PRAGMATIC INFERENCE AND DEDUCTIVE RULES

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1. Introduction

The author of the present paper, in line with other authors, rejects the generally held belief that there is little or nothing in common between pragmatic inference and deductive reasoning. In other words, that there is nothing in common between logic and natural language. Hopefully, the view has changed and in the last twenty five years non-traditional logics such as intentional, modal, tense and fuzzy logic have been used in the modelling of natural language (Montague 1970; Montague 1974; Cann 1993). Other authors (Allwood et al. 1977; McCawley 1981) wrote about what linguists should know about logic in order to apply it to natural language modelling. It is worth noting that deductive rules are used not only by linguists as metalanguage. Deductive rules or deductive reasoning is also used by the speakers of a language in everyday spoken discourse in the interpretation of utterances. There are two types of relations between pragmatic inference and deductive reasoning. **On the one hand, pragmatic inference coincides to some extent or overlaps with deductive reasoning. On the other hand, pragmatic inference contradicts or eliminates deductive reasoning**. The overlap is possible since deductive or logical rules may be viewed as second-order abstraction rules that operate on first-order mental structures that have to do with practical reasoning and meaning relations between linguistic expressions.

2. Deductive rules and pragmatic inference

Some deductive rules will be illustrated first followed by comments on pragmatic inference and how deductive rules are used in it. Deductive reasoning is reasoning according to the rules of logic. In deductive reasoning the conclusion is true whenever the premises ate true. Certainly, I shall start with rules that are more complicated than and- and or- introduction and and- and or- elimination. For example, from knowing that: *She is either in the bathroom or in the kitchen* and finding out she is not in the bathroom, we conclude that she is in the kitchen. The reasoning may be presented as premises and conclusion in the following manner:

(1) Premises: (a) She is either in the bathroom or in the kitchen.
(b) She is not in the bathroom.
Conclusion: She is in the kitchen.

If we substitute *P* for *She is in the bathroom* and *Q* for *She is in the kitchen*, where *P* and *Q* are propositions, then we shall have:

(2) Premises: (a) P or Q
(b) (not P)
Conclusion: Q

The deductive rule is **modus tollendo ponens**. Similarly, from *She's either in the bathroom or in the kitchen* and *She's not in the kitchen* as premises we infer: *She's in the bathroom*. Formally, we have:

(2) Premises: (a) P or Q
(b) (not Q)
Conclusion: P

The deductive rule is **modus tollendo ponens** again.

We can easily transform an exclusive disjunction into a relevant conditional: *Either the gardener or the butler did it* is transformed into: *If the gardener didn't do it, then the butler did it*. This will be formally represented as:

(3) P or Q
(If (not P) then Q)

From *John is coming to the party* and *If John is coming to the party Jane is coming, too* as premises we infer *Jane is coming to the party*. Formally, we have:

(4) Premises: (a) P
(b) If P then Q
Conclusion: Q

The deductive rule is **modus ponendo ponens**.

We get a negated modus ponendo ponens from:

(5) Premises: (a) John is not coming to the party.
(b) If John is not coming to the party, Jane is not coming, too.
Conclusion: Jane is not coming to the party.

Formally, we have:

(6) Premises: (a) (not P)
(b) (If (not P) then (not Q))
Conclusion: (not Q)

Modus ponens is a deductive rule that is frequently used in pragmatic inference. The rule is of the form:

(7) Premises: (a) If P then Q
(b) P
Conclusion: Q

Expressed verbally, modus ponens is of the kind:

(8) Premises: (a) If I hurry, I catch the bus.
(b) I hurry.
Conclusion: I catch the bus.

We can have a conjunctive modus ponens, which is of the form:

(9) Premises: (a) (If P and Q) then R)
(b) P
Conclusion: (If Q then R)

Expressed verbally, the conjunctive modus ponens is of the kind:

(10) Premises: (a) If I have money and I want to buy a new car, I'll buy it.
(b) I have money.
Conclusion: If I want to buy a new car, I'll buy it.

3. Sperber and Wilson's Relevance Theory

The list of deductive rules is not exhaustive (for more deductive rules refer to Sperber and Wilson 1986: 82; 95; 97). The important thing is that they are not used in isolation, but are used in pragmatic inference. In the present paper, the terms 'inference' and 'pragmatic inference' are interchangeably used. Pragmatic inference in Sperber and Wilson's sense is based on the inferential model of communication that complements the traditional code model – the transfer of verbally encoded information only. The inferential model is about the communication of one's intentions. The basic assumption behind the model is the assumption that we communicate not only verbally, but non-verbally as well, through inferences. In the interpretation of utterances, Sperber and Wilson's (1986) Relevance Theory includes deductive rules. In the theory, inferencing is a process in which a conclusion follows logically from a set of premises or is "at least warranted by the premises" (Sperber and Wilson 1986: 13).

Sperber and Wilson's theory is based on the assumption that the central cognitive system consists of a "restricted set of deductive rules" ("general-purpose inference rules") which apply to any conceptually represented information. The "restricted set of deductive rules" is "a set of computations which take account of the semantic properties of assumptions only insofar as these ate reflected in their form" (ibid.: 85). In other words, Sperber and Wilson conflate 'logical' with 'semantic' deductive rules. **Deductive rules are only a part of pragmatic inference. The other part consists of hypothesis formation and hypothesis confirmation or disconfirmation**. To interpret an utterance, a set of possible assumptions is automatically evoked. The set consists of two kinds of assumptions: implicated premises and implicated conclusion. Only the assumptions that are believed to be true are evoked. The deductive rules operate on the premises to arrive at a valid conclusion. **What is communicated by an utterance consists of: what is said, what is implicated and the attitude to what is said and implicated.** Saying has to do with the recovering of the semantic representation (by 'semantic representation' is meant the logical form or the recovering of the sense and the reference of the sentence uttered). Very often semantic representations are incomplete logical forms and in order to recover the full propositional form that the speaker intends to convey he/she combines

linguistically encoded and contextually inferred features of the semantic representation. The recovering of the complete propositional form - the "enrichment" of the incomplete propositional form - Sperber and Wilson call explicature. In their theory some of the implicatures in Grice's sense "are reanalyzed as pragmatically determined aspects of explicit content" (ibid.: 183). In other words, the explicit content of a sentence uttered is more than the recovering of ellipsed elements, reference assignment and disambiguation, as is the generally accepted view. The "enrichment" includes, together with the recovering of reference assignment of indeterminate referring expressions such as pronouns, the enrichment of underdetermined linguistic expressions such as *too*, *some* or the genitive (ibid.: 193). For example, the explicature of (12), after the enrichment of temporal reference, is the one in (13):

(11) It will get cold.
(12) The dinner will get cold very soon.

The attitude to what is said and implicated in Sperber and Wilson's sense is wider than the usual sense of the term "propositional attitude". It includes not only the "endorsement" of the proposition expressed by the speaker or his/her "dissociation" from it: in addition to the listener's ability to identify an assertion, it includes his/her ability to identify metaphor and irony.

As far as intentions go, there are two types of intentions in the use of an utterance in Relevance Theory: a communicative and an informative intention. The communicative intention is defined as a second-order informative intention. It is fulfilled after the first-order informative intention is recognized. The informative intention informs the listener of something; the communicative intention informs the listener of one's informative intention (ibid.: 29).

According to Sperber and Wilson (1986) and Wilson (1991; 1994**), the listener, in the interpretation of an utterance, is guided by a single principle, the principle of relevance that subsumes Grice's principle and maxims**. **Relevance is defined "as a relation between a propositopn P and a set of contextual assumptions C"** (Wilson 1991: 381). As a result of presumed relevance, an implicature is derived:

in the exchange in (14), the implicature in relation to (14b) is the one in (15):

(13) a. He: Will you have some coffee?
b. She: Coffee will keep me awake.
(14) Conclusion: She won't have any coffee.

The implicature in (15) has the status of a conclusion. The premises for the conclusion are also implicit and, together with the conclusion, have to be recovered by the listener. (To compare: in a logical argument, unlike pragmatic inference, the premises are explicitly stated.) The premises for (15), according to Wilson (ibid.: 386), are the ones in (16):

(15) Premises: (a) She doesn't want to be kept awake.
(b) She won't have anything that will keep her awake.

How do deductive rules apply on the contextual assumptions in (16) that are evoked by (14b)? With deduction we have a rule, an instance of the rule and both are used as premises to arrive at a valid conclusion. **In pragmatic inference the rule is equivalent to what the speaker and the listener take for granted – a shared background of beliefs**. If that is so, then the premises in (17) are closer to deduction and so are more suitable for the conclusion in (15) than are the premises suggested by Wilson in (16):

(16) Premises: (a) Coffee keeps people awake
(All people are kept awake by coffee)
(b) Coffee will keep her awake.
(c) She doesn't want to be kept awake.
Conclusion: She won't have any coffee.

The statement in (17a) is restated as: *All people are kept awake by coffee* and it is of the form: *All X are Y*. In fact, *Coffee will keep me awake* in (14b) may be interpreted as the reason for the ellipsed actual conditional in (18), where *I don't want any coffee* is the consequent and *Coffee will keep me awake* – the antecedent of the conditional:

(17) I don't want any coffee because coffee will keep me awake.

This is the intuition that most people would have for the interpretation of (14b). The conclusion in (15), namely: *She won't have any coffee* that is recovered by the listener is in fact the implicit antecedent of the conditional in (18). In fact, the conditional in (18) can be further enriched through the recovering of the attitude of the speaker towards its antecedent. The enrichment of (18) is given in (19):

(18) I don't want any coffee because I know coffee will keep me awake.

Sperber and Wilson (1986) and Wilson (1991) are right that the premise in (17c), namely: *She doesn't want to be kept awake* is dependent on the context of situation. In this case the premise in (17c) holds if the speaker of *Coffee will keep me awake* is tired and wants to go to bed early. If the speaker has to work until late at night, then the premise in (17c) will be: *She wants to be kept awake* and the conclusion in (17): *She will have coffee*, respectively.

Another reason why *She doesn't want to be kept awake* in (16a) and *She won't have anything that will keep her awake* in (16b) cannot be used as premises for (15) is the fact that there is a relation of strong dependency between them. Because of this we can form an actual conditional in which (16a) is the antecedent and (16b) the consequent:

(19) She doesn't want to be kept awake, so she won't have anything that would keep her awake.

There is no such dependency between the premises of an ordinary deductive argument, for example, the one in (17).

Sperber and Wilson and Wilson give examples of deductive reasoning in pragmatic inference that are obvious and easy to understand. The examples are only of the overlap between pragmatic inference and deductive reasoning. Yet they say nothing on how pragmatic inference and deductive reasoning diverge. In other words, they do not include as

premises the ones given in (21) because such premises do not match any deductive rules and therefore no valid conclusion can be drawn from them:

(20) Premises: (a) Peter is coming to the party.
(b) If Peter is coming to the party, Jane will not come.

Premises: (a) Peter is not coming to the party.
(b) If Peter is not coming to the party, Jane will come.

4. Fallacies with modus ponens and modus tollens

Sperber and Wilson say nothing about **the common fallacy with modus ponens – affirming the consequent and the common fallacy with modus tollens – denying the antecedent**. **The two fallacies are other examples of how pragmatic inference deviates from deductive reasoning**.

As already mentioned, modus ponens as a deductive argument is easier to understand and for that matter it is used more frequently in pragmatic inference than modus tollens. Even children come to understand it in terms of condition and prohibition:

(21) You'll play in the garden if you write your homework.

Modus ponens restates the conditional as:

(22) Premises: (a) If I write my homework, I'll play in the garden.
(b) I write my homework.
Conclusion: I play in the garden.

A common fallacy with modus ponens, as mentioned above, is to use the conditional and the affirmed consequent as premises from which to infer the antecedent:

(23) Premises: (a) If it's Monday, then it's a market day.
(b) It's a market day.
Conclusion: It's Monday.

The fallacy formally is of the form:

(24) Premises: (a) If P then Q
(b) Q
Conclusion: P

From every state of affairs in which Q is true it does not follow that P is also true. There might be a market day on another day except Monday, for example, Friday.

Modus tollens is another deductive rule that is used less frequently in pragmatic inference than modus ponens because it seems to be less obvious.

(25) Premises: (a) If Fido is a dog, then it's an animal.
(b) Fido is not an animal.
Conclusion: Fido is not a dog.

Or, presented formally, we have:

(26) Premises: (a) If P then Q
(b) (not Q)
Conclusion: (not P)

A common fallacy with modus tollens is that people wrongly infer from the premises *If P then Q* and *(not P)* the conclusion *(not Q)*. In other words, the conclusion in (28) is not valid:

(27) Premises: (a) If she smokes, she'll die of lung cancer.
(b) She doesn't smoke.
Conclusion: She won't die of lung cancer.

In (29), to avoid any misunderstanding, the fallacies with modus ponens and modus tollens are given again:

(29) **Modus ponens**
Premises: (a) If P then Q
(b) P
Conclusion: Q

Fallacy
Premises: (a) If P then Q
(b) Q
Conclusion: P

Modus tollens
Premises: (a) If P then Q
(b) (not Q)
Conclusion: (not P)

Fallacy
Premises: (a) If P then Q
(b) (not P)
Conclusion: (not Q)

Because Sperber and Wilson say nothing about the fallacies, they don't include in their analysis examples of the fallacy with modus ponens that are used by speakers in everyday discourse, for example, the one in (30):

(30) A: I bought a new car.
B: Congratulations. It means you had the money.
A: I didn't. My rich aunt mentioned me in her will.

In order to construct an argument, the exchange is restated into:

(31) Premises: (a) If X has enough money, X buys a car.
(b) X bought a car.
Conclusion: X has money.

The consequent in (31b) is wrongly affirmed and the argument is invalid. A's second turn in the exchange salvages the invalidly inferred antecedent by B by providing another possibility for A's having the money – being given the money and not only owning it. B mistakenly assumes that there is only one possibility for having the money. The exchange in (31) is constructed, it is true, but so are Sperber and Wilson's examples. The tense in the analysis is irrelevant and so is disregarded.

In everyday spoken discourse we as speakers very often omit the premises and the latter have to be recovered by the listener. Sometimes it is even difficult to decide which statement has the status of a conclusion. Yet Sperber and Wilson ignore the fact that the speaker can be explicit as well as implicit. Since implicitness is a question of degree, he/she might as well minimize implicitness and maximize explicitness. Then, instead of:

(32) (a) If the trains are on strike and the car has broken down, there is no way of getting to work. [Premise]
(b) The trains are on strike. [Premise]
(b') If the car has broken down, there is no way of getting to work.
[From (a) and (b) by conjunction *modus ponens*]
(c) The car has broken down. [Premise]
(d) There is no way of getting to work. [From (b') and (c) by modus ponens]
(Sperber and Wilson 1986: 99–100)

We may have:

(c) There is no way of getting to work. [Conclusion] (a) The trains are on strike. [Premise] and (b) the car has broken down. [Premise]

In other words, the speaker himself/herself can provide both the conclusion (33c) and the premises ((33a) and (33b)) to an argument.

To repeat, "the restricted set of rules" proposed by Sperber and Wilson do not explain counterexamples to the rules: for example, the premises in (21) and the exchange in (30). Even if we take it for granted that the cognitive system consists of deductive rules, something obviously goes wrong when it comes to the application of the rules, for we do not always construct valid arguments. Yet Sperber and Wilson do not find it necessary to consider psychological theories of deductive reasoning probably because such theories do not explain the nature of spontaneous comprehension of utterances, but only specific infinite reasoning tasks such as modus tollens. **Spontaneous comprehension of utterances is "open-ended": an assumption may be abandoned in the inferencing process and a new one introduced.** Yet, paradoxically, pragmatic inference is explained through a succession of such finite rules. That is, it is explained through something Sperber and Wilson deny. "The human deductive device" explains "the content of any set of assumptions submitted to it" (ibid.: 97). Then, paradoxically again, the exchange in (30) is invalid from a logical point of view (the fallacy of affirming the consequent), but is valid in terms of content in the Relevance Theory.

It goes without saying that commonsense reasoning deviated from deductive reasoning. **Commonsense reasoning is based on generalized experience**. It takes into account spatial relations between entities; temporal relations between events, actions, processes and states. Central to it is the relation of cause and effect/reason and consequence between states of affairs. An event or action caused by another event or action can itself be the cause of another event or action. In addition, such causal chains are self-evident:

(33) If Susan speaks English, she can read books in the original.
If Susan can read books in the original, she can read Shakespeare.
If Susan can read Shakespeare, she can read his sonnets.

One of the reasons for the less frequent use of modus tollens in comparison to modus ponens in commonsense reasoning is the fact that modus ponens coincides with the relation of cause and effect/ reason and consequence between the antecedent and consequent. The antecedent is seen as a possible, sufficient or necessary condition for the realization of the consequent or the so-called "sufficient conditionality thesis" (Van der Auwera 1986). In other words, the more frequent reasoning is from left to right (modus ponens) than from right to left (modus tollens), since it seems more natural to present the condition first. Of course, linguistically the consequent may precede the antecedent: *You'll play in the garden if you write your homework,* whereas in real life we know that the condition has to be fulfilled first. Analogously, if two events occur at different time points, t1 and t2 and t1 precedes t2, it is natural to describe the events in the order in which they occurred. Linguistically we can reverse the ordering and have t2 first, as in: *Before he went out, he read the book*. Utterances that deviate from the natural ordering of events and actions take longer to process.

We have commonsense reasoning from left to right with the fallacy with modus tollens as well: denying the antecedent instead of denying the consequent. Similarly, instead of a valid modus tollendo ponens (the example in (2)) we construct the following invalid arguments:

(35) Premises: (a) P or Q
(b) P
Conclusion: (not Q)

Premises: (a) P or Q
(b) Q
Conclusion: (not P)

Use of deductive rules in pragmatic inferencing is not the only proposal. According to Levinson, we use inductive reasoning at least in one type of pragmatic inference, namely, conversational implicature (1983: 114–115). Elsewhere Levinson claims that utterances have a preferred interpretation that is facilitated to a great extent by implicatures; that is, in utterance interpretation we are guided by the meaning of certain lexical items. Other authors claim that we use abduction or inference to the best explanation. There is at least one thing linguists interested in pragmatics agree on: that context and drawing inferences from context is not as chaotic as it seems to be at first blush. Undoubtedly, future research will show arguments for or against different proposals.

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