

# THE SEMANTICS OF NOUNS DERIVED FROM GRADABLE ADJECTIVES<sup>1</sup>

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## Abstract

What semantics should we attribute to nouns like *wisdom* and *generosity*, which are derived from gradable adjectives? We show that, from a morphosyntactic standpoint, these nouns are mass nouns. This leads us to consider and answer the following questions. How are these nouns interpreted in their various uses? What formal representations may one associate with their interpretations? How do these depend on the semantics of the adjective? And where lies the semantic unity of nouns like *wisdom* and *generosity* with the more familiar concrete mass nouns, like *wine* and *furniture*?

## 1 Introduction

The topic of this paper is what semantics should we attribute to nouns derived from gradable adjectives? A gradable adjective, like *wise*, is one that describes a property that comes into degrees, so that it accepts modifiers like *very*: *Julie is very wise*. (By contrast, an adjective like *perpendicular* is not gradable: two lines may be *perpendicular*, but not *\*very perpendicular*.) From the adjective *wise*, English has derived the noun *wisdom*. Other examples of such pairs include: *generous* □ *generosity*, *hostile* □ *hostility*, *friendly* □ *friendliness*.

We begin by examining how these nouns can be used, that is, what their morphosyntactic distribution is. This leads us to conclude that they are mass nouns. We then look at the interpretations that these nouns can receive in these constructions.

After which we address the following questions: What formal representations may one associate with these interpretations? How do these depend on the formal representation associated with the adjective? And in what respects is the semantics of deadjectival mass nouns similar to that of concrete mass nouns, like *wine* and *furniture*, on which research in formal semantics has focused?<sup>2</sup>

## 2 The uses of nouns derived from gradable adjectives

We find, first, that a noun derived from a gradable adjective can appear together with a possessive phrase: *Julie's courage*, *the courage of Julie and Tom*, or in a definite nominal expression with a relative (non-possessive) phrase: *the courage that Julie showed*, *the courage that Fred attributed to Julie and Tom*. We group these uses together as the possessive or relative phrase identifies the bearer(s) of the property described by the noun.

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<sup>2</sup> For reviews of the literature, see Pelletier & Schubert (1989), Krifka (1991) and Nicolas (2002).

Second, the noun can appear together with an indefinite, mass determiner like *some*, *much*, *a lot of* or *a little*<sup>3</sup>: *July has much / a little courage*, *John found some / a lot of courage in those men*.

Third, the noun can appear in comparative constructions, its grammatical number being singular: *July has less / more wisdom than Tom*, *John saw more courage in his opponents than in his teammates*.

Fourth, the noun may be used bare, that is, without any determiner, in sentences that are not comparative: *Julie has encountered hostility*, *John found courage in those men*, *Friendliness is nice*. We see in particular that, in all the contexts in which the noun is combined with a mass determiner, the noun can appear with no determiner.

Fifth, the noun is in general invariable in grammatical number: it seems hard, for instance, to talk of *wisdoms* or *friendlinesses*; doing so requires a special context and induces a change in meaning.

Finally, the noun may sometimes be used together with a count determiner, most notably in expressions of the form [*a(n)* + adjective + noun]: *a(n) exceptional / great / high wisdom*.<sup>4</sup>

This pattern of uses is the same as the one we find for concrete mass nouns, like *wine* or *furniture*: nouns like *wisdom* and nouns like *wine* or *furniture* have the same morphosyntactic distribution. This means, quite simply, that they are all mass nouns.<sup>5</sup>

This immediately raises three questions: What formal representations may one associate with the interpretations of nouns like *wisdom*? How do these depend on the formal representation associated with the adjective? And where lies the semantic unity of nouns like *wisdom* with the more familiar concrete mass nouns?

Before answering these questions<sup>6</sup>, let us see what interpretations mass nouns like *wisdom* receive in their various uses.

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<sup>3</sup> We call “mass” any determiner that is characteristic of mass nouns. On mass nouns, count nouns and their characteristic determiners, see note 5 below.

<sup>4</sup> We call “count” any determiner that is characteristic of count nouns; cf. the next note.

<sup>5</sup> In many languages, including English, common nouns divide into two morphosyntactic subclasses, mass nouns and count nouns (Gillon 1992). A defining characteristic of mass nouns, like *milk*, is that they are invariable, while count nouns, like *cat*, can be used in the singular and in the plural. Depending on the language, this basic morphosyntactic difference between the two types of noun is often supplemented by differences as to the determiners they can combine with. Thus, in English, mass nouns can be used with determiners like *much* and *a lot of*, but neither with *one* nor *many*. On the contrary, count nouns can be employed with numerals like *one* and determiners like *many*, but not with *much*.

It is of course well-known that mass nouns can, in certain contexts, be used as count nouns (*You should take a hot milk with some honey*), and vice versa (*You will find a lot of rabbit around here*). One then talks of conversion. Conversion is a common grammatical possibility, whereby a member of a grammatical category is used in the morphosyntactic environment characteristic of another grammatical category. For instance, proper names can be used as common nouns: *The professor has two Picassos in his class* (cf. Gillon 1992, Kleiber 1994, Nicolas Submitted). Uses of nouns like *wisdom* in the plural or with a count determiner are cases of conversion, from mass to count.

<sup>6</sup> The first two questions will be dealt with in section 4, while the third will be answered in the conclusion (section 5).

### 3 The interpretations of nouns derived from gradable adjectives

#### 3.1 The interpretation of possessive and definite uses

Take sentences like:

*Julie's generosity attracted Tom.*

They may be understood in two ways. First, as meaning something like:

- (1) The particular generosity that Julie (and Julie alone) had attracted Tom.

Second, as meaning something like:

- (2) (The fact) that Julie was generous attracted Tom.

Under the first interpretation, the noun phrase *Julie's generosity* refers to an instance of a property, an instance of generosity.<sup>7</sup> Julie's generosity is unique to her, and differs from, say, Tom's. Under the second interpretation, the expression *Julie's generosity* refers to a fact, that Julie was generous, and it is this which is understood to attract Tom, rather than the particular generosity that Julie had. A natural hypothesis is thus that expressions like *Julie's generosity* are ambiguous between two interpretations, an "instance-interpretation" as characterized in (1) and a "fact-interpretation" as in (2).

A datum in favor of this hypothesis is of course the availability of the paraphrases in (1) and (2): these paraphrases capture the intuition that sentences like *Julie's generosity attracted Tom* may be understood in two different ways. But the crucial datum comes from the existence of predicates that license one interpretation but not the other.

We observe first that there are predicates, like *admit* and *confess*, that accept expressions like *Julie's generosity* as argument, license a fact-interpretation but do not give rise to an instance-interpretation:

*Tom admitted / confessed his sadness to Julie.*<sup>8</sup>

While these sentences can be understood as *Tom admitted / confessed to Julie that he was sad*, they could not be taken to mean something that could be paraphrased as: *Tom admitted / confessed to Julie the particular sadness that he alone had*. *Admit* and *confess* require that the referent of his sadness be a fact.<sup>9</sup>

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<sup>7</sup> Instances of properties are also known to philosophers as moments, tropes or modes (see Mulligan et al. 1984 and Lowe 1998). Julie's smile, Julie's love for Tom, and the red of Julie's shirt are other examples of instances of properties. The ontology defended by Lowe (1998) offers a general, metaphysical framework congenial to the views defended in this paper. In this framework, the relationship between individuals, kinds, property instances and properties comes out as follows. July instantiates the kind HUMAN BEING. And July possesses the property of generosity, in virtue of possessing a particular instance of generosity. But we could not say that she possesses the kind HUMAN BEING, nor that she instantiates the property of generosity. So, in this ontology, an individual instantiates a kind, while she possesses properties; instantiation and property possession are categorically distinct relations.

<sup>8</sup> Adapted from a similar example given in French by Van de Velde (1995: 141).

<sup>9</sup> Notions like "factives" and "factive contexts" have been discussed in the literature (see, e.g. Kiparsky and Kiparsky 1971, Delacruz 1973). So has Vendler's idea that gerunds of the form *her performing the song* would refer to facts (Asher 1993, Vendler 1968, Kistler 1999). However, we have found very few predicates that, with expressions like *Julie's generosity*, license a fact-interpretation and (clearly) refuse an instance-interpretation. Consider for example "factive predicates" like *surprise*, *bother* and *attract*. These predicates are said to be factive because, when they take a clausal subject, they presuppose that the embedded sentence be true. If the sentence *That Julie was generous surprised Tom* is true, this entails that the sentence embedded in the subject (*Julie was generous*) is also true. Nonetheless, in general, these predicates accept many things as the

Second, we find that there are predicates, like *describe* and *admire*, that accept expressions like *Julie's generosity* as argument, license an instance-interpretation but do not give rise to a fact-interpretation:

*Tom described Julie's wisdom.*

*Tom admired Julie's wisdom.*

In these sentences, the expression *Julie's wisdom* may not be understood as meaning something like: *that Julie was wise*. These predicates license only the instance-interpretation, where the expression may be paraphrased as: *the wisdom that Julie alone had*.

Finally, as observed at the beginning of this section, there are predicates, like *attract* and *surprise*, that allow for the two interpretations:

*Julie's generosity attracted Tom.*

*Julie's generosity surprised Tom.*

We can thus conclude that expressions like *Julie's generosity* are ambiguous between an instance-interpretation and a fact-interpretation. Given their meaning, certain predicates allow for only one of these two interpretations, while some accept both.

### 3.2 The interpretation of indefinite and comparative uses

Consider now uses of the noun together with an indefinite determiner characteristic of mass nouns, like *much* or *a lot of*:

*Julie has much wisdom.*

*Julie has a lot of wisdom.*

The determiner quantifies over wisdom, and these sentences express something concerning the degree of Julie's wisdom.

Something similar is observed when the noun is used in a comparative construction:

*Julie has more / less wisdom than Tom.*

*The degree of Julie's wisdom is compared to the degree of Tom's wisdom.*

In all these uses, something is expressed concerning the degree of Julie's wisdom. We will refer to this as the "degree-interpretation".

However, we do not want to suggest that *wisdom* would be ambiguous between three interpretations, in terms of instances, facts and degrees. Rather, in definite and possessive constructions, *wisdom* is ambiguous between an instance-interpretation and a fact-interpretation, while in indefinite and comparative uses, something is expressed concerning degrees of wisdom.

### 3.3 The interpretation of bare uses

Nouns like *wisdom* can also occur without any determiner, outside of comparative constructions:

*Julie has encountered hostility.*

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referent of their subject, including ordinary people (Julie), property instances (the generosity that Julie alone had) and facts (the fact that Julie was generous).

*Honesty is nice.*

*Lord Byron invented snobbism.*

These sentences differ in their interpretations. The first makes an existential claim concerning an instance of a property: Julie has encountered an instance of hostility from a certain individual directed towards her. The second makes a general claim concerning instances of a property: generally, instances of honesty are nice (cf. Moltmann, to appear). The third tells us of the creation of a new property.

### 3.4 The interpretation of count uses

Consider now a sentence like:

*Julie showed a great wisdom.*

Its interpretation parallels that of a comparable sentence, where *wisdom* is replaced by a concrete mass noun like *wine*:

*Julie bought a great wine.*

This sentence says that Julie bought an instance (or instances) of wine that is (are) of a particular type, to which the predicate expressed by the adjective applies (this type of wine is identified as great). Similarly, the sentence that concerns wisdom says that the instance of wisdom showed by Julie is of a particular type, to which the predicate expressed by the adjective applies (this type of wisdom is identified as great).

## 4 The semantics of the noun and its link with that of the adjective

The questions we now want to address are: What formal representations may one associate with the interpretations of nouns derived from gradable adjectives?<sup>10</sup> And how do these depend on the formal representation associated with the adjective?

### 4.1 Modeling possessive and definite uses

We will treat here only the instance-interpretation of sentences like *Julie's wisdom surprised Tom*, reserving the fact-interpretation for future work.<sup>11</sup> Under this interpretation, the subject refers to an instance of wisdom, namely the particular wisdom that Julie alone had. A simple model of such sentences is obtained as follows.

We take a noun like *wisdom* to denote a relation between an instance  $x$  of a property and a bearer  $i$  of that property:

*Wisdom:*  $\lambda x \lambda i \text{ wisdom}(x,i)$

Now, the expression *Julie's wisdom* has the same meaning as the expression *the wisdom of Julie*. An element of definiteness is thus part of the meaning of *Julie's wisdom*. We may take

<sup>10</sup> We will focus on the normal uses of nouns like *wisdom*, that is, on the cases where they are used as mass nouns. Sentences where they are used as count nouns are cases of conversion; cf. section 2 and Nicolas (Submitted).

<sup>11</sup> This interpretation is available with all derived nouns, when they are headed by a possessive construction: *Julie's generosity surprised Tom* / *Julie's love for Ted surprised Tom* / *Ted's walk to Greece astonished Julie*.

There must exist a general mechanism that, given a derived noun, constructs an interpretation in terms of fact: that Julie was generous surprised Tom.

We may note that this mechanism is lexicalized in an overt construction: *the fact that* + S, where S is a sentence. Semantically, it constructs a fact, given a proposition, like the proposition expressed by the sentence S.

this element to be provided by an implicitly present, definite article *the*. It imposes semantic conditions that we label ‘the’ in our model.<sup>12</sup> The expression *Julie’s wisdom* thus translates as follows (with *j* the referent of *Julie*):

*Julie’s wisdom*: the  $x$  [wisdom( $x, j$ )]

Finally, the truth conditions of the full sentence are (with *t* the referent of *Tom*):

*Julie’s wisdom surprised Tom* is true iff the  $x$  [wisdom( $x, j$ )] is such that surprised( $x, t$ )

So now, what about indefinite and comparative uses?

## 4.2 Modeling indefinite and comparative uses

The solution becomes clear once we compare them with similar sentences with concrete mass nouns like *wine*.

### 4.2.1 Measure functions for concrete mass nouns

Instead of looking directly at:

*Julie has a lot of wisdom.*

*Julie has more wisdom than Tom.*

we consider:

*Julie has a lot of wine.*

*Julie has more wine than Tom.*

The first question we should ask ourselves is, how the sentences with concrete mass nouns like *wine* should be modeled? Higginbotham (1995) argues that to deal with such sentences, and also with the quantification of mass nouns in general, we need the notion of a measure function. In this case, the measure function will be a function  $\square$  that associates to any instance of wine  $x$  something that represents the quantity of wine that  $x$  contains.

Then we get:

*Julie has a lot of wine* is true iff Julie has some wine and the quantity of Julie’s wine is a lot

To be more precise, we can say, with Higginbotham, that the predicate “a-lot” is satisfied by a quantity of wine if this quantity is greater than a certain standard quantity of wine  $c^\circ$ :

*Julie has a lot of wine* is true

iff  $\square y$  [wine( $y$ )  $\square$  has( $j, y$ )]  $\square$  the  $x$  [wine( $x$ )  $\square$  has( $j, x$ )] is such that  $\square(x) > c^\circ$

iff the  $x$  [wine( $x$ )  $\square$  has( $j, x$ )] is such that  $\square(x) > c^\circ$  {where  $c^\circ$  is a standard quantity of wine}

This measure function can also be used to deal with comparatives:

*Julie has more wine than Tom* is true

<sup>12</sup> We do not want to be tied to any account of the semantic conditions imposed by the definite article. Let us, however, cite Sharvy (1980) as a good example of how these conditions may be made precise. He characterizes them in terms of the notion of a supremum:

the  $x$  [ $N(x)$ ] =  $\square x$  [ $x = \text{SUP}_y$  ( $y$  is such that  $N(y)$ )] {where  $\square$  is the iota operator}

That is, an expression of the form *the N* (like *the cat*, *the cats*, *the wine*, *the wisdom of Julie*) denotes the entity  $x$  which is the supremum of all the entities  $y$  to which the predicate  $N$  that corresponds to the nominal expression  $N$  applies in the circumstance. When the predicate can apply only to a single entity (as with *cat* or *wisdom of Julie*), this turns out to be equivalent to the more familiar, Russellian condition:  $\square!x Nx$ .

iff the quantity of Julie's wine is greater than the quantity of Tom's wine

iff the  $x$  [wine( $x$ )  $\sqsubseteq$  has( $j, x$ )] and the  $v$  [wine( $v$ )  $\sqsubseteq$  has( $t, v$ )] are such that  $\sqsubseteq(x) > \sqsubseteq(v)$

#### 4.2.2 Measure functions for (mass) nouns derived from gradable adjectives

This account extends to nouns like *wisdom*, as long as we interpret differently the measure function  $\sqsubseteq$ . Obviously, in the case of *wisdom*, we cannot talk of a quantity of wisdom, at least not in the same sense as we talk of a quantity of wine. But we certainly may talk of a degree of wisdom. So we just have to take the measure function to associate to an instance of wisdom a degree of wisdom. More precisely, when an instance  $x$  of wisdom manifests itself in an individual  $j$ , the measure function  $\sqsubseteq$  will associate to  $x$  the degree of wisdom of that person in the circumstance. Here is then what we get:

*Julie has a lot of wisdom* may be paraphrased as: Julie has wisdom (an instance of wisdom manifests itself in Julie) and Julie's wisdom is a lot. That is:

*Julie has a lot of wisdom* is true

iff  $\exists y$  wisdom( $y, j$ )  $\sqsubseteq$  the  $x$  [wisdom( $x, j$ )] is such that  $\sqsubseteq(x) > c^\circ$

iff the  $x$  [wisdom( $x, j$ )] is such that  $\sqsubseteq(x) > c^\circ$

{where  $c^\circ$  is a certain standard degree of wisdom}

*Julie has more wisdom than Tom* is true

iff the  $x$  [wisdom( $x, j$ )] and the  $v$  [wisdom( $v, t$ )] are such that  $\sqsubseteq(x) > \sqsubseteq(v)$

#### 4.3 Modeling bare uses

Dealing fully with bare uses would force us to take a stance on an issue that is not our direct concern. This is the general issue of how to model sentences with bare mass nouns and bare plurals. Some researchers take bare plurals and mass nouns to be indefinites (Gillon 1990). Others see them as ambiguous between an indefinite reading and a kind-reading (Wilkinson 1991). Yet others take them to uniformly refer to kinds, and a certain mechanism derives their existential interpretations (Carlson 1977). However, for the purpose of this paper, we do not need to adjudicate between such positions. Indeed, whatever we end up saying concerning bare mass nouns and plurals, we should be able to say it, in the same way, in the specific case of mass nouns derived from adjectives. Thus, concerning the sentences we gave as examples in 3.1.3, any position will give them truth-conditions that will turn out to be essentially equivalent to:

*Julie has encountered hostility* is true

iff Julie has encountered an instance of hostility from an individual  $s$  directed towards him

iff  $\exists x \sqsubseteq$ s hostility( $x, s, j$ )  $\sqsubseteq$  encountered( $j, x$ )

*Honesty is nice* is true

iff generally, instances of honesty are nice

If we could avail ourselves of the notion of a “generic” operator, Gen, binding variables  $x$  and  $i$ , then our sentence would be true iff  $\text{Gen } x, i$  [honesty( $x, i$ )  $\sqsubseteq$  nice( $x$ )]

*Lord Byron invented snobbism* is true

iff invented( $b, sn$ ) {where  $b$  stands for Byron and  $sn$  stands for the property SNOBBISM}

In other words, in *Lord Byron invented snobbism*, the bare noun *snobbism* functions as the proper name of a property.

#### 4.4 The link with the semantics of gradable adjectives

To specify how the semantics of the noun is linked to that of the adjective, we need first to say how we can model gradable adjectives.

##### 4.4.1 A simple semantics for gradable adjectives

Following Kennedy (1999, 2001), we assume that gradable adjectives denote measure functions, from individuals to degrees (see also Klein, 1991, on adjectives and degrees). We adopt, for this paper, simple assumptions concerning gradable adjectives and degrees. What is important to us is not those assumptions *per se*, but the relationship, in a model where adjectives are associated with degrees, between the semantics of the adjective and that of the derived noun.

We model *Julie is wise* as meaning: the degree at which Julie is wise is superior to a certain standard  $d^\circ$ . If  $j$  corresponds to *Julie* in the model, and *wise* is the measure function denoted by the adjective, then we have the following truth-conditions:

*Julie is wise* is true iff  $\text{wise}(j) > d^\circ$

Similarly, for comparative constructions:

*Julie is wiser than Tom* is taken to be true

iff the degree at which Julie is wise is higher than the degree at which Tom is wise

iff  $\text{wise}(j) > \text{wise}(t)$

##### 4.4.2 How the semantics of the noun is linked to that of the adjective

We can now specify the links between the semantics of the adjective and the semantics of the derived noun, through two axioms:

Axiom i) An instance of wisdom manifests itself in an individual iff that individual is wise to a certain degree:  $\exists x \text{ wisdom}(x, j) \text{ iff } \exists d d = \text{wise}(j)$

Axiom ii) The measure function  $\square$  associated with the noun *wisdom* is the measure function denoted by the adjective *wise*:  $\text{wisdom}(x, j) \square \square(x) = \text{wise}(j)$

## 5 Conclusion

### 5.1 In brief

The model we propose is as follows.

A noun derived from a gradable adjective denotes a two-place relation, between an instance of a property, and an individual in which this instance manifests itself.

Like more familiar concrete mass nouns, this noun has an associated measure function  $\square$ . This allows us to capture the interpretation of comparatives like *more* or *less* and quantifiers like *much* or *a lot of*.

The relationship between the semantics of the gradable adjective and that of the derived noun is captured by two axioms, like the ones we have for *wisdom*:



Axiom i)  $\Box x \text{ wisdom}(x,j) \text{ iff } \Box d \ d = \text{wise}(j)$

Axiom ii)  $\text{wisdom}(x,j) \Box \Box(x) = \text{wise}(j)$

In particular, the second axiom says that the measure function associated with the noun *wisdom* is the measure function denoted by the adjective *wise*.

This set of assumptions allows us to account in a simple way for the instance-interpretations and degree-interpretations that these nouns are observed to have.

Let us pause, to address the following question: Why not simply say that mass nouns like *wisdom* denote the measure function denoted by the adjective from which they derive (i.e., without attributing to *wisdom* an instance-argument)? Well, in English, *wisdom* is a mass noun just like *wine* is. Now, we recognize that expressions like *Julie's wine* refer. So it is only natural to recognize that expressions like *Julie's wisdom* also refer. In this way, we have a uniform semantics for mass nouns, something that we would not have if we said that only mass nouns like *wine* refer. By doing so, we explain in a straightforward fashion how instance-interpretations arise, while modeling, with the associated measure function, indefinite and comparative uses.

To say it differently, the model here advocated explains us where lies the semantic unity of abstract and concrete mass nouns. Being common nouns, mass nouns have the capacity to refer (and nouns like *wisdom* refer specifically to property instances). Being moreover mass nouns, they not only refer, but have an associated measure function, which allows a comparison of the instances they denote, as required by comparatives and quantifiers.

## 5.2 Extending the account to other abstract nouns

To finish, another nice feature of this account is that it extends easily to other types of abstract nouns, like *beauty*, *chaos*, *perpendicularity* and *love*. Let's look at these types of noun in turn.

### 5.2.1. *Beauty*

In English, a noun like *beauty* is not derived from any adjective. On the contrary, there is an adjective, *beautiful*, derived from the noun. The direction of the derivation turns out to make no difference. Indeed, a natural account for the noun *beauty* exactly parallels that for *wisdom*:

$\Box x \text{ beauty}(x,j) \text{ iff } \Box d \ d = \text{beautiful}(j)$

$\text{beauty}(x,j) \Box \Box(x) = \text{beautiful}(j)$

*Julie's beauty attracts Tom* is true iff the  $x$  [ $\text{beauty}(x,j)$ ] is such that  $\text{attracts}(x,t)$

*Julie's beauty is greater than Sue's* is true

iff the  $x$  [ $\text{beauty}(x,j)$ ] and the  $v$  [ $\text{beauty}(v,s)$ ] are such that  $\Box(x) > \Box(v)$

### 5.2.2. *Chaos*

Take now a mass noun like *chaos*. It is not derived and, when understood as in *The chaos of the bedroom worries Tom*, its meaning cannot be adequately paraphrased using the derived adjective *chaotic*. Still, it is natural to give it a semantics similar to that of *wisdom*, except that, when understood in this way, there is no link with any adjective. We just take the mass noun *chaos* as denoting a two-place relation, between instances of chaos and entities in which they manifest themselves, and as having an associated measure function that sends an entity to the degree of chaos that it exhibits.

*The chaos of the bedroom worries Tom* is true iff the  $x$  [ $\text{chaos}(x,b)$ ] is such that  $\text{worries}(x,t)$

*The chaos in the bedroom is greater than the chaos in the kitchen* is true

iff the degree of chaos of the bedroom is greater than the degree of chaos of the kitchen

iff the  $x$  [ $\text{chaos}(x,k)$ ] and the  $v$  [ $\text{chaos}(v,b)$ ] are such that  $\square(x) > \square(v)$

### 5.2.3. *Perpendicularity*

What about a noun like *perpendicularity*? The noun is derived from an adjective, *perpendicular*, but this adjective is not gradable. We cannot say that two lines  $l$  and  $m$  are *very perpendicular*. As a result, the noun *perpendicularity* cannot be quantified: we cannot talk of *a lot of perpendicularity*, or of *more perpendicularity*. So the noun will have no associated measure function. But there will of course remain a link with the meaning of the adjective, captured as follows:

$\square x$  *perpendicularity*( $x,l,m$ ) iff *perpendicular*( $l,m$ )

Since the adjective *perpendicular* is not gradable, the adjective does not denote a measure function, but simply a function to truth values.

### 5.2.4. *Love*

Finally, take a mass noun like *love*. It is derived from a verb, *to love*. The verb has two arguments, and so the noun may accept up to three arguments: we may talk of *Julie's love for Tom*. The noun *love* will have an associated measure function, which must be also available to the verb *to love*, since we have equivalences like:

*Julie has a lot of love for Tom* is true iff the sentence *Julie loves Tom a lot* is true

A question that needs to be explored is in what way exactly will this measure function be available to the verb.

In any case, we get truth-conditions like the following:

*Julie's love for Tom attracts Fred* is true iff the  $x$  [ $\text{love}(x,j,t)$ ] is such that  $\text{attracts}(x,f)$

*Julie has more love for Tom than for Fred* is true

iff the  $x$  [ $\text{love}(x,j,t)$ ] and the  $v$  [ $\text{love}(v,j,f)$ ] are such that  $\square(x) > \square(v)$

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<sup>13</sup> This paper is available on <http://d.a.nicolas.free.fr/research>.