A personal note

Dear Frank,

The first time I read your paper on Data Semantics (Veltman 1984), I thought this was the way linguistics should be done. This paper had a great impact on my MA thesis and my subsequent work. Later on, your defaults paper (Veltman 1996) inspired my doctoral research proposal. You have reviewed the proposal, which for me was the first time a name in a classical paper turned out to be an actual living being. I could not imagine at the time that I would spend three years as a postdoc in your project 'On vagueness—and how to be precise enough' (NOW 360-20-201).

The years I have been working in the project were simply great. I have learnt a lot about vagueness and gradability, and no less about academic practice. You accompanied me through the writing of my first journal paper; through the writing of my first grant proposal; the first conference organization; student supervision, and ultimately, through my applications to 'real' jobs.

Now, working in Bar Ilan University, back in my home town, much of my research still concentrates on questions that you have presented to me, and I make extensive use of the feedback you have given me in pursuing academic tasks. I am trying to be as kind and positive to my students, yet as effective as you have been in my supervision, and it always helps.

Thank you Frank, for making it all possible – for inspiring my thought, and for an invaluable, thoughtful tutoring into academic life. Thank you for your modesty, clarity, kindness, and friendship.

Enjoy the Festschrift and the wonderful, fruitful years ever after!
Till soon, Galit

Between-noun comparisons

Galit W. Sassoon
Bar Ilan University
galitadar@gmail.com

Abstract

Adjectives are typically felicitous in within-predicate comparisons—constructions of the form 'X is more A than y', as in *This is bigger than that*, but are often infelicitous in between-predicate comparisons—constructions of the form 'X is more A than (y is) B', as in **Tweety is bigger than (it is) heavy*. Nouns, by contrast, exhibit the inverse pattern. The challenge is to account for their felicity in between-predicate comparisons, as, for instance, in *This bird is more a duck than a goose*, while capturing their infelicity in within-predicate comparisons, as in #*This bird is more (of) a duck than that one*. Postulating either semantic gradability, or even only ad-hoc, meta-linguistic gradable interpretations for noun to capture the meaning of between-noun comparisons results in wrong predictions for within-noun comparisons and other gradable constructions (#*very duck*; *too duck*). The paper presents a solution to this problem, using the psychological notion of a contrast-set. The solution correctly predicts inference patterns and truth value judgments pertaining to between noun constructions.

1 Comparison constructions with Adjectives and Nouns

1.1 The challenges

Within-predicate comparison are constructions such as (1a), whose interpretation involves a comparison of two entities along the ordering dimension associated with a single predicate. By contrast, *between-predicate comparisons*—the main focus of this paper—are constructions such as (1b) that involve a comparison of either one or two entities along the ordering dimensions of two different predicates. Many adjective pairs exhibit incommensurability in that they cannot felicitously co-occur in a between-predicate comparison (Kennedy 1999), as illustrated in (2).

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

Nouns behave differently. First, most of the degree morphemes which classically combine with adjectives are incompatible with nouns (*#Ducker, #Duckest, #duck enough, #too duck, #very duck*). The situation persists across languages. For example the Hebrew equivalents of the examples above (*#Yoter barvaz, Haxi barvaz, #Barvaz maspik, #Barvaz miday, #Meod barvaz*) are equally odd (see Baker 2003 for a review of cross linguistic data). In particular, within noun comparisons such as (3a) and its Hebrew equivalent (3b) 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 (4a). Languages like Hebrew do not allow this possibility.

(3) 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-rightmost is more duck from the-bird the-leftmost', The rightmost bird is more a duck than the leftmost bird).
(4) a. The rightmost bird is more **of** a duck than the leftmost bird.
b. #The rightmost bird is more a **toy** duck than the leftmost bird.

Interestingly, the felicity of within noun comparisons such as those in (3), 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 literal interpretation of the noun to a metaphoric or adjectival interpretation. Thus, an utterance of (3a), which is odd in the context of real ducks, as in the picture in the left side of figure 1, significantly improves in the context of toy ducks, as in the picture in the right side of figure 1 (many thanks to Moria Ronen for this example and picture). The Hebrew (3b) becomes completely felicitous. The status of the noun *barvaz* ('duck') with other degree morphemes improves as well. However, once a literal interpretation is

enforced, comparison and degree morphology more generally becomes clearly infelicitous again, as in the use of (4b) in the context of the toy ducks in figure 1. This fact strengthens the generalization: Default literal interpretations of nouns are incompatible with the semantics of within-predicate comparison morphemes and morphemes with similar distributional constraints.

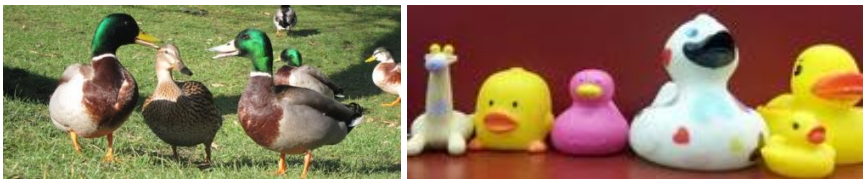

Figure 1: Literal and nonliteral ('duck-like') readings of *duck*

At the same time, nouns do occur freely, even more freely than dimensional adjectives do, in between-predicate comparisons. This is illustrated with the examples in (5), as well as the naturally occurring examples in (6) (taken from Sassoon 2013).

(5) a. Tweety is more **a duck** than **a goose**.
b. Chevy is more **a car** than **a truck**.
c. Ze yoter Kise me Me-shulxan ('This is more a chair than a table').
d. This drink is more **water** than **wine**.
e. The ostrich is more **a bird** than (the platypus is) **a mammal.**
f. A bat is no more **a bird** than a whale is **a fish.**

(6) a. The extensive piano part is more of **a first among equals** than **a showcase for a virtuoso soloist**.
b. Bling Bling says "tweet" (I'm convinced he's more **a bird** than **a cat).**
c. … stool thing which is really more **a table** than **anything else**.
d. The wall slowly unfolded until it came to a full stop, ending up more **a table** than **a wall.**

In sum, adjectives are typically more felicitous in within- than in between-predicate comparisons, while in nouns, typically, the situation is reversed. This poses a problem which this paper 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. A postulation of even only ad-hoc, contextual, meta-linguistic, last resort gradability to capture, for instance, (7c) or its Hebrew equivalent (7d), results in wrong predictions for (7a) and its Hebrew equivalent (7b).

(7) a. #Rubinstein is more a pianist than my son.
b. #Rubinstein yoter psantran me-ha-ben sheli ('Rubinstein is more pianist from the-son mine' 'Rubinstein is more a pianist than my son').
c. Rubinstein is more a pianist than a conductor.
d. Rubinstein yoter psantran me-menacea'x ('Rubinstein is more pianist from conductor' 'Rubinstein is more a pianist than a conductor').

Although noun comparisons are the main focus of this paper, a short inspection of the interpretation of adjectival comparisons may help track the way the interpretation of noun comparisons diverges. The orderings associated with the adjectives in the felicitous between-predicate comparison (1a), *The sofa is (2 centimeters) longer than {it, the table} is wide*, are based on measurements of length and width. The degrees of these two measurement scales align by virtue of a common unit, namely the length of a conventional object (such as the meter stick in Paris, or any centimeter or inch ruler). The ratio between the length of the meter and the length of an entity is a number that can be meaningfully compared to the ratio between the length of the meter and the width of an entity.

Similarly, in (8a), the degree to which a ladder is (not) tall compares to the degree to which a house is (not) high, for *tall* and *high* share a unit.[1] In (8b), the two adjectives are interpreted positively, as measuring deviations from a midpoint in different directions. The midpoint is the correct time (Kennedy 1999). Again, a common unit (for example, seconds or minutes) allows for comparison of the degree to which a clock is fast and the degree to which it is slow with respect to the actual time.

[1] For a detailed discussion of the role of negation see Kennedy (1999), Büring (2007) and Heim (2008). That covert negation occurs in the than-clause is consistent with the general grammatical prohibition of overt occurrence of than-clause constituents which are identical to a matrix-clause constituent.

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

By contrast, the orderings of the adjectives in the infelicitous (2a), *#The table is longer than the sofa is heavy*, are based on measurements that do not share a standard unit. Therefore, a unit-based comparison is impossible.

All of these examples reveal the importance of the notion of *degree differences* (or intervals) in the interpretation of statements with adjectives. Our conceptualization of entities in the world is sensitive not only to the ordering determined by their length, 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. For example, on a widespread view,[2] the truth conditions of, e.g., (1a), *The sofa is two centimeters longer than the table* yield truth iff the *difference* between the length of the table and of the sofa equals twice the length of a centimeter unit object. Similarly, adjectives are compatible with other morphemes whose semantics puts constraints on the length interval given by their argument, such as *2 meter*, *slightly*, and *very*.

One explanation for the incompatibility of nouns with this type of gradable morphemes is, therefore, that they denote ordinal properties, namely 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 noun comparison reported in the literature is associated with unit-based measure phrases (as in e.g., the infelicitous **two degrees (a) bird* and **two bits more (of) a bird*). Ordinal interpretations may also explain the infelicity of noun with difference morphemes, including in particular within-predicate comparison morphemes as in (3)-(4). For this reason, even vague difference modifiers, which do not refer to conventional units explicitly, such as *slightly* (as in *The table is **slightly** longer than the sofa is wide*), cannot naturally modify nominal comparisons, as in ??***slightly** more (of) a car than a truck*.

Thus, between-noun comparisons are not based on a common unit. Nor are they based on deviations from a midpoint, as in (8b), *My clock is faster than you clock is slow*, which entails the positive forms *My clock is fast* and *Your clock is slow*. An entity a, which is not a car, can be *more **a car** than **a truck***, and an entity b, which is not a truck, can be such that *a is more a car than b is a truck*. Rather, compared nouns are often understood to be opposing poles in the context of utterance, as in *more a duck than a goose*, *more a teacher than a student*, or *more of a first among equals than a showcase for a virtuoso soloist*. If anything, between-noun comparisons relate to the relative positions of entities with respect to the prototypes of the compared nouns, namely positions with respect to two extreme points, instead of a midpoint

Besides preserving the above result regarding the infelicity of within-noun comparisons, a semantic representation for between noun comparisons should capture several additional challenging properties. The first one is a preference for single arguments. Speakers clearly prefer the construction in (9a) to the one in (9b), and qualitative research of usages of the form 'more a noun than' in corpora (Davies 2010) suggests that the construction illustrated in (9a) is also used significantly more often:

(9) a. Tweety is more a bird than a mammal.
b. Tweety is more a bird than Mister Ed is a mammal.

A second property is the strong metalinguistic inference speakers derive from such comparisons. From (9a) it follows that the speaker prefers to call Tweety a bird than to call him a mammal, at least if these are the only available options.

Third is the negative flavor of such comparisons. Upon an utterance of a between-noun comparison, it is understood that the two nominal labels are not optimal options, for otherwise the speaker would have asserted simpler categorization statements with the given nouns, such as those in (12).

(10) a. Tweety is a bird.
b. Tweety is not a mammal.
c. Mister Ed is not a mammal.

The fourth and last property relates to the fact that the metalinguistic implications of comparisons of two different entities, as in (9b), seems to be considerably weaker. Examples such as (9b) are felt to be less useful, informative or to the point, for it is not clear what can be inferred from them (if (9b), then what??). Once the

[2] Cf. von Stechow (1984), Schwarzschild and Wilkinson (2002), Kennedy & McNally (2005), Schwarzschild (2005), Kennedy and Levin (2007, p. 17), and Sassoon (2010a,b).

analysis is presented, this observation will be cashed out by showing that inferences from single entity between-noun comparisons such as (8a) are lost in two entity comparisons such as (8b).

1.2 Existing accounts

The above mentioned properties, in particular, the metalinguistic property, led researchers to assume that besides the classical adjectival comparison morpheme, e.g. the English *–er* and *more* (as in *This is more expensive than that*), there exist an additional *more* called metalinguistic *more*. Examples of the use of the latter are given in (11). In some languages, it is expressed with distinct morphemes. For instance, Greek and Korean have two comparison morphemes, e.g., Greek *apo*/*apoti* for ordinary comparisons vs. *para* for metalinguistic comparisons (Giannakidou & Yoon 2011).

(11) a.?Dan is more tall than Ram is intelligent.
b. Your problems are legal more than financial (McCawley 1998).
c. Your problems are more legal than financial (McCawley 1998).
d. Rubinstein is more a pianist than a conductor.
e. More than I hate wine, I love bear.
f. When Dan comes home from school and Bill comes home from work, they are always hungry and tired. But usually, Dan is more **hungry** than **tired**, while Bill is more **tired** than **hungry**.

Metalinguistic *more* and its equivalents in languages of the world differ from the ordinary *more* and its equivalents in several respects (see McCawley 1998, Embick 2007 and Morzycki 2011 for in-depth discussions). Syntactically, within-adjective *more* and *-er* are thought to be degree heads that take an adjective phrase and a than-PP as complements. By contrast, metalinguistic-*more* phrases are thought to be adjuncts. This accounts for the fact that they cannot be replaced with –er (cf., the infelicitous *#Dan is taller than Ram is intelligent*), and for their flexible position relative to the adjective or noun phrase, illustrated in (11b-c) (compare to the infelicitous **Murder is illegal more than speeding*.)

Moreover, the so-called metalinguistic comparisons are robustly cross-categorial, compatible with nouns (as in (11d) and verbs (as in (11e)), among other categories (see Morzycki 2011 for a variety of examples). Accordingly, they occur with predicates that are not morphologically gradable or at least fail to reflect degree differences. Furthermore, they occur with otherwise incommensurable predicates, such as *tall* and *intelligent* in (11a).

Semantically, Giannakidou & Yoon (2011) describe these morphemes as creating comparisons of appropriateness or subjective preference of propositions according to speakers. Morzycki (2011) describes them as creating comparisons along degrees of imprecision of propositions, defined based on Lasershon's (1999) analysis of imprecision. For example, (11a), on this analysis, conveys that *Dan tall* is closer to the truth than *Ram is intelligent*. The degree of precision required to render Ram intelligent is lower than the one required to render Dan tall. On the same vein, Klein (1991) characterizes, e.g., (11a) as an answer to the question *Is Ram intelligent?*, rather than to *How tall is Dan?*

All these analyses capture the metalinguistic flavor of between-noun comparisons. However, they fail to explain the fact that in languages with two different morphemes for ordinary and metalinguistic comparisons, such as, e.g., Greek, both types of morpheme license between-noun comparisons (Giannakidou & Yoon 2011). Moreover, intuitively, comparisons such as (6a), *The extensive piano part is more of **a first among equals** than **a showcase for a virtuoso soloist***, can answer the question *How much is the piano part a showcase for a virtuoso soloist?* Similarly, (11f) can answer the questions *How tired is Dan?* and *How hungry is Mira?* (11f) seems to compare the extents to which the hunger and tiredness disturb Dan and Mira, or call for urgent action.

Thus, these comparisons seem to be more than merely metalinguistic in nature. The orderings associated with nouns occurring in between predicate comparisons appear not to be ad-hoc or arbitrary. Rather, they underlie categorization under these nouns. A better understanding of the nature of categorization under nouns may lead to a better understanding of the restrictions on the use of between-predicate *more*. This holds of the examples with adjectives, as well. Over and above degrees of truth or subjective preferences, a comparison such as *Dan is more hungry than tired* can be paraphrased as comparing objective quantities, e.g., how much hunger Dan has, so to speak, considering the sum of hunger and tiredness he has. The analysis proposed in this paper aims to make this intuition more precise.

In addition to the above considerations, none of these analyses is restricted enough. The imprecision analysis is the most restricted (see Morzycki 2011 for criticism of previous analyses on this grounds). Yet, every proposition may have a degree of precision, meaning that it follows from the analysis that any two propositions should be comparable. In particular, propositions of the form "x is more N than y is N" are predicted to be felicitous. Thus, if gradable interpretations based on imprecision are generally available for nouns, they are predicted to license within- noun comparisons, namely, between-predicate comparisons with a single noun

hosting both of the nominal positions. Such a noun would not be seen overtly in the than-clause due to its recoverability, thus the observed surface form would be 'X is more A than Y (is A)'. This prediction, as we have seen in section 1.1, is not borne out; for instance, there is a notorious felicity contrast between *This creature is more a crab than a lobster* and *#This creature is more a crab than that creature is*. The latter is judged less natural 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 at least as much as the propositions *This is a crab* and *This is a lobster* may, or more. In the same way, if gradable interpretations based on speaker preferences are available for nouns (Giannakidou & Yoon 2011), within-noun comparisons are predicted to be licensed, contra to fact.

In conclusion, commensurability in nouns is not metalinguistic in the senses defined above, or at least, other types of between-noun comparison must be available.

Bale (2011) argues for a different analysis of comparisons such as (11a), *Dan is more tall than Ram is intelligent*, which uses the degrees in the semantics of *long* and *wide* only indirectly to compare the relative positions of entities 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, (11a) is true iff the number of entities at least as tall as Dan is greater than the number of entities at least as intelligent as Ram. Similarly, McConnel Ginnet (1973), Klein (1980) and Doetjes (2010) argue for an analysis of indirect comparisons based on the strength of modifier that can truthfully apply to each adjective and argument; (11a) is true on this proposal iff 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 comparison class based analysis in van Rooij (2011), (11a) is true iff the pair comprising of Dan and the adjective *tall* belongs to the positive denotation of a special meta-language predicate *Lots* relative to some comparison class c, but the pair comprising of Ram and *intelligent* does not. Comparison classes for between-predicate comparisons comprise of entity-predicate pairs.

The problem with this type of analyses, again, is that it is not restricted 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 between, e.g., *This creature is more a crab than a lobster* and *#This creature is more a crab than that creature* remains unexplained. The ranks of each two entities with respect to being *a crab* may differ as much as their ranks with respect to being a *crab* and being a *lobster* may, or more. This argument can be generalized. Analyses that assign gradable interpretations for nouns wrongly predict that they be freely licensed in gradable constructions, contra to fact (e.g., #the most bird; #too bird; #very bird). In conclusion, we need an analysis of between-noun comparisons that will explain why the distribution of nouns is restricted to this and no other gradable constructions. To uncover the semantics of this construction, we need to look deeper at the type of conceptual gradability underlying categorization in nouns.[3]

Finally, Doherty & Schwartz (1967), among others, argue that nominal comparisons are mediated by an elided adjective *much*. *More* is the comparative *much+er*. This idea is supported by within-noun comparisons such as *Tweety is more of a bird than Mister Ed*, which seem to be equivalent to similar adjectival statements such as *Tweety is more typical of a bird than Mister E,* and to bear morphological relations to adjectival statements such as *Mister Ed is not much of a bird*. The presence of *of* supports the postulation of an elided adjective of which the preposition phrase is an argument (Doherty & Schwartz 1967: 924).

However, this observation does not straightforwardly account for the fact that between-noun comparisons are perfectly acceptable without *of*. In addition, this analysis does not explicate the ways in which comparisons between *much*-modified nouns differ from comparisons within *much*-modified nouns. Hence, this paper directly assigns semantic interpretation to *more*, leaving questions regarding decomposition for future research.

2. Toward a new solution

An important observation arises from the preceding discussion. The analysis of between-noun comparisons such as *Chevy is more **a car** than **a truck*** must involve orderings based on at least two nominal predicates. Such a solution would elegantly block the possibility of felicitous usage of within-noun comparisons, such as *#This Chevy is more **a car** than that Chevy,* for the latter only has one predicative argument.

The next section develops an implementation of this idea, making crucial use of the psychological notion of *contrast-based categorization* presented in section 2.1. This type of categorization rests on competition between

[3] An analysis in terms of ranks as in Bale (2011) is also inconsistent with an ordinal view of nouns. A scale of ranked positions yields 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, contra to fact (van Rooij 2011). An imprecision analysis of nominal gradability a la` Morzycki (2011) is based on ranking imprecise interpretation of a noun by the extent to which they resemble the precise interpretation, and then assigning entities degrees according to the rank of the most precise noun interpretation that applies to them. This implementation renders differences and ratios meaningful, as well. However, this problem may be avoided if instead of degree rankings, a mere ordering of imprecise interpretations is used (as in Lasersohn 1999). The analysis in van Rooij (2011) is tailored to avoid this kind of problems.

linguistic concepts that are perceived as *contrasting*, namely as denoting non-overlapping categories. Following the presentation of a contrast-based analysis in section 2.2, a generalization is proposed for the case of comparisons involving linguistic concepts that are perceived as denoting overlapping categories. Distinctions in inference patterns are discussed.

2.1 Contrast-based categorization

Consider the following between predicate-comparisons. The common denominator between these three examples is that the predicate pairs occurring in them are perceived as contrasting. Contrasting concepts easily compare.

(12) a. Tweety is more **a bird** than **a mammal**.
b. This Thai dish is more **sour** than **sweet**.
c. This ball is more **red** than **blue**.

The nouns in (12a) denote taxonomical categories, the borders between which ought to be fully discriminated. As for the adjectives in (12b,c), instead of a unique antonym, a set of contrasting categories K_P plays a role in the interpretation of each one of them as well:

(13) a. K_{bird} = {mammal, bird, reptile, insect, fish ...}.
b. K_{sweet} = {sweet, sour, salty, …}.
c. K_{red} = {pink, white, orange, yellow…}.

The idea that contrasting categories affect categorization was introduced within dimension-based categorization theories (see Tversky 1977; Hampton 1995; Smith and Minda 2002, among others.) On these similarity-based analyses, entities classify under nouns iff their values on multiple dimensions sufficiently match the ideal values for the noun. The degree of an entity in a given noun is built by addition or multiplication of its degrees in multiple dimensions. The resulting weighted sum or product should exceed a threshold—a membership standard—for the entity to positively classify under the noun.

This standard-based categorization principle predicts many offline and online typicality effects (Murphy 2002). Importantly, it predicts the by and large, monotonic relation between likelihood of categorization of an entity and its similarity to the prototype; e.g., Hampton (1998) found a very strong coupling between the mean typicality ratings of items and the probability that they were categorized positively in about 500 items of 18 categories. Thus, this theory captures the fact that we can determine membership of infinitely many new instances, on the basis of a finite set of known facts (dimensions and members). Newly encountered entities whose mean similarity is higher than that of known members can be automatically regarded as members.

However, in Hampton's (1998) data, there were also systematic dissociations between typicality and membership present. One of the three main reasons for them was the existence of *contrast concepts*. For example, both *kitchen utensil* and *furniture* were part of the stimuli. This reduced the likelihood of classification, but not the typicality of items like a *refrigerator* in the category *furniture*. To account for this, concepts P are often assumed to belong to a contrast set, K_P, of at least two disjoint categories that cover a local domain, D_{Kp}:

(14) The contrast set: $\forall K_P \subseteq \text{CONCEPT}, |K_P| > 1$:
a. Mutual exclusivity: $\forall Q_1,Q_2 \in K_P, (\llbracket Q_1 \rrbracket \cap \llbracket Q_2 \rrbracket) = \varnothing$.
b. Domain cover: $D_{Kp} = \{d \in \llbracket Q \rrbracket \mid Q \in K_P\}$.

Contrast-based categorization is based on the following rules (Tversky 1977; Smith and Minda 2002; Ashby and Maddox 1993). First, the similarity degree of d in P, Deg(d,P), is normalized relative to the sum of d's degrees in the concepts of K_P, as stated in (15a). The resulting degree—the ratio between d's similarity to P and d's similarity to the contrast categories—represents the extent to which d is P and not anything else. Second, an entity is classified in the contrast concept it resembles most, as stated in (15b), namely in the concept that yields the highest normalized degree.

(15) a. The similarity of d to P normalized relative to K_P:
$\text{Norm}(d,P,K_P) = \text{Deg}(d,P) / \Sigma_{Q \in K_P}\text{Deg}(d,Q)$.
b. An entity is classified in the contrast category it resembles most:
$\llbracket P \rrbracket_{KP} = \{d \in D_P \mid \forall Q \in K_P, \text{Norm}(d,P,K_P) > \text{Norm}(d,Q,K_P)\}$.

For example, assume that the contrast set is the triple K = {P, Q, Z}, and consider two items d_1 and d_2 whose degrees are listed in table 1. Because the sum of degrees of each entity is 1, the normalized degrees are identical

to the original similarity degrees. In each predicate P, Norm(d,P,K) = Deg(d,P)/1. As the table indicates, d_2 is more similar to Z than d_1 (**0.40 > 0.34**), but d_1 is Z, the category which d_1 resembles most, (0.34 > 0.33 = 0.33) and d_2 is P, the category d_2 resembles most (0.42 > 0.40 > 0.18). Thus, membership likelihood *may not* be monotonically related to normalized similarity: d_2 is more of a Z than d_1, but is not classified under Z.

Degrees:	P	Q	Z	Sum
d_1	0.33	0.33	**0.34**	1
d_2	**0.42**	0.18	**0.40**	1

Normalized degrees:	P	Q	Z
	0.33	0.33	**0.34**
	0.42	0.18	**0.40**

Table 1: Degrees and normalized degrees in contrast categories

The situation is different, however, with binary contrast sets K = {P, Z}, as in table 2. Recall that the normalized degree of an entity in a predicate equals its degree of similarity to that predicate divided by the sum of its degrees of similarity to the contrast concepts, e.g., for d_2 and P, **Norm(d_2,P,K_P) =** deg(d_2,P)/(deg(d_2,P) + deg(d_2,Z)) = 1/(1 + 0.66) = 0.60. Thus, as the table above indicates, d_1 is Z, the category d_1 resembles most in K, and d_2 is P, the category d_2 resembles most in K. In accordance, before normalization d_2 is more similar to Z than d_1, but with respect to K, d_2 is less so. For example, a refrigerator better exemplifies the noun 'furniture' than a lamp does, but this changes when the contrast set K comprises of the nouns 'furniture' and 'kitchen utensil'. The refrigerator classifies as a kitchen utensil, while the lamp classifies as a piece of furniture.

Degrees:	P	Z	Sum
d_1	0.49	**0.51**	1
d_2	**1**	0.66	1.66

Normalized degrees:	P	Z	Sum
	0.49	0.51	1
	0.60	0.40	1

Table 2: Degrees and normalized degrees in binary contrast categories

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 d, Norm(d,Z,{P,Z}) = 1 – Norm(d,P,{P,Z}). It follows that if d_1's normalized degree in P is bigger than d_2's, then d_1's normalized degree in Z is smaller than d_2's. For instance, if entities' degrees 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 to which they resemble most, this means that d_2 being more Z than d_1 relative to {P,Z} is incompatible with classification of d_1, but not d_2, under Z. The reason is that if Z is the category to which d_1 resembles most, then deg(d_1,Z,{P,Z}) > ½. Hence, deg(d_2,Z,{P,Z} which is a higher degree, is definitely bigger than ½, meaning that it as well should classify under Z relative to {P,Z}.

In conclusion, in binary contrast-sets, membership *is* coupled with *normalized* similarity. If $|K_P| = 2$, new entities, which are more P relative to K_P than known Ps, can be automatically regarded as P relative to K_P.

2.2 Contrast-based comparisons

Most of the predicates with more than one contrasting category seem to be nouns or noun phrases of taxonomic categories, for instance, animals and plants, but other nouns as well as adjectives can also be regarded as contrasting within a suitable context. Many between-noun comparisons, and some between-adjective comparisons, appear intuitively to involve concepts of the same contrast set. The following semantics reflects this intuition, by taking between-noun comparisons, and similar adjectival comparisons, to be comparisons of degrees normalized relative to a contrast set K consisting of the predicative arguments of *more*.[4]

(16) a. Contrast-set comparisons:
$[\![$X is more **A** than Y is **B**$]\!]_{w,g} = 1$ iff
For **K = {A,B}**: Norm($[\![X]\!]_{w,g}$,**A**,K,w,g) **>** Norm($[\![Y]\!]_{w,g}$,**B**,K,w,g).

b. Norm(d,P,K_P,w,g) = Deg(d,P,w,g) / $\Sigma_{Q \in K_P}$Deg(d,Q,w,g).

[4] For generality, this semantic definition is formulated for the two-subject case. The preference for a single subject is explained below on semantic grounds. However, the account does not exclude the possibility that certain syntactic structures are restricted to single entity comparisons.

For example, in deciding whether Tweety is more a bird than Mister Ed is a mammal, the contrast set K consists of the predicative arguments of *more*, *bird* and *mammal*, as in (17a). As contrastive categories, they ought to be treated as contextually disjoint and the only alternatives covering a local domain of discourse. The similarity of an entity to a contrast concept is normalized relative to K. As shown in (17b-c), an entity's normalized degree is the ratio between its similarity to the category applied to it and its similarity to the contrast category – the one applied to the compared entity.

(17) a. $[\![$Tweety is more a bird than a mammal $]\!]_{w,g} = 1$ iff for K = {bird, mammal},
$Norm([\![Tweety]\!]_{w,g},bird,K,w,g) > Norm^{+}([\![Tweety]\!]_{w,g},mammal,K,w,g)$.

b. $Norm([\![Tweety]\!]_{w,g},bird,K,w,g) = deg([\![Tweety]\!]_{w,g},bird,w,g) /$
$(deg([\![Tweety]\!]_{w,g},bird,w,g) + deg([\![Tweety]\!]_{w,g},mammal,w,g))$

c. $Norm([\![Tweety]\!]_{w,g},mammal,K,w,g) = deg([\![Tweety]\!]_{w,g},mammal,w,g) /$
$(deg([\![Tweety]\!]_{w,g},bird,w,g) + deg([\![Tweety]\!]_{w,g},mammal,w,g))$.

The normalized degrees of the entity-arguments compare. Thus, the given sentence is true in w and g iff Tweety is closer to the prototype of *bird* than Mister Ed is close to the prototype of *mammal*, when taking only these two prototypes into account.

This account captures the special features of between-noun comparisons. First, recall that these type of comparisons has a strong metalinguistic flavor; e.g., from *Tweety is more a bird than a mammal*, it follows that the speaker prefers to call Tweety a bird than to call him a mammal, at least if these are the only available options. Recall that in binary contrast sets, categorization is always monotonic to similarity. Thus, *Tweety is more a bird than a mammal* implies that *Tweety is a bird*, given the contrast set. This gives rise to the implication that the speaker prefers to call Tweety a *bird* than to call him a *mammal*.

Second, this type of comparison has a negative flavor. It is implied that *mammal* and *bird* are not optimal labels for Tweety, for otherwise the speaker would have stated that *Tweety is a bird, not a mammal*. The comparison construction does not entail this alternative statement. If the contrast set is bigger, or if categorization is not based on a contrast set, Tweety may not classify as a bird. In fact, the message that the speaker prefers to call Tweety a *bird* than to call him a *mammal* is likely to be informative precisely when **the default setting of parameters for categorization** – the dimensions, their weights, and the set of contrast categories, if such a set is involved as a default – **do not render Tweety a bird**. Only the setting of parameters with K = {bird,mammal} does so.

Third, for many speakers the construction in (17a) is preferred to the one in (18a).

(18) a. $[\![$ Tweety is more a bird than Mr. Ed is a mammal $]\!]_{w,g} = 1$ iff for K = {bird, mammal},
$Norm([\![Tweety]\!]_{w,g},bird,K,w,g) > Norm([\![Mr.\ Ed]\!]_{w,g},mammal,K,w,g)$

b. $Norm([\![Tweety]\!]_{w,g},bird,K,w,g) = deg([\![Tweety]\!]_{w,g},bird,w,g) /$
$(deg([\![Tweety]\!]_{w,g},bird,w,g) + deg([\![Tweety]\!]_{w,g},mammal,w,g))$

d. $Norm([\![Mister\ Ed]\!]_{w,g},mammal,K,w,g) = deg([\![Tweety]\!]_{w,g},mammal,w,g) /$
$(deg([\![Mister\ Ed]\!]_{w,g},bird,w,g) + deg([\![Mister\ Ed]\!]_{w,g},mammal,w,g))$.

The problem with (18a) is a low potential for inference. *Tweety is more a bird than Mr. Ed is a mammal* implies very little about their categorization. They may both be birds or both be mammals relative to {bird, mammal}. Only single-entity comparisons have categorization entailments; e.g., (17a) entails that Tweety is a bird relative to K, but the two entity comparison in (18a) is consistent with Tweety not being a bird relative to K. The normalized degrees of a single entity are complementary in the sense that they sum up to 1. This is the source of the metalinguistic inference – the bigger normalized degree of an entity is also the biggest one for that entity. This is also the reason for the absence of inference in two entity comparisons. The compared degrees in such comparisons need not be the highest ones for any of the entities.

For the two entity comparison in (18a) we only derive weaker entailment, such as the trivial (19a-c).

(19) Tweety is more a bird than Mister Ed is a mammal $\Rightarrow$
a. Mr. Ed is less a mammal than Tweety is a bird.
b. Tweety is less a mammal than Mr. Ed is a bird.
c. Mr. Ed is more a bird than Tweety is a mammal.

To see this consider again the context given in table 2. In this context, (18a) is true because for K = {bird, mammal}, $Norm([\![Tweety]\!]_{w,g},bird,K,w,g) = 0.60$, which is bigger than $Norm([\![Mister\ Ed]\!]_{w,g},mammal,K,w,g) = 0.51$. (19a) is also true for the exact same reason. At the same time, (19c) is true, and so is (19b), because $Norm([\![Mr.\ Ed]\!]_{w,g},bird,K,w,g) = 0.49$, which is bigger than $Norm([\![Tweety]\!]_{w,g},mammal,K,w,g) = 0.40$. 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. Thus, 'X is more A than Y is B' entails that 'Y is more A than X is B' as well. This shows how little informative value such statements carry. Examples of the form 'X is more A than Y is B' appear to only contradict examples of the form 'X is more B than Y is A' (but even in this respect, see the discussion of overlapping categories below). Finally, despite the fact that Mr. Ed is more a bird than Tweety is a mammal, Mr. Ed is not a bird relative to K, for the contrast concept it resembles most is *mammal* (0.51 > 0.49). This fact illustrates that in two entity comparisons the metalinguistic flavor is lost.

To illustrate these inferences with natural examples about which we have judgments based on background knowledge, consider (20a). It is intuitively true because the dolphin resembles a fish not a bird, while, as figure 2 shows, the platypus resembles both. This truth value judgment is captured by the proposed analysis, for both of the degrees of the platypus in these circumstances appear close to 0.50, as opposed to the dolphin's degrees in the two nouns, which are less balanced. Also, intuitively, it holds true, as predicted, that the Platypus is more a fish than the dolphin is a bird, merely 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 'X is more A than Y is B' to 'Y is more A than X is B'. However, it does follow that the platypus is less a bird than the dolphin is a fish, i.e., it is not the case that 'Y is more B than x is A'. In fact, intuitively, *The platypus is no more a bird than the dolphin is a fish* is true, but the semantics of *no* as used in this construction falls outside the scope of this paper. Finally, (20a) does not imply that the dolphin is a fish relative to K = {fish,bird}. Thus, this construction is more marked for lack of inferential power.

(20) a. The Dolphin is more a fish than the platypus is a bird
b. The Dolphin is more a mammal than the platypus is a bird.
c. Anemones are more red than Cyclamens are purple.

We accept usages of this construction mainly in trivial cases such as those illustrated in (20b,c). (20b) is clearly true merely because the dolphin is a mammal, and the platypus, which is a mammal too, is not a bird. Similarly, (20c) is true because Anemones are clearly red, while Cyclamens are neither red nor purple. They are pink.

Notice also that different entities may render salient different contrast categories. We have world knowledge telling us that the platypus and dolphin are mammals, or borderline between mammal and bird and between mammal and fish, respectively. Thus, we may be disposed to add the contrast concept *mammal*, or even accommodate different contrast sets when relating to these species as in (20a). But this creates a clash with the semantics that strictly defines the contrast set to comprise from the two compared nouns. In addition, such a move only decreases the inferential power. Recall that for a binary set such as {bird, mammal}, (18a) is predicted to entail (19b), because the normalized degrees of each entity sum up to 1. For a bigger contrast set, even this inference is lost. Table 3 illustrates this case. Tweety is more a bird than Mr Ed is a mammal, because 0.3 > 0. However, it is not the case that Tweety is less a mammal than Mr. Ed is a bird, Tweety is more so, because 0.2 > 0.

Normalized degrees:	Fish	Bird	Mammal	Sum
Mr. Ed	1	0	0	1
Tweety	0.5	0.3	0.2	1

Table 3: Degrees and normalized degrees in nonbinary contrast categories

Figure 2: A platypus

Moreover, entity-arguments might render salient different comparison classes that may create incommensurable contrast dimensions. For instance, example (21a) shows that adjectives that are associated with doubly-closed scales compare. Any two doubly-closed scales can be easily converted to a single one.[5] However, scales of volume filled based on different containers do not easily compare, as the slight oddity of example (21b) illustrates. Example (21c) has a reading which is true but still funny, illustrating that a preference for a single type of entity occurs even in within-predicate comparisons with dimensional adjectives. The ideal objects of comparisons are things which are all alike except with respect to the degree to which they are full or empty. In nouns, no two things seem to be all alike except for the degree to which they are, e.g., birds or mammals, because nouns are associated with much richer clusters of dimensions than dimensional adjectives. Thus, in comparisons with nouns, only single entities easily compare.

(21) a. This glass is more full than empty.

[5] Nouns map entities to exemplariness degrees on scales that are readily closed and converted, by virtue of the process of averaging on which they are based. To see this, think about the calculation of a student's yearly average. When the scales for grading different areas of study are different (e.g., a 1 to 7 scale in math and a 10 to 100 scale in literature), it is obviously necessary to convert all of the scales into a uniform one, before averaging.

b. ?This glass is more full than this bottle is empty.
c. A completely full Espresso cup is less full than a half full tea cup.

(22) a. This {sky, ball} is more red than blue.
b. ?This {sky, ball} is more red than that ball is blue.

The same point is illustrated in (22a), which can convey the meaning that the red area is bigger than the blue area, as opposed to (22b), that can hardly be used to convey that the red area on this ball is bigger than the blue area on that ball. The balls may differ in size, drawing, number of colors, shades of colors and other dimensions, all of which may affect the way color might be measured.

As these examples illustrate, certain adjectival comparisons may be contrast-based, such as, e.g., *Mira is more tired than hungry*, or *This thing is more a table than a wall*. The latter is understood as conveying merely that the position of the object in question is more *horizontal* than *vertical*. Intuitively, these two adjectives set out standards on the same scale (the angels 0^o vs. 180^o relative to earth), and it is implied that the argument is closer to one of them. This can be captured with the contrast-based analysis, assuming an assignment of high weights for these two dimensions. As a default, additional dimensions seem to be at play (e.g., function or color). This may render an entity argument a table relative to K, but not a table per se (hence, only more a table).

Nonetheless, the between predicate comparisons of the sort discussed here differ significantly from typical within-adjective comparisons. Recall that degree modifiers such as the ones in (23a) can modify adjectival comparisons and contribute an evaluation of the size of difference between the degrees of the compared entities. It has been argued that adjectives denote mappings to degrees for which a difference operation can meaningfully apply. Categorization under nouns is mediated by degrees, but not by ones for which differences are meaningful. The nominal degrees are based on context sensitive dimensional weights and on various transformations such as inversion and normalization that leave little chance for any degree differences to be preserved. On this analysis, it is not surprising that difference modifiers are ungrammatical within contrast-based comparisons, as the examples in (23b-e) taken from Morzycki (2011) illustrate.[6]

(23) a. George is {much, slightly, somewhat, a lot, no} taller than Bill.
b. George is {much, ?slightly, ??somewhat, ??a lot, ?no} more dumb than crazy.
c. George is dumb {much, *?slightly, *?somewhat, *?a lot, *?no} more than crazy.
d. Tweety is {much, ?slightly, ??somewhat, ??a lot, ?no} more a bird than a mammal.
e. Tweety is a bird {much, *?slightly, *?somewhat, *?a lot, *?no} more than a mammal.

Furthermore, Morzycki attributes to a reviewer the observation that when degree modification of metalinguistic *more* as in (23) is accepted, it induces a **comparison of deviation** reading. As section 1 suggests, this is a typical type of adjectival comparison, based on degree differences. It is therefore no wonder that modifiers that presuppose a difference-scale trigger this type of reading.

The discussion so far suggests that adjectives can participate in at least two types of between-predicate comparisons, difference-based comparisons and contrast-based comparisons. Certain examples, I argued, illustrate the latter, rather than the former. 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 (24a), the Estonian translation of *the sofa is 2cm longer than it is wide*, whereas the free morpheme ***pigem*** creates contrast comparisons, as in the between-noun comparison in (24b), and the between-adjective comparisons in (24c,d), which include the Estonian translations of *more similar than different* and *more tired than hungry*.

(24) a. Sohva on (2cm) pik**em** kui laud
'The sofa is (2 cm) longer than wide'
b. Ta on **pigem** helilooja kui tantsija.
'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'
e. #Mozart on rohk**em** helilooja (heliloojam) kui Arvo Pärt.
'Mozart is more of a composer than Arvo Pärt'
f. #Mozart on **pigem** helilooja kui Arvo Pärt.
'Mozart is more of a composer than Arvo Pärt.

[6] Interestingly, the degree modifier *much* patterns differently from the other modifiers (Morzycki 2011). This issue deserves future research. At any rate the present proposal fairs better than existing accounts of between-predicate comparisons. The latter have little to say about the facts in (23).

g. John on terv**em** kui Bill
'John is healthier than Bill'
h. #John on **pigem terve** kui Bill
#'John is more healthy than Bill'

Within-noun comparisons are infelicitous with either morpheme. For instance, neither (24e) with *–em*, nor (24f) with *pigem* can naturally express that Mozart is more of a composer than Arvo Pärt. Finally, *pigem* cannot be used with a multidimensional adjective like *healthy* in (24h) to get the meaning of (24g). The word **pigem** indicates that a contrast is present, so a comparison with a single adjective is marginal at best. This data suggests that contrast morphemes always involve normalization, even with adjectives.[7] All in all, the notion of a contrast set appears to capture the inference patterns and other special properties of between-noun comparisons and certain between-adjective comparisons.

It is now the time to give a solution to the main problem this paper set out to address. A clear advantage of the contrast-based analysis over existing alternatives is that contrast-based *more* in statements of the form 'X is more A than (y is) B' cannot be licensed when A and B are one and the same predicate.

The notion of a contrast set K presupposes the existence of at least two different contrast concepts, $|K| > 1$, namely, $A \neq B$. This is so for a reason. All entities are predicted to always be equally A relative to the singleton contrast set {A}. The reason for this is that a degree normalized relative to one and the same predicate always equals 1, for Norm(d,**A**,w,g) = deg(d,**A**,g,w)/ deg(d,**A**,g,w). The only exception to this generalization is the undefined case, 0/0. These results explain the fact that a statement of the form 'X is more a bird than Y' is intuitively considered false. This judgment emerges precisely because all birds are judged to be equally so. This judgment persists despite of the fact that speakers are willing to admit graded exemplariness judgments when interpreting statements of the form 'X is more (typical) of a bird than Y'.

Last, but not least, an analysis in terms of a contrast set has to be generalized to apply to comparisons with nouns that refer to potentially overlapping categories. Examples include the nouns in (25a), *pianist* and *composer*, among many other nouns that name human traits, dispositions, habits or professions. Importantly, comparisons of overlapping categories exhibit systematically different inference patterns. In particular, we may hold both (25b) and (25c) true together.

(25) a. Frank is more a pianist than Bill is a conductor.
b. Frank is more a philosopher than Galit is a linguist
c. Frank is more a linguist than Galit is a philosopher

We may aim to treat the compared nouns in (25b,c) as contrasting, but this would rule out the possibility that both (25b) and (25c) be simultaneously true. Thus, let us conclude the discussion with a generalized definition of normalized degrees which will be of use in such cases. The problem parallels that of the calculation of probabilities of overlapping events e_1 and e_2. The solution requires resort to the set of disjoint sub events e_3, e_4 and e_5, such that $e_1 = e_3 + e_4$ and $e_2 = e_3$ and e_5. Similarly, the generalized definition of contrast comparisons uses for, e.g., (25b,c), the set of disjoint contrast categories *philosopher who is not a linguist* (P&¬L), *linguist who is not a philosopher* (L&¬P) and *one who's both a linguist and a philosopher* (L&P). The degree of each entity in *linguist* and *philosopher* is normalized relative to these disjoint categories.

(26) a. Contrast-set comparisons, a generalized definition:
$[\![$ X is more A than Y is B $]\!]_{w,g} = 1$ iff for K = {A,B}, $\text{Norm}^{O}([\![X]\!]_{w,g},A,K,w,g) > \text{Norm}^{O}([\![Y]\!]_{w,g},B,K,w,g)$.
b. $\text{Norm}^{O}(d,A,\{A,B\},w,g) = (\text{Deg}(d,A \,\&\, \neg B,w,g) + (\text{Deg}(d,A \,\&\, B,w,g)) / (\text{Deg}(d,A \,\&\, \neg B,w,g) + (\text{Deg}(d,A \,\&\, B,w,g) + (\text{Deg}(d, \neg A \,\&\, B,w,g))$.

In non overlapping categories, the value (Deg(d,A & B,w,g) equals zero. Thus, the generalized definition reduced to the one presented earlier. Table 4 illustrates the utility of this generalized notion of a contrast set for the case of overlapping categories. A suitable context for this table is one in which Frank's work is truly interdisciplinary; his work is distinguished relative to the work of specialists both in linguistics and philosophy. Galit, by comparison, is an ordinary linguist. She does linguistics research reasonably well, but only rarely does her work have any philosophical significance, and she never asks purely philosophical questions. The shift to the disjoint contrast-set allows for an assignment of normalized degrees for each entity that sum up to more than just 1; e.g., the sum of normalized degrees is 1.1 in Galit's case, and it is 2 in Frank's case. This reflects the

[7] If forced, the use of (24h) implies that neither John nor Bill could really be called healthy, which may either be an instance of the negative implication characterizing contrast comparisons, or an instance of an independent phenomena that requires an independent account. I leave this issue for future research.

potentially overlapping nature of the concepts in question, and the degree to which each entity exemplifies each concept separately or both concepts together.

Degrees: %	P&¬L	L& ¬P	L&P	**Normalized degrees**:	Norm(P) deg(P&¬L) +deg(P&L)	Norm(L) deg(L&¬P) +deg(P&L)	Sum
Frank	0	**0**	100		100/100 = **1**	100/100 = 1	**2**
Galit	10	80	10		10+10/100 = **.2**	90/100 = .9	**1.1**

Table 4: Degrees and normalized degrees in overlapping categories

3. Conclusions and remaining matters

For entities to compare relative to a nominal concept A either a designated morpheme ought to mediate the interpretation such as *typical*, *true*, *big*, *good*, *much*, or the bare particle *of*, or another concept B ought to occur and license a contrast-based comparison. In that case, a tendency toward interpretations relative to binary contrast sets and single entities emerges so as to increase the inferential power, which is reduced in more than two-category or two-entity comparisons. Moreover, comparisons with non-disjoint categories support a generalized definition of normalized degrees. The resulting analysis of contrast comparisons captures intuitive truth value judgments and inference patterns in disjoint vs. overlapping categories. Furthermore, it extends to between-adjective comparisons that are typically analyzed as metalinguistic or indirect.

The theory of contrast based categorization was developed based on experimental research. Its linguistic significance has yet to be pinned down, including its connection to other alternative-based mechanisms such as those used for implicature calculation.

An additional question left for the future concerns the reasons for the infelicity of between-predicate equatives, such as *As *(much) {a chair as a table, crazy as dumb}* (Morzycki 2011). The role of *much* in triggering normalized contrast-based measurements for nouns, and its use to assist licensing of gradable interpretations in sentences with a single noun, for instance, *pretty much a chair* or *not much of a bird*, is not yet well understood.

Another topic for future research regards the role of dimensions in the interpretation of contrast-based morphemes. Between predicate *more* may also be an operation over dimensions. Examples in point are comparisons such as *Their suggestions are more similar than different*, which, intuitively, convey that the number of similarity dimensions with respect to which the suggestions classify as *similar* (|{F∈Dim(similar): The suggestions are similar with respect to F}|) exceeds the number of dimensions with respect to which they classify as *dissimilar* (|{F∈Dim(similar): The suggestions are dissimilar with respect to F}|). A function D is defined in (27a) that relates predicates with dimension counts—functions from entities to degrees representing the number of dimensions whose norm they exceed. In the slightly modified contrast-based analysis proposed in (27b,c), the between-predicate morpheme systematically relates to such dimension counts.

(27) a. Let us call the dimension set of A Dim(A) and define D as follows:
$D(d,A) = |\{F \in Dim(A): F(d)\}|/|Dim(A)|$.

b. $[\![X \text{ is more A than Y is B }]\!]_{w,g} = 1$ iff for $K = \{A,B\}$, $Norm^D([\![X]\!]_{w,g},A,K,w,g) > Norm^D([\![Y]\!]_{w,g},B,K,w,g)$.

c. $Norm^D(d,A,\{A,B\},w,g) = (D(d,A \,\&\, \neg B,w,g) + (D(d,A \,\&\, B,w,g)) / (D(d,A \,\&\, \neg B,w,g) + (D(d,A \,\&\, B,w,g) + (D(d, \neg A \,\&\, B,w,g))$.

For example, according to the definitions in (27), for an entity to be *more a bird than a mammal* is to classify positively with respect to a larger proportion of dimensions of birds than of mammals.

This analysis yields the same results as the previous one as long as the degree functions associated with the compared nouns A and B are by default such that an entity's degree reflects the number of dimensions with respect to which it classifies positively. This happens when A and B's degree functions are based on binary dimensions, with equal weights, and on additive-, as opposed to multiplicative averaging. To appreciate the distinction between addition and multiplication of degrees, consider a set of binary dimensions with equal weights. For entities that match the ideal in all of them, 1 … 1, except for one mismatch, 0, addition gives 0 + 1 + …+ 1 >> 0, while multiplication gives 0 × 1 ×…× 1 = 0 (Murphy 2002). Thus, with binary dimensions of equal weights, additive, but not multiplicative classification is rendered equivalent to quantification (mere counting of dimensions). Entities are required to have sufficiently many (all/ most/ some) of the dimensions. On

these circumstances, each dimension has an independent and constant effect on the similarity and categorization status of an entity, so that adding up the dimensional degrees amounts to counting dimensions.

There are reasons to think that the interpretation of between-predicate comparisons should be formulated in terms of an operation over dimensions, as in (27). An important support for this revision comes from the fact that some nouns compare more easily than others, and these are precisely those nouns that tend more to allow an interpretation based on dimension counts, namely additive nouns, whose dimensions are represented as independent. Interestingly, dimension independence characterizes social concepts and to some extent artifact concepts, while dimension interaction characterizes plants and animals (Hampton, Storms, Simmons and Heussen 2009). In accordance, nouns denoting social categories and artifacts are more acceptable than nouns denoting animals and plants, as the contrast between (28a) and (28b), respectively, illustrates.

(28) Between-noun comparisons:
  a. This artist is more a composer than a poet >>
  b. ?This tree is more an oak than a pine

The degree of accessibility of a noun dimension seems to affect the noun's felicity in between-predicate comparisons, in support of an analysis in terms of dimension counts.

To illustrate dimension interrelatedness, each *bird* subkind is associated with a bundle of dependent or interrelated dimensions; for instance, all the robins look and behave much like prototypical robins (they are small, they eat seeds and fruit, they communicate by singing, and so on), and all the eagles look and behave much like prototypical eagles (they are big, they eat animals, they communicate with calls, and so on), but no bird looks somewhere in between these two prototypes, with half of the characteristics of a robin and half of those of an eagle.

In accordance, dimension interrelatedness, which is represented by multiplicative dimension binding, can be identified by a tendency for gaps between categories, whereas dimension independence, which is represented by additive dimension binding, can be identified by a tendency for gluts—overlaps between categories. While the denotations of natural kind concepts in the actual world have a limited number of borderline cases, Hampton, Storms, Simmons and Heussen (2009) have invented scenarios with potential borderline cases. On one such scenario, a historical nuclear accident nearby a remote island resulted in the evolution of hybrid creatures, e.g., a subkind with some features of lobsters and some features of crabs, a sub kind with features of a pine and an oak, and so on. In a second scenario, a secluded community in a remote area of eastern Europe had the habit of using artifacts in ambiguous ways so that some pieces of clothing had features of both a scarf and a tie, some places had features of both a church and an art gallery, and so on. Participants were asked to help scientists classify the creatures and artifacts they were presented with. The results exhibited a clear domain difference. In line with a multiplicative-similarity analysis (the assumption of dimension interrelatedness), hybrids of two different natural kinds were often classified in neither one of the kinds, whereas hybrids of artifacts were often classified in both categories, in line with an analysis in terms of dimension independence.

Dimension independence is a strong feature of social concepts (labels of, e.g., human traits and behavioral features). Wattenmaker (1995) found that the categorization criterion for social concepts can often be represented by a simple counting strategy. Entities that have most of the properties denoted by a concept's dimensions are classified positively. As already noted, this case involves the assumption of binary dimensions with equal weights and an additive averaging function. This case is special because it is the only case in which the effect of averaging reduces to an effect that can be represented via counting, as in $\lambda d.\ \lambda n.\ D(d,A) > n$ (the property that d has iff the number of dimensions F of A, such that d is F, is n.)

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