COMPARISONS OF NOMINAL DEGREES

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There are two fundamentally different kinds of comparison: DIFFERENCE comparisons and CONTRAST comparisons. Unlike adjective phrases, noun phrases can occur in contrast comparisons (such as *This bird is more a duck than a goose*), but not in difference comparisons (*#This bird is more a duck than that one is*), where the mediation of a partitive particle is necessary (as in *more of a duck*). The problem is that postulating either semantic gradability or even just ad-hoc, metalinguistic, gradable interpretations for nouns in order to capture the meaning of contrast comparisons results in wrong predictions for difference comparisons and for most other gradable constructions (*#very duck*, *#too duck*, *#duck enough*, *#the most duck*). This article presents an account that exploits the psychological notion of a CONTRAST SET to explain these data and to correctly predict the truth conditions and characteristic inference patterns of contrast comparisons. Two main conclusions are, first, that if adjectives are degree expressions, so are nouns, and second, that nouns form a different type of degree expression.*

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1. COMPARISON CONSTRUCTIONS WITH ADJECTIVES AND NOUNS. This article addresses the differences between the comparison constructions in which nouns and adjectives participate, and the differences between nouns and adjectives that explain them.[1] It only deals with comparisons of the degree to which entities exemplify adjectives or nouns (as in e.g. *taller* or *more a student than a teacher*). It sets aside cardinality comparisons (as in e.g. *more students than teachers came*; cf. Wellwood 2014) and partitive comparisons in which *more* takes a PP complement instead of a nominal one (as in *more of a bird*, but see discussion in §4.2). The primary focus is therefore on the circumstances in which noun phrases directly combine with *more* to express degree relations.

It is proposed that there are two different semantic types of comparison. The most widely investigated type is based on the calculation of the difference between two degrees or degree intervals. Adjectives typically participate in this type of comparison (as in *slightly taller* or *a lot more beautiful*), including, in particular, adjectives like *tall*, which are associated with a unique dimensional scale open at one or two sides (e.g. height).

Difference comparisons are typically WITHIN-PREDICATE COMPARISONS, namely constructions like 1a, whose interpretation involves a comparison of degrees of two different entities in the dimensional scale of a single predicate. By contrast, BETWEEN-PREDICATE COMPARISONS are constructions like 1b, which involve a comparison of degrees of either one or two entities in the dimensions of two different predicates. The two adjectives in 1b can cooccur in this type of comparison because they share a scale and a unit. But many adjective pairs exhibit incommensurability—failure to felicitously cooccur in between-predicate comparisons, as illustrated in 2 (Kennedy 1999).

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[1] This article develops a preliminary idea from my dissertation (Sassoon 2013) and the proceedings of TbiLLC 2013 (Sassoon 2015), supports it with new data, and presents new syntactic and semantic accounts.

(1) a. The sofa is (two inches) longer than the table (is).
b. The sofa is (two inches) longer than {it, the table} is wide.
(2) #The table is longer than the sofa is heavy.

Nouns and noun phrases—the main focus of this article—behave differently. They do occur freely, even more freely than dimensional adjectives do, in between-predicate comparisons, such as the naturally occurring examples 3a (from the internet) and 3b–e (from the Corpus of Contemporary American English (COCA; Davies 2010–)).

(3) a. [a description of a drawing] … she is *more an insect than a droid*[2]
b. … it's *more a sound than a word*—zigazigaziga (COCA, 2015 news)
c. In modern Italy the godparent is *more a friend than a parent* (COCA, 1995 academic)
d. The author is *more a philosopher than a historian* (COCA, 2014 academic)
e. He is so pale and waxen, *more a ghost than a man* (COCA, 1997 fiction)

At the same time, most of the degree morphemes that classically combine with adjectives are incompatible with nouns (#*ducker*, #*duckest*, #*too duck*, #*very duck*). The situation persists across languages. For example, the Hebrew equivalents of the examples above are equally odd (#*yoter barvaz*, #*haxi barvaz*, #*barvaz miday*, #*meod barvaz*, respectively; see Baker 2003 for crosslinguistic data). In particular, within-noun comparisons such as 4a and its Hebrew equivalent 4b are infelicitous. In English, for a within-noun comparison to be felicitous, the noun must occur as the complement of a preposition, such as *of* in 5. Languages like Hebrew do not have this construction.

(4) a. #The rightmost bird is more a duck than the leftmost bird.
b. #Ha-cipor ha-yemanit hi yoter barvaz me-ha-cipor ha-smalit.
the-bird the-right is more duck from-the-bird the-left
'The rightmost bird is more a duck than the leftmost bird.'
(5) The rightmost bird is more *of* a duck than the leftmost bird.

Interestingly, the felicity of within-noun comparisons such as 4a,b—namely comparisons with bare nouns (i.e. nouns not modified by *of*, *typical of*, *much of*, or the like)—improves significantly in contexts that trigger a shift away from the noun's literal interpretation. Thus an utterance of 4a, which is odd in the context of real ducks, significantly improves in the context of toy ducks, and the Hebrew 4b becomes completely felicitous. The status of the noun *barvaz* 'duck' with other degree morphemes improves as well. Once a literal interpretation is enforced, however, comparison and degree morphology more generally become clearly infelicitous again, as in uses of 6 in the context of toy ducks. Thus, default literal interpretations of nouns are typically incompatible with the semantics of within-predicate comparison morphemes and similar degree morphemes.

(6) #The rightmost bird is more a *toy* duck than the leftmost bird.

Indeed, experimental evidence suggests that, generally, adjectives are more felicitous in within- than in between-predicate comparisons, while in nouns the situation is reversed. An acceptability-judgment survey with twenty nouns (Sassoon 2017) reveals that single-entity between-noun comparisons such as 7a are significantly more acceptable than within-noun comparisons such as 7b, which in turn are considerably more acceptable than two-entity between-noun comparisons such as 7c. In addition, within-adjective comparisons are more acceptable than all nominal comparisons and between-adjective comparisons (e.g. *more American than Italian*).

[2] IvanksMW, September 17, 2007, *Deviant Art*, 'Queen of blades again'; http://ivanksmw.deviantart.com/art/Queen-of-Blades-Again-65174912.

(7) a. Chevy is more *a car* than *a truck*.
b. #This Chevy is more *a car* than that Chevy.
c. ##This Chevy is more *a car* than that Chevy is *a truck*.

Also, the uses of *more a* or *more a noun than* in COCA clearly suggest that the construction in 7a is used more often than the ones in 7b,c (but these data await a more systematic quantitative study). These data pose a problem that this article sets out to address. The problem is how to account for the felicity of nouns in between-predicate comparisons, while capturing their infelicity in within-predicate comparisons. As §4 illustrates, a postulation of even just ad-hoc, contextual, metalinguistic, last-resort gradability to capture an example like 7a results in wrong predictions for 7b,c.

Thus, an alternative account is proposed whereby nouns officially denote degree expressions. Their scales are neither metalinguistic nor ad hoc. Rather, they are tightly related to categorization under them. However, typical adjectival comparisons are based on calculation of degree differences, while nouns are merely ordinal—they are associated with scales that do not represent degree differences, resulting in infelicity of within-noun comparisons like 7b.

Moreover, it is proposed that the analysis of between-noun comparisons such as 7a must involve orderings based on at least two nominal predicates in order to block the possibility of felicitous usage of within-noun comparisons such as 7b, which only have one predicative argument. It is proposed that the semantics of between-predicate comparisons is mediated by cognitive mechanisms recruited in tasks involving the partitioning of a domain of entities into contrasting categories like *mammal*, *bird*, and *reptile*, or *car* and *truck*.

The cognitive psychological research of concepts and categorization shows that categorization under a nominal predicate like *car* may be different in the context of the CONTRAST SET {car, truck} vs. the contrast set {car, bicycle, boat}, or in a context with no salient competing alternatives at all (Rosch & Mervis 1975, Tversky 1977, Hampton 1998, Gärdenfors 2000, 2004, Murphy 2002, Stewart & Brown 2005, Voorspoels et al. 2012). Contrast-based categorization proceeds in such a way that entities classify in the category whose prototype they resemble most. The prototype need not stand for any actual entity. It is merely a combination of dimensional values representing an ideal category member.

Between-noun comparisons have some additional challenging properties that any semantic representation of these constructions should capture. The first one is the fact that the noun phrases *bird* and *mammal* in examples like 8a are INTERPRETED OPAQUELY. The existence of no actual bird or mammal in the context of evaluation follows.

The second property of such comparisons is the already indicated PREFERENCE FOR SINGLE ENTITY-ARGUMENTS. Speakers clearly prefer the construction in 8a to the one in 8b (cf. 7a,c).

(8) a. This creature is more a bird than (it is) a mammal.
b. #This creature is more a bird than that one is a mammal.

A third property is a strong INFERENCE WITH A METALINGUISTIC FLAVOR. From 8a, it follows that *bird* is a better label for the given creature than *mammal* is. For this reason, the speaker prefers to call the creature a bird rather than to call it a mammal. However, this preference seems to stem from external, intersubjective states of affair that indicate the creature's relative distance from two labels' prototypes. For example, utterances 9a–b express judgments about external affairs, as opposed to subjective preferences based on personal interests or desires.

(9) a. … we have evidence in the fossil record that put this species closer to reptiles in traits that it has … So it is *more a reptile, than a bird*, even if it looks like a bird.[3]

b. a sagging bunk bed, a straight chair with turned legs, a shelf of books, a sink, and a gas fired hotplate—*more a cell than a room* (COCA, 2015 fiction)

A fourth property is a NEGATIVE FLAVOR. An utterance of a comparison like 9a often suggests that the two nominal labels are suboptimal. Otherwise, perhaps the speaker would have simply asserted a classification form, as in 10.

(10) This creature is a reptile/(not) a bird.

The fifth property regards the much WEAKER IMPLICATIONS of two-entity comparisons, such as 8b. These comparisons are felt to be less useful, informative, or to the point, for it is not clear what can be inferred from them (if 8b is true, then what??). This observation is explained in more detail in §3.2.

Finally, contrast comparisons come in slightly DIFFERENT FLAVORS, depending on the nature of the contrasting predicates. In particular, nominal concepts like *philosopher* and *linguist* tend to be associated with overlapping sets of entities, and their contrast comparisons tend to have readings based on dimension-set cardinalities. For example, 11a is true on this reading if and only if the researcher in question has more properties of *a linguist* than of *a philosopher*. The question is whether *more* here should be analyzed in the same way as in other cardinality comparisons such as 11b. In addition, readings based on dimension-set cardinalities prevail in partitive comparisons like 11c. In 11d, the subject is intuitively a president, not a dictator, but one with more dictator properties than president properties.

(11) a. This researcher is more a *linguist* than a *philosopher*.

b. We have more *linguists* than *philosophers* in the group.

c. This researcher is more **of** a *linguist* than {that one, a philosopher}.

d. He is really more **of** a *dictator* than a *president*. (COCA, 2013 news)

No study I am aware of has looked at the semantic differences between contrast and partitive comparisons (for their morphosyntax see Doherty & Schwartz 1967). Section 4 suggests that their shared cardinality reading does not justify a uniform semantic analysis. Rather, it has a different source in each case.

Furthermore, distinct inference patterns characterize *more* and *less* comparisons of nouns labeling overlapping vs. disjoint categories. To consider one example, the nouns in 12c,d are associated with potentially overlapping categories (*toy* and *computer*), as opposed to the disjoint categories associated with the nouns in 12a,b (*mammal* and *bird*). Intuitively, whenever 12a is true (e.g. assuming the dolphin closely resembles the prototype of a fish and thus does not resemble a bird, while the platypus mildly resembles both a bird and a fish), 12b also seems to be true. But when 12c is true, 12d can be clearly false. A generalized definition of a contrast set is proposed that captures the two types of inference pattern.

(12) a. The dolphin is more a fish than the platypus is a bird. ⇒

b. The dolphin is less a bird than the platypus is a fish.

c. My iPhone is more a toy than my abacus is a computer. *not* ⇒

d. My iPhone is less a computer than my abacus is a toy.

[3] Balstrome, October 2005; http://mybroadband.co.za/vb/showthread.php/220582-Darwinius-The-fake/page18.

The proposal in this article is situated within the dominant degree approach to comparison and gradability, which provides compositional analyses of semantics for comparison constructions with gradable adjectives (von Stechow 1984, 2009, Kennedy 1999, 2007, Heim 2000, Schwarzschild & Wilkinson 2002, Schwarzschild 2005, Solt 2009, Bochnak 2010, Beck 2011). In order to analyze nouns and contrast comparisons, the article adopts into this framework mechanisms for clustering entities into contrasting categories using a formalism of prototypes in conceptual spaces. These mechanisms have been developed and used broadly in different disciplines, including, in addition to linguistics and psychology, biology, physics, and computer science, where they are used for mining large data sets (Gärdenfors 2000, 2004, Voorspoels et al. 2012).

The structure of the article is as follows. I first present standard assumptions about the semantics of adjectives and adjectival comparisons and explain why they do not work for nouns (§2). Adjectival comparisons involve computations of degree differences, whereas noun phrases are ordinal—their scales are incompatible with these computations. Section 3 uses a formalism of conceptual spaces, prototypes, and contrast sets to provide gradable representations for noun phrases and a compositional semantics for nominal comparisons that captures their properties. Additional data and consequences are delved into in §4, including inference patterns of different contrast comparisons, and semantic differences between contrast and partitive comparisons. Finally, I argue in §5 that the proposal improves upon other analyses in that it does not overgenerate.

2. ADJECTIVAL COMPARISONS, DATA, AND FORMAL ANALYSIS.

2.1. ORDINARY ADJECTIVAL COMPARISONS AS DIFFERENCE (VS. CONTRAST) COMPARISONS. The adjectives in the felicitous between-predicate comparison in 1b, *The sofa is (two inches) longer than* {*it*, *the table*} *is wide*, are associated with measurements of length and width. The degrees in these two measurement scales align by virtue of a common unit, namely the length of a conventional object, such as the part of any inch ruler representing a single unit. The ratio between the length of an inch and the length of an entity is a number that can be meaningfully compared to the ratio between the length of an inch and the width of an entity.

Similarly, in 13a, the degree to which a ladder is (not) tall compares to the degree to which a house is (not) high (Büring 2007, Heim 2008), for *tall* and *high* share a unit. In 13b, the two adjectives are interpreted as measuring deviations from a midpoint—the correct time—in different directions (Kennedy 1999). Again, a common unit (for example, second or minute) allows for comparison of the degrees to which one clock is fast and another is slow with respect to the actual time. By contrast, the adjectives in the infelicitous comparison in 2, #*The table is longer than the sofa is heavy*, are associated with measurements that do not share a standard unit. Therefore, a unit-based comparison is impossible.

(13) a. The ladder is shorter than the house is high.
b. My clock is faster than yours is slow.

These examples reveal the importance of DEGREE DIFFERENCES in the interpretation of adjectives. Our conceptualization of the world is sensitive not only to the ordering determined by the length of entities, but also to the differences between their lengths, as well as the ratios between these differences. This fact renders adjectives compatible with gradability morphemes whose interpretation is mediated by degree-difference operations.

Indeed, on a widespread view (von Stechow 1984, Schwarzschild & Wilkinson 2002, Kennedy & McNally 2005, Schwarzschild 2005, Kennedy & Levin 2008), an example like 1b conveys that the DIFFERENCE between the length of the sofa and the width of the sofa equals twice the length of an inch unit object. Similarly, adjectives are compatible with other morphemes whose semantics puts constraints on the length interval of their argument, such as *slightly* and *very*.

One explanation for the incompatibility of nouns with this type of gradable morpheme is therefore that they are ordinal, namely, they denote properties that encode entity orderings, but do not reliably reflect differences and ratios between entities. Accordingly, gradability and comparison in nouns is not unit-based. In fact, except for adjective nominalizations such as *height* and *length*, no noun or nominal comparison reported in the literature is associated with unit-based measure phrases (cf. the infelicitous **two degrees (a) bird* and **two bits more (a) bird*). Even vague difference modifiers such as *slightly* (as in ***slightly** longer than the sofa is wide*), which do not refer to conventional units explicitly, cannot naturally modify nominal comparisons (cf. ??***slightly** more a car than a truck*; Morzycki 2011), in accord with an ordinal view of nouns.

Thus, ordinality may explain the infelicity of nouns with difference morphemes, including, in particular, within-predicate comparison morphemes like 7b.

Between-noun comparisons are not based on a common unit. Nor are they based on deviations from a midpoint, as in 13b, which entails the positive forms *My clock is fast* and *Your clock is slow*. A vehicle that is not a car can be *more **a car** than **a truck***, or *than another vehicle is a truck*, where the latter is not a truck. Instead, compared nouns are often understood as relating to opposing poles in the context of utterance, as in *more a duck than a goose* or *more a teacher than a student*. If anything, between-noun comparisons relate to the similarity of entities to the prototypes of the compared nouns (or noun phrases), namely their relative positions with respect to two extreme points (two different prototypes), instead of a single midpoint. For this reason, I refer to this type of comparison as a 'contrast comparison'.

Going back to adjectives, notice that some of them can participate in both difference and contrast comparisons. Fortunately, certain languages provide morphological evidence for these claims, one of which is Estonian (I am grateful to Paula Henk for the data). The suffix *-em* creates difference comparisons, as in 14a, whereas the free morpheme *pigem* creates contrast comparisons with both nouns and adjectives, as in 14b and 14c,d, respectively.

(14) a. Sohva on (2 cm) pik*em* kui laud.
'The sofa is (2 cm) long-*em* than wide.'
'The sofa is (2 cm) longer than wide.'
b. Ta on *pigem* helilooja kui tantsija.
'He is more composer than dancer.'
'He is more a composer than a dancer.'
c. Nad on *pigem* sarnased kui erinevad.
'They are more similar than different.'
d. Beebi on *pigem* näljane kui väsinud.
'The baby is more tired than hungry.'

Within-noun comparisons are infelicitous with either morpheme. For instance, neither 15a with *-em* nor 15b with *pigem* can naturally express that Mozart is more of a composer than Arvo Pärt. Finally, *pigem* cannot be used in within-adjective comparisons either, as in 15c. The word *pigem* indicates that a contrast is present, so a comparison with a single adjective is marginal at best.

(15) a. #Mozart on helilooja*m* kui Arvo Pärt.
'Mozart is composer-*em* than Arvo Pärt.'
'Mozart is more of a composer than Arvo Pärt.'
b. #Mozart on *pigem* helilooja kui Arvo Pärt.
'Mozart is more composer than Arvo Pärt.'
'Mozart is more of a composer than Arvo Pärt.'
c. John on {terv*em* kui, #*pigem terve*} Bill.
'John is {healthy-*em*, #*pigem* healthy} than Bill.'
'John is {healthier, #more healthy} than Bill.'

To wrap up, degree modifiers such as the ones in 16a can modify adjectival comparisons and contribute an evaluation of the size of difference between the degrees of the compared entities. Arguably, this is possible because adjectives associate with degrees to which a difference operation can meaningfully apply. By contrast, categorization under nouns is mediated by degrees for which differences are not meaningful.

(16) a. George is {slightly, somewhat, a lot, no} taller than Bill.
b. Tweety is {?slightly, ??somewhat, ??a lot, ?no} more a bird than a mammal.
c. Tweety is a bird {*?slightly, *?somewhat, *?a lot, *?no} more than a mammal.

Furthermore, some adjectives resemble nouns in having prototypes (Lakoff 1987, Gärdenfors 2000). They can participate in contrast comparisons, where difference modifiers are not acceptable (Morzycki 2011), since prototypicality does not support difference calculations. Morzycki suggests that when a degree modifier as in 17 is accepted, it induces a COMPARISON-OF-DEVIATIONS reading similar to the reading of 13b. As explained above, this is a typical type of adjectival comparison, based on degree differences. It is, therefore, no wonder that difference modifiers trigger this reading.

(17) a. George is {?slightly, ??somewhat, ??a lot, ?no} more dumb than crazy.
b. George is dumb {*?slightly, *?somewhat, *?a lot, *?no} more than crazy.

Existing accounts of between-predicate comparisons have little to say about the unacceptability of 16 and 17 (see §4). However, an explanation is uncovered once one looks deeper at the type of conceptual gradability that underlies categorization in nouns. Empirical research of noun phrases supports their ordinal nature in two important ways.

For one, classification of entities is based on prototypes, namely on a consideration of the extents to which entities' degrees in certain scalar dimensions match prototypical values. However, many of the scalar dimensions involved are ordinal (Gärdenfors 2000, 2004). For example, classification of animate objects into species is often mediated by dimensions such as shape, color, behavior, genetic layout, inner biological function, reproduction mode, and offspring characterization (Rosch 1973, Tversky 1977, Lakoff 1987, Hampton et al. 2009, Pothos & Wills 2011). A dimension like size in the context of birds is a measurement of the distance of entities from the ideal size for the given bird species. Such a measurement can have the potential to reliably represent size differences, since one bird can be twice as large as another or two centimeters larger.

However, a dimension like reproduction mode, in the context of mammals, can have values such as {gives birth, does not give birth}, in which most mammals match the ideal value, most nonmammals do not, and the platypus, for example, is an exception: an egg-laying mammal. This dimension is merely ordinal—it consists of two ordered values, the difference between which reflects no real distance metric—as are also dimensions representing typical movement type, which can include values such as running, swimming, and flying, ordered by their optimality for mammals.

Artifact objects are classified through dimensions such as their function, intended function, material, shape, color, and size (see e.g. Hampton et al. 2009). In the context of classification under *chair*, the function dimension can be modeled either as binary (used as a seat yes/no), ternary (often/sometimes/never used as a seat), or on a finer scale.

In all of these cases, the dimensional values can be modeled by means of numerical degrees. In fact, cognitive psychologists normally model them using real numbers between zero and one. These degrees can be subtracted from or multiplied by other degrees. Nonetheless, the differences and ratios between values of entities on many of these dimensions are clearly not meaningful. That is, various numerical representations that determine different degree differences or ratios between entities are equally good means for modeling the prototypicality of entities in a given dimension.

Formally, this contextual variability can be modeled in a standard way (Kamp 1975, Kamp & Partee 1995). The information speakers carry in a world of evaluation c is often modeled in terms of the set W_c of worlds w that, according to the information in c, are still candidates to be the actual world (Stalnaker 1978). Ordinal concepts can be viewed as associated with degree functions that, in different worlds, determine identical orderings between entities, but different differences between their degrees. Such world sets render the notion of degree differences indeterminate in c, even if in each world the assigned degrees support difference and ratio operations.

Besides many ordinal dimensions, an additional factor contributing to the ordinality of nouns is the fact that the dimensions are weighed by their importance in discriminating members from nonmembers. For instance, in the classification of artifacts, functional properties are more important, whereas in the classification of natural kinds, visual properties are more important (Hampton et al. 2009).

Again, the weights are often modeled as positive real numbers that sum up to 1. However, a number of weight assignments can correctly predict the ordering of entities by their similarity to a noun's prototype. In fact, weight assignments admit considerable contextual variability (Murphy 2002). For example, visual properties are often used as indicative of classification, but their weights reduce considerably when visual cues are not available (e.g. at night) or additional cues are considered important (e.g. in scientific contexts; Gärdenfors 2000). As before, this contextual variability can be modeled in terms of different weight assignments in different worlds. Shifts in dimensional weights often change the numerical values assigned to entities, while preserving the orderings between these values.

In sum, nominal concepts are gradable in the sense of being associated with measure functions that assign to entities prototypicality degrees representing how good of examples they are relative to other examples. However, these degrees do not provide meaningful information about differences between entities. This observation paves the way for a gradable representation for nouns that would nonetheless capture their incompatibility with difference comparisons. The next section provides a semantics of ordinary adjectival comparisons as difference comparisons and shows that it is incompatible with ordinal concepts.

2.2. A FORMAL ANALYSIS OF DIFFERENCE COMPARISONS: WHAT WE ASSUME ABOUT ADJECTIVAL COMPARISONS THAT WILL NOT WORK FOR NOUNS. On the degree approach to gradability (von Stechow 1984, 2009, Kennedy 1999, 2007, Heim 2000, Schwarzschild & Wilkinson 2002, Kennedy & McNally 2005, Schwarzschild 2005, Solt 2009, Beck 2011), gradable adjectives (even ones with no conventional units, like *sad* or *navigable*) are associated with a set of ordered degrees (a dimensional scale) reflecting the extent to which entities may exemplify them. For example, *tall* lexicalizes a scale S_{tall} of degrees representing heights. An adjective like *tall* or adjective phrase like *similar to Sue* is further associated with a measure function (e.g. s(tall,w)) from entities to a degree on the adjectival scale. Kennedy (1999) accounts for the incommensurability of adjectives like *heavy* and *long* (the unacceptability of 2) by treating their degrees as primitive objects of different sorts, which only resemble numbers in that they can be summed, subtracted, and multiplied. For concreteness, I adopt a dominant degree-based account of the syntax-semantics of adjective phrases and degree constructions (Heim 2000, von Stechow 2009, Beck 2011). This account adopts the language definition from Heim & Kratzer 1998, with the addition of the primitive type d for degree-denoting expressions. In each world w, *tall*, for example, denotes a relation between degrees d and entities x that are tall to at least degree d in w.

(18) $[\![\text{tall}_{\langle d,\langle e,t\rangle\rangle}]\!]_w = R_{tall,w} = \lambda d \in S_{tall,w}\ \lambda x \in D_e.\ s(tall,w)(x) \geq d.$

This relation holds of any entity x and any degree d between zero and x's height, s(tall,w)(x).

On this account (following Bresnan 1973), the specifier of an adjective phrase hosts degree phrases, like *two meters* or *very* in 19. Comparison morphemes like *-er* and their *than*-clauses form a constituent that occupies this position as well, like *-er than* OP_1 *Lu is* t_1 ~~*tall*~~ in 19. This *than*-clause contains a covert version of *tall* (covertness is obligatory for material that also occurs in the matrix clause) and a silent operator, OP_1. This operator is raised from the specifier of the covert adjective and is introducing a lambda operator that binds its degree trace, t_1. Thus, the form [*-er* [*1. Lu is* t_1 *tall*]] is used henceforth as the logical form (LF) of *-er than Lu is* (where nodes with indices are interpreted as lambda abstracts).

(19) Al is {two meters, very, pretty, [-er than OP_1 Lu is t_1 ~~tall~~]} tall.

In this account, the type of a degree phrase like [*-er* [*1. Lu is* t_1 *tall*]] is that of a degree quantifier, $\langle\langle d,t\rangle,t\rangle$. To resolve type mismatch, they raise, leaving a trace of type *d*. Their argument is the degree predicate created by abstraction over their trace below their landing site, as the LF in 20b illustrates.

(20) a. Al is taller than Lu is.
b. LF: [[-er [1. Lu is t_1 tall]] [2. Al is t_2 tall]].

In the absence of an overt degree phrase, a null morpheme *pos* is postulated, as in 21a, where it is dubbed *pos1* because §3 makes use of a slightly different morpheme *pos2* to capture contrast-based interpretations of classification forms. *Pos1*'s first argument is a free standard variable 'ST'. Like other degree phrases, $[\text{pos1 ST}]_{\langle\langle d,t\rangle,t\rangle}$ raises, leaving a degree trace that is abstracted over, as in 21b. The trace t_2 and subject *Al* saturate the adjective's arguments, as in 21c, and abstraction yields the degree-predicate clausal interpretation in 21d.

In 21e, the variable ST is assigned as a value the STANDARD INTERVAL, Standard(s(tall,w)), which is chosen based on the distribution of values of the function s(tall,w) (Kennedy 2007). The standard interval includes the set of degrees that are neither short nor tall in the context up to some degree that counts as tall. By 21f, *pos1* is a universal determiner (von Stechow 2009). It takes the standard interval and clausal interpretation as arguments in 21g–h and yields truth in w and g if and only if (henceforth, iff) for every degree d in g(ST), Al is at least d tall in w.

(21) Standard-based classification forms

a. Al is pos1 ST tall.

b. LF: [[pos1 ST][2. Al is t_2 tall]].

c. $[\![\text{Al is } t_2 \text{ tall}]\!]_{w,g} = [\![\text{tall}]\!]_{w,g}(d)([\![\text{Al}]\!]_{w,g}) = R_{tall,w}(d)(Al)$.

d. $[\![\text{2. Al is } t_2 \text{ tall}]\!]_{w,g} = \lambda d\ R_{tall,w}(d)(Al)$.

e. $[\![\text{ST}]\!]_{w,g} = g(ST) = \text{Standard}(s(tall,w))$.

f. $[\![\text{pos1}]\!]_{w,g} = \lambda D'.\ \lambda D.\ \forall d, D'(d): D(d)$.

g. $[\![\text{pos1(ST)}]\!]_{w,g} = \lambda D.\ \forall d, g(ST)(d): D(d)$.

h. $[\![\text{pos1}]\!]_{w,g}(g(ST))(\lambda d\ R_{tall}(d)(Al)) = 1$ iff $\forall d, g(ST)(d): R_{tall,w}(d)(Al)$.
$= 1$ iff $\forall d$, Standard(s(tall,w))(d): s(tall,w)(Al) $\geq$ d.

Difference-comparison morphemes can be analyzed similarly to *pos1*, with their standard interval set by the *than*-clause. However, difference-comparison morphemes also license differential arguments, such as *two inches* in 22a. Hence, Schwarzschild and Wilkinson (2002) take the LF of 20a to include a covert differential as well. *-er*'s differential argument slot is a degree representing the difference between, for example, Al's and Lu's heights. Since *two inches* is a degree quantifier instead of a degree (Breakstone et al. 2011), it moves, leaving a degree trace t_3. Once *-er* takes as arguments the *than*-clause, trace, and matrix clause, the trace is abstracted over, forming the degree predicate [*3.* [t_3 *-er* [*1. Lu is* t_1 *tall*]] [*2. Al is* t_2 *tall*]]. The quantifier *two inches* is combined with (the intension of) this predicate to yield truth iff (in every world w consistent with the information in the world of evaluation) the degree to which Al is tall, Max(λd. tall(Al,d)) (namely s(tall,w)(Al)), is at least two inches bigger than the degree to which Lu is tall, Max(λd. tall(Lu,d)) (namely, s(tall,w)(Lu)). This LF diverges from the standard one only in resorting to intensions via ↑.

(22) a. of *Al is two inches taller than Lu*:

b. LF: [2-inches$_{\langle\langle s,\langle d,t\rangle\rangle,t\rangle}$↑ [3. [$t_3$ -er [1. Lu is t_1 tall]] [2. Al is t_2 tall]]]

Hence, *-er*'s sensitivity to degree differences (the feature that rules nouns out) is captured by an interpretation that exploits a DIFFERENCE OPERATION (von Stechow 1984, Schwarzschild & Wilkinson 2002, Kennedy & McNally 2005, Schwarzschild 2005, Kennedy & Levin 2008) and a DIFFERENTIAL ARGUMENT, which introduces QUANTIFICATION OVER WORLDS with different assignments of degrees to, for example, entities' heights, weights, or prototypicality in *mammal* (Kamp 1975, Kamp & Partee 1995, Sassoon 2013).

For example, the degrees of flying, swimming, and running entities (e.g. wolves, beavers, and bats) on the movement scale in the *mammal* prototype are values such as a, a + b, and a + b + c, respectively. But the difference c between the degrees of running and swimming entities can be either tiny or huge. Hence, all other things being equal, we can infer that the former are more similar to the prototype than the latter, but we cannot tell whether slightly or a lot more. For x to be '*slightly* more a mammal than y with respect to movement', the distance between them should be slight in any possible assignment of value to c. Arguably, this condition cannot be met (cf. Gärdenfors 2000, 2004). The rest of this section explains and illustrates this and then derives the interpretation of 22b.

Formally, according to measurement theory (Krantz et al. 1971, van Rooij 2011), the degree functions of DIFFERENCE-BASED predicates preserve degree differences across worlds, up to a constant (a real number: $d \in \Re$). This constant reflects the ratio between the unit objects (atomic individuals) used to derive numerical degrees in the two worlds (e.g. one-inch-long rods, or one-meter-long rods like the meter stick in Paris).

(23) Difference-based vs. ordinal predicates P

a. P is DIFFERENCE-BASED in c iff $\forall w_1,w_2$ in W_c, $\exists d \in \Re$, such that $\forall x_1,x_2$ in X: $(s(P,w_1)(x_1) - s(P,w_1)(x_2)) = d \times (s(P,w_2)(x_1) - s(P,w_2)(x_2))$.

b. P is ORDINAL in c iff $\forall w_1,w_2$ in W_c, $\forall x_1,x_2$ in X: $s(P,w_1)(x_1) < s(P,w_1)(x_2)$ iff $s(P,w_2)(x_1) < s(P,w_2)(x_2)$

For example, imagine that entities' degrees represent counts of centimeters in w_1 (a centimeter-long object is mapped to 1) vs. meters in w_2 (where instead meter is mapped to 1). The heights of three rods may be represented by the respective degrees 200, 100, and 50 in w_1 and 2, 1, and 0.5 in w_2. The differences between these degrees are the same up to a constant, 100 representing the fact that the unit object is 100 times bigger in w_2 than in w_1: (i) (200 – 100) = **100** × (2 – 1); (ii) (100 – 50) = **100** × (1 – 0.5); and (iii) (200 – 50) = **100** × (2 – 0.5). Thus, criterion 23a is met.

As a result, the differences between the height degrees of any two rods in the two worlds can also be expressed as multiples of the degree assigned to a reference object, as in *This rod is 1.5 meters taller than that one*. For example, suppose again that the meter x_m is assigned degree 1 in w_2 and 100 in w_1. Then, the differences (2 – 0.5) in w_2 and (200 – 50) in w_1 may both be called a difference of *1.5 meters*, as both equal 1.5 multiples of the degree of the meter in that world: (2 – 0.5) = **1.5** × $s(tall,w_2)(x_m)$ and (200 – 50) = **1.5** × $s(tall,w_1)(x_m)$.

By contrast, the degree functions of ordinal concepts map entities to degrees in a manner that only preserves orderings. For example, the similarity of a robin, a crow, and an ostrich to the prototype of *bird* may be represented by the respective degrees 1, 0.6, and 0.4 in w_1, vs. 1, 0.5, and 0.2 in w_2. These degrees preserve the entity ordering (meeting constraint 23b), for in both worlds the robin is more typical than the crow, which is more typical than the ostrich. However, there is no constant d such that degree differences are preserved up to d (because (1 – 0.6) = **.8** × (1 – 0.5), but (0.6 – 0.4) = **.66** × (0.5 – 0.2), and (1 – 0.4) = **.75** × (1 – 0.2)).

As a result, no reference object whatsoever might form a unit for *bird*, such that the similarity difference between a robin and an ostrich in each world would equal d multiples of the similarity degree of that object. For example, suppose the similarity degree of a penguin x_p is 0.4 in w_1 and 0.2 in w_2. There is no number d such that both of the differences (1 – 0.6) and (1 – 0.5) can be called *d penguins*, because (1 – 0.6) = 1 × $s(bird,w_1)(x_p)$, but (1 – 0.5) = 2.5 × $s(bird,w_1)(x_p)$. It is in this sense precisely that nouns are argued to be ordinal.

The following semantics of difference comparisons suggests that information about fixed degree differences is crucial for their application, and thus ordinal nominal concepts cannot participate in these comparisons. A difference-based comparison like 22, *Al is two inches taller than Lu*, with LF: [*2-inches*$_{\langle\langle s,\langle d,t\rangle\rangle,t\rangle}$↑ [*3.* [$t_3$ *-er* [*1. Lu is* t_1 *tall*]] [*2. Al is* t_2 *tall*]]], is true in a world c iff in every world in W_c (the set of worlds consistent with the information speakers have in c), the difference between the two compared degrees is a degree that is twice the degree assigned in w to any inch-long object (the difference between Al and Lu is at least two inches in any accessible world w). Such a condition is deemed false when differences between degrees of entities (measured in terms of a reference object) vary across worlds, as illustrated.

Compositionally, *-er*$_{diff}$ is analyzed as the degree determiner in 24a. It takes as arguments a differential degree (the trace of *two inches*) and two degree predicates (*-er*'s clausal complements). The *than*-clause interpretation is the set of degrees d such that Lu is at least d tall, as in 24b, and the matrix-clause interpretation (formed after raising *-er* together with its *than*-complement) is the set of degrees d such that Al is at least d tall, as in 24c. The stages in which the interpretations of *-er* and its arguments combine are 24d–f. The interpretation of the predicate created by abstraction over the value of the trace of *two inches*, d_3, is in 24g.

The interpretation of *two inches* in 24h takes an intension of a degree predicate (a function from worlds to degree intervals, e.g. the sets of degrees to which Al is taller than Lu) and returns truth in a world c iff in every world consistent with the information in c, the maximal degree of the interval denoted by the degree predicate in that world equals two times the degree of the reference object inch in that world. In 24i, this interpretation is applied to the intension of the degree predicate in 24g, a function from worlds to the set of degrees d_3 such that the difference between Al's and Lu's heights in those worlds is at least d_3 (i.e. the set of degrees between 0 and s(tall,w)(Al) − s(tall,w)(Lu)). The result is truth iff in every accessible world w, the difference between Al's and Lu's heights in w (i.e. the maximal degree d_3 such that the difference between Al's and Lu's heights is at least d_3), s(tall,w)(Al) − s(tall,w)(Lu), equals two times the degree of the reference object inch in w.

(24) Clausal difference comparisons
a. $[\![\text{-er}_{\text{diff}}]\!]_w = \lambda D_2 \lambda d_{dif} \lambda D_1.\ (\text{Max}(D_1) - \text{Max}(D_2)) \geq d_{dif}$.
b. $[\![\text{1. Lu is } t_1 \text{ tall}]\!]_{w,g} = \lambda d \in D_e.\ \text{s(tall,w)(Lu)} \geq d$.
c. $[\![\text{2. Al is } t_2 \text{ tall}]\!]_{w,g} = \lambda d \in D_e.\ \text{s(tall,w)(Al)} \geq d$.
d. $[\![\text{-er [1. Lu is } t_1 \text{ tall]}]\!]_w = [\![\text{-er}_{\text{diff}}]\!]_c([\![\text{1. Lu is } t_1 \text{ tall}]\!]_{w,g})$
$= \lambda d_{dif} \lambda D_1.\ (\text{Max}(D_1) - \text{Max}(\boldsymbol{\lambda d \in D_e.\ \text{s(tall,w)(Lu)} \geq d})) \geq d_{dif}$.
e. $[\![t_3 \text{ -er [1. Lu is } t_1 \text{ tall]}]\!]_w =$
$= \lambda D_1.\ (\text{Max}(D_1) - \text{Max}(\lambda d \in D_e.\ \text{s(tall,w)(Lu)} \geq d)) \geq \mathbf{d_3}$.
f. $[\![\text{[} t_3 \text{ -er [1. Lu is } t_1 \text{ tall]] [2. Al is } t_2 \text{ tall]}]\!]_w =$
$= (\mathbf{Max(\lambda d \in D_e.\ s(tall,w)(Al) \geq d)}) - \text{Max}(\lambda d \in D_e.\ \text{s(tall,w)(Lu)} \geq d)) \geq d_3$.
$= (\text{s(tall,w)(Al)} - \text{s(tall,w)(Lu)}) \geq d_3$.
g. $[\![\text{[3. [} t_3 \text{ -er [1. Lu is } t_1 \text{ tall]] [2. Al is } t_2 \text{ tall]]]}]\!]_w =$
$= \lambda d_3.\ (\text{s(tall,w)(Al)} - \text{s(tall,w)(Lu)}) \geq d_3$.
h. $[\![\text{two inches}]\!]_c = \lambda S \in D_{s,dt}.\ \forall w \in W_c\ (\text{Max}(S(w)) \geq \mathbf{2 \times s(long,w)(x_{inch})})$.
i. $[\![\text{Al is two inches taller than Lu is}]\!]_c =$
$[\![\text{2-inches}_{\langle s\langle\langle d,t\rangle,t\rangle\rangle}\uparrow \text{ [3. [} t_3 \text{ -er [1. Lu is } t_1 \text{ tall]] [2. Al is } t_2 \text{ tall]]]}]\!]_c =$
$([\![\text{two inches}]\!]_c)(\lambda w \lambda d_3.\ (\text{s(tall,w)(Al)} - \text{s(tall,w)(Lu)}) \geq d_3)(w) = 1$ iff
$\forall w \in W_c\ \text{Max}(\lambda d_3.\ (\text{s(tall,w)(Al)} - \text{s(tall,w)(Lu)}) \geq d_3) \geq \mathbf{2 \times s(long,w)(x_{inch})}$
$= 1$ iff $\mathbf{\forall w \in W_c: (s(tall,w)(Al) - s(tall,w)(Lu)) \geq 2 \times s(tall,w)(x_{inch})}$.

Assuming, following Schwarzschild and Wilkinson (2002), that the derivation of 20a, *Al is taller than Lu*, includes a COVERT DEFAULT DIFFERENTIAL *diff* (cf. 25a), then by 25b, it is true in c iff for some real number d bigger than zero, some reference object x_u, and some gradable predicate intension f (e.g. the intension of *tall* or *long*), in every accessible world w, the difference between Al's and Lu's heights is d times the reference object's degree. That is, a speaker may not know which differentials *diff* truthfully apply to Al's and Lu's height difference, but may be positive that such differentials exist.

(25) a. $[\![\text{diff}]\!]_c = \lambda S \in D_{s,dt}.\ \exists d > 0, \exists x_u \in D_e, \exists f \in D_{s,ed}: \forall w \in W_c\ (\text{Max}(S(w)) \geq \mathbf{d \times f(w)(x_u)})$.
b. $[\![\text{Al is (diff) taller than Lu is}]\!]_c = 1$ iff $\exists d > 0, \exists x_u \in D_e, \exists f \in D_{s,ed}$:
$\forall w \in W_c: (\text{s(tall,w)(Al)} - \text{s(tall,w)(Lu)}) \geq d \times f(w)(x_u)$.

These truth conditions reduce to the requirement that Al would be taller than Lu, but at the same time, they capture the compatibility of *more* with differentials. They also capture *more*'s incompatibility with ordinal concepts. On this account, er_{diff} and $more_{diff}$ can never truly apply to nominal phrases or clauses, because nouns are ordinal, and in ordinal concepts degree differences are not fixed across worlds. Conversely, adjectival predicates, even ones like *navigable*, which are not associated with conventional unit names, can always be modeled as difference-based (cf. Schwarzschild & Wilkinson 2002, Sassoon 2013).

This article focuses on comparison constructions, but note that this analysis extends to explain the unacceptability of nouns in superlatives (cf. *tallest* vs. *#linguist-est* or *most linguist*), assuming that superlative morphemes decompose into comparative morphemes plus additional morphology. Bobaljik (2012) brings robust crosslinguistic evidence to this effect (see also Hackl 2001, Solt 2009). This is not surprising given that, for example, *tallest in class* denotes the property of being *taller* than all class members.

Furthermore, this account extends to explain the unacceptability of nouns with other adjective-selecting differentials like *slightly*, *a bit*, or *a lot*, assuming that these differentials also involve sensitivity to degree differences through reference to unit objects, as with *diff* in 25. Arguably, these differentials only differ from *two inches*, for example, in not specifying any particular conventional unit, presupposing less pedantic measurement practices. For example, intuitively, the use of *n inches* reflects higher precision than the use of *slightly*, which, in turn, reflects higher precision than *a bit*. After all, *bits* seem to be no more than context-dependent, imprecise units. These suggestions merit future research.

In sum, linguists normally explain the fact that noun phrases do not combine with degree morphemes by assuming that nominal predicates directly denote entity sets (type ⟨e,t⟩; Kennedy 1999, Baker 2003, Constantinescu 2011), while adjectival predicates denote degree relations (von Stechow 1984, Kennedy 1999). However, nominal predicates occur in contrast comparisons. Moreover, the data reviewed in §2.1 indicate an alternative distinction between adjectives and nouns. They differ in the nature of their degree function, rather than in its mere availability. So-called gradable predicates (predicates like *tall* that can combine with difference-comparative and superlative morphemes) are associated with difference-preserving measure functions, whereas sharp predicates (*even*, *bird*) are associated with binary functions (functions to only two degrees, e.g. 1 and 0), functions that do not preserve ordering (in the sense of 23b), or at most order-preserving functions.

The unacceptability of nouns in most of the typically adjectival degree constructions is thus captured, while their acceptability in contrast comparisons can nonetheless be explained, as the next section proposes.

3. Gradability in nouns: what makes nouns susceptible to contrast comparisons? In different disciplines, classification under nominal concepts is modeled using methods for clustering conceptual spaces into regions surrounding prototypes (Rosch & Mervis 1975, Gärdenfors 2000, 2004, Stewart & Brown 2005, Voorspoels et al. 2012, Sassoon 2013). To account for gradability in nouns, §3.1 incorporates these mechanisms into formal semantics. Section 3.2 uses them to develop a compositional account of contrast comparisons that captures their special properties, and §3.3 discuses consequences for adjectives in contrast comparisons.

3.1. A formalism of prototypes. A conceptual space is a geometrical representation in which objects are characterized by their values on a set of dimensions (Voorspoels et al. 2012). For example, dimensions of the domain of sounds include pitch and volume. Two important features of this framework are that these dimensions are discernible by the human auditory perception system and cannot be separated in the perceptual sense. They are bundled up (Gärdenfors 2000, 2004).

(26) Conceptual spaces:

a. A CONCEPTUAL SPACE (CS) is a set of dimensions fi … f_n. For example, a space for a set of crows and pigeons may include dimensions like ‘color’, ‘shape’, or ‘communication mode’.

b. DIMENSIONS are sets of values of entities, numerically ordered by degrees in some range R. For example, the values of the given ‘color’ dimension may be *black* and *white*, and they may rank as 1 and 0, respectively.

A CS provides a tool for clustering into categories any domain of possible entities in the application range of the dimensions, $X \subseteq D_e$, where for each entity there is a point in the space representing its dimensional values. Categorization is partitioning of the space into natural subregions. Gärdenfors (2000) defines a natural concept as a convex region of a CS. This criterion models the fact that, for instance, if black and brown rabbits exist, then, intuitively, any otherwise similar entities whose color is in between black and brown are classified as rabbits as well. Formally, a convex region is one in which for every pair of points v1 and v2 in the region, all points in between v1 and v2 are also in the region.

This criterion utilizes only simple notions of ‘distance’ and ‘between-ness’. A distance function d is a function from pairs of points in a space to numerical values representing (dis)similarity: the smaller the distance between two objects, the more similar they are (see also Voorspoels et al. 2012). A point b is between two points a and c iff: d(a,c) = d(a,b) + d(b,c) (Gärdenfors 2000, 2004).

Gärdenfors (2000, 2004) discusses algorithms for clustering points into natural (convex) categories and dynamic operations for their maintenance and modification in the presence of new entities or contextual needs, and evaluates their computational and psychological feasibility. Clustering algorithms always presuppose a particular number of clusters. Their task is to partition a data set into this number of clusters in an optimal way in comparison to other partitions into this number of clusters. An optimal partition clusters objects in a way that minimizes the distance between each object and the center of its cluster—the PROTOTYPE—and maximizes the distance between each object and the center of other clusters, in comparison to other partitions. Obviously, partitions with a single object per cluster are optimal, but the challenge is to find an optimal partition into a smaller number of clusters.

Thus, on this view each concept, for example *bird*, is associated with a prototype, p_{bird}, with a function from entities x to their distance from this prototype, $d(p_{bird},w)(x)$, and a reversed function to entities’ similarity to the prototype, s(bird,w)(x). A prototype is a set of values in the dimensions comprising the space, which no actual entity has to realize, as stated in 27a. Functions representing similarity and distance are added to the model in 27b.

(27) Prototypes:

a. Let ‘Prot’ be a prototype-assigning function, which in every world w assigns each concept P a PROTOTYPE, Prot(P,w) = p, namely a member of the domain of possible entities ($p \in D_e$) whose values in the dimensions of CS represent the ideal values for P in w. For example, the prototype of a *crow* would be black and have the average crow size.

b. Let ‘d’ and ‘s’ be degree function-assigning functions. In any world w, they assign each prototype p of a predicate P a DISTANCE FUNCTION d(p,w) and a SIMILARITY FUNCTION s(P,w), namely functions from entities to degrees, where the closer entities are to P's prototype, the higher their similarity to it is ($\forall x_1, x_2 \in X$, s(P,w)(x) ≥ s(P,w)(y) iff d(p,w)(x) ≤ d(p,w)(y)).

More specifically, Gärdenfors (2000, 2004) adopts the prototype approach to categorization (Rosch 1973, Tversky 1977, Lakoff 1987, Hampton 1995, 1998, Hampton et al. 2009), whose claims are consistent with the convexity criterion (but stronger). The prototype approach has empirically grounded the claim that certain specific distance and similarity functions are prominent in the processing of linguistic concepts.

First, as stated in 28a, the degree to which an entity x exemplifies a category P (*bird*) depends on the distance between x's value and P's ideal value in each dimension f (the ideal bird genetic makeup, appearance, communication mode, movement type, etc.). In 28b, these distances are weighed and summed to yield the averaged distance of x from the prototype.

(28) Dimension-based distance functions: For every world w and predicate P with prototype p in w:
   a. The **distance of x from p in a dimension f_i** in w is: **$d(p,f_i,w)(x)$** = $|f_i(x) - f_i(p)|$.
   b. The additive **mean-distance of x from p** in dimensions $f_1 \dots f_n$ with weights $W_1 \dots W_n$ in w is: **d(p,w)(x)** = $W_1 d(p,f_1,w)(x) + \dots + W_n d(p,f_n,w)(x)$.

However, indeterminacy and contextual variability in the assignments of dimensional weights and degrees render nouns ordinal. Even the averaging function used to add up the dimensional values varies between different contexts, speakers, and tasks, albeit in an order-preserving fashion (Hampton 1995, Murphy 2002, Smith & Minda 2002). Similarity is usually approximated by either weighted sums, as in 28b, or weighted products of entities' dimensional degrees (Wattenmaker 1995, Hampton et al. 2009), and sometimes similarity involves multiple prototypes (Pothos & Wills 2011, Voorspoels et al. 2012).

Second, the similarity of x to the bird prototype, s(bird,w)(x) (x's degree of birdhood) negatively correlates with distance. In particular, the exponential inverse function in 29 efficiently describes large amounts of data about similarity and categorization in human subjects and animals (the UNIVERSAL LAW OF GENERALIZATION; Shepard 1987).

(29) Dimension-based similarity functions: **s(P,w)(x)** = $1 / (e^{d(p,w)(x)})$.

According to 28 and 29, the dimension set of a nominal predicate like *bird* in w includes those scalar properties (out of the dimensions $f_1 \dots f_n$ in the dimension space) that correlate with, and thus help characterize, the scalar property associated with *bird*, s(bird,w).

(30) A predicate F (with similarity function f_F) is a dimension of P in w, $dim(f_F,f_P,w)$, iff f_F has a nonzero weight in w and thus helps in generating s(P,w) (for short, f_P).

Abundant psychological evidence suggests that in contexts with no contrast alternatives (which Ø in 31 reflects), entities x are classified under nouns like *bird* iff their distance from its prototype, $d(p_{bird},w)(x)$, is small enough—that is, their similarity to its prototype exceeds a standard: s(bird,w)(x) ≥ Standard(bird,w) (Rosch 1975, Mervis & Rosch 1981, Lakoff 1987).

(31) Standard-based classification: If the set k of contrast categories is empty in w, an entity x is classified as P in w, **Pos(P,w, Ø)(x)**, iff x's similarity to P is as high as P's standard: **s(P,w)(x) ≥ Standard(s(P,w))**.

The standard-based criterion in 31 predicts many facts about human categorization processes (Murphy 2002). Importantly, it predicts the by-and-large monotonic relation between the probability of categorization of an entity and its averaged similarity to the prototype. For example, considering about 500 items of eighteen categories, Hampton (1998) found very strong coupling between the two. Thus, this criterion captures the fact that we can determine membership of infinitely many new instances on the basis of familiarity with a finite set of dimensions, prototypes, and category members. Newly encountered entities whose similarity to a prototype is higher than that of known members can automatically be regarded as members.

Recall that on the analyses in §2.2, *pos1* introduced standard-based interpretations for classification forms with adjectives (cf. 21). The psychological evidence suggests that, at least conceptually, nominal predicates are standard-based as well. This conceptual similarity to gradable adjectives speaks against a nongradable account of nouns. Moreover, recall that the indefinite article in, for example, *more (a) bird than (a) mammal*, is optional, and the nouns are interpreted opaquely. In fact, much like adjectives, such nominal contrast-comparison phrases cannot fill in an argument position, as the infelicity of 32a,b illustrates. Rather, they occupy predicate positions, as in 32c–d from COCA's 2015 fiction section.

(32) a. *More a mammal than a bird ran behind the tree
 b. *There is more a mammal than a bird behind the tree.
 c. Luke is right, that splendid confection is more *a crown for a queen* than *a hat*.
 d. It's more *a tool in an arsenal* than *a panacea*.

These data suggest that nominal predicates in contrast-based comparisons are neither DPs nor nominal heads N (cf. the complex predicates in 32c,d). They seem to be NPs. Moreover, being opaque, these NPs lend themselves naturally to a gradable analysis with similarity-based degree-relational denotations, $\lambda d \lambda x.\ s(P,w)(x) \geq d$ (instead of entity sets, $\lambda x.\ s(P,w)(x) \geq \text{Standard}(s(P,w))$). Degree relations can be associated with a constituent larger than a head, for example, an AP like *similar to Bill*. See Barsalou 1983 for evidence for a graded structure in complex phrases such as *wedding gifts*, *things you rescue from a burning house*, or *things not to eat or drink when on a diet*.

The nominal head *crown* in *a crown for a queen* can be analyzed as a function from an argument (*for a queen*) to a degree relation (on a par with *similar to Sue*) or as denoting a degree relation, where *for a queen* is an adjunct whose type is a modifier of degree relations (a function from degree relations to degree relations). On such an account, both adjectival and nominal standard-based classification forms involve a morpheme like *pos1*.

However, psychologists show that their data include some systematic mismatches between similarity and categorization, suggesting that standard-based categorization cannot cover all of the facts. A main source for mismatches stems from the existence of CONTRAST CONCEPTS (Hampton 1998). A contrast effect occurs when categorization or prototypicality judgments in, for instance, *bird* are based not only on similarity to a bird, but also on dissimilarity to, for example, *mammal*. Potential contrast concepts are ones with the same level of abstraction as *bird*, which are members of the same immediate superordinate category (e.g. *animals*) and are considered mutually exclusive (e.g. one and only one of them is applicable to any animal; Miller & Johnson-Laird 1976, Smith & Minda 2002).

Empirical evidence for contrast effects has been observed both in artificial categories (Goldstone et al. 2003, Davis & Love 2010) and ordinary linguistic categories (see e.g.

Rosch & Mervis 1975, Miller & Johnson-Laird 1976, Tversky 1977, Hampton 1998, Gärdenfors 2000, 2004, Verheyen et al. 2011, Voorspoels et al. 2012). For example, both *kitchen appliance* and *furniture* were part of the stimuli analyzed by Hampton (1998). This reduced the likelihood of classification more than the prototypicality of items like a *refrigerator* in the category *furniture*. Objects were classified in the category whose prototype they were closest to. This was found to be a prominent classification strategy. But contrast effects were shown to affect prototypicality ratings as well, even where the contrast set included relatively remote superordinate categories like *clothes*, *musical instruments*, *kitchen utensils*, and *tools* (Voorspoels et al. 2012).

In sum, standard-based classification is prevalent, but in the context of a competition between alternative classifications, similarity degrees undergo additional transformation, and a different, contrast-based classification criterion is employed.

I therefore propose to add contrast sets to the model. By 33a, in a world w, a unique contrast set k can be associated with, for example, s(bird,w) (for short, f_{bird}), consisting of at least one more similarity function (e.g. f_{mammal}). By 33b(i), categorization relative to k involves NORMALIZATION—the similarity of an entity x to a *bird* in w is divided by the sum of x's similarities to the contrast predicates (e.g. $Norm(f_{bird},k,w)(x) = f_{bird}(x) / (f_{bird}(x) + f_{mammal}(x))$), in order to represent the extent to which x exemplifies the concept *bird* as opposed to its alternatives. By 33b(ii), x is a bird relative to k in w, **Pos(bird,w,k)(x)** = 1, iff x's highest normalized degree is in *bird*. What follows is 33b(iii): contrast concepts are associated with disjoint entity sets that together cover the contrast domain X_k. By 33c, if k is not f_{bird}'s contrast set in w, then for any x, **Pos(bird,w,k)(x)** is undefined.

(33) Contrast-based classification: For each world w, **number n bigger than 1**, and predicate P, if a set k of size n counts as f_P's contrast set in w, *con*(f_P,*k*,*w*), then:

a. k is a set of n degree functions with the same domain X_k, including f_P. The predicates whose functions are in k are the contrast predicates. k is the unique contrast set of its members in w: $\forall f \in k$, con(f,k,w) & $\forall k' \subseteq D_{ed}$, such that con(f,k′,w): k′ = k.

b. (i) $\forall x \in X_k$, $Norm(f_P,k,w)(x) = f_P(x) / \sum_{f \in k} f(x)$ (any degree of f_P is normalized relative to k);

(ii) $Pos(P,w,k) = \lambda x \in X_k, \forall f \in k, f \neq f_P: Norm(f_P,k,w)(x) > Norm(f,k,w)(x)$ (P's k-based extension in w is the set of entities x in X_k whose normalized degrees relative to k in w are higher in P than in any contrast predicate);

(iii) $\cap\{Pos(Q,w,k) \mid s(Q,w) \in k\} = \emptyset$ & $\cup\{Pos(Q,w,k) \mid s(Q,w) \in k\} = X_k$ (the contrast predicates' k-based extensions are disjoint and cover X_k).

c. Otherwise (if ¬*con*(f_P,*k*,*w*)), $\forall x \in D_e$: $Norm(f_P,k,w)(x) = Pos(P,w,k)(x) = \perp$ (if k is not f_P's contrast set in w, then P's k-based normalized function and extension are undefined for any x).

Consider an example. World indices are omitted for simplicity's sake. The contrast concepts *kitchen appliance* (P), *accessory* (Q), and *furniture* (Z) yield the contrast set $k = \{f_P, f_Q, f_Z\}$. The degrees and normalized degrees of two entities are described in the left side of Table 1. Because the sum of degrees of each entity in this example is 2, their normalized degrees in each predicate P, $Norm(f_P,k)(x)$ equals $f_P(x) / 2$. A kitchen lamp x_1 resembles the prototypes of these categories to more or less the same degree, while an ordinary refrigerator x_2 scores low in *accessory*, high in *furniture*, and even higher in *kitchen appliance*.

In this context, a lamp alone may classify as *furniture* (x_1 is Z, the category that x_1 resembles most: 0.34 > 0.33 = 0.33; x_2 is P, the category x_2 resembles most: 0.42 > 0.40 > 0.18), despite being a poorer example of furniture (x_2 is more similar to Z than x_1: 0.40 > 0.34). This happens because a refrigerator scores highly as a kitchen appliance and therefore fits this category best. Thus, membership likelihood MAY NOT be monotonically related to normalized similarity: x_2 is not Z, despite being more of a Z than some Z, x_1.

CONTRAST SET WITH THREE MEMBERS					CONTRAST SET WITH TWO MEMBERS			
DEGREES	P	Q	Z	SUM	DEGREES	P	Z	SUM
x_1	0.66	0.66	0.68	2	x_1	0.49	0.51	1
x_2	0.84	0.36	0.80	2	x_2	1	0.66	1.66
NORMALIZED DEGREES	P	Q	Z	SUM	NORMALIZED DEGREES	P	Z	SUM
x_1	0.33	0.33	0.34	1	x_1	0.49	0.51	1
x_2	0.42	0.18	0.40	1	x_2	0.60	0.40	1

TABLE 1. Degrees and normalized degrees in a nonbinary (left) vs. binary (right) contrast set.

The situation is different, however, with a binary contrast set k = $\{f_P, f_Z\}$, for example, one based on the contrast concepts *kitchen appliance* (P) and *furniture* (Z), as in the right side of Table 1. Typically, a refrigerator x_2 better exemplifies the noun *furniture* than a lamp x_1 does (x_2's degree in Z exceeds x_1's), but this changes when their degrees are normalized relative to k (x_2's normalized degree in Z no longer exceeds x_1's). Correspondingly, relative to k, the lamp is classified under *furniture*, while the refrigerator is classified under *kitchen appliance* (x_1 is Z, the category x_1 resembles most, and x_2 is P, the category x_2 resembles most: $\mathrm{Norm}(f_P,k)(x_2) = f_P(x_2) / (f_P(x_2) + f_Z(x_2)) = 1/1.66 = 0.60$).[4]

In conclusion, in binary contrast sets, membership is coupled with NORMALIZED similarity. When |k| = 2, new entities that are more P relative to k than known Ps can be automatically regarded as P relative to k. Inferences about classification follow from the way an entity's degrees in the contrast predicates compare.

These data and analyses have implications for various natural language constructions. First, classification forms with gradable predicates, like *The box is red*, may involve standard-based classification as in standard accounts (von Stechow 1984, 2009, Kennedy 1999), but contrast-based classification is prevalent in nouns as well as certain adjectives (e.g. color adjectives have prototype representations; Gärdenfors 2000, 2004). Two different classification morphemes seem to be in need: *pos1* to introduce a standard when no contrast is present, and *pos2* to resolve a competition between contrast categories, as §3.2 suggests. Second, the compared predicates in nominal comparisons seem to function as a contrast set. Section 3.2 suggests that such an analysis captures the inference patterns of contrast comparisons and does not overgenerate. The proposed accounts diverge from the standard ones (see §2.2) only as much as the addition of a contrast set requires.

[4] Importantly, in a binary contrast set, by definition, the normalized degree of an entity in one concept equals 1 minus its degree in the contrast concept. For any x, $\mathrm{Norm}(f_Z,\{f_P, f_Z\})(x) = 1 - \mathrm{Norm}(f_P,\{f_P, f_Z\})(x)$. It follows that if x_1's normalized degree in P is bigger than x_2's, then x_1's normalized degree in Z is smaller than x_2's. For instance, if the degrees of two entities in P are a and b such that $1 \geq a > b \geq 0$, then their degrees in Z are $1 - a$ and $1 - b$, respectively, where $1 - a < 1 - b$. Together with the fact that entities classify in the category that they resemble most, this means that x_2's being more Z than x_1 relative to $\{f_P, f_Z\}$ is incompatible with classification of x_1, but not x_2, under Z. The reason is that if Z is the category x_1 resembles most, then $\mathrm{Norm}(f_Z,\{f_P, f_Z\})(x_1) > 0.5$, and if $\mathrm{Norm}(f_Z,\{f_P, f_Z\})(x_2)$ is a higher degree, it is surely bigger than 0.5. Hence, x_2 also classifies as Z relative to $\{f_P, f_Z\}$.

3.2. NOMINAL CLASSIFICATION AND COMPARISON CONSTRUCTIONS AS CONTRAST-BASED. On this proposal, when nominal predicates like *bird* are interpreted relative to a contrast set of a certain size n in a world w, they denote degree relations based on the normalization of their similarity functions relative to their unique contrast set k of size n, as explained in §3.1.

(34) $[\![\text{bird } t_k]\!]_{w,g} = R_{bird,k} = \lambda d \lambda x,\ Norm(f_{bird},g(k),w)(x) \geq d.$

$R_{bird,k}$ is only defined if g(k) is f_{bird}'s contrast set in w, con(f_{bird},g(k),w), because otherwise Norm(f_{bird},w,g(k)) is undefined.

Notice that for each measure function f there is a unique degree relation $R_f = \lambda d\lambda x.\ f(x) \geq d$, and for each degree relation R there is a unique function $f_R = \lambda x.\ Max(\lambda d.\ R(d)(x)) = \lambda x.\ Max(\lambda d.\ f_R(x) \geq d) = \lambda x.\ f_R(x)$. Thus the relation $\lambda d\lambda x.\ norm(f_P)(k)(d)(x) \geq d$ below is freely replaced with the function $norm(f_P)(k)(d)$ whenever this is necessary.

The LF of nominal classification forms, like the one in 35a, resembles the standard LF with *pos1*. Like *pos1* in 21a, *pos2* saturates a standard variable, ST_k, and raises, leaving a trace of type d. The trace is abstracted over below its landing site. Crucially, however, the value of the standard variable ST_k is set contextually (by g), based on the contrast-set assignment g(k) in 35b. For example, when the classification task involves discerning between small birds and flying insects, *insect* is a likely contrast concept. The value of the standard variable will thus include Tweety's normalized degrees relative to *bird* and *insect*. But when the task is to discern between water birds and water mammals or fish, the latter two are likely contrast concepts. In this case, the standard variable's value will include Tweety's normalized degrees in *bird*, *mammal*, and *fish*, as in 35b,c.

(35) a. The LF of *Tweety is a bird*: [pos2 ST_k] [1. Tweety is a t_1 [bird t_k]].
b. $[\![t_k]\!]_{w,g} = g(k) = \{f_{bird}, f_{mammal}, f_{fish}\}$
c. $[\![ST_k]\!]_{w,g} = g(ST_k) = \{Norm(f,g(k),w)(t) : f \in g(k)\}$
$= \{Norm(f_{bird},g(k),w)(t), Norm(f_{mammal},g(k),w)(t), Norm(f_{fish},g(k),w)(t)\}$

The semantics of *pos2*'s second argument, [*1. Tweety is t_1 bird t_k*], is built in two steps. First, the values of *pos2*'s degree trace t_1 and of *Tweety* saturate the nominal degree relation (cf. 36a–c). Second, abstraction over the trace's value yields the degree predicate in 36d. Like *pos1*, *pos2* in 36e denotes a degree determiner—a relation between a standard interval D′ and a degree predicate D (nominal clause meaning) that includes the maximum of the standard interval, Max(D′). *Pos2* is defined only when D′ includes a maximum, namely, a degree d that is bigger than any other degree in D′, as stated in 36f. By 36g, *pos2 ST_k* denotes a function from degree predicates to truth iff they include that maximum of the standard interval (e.g. Tweety's maximal normalized degree). In 36h, this function is combined with the nominal clause interpretation yielding truth iff the set of Tweety's normalized *bird* degrees includes Tweety's maximal normalized degree in any contrast concept. This condition is met iff Tweety's normalized similarity to a bird exceeds any of its other normalized similarities (e.g. to a fish or a mammal).

(36) Contrast-based classification forms:
a. $\forall w, [\![\text{Tweety}]\!]_w = t$
b. $\forall w, [\![[\text{bird } t_k]_{\langle d,et\rangle}]\!]_{w,g} = \lambda d\lambda x,\ Norm(f_{bird},x,g(k),w) \geq d.$
c. $\forall w, [\![\text{Tweety is } t_1 \text{ [bird } t_k]]\!]_{w,g} = Norm(f_{bird},t,g(k),w) \geq d.$
d. $\forall w, [\![1.\text{ Tweety is } t_1 \text{ [bird } t_k]]\!]_{w,g} = \lambda d.\ Norm(f_{bird},t,g(k),w) \geq d.$
e. $[\![pos2_{\langle k,\langle dt\rangle\rangle,\langle\langle k,dt\rangle,t\rangle}]\!]_{w,g} = \lambda D'.\ \lambda D.\ D(Max(D')).$

f. $\forall$D,d, Max(D) = d iff d $\in$ D & $\forall$d′ $\in$ D such that d′ $\neq$ d, d > d′.
g. $[\![$pos2 $ST_k]\!]_{w,g}$ = λD. D(Max(g(ST_k)))
= λD.D(Max({Norm(f_{bird},g(k),w)(t),
Norm(f_{mammal},g(k),w)(t), Norm(f_{fish},g(k),w)(t)}).
h. $[\![$pos2$]\!]_{w,g}$(g(ST))(λd. Norm(f_{bird},g(k),w)(t) $\geq$ d) = 1
= 1 iff [λd. Norm(f_{bird},g(k),w)(t) $\geq$ d](Max(g(ST)))
= 1 iff Norm(f_{bird},g(k),w)(t) $\geq$ Max(g(ST))
= 1 iff Norm(f_{bird},g(k),w)(t) = Max({Norm(f_{bird},k,w)(t),
Norm(f_{mammal},g(k),w)(t), Norm(f_{fish},g(k),w)(t)})
= 1 iff $\forall$f $\in$ g(k), f $\neq$ f_{bird}, Norm(f_{bird},g(k),w)(t)) > Norm(f,g(k),w)(t)).

Turning to contrast comparisons, note that in English they have a more flexible word order than ordinary comparisons, as 37a vs. the ungrammatical 37c illustrates (McCawley 1998, Morzycki 2011). In 37a, the contrast-based morpheme *more$_{con}$* forms a single postposed constituent with the *than*-phrase (e.g. *more than (he is) a mammal*). In 37b, they do not form a continuous string, but are assumed to nonetheless form an underlying constituent, from which the *than*-phrase is eventually extraposed (Morzycki 2011; see also Bhatt & Pancheva 2004 for an overview of ordinary comparisons).

(37) a. Tweety is a bird more than (he is) a mammal.
b. Tweety is more a bird than (he is) a mammal.
c. *Murder is illegal more than speeding.
d. Murder is more illegal than speeding.

Based on theoretical arguments, experimental results, and crosslinguistic data, Pancheva (2006) argues for an account of phrasal comparatives, such as 38a,b, where *than* takes a small-clause complement, much in line with *than* in clausal comparatives, such as 38c,d. Much of *than*'s small-clause complement is not pronounced, but is detectable through syntactic constraints on movement such as subject islands. Thus, all comparatives are assigned a clausal syntax and a uniform semantics in terms of degrees. Following Pancheva 2006 and references therein, I analyze contrast comparisons' *than*-phrases with no overt subject as in 38e, where *mammal* projects a nominal small clause, which surfaces as a covert pronominal subject coindexed with Tweety. The minor difference between 38e and 38f is that in 38e the *than*-clause subject is identical to the matrix subject and therefore elided.

(38) a. She is taller than him.
b. Bill met more students than teachers.
c. She is taller than he is.
d. Bill met more students than Sue ever did.
e. $Tweety_1$ is more a bird than ~~x_1~~ a mammal.
f. Tweety is more a bird than Mr. Ed is a mammal.

Hence, 39 illustrates an LF of a contrast comparison.

(39) LF of *$Tweety_1$ is more a bird than (he_1 is) a mammal*:
[$More_{con}$ [k.2. $Tweety_i$ is a t_2 [mammal t_k]]] [k.1. He_i is a t_1 bird t_k].

This section shows how a uniform semantic analysis for contrast comparisons with one and two compared entities can nonetheless capture the differences between them. To avoid unwarranted inferences about classification in contrast predicates, the clausal arguments of *more* are not *pos2*-clauses. Rather, they are clauses like 36d, [*1. Tweety is t_1* [*bird t_k*]]. In 36, however, the contrast-set variable t_k was assigned a specific value by g, while in 40a,b this variable is abstracted over, yielding clausal interpretations of type ⟨k,dt⟩ (functions from contrast sets k into degree predicates). For simplicity, the assignment index g is added only in 40b where it is necessary to assign value for the pronoun *he*.

The clausal contrast-based morpheme $more_{con}$ in 40c takes intensions of such clauses (type ⟨s,⟨k,dt⟩⟩) and returns truth iff in every world w consistent with the information in c, there is a contrast set k and a degree d such that the matrix-clause interpretation truthfully applies to k and d, while the *than*-clause interpretation does not. The contrast set k has to meet a minimality constraint—k has to be the smallest set relative to which both arguments have a well-defined interpretation. Thus, k should be binary.

(40) Contrast comparisons:

a. $[\![\text{k.1. Tweety is a } t_1 \text{ [bird } t_k]]\!]_w = \lambda k\text{: con}(f_{bird},k,w)\ \&\ t \in X_k.\ \lambda d.\ \text{Norm}(f_{bird},t,k,w) \geq d.$

b. $[\![\text{k.2. He}_i \text{ is a } t_2 \text{ [mammal } t_k]]\!]_{w,g(i/t)} = \lambda k\text{: con}(f_{mammal},k,w)\ \&\ t \in X_k.\ \lambda d.\ \text{Norm}(f_{mammal},t,k,w) \geq d.$

c. $[\![\text{more}_{con}]\!]_c = \lambda S_2 \in D_{s,kdt}\ \lambda S_1 \in D_{s,kdt}.\ \forall w \in W_c, \text{ such that } \boldsymbol{\exists k, |k| = 2}, S_1(k)(w) \neq \bot\ \&\ S_2(k)(w) \neq \bot.\ \exists d\ S_1(k)(d)(w)\ \&\ \neg S_2(k)(d)(w).$

Hence, by 41a, examples 39 and 38e are true in c iff in every world consistent with the information in c in which the degree functions of *bird* and *mammal* form a binary contrast set k, Tweety is a bird and not a mammal. This is the case in each world where Tweety's normalized similarity to a bird is higher than his normalized similarity to a mammal relative to $\{f_{bird}, f_{mammal}\}$. That is, Tweety is closer to the prototype of *bird* than to the prototype of *mammal*, when taking only these two prototypes into account.

Example 41b presents the interpretation of a two-entity between-noun comparison, namely truth iff Tweety is closer to the prototype of *bird* than Mr. Ed is close to the prototype of *mammal* relative to the unique minimal contrast set applicable ($\{f_{bird}, f_{mammal}\}$).

(41) a. $[\![\text{Tweety}_i \text{ is more}_{con} \text{ a bird than (he}_i \text{ is) a mammal}]\!]_c =$
$[\![\text{more}_{con}]\!]_c(\lambda w[\![\text{k.2. He}_i \text{ is a } t_2 \text{ mammal } t_k]\!]_{w,g(i/t)})(\lambda w[\![\text{k.1. Tweety is a } t_1 \text{ bird } t_k]\!]_w)$
$= 1 \text{ iff: } \forall w \in W_c, \text{ such that } \exists k, |k| = 2, [\![\text{k.1. Tweety is a } t_1 \text{ [bird } t_k]]\!]_w(k) \neq \bot\ \&\ [\![\text{k.2. He}_i \text{ is a } t_2 \text{ [mammal } t_k]]\!]_{w,g(i/t)}(k) \neq \bot.$
$\exists d\ [\![\text{k.1. Tweety is a } t_1 \text{ [bird } t_k]]\!]_w(k)(d) = 1\ \&\ [\![\text{k.2. He}_i \text{ is a } t_2 \text{ [mammal } t_k]\!]_{w,g(i/t)}(k)(d) = 0. \text{ iff}$
$\forall w \in W_c, \text{ such that } \exists k, |k| = 2, \text{con}(f_{bird},k,w)\ \&\ \text{con}(f_{mammal},k,w).$
$\exists d\ \text{Norm}(f_{bird},k,w)(t) \geq d\ \&\ \neg\text{Norm}(f_{mammal},k,w)(t) \geq d. \text{ iff}$
$\forall w \in W_c, \text{ such that } f_{bird} \text{ and } f_{mammal} \text{ form a binary contrast set in w:}$
$\text{Norm}(f_{bird},\{f_{bird}, f_{mammal}\},w)(t) > \text{Norm}(f_{mammal},\{f_{bird}, f_{mammal}\},w)(t).$

b. $[\![\text{Tweety is more}_{con} \text{ a bird than Mr. Ed is a mammal}]\!]_c =$
$[\![\text{more}_{con}]\!]_c(\lambda w[\![\text{k.1. Tweety is a } t_1 \text{ bird } t_k]\!]_w)(\lambda w[\![\text{k.2. Mr. Ed is a } t_2 \text{ mammal } t_k]\!]_w)$
$=1 \text{ iff: } \forall w \in W_c, \text{ such that } \exists k, |k| = 2, [\![\text{k.1. Tweety is a } t_1 \text{ bird } t_k]\!]_w(k) \neq \bot\ \&\ [\![\text{k.2. Mr. Ed is a } t_2 \text{ mammal } t_k]\!]_w(k) \neq \bot\text{:}$
$\exists d\ [\![\text{k.1. Tweety is a } t_1 \text{ bird } t_k]\!]_w(k)(d) = 1\ \&\ [\![\text{k.2. Mr. Ed is a } t_2 \text{ mammal } t_k]\!]_w(k)(d) = 0. \text{ iff}$
$\forall w \in W_c, \text{ such that con}(f_{bird},\{f_{bird}, f_{mammal}\},w)\ \&\ \text{ed}, t \in X_{bird \cup mammal}.$
$\text{Norm}(f_{bird},\{f_{bird}, f_{mammal}\},w)(t) > \text{Norm}(f_{mammal},\{f_{bird}, f_{mammal}\},w)(\text{ed}).$

This semantics of contrast comparisons captures their special properties. First, recall that in binary contrast sets, categorization is always monotonic to similarity. Thus, 41a implies that *Tweety is a bird* relative to the contrast set. This gives rise to the implication that *bird* is a better label for Tweety than its contextual alternative and that the speaker therefore prefers to call Tweety a *bird* than to call him a *mammal*.

Second, the normalized degrees of a single entity are complementary in the sense that they sum up to 1, so the higher degree must exceed the standard 0.5. This is the source of the inference—the higher degree of an entity is also its highest one (see the discussion of Table 1 in §3.1). This is also the reason for the absence of inference in two-entity comparisons like 41b. Since two different entities are compared, their normalized degrees may both be either above or below 0.5. Thus, no classification facts follow.

Third, even in 41a, it may well be implied that *mammal* and *bird* are not optimal labels for Tweety, since the comparison does not strictly entail that *Tweety is a bird, not a mammal*. With a different contrast set, or with no contrast set at all, Tweety may or may not classify as a bird. That is, in actuality, there may exist an optimal labeling for Tweety, but in the context of use, there is not a relevant or useful labeling. The message conveyed, according to this analysis, is precisely that *bird* is a better labeling than *mammal*, under the perspective that ignores unmentioned alternatives. For this reason alone, the speaker prefers the former to the latter.

Fourth, the noun phrases *bird* and *mammal* are correctly predicted to be interpreted opaquely. The existence of no actual bird or mammal in the context of evaluation follows.

Fifth, the inference that does follow from examples like 41b is that it is NOT possible to consider Mr. Ed a mammal (let his normalized degree exceed 0.5) without considering Tweety a bird (letting his normalized degree be lower than 0.5). Thus, two-entity comparisons only have CONDITIONAL IMPLICATIONS. It follows from 41b that when *bird* and *mammal* are the only alternatives under consideration, then *If Mr. Ed is a mammal, Tweety is a bird*, and *If Tweety is not a bird, then Mr. Ed is not a mammal* (assuming that 'If φ, then ψ' is true in c iff in every world in W_c, φ is false or ψ is true). Without the forced choice of a binary contrast set, however, even these weak conditional inferences are lost (cf. the discussion of the left side of Table 1 in §3.1).

Sixth, this proposal completes the solution to the main problem this article set out to address. Comparisons with two clausal arguments that contain one and the same nominal predicate, such as 'x is more a bird than y ~~is a bird~~', cannot be licensed. The experimental findings reviewed in §1 suggest that this fact about English prevails despite the willingness on the side of most speakers to accept comparisons of the form 'x is more (typical) **of** a bird than y'. In addition, it appears to prevail also in languages like Hebrew, which do not have the grammatical alternative with *of*. The oddity of 'x is more A than y ~~is A~~' follows straightforwardly from the fact that contrast-based interpretations are possible only in the presence of a contrast set whose size is bigger than 1, as definition 33 indicates.

In sum, the comparative morpheme in comparisons of this form cannot be difference-based *more*, as nominal predicates are ordinal (their functions do not support degree differences), and it cannot be contrast-based *more*, as the notion of a contrast set presupposes the existence of at least two different contrast concepts.

Seventh, the reduced felicity of two-entity comparisons like 41b, as compared with single-entity comparisons like 41a, may result from a combination of a lower inferential import with a higher processing cost. The single-entity case, 'x is more P than (x is) Q', is true in c iff in every world in W_c, in which P and Q are the only contrasting alternatives, (s(x,P,w) ~~/ (s(x,P,w) + s(x,Q,w))~~) > (s(x,Q,w) ~~/ (s(x,P,w) + s(x,Q,w))~~). The denominators on the two sides of the 'bigger than' relation are identical, so they cancel out. Thus, the computation required to determine the relation between the normalized degrees is simpler than in the two-entity case, 'x is more P than y is Q', where the stage of division cannot be dispensed with because the denominators are different ((s(x,P,w) + s(x,Q,w)) ≠ (s(y,P,w) + s(y,Q,w)). Thus, two-entity comparisons exert a higher processing cost for a weaker inferential import.

Finally, the present account captures the fact that entity-denoting expressions can participate in contrast comparisons, as, for instance, in *more Kate Middleton than Queen Elizabeth* (COCA, 2015 fiction section) and *more a mythological figure than the complicated human being that she actually was* (COCA, 2015 academic section). In any world, the function $f_{x,w}$ represents similarity to x, the referent of, for example, the definite description *the complicated human being that she actually was*. Similarity to x is directly defined as the reversal of the function d(x,w) from entities to their averaged distance from x in the dimensions of the conceptual space (cf. 28, 29). This makes the description susceptible to contrast comparisons. Indeed, x and the prototype of *mythological figure* seem to fall on two extreme points of dimensions like *human* and *complicated*, which the description indicates.

In sum, the account captures the features this article set out to explain.

3.3. ADJECTIVES THAT CAN BE COMPARED CONTRASTIVELY. Let us first wrap up. Psychological evidence suggests that nominal concepts are ordinal. Section 2.2 argued that this explains why they are not licensed in difference-based comparatives, superlatives, and degree modifiers. Section 3.2 supported a complementary proposal whereby contrast comparisons compare nominal degrees. The set of contrast comparisons in COCA includes a rich set of different pairs of nominal predicates, suggesting that the construction is used productively with nouns. In addition, it includes a more restricted set of adjective pairs. Thus, this section considers the consequences of the account for the licensing of adjectives in contrast comparisons.

First, it is correctly predicted that adjectives with interpretations based on prototypes can participate in contrast comparisons. For instance, the DIMENSIONAL ADJECTIVES in 42a,b are associated with prototypes, similarity functions, and contrasting alternatives (Gärdenfors 2000). Classification under these adjectives is based on bundled dimensions, such as, for example, hue and saturation, which speakers can perceive but not separate from one another. Thus, contrast comparisons with such adjectives can be assigned the same account as nominal comparisons.

(42) a. He looked **more *green* than *blue*** now; maybe because he was warming up. (COCA, 2007 science fiction)
b. Catch that waitress and see if she has something **more *sweet* than *sour***.[5]

Second, the boldface parts of 42a,b can also be interpreted relative to a scale of quantity, ranging from, for example, completely green to completely blue. In fact, since contrast comparisons are based on a contrast between two extreme points, generally, adjectival antonyms with upper closed scales (e.g. *full-empty* and *right-wrong*; Kennedy & McNally 2005, Kennedy 2007) can also participate in contrast comparisons.

(43) a. For the first time since 2012, Lake Travis is more *full* than *empty*, according to data from the Lower Colorado River Authority. … the lake is at 52 percent capacity.[6]
b. Marx has proven more *right* than *wrong* about capitalism (COCA, 2000 news)

[5] *Nothing happens until it happens to you: A novel without pay, perks, or privileges*, by Terrence M. Shine. New York: Crown, 2010, p. 263.

[6] 'Flood warning issued for Onion Creek until late Sunday', by News staff, *Statesman*, May 24, 2015; http://www.statesman.com/news/weather/austin-energy-restoring-service-about-7000-still-w/nmM7c/.

Predicates with closed scales can compare contrastively because their ranges can be converted into a single range to enable comparison. Conversion is possible via a linear transformation that utilizes endpoints (Kamp & Partee 1995; e.g. the degree $f_{full}(x)$ of each entity x can be transformed into a degree between 0 and 1, as follows: $(f_{full}(x) - Min(f_{full})) / (Min(f_{full}) - Max(f_{full})))$.

Nouns map entities to exemplariness degrees on scales that are readily closed and converted for the purpose of averaging, on which their interpretation is based (cf. definition 28b). To see why averaging involves closed and converted scales, consider the calculation of a student's yearly average. Obviously, different scales for grading different areas of study (e.g. a 1–7 scale in math and a 10–100 scale in literature) have to be converted into a uniform range before averaging. The upper closure in nominal scales is zero distance from the prototype, and although distance can be infinitely large, as explained in §2.1, nominal dimensional scales often consist of a finite and, in effect, rather small set of degrees. Thus these scales have a lower closure as well.

By contrast, the upper open scales associated with dimensional adjectives like *tall* and *heavy* cannot be easily converted to a single scale. A contextual endpoint has to be accommodated for that matter. Thus, these adjectives do not easily compare. In fact, the claim that two different comparison types exist, difference and contrast comparisons, is supported by the fact that these comparisons differ in their distributional constraints. Open-scale adjectives can easily participate in difference comparisons.

Third, unlike the dimensional adjectives and natural nouns considered above, the nouns in 44 and adjectives in 45 have MULTIDIMENSIONAL interpretations. That is, they are more easily perceived as having separate dimensions (Gärdenfors 2014). For example, we normally do not classify individuals as *red* with respect to saturation but not hue, but we often count individuals as *different* in shape but not in size. Since the dimensions are conceptually accessible, comparisons such as 44 and 45 can receive readings in which the compared degrees consist of the NUMBER OF DIMENSIONS of each contrasting predicate, whose norms entities exceed. For example, intuitively, the boldface part of 45 conveys that the number of dimensions ('aspects of behavior') in which identical twins are *alike* is bigger than the number of dimensions in which they are *different* (cf. 46).

(44) This researcher is more a *linguist* than a *philosopher*.

(45) Twins help psychologists better understand the role that genes and environment play in human development, Segal said. Fraternal twins are more *different* than *alike*, Segal said. **Identical twins are more *alike* than *different*.** 'What we've found is genes are really pervasive. They affect every aspect of our behavior,' Segal said. Genes affect what kind of foods we like, job satisfaction, and personality. (COCA, 2014 news)

(46) $\forall w \text{ in } W_c: |\{f_F: \dim(f_F, f_{similar}, w): | f_F([\![\text{The phenomena}]\!]_w) \geq \text{standard}(f_F, w)\}| >$
$|\{f_F: \dim(f_F, f_{different}, w): | f_F([\![\text{The phenomena}]\!]_w) \geq \text{standard}(f_F, w)\}|.$

Readings based on dimension counting characterize certain nouns more than others. Section 4 discusses consequences of this fact for comparisons with different nouns.

4. CONSEQUENCES OF THE ANALYSIS: ADDITIONAL CASES AND CONSTRUCTIONS. Nouns denoting SOCIAL CONCEPTS, including artifact names such as *chair* or *theatre*, professions such as *philosopher* or *lawyer*, and other human properties such as *child*, *girl*, or *woman*, tend to be associated with relatively independent dimensions that can be accessed and counted. By contrast, the dimensions of NATURAL-KIND nouns, such as *duck* and *oak*, are more interconnected and harder to individuate and count (Wattenmaker 1995, Hampton et al. 2009).

Similarity to the prototype of a social noun such as *chair* along a dimension (e.g. *used as a seat*) tends to increase an entity's overall similarity to the prototype (and therefore its classification probability) in a constant additive way, independent of what the similarity degrees in other dimensions are (e.g. *designed to be a seat* or *has backrest*). But the effect of similarity to the *zebra* prototype along a dimension (e.g. *appearance* or *offspring nature*) depends on other dimensional degrees. A zero degree in one dimension can nullify all of the other dimensional contributions. Such data motivated additive models of classification in social nouns (e.g. s(chair,w)(x) equals the WEIGHTED SUM of x's dimensional degrees in w′, as in 28b), but not in natural-kind nouns. For example, only nonadditive modeling of s(zebra,w)(x) as, for instance, the weighted product of x's dimensional degrees correctly predicts that a zero degree in one dimension would nullify the other dimensional contributions (Wattenmaker 1995, Hampton et al. 2009).

As a correlate, the resulting entity sets also differ. An entity that is somewhat a zebra and somewhat a donkey is not classified as either (because any dimension's violation significantly reduces similarity and classification probability in both concepts). Instead, it is intuitively regarded as belonging to a new species. But a person who is somewhat a philosopher and somewhat a linguist is often classified as both because a few dimension violations hardly affect similarity and thus classification probability. Hence, the entity sets associated with natural-kind nouns tend to be DISJOINT, whereas the entity sets associated with social nouns tend to overlap (see experimental evidence in Hampton et al. 2009).

One observation about nouns, which cannot be thoroughly addressed in this article, is that in some circumstances their dimensional scales are modeled as binary (e.g. as mappings of entities to 0 or 1) and the dimensions are weighed equally. In social nouns, since they are additive, this accommodation reduces similarity to mere dimension counting: one's similarity to a philosopher reduces to the number of philosopher properties one has, and therefore x is more a philosopher than a linguist iff x has more dimensional properties of a philosopher than of a linguist. Since counting is essentially additive, dimension-counting interpretations do not typically occur in these circumstances for natural-kind nouns, where the dimensional contributions are multiplied (Wattenmaker 1995, Hampton et al. 2009).

In dimension-counting interpretations, degree differences are meaningful. Social nouns more easily accommodate such interpretations than natural-kind nouns, and accordingly, experiments suggest that they are also more acceptable in degree constructions (Sassoon 2017).

A summary of the main properties typical of social and natural-kind nouns is given in 47.

(47) a. Social nouns: additivity; overlapping categories; dimension-counting readings
b. Natural-kind nouns: nonadditivity; disjoint categories; no dimension counting

Section 4 discusses two consequences of these differences. First, different inference patterns characterize involving *more* and *less* contrast comparisons with disjoint vs. overlapping categories. Second, contrast comparisons differ from partitive comparisons (like *more of a philosopher*), where dimension counting (as opposed to mere averaging over dimensional degrees) is argued to be more central.

4.1. INFERENCES WITH DISJOINT VS. OVERLAPPING CONTRAST CATEGORIES. Contrast-based $less_{con}$ can be given the semantics of $more_{con}$, except with the relation 'smaller' instead of 'bigger' in the truth conditions. Such an account captures straightforwardly the validity of several uncontroversial inference patterns. Other patterns are violated by two-entity comparisons with social nouns. These nouns often denote POTENTIALLY OVERLAPPING CATEGORIES, and this has implications for inference and for the contrast-based account, which this section considers briefly.

The inference patterns in 48 are a case in point. With disjoint categories, such as the taxonomic categories *bird* and *mammal*, 48b follows from 48a and vice versa. For instance, 49a is true iff 49b is true.[7] In addition, the move between 48b and 48c is trivial. It follows that 49a is true iff 49c is true as well.[8]

(48) a. X is more A than Y is B. Only for disjoint A and B: ⇒
b. X is less B than Y is A.
c. Y is more A than X is B.

(49) a. Tweety is more a bird than Mr. Ed is a mammal.
b. Tweety is less a mammal than Mr. Ed is a bird.
c. Mr. Ed is more a bird than Tweety is a mammal.

Lastly, as odd as the pattern in 48a,c (e.g. the inference between 49a and 49c) seems to be on first sight, remember that it is related to no implications regarding the entities' classifications. For example, despite the fact that 49c is true in the context of the right side of Table 1, *Mr. Ed is not a bird* relative to $\{f_{bird}, f_{mammal}\}$, as the contrast concept it resembles most is *mammal* (0.51 > 0.49).

These inferences can be illustrated with natural examples about which we have background knowledge that may lead to actual truth-value judgments. Consider, for example, the fact that the dolphin resembles a fish, not a bird, while the platypus resembles both. It is adapted to swimming, has webbed feet, the body of a beaver, and a duck's beak. Given this fact, 50a is intuitively true. This judgment is captured by the analysis, for both of the degrees of the platypus in these circumstances appear to be relatively low, but they are also relatively balanced. Therefore, after normalization, both are close to 0.5. By contrast, the dolphin's degrees in the two nouns are not balanced at all. Therefore, its normalized degree in *fish* is much higher than 0.5 and in *bird* it is much lower.

(50) a. The dolphin is more a fish than the platypus is a bird.
b. The platypus is more a fish than the dolphin is a bird.
c. The platypus is less a bird than the dolphin is a fish.

Intuitively, 50b also holds true in the same circumstances, and this judgment also follows because the dolphin does not resemble a bird in any way, while the platypus does resemble a fish in some ways. This is an illustration of the pattern of inference from 48a,c. Additionally, 50c follows intuitively, illustrating pattern 48a,b. Finally, there is

[7] The sentence in 49a is true iff in any w in W_c, for $k = \{f_{bird}, f_{mammal}\}$, Norm(tweety,$f_{bird}$,k,w) is bigger than Norm(ed,f_{mammal},k,w). This is the case iff Norm(tweety,f_{mammal},k,w) (which equals 1 − Norm(tweety,f_{bird},k,w)) is smaller than Norm(ed,f_{bird},k,w) (which equals 1 − Norm(ed,f_{mammal},k,w)), which is the case iff 49b is true. For instance, given a world consistent with the right side of Table 1, both comparisons hold because Norm(tweety,f_{bird},k,w) = 0.60, which is bigger than Norm(ed,f_{mammal},k,w) = 0.51, and accordingly, Norm(tweety,f_{mammal},k,w) = 0.40, which is smaller than Norm(ed, f_{bird},k,w) = 0.49.

[8] In the context of the right side of Table 1, both propositions are true because Norm(tweety,f_{bird},k,w) equals 0.60, which is bigger than Norm(ed,f_{mammal},k,w) = 0.51, and accordingly, Norm(ed,f_{bird},k,w) equals 0.49, which is bigger than Norm(tweety,f_{mammal},k,w) = 0.40. This result follows from the fact that the two normalized degrees of each entity in a binary contrast set sum up to 1, as explained above.

no implication that the platypus is either a fish or a bird relative to $\{f_{fish}, f_{bird}\}$, supporting the claim that this construction is marked for lack of inferential power.

All considered, judgments based on comparisons of disjoint, taxonomic categories appear to confirm the patterns in 48. Intuitively, however, these patterns do not hold in comparisons with potentially overlapping categories, such as *philosopher* and *linguist*. For example, 51b does not follow from 51a, and 52b does not follow from 52a. In fact, both 52a and 52c may be true simultaneously. But treating the compared nouns as contrasting would rule out this possibility. Additional examples include the nouns *pianist* and *composer*, among many other nouns that name artifacts, human traits, dispositions, habits, or professions. Importantly, comparisons of disjoint and overlapping categories exhibit systematically different inference patterns, and the analysis should account for this difference. Fortunately, a modified generalized definition of a contrast set and normalized degrees can accommodate the two category types.

(51) a. My iPhone is more a toy than my abacus is a computer. *not* ⇒
b. My iPhone is less a computer than my abacus is a toy.

(52) a. Frank is more a philosopher than Bill is a linguist. *not* ⇒
b. Bill is more a philosopher than Frank is a linguist.
c. Frank is more a linguist than Bill is a philosopher. *consistent with 52a*

The modified definition of a binary contrast set should exclude the requirement that the contrast-based extensions have to be disjoint. This requirement will now be introduced for disjoint categories only, by locating their ideal dimensional values in two opposing poles on their dimensional scales.

Moreover, a definition for potentially overlapping contrast alternatives should be analogous to the definition of probabilities of overlapping events $e_1 = e_a + e_b$ and $e_2 = e_b + e_c$. This definition resorts to the set of disjoint subevents e_a, e_b, and e_c. Thus, instead of the binary set k for the contrast predicates *linguist* and *philosopher*, the following generalized definition of binary contrast-based normalization and classification uses for examples like 52 the set **b(k)** of degree functions of the disjoint contrast predicates *philosopher who is not a linguist* (P&¬L), *linguist who is not a philosopher* (L&¬P), and *linguist and philosopher* (L&P). The role of the functions in this set can be defined by 33a–c, as before, as stated in 53(i).

The definition of normalized degrees in 53(ii) is then changed, so that, for example, Bill's degree in *linguist* is now the sum of his degrees in the disjoint categories L&¬P and L&P, and Frank's degree in *philosopher* is the sum of his degrees in L&P and P&¬L. These sums are normalized relative to the sum of degrees of the logically disjoint categories. Similarly, the definition of a k-based extension in 53(iii) is changed so that for *linguist*, it is the sum of the b(k)-based extensions of L&¬P and L&P.

(53) Binary-contrast-based classification, a generalized definition: For any w, P, Q, and set $k = \{f_P, f_Q\}$, which counts as its members' contrast set in w ($\forall f \in k$, con(f,k,w)):

(i) $b(k) = \{f_{P\&Q}, f_{\neg P\&Q}, f_{P\&\neg Q}\}$ and $\forall f \in b(k)$, con(f,b(k),w)
(b(k) is the set of degree functions of the Boolean combinations of the contrast predicates, and it counts as the contrast set of its members);

(ii) $\forall x \in X_k$, $Norm(x,f_P,k,w) = (f_{P\&Q}(x) + f_{P\&\neg Q}(x)) / \Sigma_{f \in b(k)} f(x)$
(the k-based normalized degree of each entity x in P within w equals the sum of the b(k)-based normalized degrees of x in P&Q and P&¬Q in w);

(iii) Pos(P,w,k) = Pos(P&¬Q,w,b(k)) ∪ Pos(P&Q,w,b(k))
(the k-based extension of P in w equals the sum of the b(k)-based extensions of P&Q and P&¬Q in w).

For disjoint categories, the generalized definition of contrast-based normalization and classification reduces to the one presented in §3.1. Generally, for no entity to fall under P&Q, entities should always rank higher in either P&¬Q or Q&¬P. This is likely to be the case when P's and Q's ideal values on shared dimensional scales are on opposing poles. Assuming this much, the original definitions in 33 promise that any x would most resemble the prototype either of P&¬Q or of Q&¬P, for it has to fall in one of these k-based extensions.

For overlapping categories, however, the value of entities x in s(P&Q,w) can be bigger than their other degrees. To see the utility of the generalized definition in this case, consider the right side of Table 2. A suitable context for this table is one in which Frank's work is truly interdisciplinary and distinguished relative to the work of specialists both in linguistics and philosophy. Bill, by comparison, is an ordinary linguist. He does linguistics research reasonably well, but only rarely does his work have any philosophical significance, and he never asks purely philosophical questions. The new definition of a normalized P degree as the sum of normalized degrees of two disjoint categories (P&¬Q and P&Q) allows for an assignment of normalized degrees for each entity that SUMS UP TO MORE THAN JUST 1 (e.g. the sum of normalized degrees is 1.1 in Bill's case and 2 in Frank's case). This reflects the potentially overlapping nature of the concepts in question, and the degree to which each entity exemplifies each concept separately or both concepts together.

Both 52c and 52a are true in this context, as desired, because Norm(frank,f_L,k,w) = 1 > Norm(bill,f_P,k,w) = 0.2, and Norm(frank,f_P,k,w) = 1 > Norm(bill,f_L,k,w) = 0.9, respectively. In addition, 52a is true, while 52b is false. I leave this for the reader to check.

CONTRAST SET WITH THREE MEMBERS			
NORMALIZED DEGREES	FISH	BIRD	MAMMAL
Mr. Ed	0	0	1
Tweety	0	0.7	0.3

GENERALIZED NOTION OF CONTRAST SET			
DEGREES	P&¬L	L&¬P	L&P
Frank	0	0	100
Bill	10	80	10
Normalized degrees w.r.t. b({f_L,f_P})	**Norm(P)** = (s(P&¬L) + s(P&L))/100	**Norm(L)** = (s(L&¬P) + s(P&L))/100	Sum
Frank	100/100 = 1	100/100 = 1	2
Bill	10+10/100 = 0.2	90/100 = 0.9	1.1

TABLE 2. Additional examples of contrast sets.

The shift to b(k) with overlapping predicates (in particular, social nouns) fits well the idea that they associate with dimension counters. The prototypes of overlapping categories may share many properties (i.e. may have the same values in many dimensions). Thus, $f_{L\&\neg P}$ may assign entities a degree reflecting the proportion of properties that truly apply to them out of the properties characterizing linguists but not philosophers, while $f_{L\&P}$ may assign entities a degree reflecting the proportion of properties that truly apply to them out of the properties characterizing both linguists and philosophers. Bill, in the given example, has properties characterizing linguists but not philosophers, while Frank has the properties characterizing both linguists and philosophers.

Notice that we have world knowledge telling us that the platypus and dolphin are mammals, or borderline cases of *mammal*. Thus, we may be disposed to add the contrast concept *mammal* in, for instance, 50. But such an addition clashes with the semantics that requires a binary contrast set and decreases the inferential power. For example, the patterns in 48a–c fail to hold, as the left side of Table 2 illustrates. Tweety is more a bird than Mr. Ed is a fish, because 0.7 > 0, but not less a fish than Mr. Ed is a bird, because 0 = 0. He could easily be more so. The failure of inference in the case of overlapping categories can be seen as yet another case of unwarranted addition of contrast categories defined in terms of Boolean combinations of the two basic properties.

Moreover, some speakers may hold in mind conditions sufficient for the dolphin to count as a mammal that override any of the superficial similarities it shares with a fish. Others may not have this taxonomic knowledge. But this issue is orthogonal to the claims in this article. The game is to predict speakers' judgments given their background context.

To summarize, this section accounted for the different interpretations and inference patterns manifested by contrast comparisons with disjoint vs. overlapping categories. Dimension counting is more prevalent with the latter than the former, suggesting that the semantics of contrast comparisons does not necessitate dimension counting. The next section suggests that this fact distinguishes contrast comparisons from partitive comparisons.

4.2. THE DIFFERENCES BETWEEN CONTRAST COMPARISONS AND SIMILAR CONSTRUCTIONS. An advantage of an analysis of contrast comparison with, for example, social nouns in terms of dimension counting is that it pretty much unifies the interpretation of *more* in quantity comparisons, such as 54, and degree comparisons, such as 55. In both cases, the cardinalities of two sets compare: in the quantity comparison, sets of chairs and tables, and in the degree comparison, set of dimensions of chairs vs. tables.

(54) More tables than chairs are dirty.

(55) This is more a table than a chair.

However, the cardinality (dimension-counting) interpretation of 55 is optional. An entity with no properties of tables at all (e.g. a rock) can still be described as *more (a) table than (a) chair*, providing that it is closer to the ideal dimensional values of tables than of chairs. It is precisely here that partitive comparisons such as 56a,b seem to diverge from contrast comparisons like 55. In 56, interpretation seems to be BASED on comparisons of cardinality of property sets; 56a,b entail that the subject has some generic table properties.

(56) a. This is *more of a table than* a chair.
 b. This is *more of a table* than that.

Since this is a plausible interpretation for 55 as well, the distinction is subtle, but suggestive evidence for it nonetheless exists. Consider the contrast in 57 and 58. While 57 is marginal, it is clearly much better than 58, suggesting that the partitive construction in 57 has existence entailment (it is entailed that John has some philosopher properties), whereas the contrast construction in 58 without *of* does not.

(57) ?There's more of a philosopher in John than in Bill.

(58) *There's more a philosopher in John than in Bill.

In sum, similarity to a prototype can be measured by number of properties (thus, adding *of* may have no effect), but it does not have to be so measured; thus there are no existence entailments. A football player, not having any generic property of a linguist, may still be truthfully described as *more a linguist than a philosopher*, providing that he is even further away from the philosopher's prototype than the linguist's prototype.

This observation adds up to the fact that the indefinite article is optional in 55, but obligatory in 56a,b. This gives rise to the following speculative sketch of an analysis for partitive comparisons. The noun phrases in partitive comparisons have a generalized quantifier interpretation. For example, in 56b *a table* denotes the set of generic table properties, and the comparison entails that the subject *This* has more of these properties than the object *that*. The generic interpretation results from a type shift triggered by the partitive. Recall that in *more of the tables*, partitive *of* triggers a shift of a definite plural meaning to sets of plural individuals. Such a shift is considered impossible with singular nouns like *a table* (Zamparelli 2002). Thus, the latter appear free to shift to property sets, giving rise to comparisons of cardinalities of property sets.

While the semantic differences between contrast and partitive comparison await future research, a preliminary crosslinguistic investigation of Romance and Hebrew data seems to support the theoretical sketch above. First, the article in partitive comparisons always has a generic use. We thus find the English indefinite article in *more of a philosopher than Bill*, but we find the definite article in, for example, Italian, where the definite article is more strongly associated with genericity (*ha piu del filosofo che Mario* 'has more of the philosopher than Mario', 'is more of a philosopher than Mario'). Second, bare nouns have different basic types across languages, allowing different readings. Yet data based on Italian- and Spanish-speaking informants suggest that bare-noun comparisons (e.g. *e' piu filosofo* 'is more philosopher') systematically relate to similarity, while partitive ones (*ha piu del filosofo* 'has more of the philosopher') relate to cardinality, and only the latter entail existence of properties. These issues merit systematic future research.

5. Comparison to other theories and conclusions. Let us compare the proposed account to existing alternatives. These accounts capture the metalinguistic flavor of between-predicate comparisons, exploiting devices for metalinguistic interpretation. However, other features are not addressed, including, in particular, the relative acceptability of different comparison types. Yet the phenomena are clearly complex, and different accounts seem to capture different readings of comparison constructions.

Let us begin with Klein (1991), who characterizes, for example, 59a as an answer to the question *Is Ram intelligent?* rather than to *How tall is Dan?*. But 59b, for example, is intuitively a much more natural between-predicate comparison, which can answer both question types: *How much is Rubinstein a pianist/conductor?*. In fact, as discussed above, one-dimensional adjectives such as *tall* do not easily fit into contrast comparisons (cf. Kennedy 1999). Thus, Klein's interpretation may result from some last-resort attempt to make sense of them. But other types of adjectives and nouns naturally compare, and their comparisons appear more than merely metalinguistic in nature. The orderings the comparisons relate to are not ad hoc or arbitrary. Rather, they underlie categorization in these predicates, and their study seems to improve our understanding of these comparisons.

(59) a. ?Dan is more tall than Ram is intelligent.
b. Rubinstein is more a pianist than a conductor.

Giannakidou and Yoon (2011) report that Greek and Korean have two comparison morphemes. For example, the Greek morphemes *apo*/*apoti* are used in comparisons of ordinary degrees, while the Greek morpheme *para* is used in comparisons of appropriateness or subjective preference of propositions according to speakers. Their examples suggest that both types of morpheme license between-noun comparisons, as 60 illustrates.

(60) O Pavlos ine perissotero filologhos *para*/*apoti* glossologhos.
the Paul is more philologist *para*/*apoti* linguist.
'Paul is more/rather a philologist than a linguist.'

This state of affairs suggests that nominal comparisons are not necessarily relating in a metalinguistic fashion to subjective attitudes of speakers toward propositions or words. Nominal predicates may participate in comparisons relating, via ordinary linguistic interpretation, mechanisms to degrees underlying classification in nouns. For example, 59b can relate to the relative similarity of Rubinstein to the prototypes of *pianist* and *conductor*. Since these degrees underlie categorization, they naturally affect the preferences of speakers in choosing which label to attribute to individuals. Such implications follow from a contrast-based account. Other metalinguistic implications are likely to be embedded within the semantics of certain comparative morphemes in the languages of the world, such as *rather* or *para*.

Morzycki (2011) describes the so-called metalinguistic *more* as comparing degrees of imprecision of propositions, defined based on Lasersohn's (1999) analysis of imprecision. For example, on this analysis, 59a conveys that *Dan is tall* is closer to the truth than *Ram is intelligent* is. This analysis is the most restrictive one (see Morzycki 2011 for criticism of previous analyses on this ground). Yet it does not appear to be restrictive enough. Every proposition may have a degree of precision. Thus, it follows from the analysis that any two propositions should be comparable. In particular, nothing in this analysis explains the significant preference for single-entity over two-entity comparisons. The latter are predicted to be perfectly felicitous.

Moreover, nothing explains why the imprecision-based graded interpretations of nouns do not license within-noun comparisons, such as 61, which are systematically and significantly less good. An additional mechanism is needed to explain this. The present article suggests instead that nouns are ordinal because they are associated with similarity scales. Therefore, unless modified by *typical* or *much of*, nouns can only surface in contrast comparisons. By their nature, such comparisons require more than a single predicate.

(61) #This bird is more a duck than that one.

For instance, 62b is judged less natural than 62a despite the fact that the propositions *This is a crab* and *That is a crab* may differ in terms of their distance from the truth just as much as the propositions *This is a crab* and *This is a lobster* may. In the same way, Giannakidou and Yoon's (2011) account does not explain why interpretations based on speaker preferences do not license within-noun comparisons. Thus, I propose that these metalinguistic scales of speaker preferences and imprecision emerge in addition to, and possibly as a consequence of, the workings of contrast sets and contrast-based categorization mechanisms. On their own, these scales do not seem to form an exhaustive account of gradability in nouns.

(62) a. This creature is more a crab than a lobster.
b. #This creature is more a crab than that one is.

Another family of theories resorts to rank-based degrees. For example, Bale's (2011) account of examples like 59a uses the entities' degrees in *tall* and *intelligent* only indirectly to compare their relative positions on the two respective scales. In simple terms, entities are ordered in line by their degree in each adjective, and then are associated with new degrees called ranks, representing the number of positions up to them in the line. Thus, 59a conveys that Dan's height rank is higher than Ram's intelligence rank.

Similarly, McConnell-Ginet (1973), Klein (1980), and Doetjes (2010) argue for an analysis based on the strength of modifiers that can truthfully apply to each adjective and argument; on this proposal, 59a conveys that for some modifier *M* (e.g. *slightly*, *pretty*, *very*, *very very*, *very very very*), *Dan is M tall* is true, but *Ram is M intelligent* is not true. On the analysis in van Rooij 2011, comparison classes are postulated for between-predicate comparisons, consisting of entity-predicate pairs. Thus, 59a conveys that the pair consisting of *Dan* and *tall* belongs to the positive denotation of a special metalanguage predicate *Lots* relative to some comparison class c, but the pair of *Ram* and *intelligent* does not.

The problem with this type of analysis, again, is that it is not restrictive enough. For instance, using Bale's ranks for nouns would wrongly allow within-noun comparisons. If gradable interpretations based on ranks are generally available for nouns, the felicity contrast in 62 remains unexplained. The ranks of each two entities with respect to *crab* may differ just as much as their ranks with respect to *crab* and *lobster* may. This argument is general. Analyses that assign gradable interpretations for nouns wrongly predict that they should be freely licensed in degree constructions, contrary to fact (e.g. *#the most bird*, *#too bird*, *#very bird*). Only a contrast-based analysis explains why nouns are restricted to between-noun comparisons, while being incompatible with other single-predicate degree constructions.

An analysis in terms of ranks as in Bale 2011 is also inconsistent with an ordinal view of nouns. A scale of ranked positions makes the notion of degree differences and ratios meaningful. Thus, combinations of nouns with gradable morphemes that relate to degree differences and ratios are predicted to be felicitous, contrary to fact (van Rooij 2011). Moreover, contextual variability between worlds in W_c cannot help here, because rendering the distances between ranks bigger (or smaller) requires a change in the ordering as well.

An imprecision analysis of nominal gradability à la Morzycki (2011) is based on ranking imprecise interpretations of a noun by the extent to which they resemble the precise interpretation, and then assigning to entities degrees according to the rank of the most precise noun interpretation that applies to them. Thus, this implementation renders differences and ratios meaningful as well. This problem may be avoided by using, instead of degree rankings, a mere ordering of imprecise interpretations, as in Lasersohn 1999, plus order-preserving contextual variability in the assignment of degrees, as in the present account.

The analysis in van Rooij 2011 is tailored to avoid precisely this kind of problem. However, it is missing an explanation of what the grading relative to the metalinguistic predicate stands for, and of the way semantics is composed when the arguments of the comparative morpheme are clauses. Both issues hinge on the role of the metalinguistic predicate in the semantic composition of classification clauses. If its role is, as this article suggests, triggering contrast-based classification, then the question left open is whether it is indeed possible to express this role without degrees (see Constantinescu 2011 for a degree-less account of several constructions that license nouns).

Finally, Doherty and Schwartz (1967) argue that nominal comparisons are mediated by an elided adjective *much*. However, they do not explicate the ways in which comparisons between *much*-modified nouns like 62a differ from comparisons within *much*-modified nouns like 62b. Hence, to capture the data, decomposition of *more* overall does not seem to suffice. In addition, nominal comparisons pose a challenge to decomposition accounts of *more* as *much-er* (Hackl 2001, Solt 2009, Wellwood 2014). While *much* usually associates with monotonic or additive dimensions such as cardinality (as in *more students*) or length (*ran more*), nominal similarity scales do not seem to obey this constraint (Bochnak 2010).

To conclude, the discussion overall supports the relevance of mechanisms of categorization to the semantics of comparison. These mechanisms help to capture the truth conditions and intuitive truth-value judgments of contrast comparisons, various valid inference patterns, the dependency of other inferences on the number of compared entities and the type of compared predicates (e.g. overlapping vs. disjoint predicates), and the differential acceptability of single-entity vs. two-entity comparisons, and of comparisons of closed-scale vs. open-scale predicates.

The role of contrast sets should be further evaluated in the future against the robustly cross-categorial nature of between-predicate comparisons. Research may profit from considering the relevance of contrast sets for categories like verbs, adverbs, and prepositions, as in Morzycki 2011.

(63) a. More than I love wine, I hate beer.
b. He did it quickly more than carefully.
c. Al is under the table more than on top of the rug.

Unacceptability of difference modifiers like *slightly* would support a contrast-based analysis, as will paraphrases relating to prototypes (see Bochnak 2010 for prototypicality in verbs). For example, 63c can be paraphrased as 'Al's location is closer to the prototype of *under the table* than of *on top of the rug*'. Further support would come from contrast-based inferences. For example, 63c implies that *under the table* is a better label, ignoring unmentioned alternatives.

Furthermore, the proposed differences between contrast and partitive constructions (*more of*) invite theoretical, crosslinguistic, and experimental research, as do superlative and equative constructions.

The contrast-based account realizes the Saussurean idea that more than anything, the nature of a sign is affected by the signs surrounding it (de Saussure 1972 [1916]). The linguistic significance of contrast sets has yet to be pinned down, including its connections to other alternative-based mechanisms, such as those used for granularity representation (Krifka 2007), implicature calculation (Fox & Katzir 2011), focus (Rooth 1992), and question analysis (see Aloni & Roelofsen 2011:475–77 for challenges with overlapping concepts).

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