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1
Implicatures

Manfred Krifka

This volume contains five chapters that discuss experimential evidence relating to implicatures. The kind of implicatures relevant here are conversational implicatures. According to H. Paul Grice, who introduced this notion in 'Logic and conversation' (1967 [1989]), such implicatures originate from the literal meaning of expressions and the fact that speakers follow certain rules in uttering them. Grice discussed four of these rules – the maxims of Quality ('Do not say anything that you believe false!'), Quantity ('Be as informative as required!'), Relation ('Be relevant!') and Manner ('Be perspicuous, strive for brevity and order!'). He showed with many examples how the literal meanings of the expressions, together with the maxims and a general principle of cooperation, and perhaps with certain features of the context, result in additional meanings – the conversational implicatures. These additional meanings have properties that distinguish them from the literal meanings and the entailments that the literal meanings induce. In particular, they are not stable: they need not arise in the first place, given particular properties of the context, and they might be cancelled. For example, the assertion *Mary has three children* triggers the implicature that she does not have four children, but this can be cancelled: *Mary has three children, perhaps four* is not a contradiction.

This concept of implicature proved to be extremely fruitful in the investigation of the nature of communication. Grice's theory led to various developments, stressing different aspects and leading to different kinds of explanations. Relevance Theory, initiated by Sperber & Wilson (1986), reduces Gricean-style arguments to the one maxim of Relation, and to issues of how complex it is to work out the relevance of an implicature in a particular case. Another line, which became known as Neo-Gricean, with Horn (1984) and Levinson (2000) as important

representatives, classifies implicatures as information-enriching or as information-reducing. The first case covers instances in which the literal information is supplemented with stereotypical assumptions; in the second, additional information results from the assumption that the speaker expressed everything that is necessary to convey the intended meaning. More recently, a problem for all Gricean approaches was addressed: Grice assumes rather complex reasoning processes by speaker and hearer about each other's motives. It could be shown that pragmatic tendencies can be modelled like conflicting constraints in Optimality Theory (see the contributions in Blutner & Zeevat 2004), and furthermore, that the constraints and their orderings can be seen as emerging from forces that can be described within Evolutionary Game Theory (see the contributions in Benz, Jäger & van Rooij 2006).

Just as in other branches of theoretical linguistics, research on implicatures first relied on the introspection of competent speakers. But in the last decade, implicatures have become an important topic within psycholinguistics. The effects of the additional meaning components were rigidly investigated with different kinds of subjects, including children, autists, and old people. Different methods were used to investigate implicatures, beyond those that required rather high-level abilities such as truth-value judgments and tests of whether cancellations lead to contradictions, with the goal to determine the nature of these meaning components, and the ways in which they arise. To name but a few, Storto & Tanenhaus (2005) has used evidence from eye movements in a visual-world paradigm; Bott & Noveck (2004) have recorded answer times related to different kinds of meaning components, and Noveck & Posada (2003) have investigated effects of scalar implicatures in event-related potentials. The results of this research actually have the potential of deciding between different conceptions of implicatures. For example, Relevance Theory predicts that implicatures are typically generated when features of the context require it, whereas other theories predict that they are generated automatically, and may be cancelled by the context. This should show up in the way implicatures are processed. Also, while implicatures have certain features in common – in particular, that they can be cancelled – they originate in different ways, and may show quite different properties in the ways they are processed.

The best-known, and perhaps most systematic, case of conversational implicatures are scalar implicatures (Gazdar 1979; Hirschberg 1985), and this is the type that all five chapters in this Part of the book investigate. Scalar implicature arises when a complex expression [...α...] contains a part, α, for which there are alternative expressions, α′, α″,

etc. (equivalently, we could talk about the corresponding meanings of these expressions). These alternatives might be highlighted by focus (a case that is discussed in the contribution by Zondervan), or they might be specified by the lexicon, a case commonly known as Horn scales (e.g., if α is a number word, other number words form the alternatives). They also might be given by the context. The scalar implicature arises because the speaker signals by selecting the expression [...α...] that this is the best choice among the alternatives [...α...], [...α′...], [...α″...], etc. The other choices may be rejected for various reasons: they might not be informative enough (hence, violate the maxim of Quantity), or they might be false (hence, violate Grice's maxim of Quality). For example, if the speaker knows that Mary has exactly three children, then saying that Mary has two children would not be informative enough, and saying that she has four would be false. There is a third reason: the alternatives might be suboptimal in terms of their argumentation value (an aspect that has been investigated, in particular, in work by and following Oswald Ducrot). For example, if Mary got an A and a B in two exams, and the question is whether she is good at school, then saying that she got an A in an exam is better, if one wants to argue that she is good, than to say that she got a B. Notice that in this case there is no logical relationship between the two alternatives.

The contribution by Lewis Bott, 'Changes in Activitation Levels with Scalar Implicatures', addresses the issue of whether there is a difference between explicit negation and the implicit negation that is triggered by scalar implicature (that is, the case when an alternative [...α′...] of an expression [...α...] is rejected because it is false). The prototypical cases of scalar implicature are difficult to use for this purpose: while *some children cried* triggers the implicature *not all children cried*, it is difficult to check whether the contrasted item *all* shows different effects when compared with explicit negation, as in *some but not all children cried*. Instead, Bott chooses a dialogical setting, namely question–answer pairs such as A: *John is intelligent and handsome*. – B: *Well, I think he is intelligent*, which implicates that *John is not handsome* (a pattern that has been investigated by Hirschberg 1985). The main technique used is measuring the reaction time for probe recognition, where participants have to respond to a probe item that might have occurred in the sentence that they read. The experiment showed that the implicitly negated item is indeed activitated, as the probe recognition for this item is increased. Interestingly, this happens only after a delay of 2000 ms, which might be seen as evidence of the processing costs that forming the implicature incurs.

Bott points out an apparent difference with explicit negation, as MacDonald & Just (1989) have found a slower probe recognition for negated items in sentences like *Elizabeth bakes some bread but no cookies*. However, in this case one can argue that a discourse referent for cookies is introduced whose life span ends with the sentence, and hence is 'removed' from the memory. In contrast, in the case at hand, no relevant discourse referents are introduced. Something like this difference is also suggested by Kaup (2001), an article discussed by Bott. In the current experimental setting, the negated expressions are adjectives, which do not introduce discourse referents, and hence we do not expect slower probe recognition due to a restricted life span of a discourse referent.

The second experiment looked at the contrast between explicitly negated and explicitly confirmed items (e.g., *John is intelligent but he is not handsome*). The experiment showed that even in this case, negated items induce a slower probe reaction time. Incidentally, a comparison between the two experiments shows that the probe reaction time is slower with implicated negation than with explicit negation, and in particular, that implicated negation requires a long delay to show its effects. Unfortunately, it is not easy to directly compare cases like *Well, he's intelligent* and *He is intelligent, but not handsome* (the latter presumably always will show a faster probe recognition time because the adjective is mentioned explicitly).

The contrast between explicit and implicit negation was tested in another experiment, using a different technique. Subjects had to answer the question, which was the 'most important' part of the message. The general consensus was that explicitly given information is considered 'more important'. It is not quite clear whether this means that the information (that John is not handsome) is transmitted more efficiently when it is explicitly negated. It is evident that the speaker has a higher commitment to the proposition if it is explicitly stated, but the more effective way might well be to convey it by implicature – why else would implicatures be a preferred mode of information transmission in advertisements? It might well be that a task that involves judgment of importance is too complex for subjects. Even judgments for truth values are tricky when implicatures are involved, as we will see with the next chapter.

The contribution by Meredith Larson, Ryan Doran, Yaron McNabb, Rachel Baker, Matthew Berendes, Alex Djalali and Gregory Ward, 'Distinguishing the *Said* from the *Implicated* Using a Novel Experimental Paradigm', investigates whether speakers treat implicatures differently from entailments. The method used is a version of the Truth Value

Judgment Task it is checked whether speakers judge a sentence, in a given context, as true even though an implicature is violated. It is customary to call judgments 'logical' in the case that they are solely based on the literal meanings, and 'pragmatic' in the case that they are affected by implicatures. The authors argue that truth-value judgments are a better way to find out about entailment/implicature differences than to ask, for example, what the speaker meant or what the sentence said. For example, assume that the question *How much cake did Gus eat at his sister's birthday*? is answered by *He ate most of the cake*, and the information is given that he in fact ate all of it. A person sensitive to the special status of implicatures would give the 'logical' answer that this sentence is true, while a person insensitive to it would give the 'pragmatic' answer that it is false. In one particularly interesting condition, speakers did not rate the truth of sentences after being familiarized with a character named 'Literal Lucy', who interprets sentences always in the most literal way. This helps sharpen intuitions about different aspects of meaning. (Another method could be to assume statements made in front of a court where only contradictions between what the sentence literally says constitute a lie in a 'technical' sense.)

The experiment investigated whether subjects distinguished in their judgments between entailments (the literal meaning) and generalized conversational implicatures (also, entailments based on context-related expressions like deictics were investigated). The method used was truth-value judgments, where a particular proposition was given as a fact. The subjects did distinguish between these meaning components, to some degree at least: while entailments that are incompatible with what was given as a fact nearly always led to judging a sentence as false, this was significantly less so when there was a conflict between an implicature and what was given as a fact. In the experiment, the kinds of implicatures were carefully controlled, using the classification scheme of Levinson (2000). Levinson distinguished between Q-implicatures (roughly, scalar implicatures); I-implicatures (implicatures towards a stereotypical interpretation); and M-implicatures (implicatures triggered by complex expressions such that their meaning is not to be interpreted in a stereotypical way). Interestingly, the three classes of implicatures do not seem to be treated in fundamentally different ways in the truth-value judgment experiment.

However, when looking into the data for specific subtypes of implicatures, several observations can be made that suggest that there are subtypes that are treated quite differently. For instance, repeated expressions indicate a large quantity; *Mary waited and waited* suggests that Mary

waited for a long time. The authors see this as a case of M-implicature, following Levinson (2000). However, the subjects treated this meaning component as very similar to entailments: they considered the sentence false if Mary in fact only waited for a short time. One plausible explanation of this is that this reduplicating construction refers to a large quantity as part of its literal meaning, and does not trigger an implicature at all. It may very well be a case of an implicature that became an idiomatic construction.

Interestingly, the interpretation of number words behaves quite similarly in this respect. If the question *How many children does Lisa have?* is answered by *Lisa has three children*, this is considered false in about 75% of the cases if Lisa has in fact four children. That is, number words tend towards 'logical' answers. This is different from other expressions that trigger scalar implicatures, like rankings (*junior* vs. *senior*), quantifiers (*most* vs. *all*) and adjectives (*pretty* vs. *beautiful, gorgeous* etc.), which tend – in increasing degree – towards a 'pragmatic' interpretation. One possible interpretation of such differences between different kinds of alternatives is that numerals always trigger alternatives – after all, children learn the alternatives of number words by heart when they learn to count. The other kinds of alternatives are not automatically triggered; this holds especially in the case of adjectives. It is well-known from previous research that number words trigger scalar implicatures more regularly than other expressions, and are learned earlier in language acquisition (cf. Papafragou & Musolino 2003; Hurewitz *et al.* 2006).

Chapter 3, 'A Large-scale Investigation of Scalar Implicature', by Petra Hendriks, John Hoeks, Helen de Hoop, Irene Krämer, Erik-Jan Smits, Jennifer Spenader and Henriëtte de Swart, is remarkable for several reasons. It reports on a study using more subjects than all previous investigations of scalar implicatures combined (more than 4,000); it investigates a large span of age groups (from 5 to 64 years); and it results in data that are very hard to interpret in the light of current theories. Previous experiments on scalar implicatures with children, especially Noveck (2001), building on earlier work by Smith (1980), have shown that children appear to be more 'logical' than adults, as they judged sentences with existential quantifiers as true even if a corresponding sentence with universal quantifiers would be true (example: *Some giraffes have long necks*). Noveck's test items were the French quantifiers *certains* and *tous*, and the age range he investigated were children from 7 years on and adults as a control group. (He also investigated weak and strong modals.) His findings were interpreted as evidence that the generation of scalar implicatures amounts to additional work that children

cannot perform, or do not perform as reliably as adults. These findings inspired research that resulted in a number of other papers, with the general direction that children are able to perform these implicatures in principle but may be prevented from doing so in special experimental settings (e.g., Pouscoulous & Geurts 2007). Also, it was shown that there are adults that behave as 'logically' as children in their ability to keep implicatures distinct from the literal meaning of expressions.

In the current study on Dutch reported in Chapter 3, Hendriks *et al.* look at the use of the number word *twee*, the indefinite article *'n* and the partitive quantifier *enkele van de* in pragmatically correct uses and in uses that are logically correct but pragmatically infelicitous, using a picture-mapping task. The study investigated NPs in three positions: as sentence-initial topics, as non-initial existentials, and in object positions (but it turned out that this factor did not play a major role). The most suprising finding was that in the number word case, young children and old people answered more 'pragmatically', and less 'logically', than middle-aged adults (but even that group never showed more than 30% 'logical' answers). The authors interpret this as saying that the implicature is generated easily, but that young adults show a greater ability to suppress the implicature, or distinguish it from the literal meaning, due to their greater processing abilities. This is a plausible explanation, and is consonant with the finding of Feeney *et al.* (2004) that adults that answer logically need more time for their answers.

The authors do not comment on the time development with the quantifier *enkele van de*, as there were too few cases in each age group in this experiment. But notice that there is indeed a slight decrease of 'logical' answers from 5 to 15 years, which is consonant with Noveck's findings. The reason for this difference between *twee* and *enkele van de* might be what was mentioned in the discussion of Chapter 2 – namely, that children form Horn scales with number words due to the culturally established practice of counting, but not with quantifiers like *some* and *all* (see also Breheny 2005). But then adults aged 30 behave like young kids all over again, adults aged 40 are the least 'logical' of all, while adults aged 60 behave more 'logically' than any other age group. It is to be hoped that a larger or more controlled study will result in data that are more easy to interpret.

The third item that the authors investigate, the indefinite article, behaves quite differently, as we have a very high proportion of 'logical' responses. This is consonant with the idea that the indefinite article does not form a Horn scale with number words (it rather forms a contrast set with the definite article, which is irrelevant here). It would have

been interesting to see whether the indefinite article *'n* and the number word *een* behave differently (the prediction is, of course: yes, they do, as the number word has other number words as alternatives). As for the time course of the answers, it is remarkable that young children gave significantly fewer 'logical' responses than adults, which certainly does not fit into the general picture that Noveck (2001) suggested.

One critical difference between Noveck (2001) and the work reported here is that Noveck did not present his subjects with pictures. Noveck contrasted sentences like *All elephants have trunks* (judged by >90% of the children as true) with *Some giraffes have long necks* (judged by ~85% of the children as true, but only by <50% of the adults), which show a clear difference. But the subjects were not exposed to a picture with a definite (small) number of entities, and they might well have been careful in rejecting existential sentences because they were aware of possible exceptions to generic sentences like *Giraffes have a long neck* (cf. also Guasti *et al.* 2005 for the observation that visual contact with a scene increases the quantity of pragmatically appropriate answers). Another relevant difference might be that subjects had to judge the performance of a character, a toy sheep, that was introduced as not very clever; perhaps adults were likely to revert to a 'logical' mode because they tended to interpret the sheep's utterance in a benevolent way.

Napoleon Katsos, in his chapter 'Evaluating Under-Informative Utterances with Context-Dependent and Context-Independent Scales: Experimental and Theoretical Implications', turns to the difference between generalized conversational (scalar) implicatures (GCIs) and particularized conversational (scalar) implicatures (PCIs). While GCIs are triggered without any special role of context, due to the fact that the triggering items (like *some* vs. *all*) form a Horn class as part of their lexical meaning, PCIs are triggered in an ad hoc way by specific properties of the context (e.g. A: *Did you eat the sandwich?* – B: *Just the cheese* (i.e., not the rest of the sandwich). As Katsos suggests, differences between the processing of these two types of implicature might be able to decide between different theories of scalar implicatures. The often-reported underperformance of children in generating scalar implicatures, their tendency towards a more 'logical' answer, can be interpreted in at least two ways. Hypothesis (a): Perhaps children have learned the meanings of *some* and *all*, but they have not learned yet that they form a Horn scale. They may already know that it is better to be informative if there are alternative expressions, but they might not consider *some* and *all* as forming alternatives. Hypothesis (b): Perhaps children already know that *some* and *all* form alternatives, and of course know that contextually given

items form alternatives, but they do not have the cognitive resources under particular experimental circumstances to actually take such alternatives into account and compute the implicatures. Katsos points out that under hypothesis (a), we should expect that children process GCIs and PCIs differently: they might be negligent with GCIs because they do not form the relevant Horn scale as part of their lexicon, but they might easily compute PCIs as they are given explicitly by the context. Under hypothesis (b), we do not expect this type of difference. The experiment that is reported in Chapter 4 supports, by and large, hypothesis (b): in a Truth Value Judgment Task with pictures, children (or adults) do not make a distinction between GCIs and PCIs. (Interestingly, the group of 7-year-olds is an exception, as they do reject sentences with false PCI implicatures more often than sentences with GCI implicatures, which is contrary to what is expected by hypothesis (a), and not expected by hypothesis (b).) However, Katsos also reports that adults often react to implicature violations in a weaker way than to outright falsities, which shows that they see the difference between literal meanings and implicatures quite clearly. And he observes that they show this weaker reaction especially with scales that are constructed in an ad hoc fashion, whereas they tend to see inappropriate implicatures that arise on the basis of lexical Horn scales as more severe violations. In contrast, children treat the two classes in the same way. As a general conclusion, there is no evidence from this experiment that children do not construct Horn scales and therefore perform differently from adults. Rather, they are unable to compute implicatures in all circumstances in which adults compute them for another reason, pointing to restrictions in their ability to process them.

The final contribution to Part I, by Arjen Zondervan, 'Experiments on QUD and Focus as a Contextual Constraint on Scalar Implicature Calculation', investigates how the linguistic context determines whether scalar implicatures actually arise. That conversational implicatures can be cancelled, and may not appear at all, was, of course, already mentioned in Grice's original work. Much work has been done in investigating the sentence-internal factors that have an effect on the blocking of scalar implicatures, such as negation or the scope of certain operators, as, for example, in Chierchia (2004). Little has been done on sentence-external factors. There are influences due to the situation of the utterance (I recall a sign at the San Antonio *Schlitterbahn*, in front of a fun ride, saying *You must be four feet tall for this ride*, wondering whether I, with 5′ 10″, would be allowed in). Zondervan's chapter investigates how the Question under Discussion (QUD) under which a sentence is

interpreted determines whether implicatures arise. A QUD determines, for the sentence that answers it, what is new information, or in focus; this is typically marked in some way, e.g. by sentence accent or syntactic constructions like clefts. The effect of focus is well-known; Zondervan cites van Rooij & Schulz (2004) and van Kuppevelt (1995). There is an earlier source, Jacobs (1984), who argues that focus has a similar effect on the interpretation of illocutionary operators like assertion, which in turn relate to the context of utterance. The phenomenon is perhaps most obvious with number words. A question like *Who has two children?* can in many contexts be answered by [*Máry*]$_{\text{F}}$ *has two children*, even if Mary has three. If a question like *How many children does Mary have?* is answered by *Mary has* [*twó*]$_{\text{F}}$ *children*, this would most likely be considered false. In the case of disjunctions, the effect is somewhat weaker. A question like *Who has a dog or a cat?* can be answered by [*Jóhn*]$_{\text{F}}$ *has a dog or a cat*, even if John has both a dog and a cat. If the question *Which kind of animals does John have?* is answered by *John has* [*a dóg or a cát*]$_{\text{F}}$ in this case, this might be considered misleading but not false.

Zondervan investigates scalar implicatures in cases with explicit and implicit context questions, using a Truth Value Judgment Task. Two of the experiments concern explicit QUDs, two others concern implicit QUDs. In all cases, focus clearly made a difference; scalar implicatures were assumed to be part of the truth conditions more often in the focused case than in the non-focused case. But even in the non-focused case, scalar implicatures were interpreted as being part of the truth conditions in about half the cases; in the focused case, they were interpreted as part of the truth conditions to a higher proportion (around 75%). The differences are highly significant for all experiments, but, as the author admits, they are not as black-and-white as the theory predicts. It appears that scalar implicatures are computed (and treated as part of the truth conditons) in many cases without focus. The reason why, in the case of focused constituents, subjects did not come close to 100% probably is due to the fact that some subjects do make a distinction between implicatures and truth conditions (and hence react 'logically'): they might all compute the scalar implicatures in this case, while only about half the respondents consider them as part of the truth conditions. This corresponds to the fact that there was substantial variation between subjects, but far less variation within subjects.

We can work with the following reasonable assumptions. First, scalar implicatures *can* be triggered in the absence of focus, but *have* to be triggered by items in focus. A plausible reason for this is that focus

Table 1.1 Strategies that subjects might have followed in Zondervan's experiments (Chapter 6)

	SI trigger not focused	**SI trigger focused**
Strategy 0	do not compute SI	do not compute SI
Strategy 1	do not compute SI	compute SI, keep separate from literal meaning
Strategy 2	do not compute SI	compute SI, treat as part of literal meaning
Strategy 3	compute SI, keep separate from literal meaning	compute SI, keep separate from literal meaning
Strategy 4	compute SI, keep separate from literal meaning	compute SI, treat as part of literal meaning
Strategy 5	compute SI, treat as part of literal meaning	compute SI, treat as part of literal meaning

introduces alternatives explicitly, and hence the strength of these alternatives must be compared and be factored in. In the absence of focus, the speaker and/or the hearer might not even be aware of alternative expressions, or at least do not consider them as part of the interpretation process, as the alternatives are not highlighted. Second, scalar implicatures might be assumed to be so important that they are considered part of the literal meaning. Again, it is to be expected that this is more likely to happen in case the implicature trigger is in focus. Hence we find in Table 1.1 reasonable strategies that the subjects might have followed.

The answers of subjects using strategy 0, 1 or 3 would never indicate the presence of a scalar implicature in a Truth Value Judgment Task (this was 19% in the reported first experiment). The answers of subjects using strategy 2 or 4 would indicate the presence of scalar implicatures for focused items only (this was 31%). The answers of of subjects using strategy 5 would indicate focus in all cases (47%). This comprises the large majority of subjects; only 3% (that is, a single subject in the study) behaved in other ways. Zondervan's present experiment does not distinguish between these different strategies. The large group following strategy 5 shows that scalar implicatures are often computed for non-focused items, and treated as indistinguishable from entailments, as if they were part of the literal meaning.

The five chapters assembled here present a snapshot of current research on the topic of implicatures. They show bits and pieces of our increasing knowledge, but – to a quite large degree, I think – they also bear witness to our ignorance. This holds both for the experimental methods to be used, and for our theories. Currently, even the same methods – like truth-value judgments – sometimes yield quite different results when the experimental setting changes slightly. And our current theoretical classification of implicatures does not guarantee that they behave in the same ways in experiments testing the processing of implicatures. So, there is interesting work ahead.

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