Graded salience: probabilistic meanings in the lexicon

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1. Introduction

This paper draws together ideas published in Allan (1976; 1980; 1981; 2000; 2001) which relate to a potential variety of senses for a given lexeme when it is listed in the lexicon (as a listeme), each sense being appropriate to a particular set of contexts of use. The problem for the lexicographer (if this is the correct term for someone modelling the mental lexicon) is how to tag the various senses such that they can be readily accessed in appropriate contexts. This tagging within the lexicon raises questions of salient and default meaning. Allan (2001 Chapter 3) and Allan (2006) give my model for the structure of a lexicon and its relation to a (mental) encyclopedia. In my view the encyclopedia is a general knowledge base of which the lexicon is a proper part which stores information about the formal, morphosyntactic, and semantic specifications of listemes.[1] The network of relationships among the components of a lexicon and the encyclopedia are shown in Figure 1, where formal data, F, is represented as a triangle, morphosyntactic data, M, by a circle, semantic data, S, is a rectangle, and encyclopedic data, E, is an ellipse. It illustrates my assumptions and the reader does not need to approve the supposed configuration because in this chapter I am only concerned with component S.

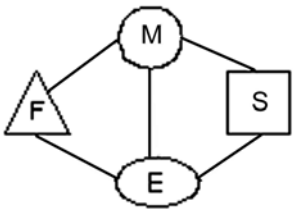

Figure 1. Networked components of the lexicon with the encyclopedia.

1. These interrelationships are consistent with approaches like Frame Semantics, Cognitive Grammar and Construction Grammar; also the finding in Hagoort, Hald, Bastiaansen, and Petersson (2004: 440) that "word meaning and world knowledge are recruited and integrated very rapidly, within some 400 ms."

So far as is possible, a listeme should be monosemic; the different aspects of its meaning should be included together with an account of the probability and contextual conditions under which each aspect of the meaning is the preferred interpretation. These probabilistic meanings can be described as 'grades of salience'. As a tool for ranking degrees of probability I propose a credibility metric because bivalent truth conditions are inadequate for practical use when communicating using natural language; likewise, the distinction in modal logic between the possible (diamond) operator and the necessary (box) operator is too gross an instrument. The credibility metric allows for an unbounded number of distinctions between 0 (undoubtedly false) and 1 (undoubtedly true). I present probabilistic meanings as nonmonotonic inferences, i.e. inferences that are not necessary entailments but defeasible without self-contradiction. They are contextually affirmed or disconfirmed, either from the co-text or some other factor in the common ground. (Common ground is constituted from discourse context, situation of utterance, and input from relevant encyclopedic knowledge, see Allan (2001); Stalnaker (2002).)

In the rest of this chapter I define and distinguish salient from default meanings (§2). I use a discussion of the semantics of *bird* as a vehicle for introducing the credibility metric (§3); then apply the notion of graded salience to the semantics of the noun *bull* (§4) and the verb *climb* (§5). In §6 I return to the persistent misapprehension that countability is a characteristic of English nouns; I reaffirm the finding of Allan (1980) that identifiable contextual conditions render a noun countable or not, and the fact that different nouns respond to different conditions needs to be noted in the lexicon. The situation with respect to collective nouns and nouns that are collectivizable is somewhat similar (§7). I claim it is a matter of graded salience that some animal nouns are used to refer to either the animal's meat or its pelt (§8). Then §9 returns to the much disputed semantics and pragmatics of *and* which can readily be accounted for using the notion of a monosemic semantics with a graded variety of differing interpretations that depend on context.

2. Salient meanings, default meanings, and the lexicon

Although it is not represented in the lexicon, one device that makes lexical meaning salient is "contrastive focus reduplication" (Ghomeshi, Jackendoff, Rosen et al. 2004); examples (slightly adapted from http://www.umanitoba.ca/faculties/arts/linguistics/russell/redup-corpus.html) are bolded in (1)–(4).

(1) Do you want to go to the **BANK-bank**? [*as opposed to an ATM*]
(2) What's the difference between brain-dead and **DEAD-dead**?

(3) People don't love movie stars because they **KNOW-them-know-them**.
(4) Don't think virgin Madonna, think **MaDONna-Madonna**.

These reduplications place heavy stress on the accented syllable within the first instance of the reduplicated item in order to focus on and make particularly salient the default reference rather than a peripheral one. They are a type of pragmatic regulator in the sense of Lasersohn (1999) in that they constrain meaning[2]. For instance, if we ignore the potential lexical ambiguity, (1) focuses on the default reference for *bank*, "an establishment for the custody of money", contrasted with the more peripheral "an outlet established by a bank". (2) focuses on the default reference for *dead*, "now completely without life", contrasted with the more peripheral "brain-dead". The negative in (3) denies the default reference "have familiar personal acquaintance with", reducing *know* to the more peripheral "be aware of, be cognizant of"; while the negative in (4) denies default reference to "the real Madonna, virgin mother of Christ", transferring reference to the celebrity named after her, Madonna Louise Ciccone (b. 1958).[3] As is clear from (1)–(4), contrastive focus reduplication invokes salient lexical meaning that arises from the semantic specification of the listeme in the lexicon, but it is not relevant to the specification of probabilistic meaning in the lexicon.

The preceding discussion refers to "making salient the default reference". At first sight a salient meaning should be almost the opposite of a default meaning. Something that is salient jumps out at you; by contrast a default is the fall-back state when there is no contextual motivation to prefer any other. On a second look, what qualifies a state to become the default is its salience in the absence of any contextual motivation to prefer another. Giora (2003: 34, 37) defines salience on what is foremost in the mind based on "such factors as familiarity, conventionality, and frequency of occurrence". Clearly this applies to salience on a particular occasion, can it also apply to the condition of comparative decontextualization that is encountered with a lexicon entry? Typically, meanings in a lexicon are

2. In any normal situation *Sue arrived at three o'clock* is treated as true if she arrived close to thee o'clock; Lasersohn refers to this slackness as a "pragmatic halo". A pragmatic regulator is an adverb such as *precisely* or *exactly* in *Sue arrived precisely at three o'clock* or *Sue arrived at exactly three o'clock* which restricts the slack in the interpretation. Unlike Lasersohn, I don't believe the slack is erased, but it is certainly restricted.
3. Madonna's first number one hit song 'Like a virgin' is evoked here (by Dylan addressing Jez in the 1997 film *Shooting Fish*).

given so as to apply to as wide a range of contexts as possible and these are what I describe as default meanings; see (5).[4]

(5) Default meanings are those that are applied more frequently by more people and normally with greater certitude than any alternatives.

Thus default meanings are largely similar to salient meanings except that the latter, according to Giora, are foremost in the mind of an individual: "Salience […] is relative to an individual. What is foremost on one's mind need not necessarily be foremost on another's" (Giora 2003: 37). We might here distinguish between a linguist's model of the mental lexicon as an abstraction or generalization over the hypothetical lexicon of a typical individual and the real-life internalized lexicon of a particular individual in which certain meanings may indeed be salient because of that individual's unique experience. The upshot of this perambulation is that what I describe as the representation and ranking of default meanings in the lexicon are based on my own intuitions about the relative saliency of those meanings – which Giora would refer to as "graded salience" (Giora 2003: 10); but I propose that my intuitions need to be replaced by objective rankings obtained after examining data from a wide variety of corpora.

3. Birds, possibilities, and credibility

Birds are feathered, beaked, and bipedal. Most birds can fly. Applied to an owl this attribute of flight is true; applied to a penguin it is false. Birds are sexed, and a normal adult female bird can lay eggs. It is a defining characteristic that members of the female sex carry ova; I'll label this function SXF (which can be glossed "sexual female"). Where they don't, or the ova are non-viable, the organism can count for our purposes as a gendered female (GENF) but not SXF. Mostly, sexual females are gendered females too; see (6) where → indicates semantic entailment.

(6) MOST(x)[SXF(x) → GENF(x)]

Although we do speak of human eggs, nonetheless the default egg is from an oviparous genus such as a bird, so I'll assume this is noted in the lexicon.[5] Based on Allan (2001: 252) I propose that the semantic part of the

4. Alternative definitions of 'default' are to be found in Jaszczolt (2006).

5. One reconstruction of the Proto-Indo-European word for EGG is *$*h_a\bar{o}(w)iom$* "bird-thing" from *$*h_ae(w)ei$*- "bird" (I am grateful to Olav Kuhn for this information).

lexicon entry for *bird* be (7), where ∧ symbolizes logical conjunction, +> indicates (defeasible) nonmonotonic inference – NMI, which in the past I have referred to as 'implicature', and which is cancelled for species such as emus and penguins; ◇ is the possibility operator.

(7) $$\forall x \left[\begin{array}{l} \text{BIRD}(x) \rightarrow \lambda y[\text{FEATHERED}(y) \wedge \text{BEAKED}(y) \wedge \text{BIPEDAL}(y)](x) \\ \text{BIRD}(x) +> \Diamond\text{FLY}(x) \\ \lambda z[\text{BIRD}(z) \wedge \text{SXF}(z) \wedge \text{ADULT}(z)](x) \rightarrow \text{OVIPAROUS}(x) \end{array}\right]$$

The lambda-operator is useful to identify an individual as having a number of properties jointly, e.g. being a member of the set of creatures that are simultaneously feathered and beaked and bipedal. In (7) the line BIRD(x) +> ◇FLY(x) identifies that a bird is most probably capable of flight. In the case of a sparrow the semantic component of the lexicon entry may look like (8)[6]; for a penguin, like (9) (¬ is the negation operator).

(8) $$\forall x \left[\begin{array}{l} \text{SPARROW}(x) \rightarrow \text{PASSERINE}(x) \\ \text{PASSERINE}(x) \rightarrow \lambda y[\text{BIRD}(y) \wedge \Diamond\text{FLY}(y)](x) \end{array}\right]$$

(9) $$\forall x \left[\begin{array}{l} \text{PENGUIN}(x) \rightarrow \text{SPHENISCIDA}(x) \\ \text{SPHENISCIDA}(x) \rightarrow \lambda y[\text{BIRD}(y) \wedge \neg\text{FLY}(y)](x) \end{array}\right]$$

For both (8) and (9) the oviparity of SXF sparrows and penguins is an entailment of their being birds.

Here I'll introduce a credibility metric for a proposition. The truth value of a proposition *p* hinges on whether or not *p* is, was or will be the case. What matters to language users is not so much what is in fact true, but what they believe to be true. The credibility of *p* is what is believed with respect to the truth of *p*, or believed is known, or is in fact known of its truthfulness. Because most so-called 'facts' are propositions about phenomena as interpreted by whomever is speaking, we find that so-called 'experts' differ as to what the facts are (for instance, on the economy or what should be done about narcotics). Whether ordinary language users judge a proposition true or false depends not only on its pragmatic halo (see footnote 2) but also on how credible it is and this is reflected in the way that they use and understand language. There is a credibility metric such as that in Table 1, in which complete confidence that a proposition is true rates 1, represented CRED = 1, and complete confidence that a proposition is false rates CRED =

6. Information about the typical appearance, habits, and habitat (etc.) will be located in the networked encyclopedia entry.

0; indeterminability is midway between these two, CRED = 0.5. Other values lie in between. (□ is the necessity operator, and $\underline{\vee}$ symbolizes exclusive disjunction.)

Table 1. The credibility metric for a proposition

CRED = 1.0	Undoubtedly true:	$\Box p$, I know that *p*
CRED = 0.9	Most probably true:	I am almost certain that *p*
CRED = 0.8	Probably true:	I believe that *p*
CRED = 0.7	Possibly true:	I think *p* is probable
CRED = 0.6	Just possibly true:	I think that perhaps *p*
CRED = 0.5	Indeterminable:	$(\Diamond p \geq 0.5) \underline{\vee} (\Diamond \neg p \leq 0.5)$
CRED = 0.4	Just possibly false:	It is not impossible that *p*
CRED = 0.3	Possibly false:	It is not necessarily impossible that *p*
CRED = 0.2	Probably false:	It is (very) unlikely that *p*
CRED = 0.1	Most probably false:	It is almost impossible that *p*
CRED = 0.0	Undoubtedly false:	$\Box \neg p$, I know that $\neg p$

In reality, one level of the metric overlaps an adjacent level so that the cross-over from one level to another is more often than not entirely subjective; levels 0.1, 0.4, 0.6, 0.9 are as much an artefact of the decimal system as they are independently distinct levels in which I have a great deal of confidence. Nonetheless, I am certain that some variant of the credibility metric exists and is justified by the employment of the adverbials (*very*) *probably*, (*very*) *possibly* and *perhaps* in everyday speech. This metric is needed in some lexical entries. For instance in (7), BIRD(x) +> ◇FLY(x) rates CRED ≥ 0.7; in (8), PASSERINE(x) → ◇FLY(x) rates CRED ≥ 0.9; in (9), SPHENISCIDA(x) → ¬FLY(x) rates CRED = 1. We may describe these as instances of graded salience.

4. Bulls

The salient bovine in (English language) children's books is a *cow*: there are more cows than bulls not only where there is a dominant dairy industry, but also in the beef industry where one bull will service up to 35 cows to maintain stock levels. Thus, for economic reasons (milk production, reproductive value) cows are more common and more important than bulls. Consequently, the default connotation of *domestic bovine* is female; hence the salience of the term *cow*. In times past, when bovines were used as beasts of burden, the default term for them was *ox* – a castrated male. So it is that the gendered generics *cow* and *ox* are a function of the connotations

of the animals denoted; i.e. they are effects of the pragmatics of bovine husbandry (Allan 2007). My interest here though is the lexicon entry for *bull*.

The first entry under *bull* in the *Oxford English Dictionary* (1989) is "The male of any bovine animal; most commonly applied to the male of the domestic species (*Bos Taurus*); also of the buffalo, etc." Part of this is more formally stated in (10).

(10) $\forall x[\lambda y[\text{BULL}(y) \wedge \text{ANIMAL}(y)](x) \rightarrow \lambda z[\text{MALE}(z) \wedge \text{BOVINE}(z)](x)]$

I will ignore the facts in (11).

(11) $\text{MALE}(x) \rightarrow \text{GEN}\mathrm{M}(x) +\!> \text{SX}\mathrm{M}(x)$

(10) is inaccurate because the noun *bull* is not restricted in application to bovines; it is also properly used of male elephants, male hippos, male whales, male seals, male alligators, and more. The initial plausibility of (10) is due to the fact that it describes the stereotypical bull. The world of the English speaker is such that *bull* is much more likely to denote a bovine than any other species of animal. Peripheral uses of *bull* are examples of semantic extension from bovines to certain other kinds of large animals; consequently they require that the context make it abundantly clear that a bovine is not being referred to. This is often achieved by spelling it out in a construction such as *bull elephant* or *bull whale* which is of greater complexity than the simple noun *bull* used of bovines – a difference motivated by the principle of least effort (Zipf 1949). There is no regular term for "the class of large animals whose males are called 'bulls', females 'cows', and young 'calves'" so in Allan (2001: 273) I coined the term **bozine* to label this meaning. The semantics of English *bull* is given in (12) from which the implicated bovinity will be cancelled where the animal is contextually specified as giraffid, hippopotamid, proboscid, pinniped, cetacean, or crocodilian.

(12) $$\forall x \left[\begin{array}{l} \lambda y[\text{BULL}(y) \wedge \text{ANIMAL}(y)](x) \rightarrow \lambda z[\text{MALE}(z) \wedge *\text{BOZINE}(z)](x) \\ \lambda y[\text{BULL}(y) \wedge \text{ANIMAL}(y)](x) +\!> \text{BOVINE}(x) \end{array} \right]$$

Once again we see a default interpretation being recorded in the lexicon because of the salience of this particular characteristic, viz. bovinity, of the default reference (i.e. the denotatum) for *bull*. In the second line of (12), the NMI $\lambda y[\text{BULL}(y) \wedge \text{ANIMAL}(y)](x) +\!> \text{BOVINE}(x)$ yields a credibility rating of $\text{CRED} \geq 0.8$.

5. Climbing

Jackendoff (1985) identified some interesting characteristics of the verb *climb*. From (13) we understand that Jim climbed up the mountain – contrast (13) with (14). We also understand that he used his legs and feet – contrast (13) and (14) with (15).

(13) Jim climbed the mountain.
(14) Jim climbed down the mountain.
(15) Jim climbed (down) the mountain on his hands and knees.

Snakes, airplanes, and ambient temperature lack legs and feet they can use when climbing (which is presumably a metaphorical extension with these actors), and they can't normally be said to *climb down*, some other verb must be employed.

(16) The snake climbed { the tree. / ?? down the tree. }

(17) The airplane climbed { to its cruising altitude. / ?? down to land. }

(18) The temperature climbed { to 42. / ?? down to minus 10. }

In (19) I capture the fact that the default interpretation of *climb* presumes both upward movement, symbolized ↑[7], and the use of feet (and therefore legs, too). The nonmonotonic inference rates CRED ≈ 0.7.

(19)

$$\forall_x \left[\begin{array}{l} \text{CLIMB}(x) \rightarrow \lambda y[\text{GO}(y)\_\uparrow \vee \text{USE\_FEET}(y)[\text{CAUSE}(y)[\text{MOVE}(y)\_\uparrow]](x) \\ \text{CLIMB}(x) +\!> \lambda y[\text{GO}(y)\_\uparrow \wedge \text{USE\_FEET}(y)[\text{CAUSE}(y)[\text{MOVE}(y)\_\uparrow]](x) \end{array} \right]$$

In this and the two previous sections I have shown that a lexicon entry can be constructed to indicate the necessary components of meaning for the entry and also the most probable additional components of meaning that obtain for most occasions of use but which may be cancelled as a function of contextual constraints. This proposal goes beyond what is found in other lexicographical models such as the generative lexicon (Pustejovsky 1995) or FrameNet (http://framenet.icsi.berkeley.edu). For each lexicon entry the

7. ↑, at 90º, is the prototype for "upward" which covers any angle greater than 0º and less than 180º.

semantic identity of the listeme is presented as a meaning postulate; for instance, the noun *bull* is semantically represented by the predicate BULL ranging over a variable for the entity denoted. This is not decomposed into semantic primitives but gives rise to certain inferences some of which are necessary semantic entailments, others are probabilistic nonmonotonic inferences. Similar conditions apply to the verb *climb*. They apply quite generally. In the examples given so far, the semantic identity of content words is presented in the metalanguage in the graphological form they have in English, but this is not quite the case with grammatical listemes such as PLURAL and PAST_TENSE.

6. Nouns and countability

In English, countable denotata are denumerable by the quantifiers *a(n), one, two* (and all natural numbers), *(a) few, several, many, each, every, both*. Uncountables can be quantified by e.g. *much, little*. The English number system (to which quantifiers are linked) simply contrasts PLURAL "more than one" with SINGULAR "one". It has been shown by, for instance, Weinreich (1966), Allan (1980) and Bunt (1985) that a noun is countable or uncountable only within the context of a particular NP. All English NPs are either countable or uncountable. The principal motivation for countability is to identify the individual from the mass as in (20)–(21); compare the two uses of *oak* and *lamb* respectively.

(20) $_{[}$An oak$_{NP_1]}$ is the source for $_{[}$oak$_{NP_2]}$.

(21) It is because I like $_{[}$lambs$_{NP_1]}$ that I don't like $_{[}$lamb$_{NP_2]}$.

Typically, uncountable referents are perceived as an undifferentiated unity, NP_2 in (20)–(21); whereas countables are perceived as discrete but similar entities, NP_1 in (20)–(21). In (21) the animals as individuals implicitly contrast with their meat – the edible stuff which they embody. An animal noun that heads an uncountable NP is used to refer to the meat when it is usual for the consumer to eat only part of the animal at a sitting. Much the same applies to NPs denoting other kinds of food. Where more than one object is eaten at a sitting, a countable NP is used (Allan 1976). These nonmonotonic inferences are shown in (22)–(23).

(22) For dinner we are having { lamb / rabbit / chicken / goat }
+> Eater consumes part of the animal at one sitting

(23) For lunch we are having { pilchards / oysters / an egg / sandwiches }
+> Eater consumes one or more at one sitting

The NMIs in (22)–(23) explain the grammaticality judgements in (24).

(24) Would you like another { oyster, / ??lamb, } or have you had enough?

Cancellation of the NMI of (22) is possible in generics like (25)–(26), which show that form and context together indicate the proper interpretation to be given to a lexical item.

(25) Hindus don't eat cows, and Muslims don't eat pigs.
(26) Those people won't eat lambs, but they do eat goats.

(25) shows that it is animal-nouns and not meat-nouns that are countable in (25)–(26), otherwise (25) would name *beef* and *pork*; indeed these are also acceptable, but only as uncountables (mass nouns), cf. (27).

(27) Hindus don't eat beef, and Muslims don't eat pork.

The difference between (25) and (27) is that – in line with (22) – example (27) presents the situation in respect of individual Hindus and Muslims, whereas (25) identifies what is tabooed behaviour among the collected plurality of Hindus and the collected plurality of Muslims. The question arises whether the properties I have been discussing of the nouns denoting foodstuffs should be noted in the lexicon. Perhaps before making a decision we should further investigate nouns and countability.

In English, grammatical number is registered in several ways. Prototypically, number is indicated by the absence or presence of plural inflexion on the NP head, as in (28).

(28) cat***s***, ox***en***, m***i***ce, dat***a***, phenomen***a***, lacun***ae***, croc***i***, cherub***im***, t***ee***th; th***ese***, th***ose***.

In (29) the noun *sheep* is uninflected, but recognizably plural because of NP-internal number registration on the italicized demonstrative and NP-

external number registration on the verb and the possessive pronoun in bold type.

(29) *Those* sheep **are** wiggling **their** ears.

NP-internal number registration is normally concordant, cf. *a chair* vs **a chairs*; *these chairs* vs **these chair*. Allan (1980; 2001) identified four syntactic tests for countability preferences in English nouns. Although each test identifies whether or not a NP is countable, head nouns vary in the number of countable environments they occur in: some nouns are to be found in more types of countable NP than others, thus revealing the scale of countability preference shown in Table 2.

Table 2. Countability preferences among English nouns

MOST COUNTABLE						LEAST COUNTABLE
car	> *oak*	> *cattle*	> *Himalayas / scissors*	> *mankind*	> *admiration*	> *equipment*

Test A. If *a(n)* or *one* concatenates with a singular head noun, the NP is countable (e.g. ***A car** is a great blessing*; *Every livestock farmer has at least one sheep and* ***one cattle***).

Test B. The NP is countable if a plural head noun is preceded by a fuzzy denumerator such as *(a) few, several, many, a dozen or so, about fifty*, and high rounded numbers (e.g. ***700,000 cattle** died in the drought*; *George is vying for* ***several admirations** at the same time*).

Test C. If the NP takes external plural number registration, it is countable (e.g. *"**Mankind are** my favourite species," said Dr Who*; ***Admiration(s)** are what an academic craves*).

Test D. If *all* concatenates with a singular head noun and the NP has singular external concord, the NP is uncountable (e.g. ***All equipment** must be registered with the Dean's office*; ***All car** is a mode of transport*).

The strongest evidence that a noun prefers a countable environment is where it succeeds in both Test A and Test B. Nouns like *car* and *oak* are shown to be most countable, but the countability of *?Himalayas/scissors* is dubious. As I said earlier, it is always the case that a given occurrence of an English NP will be either countable or uncountable, but no noun listeme is intrinsically countable or uncountable; this is why the interpretation of the two occurrences of the lexeme *oak* in (20) and of *lambs* and *lamb* in (21) is different. Nevertheless, the semantics of the noun does interact with the semantics of countability with meaningful effects.

Allan (1976; 2001) proposed the Principle for N_0 usage for English in (30).

(30) N_0, the form of the noun unmarked for number, is used when the reference of the NP of which N_0 is the head is perceived not to consist of a number of significant similar units.

The reference to "similar units" is to account for use of N_0 in uncountable NPs headed by words like *furniture, equipment, crockery,* and *silverware* or *cutlery*. Where several pieces of furniture are similar in form and function, they are labelled using a countable NP such as *chairs, beds, tables*; similarly for *spoons, forks,* etc. Although what we call *furniture* or *silverware* consists of perceivably discrete objects, these are typically dissimilar in form and function (Wierzbicka 1988). Consider some mass nouns such as *coffee, wheat, sugar,* and *sand*. As the term 'mass noun' suggests, the denotata are only significant en masse. In uncountable NPs, such nouns denote a mass of perceivable natural units such as coffee beans or grains; grains, ears, spikelets, or stalks of wheat; granules of sugar; grains of sand. The natural units which compose the denotata of mass nouns are conventionally perceived to be too insignificant as individuals to merit labelling individually. Of course, language does permit us to label the components of the mass, but not by using a simple noun that uniquely labels them. Instead they are denoted by composed phrases such as *coffee bean, grain of sand*, which employ listemes like *bean, grain, coffee,* and *sand* each with a broader meaning. As remarked earlier, a less complex label tends to be used for things which are significant within the everyday life of a community (and so tend to be frequently referred to); a more complex label is used for less significant things. Where contextually identifiable artificial units exist (normally by social convention), so-called 'mass' nouns readily and very naturally occur in countable NPs, as in (31).

(31) Give me two { beers, / coffees, / sugars, } please.

Furthermore, although nouns such as *wine, wheat*, and *coffee* readily occur in the uncountable NPs of (32), they equally happily occur within the countable NPs of (33) to denote a variety, kind, or species.

(32) (a) All wine is acidic.
(b) All wheat is highly nutritious.
(c) Coffee is grown at a lower altitude than tea.

(33) (a) We have fifty wines on our list, madam.
(b) Up in Nyeri, you need a wheat that likes a high altitude.
(c) The Arabica and Robusta coffees provide most of the world trade in coffee.

Notice how the differentiation between singular and plural of mass terms is exploited for additional semantic effect. Such semantic exploitation of different grammatical forms is common across languages.

The upshot of this discussion of countability is that nouns in the English lexicon need to be marked with the seven degrees of countability recognized in Table 3, from 0 countability to those nouns ranked at level 6, which are countable in a majority of environments.

Table 3. Countability rankings among English nouns in the lexicon

6	5	4	3	2	1	0
car >	*oak* >	*cattle* >	*Himalayas / scissors* >	*mankind* >	*admiration* >	*equipment*

The rankings in Table 3 are correlated with grammaticality in the particular morphosyntactic contexts identified in Tests A–D; they can be correlated with the credibility metric of Table 1 if expressed by the graded salience shown in (34).

(34) $[NP_{COUNTABLE}\ [X\ N_{NP\text{-}HEAD}[car]\ Y]]$ CRED ≥ 0.99
$[NP_{COUNTABLE}\ [X\ N_{NP\text{-}HEAD}[oak]\ Y]]$ CRED ≥ 0.75
$[NP_{COUNTABLE}\ [X\ N_{NP\text{-}HEAD}[cattle]\ Y]]$ CRED ≥ 0.7
$[NP_{COUNTABLE}\ [X\ N_{NP\text{-}HEAD}[scissors]\ Y]]$ CRED ≤ 0.6
$[NP_{COUNTABLE}\ [X\ N_{NP\text{-}HEAD}[mankind]\ Y]]$ CRED ≤ 0.5
$[NP_{COUNTABLE}\ [X\ N_{NP\text{-}HEAD}[admiration]\ Y]]$ CRED ≤ 0.2
$[NP_{COUNTABLE}\ [X\ N_{NP\text{-}HEAD}[equipment]\ Y]]$ CRED ≤ 0.02

It would, however, seem preferable to be more precise about the specific conditions under which each noun may be countable: for instance, *cattle* is uncountable in the environment that obtains under Test A, but countable under the environments described in Tests B, C, and D; *mankind* is countable under A and C but uncountable under B and D; and so forth.

7. Collectives and collectivizing

Allan (1976; 2001) discusses the semantics of collective nouns such as *admiralty, aristocracy, army, assembly, association, audience, board, class,*

clergy, committee, crowd, flock, government and collectivized nouns such as those italicized in (35)–(36).

(35) These three *elephant* my great-grandfather shot in 1920 were good tuskers, such as you never see today.
(36) Four silver *birch* stand sentinel over the driveway entrance.

Collective nouns allow reference to be made to either the set (collection) as a whole or to the set members. In many dialects of English (but not all) the different interpretations are indicated by NP-external number registration; consider (37).

(37) The herd{is / are} getting restless and {it is / they are} beginning to move away.

Whereas singular NP-external registration indicates that the set as a holistic unit is being referred to, cf. (38), the plural indicates that the set members are being referred to, (39). In these and later examples X and Y are (possibly null) variables for NP constituents; NP_{SG} is a singular NP while NP_{PL} is plural; x, y, z are sets, either unit sets (individuals) or multimember sets, so one should understand from (38) and (39) that $\forall x[\exists y[y \subseteq x]]$.

(38) $\forall x[NP_{SG}[X\ N_{HEAD}[\lambda y[\text{MANY}(y) \wedge \text{COLLOCATED}(y)](x)]\ Y] \rightarrow \text{COMBINED\_MEMBERSHIP}(x)]$

(39) $\forall x[NP_{PL}[X\ N_{HEAD}[\lambda y[\text{MANY}(y) \wedge \text{COLLOCATED}(y)](x)]\ Y] \rightarrow \text{CONSTITUENT\_MEMBERS}(x)]$

Thus, (40) identifies the composition of the committee, while (41) identifies dissension among the membership of the committee.

(40) The committee{is / ?*are} composed of many notable scholars.

(41) The committee{?*is / are} at odds with each other over the new plan.

NPs denoting institutions, e.g. *the company I work for, the BBC, the university* must be singular when the institution as a building, location, or single constituent body is referred to, as in (42), but can have plural NP-external registration when the people associated with it are referred to, (43).

(42) The library $\left\{\begin{matrix}\text{is}\\ \text{?*are}\end{matrix}\right\}$ located in the new civic centre.

(43) The library $\left\{\begin{matrix}\text{charges}\\ \text{charge}\end{matrix}\right\}$ a heavy fine on overdue books.

The facts with respect to such collective nouns are represented in (44)–(46).

(44) $\forall x \exists z[N[\text{LIBRARY}(x)] \rightarrow$
$\lambda y[\text{MANY}(y) \wedge \text{BOOK}(y) \wedge \text{COLLOCATED}(y)](z) \wedge X \supseteq Z]$
$+> \exists x[NP_{SG}[X\ N_{HEAD}[\text{LIBRARY}(x)]\ Y] \wedge \text{INSTITUTION}(x)]$

(45) $\forall x[NP_{SG}[X\ N_{HEAD}[\text{INSTITUTION}(x)]\ Y] \rightarrow$
$\text{CONSTITUENT\_BODY}(x) \vee \text{SITE}(x)]$

(46) $\forall x[NP_{PL}[X\ N_{HEAD}[\text{INSTITUTION}(x)]\ Y] \rightarrow \text{STAFF\_MEMBERS}(x)]$

There is no evidence in (37)–(46) of probabilistic representation being required in the lexicon.

In a plural NP headed by N_0 (see (30)), the absence of plural inflexion on the head noun marks 'collectivizing'. Consider the italicized nouns in (35)–(36) and (47)–(50).

(47) A three month shooting trip up the White Nile can offer a very good mixed bag, including, with luck, Elephant, Buffalo, Lion, and two animals not found elsewhere: Nile or Saddle-back (Mrs, Gray's) Lechwe and White-eared Kob. (Maydon (ed.) 1951: 168)

(48) On the way back to camp we sighted two *giraffe* on the other side of the river, which were coming down to the water's edge to drink. (Arkell-Hardwicke 1903: 285)

(49) These *cucumber* are doing well; it's a good year for them.

(50) The *cat-fishes*, of which there are about fifty distinct forms arranged in four families, constitute the largest group, with probably the greatest number of individuals per species. In some parts of the country where nets are little used and fishing is mainly done with traps and long lines, at least three-quarters of the annual catch is of *cat-fish*. (Welman 1948: 8)

The plural NP "cat-fishes" at the beginning of (50) refers to species of cat-fish whereas the singular NP at the end refers to individuals caught by fishermen. Collectivizing of trees and other plants is much less common than collectivizing animals – from which it, perhaps, derives. Vermin are

never collectivized, although individual speakers may differ over what counts as vermin. Early uses of the collectivized form were applied to animals hunted for food or trophies. Today, collectivizing occurs in contexts and jargons of hunting, zoology, ornithology, conservation, and cultivation where N_0 is characteristically used of referents that are NOT perceived to be significant as individuals. Contributing factors to the establishment of N_0 as the mark of collectivizing might have been the unmarked plural of *deer* – which once meant "wild animal, beast" – and the fact that meat nouns are N_0 (discussed in §8 below). Despite the fact that there is a good deal of variation in the literature (see Allan 1976: 100f), collectivizable nouns should be marked in the lexicon. Reference will need to be made to the discourse domain being one of the contexts identified above and vermin will need to be excluded. The kind of entry I envisage is (51).

(51) IF Domain = conservation THEN $\forall$ x[NP_{PL}[X N_0[GIRAFFE(x)] Y]];
CRED $\approx$ 0.6

Clearly, more work is needed.

8. Animals for food and fur

In this section I take up a discussion from Allan 1981. Look at the sentences in (52)–(53).

(52) Harry prefers lamb to goat.
(53) Jacqueline prefers leopard to fox.

I believe that it is most likely that you will interpret the animal product nouns in (52) to refer to meat, such that (52) is paraphrasable by (54), whereas the animal product nouns in (53) refer to animal pelts and (53) is therefore paraphrasable by (55).

(54) Harry prefers eating lamb to eating goat.
(55) Jacqueline prefers leopard skin to fox fur.

The converses are unlikely, especially, *Jacqueline prefers eating leopard to eating fox.* The predicate *prefer* in (52)–(53) offers a neutral context permitting the default animal product to rise to salience. This suggests that the lexicon entries for *lamb* and *goat* should include a specific application of the formula in (57); so will that for *whale* in (56).

(56) In Tokyo, whale gets ever more expensive!

(57) $$\forall x \left[\begin{array}{l} \lambda y[N_{MASS}(y) \wedge \text{ANIMAL}(y)](x) \rightarrow \text{PRODUCT\_OF}(x) \\ \lambda y[N_{MASS}(y) \wedge \text{ANIMAL}(y)](x) +> \text{MEAT\_OF}(x) \end{array} \right]$$

The lexicon entries for *leopard* and *fox* should include a specific application of the formula in (59); so will all of the italicized animal product nouns in (58).

(58) (a) Jacqueline was wearing *mink*.
(b) Elspeth's new handbag is *crocodile*, I think.
(c) This settee's made of *buffalo*.
(d) The tannery has loads of *impala* right now.

(59) $$\forall x \left[\begin{array}{l} \lambda y[N_{MASS}(y) \wedge \text{ANIMAL}(y)](x) \rightarrow \text{PRODUCT\_OF}(x) \\ \lambda y[N_{MASS}(y) \wedge \text{ANIMAL}(y)](x) +> \text{PELT\_OF}(x) \end{array} \right]$$

An uncountable NP headed by an animal noun will refer to the pelt of the animal denoted by that NP when there is in the clause an NP head or clause predicate describing apparel, accessories to apparel, furniture, the creation of an artefact, or any object likely to be made from leather and any place or process that involves pelts, hides, or leather such that these constrain the domain for the interpretation of N_0. Thus the nonmonotonic inference in (57) is cancelled by the implications of *the lining* in (60); from (59) the NMI is cancelled by the predicate *eat* in (61).

(60) I prefer the lining to be made of lamb, because it's softer.
(61) All we had to eat was leopard.

Rather more subtle interpretations are required in (62)–(65).

(62) A plate of lamb can be worn by no-one.
(63) The girl holding the plate was wearing rabbit.
(64) The girl who wore mink was eating rabbit.
(65) Because she decided she preferred the lamb, Hetty put back the pigskin coat.

In (62) "plate of lamb" identifies meat. Although the most likely interpretation of *a plate of steel* is "a plate made of steel" (CRED $\geq$ 0.95), *a plate of lamb* is, with similar credibility, interpreted as "a plate bearing food". The predicate "wearing rabbit" in (63) identifies the rabbit pelts as apparel (again, CRED $\geq$ 0.95) and, likewise, "wore mink" in (64) identifies

mink as apparel while the predicate in "eating rabbit" coerces the reference to rabbit meat. In (65) "the lamb" is most likely to be interpreted as meat (CRED $\geq$ 0.8) until this is revealed as a 'garden-path' misinterpretation expressed by the preference for a porcine pelt in the second clause which cancels this implicature replacing it with the coerced interpretation 'lambskin coat'.

In this section of the chapter I have claimed that animal nouns in uncountable NPs that denote a product from the dead animal typically refer to either the animal's flesh or its pelt, but this probabilistic inference can be cancelled by certain contextual elements that condition the domain for interpretation. Credibility rankings can be assigned along the lines illustrated in (66).

(66) $\lambda y[\text{LAMB}_{\text{MASS}}(y) \wedge \text{ANIMAL}(y)](x) \text{ +> } \text{MEAT\_OF}(x)$; CRED ≥ 0.8
IF NOT MEAT_OF(x) THEN PELT_OF(x)

$\lambda y[\text{GOAT}_{\text{MASS}}(y) \wedge \text{ANIMAL}(y)](x) \text{ +> } \text{MEAT\_OF}(x)$; CRED ≥ 0.7
IF NOT MEAT_OF(x) THEN PELT_OF(x)

$\lambda y[\text{RABBIT}_{\text{MASS}}(y) \wedge \text{ANIMAL}(y)](x) \text{ +> } \text{MEAT\_OF}(x)$; CRED ≥ 0.7
IF NOT MEAT_OF(x) THEN PELT_OF(x)

$\lambda y[\text{LEOPARD}_{\text{MASS}}(y) \wedge \text{ANIMAL}(y)](x) \text{ +> } \text{PELT\_OF}(x)$; CRED ≥ 0.9
IF NOT PELT _OF(x) THEN MEAT _OF(x)

$\lambda y[\text{FOX}_{\text{MASS}}(y) \wedge \text{ANIMAL}(y)](x) \text{ +> } \text{PELT\_OF}(x)$; CRED ≥ 0.9
IF NOT PELT _OF(x) THEN MEAT _OF(x)

$\lambda y[\text{MINK}_{\text{MASS}}(y) \wedge \text{ANIMAL}(y)](x) \text{ +> } \text{PELT\_OF}(x)$; CRED ≥ 0.9
IF NOT PELT _OF(x) THEN MEAT _OF(x)

$\lambda y[\text{BUFFALO}_{\text{MASS}}(y) \wedge \text{ANIMAL}(y)](x) \text{ +> } \text{PELT\_OF}(x)$; CRED ≥ 0.8
IF NOT PELT _OF(x) THEN MEAT _OF(x)

$\lambda y[\text{CROCODILE}_{\text{MASS}}(y) \wedge \text{ANIMAL}(y)](x) \text{ +> } \text{PELT\_OF}(x)$; CRED ≥ 0.8
IF NOT PELT _OF(x) THEN MEAT _OF(x)

$\lambda y[\text{IMPALA}_{\text{MASS}}(y) \wedge \text{ANIMAL}(y)](x) \text{ +> } \text{PELT\_OF}(x)$; CRED ≥ 0.7
IF NOT PELT _OF(x) THEN MEAT _OF(x)

In (66) these rankings are made intuitively but they ought to be made on the basis of the frequency of such interpretations retrieved from large and diverse corpora. It would seem obvious that there should be some generalization over nouns that can refer to either meat or pelts; one might refer to these two alternatives as "graded salience" (Giora 2003: 10), but this notion is yet more relevant in the lexicon entry for *and*.

9. And

And may conjoin all sorts of sentence constituents and whatever is felicitously conjoined is grouped together such that there is always some plausible reason for the grouping. With the exception of some conjoined NPs that I will refer to as NP-*COM-Conjunction (and briefly exemplify in (70)–(74)), the conjoined constituents are synonymous with a conjunction of sentences, e.g. in (67)(e) "Two is a number ∧ Three is a number".

(67) (a) Sue is tall and slim.
(b) Eric was driving too fast and hit a tree.
(c) Elspeth always drove slowly and carefully.
(d) Joe and Harriet are tall.
(e) Two and three are numbers.

I have never seen any convincing evidence which demonstrates that the semantics of Φ *and* Ψ is other than is shown in (68) – on the assumption that Φ and Ψ are well-formed (combinations of) propositions expressed as well-formed conjunctions in English. There is, in addition, a series of nonmonotonic inferences that exemplify Giora's "graded salience" (Giora 2003: 10); they are listed with the strongest contextually-possible inference as the first to be considered.

(68) Φ *and* Ψ ↔ Φ ∧ Ψ

IF CRED(¬Φ → ¬Ψ) ≥ 0.9 ∧ CRED(CAUSE(Φ,Ψ) ≥ 0.8, THEN Φ *and* Ψ +> Φ *causes* Ψ (e.g. *Flick the switch* ***and*** *the light comes on*; cause < effect[8]) ELSE

IF CRED(ENABLE ([DO(Ø,Φ)],Ψ)) ≥ 0.9 ∧ CRED(¬Φ → ¬Ψ) ≥ 0.8, THEN Φ *and* Ψ +> Φ *enables the consequence* Ψ ∨ Φ *is a reason for* Ψ (e.g. *Stop crying* ***and*** *I'll buy you an ice-cream*; action < consequence) ELSE

IF CRED(Φ < Ψ) ≥ 0.8, THEN Φ *and* Ψ +> Φ *and then later* Ψ (e.g. *Sue got pregnant* ***and*** *married her boyfriend*) ELSE

IF CRED(ENABLE(Φ,[DO(S,[SAY(S,Ψ)])) ≥ 0.8[9], THEN Φ *and* Ψ +> Φ *is background for* Ψ (e.g. *There was once a young prince,* ***and*** *he was very ugly*) ELSE

8. Φ < Ψ means "Φ precedes Ψ (chronologically)"

9. S identifies the speaker, here and below.

Φ *and* Ψ +> Φ *is probably more topical or more familiar to S than* Ψ (e.g. *On Saturdays my mum cleans the flat* ***and*** *Sue washes the clothes*)

Note the conditional relations in (69):

(69) Φ *causes* Ψ → Φ *is a reason for or enables the consequence* Ψ → Φ *temporally precedes* Ψ[10]

Whether the last two discourse based NMIs of (68) are part of this sequence remains to be discovered. Consider (from (68)) *Sue got pregnant and married her boyfriend*: it is false (CRED = 0) that Sue's getting pregnant literally causes her to marry her boyfriend, though it may be her reason for doing so, CRED ≈ 0.4; but it is quite probable (CRED ≈ 0.75) that her marriage to the boyfriend is a consequence of her being pregnant, whether or not he is the biological father-to-be. It is almost certain (CRED ≥ 0.9), even though defeasible, that Sue's pregnancy precedes her marriage. Out of any natural context of use it is not possible to determine whether or not saying *Sue got pregnant* is a background for going on to say that she married her boyfriend. This aside, it has been possible to propose a (partial) lexicon entry for *and* which includes its implicatures in grades of salience. There seems to be no good reason to treat *and* as multiply ambiguous semantically when one core meaning can be identified (logical conjunction) and all other interpretations can be directly related to that as a hierarchy of nonmonotonic inferences processed algorithmically.

In NP-*COM-Conjunction, *COM is a ≥2-place predicate with a sense "is added to, is mixed or combined with, acts jointly or together with, is acted upon jointly or together with" (Allan 2000: 196). It is found in (70), which is not semantically equivalent to (71) – contrast the latter with (67)(e).

(70) Two and three are five.
(71) *Two is five ∧ Three is five

A revealing recipe-like paraphrase of (70) is (72), which accounts for the fact that (73) is a paraphrase of (70).

10. Kasia Jaszczolt (p.c.) has questioned whether temporal precedence is applicable with statives such as *She is underage and can't drive*. I don't strongly disagree but I think being underage is prior to inability to drive and this is evident in *She is no longer underage and can now drive.*

(72) Take two$_x$ and take three$_y$, combine them (*COM(x,y)), and you get five$_w$, cf. *Mix flour$_x$ and water$_y$ to make paste*$_w$.

(73) Two and three make five.

NP-*COM-Conjunction is recognized when a conjunction of sentences either cannot apply or is unlikely to apply as in (70) and (74).

(74) Joe and his wife have a couple of kids.

The subject NP of (74) is most likely NP-*COM-Conjunction whereas that of (75) is not.

(75) Joe and his sister have a couple of kids.

(75) is, given social constraints on incest, most likely an infelicitous manner of expression where the conjunction is intended to be Φ *and* Ψ with the weakest of nonmonotonic inferences.

10. Probabilistic meanings in the lexicon

In this chapter I have (once again) argued that probabilistic meanings need to be entered into the lexicon. So far as is possible, a listeme should be treated as monosemic and different aspects of its meaning should be included together with an account of the probability of each different interpretation being the preferred interpretation and in what circumstances. These probabilistic meanings can be seen as grades of salience. As a tool for ranking degrees of probability I proposed the credibility metric. Bivalent truth conditions alone are inadequate for practical use in natural language communication and the distinction in modal logic between the possible (diamond) operator and the necessary (box) operator is also too gross an instrument. My credibility metric in principle allows for an unbounded number of distinctions between 0 and 1, even though in practice it uses a decimal scale.

I have presented probabilistic meanings as nonmonotonic inferences. One may wish to call them conversational implicatures, implicitures, or even explicatures; whatever they are to be called, they are defeasible inferences and not necessary entailments. They are contextually affirmed, whether from co-text or some other factor in the common ground. The integration of such pragmatic factors in semantic interpretation is justified by the findings of, for instance, Hagoort, Hald, Bastiaansen, and Petersson (2004) or Terkourafi (2009), in addition to the arguments advanced here and in my previous work. It will be interesting to discover how lexicographic

models like FrameNet might be adapted, as they ought to be, to incorporate my proposals.

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