The Lexicon and Quantity Implicatures[1]

Keith Allan
Monash University
keith.allan@arts.monash.edu.au

1. Introduction

The present paper is about the conversational implicatures (hereafter referred to simply as 'implicatures') that result from the two maxims of **quantity** identified by Grice 1975 and subsequently discussed by (amongst others) Atlas and Levinson 1981, Horn 1984, and Levinson 1995. The question I seek to resolve is whether Q[uantity] implicatures should be entered in the lexicon or whether they constitute encyclopedic information. Allan 1995, fc argues for a division of labour between the lexicon and the encyclopedia. The lexicon contains formal, morphosyntactic, and semantic specifications of listemes and the encyclopedia contains other kinds of information about listemes, e.g. their etymology, and information about their denotata.

Conversational implicatures are pragmatic (Grice 1975, Gazdar 1979, Levinson 1983): they arise from the use of language in particular contexts. They differ from entailments in being defeasible. In other work (Allan 1999), Q1 implicatures, deriving from the first maxim of quantity, are included in lexical entries capture the default meaning (this is exemplified in §3). I shall argue here that what Jackendoff 1983, 1985, 1990 refers to as 'preference conditions' on lexical items are implicatures deriving from the second maxim of quantity augmented with the Atlas and Levinson principle of informativeness, a combination here referred to as Q2 — a quantity 2 implicature. Jackendoff incorporates preference conditions within his lexical entries. For instance, the lexical meaning of *bird* includes both an indefeasible part identifying the class of creatures (expressed in the lexicon as a truth statement), and a defeasible part "capable of flight" that identifies what is probably the case (in the absence of contrary evidence). Surveying as many examples of quantity implicature as space permits, I find that all Q implicatures based on a single lexical item are noted in the lexicon entry. Nonlexical implicatures arise from collocations of lexical items and can perhaps be located within the encyclopedia of which the lexicon is a part.

---

1. This is an abbreviated version of a similarly titled piece retrievable from http://www.arts.monash.edu.au/ling/lexicon_quantity.pdf.

2. Cooperation, common ground, and implicature

Like other social activities, language interchange requires participants to mutually recognize certain conventions (in the sense of Lewis 1969). Among them, are the conventions that Grice described as maxims of the cooperative principle (Grice 1975:45). Grice identified four categories of maxims: quantity, quality, relation, and manner and we are concerned only with the first of them.

> The category of QUANTITY relates to the quantity of information to be provided, and under it fall the following maxims:
>
> 1. Make your contribution as informative as is required (for the current purposes of the exchange).
> 2. Do not make your contribution more informative than is required.
>
> (Grice 1975:45)

The maxims are not laws to be obeyed, but reference points for language interchange — much as the points of the compass are conventional reference points for identifying locations on the surface of the earth. Conversational implicatures arise from both observing and from flouting the maxims. Conversational implicature is the pragmatic counterpart to the semantic relations of entailment and conventional implicature (cf. Lyons 1995:276, Allan fc).

■ In the formula $\Phi \triangleright \Psi$, Ψ is a conversational implicature of Φ, which is a part (or perhaps the whole) of Speaker's utterance U made in context C under conventional cooperative conditions. Ψ is a pragmatic inference calculated from the meaning of U considered in the light of: (i) the cooperative principle, (ii) the context C, and (iii) encyclopedic knowledge. A conversational implicature is defeasible (can be canceled) without contradicting the utterance which implicates it.

It is defeasibility that distinguishes conversational implicature from entailment and conventional implicature.

Conversational implicature depends upon common ground (Stalnaker 1973, 1974, Clark 1996). S[peaker] and H[earer] are mutually aware that, normally, their interlocutor is an intelligent being. S does not need to spell out those things which are

(a) obvious to the sensory receptors of H, or
(b) which H can very easily reason out on the basis of
  (i) knowing the language and the conventions for its use, and
  (ii) using the knowledge that each of us develops from birth as we experience the world around us.

The Grice quantity implicatures can be usefully augmented with Atlas and Levinson's (1981:40-50) informativeness principle, paraphrased in Levinson 1983:146f, 'read as much into the utterance as is consistent with what you know about the world'. For the purpose of this paper, the augmented Grice implicatures are revamped as follows:

- Q1 enjoins S to make the strongest claim possible consistent with his or her perception of the facts.
- Q2 enjoins S to give no more and no less information than is required to make his / her message clear to H.

Complementing these is a principle of interpretation by H:

- Given the semantic content of the utterance and H's perception of the contextually relevant facts, the strongest inference possible is to be drawn from the utterance.

Horn 1972 identified a category of scalar implicatures (cf. Horn 1989:232, Gazdar 1979:55-62, Levinson 1983:134).

- Given any scale of the form $<e_1, e_2, e_3, ..., e_n>$, if S asserts e_i then s / he potentially conversationally implicates that it is not the case that e_{i-1} holds nor e_{i-2} nor any e higher up the scale.
  <all, most, many / much, some, a few / little, a(n)>
  <n ≥ 6, 5, 4, 3, 2, 1>
  <no, not all, few / little>
  <always, often, sometimes>
  <necessarily / certainly *p*, probably *p*, possibly *p*>
  <and, or>

Scalar implicatures are negative upscale, or Q1, implicatures. If S says *I have two children*, this implicates that s / he has no more than two children. In the case that, say, Ed asserts *I have two children* when in fact he has five, he utters a logical truth and yet can be accused of speaking "falsely" because he has failed to observe the conventions for the normal use of language and misled H by ignoring the communicative significance of Q1 implicatures.

I have already said that Q1 results in negative upscale implicature:

(1)	a.	three	▷	no more than three	<n ≥ 4, 3>
	b.	*p* or *q*	▷	not both *p* and *q*	<and, or>
	c.	I ran over a dog at the weekend	▷	The dog was not mine or yours	<definite, indefinite>
	d.	Kim had the ability to win that race	▷	S doesn't know that Kim did win that race	<do A, have an ability to do A>

With Q2 implicature, because S has not indicated otherwise, H is expected to make the default interpretation, cf. (2). Q2 implicatures can be thought of as common ground (including shared knowledge of language and its use) which H uses to expand upon what is actually said. There are many more Q2 than Q1 examples.

(2)	a.	It's a bird	▷	It's capable of flight (if it's alive)
	b.	Sally climbed and climbed	▷	Sally used her legs and feet and went upwards
	c.	Kim was able to win that race	▷	Kim won that race (cf.(1d))
	d.	Sam broke an arm	▷	Sam broke his own arm (cf. (1c))
	e.	The driver stopped the car	▷	by applying the footbrake

What I am here calling Q2 implicatures, Jackendoff 1983 Chs 7-8, 1985, 1990:35ff refers to as 'preference conditions'. For example:

(3)

TERM	PREFERENCE CONDITION
bird	something which can fly [cf. (2a)]
climb	climb upward and use feet [cf. (2b)]
go, drive, walk	go, drive, walk forward

Consider them in more detail, starting with

(4) I'm looking at a bird.

Especially when unaided by a natural context, (4) denotes a bipedal creature with beak and feathers that can fly. Even though some chicks are naked when they come out of the egg, and penguins and emus don't fly, these are all members of the category Bird. Jackendoff 1983:144 represents the condition that a typical bird can fly as (5).

(5) $\begin{bmatrix} \text{TYPE} \\ \text{BIRD} \\ \text{P(CAN FLY)} \end{bmatrix}$

Preference conditions are common to reasoning in many areas of cognitive processing: scripts and frames (cf. Schank and Abelson 1977, Schank 1982, 1984, 1986, Fillmore 1982, Fillmore and Atkins 1992, Barsalou 1992, Lehrer and Kittay (eds) 1992) are examples; they operate in the perceived groupings of notes and chords in musical scores (Jackendoff 1983:131f, Lerdahl and Jackendoff 1982 Ch.3); and in visual perception. As common sense surely predicts, semantics is not autonomous from other aspects of cognition.

Preference conditions arise from reasonable expectations about the way the world is. They are implicated whenever the common ground (including what S says) gives no indication to the contrary. Like all conversational implicatures, preference conditions are open to cancelation; for instance, preference condition (6) permits (7) without contradiction.

(6) $\forall x[\mathbf{bird'}(x) \triangleright \mathbf{can'}(x,[\mathbf{fly'}(x)])]$
(7) $\forall x[\mathbf{emu'}(x) \rightarrow \mathbf{bird'}(x) \wedge \neg[\mathbf{can'}(x,[\mathbf{fly'}(x)])]]$

Now take the verb *climb* (with grossly simplified semantics):

(8) $\forall x[\mathbf{climb'}(x) \rightarrow \mathbf{go\_upward'}(x) \vee \mathbf{move\_in\_a\_vertical\_axis\_using\_feet'}(x)]$
$\forall x[\mathbf{climb'}(x) \triangleright \mathbf{go\_upward'}(x) \wedge \mathbf{move\_in\_a\_vertical\_axis\_using\_feet'}(x)]$

Hence (where A $\Vdash$ B symbolizes "A entails B", A $\nVdash$ B "A does not entail B", A $\dashv\Vdash$ B "A is synonymous with B", A $\not\dashv\nVdash$ B "A is not synonymous with B"):[2]

(9) Bill climbed the mountain $\dashv \begin{cases} \Vdash \text{ Bill climbed up the mountain} \\ \nVdash \text{ Bill climbed the mountain on his knees.} \end{cases}$

(10) Bill climbed down the mountain $\not\dashv\nVdash$ Bill climbed the mountain

Together with the necessary semantic properties, preference conditions identify the typical attributes of the denotatum. Preference conditions enable a rational explanation to be given for the application of a single lexeme to denotata with diverse characteristics such as birds that fly and others that don't. It is a lesson in capturing the flexibility of natural language in a principled manner. The question that arises is whether all Q2 implicatures can be accommodated in the lexicon or whether some should be located in the associated encyclopedia.

3. Lexical entries for Q implicatures

The Q1 implicatures in (1) can be straightforwardly incorporated into the lexicon. In Allan 1999, fc the semantics for (1a), repeated below, is (11). $|\alpha|$ is a measure function on α; it gives the quantity (not necessarily cardinality) of α.

(1) a. three $\triangleright$ no more than three

(11) $[\mathit{three}\ y\text{: } y \subseteq [\mathrm{PL}_Q\ x\text{: } \mathbf{cat'}(x)]](\mathbf{grey'}(y)) \longleftrightarrow |c \cap g| \geq 3$
$[\mathit{three}\ y\text{: } y \subseteq [\mathrm{PL}_Q\ x\text{: } \mathbf{cat'}(x)]](\mathbf{grey'}(y)) \triangleright |c \cap g| = 3$

---

2. If A and B are sentences of the object language and their respective semantic descriptions are respectively *a* and *b*, then A ENTAILS B, A$\Vdash$B, iff $a \rightarrow b$ in all possible worlds. If A and B are sentences of the object language and their respective semantic descriptions are respectively *a* and *b*, then A IS SYNONYMOUS WITH B, A $\dashv\Vdash$ B, iff $a \longleftrightarrow b$ in all possible worlds.

(11) is the semantics for *Three cats are grey*. [PL_Q x: **cat′**(x)] is a restricted quantifier in which **cat′**(x) functions as a restrictor on the scope of the plural indicated by the morphology of *cats*. This in turn functions as a restrictor on the quantifier *three*. x and y are ensembles rather than individuals.[3] $|c \cap g|$ is the quantity of the overlapping ensembles denoted by the predicates **cat′** and **grey′**. In colloquial English, $|c \cap g|$ means "the number of cats which are grey". Thus the two lines of (11) may be informally glossed:

(11′) In the particular situation in the world and time spoken of, *three cats are grey* is true only if the number of cats which are grey is at least three; and *three cats are grey* implicates that the number of cats which are grey is exactly three.

The truth statement identifies what must be the case for a proper use of the quantifier *three*, and the conversational implicature identifies what is probably the case, i.e. the way *three* will be understood in default of any contrary evidence. If the lexicon contains redundancy rules, the Q1 of cardinal quantifiers can be determined as follows:

■ Where Φ is a formula containing a cardinal quantifier Q_i; i is a member of the set of natural numbers, |N; and α is the ensemble denoted by the scope of Q_i: If $\Phi \rightarrow |\alpha| \geq i$, then $\Phi \triangleright |\alpha| = i$.

Lexical redundancy rules will be inefficient with noncardinal quantifiers.

Given the argument that lexical entries for quantifiers include Q1 implicatures (an argument supported by extensive data in Allan 1999, fc), there is a basis for supposing that the lexical entry for *or* should also include its Q1 implicature, cf. (1b) and (12-12′):

(1) b. *p* or *q* $\triangleright$ not both *p* and *q*

(12) Φ *or* $\Psi \leftrightarrow \Phi \vee \Psi$
Φ *or* $\Psi \triangleright \Phi \veebar \Psi$

(12′) In the particular situation in the world and time spoken of, if *Φ or Ψ* is grammatical, *Φ or Ψ* is true only if it is true that either Φ is true or Ψ is true or both Φ and Ψ are true. *Φ or Ψ* implicates that either Φ or else Ψ is true, but not both and not neither.

Inclusive disjunction is usually indicated by *and/or* in English; *or* on its own has the default meaning "or else". Thus an alternative formalization of the implicature is $\neg(\Phi \wedge \Psi) \wedge \neg(\neg\Phi \wedge \neg\Psi)$; but being deducible from (12), no such formula need be included in the lexicon.

---

3. Ensemble theory is described in Bunt 1985 upon which Allan 1999, fc relies. It is essentially a meronymic theory founded on set theory in which the primitive relation is 'part of' rather than 'member of'. An ensemble is a set just in case its parts are atomic and cannot be further subdivided.

The case of (1c) is more complicated. Contrast it with (13).

(1) c. I ran over a dog at the weekend $\triangleright$ The dog was not mine or yours
(13) I ran over the dog at the weekend.

In Allan 1999, fc the indefinite and definite are contrastively defined as follows:

- The INDEFINITE requires H to create an ensemble x from an ensemble y such that $x \subset y$.
- The DEFINITE picks out the ensemble x for H by equating it with ensemble y such that x=y (which is what universals do), or naming it, for example $[h/x]\Phi$ where [h=Harry] and x is a variable in formula Φ.[4]

Thus the definite is used whenever S presupposes that the reference is identifiable to H. The conditions on identifiability are complex and I will not try to describe them here (see Allan opp.cit., Du Bois 1980, Hawkins 1978, Lewis 1979, Givón 1984, Lambrecht 1994, among others). Like other quantifiers, the definite article can be formalized as a restrictive quantifier: [*the* x: Fx] is semantically $\exists!x[x \subseteq f \rightarrow x=f]$ to be read "there is exactly one ensemble x and if it is a subensemble of f, then x is identical with f" which can be paraphrased by "there is exactly one ensemble f at the relevant world and time spoken of". In a clause, the simplified formulation is (14):

(14) $[\textit{the}\ x: Fx](Gx) \leftrightarrow \exists!x[x \subseteq f \cap g \rightarrow x=f]$

(14), sketched in Fig.1[5], says *the f is g* is true in the world spoken of only if there is exactly one ensemble f identical with the ensemble of f which is g.

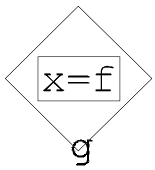

Figure 1. Sketch of (14)

The conditions on the indefinite are described above. The semantics of indefinite *a(n)* is identical with that for *one*; but the implicature is not, because being an article, *a(n)* is in contrast with *the* (its Saussurean 'valeur'). The semantics of *one* is given in (15), that for *a(n)* in (16).

---

4. '$[h/x]\Phi$' means replace every variable x in formula Φ by h. '[h=Harry]' illustrates the device that introduces proper names to the calculus for quantification.

5. Diagrams are imprecise illustrations. For instance, neither the formula in (15) nor the English it represents are specific about whether $f \subset g$ (as in Fig.2) or f=g. Incidentally, there is nothing significant about the shape of ensemble boundaries in Figs 1-2.

(15) $[\textit{one}\ y{:}\ y \subseteq [\varnothing_Q\ x{:}\ Fx]](Gy) \leftrightarrow |f \cap g| \geq 1$
$[\textit{one}\ y{:}\ y \subseteq [\varnothing_Q\ x{:}\ Fx]](Gy) \triangleright |f \cap g| = 1$

(16) $[\textit{a(n)}\ y{:}\ y \subseteq [\varnothing_Q\ x{:}\ Fx]](Gy) \leftrightarrow |f \cap g| \geq 1$
$[\textit{a(n)}\ y{:}\ y \subseteq [\varnothing_Q\ x{:}\ Fx]](Gy) \triangleright |f \cap g| = 1 \wedge \neg\exists! y[y \subseteq f \rightarrow y = f]$

Because (15-16) are indefinite, for both: $\forall y \exists z[y \subseteq f \wedge z \subset f \wedge z \neq y]$, cf. Fig.2.

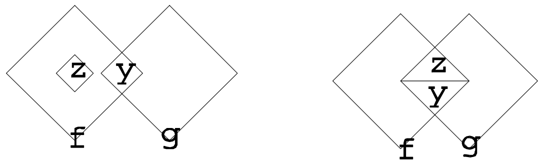

Figure 2. Sketches of indefinites

The second conjunct of the implicature in (16), $\neg\exists! y[y \subseteq f \rightarrow y = f]$, says that it is not the case that there is exactly one ensemble y which, if it is a subensemble of f, is identical with f. This contrasts with a definite — as graphically demonstrated by comparing Fig.1 with Fig.2. Whenever possible, a definite is preferred to an indefinite, so the indefinite implicates that the definite is not applicable, and the relevant inferences are drawn. When applied to the particular context, it is this second conjunct of the implicature in (16) that gives rise to the implicatures in (1c). This condition applies with very different effects in respect of sentences like (2d), *Sam broke an arm* — by implication, his own. Such cases are discussed later. The implicature given in (1c) is just one of several possible lexicalizations of $\neg\exists! y[y \subseteq f \rightarrow y = f]$ in the context of the implicating sentence.

Finally, consider the Q1 implicature in

(1) d. Kim had the ability to win that race $\triangleright$ S doesn't know that Kim did win that race

The negative implicature is not valid for a non-past: neither sentence in (17-18) implicates that Kim will not win that race; but they do entail that s/he hasn't yet done so.

(17) Kim has the ability to win this race $\Vdash$ Kim has not yet won this race.
(18) Kim will have the ability to win that race $\Vdash$ Kim has not yet won that race.

Win is a telic achievement verb in the sense that something effects winning (i.e. superceding competitors) as its conclusion. The winner may play an active part as in (19a) or not as in (19b) (x is the winner and $\varnothing$ is a dummy argument that can be lexicalized *something*).

(19) a. **do′**(x,[**effect′**(x,[**win′**(x, *a_race*)])])

b. $\textbf{effect}'(\varnothing,[\textbf{win}'(x,\ \textit{a\_lottery})])$

(19a) can be glossed "the winner does something to effect winning a race", and (19b) "something happens with the effect that the winner wins a lottery". When winning is the achievement of effort, there are the entailments in (20-21):

(20) Kim won that race $\Vdash$ Kim was able to win that race [= (2c)]
(21) Kim was able to win that race $\Vdash$ Kim had the ability to win that race [= (1d)]

It follows from (20-21) that *Kim didn't have the ability to win that race* $\Vdash$ *Kim wasn't able to win that race* $\Vdash$ *Kim didn't win that race.* (21) shows that despite their incompatible implicatures, (2c) $\Vdash$ (1d), a fact I will return to. If Kim won, then s/he proved her ability to win (whether honestly or corruptly); so if S is speaking felicitously, the first conjunct of (22) must be uttered before S is aware that Kim has won. In the present tense the difference between *have the ability to* and *be able to* is neutralized.

(22) $_{[\Phi}$ Kim $\left\{\begin{array}{c}\text{has the ability}\\ \text{is able}\end{array}\right\}$ to win that race$_{\Phi]}$ and, in fact, $_{[\Psi}$ she has won$_{\Psi]}$.

If sentence Φ in (22) is felicitous at time t_i then Ψ is only felicitous at time $t_{i+1,}$ where $t_i \prec t_{i+1}$ and $A \prec B$ symbolizes "A precedes B". In *Kim had the ability to win*, S entertains the possibility of Kim's having been capable of winning and the possibility would normally have been resolved by the facts of whether or not Kim won. To speak felicitously, S should have chosen one of the sentences in (20), *Kim won that race* or *Kim was able to win that race* (=(2c)) if s/he knows that Kim won, hence the lefthand side of (1d) implicates that S doesn't know that Kim won — or in other words, admits the possibility that Kim did not win. In (23), **N** is the present tense operator and $\Diamond\Phi$ symbolizes "it be possible that Φ".[6]

(23) $\textbf{N}[\Diamond[\textbf{P}[\textbf{be\_able}'(\textit{Kim},[\textbf{do}'(\textit{Kim},[\textbf{effect}'(\textit{Kim},[\textbf{win}'(\textit{Kim},\ \textit{that\_race})])])])]]]$
$\triangleright\ \textbf{N}[\Diamond[\textbf{P}[\neg[\textbf{do}'(\textit{Kim},[\textbf{effect}'(\textit{Kim},[\textbf{win}'(\textit{Kim},\ \textit{that\_race})])])]]]]$[7]

The semantics of the entailing sentence of (17), *Kim has the ability to win this race*, is (24), which can be paraphrased *It is possible that Kim is able to win this race.*

6. The possibility operator can fall within the scope of **P**; compare *It is possible that Kim was able to win* with *It was possible that Kim was able to win*.

7. The location of the negative appears to have the following effects: ¬**do**′... is the most neutral denial of winning; ¬**effect**′... seems to indicate a lack of effort on Kim's part; ¬**win**′... suggests Kim threw the race.

(24) $\mathbf{N}[\Diamond[\mathbf{N}[\mathbf{be\_able}'(\mathit{Kim},[\mathbf{do}'(\mathit{Kim},[\mathbf{effect}'(\mathit{Kim},[\mathbf{win}'(\mathit{Kim}, \mathit{this\_race})])])])]]]$

$\triangleright$ There are reasonable grounds for the belief that Kim has the ability to win this race

A reasonable ground might be Kim's performance in comparable races. The implicature arises from the precondition[8] for felicitous utterance. It is clear that the different implicatures of (1d) and (17-18) are a function of the tense operator that scopes over *have the ability to*. The question arises: Is this the kind of information to be noted in a lexicon?

I shall answer affirmatively, but before doing so, let's turn our attention to (2c), *Kim was able to win that race*. The precondition for felicitous utterance of nonpast *Kim is able to win this race* gives rise to the same implicature as in (24). The grounds for such a belief in a race already run only justify the statement about Kim's capability if s/he did win; hence, the Q2 implicature that Kim did win.

(25) $\mathbf{P}[\mathbf{be\_able}'(\mathit{Kim},[\mathbf{do}'(\mathit{Kim},[\mathbf{effect}\ '(\mathit{Kim},[\mathbf{win}'(\mathit{Kim}, \mathit{that\_race})])])])]$

$\triangleright\ \mathbf{P}[\mathbf{do}'(\mathit{Kim},[\mathbf{effect}'(\mathit{Kim},[\mathbf{win}'(\mathit{Kim}, \mathit{that\_race})])])]$

Looking back to (20-21), we can identify the following relations.[9]

Kim won that race $\Vdash$	*Kim was able to win that race* $\Vdash$	*Kim had the ability to win that race*
outcome of ability	exercise of ability	potential ability

The exercise of ability is, by default, expected to lead to a successful outcome, hence the Q2 implicature in (2c) and (25). Potential ability, however, has unknown outcome; hence the Q1 implicature in (1d) and (23). The implicatures can be included in the lexicon as shown in (26) and (27), where **T** is a variable over tenses.

(26) *be able to* $\rightarrow \mathbf{T}[\mathbf{be\_able}'(x,[\mathbf{do}'(x, ...)])]$

IF $\mathbf{T}=\mathbf{P}$ THEN $\mathbf{P}[\mathbf{be\_able}'(x,[\mathbf{do}'(x, ...)])]\ \triangleright\ \mathbf{P}[\mathbf{do}'(x, ...)]]$

(27) is the basis for (2c) with its Q2 implicature.

(27) *have the ability to* $\rightarrow \mathbf{T_i}[\Diamond[\mathbf{T_j}[\mathbf{be\_able}'(x, ...)]]]$

IF $\mathbf{T_j}=\mathbf{P}$ THEN $\mathbf{T_i}[\Diamond[\mathbf{P}[\mathbf{be\_able}'(x,[\mathbf{do}'(x, ...)])]]]\ \triangleright\ \mathbf{T_i}[\Diamond[\mathbf{P}[\neg[\mathbf{do}'(x, ...)]]]]$

(26) is the basis for (1d) with its Q1 implicature.

8. Sincerity condition on statements, if you will. See Allan 1994.

9. There is idiolectal and perhaps dialectal variation with respect to these relations. For instance, some people find contradictory *I had the ability to win but I wasn't able to win*. Others, like myself, do not.

The reason that (2c)$\Vdash$(1d), i.e. *Kim was able to win that race* $\Vdash$ *Kim had the ability to win that race*, despite their different implicatures is that implicature is in part a function of the choice of words in an utterance: choosing the former indicates that the implicature of the latter does not apply. The same rule applies when *three* is used instead of *two*: *three* logically implies *two* and *two* implicates “no more than two”, which is certainly not the implicature of *three*. The rule applies just as well to *emu* and *bird*: the Q2 implicature “can fly”, does not apply to *emu* despite the fact that *x is an emu* $\Vdash$ *x is a bird*. It is therefore a regular effect of lexical choice that *Kim was able to win that race* does not implicate “S does not know that Kim did win that race”.

(26) gives the semantics for (2c) and, like (2a-b), it includes a Q2 implicature in the lexicon; so let’s consider the other examples of Q2 implicature in (2).

(28a-b) clearly contrast with (1c).

(28) a. Sam $\left\{\begin{matrix}\text{dropped}\\ \text{waved}\end{matrix}\right\}$ an arm $\triangleright$ The arm is his own[10]

b. Sam $\left\{\begin{matrix}\text{broke}\\ \text{lost}\end{matrix}\right\}$ an arm $\triangleright$ The arm is his own

Examples like (28a) are restricted to movement of a proper subset of body parts when change in its location is in focus (consider the possible ambiguity of *Sam shook a hand*: shook his own hand about; performed a greeting by shaking the hand of another). At best (28a) would be a context sensitive rule such as:

(29) $x\ moves\ y \wedge y\ is\ a\ body\ part \rightarrow \mathbf{do'}(x,[a(n)\ y\text{: } \mathbf{body\_part'}(y)]([\mathbf{move'}(x,y)]) \wedge \exists z[\mathbf{have'}(x,[\mathbf{body\_part'}(z)]) \wedge y \subset z])]$

$\triangleright$ y is x’s body part

This would have to be located in a lexicon under a large number of either movement verbs or body part nouns; but neither seems appropriate. (29) characterizes knowledge about a combination of listemes, not a single listeme.

There is a similar problem with (28b). Injury to or loss of a proper subset of a set of body parts gives rise to the implicature as shown; but representing this in the lexicon is at least as problematic as for (28a). The default interpretation is unaccusative: “something happens such that x suffers damage or loss to a body part”. H must determine this from the combination of verb and body-part NP. In

10. I ignore the unlikely possibility of *arm* being used for “armament” rather than a body part. It behooves me to explain why the use of the indefinite in (2d) has, loosely speaking, the opposite effect from its use in (1c). An indefinite can only be used when the body-part NP refers to a proper subset of the relevant body parts. A possessive definite can be used, e.g. *Sam broke his arm*, even though Sam has more than one arm. A detailed explanation is outside the scope of this paper, but briefly it is explicable in terms of the newsworthiness of the event and distinguishing which of Sam’s arms it was is at best a secondary matter (see Allan 1986, fc).

fact (28) identifies the tip of a problematic iceberg, as indicated in (30). Unlike (28b), these normally name deliberate actions.

(30) *x ameliorates the condition of a body part*
a. Sam shaved a leg ▹ her own leg
b. Sam plucked an eyebrow ▹ her own eyebrow
c. Sam scratched an arm ▹ her own arm
[also in the unaccusative injury sense]

Other acts affecting a body part refer to someone other than the actor, (31), as do other kinds of acts involving body parts, (32).

(31) a. Sam tickled an arm ▹ not his own arm
b. Sam groped a thigh ▹ not his own thigh
c. Sam kissed a gloved hand ▹ not his own hand
d. Sam kicked an arm ▹ not his own arm

(32) Sam $\left\{\begin{array}{c}\text{photographed}\\\text{spotted}\end{array}\right\}$ an arm ▹ The arm is not his own

The interpretations of (28-32) rely on knowledge about common human behaviours. For instance, it is common ground that people wave their arms for various purposes, and rare to wave anyone else's; consequently, the latter should be explicitly mentioned. If Sam were a window dresser and the arm referred to is that of a mannikin, this would need to be established as part of the common ground. Attending one's bodily comfort and appearance is the common ground in (30); but if context indicated that Sam is at work as a beautician she might well be plucking someone else's eyebrow.[11] These are aspects of encyclopedic knowledge that will be called upon in computing the meanings of the combinations of listemes in (2d) and the associated examples.

Let's take a final example.

(2) e. The driver stopped the car ▹ The driver applied the foot brake in order to stop the car

The driver could have used a handbrake to stop the car, so the implicature in (2e) is cancelable. In another scenario, the car could have been a child's pedal car with no brakes at all — which is consistent with the entailment in (33), but not the implicature in (2e).

11. An anonymous reader found the default meaning of (30) has Sam attending to someone else's limb (as a beautician, or whatever). On the other hand, when *one* replaces *a(n)* as in *Sam shaved one leg*, this reader finds the attention to Sam's own body-part is the salient meaning.

(33) The driver stopped the car at time t_i
⊩ The car was in motion at t_{i-1} ∧ the person controlling the car did something at t_{i-1} to cause the car to stop
⊩ The car did not stop because it crashed, or ran out of petrol, or the battery died

Is it the semantic frame of *car* or its encyclopedia entry that carries the information that a car has a foot brake and a handbrake which serve different primary functions? The semantic specification of car in the lexicon will be a refined and expanded version of (34).

(34) *car* ←→ **car′**(x) → λy[**vehicle′**(y) ∧ **more_than_two_wheeled′**(y) ∧ ∃z[**seat_for_the_driver′**(z) ∧ **face_front′**(z) ∧¬∃w[**seat′**(w) ∧ **in_front_of′**(w,z)] ∧ **accommodate′**(y,z)]](x)
▹ x has a motor and up to about six passenger seats; it has two wheels at each side for forward and backward movement.

(34) says nothing about any means of stopping or starting a car. The encyclopedia entry linked to *car* will contain information of the following kind:

■ (a) An account of the semantic links between *car*, *cart*, *carriage* and *carry* and of the growing salience of the "automobile" sense of *car* during the 20th century.

(b) The principal function of a car is to transport people. A car is controlled by one of them, the driver.

(c) Description of the components of a typical car and of their functions. E.g.

(i) The wheels of a car are rimmed by tyres that are typically pneumatic. The front wheels turn to direct the car as it moves. This turning is effected by the driver who changes direction by rotating the steering wheel inside the car.

(ii) A car is typically propelled (and otherwise powered) by a motor, usually an internal combustion engine. The motor is started by an ignition switch, activated on most cars by a key.

(iii) When running, the engine causes the wheels to move when the gears within the transmission are engaged. The speed of the running engine is controlled by an accelerator pedal operated by the driver.

(iv) That the car's motion is stopped by applying brakes to the wheels. These brakes are controlled by the driver applying a foot brake. A handbrake holds the car from moving when it is parked.

(v) Most cars have two rows of seats facing forward, the driver occupying a seat in the front row.

...

(d) Some car marques are: BMW, Ford, Holden, Lamborghini, ...

...

Despite the fact that a motor car's brakes are contingently inalienable, the weight of evidence suggests that their function within a car does not arise directly from lexical or semantic properties of the word *car*. Instead, it is something we know about the objects denoted by *car*. The Q2 implicature of (2e) must, therefore, derive from encyclopedic information about cars and the default means of stopping them.

In the preceding section I defined Q1 and Q2 implicatures and endorsed their pragmatic status. In this section I have defended the claim that the Q1 and Q2 implicatures of listemes should be included among their 'semantic' specification in the lexicon. An implicature identifies the default interpretations, i.e. the PROBABLE meaning in the absence of constraints imposed by a particular context. IF, THEN, ELSE conditions sequence probabilities among implicatures in the lexicon.[12] The standard implicatures must be learned by the language user along with the NECESSARY sense(s) of the listeme. A strong argument for this innovation to the lexicon is a quantifier like *two. Two* necessarily means "at least two"; but if you ask a lay population, they interpret it as meaning "exactly two", its most probable meaning. This is a fact ignored only by an incompetent lexicographer. The vast majority of the lay population of English speakers assumes that *bull* denotes a male bovine. This is the standard implicature; there are bull elephants, bull hippos, bull whales, bull alligators, etc. each of which can be referred to simply as a *bull* when common ground makes use of the term unambiguous and cancels the implicature. To my mind, there is no doubt that Q1 and Q2 implicatures must be entered into the lexicon; and I have shown how this might be done for a variety of listemes. The implicatures that attach to collocations of listemes, however, are not located in the lexicon; like the meanings of the collocations themselves, them must be computed.

4. Key points

- A premise for this paper was that semantic specification in the lexicon should incorporate defeasible default (probable) meaning of a lexicon item together with the logically necessary components of lexical meaning.
- The defeasible default meaning is a conversational implicature; and, because such implicature is pragmatic and often based on encyclopedic knowledge, it seemed reasonable to suppose that implicature might be at the interface of lexicon and encyclopedia.
- Despite the fact that conversational implicatures are pragmatic entities, generalized quantity implicatures (the only implicatures examined) are readily included in a lexicon entry.
- All the Q implicatures associated directly with a single lexicon item were readily and usefully incorporated into the lexical entry for the item, and there is no reason to expect that exceptions will be uncovered.
- Where the implicature arises from a combination of listemes, it cannot be included in the lexicon, but must be generated by the semantic component of the grammar.

12. ELSE conditions have not appeared in this paper. See Allan 2000 for their use.

- Where the implicature arises from encyclopedic information evoked by a semantic frame or script and not the semantic specifications of the lexicon entry, as in the case of (2e), it cannot be included in the lexicon.

References

Allan, Keith. 1986. *Linguistic Meaning (Vols 1 and 2)*. London: Routledge and Kegan Paul.

— 1994. Felicity conditions on speech acts. *Encyclopedia of Language and Linguistics*, ed. by Ron Asher. Vol.3, pp.1210-13. Oxford: Pergamon Press.

— 1995. What names tell about the lexicon and the enyclopedia. *Lexicology* 1:280-325.

— 1999. The semantics of English qantifiers. *The Clause in English: In Honour of Rodney Huddleston*, ed. by Peter Collins and David Lee, pp.1-31. Amsterdam: John Benjamins.

— 2000. Quantity implicatures and the lexicon. *The Lexicon-Encyclopedia Interface* ed. by Bert Peeters. Amsterdam: Elsevier.

— fc. *Natural Language Semantics: The Study of Meaning in Human Languages*. Oxford: Basil Blackwell.

Atlas, Jay and Stephen Levinson. 1981. It-clefts, informativeness, and logical form. In Cole (ed), pp.1-62.

Barsalou, Lawrence W. 1992. Frames, concepts, and conceptual fields. In Lehrer and Kittay (eds), pp.21-74.

Bunt, Harry C. 1985. *Mass Terms and Model-Theoretic Semantics*. Cambridge: Cambridge University Press.

Clark, Herbert H. 1996. *Using Language*. Cambridge: Cambridge University Press.

Cole, Peter (ed.). 1981. *Radical Pragmatics.* New York: Academic Press.

DuBois, John W. 1980. Beyond definiteness: the trace of identity in discourse. *The Pear Stories*, ed. by Wallace Chafe, pp.203-74. Norwood NJ:Ablex.

Fillmore, Charles J. 1982. Frame semantics. *Linguistics in the Morning Calm*, ed. by Linguistic Society of Korea, pp.111-38. Seoul: Hanshin.

Fillmore, Charles J. and Beryl T. Atkins. 1992. Toward a frame-based lexicon: the semantics of RISK and its neighbors. In Lehrer and Kittay (eds), pp.75-102.

Gazdar, Gerald. 1979. *Pragmatics: Implicature, Presupposition, and Logical Form*. New York: Academic Press.

Givón, Talmy. 1984. *Syntax: A Functional-Typological Perspective. Vol.1*. Amsterdam: John Benjamins.

Grice, H. Paul. 1975. Logic and conversation. *Syntax and Semantics 3: Speech Acts*, ed. by Peter Cole and Jerry L. Morgan, pp.41-58. New York: Academic Press. Reprinted in Grice 1986.

Grice, H. Paul. 1986. *Studies in the Way of Words*. Cambridge MA: Harvard University Press.

Hawkins, John A. 1978. *Definiteness and Indefiniteness.* London: Croom Helm.

Horn, Laurence R. 1972. *On the Semantic Properties of the Logical Operators in English*. Bloomington: Indiana University Linguistics Club.

— 1984. Toward a new taxonomy for pragmatic inference: Q-based and R-based implicature. *Meaning, Form, and Use in Context: Linguistic Applications* (Georgetown University Round Table on Languages and Linguistics) ed. by Deborah Schriffin, pp. 11-42. Washington DC: Georgetown University Press.

— 1989. *A Natural History of Negation*. Chicago: University of Chicago Press.

Jackendoff, Ray. 1983. *Semantics and Cognition*. Cambridge MA: MIT Press.

— 1985. Multiple subcategorization and the θ-criterion: the case of *climb. Natural Language and Linguistic Theory* 3:271-95.

— 1990. *Semantic Structures*. Cambridge MA: MIT Press.

Lambrecht, Knud. 1994. *Information Structure and Sentence Form: Topic, Focus, and the Mental Representations of Discourse Referents*. Cambridge: Cambridge University Press.

Lehrer, Adrienne and Eva F. Kittay (eds). 1992. *Frames, Fields, and Contrasts*. Hillsdale: Lawrence Erlbaum.

Lerdahl, Fred and Ray Jackendoff. 1982. *A Generative Theory of Tonal Music*. Cambridge MA: MIT Press.

Levinson, Stephen. 1983. *Pragmatics*. Cambridge: Cambridge University Press.

— Three levels of meaning. *Grammar and Meaning: Essays in Honour of Sir John Lyons*, ed. by Frank R. Palmer, pp.90-115. Cambridge: Cambridge University Press.

Lewis, David. 1969. *Convention*. Cambridge MA: Harvard University Press.

— 1979. Scorekeeping in a language game. *Journal of Philosophical Logic* 8:339-59.

Lyons, John. 1995. *Linguistic Semantics an Introduction*. Cambridge: Cambridge University Press.

Schank, Roger C. 1982. *Dynamic Memory: a Theory of Reminding and Learning in Computers and People.* Cambridge: Cambridge University Press.

— 1984. *The Cognitive Computer*. Reading MA: Addison-Wesley.

— 1986. *Explanation Patterns*. Hillsdale NJ: Lawrence Erlbaum.

— and Robert C. Abelson. 1977. *Scripts, Plans, Goals and Understanding: An Inquiry into Human Knowledge Structures.* Hillsdale, NJ: Lawrence Erlbaum.

Stalnaker, Robert C. 1973. Presupposition. *Journal of Philosophical Logic* 2:77-96.

— 1974. Pragmatic presupposition. *Semantics and Philosophy*, ed. by M.K. Munitz and P.K. Unger. New York: New York University Press.