} \text{ than Bill's coffee is}]\!]^A = \top$ iff
$\exists s[\text{Holder}(s)(ac)\ \&\ \mathbf{hot}(s)\ \&\ A(\mu)(s) \succ$
$max(\lambda d . \exists s'[\text{Holder}(s')(bc)\ \&\ \mathbf{hot}(s')\ \&\ A(\mu)(s') \succcurlyeq d])]$

This assumes, of course, that the measure function TEMPERATURE is as in (66). If $[\![\textit{global warming}]\!]$ and $[\![\textit{fever}]\!]$ are predicates of states of heat, then we can see why temperature is a licit dimension for nominal comparatives such as (67). I discuss dimensions like these with nominal comparatives more extensively in §3.4.

(66) TEMPERATURE : $D_v \mapsto D_d$

(67) a. We are experiencing **more global warming** than expected. TEMP
b. Mary has **more fever** now than she did 5 minutes ago. TEMP

On this account, sentences like those in (68a) and (68b) differ in their dimensions for comparison because of what is measured. (68a) involves measurement of the individual satisfiers of $[\![\textit{coffee}]\!]$, which, by monotonicity, leads to measurement by VOLUME, whereas (68b) involves measurement of the state satisfiers of $[\![\textit{hot}]\!]$, which leads to TEMPERATURE.

(68) a. Al drank **more coffee** than Bill did. VOLUME
b. Al drank **hotter coffee** than Bill did. TEMP

I do not provide a full account of the semantics of attribute adjectival comparatives here, but a sketch of how it might compare with that of nominal comparatives is given in (69). Abbreviating the *than*-clause as δ, the interpretation of *more coffee* would be as in (69a), and of *hotter coffee* as in (69b). The latter representation assumes something like a small clause, and an expression (or rule) that existentially binds the state variable of the adjective internal to the nominal phrase.

(69) a. $[\![\text{more coffee}]\!]^A = \lambda x.A(\mu)(x) \succ \delta$ & $\mathbf{coffee}(x)$
b. $[\![\text{hotter coffee}]\!]^A = \lambda x.\exists s[\text{Holder}(s)(x)$ & $\mathbf{hot}(s)$ & $A(\mu)(s) \succ \delta]$ & $\mathbf{coffee}(x)$

3.3. Morphosyntactic evidence

This theory of comparatives holds that the morpheme *much* introduces measure functions, regardless of the syntactic category of expression that the comparative morphology combines with. This is, in effect, a semantic account of the the morphosyntactic analysis given in Bresnan (1973). Thus, to the extent that Bresnan's analysis is successful, it supports the idea that GA and non-GA comparatives are semantically more similar than is often thought.[10]

Bresnan (1973) considers the class of comparative morphemes in the nominal domain, observing that all but one of them occurs with *much*, (70).[11] She suggests that this paradigm is explicable if the form *more* decomposes into two morphemes, *much* and *-er*: whenever portions of matter are compared, *much* is required.

(70) a. as much soup
b. too much soup
c. so much soup
d. that much soup
e. * more much soup

Yet, she notes: if *more* decomposes into *much* and *-er*, and given that forms like (71) are grammatical, the prediction should be that all of (72a)-(72d) are possible, contrary to fact. Instead, the grammatical mode of combining comparative morphemes with adjectives like *delicious* is as in (73).

(71) more delicious

(72) a. * as much delicious
b. * too much delicious
c. * that much delicious
d. * so much delicious

(73) a. as delicious
b. too delicious
c. that delicious
d. so delicious

To maintain the analysis of *more* as a composite of *much* plus *-er*, Bresnan posits the deletion rule in (74). This rule deletes *much* before adjectives (and adverbs), and applies after the rule that produces *more*. (If it applied in the opposite order, (74) would bleed that rule.) As a result, what is underlyingly *as much intelligent* surfaces as *as intelligent*.[12]

[10]Thanks to J. Lidz, p.c., for helping me to present Bresnan's arguments in a more readable form.

[11]I set aside discussion of the form *many*; Wellwood 2014 argues, based on crosslinguistic evidence, that it is a suppletive variant of *much*.

[12]Bresnan's analysis is situated within a model of grammar that posits the levels of Deep Structure and Surface Structure, but can be recast in terms familiar from contemporary Distributed Morphology; see Dunbar & Wellwood, submitted. Updating her account, the posited rule in (74) can be seen as morphophonological (or PF) in nature, and consequently not affecting LF interpretation.

(74) much → ∅ / __ A

Providing supporting evidence for this hypothesis, Bresnan considers the properties of *than*-clauses. She first notes the (independent) generalization that it is not possible to contract the copular form *is* to *'s* before a deleted constituent; consider the contrast between (75a) and (75b). In (75a), *happy* deletes and the form *is* surfaces; in (75b), the same deletion blocks the contraction.

(75) a. Al is happy, and Bill is Δ, too. Δ = happy
b. * Al's happy, and Bill's Δ, too. Δ = happy

Yet, it is not possible to contract *is* to *'s* in the *than*-clause of a GA comparative; contrast (76a) and (76b). On the hypothesis that there is a rule of *much*-deletion as in (74), the ungrammaticality of (76b) can be explained as an instance of whatever is responsible for (75b). If there were no such rule, (76b) would need an independent explanation.

(76) a. The cat is prettier than the dog is Δ ugly. Δ = much
b. * The cat is prettier than the dog's Δ ugly. Δ = much

Moreover, clauses headed by *as* or *than* can act as interveners for the rule in (74), as shown in (77a) and (78a). Here, the *as*/*than* clauses remain in situ, and the forms *as much*/*more* surface. If they extrapose to the right, as in (77b) and (78b), the conditions for the application of (74) obtain. Importantly, these pairs are not obviously semantically distinct: (77) express a possibility with respect to the plants' height, and (78) that John's height is at least 6 feet.

(77) a. These plants may grow **as much** as 6 feet **high**.
b. These plants may grow **as high** as 6 feet.

(78) a. John is **more** than 6 feet **tall**.
b. John is **taller** than 6 feet.

On Bresnan's proposal, the underlying structures of the strings in (77) can be given schematically as in (79), and those of (78) as in (80). Given the account of the semantics of *much* that I have presented, such structures are straightforwardly interpretable, yet they are not expected by any theory in which both *much* and GAs introduce measure functions.

(79) a. These plants may grow as much [as 6 feet] **high**
b. These plants may grow as ~~much~~ t_i **high** [as 6 feet]$_i$

(80) a. John is -er much [than 6 feet] **tall**
b. John is -er ~~much~~ t_i **tall** [than 6 feet]$_i$

Corver (1997) provides a tempting alternative to this analysis, in which the *much* that occurs in such sentences is not interpreted. Instead, *much* is systematically homophonous between a semantically active and a semantically inactive expression. In an example like (81b), he claims, 'dummy-*much*' is inserted to phonologically support the pro-form *so*. *much* cannot be interpreted here, the reasoning goes, since *so* resumes the (measure function-based) semantics of the GA.

(81) a. John is **generous**, in fact he is **too generous**.
b. John is **generous**, in fact he is **too much so**.

Despite their differences, both Bresnan and Corver posit the presence of a head that uniformly merges with comparative morphemes, regardless of the lexical category of expression that this morphology then combines with. They disagree on whether that head should be identified with the phonology of *much* or not. For present purposes, the relevant question is whether this head has a non-trivial semantics, or not. I assume that this head introduces monotonic mappings to degrees, and in what follows, I continue to refer to it as *much*.

3.4. much is appropriately general

On my account, no noun, verb, or GA denotes a measure function. Yet, if nominal and verbal comparative constructions were restricted to "extensive" or "quantity" dimensions for measurement, unlike GAs, such an account might be said to miss a generalization.[13] However, nominal and verbal comparatives are not, in fact, restricted to extensive dimensions, just as GAs are not restricted to intensive dimensions.

GA comparatives with *hot* and *hard* can give rise to dimensions like temperature and hardness (82), whereas nominal comparatives with e.g. *coffee* and *plastic* forbid them (83). If the (a) examples in (82) and (83) represent measures of coffee, and the (b) examples measures of plastic, then the GA comparatives would measure intensively and the nominal comparatives extensively.

(82) a. This coffee is **hotter** than that coffee is. TEMP,*VOL
b. This plastic is **harder** than that plastic is. HARD,*WEIGHT

(83) a. Al has **more coffee** than Bill does. *TEMP,VOL
b. Al has **more plastic** than Bill does. *HARD,WEIGHT

Yet, the reverse pattern also obtains. GAs like *full* and *heavy* give rise to extensive dimensions (84), and nouns like *heat* and *firmness* to intensive (85). Exactly the dimensions that were ruled out in (82) and (83) are possible simply by changing the GA or the noun.

(84) a. This glass is **fuller** than that glass is. *TEMP,VOL
b. This plastic is **heavier** than that plastic is. *HARD,WEIGHT

(85) a. This rock has **more heat** than that one does. TEMP,*VOL
b. This mattress has **more firmness** than that one does. HARD,*WEIGHT

Similarly, comparatives with adverbs like *fast* and *loud* give rise to the dimensions speed and loudness (86), whereas those with verbs *drive* and *sing* forbid them (87). If these examples uniformly represented measures of driving and singing events, then the adverbial comparatives would measure intensively and the verbal comparatives extensively.

(86) a. Al drove **faster** than Peter did. SPEED,*DIST
b. Al sang **louder** than Peter did. LOUD,*DUR

(87) a. Al **drove more** than Peter did. *SPEED,DIST

[13]Recall Rett's 2008 head, QUANTITY, with nouns (cf. Bochnak 2010). When the literature finds "intensive" dimensions with nouns and verbs, it tends to invoke the degree analysis. See Morzycki's 2005 discussion of *more of a fool* versus *?more of a person* (cf. Bolinger 1972), and discussion of *want* ϕ *more* in Villalta 2008 and Lassiter 2011.

b. Al **sang more** than Peter did. *LOUD,DUR

Yet, again, this pattern reverses: comparatives with adverbs can invoke extensive dimensions (88), and *more* with verbs can give rise to intensive (89). All we need to do is change the adverb or verb, and the dimensions for measurement are correspondingly different.

(88) a. Al drove **farther** than Peter did. *SPEED,DIST
b. Al's singing thundered **longer** than Peter's did. *LOUD,DUR

(89) a. Al **sped up more** than Peter did. SPEED,*DIST
b. Al's singing **thundered more** than Peter's did. LOUD,*DUR

Intensivity isn't available solely to GAs as such. And it can't be a diagnostic for the interpretation of a lexical item as a measure function. If it were, one would have to differentiate e.g. *as much fever* and *as much coffee* either by saying that (i) *much* sometimes goes uninterpreted (*as much fever*), or (ii) it is uniformly interpreted essentially as the identity predicate. If (i), we are tasked with saying precisely when *much* will be interpreted, and when not. (ii) is essentially the proposal of Cresswell (1976), which I discuss in §4.

The distinction between intensive and extensive measures is not predictable by syntactic category, and it's not clear what else it would be predictable from. Perhaps the differences in meaning between *rock* and *gold*, or *walk* and *run* should be of just the sort to give rise to different dimensions. After all, what differentiates some rock from some gold but a measure of purity, and what differentiates a walking from a running but the agent's speed? Yet, such sentences resist the plausible intensive dimensions, (90)-(91).[14]

(90) a. Al has **more rock** than Bill does. *PURITY,WEIGHT
b. Al has **more gold** than Bill does. *PURITY,WEIGHT

(91) a. Al **walked more** than Bill did. *SPEED,DIST
b. Al **ran more** than Bill did. *SPEED,DIST

On the account I offer, the observation of apparently intensive dimensions for measurement is not tied to a lexical item's logical type. This wouldn't track independent facts about the language, in particular the distribution of *much*. Since adjectives and adverbs do not seem ultimately "freer" than nouns and verbs in this respect, it is reasonable to say that *much* introduces measure functions here too.

3.5. Adjectives have a state argument

Finally, if *much* is present in GA comparatives, and if there it measures states, then GAs should have a distribution like that of other davidsonian predicates.

Indeed, GAs can appear with a variety of different modifiers, (92), which don't appear to be predicates of anything other than eventualities. Certainly not degrees, as those are not temporally or spatially located. Nor do they appear to be predicates of individuals: (92a) doesn't mean 'Al is happy and Al is in the morning', and (92b) doesn't mean 'Al is happy and Al is with Carl'. Further, at least some are not plausibly predicates of times: (92f) does not mean 'Al is happy at t and t is in the country but not in the city'.

[14]There is something of a debate surrounding (90). Schwarzschild 2006 agrees with the judgment reported, whereas Bale and Barner 2009 disagree. The relevant point could be made by contrasting e.g. *more coffee* versus *more [hot coffee]*; modifying the noun by *hot* doesn't suddenly allow for a comparison by temperature.

(92) a. Al is happy **in the morning**.
b. Al is happy **on the playground**.
c. Al is happy **with Carl**.
d. Al is happy **because Carl won the lottery**.
e. Al is happy **when Carl does well**.
f. Al is happy **in the country but not in the city**.

Moreover, there is positive evidence that these modifiers must be appropriately 'low'. Fults (2006) observes that they crucially must be interpreted within the scope of the comparative morpheme. (93) cannot be understood as comparing Al's degree of patience directed at Mary, spatially located in a certain way, with Bill's degree of patience simpliciter. Fults' extensive investigation of GA modification concludes that a state-based analysis of GAs best captures such data.

(93) Al is **more patient with Mary on the playground** than Bill is.

Supporting Fults' conclusion is the fact that the same types of modifiers routinely show up with verbal predicates like the "fake" stative *sit* (Parsons 1990) and eventive *run*, (94). In these cases, the modifiers are uncontroversially analyzed as expressing predicates of eventualities.

(94) a. Al **sat** with Mary in the morning on the playground in the country.
b. Al **ran** with Mary on the playground in the morning in the country.

The eventualities GAs predicate of, furthermore, are different from facts. Landman (2000) discusses statives like *in love with*, (95), in which the *it* in the last clause can't refer to *the fact that* Oedipus was in love with Jocasta, since in that case the dialogue should sound contradictory, contrary to intuition. Rather, the pronoun refers to *the state of* Oedipus being in love with Jocasta. This argument can be reproduced with a GA as in (96).

(95) Oedipus was in love with Jocasta. Though **the fact that he was in love with her** was a burden on his conscience, he had to admit that **it** felt good.

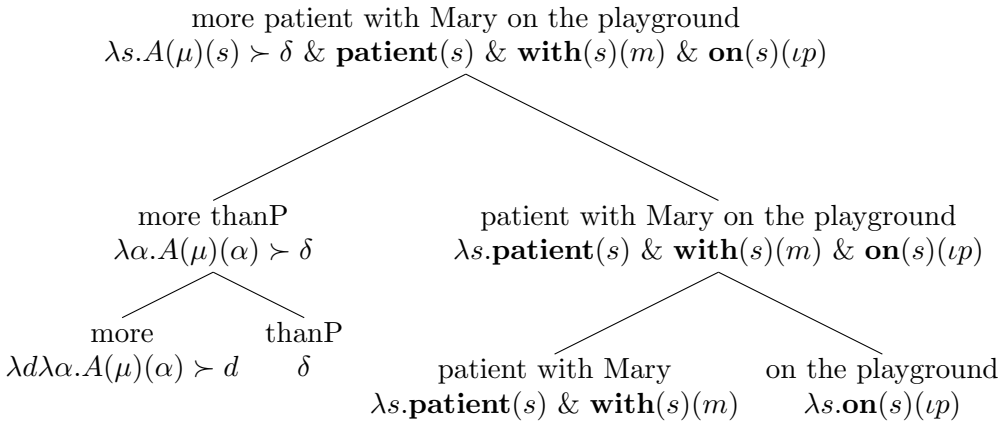
(96) Mary was very happy when John failed his defense. Though **the fact that she was happy** made her feel bad, still she had to admit that **it** felt good.

In sum, GAs do pattern like davidsonian predicates. And given such a semantics, it is straightforwardly possible to account for sentences in which they are multiply modified, for example the comparative in (93). I analyze this sentence as expressing a comparison of measures of patience-states that bear a certain thematic relation to Mary, and are spatially located in a certain way.

A sketch of the composition of the matrix AP of (93), abbreviating the interpretation of the *than*-clause as δ, is given in (97). The result is a predicate of states of patience s that bear certain relations to Mary, m, and the playground, ιp, and whose $A(\mu)$-measure is greater than δ.[15]

[15]I do not intend (97) to suggest that (i) would be semantically equivalent to (ii). The non-equivalence could be derived, I suspect, by further elaborating the structural heights at which *with*-phrases can attach, and the effects of structural height on interpretation. The *with*-phrase in (i) relates Mary to the state of patience

(97)



This interpretation is exactly parallel, modulo the type of eventuality modified and the specific content of the thematic relations, to the verbal comparative in (98a). Focusing just on the VP of (98a), I would assign it the interpretation in (98b).

(98) a. Al ran with Mary on the playground more than Bill did.
b. $\lambda e.A(\mu)(e) \succ \delta$ & **run**(e) & **with**$(e)(m)$ & **on**$(e)(\iota p)$

Landman (2000) was not concerned with the use of adjectives in comparatives, and so did not offer an opinion on how states might be measured. Fults (2006) did consider the context of comparative constructions, positing that degrees are introduced in adjectival comparatives by a covert predicate DEG, but didn't ultimately specify its semantics. Combining Landman's and Fults' theories with that offered here fills these gaps.

4. The alternatives

I have given a parallel treatment to GAs, nouns, and verbs in comparatives: all require *much* to introduce measures. Before continuing, I want to address two thoughts that may be on the minds of some readers. First, instead of interpreting *much*, we could just analyze it as semantically vacuous, and let the relevant noun, verb, or GA introduce its own measure function. Alternatively, we could abolish degrees from the theory altogether.

Cresswell (1976) (cf. von Stechow 1984) implements the first thought. He assumes that *much* is always present, following Bresnan (1973), but holds that it is essentially semantically vacuous: it simply marks the presence of the noun or GA's degree argument. This amounts to the idea that expressions like *water* and *tall* both lexically code for specific measures.

As he notes, however, this analysis predicts that pairs like (99a)-(99b) should be synonymous, contrary to fact. The difference in meaning between the two must be due to (at least) the presence of *much*, but this would be impossible if it made no positive semantic contribution (Cresswell 1976:290-1). In fact, on this account it isn't obvious that (99a) should even be interpretable.

itself ('patience *directed at/with respect to* Mary'), and in (ii) to the occasion of the state's holding ('on that occasion, being patient and *in spatiotemporal proximity* to Mary').

i. Al is patient with Mary.

ii. Al is patient and Al is with Mary.

(99) a. Drink **this water**.
b. Drink **this much water**.

On the account I advocate, *much* introduces degrees. Degrees can be demonstrated, as in (99b); there is no degree to demonstrate in (99a).

Reichenbach (1947) gives a semantics of comparatives stated directly in terms of orderings inherent to properties, with no reference to degrees. For him, individuals are the unique bearers of 'specific properties', which can themselves have higher-order properties. For example, he translates (100a) as (100b), which is read 'there is a specific property f of Al which itself has the MOVE property and the SLOW property'. He translates the comparative in (101a) as in (101b).

(100) a. Al moves slowly.
b. $\exists f[f(a)\ \&\ \mathbf{move}(f)\ \&\ \mathbf{slow}(f)]$

(101) a. Al is **taller** than Bill is.
b. $\exists f \exists g[f(a)\ \&\ g(b)\ \&\ \mathbf{tall}(f)\ \&\ \mathbf{tall}(g)\ \&\ f \succ g]$

The problem arises when we consider how the account might extend to equatives like (102a), as in ((102b); cf. Bartsch & Venneman 1972). The issue is in the stated identity between f and g: how can f and g be unique to Al and Bill, respectively, and yet nevertheless be identical? Even if $\succcurlyeq$ is replaced by $=$, the issue remains: Al and Bill's specific properties can never be identical, and still specific; yet, Al and Bill may have the same height.

(102) a. Al is **as tall** as Bill is.
b. $\exists f \exists g[f(a)\ \&\ g(b)\ \&\ \mathbf{tall}(f)\ \&\ \mathbf{tall}(g)\ \&\ f = g]$

This problem dissolves on an account of *-er* and *as* that appeals to degrees. Adopting Reichenbach's style for a moment, (102a) would translate as (103). Here, the states s and s' are uniquely related to their bearers by some thematic relation Θ, and the relevant identity is stated over the measures of those states, rather than over the states themselves.

(103) $\exists s \exists s'[\Theta(s,a)\ \&\ \Theta(s',b)\ \&\ \mathbf{tall}(s)\ \&\ \mathbf{tall}(s')\ \&\ \mu(s) = \mu(s')]$

5. Grammar in measurement

The theory in which *much* introduces degrees expects grammar to directly affect which dimensions for comparison are possible. The data I now consider are cases where grammatical shifts make available comparisons by number. In each case, I suggest that pluralities are measured. If pluralities are distinct from the entities comprising them (though what this distinction amounts to is contentious), this type of dimension is expected.

Adding the plural morpheme to a noun in a nominal comparative (104b) is enough to rule out dimensions that were possible without it, (104a). This addition of functional structure changes what is being talked about—ordered masses in (104a), versus ordered pluralities in (104b). Correspondingly, which dimensions are possible change: with *rocks*, only measurement by NUMBER is possible (cf. Bale and Barner 2009).

(104) a. Al found more **rock** than Bill did. WEIGHT,VOL,*NUM
b. Al found more **rocks** than Bill did. *WEIGHT,*VOL,NUM

Parallel effects in the verbal domain are obscured by the fact that the verbal plural in English is covert (e.g. Ferreira 2005). *run* with an *in* adverbial allows for measurement by TEMPORAL DURATION or NUMBER (105a), reflecting an ambiguity between derivations with and without the covert plural. With a *to* adverbial, only NUMBER is possible (105b): singular telic predicates are uninterpretable in the comparative (see §2.2, and Wellwood et al. 2012), and so (105b) must reflect the presence of the verbal plural.

(105) a. Al ran **in the park** more than Bill did. DIST,DUR,NUM
b. Al ran **to the park** more than Bill did. *DIST,*DUR,NUM

As well as playing a restrictive role, grammar can be expansive. Unlike the mass-count flexible *rock*, comparatives with count nouns like *idea* have no stable interpretation, despite the conceptual plausibility of measurement by PROFUNDITY or NUMBER in such contexts, (106a). Yet, adding the plural morpheme allows ideas to be compared in terms of their number, (106b).[16]

(106) a. ? Susie has more **idea** than Al does. *PROFUND,*NUM
b. Susie has more **ideas** than Al does. *PROFUND,NUM

Again using temporal modifiers, a similar effect can be observed in the verbal domain. Telic predicates like *form a triangle* with a punctual adverbial cannot be used with *more*, (107a). Such adverbials locate a singular event in time, and singular events are incompatible with *much*. In contrast, with a durative adverbial, a comparison by number is possible (107b): *that day* provides a temporal span during which a plurality of events can occur, and so the verbal plural is inferrable.

(107) a. ? **Then** the girls formed a triangle more than the boys did. *SIZE,*NUM
b. **That day** the girls formed a triangle more than the boys did. *SIZE,NUM

Both restrictive and expansive roles can be found in the adjectival domain. A gradable adjective like *drunk* is perfectly interpretable with *more* pre-posed as in (108a), and is interpreted in terms of degrees of drunkenness. With *more* post-posed, this pattern reverses: (108b) cannot be understood as a comparison in terms of degrees of drunkenness, but it can be understood as a comparison of the numbers of occasions on which Al and Bill were in states of drunkenness.

(108) a. Al is **more drunk** than Bill is. DRUNKEN,*NUM
b. Al is **drunk more** than Bill is. *DRUNKEN,NUM

On the other hand, non-gradable adjectives like *pregnant* cannot be interpreted as comparisons of degrees of pregnantness per se, (109a). Yet, if *more* occurs post-adjectivally, the sentence canonly be read as a comparison of numbers of occasions on which Al and Susie were pregnant, (109b).[17]

(109) a. ? Al was **more pregnant** than Susie was. *PREGNANT,*NUM
b. Al was **pregnant more** than Susie was. *PREGNANT,NUM

[16]Thanks go to an anonymous reviewer for *L&P* for suggesting this example; a previous draft suggested, among other things, use of the Universal Grinder.
[17]Any reading in terms of temporal duration is likely coercive.

Finally, grammar can have more elusive effects. There are a few rare adjectives that can appear in comparatives and lead to a comparison by number, such as *abundant*, (110a), and *numerous*, (110b). Comparatives with *abundant* are only interpreted so when its subjects are plural, however. With mass noun subjects, only a dimension like volume is possible, (111a), and *numerous* is odd, (111b).

(110) a. **Happy girls** were **more abundant** than sad girls. NUM,*VOL
b. **Happy girls** were **more numerous** than sad girls. NUM,*VOL

(111) a. **Oil** is **more abundant** here than gasoline is. *NUM, VOL
b. ? **Oil** is **more numerous** here than gasoline is. *NUM,*VOL

Changing the grammatical context in which the comparative occurs routinely affects the dimensions for comparison that are available to interpretation. On the theory I've offered, *much* is sensitive to what is talked about, and how it's ordered. A restriction to measurement by NUMBER, I have suggested, indicates measurement of pluralities, whatever they end up being exactly. I cannot provide a full account here, though see Wellwood 2014 for an attempt.

What of the ordering on pluralities? Plural predicates are cumulative: if some entities$_x$ satisfy $[\![cups]\!]$ and some entities$_y$ satisfy $[\![cups]\!]$, then they$_{x+y}$ satisfy $[\![cups]\!]$. This suggests that pluralities are ordered by what we might call the 'plural part-of' relation, whether this ultimately means individual part-of (Link 1983), the subset relation (e.g. Winter 2001), or something else.[18] Regardless, NUMBER is monotonic on such orderings (Schwarzschild 2006): smaller pluralities have a smaller number than larger pluralities.

Regardless, these effects are important because, in many cases, it's not at all obvious that the pattern could be pinned on any particular lexically-specified measure function.

6. Responses to possible objections

6.1. Bare occurrences of GAs

Interpreting GAs as predicates of states (simpliciter) might, on the face of it, incorrectly predict a weaker meaning for such occurrences than is observed. Why don't (112) just express that there is a state of height that Al is in (e.g. $\exists s[\textsc{tall}(s)$ & $\text{Holder}(s)(a)]$), which is trivially true if Al physically exists?

(112) a. Al is **tall**.
b. Al is a **tall** man.

There are at least three ways of approaching this question, which I discuss focusing on the copular construction.

The first would be to accept that, indeed, such sentences would have a trivial interpretation, and so receive strengthened interpretations in context. Such an avenue is pursued by Panzeri and Foppolo (2012) and Panzeri et al. (2013) to explain otherwise puzzling developmental data. They found that 3 year-old children treated novel objects of any size as positive instances of adjectives like *tall* or *short*, and that adults could be made to act the

[18] I'm not sure exactly how this discussion extends to Gillon's 1992 'aggregates' theory, or to Boolos' 1984 'plural variable' theory.

same way when it was made clear that informativity was not at stake.[19] On such accounts, children start out with a literal (i.e., weak) meaning for GAs, and as pragmatic competence develops, they strengthen this meaning in context, as adults generally do.

The second would be to posit that there is a covert *much* with bare adjectives, which is deleted by the same rule that applies in adjectival comparative constructions with, e.g., *as*, *too*, and *how*, as well as a covert POS morpheme (see von Stechow's 1984 analysis of sentences like *Much gold fell off the counter*).

The third option would be to blame the construction itself. In (113a), the relevant argument is understood to meet some minimal standard of validity, while in (113b), it exceeds some significant standard. Why? Perhaps certain constructions require a notion of 'exemplification' that other, minimally contrasting constructions don't (see Schmidt et al. 2009 for evidence that bare GA predications require 'indifference' with respect to the superlative exemplar of a category in context). Other such pairs (*beauty/beautiful*, *intelligence/intelligent*, etc) can be constructed.

(113) a. This argument **has validity**.
b. This argument **is valid**.

Regardless, some general observations suffice to support the idea that bare adjectival constructions should not be analyzed as degree constructions at all. For one, appeal to degrees with bare GA occurrences suggests a precision and crispness that such occurrences lack (see Fults 2006 and Kennedy 2007 for data, discussion, and arguments). For another, data from Navajo suggest that such copular predications are very different from other GA comparatives. Navajo GAs are marked by either 'comparative' or 'absolute' aspect; when they appear bare, a GA like *tall* can only take absolute aspect, yet other Navajo comparative constructions (the comparative, equative, etc.) require comparative aspect (Bogal-Allbritten 2013).

6.2. MP constructions

How are sentences like (114) interpreted, if *tall* does not introduce a measure function? If expressions like *6 feet* denote a degree, it can saturate the degree argument of ABS (on the measure function analysis employed here), or $[\![tall]\!]$ (on the individual-degree relation analysis).

(114) Al is **6 feet tall**.

Very few gradable adjectives appear in the measure phrase (MP) construction, as Schwarzschild (2005), Bale (2006), and Beck (2011) point out. Theories that posit degree arguments in the lexical semantics of GAs fail to predict this pattern; yet, witness the ungrammaticality of examples like (115). Meanwhile, every GA that is anomalous or ungrammatical in the MP construction is fine with MPs in the comparative (*This rock is two pounds too heavy/a thousand dollars more expensive than that one*).

(115) a. * Al is **160 pounds heavy**.

[19]Here's how they did this. They presented adults with an alien puppet who, they said, is just learning the language, and tasked them to say of his statements whether they were correct or not. However, they should not say he is incorrect when what he says is just "not optimal" yet strictly speaking "true", i.e., in cases where a scalar implicature is violated.

b. * That book is **a thousand dollars expensive**.

c. * The temperature is **99 degrees Fahrenheit hot**.

Meanwhile, GAs can be productively modified by an XP that picks out an entity or state of affairs that typifies some standard, for example (116). The present account could be expanded to handle such facts by appealing to equivalence classes of states (cf. a proposal briefly entertained in Bale 2006): (116a) could be paraphrased as 'Al is in a state of heaviness that it is in an equivalence class with a state of heaviness that Andre-the-Giant is/was in'. Regardless, there is no obvious sense in which expressions like *Andre the Giant* or *dinner at the Ritz* are degree-denoting.

(116) a. Al is **Andre-the-Giant heavy**.

b. Our meal was **dinner-at-the-Ritz expensive**.

c. The temperature is **Florida hot**.

To capture the exceptional cases in which MPs do combine with a GA, the present account could be augmented with a lexically-specified type-shifting rule (see Schwarzschild 2005 for a proposal like this): perhaps MPs can be lifted to the type of individuals or states in restricted cases, and then combine with GAs by a similar mechanism as would capture (116).

6.3. very

The analysis of GAs as expressing measure functions allows for a tidy explanation of why expressions such as *very* combine with GAs directly, but not with nouns and verbs. Indeed, *very* is often used to test for measure function-denoting expressions. What are such tests diagnosing?

Suppose that *very* is a comparative morpheme, on a par with *-er*, *as*, etc.[20] On my account, this means that it must combine with *much* before it combines with an expression of any other category. Indeed, *much* is required with *very* when that expression modifies nouns and verbs, (117). It is prohibited in (118) for the same reason that it can't surface with *as*: obligatory *much*-deletion (Bresnan 1973).[21]

(117) a. Al didn't eat **very *(much) soup**.

b. Al didn't **run very *(much)**.

(118) Al wasn't **very (*much) intelligent**.

If in Corver's (1997) examples, *so* resumes the semantics of *generous*, then (119) suggests the same conclusion.

(119) John is **generous**, in fact he is **very *(much)** so.

[20]For the semantics of *very*, see discussion and proposals in Wheeler 1972, Lasersohn 1999, Katz 2005, Kennedy and McNally 2005, Bale 2006, and references therein.

[21]These examples use a negative environment for illustration, because bare *much* is odd in positive contexts. Instead of *Al ate (very) much soup*, English speakers say *Al ate a lot of soup*. I have no explanation for this. Solt 2009 discusses this NPI-like behavior.

6.4. Scalar change verbs

Several authors have profitably appealed to 'degree scales' to spell out the interpretation of certain classes of verbs. To the extent that the interpretive pattern of such verbs is like that of GAs, such an extension of the measure function-based account is warranted. What are these authors detecting, if not scale structure?

Rappaport Hovav (2008) suggests a scalar analysis for verbs involving what she calls 'property scales' (e.g., *lengthen, shorten, dim*; see Dowty 1979 for discussion in terms of 'degree achievements', also Hay et al. 1999, Kennedy and Levin 2008) and those involving 'path scales' (e.g., *ascend, descend, enter*).[22] Uses of such verbs imply that an entity is in a state at time t' that is 'degrees different' from a qualitatively similar antecedent state at t.

(120) a. The tailor **lengthened** the dress.
b. The balloon **ascended**.

Yet, such verb phrases do not combine directly with comparative morphemes: like other verbs, they require *much*, (121). As Rett (2013) notes, if these expressions associate with scales, they must do so in a different fashion than GAs do.

(121) a. The pants were **lengthened as *(much)** as the dress was.
b. The balloon **ascended as *(much)** as the kite did.

In general, degree-based accounts of 'scalar change' verbs first assume an analysis of GAs in terms of measure functions, look towards verbal predications to see if they have GA-like properties, and, detecting such properties, analyze the relevant verbs as having a degree semantics. Yet, the same reasoning can be applied with a different starting assumption: that GAs are predicates of states. Then, the questions would include: how are states involved here, and what makes them measurable?

Meanwhile, the examples in (121) have (in addition to their 'degree' readings) the kinds of readings that we have come to expect from eventive comparatives. Consider (122), with *for*-adverbials used to ensure an atelic interpretation of the verb phrase. Assuming that the sentences in (122) are true, and knowing nothing about how much longer the pants or the skirt actually became, there is nevertheless a reading of (123) that is intuitively true.

(122) a. The pants were lengthened **for an hour**.
b. The skirt was lengthened **for 45 minutes**.

(123) The pants **were lengthened more** than the skirt was.

A promising avenue of research might be to investigate whether verbal forms like these mask a stative and an eventive component, each of which may be targeted by $A(\mu)$ in the comparative. Measuring the stative component in (121a) results in a comparison by length, and measuring the eventive component in (123) results in a comparison by temporal duration.

6.5. Fine-grainedness

Lastly, how can a conjunct like '$A(\mu)(s) \succ \delta$' be true or false, independent of the linguistic specification of what type of state s is?

[22]There are also those involving 'extent scales'. See discussion in Hay et al. 1999, Caudal and Nicolas 2005, Piñón 2008, Bochnak 2010, and Henderson 2013.

This question is reminiscent of one found in the neodavidsonian literature, usually when thinking about thematic relations like Agent (see Pietroski 2014 for detailed discussion). Adapted to the present context, one answer is to say that, naïve intuitions aside, there really are just very many different sorts of states (cf. Parsons 1990), and a tallness state just isn't, for example, the same thing as a wideness state.

The second type of solution involves relativization of $[\![much_{\mu}]\!]^{A}$ to predicates (cf. Schein's 2002 perspectives, or scenes, on events). In the present context, that would mean that the GA comparative involves something more like '$A(\mu)(P)(s) \succ \delta$', for any P, read 'the $A(\mu)$-measure of s relative to the description P is greater than δ', making the requisite changes to the surrounding syntax and semantics.

I assume that the individuals, events, and states that $A(\mu)$ predicates of are fine-grained enough to do the semantic work required of them. If this seems too ontologically profligate, the account can be recast within a relativist's aesthetic.

7. Conclusion

I have considered the semantics of degree constructions with expressions like *-er* and *as* across their nominal, verbal, and adjectival occurrences. I proposed that, across these occurrences, *much* introduces measure functions. The theory provides, among other things, a sense of why *much* appears everywhere with degree words in English (even when it doesn't always seem so): it is required to introduce degrees for elaboration by expressions like *-er* and *as*.

This proposal is not challenged by the intuition that the gradability of adjectives (and adverbs) is fundamentally different from that of nouns and verbs. That intuition tracks a felt difference between the "sorts of things" that *much* measures, which are, to be sure, quite different. From a formal perspective, however, *hot*/*fast* apply to things that come in various levels/extents along the relevant dimensions, and *coffee*/*run* apply to things that come in various levels/extents along the relevant dimensions. What sorts of things they are doesn't, however, play a crucial role in logical form.

The theory leads to a different notion of 'measurement' in semantics than is usually employed. Instead of a variety of measure functions acting on the same objects (portions of coffee, soup, etc) in unpredictable ways, rather, according to the present analysis, language encodes measurement of very different sorts of things in limited ways. Since even GAs introduce 'measurables', measurement is here uniformly understood as a monotonic mapping from ordered sets of entities, events, or states to degrees (cf. Berka 1983).

The proposal holds that some things are not measurable, and it thus provides an account of when degree constructions will be semantically anomalous. On contemporary degree-theoretic approaches, anomalies are explained differently depending on the lexical category of the expression targeted for measurement: GAs are felicitous just in case they express measure functions, while nouns and verbs are so only if they satisfy the definedness conditions of (something like) *much*. On the present theory, the GA/non-GA pattern is reduced to the nominal and verbal pattern.

The account is suggestive of contemporary theories that posit a substantial role for syntax in determining semantic relations (see especially Borer 2005b), and, with some modifications, to semantic theories that restrict much of meaning composition to conjunction of one-place predicates (Pietroski 2010, 2012). Such theories might offer a framework for understanding

why we would see a *much*-based strategy for degree constructions in the first place, rather than lexicalization of gradable expressions as measure functions directly.

Correspondingly, the theory could support straightforward syntactic bootstrapping hypotheses in language acquisition (Gleitman 1990, a.o.; see Borer 2004 for pertinent discussion). Once a child has acquired the meanings of expressions like *-er* and *as*, this knowledge can guide her hypotheses about the meaning of novel adjectives, nouns, etc. For instance, presenting a child with *This one is more gleeb-y than that one* or *This one has more gleeb than that one*, she might infer that the adjective refers to a gradable property, or that the noun is mass.

In the end, these thoughts suggest a bold conjecture about what we should expect to see cross-linguistically: no language should lexicalize open-class expressions as measure functions. This runs contrary to the hypothesis of Beck et al. (2010), in which languages vary parametrically in this way; this idea is taken up by Bochnak (2013) to explain the absence of degree constructions in languages like Washo. The present theory would suggest that this can't be the right analysis. However, I leave consideration of the matter for the future.

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