RELEVANCE THEORY AND THE MODULARITY THESIS
A Logical-Deductive Model of the Information Processing Capacity of the Mind

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ABSTRACT

Sperber & Wilson's 1986 proposed model of the information processing capacity of humans is essentially built upon Fodor's theory of Modularity. In this paper, I will discuss the plausibility of a deductive model, in terms of the definitions set down for Modularity, and also in terms of the working criteria for Sperber & Wilson's Relevance theory. It is argued that Sperber & Wilson's arguments in favour of deductive processes suffer a number of contradictions, and that global processes cannot be deductive in nature.

1. Introduction

Relevance theory is a recent account of human communication, which is grounded within a general view of cognition. Sperber & Wilson (S&W) argue that human cognitive processes generally operate on the basis of the greatest possible cognitive effect for the smallest possible processing effort (1986:vii). The path to this objective is for hearers to focus their attentions only on that which appears to be most relevant. S&W (1987:697) have based their approach on the belief that human attention and thought automatically turn toward information that seems relevant.

While fundamentally based on Fodor's "Modularity" thesis, S&W's approach varies from that account, in their claim that the key process involved in the inferencing process is the formation of assumptions by deduction (1986:83). In fact, S&W claim the only logical rules accessible for comprehension are deductive rules (1986:69).

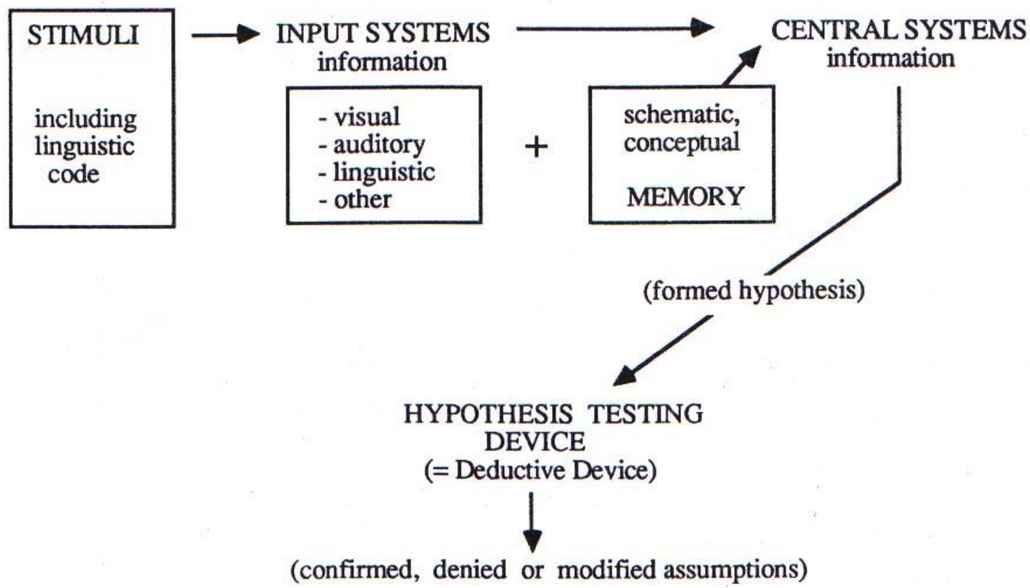
This paper is a consideration of S&W's model of the inferencing mechanisms of the mind, primarily in terms of the postulated deductive nature of the mind's information processing systems. This includes a discussion of conflicting definitions that arise from S&W's proposed model. Subsequently, this paper will address the theoretical plausibility of deductive systems for information processing models.

2. Sperber & Wilson's Model

S&W's 1986 model of the human information processing capacity is meant to address the process of non-demonstrative inferencing. This process contrasts with demonstrative inferencing in that the latter refers to reasoning from fixed premises where the truth of the premises guarantees the truth of the conclusions. However, in non-demonstrative inferencing, the truth of the premises merely makes the truth of the conclusions probable (1987:701). S&W claim that non-demonstrative inferencing involves representations and computations at different cognitive levels. See Figure 1 (Luchjenbroers 1989:192).

S&W's approach is based on the position that assumptions involve some creative process of hypothesis formation and confirmation (S&W 1986:40). Hypotheses are formed in the Central systems, on the basis of perceptual information from the Input systems, and where relevant, contextual information from memory. The Input systems bare a one-to-one relation between a (perceptual) stimulus and its cognitive interpretation. In fact, the role of the Input systems is to convert the various types of input information into a form that is capable of being processed by the Central (thought) systems.

FIGURE 1. **S&W's Information Processing Model**



S&W specify that this form is a 'logical form' (semi-propositional form), or 'assumption schema', that with contextual information from memory, can be converted into full propositions. Although arguably the case for linguistic input, it appears to follow that, accordingly, all the input systems must convert information into logical forms, if this is the form required by the Central systems for processing. Consequently, this also suggests that all types of information (linguistic, perceptual and conceptual) are converted into propositional forms, and therefore, only propositions or semi-propositional forms are capable of being processed and stored in the mind. This further suggests a commitment to the view that propositions are the language of thought.

The Central systems are responsible for integrating Input information with information stored in memory to form hypotheses. This process involves inferential tasks being performed with Input information (S&W 1986:66), which converts the 'logical form' (i.e. output of the Input systems) into hypotheses about the world. Thus, Central system inferencing processes apply to the output of the non-inferential Input information. This position is compatible with Fodor's suggestion that, given that one accepts the arguments for modular Input systems, there must exist some higher-ordinate cognitive capacity for integrating information from the various Input systems into (singular) coherent assumptions about the world.

Fodor further suggests a subsequent mental process after the formation of hypotheses (or assumptions); namely, some capacity to compare these newly formed assumptions with already existing assumptions in memory. To this end he suggests a Hypothesis Testing Device (HTD). This faculty would process newly formed hypotheses for confirmation against a backdrop of the user's existing representation of the world. Thus the HTD compares newly formed hypotheses, with existing assumptions about the world, to either confirm, contradict or modify those assumptions in memory. This is the 'Hypothesis Confirmation' stage of information processing. Similarly, S&W's model involves a third processing stage in the fixation of belief; namely, the 'Deductive Device'. As Blakemore points out (1987:84), such a device would provide the hearer with a means to automatically compute the effects of adding a new proposition to an already existing set of assumptions.

The difference between Fodor's and S&W's label for this cognitive procedure rests on S&W's apparent belief that it functions solely on the basis of deductive reasoning. S&W describe the process of hypothesis confirmation as a purely logical process governed by inference rules (1986:68). Their rationale for positing a general processing strategy of deductive reasoning includes the following arguments (S&W 1986:65):

(i) it would provide a tool that would guarantee the accuracy of any conclusions deduced from initially accurate premises;

(ii) such a generative system would enable economy of storage in memory;

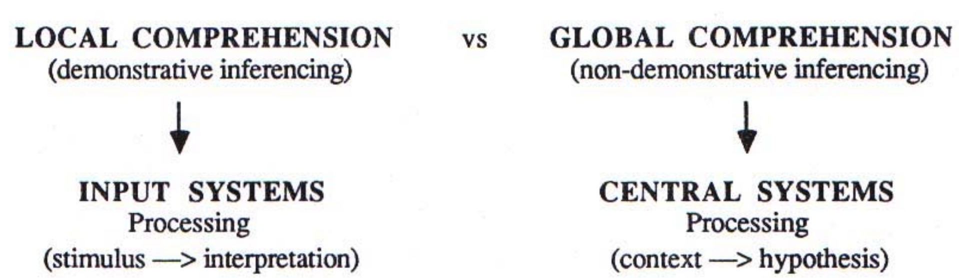
(iii) it would provide a tool that would expose inconsistencies and hence inaccuracies (i.e. contradictions).

Although it is unclear to what or to which systems S&W intend these benefits of deductive reasoning to apply (i.e. whether just the HTD or both the Central systems and the HTD). At least the second and third points would apply only to the functioning of the HTD, and not the Central systems per Se.

2.1 Local vs Global Processing

In order to elucidate the natures of the separate cognitive levels, S&W distinguish between 'local' and 'global' comprehension processes, which in turn apply to the levels of Input versus post-Input processing. These two levels represent different types of information interpretation procedures. S&W (like Fodor 1983) define local comprehension as a process of deductive reasoning from fixed premises; whereas global comprehension refers to the kind of empirical scientific reasoning that has free access to all perceptual information and conceptual information in memory (S&W 1986:67). In effect, local comprehension adheres to formal logic principles (in an analytic sense); whereas global comprehension involves more, in that it may utilize all available knowledge. This includes perceptual and linguistic information from the Input systems, in conjunction with conceptual information in memory. See Figure 2.

FIGURE 2. Comprehension Procedures



S&W's 1986 model is clearly based on Fodor's 1983 'Modularity' thesis, which in turn is built on Gall's (1758-1828) theory that the mind is organized into vertical faculties (Fodor 1983). Gall's theory holds that information processing in the mind occurs within domain specific faculties, or 'modules', which are informationally encapsulated; computationally autonomous; neurologically hardwired; and are innately specified (Fodor 1983:119). Each faculty is distinct in its functioning and is independent in the performance of its functions. Therefore one faculty may be 'weak' and another 'strong'. For example, one may be good at arithmetic, yet clumsy at playing the piano. Empirical evidence appears to support the modularity view of functionally definable subsets of the cognitive system (Fodor 1983:38).

An example of this is the apparent independence of the visual faculty from knowledge - e.g., in a visual test, one may perceive two lines as being of the same length, even though one knows they are not.

S&W (1986) have defined the Input systems within their approach as being modular (in Fodor's sense), and as being local in functioning. Therefore Input systems bear a one-to-one relation between a specific stimulus and its necessary (i.e. logical) conclusion. In this sense, Input systems are purely deductive in nature. There is no dispute that local, or demonstrative, processing is deductive in nature.

Fodor further enlarged upon Gall's theory by stating that there is reason to believe that some cognitive functions are non-modular. Essentially, Fodor argued that it is feasible to assume that some super-ordinate cognitive system exists that is responsible for integrating the information from the various Input systems with schematic information in memory, to form hypotheses. Such systems must then be informationally unencapsulated in that they have access to information from various sub-systems. It is these that constitute what S&W call Central systems, and which are believed to be non-demonstrative in functioning. Furthermore, Central systems involve Global' reasoning, in that premises are derived from a potentially vast context from the various sources of Input information as well as information in memory.

Fodor argued that the nature of non-demonstrative inferencing (or more specifically, Central system processing) is unknown. In contrast, S&W claim that these, like local (Input) systems, involve deductive processes. S&W (1987) have also claimed that although non-demonstrative inferencing cannot consist in a deduction, "by its very definition" (1987:702), they maintain that deduction is a key process in non-demonstrative inferencing, and any assumption that non-demonstrative inferences cannot contain a deduction as one of its subparts, is unwarranted (1987:702). It is this aspect of S&W's theory that is being disputed in this paper.

S&W argue that non-demonstrative systems would function on the basis of deductive rules. These are in particular elimination rules (attached to concepts) of the types: "p & q; p; q" and "if p -> q; p; q". Such inferential processes are by definition truth-preserving operations. Consequently, S&W's theory is based on the premise that inferencing is a truth-preserving operation which results in newly generated assumptions that stand in a semantic entailment relationship to the premise(s). It could be argued that the HTD may operate according to such narrow deductive rules, as it involves the comparison of a specific new hypothesis against an old one which is also specific. However, the incorporation of such rules in Central system processing in general, is much harder to justify, given the possibly vast array of Input information that may be selected for processing.

In effect, S&W (1986:94-5) posit a mental device that functions as an automaton with a memory which reads, writes and erases logical forms, and stores the resulting assumptions in memory. S&W (1986:94) describe the major advantage of such a deductive system as: (i) it decides in advance what assumptions are to be used as premises and which operations may or must apply. In fact S&W claim (1986:68) that the rationale for positing such a general processing strategy is that it would provide a tool that would guarantee the accuracy of any conclusions deduced from initially accurate premises. Although such guarantees have definite theoretical appeal, the psychological reality of such a system is dubious.

3. Problems of Definition

3.1 Deductive Reasoning & Local or Global Processing?

A fundamental contrast between Fodor's (1983) and S&W's (1986) models lies in respect to their account of global processes and the fixation of belief. Namely, Fodor argued that the processes of hypothesis formation and confirmation is scarcely understood and "nobody begins to understand how such factors have their effects" (Fodor 1983:128). S&W's answer to this problem is to postulate that the processes of hypothesis formation and confirmation occur at differing levels of computation within the mind; both of which operate according to deductive rules.

In support of their position in favour of deductive reasoning, S&W point out that although it has generally been assumed that non-demonstrative inferencing must necessarily be based on inductive rules of some kind, "this is a matter of analogy, not argument" (1986:68). Therefore S&W hold that, although demonstrative inferencing is local and clearly deductive in nature, the conclusion that non-demonstrative global reasoning must be non-deductive, is not valid.

As indicated above, S&W's use of the contrast of local versus global comprehension appears to apply to the contrast between Input versus post-Input information processing. However, they argue that the HTD is different from the Central systems in nature and in functioning. S&W (1986:84) refer to the HTD as a deductive system, on the basis that deductive rules result in computations which apply to assumptions by virtue of their logical form. They posit a Deductive Device (1986:83) that is:

(i) opposed to the Input system, by virtue of its processing conceptual representations of logical or propositional form; and

(ii) opposed to the Central systems, by virtue of the different types of computations involved.

Although in Figure 1 above the HTD (Deductive Device) was illustrated as being quite separate from the Central system where hypothesis formation takes place; this distinction was made purely to separate the processes of hypothesis formation from hypothesis confirmation. S&W do not make it clear how the computations of the Central systems differ from those of the HTD.

It could be argued that the hypothesis confirmation stage is a deductive process. Evident from S&W's account is that local processing, which defines Input system functioning, proceeds from a specific stimulus (or premise) to a necessary interpretation (or conclusion). This is clearly a deductive process. Similarly, the process of hypothesis confirmation presumably proceeds from specific premises - one of which must be the newly formed hypothesis - which then leads to a necessary conclusion that stands in a semantic relation to the premises. In this way hypothesis confirmation could be called a local, deductive process.

In contrast, the process of hypothesis formation is clearly global, where premises are chosen from an array of possible contexts relevant to the hearer. As the specific premise(s) chosen for hypothesis formation is highly dependent on the particular Input information and schematic information in memory deemed most relevant to the hearer, Central system processing cannot provide specific premises needed for deductive inferencing. Consequently, defining the functioning of Central systems as 'deductive' is meaningless, because necessary or reliable conclusions, generated from necessary or reliable premises, are a communicative goal, but not a necessary fact.

In effect, the definitory problem identified here is that global, non-demonstrative processes are not deductive in nature, due to the absence of specific premises; and deductive processes are local in nature. Therefore, as Central systems are global, they cannot be deductive. Similarly, the HTD, if deductive in functioning, cannot be global. In this way, the HTD would be independent in its functioning from the Central systems and the HTD would provide the benefits postulated by S&W (as stated in section 2).

3.2 Deductive Reasoning & Confirmation Theory

A second major definitory problem for S&W's model is that they envisage an HTD that would assign a metric to compute the confirmation level of a given hypothesis relative to the hearer's existing store of hypotheses about the world. The terminological problems to be discussed here involves the notions of assigning a metric, confirmation values, and probability theory, and also the consequences of defining deductive systems in such non-deductive terms.

Essentially, S&W propose a deductive model; however, deductive logic is not a theory of confirmation. Deductive logic is a theory of validity, which is a local property of sentences (Fodor 1983:128). In contrast, Fodor argues that confirmation theory is highly sensitive to the global properties of belief systems, and consequently forms a field that mostly does not exist (Fodor 1983:128). Fodor's position is based on his view that global processes are scarcely understood, and that hypothesis confirmation is sensitive to factors for which probability theory provides no metric (1983:139).

In contrast, S&W argue against a logical account, and also against a computation account that assigns probability or confirmation values to assumptions in the HTD, despite their stated conviction that (at least) the Deductive Device operates according to deductive rules (1987:702). S&W (1986:76) consequently argue for a 'non-logical' or 'functional' approach which assesses the strength or soundness of assumptions on the basis of "intuitions about their degree of confirmation (emphasis added).

S&W argue that the strength of an assumption is the result of its processing history, and cannot be accounted for in terms of a confirmation theory (1986:77). They nevertheless maintain the notion of confirmation values in order to represent the lower and upper limits of probability. Such confirmation values would be assigned to premises or conclusions as a measure of their truth or falsity (1986:110). S&W (1986:77) explain that the strength of an assumption is determined by its confirmation value, which need not be represented in the mind, although they claim it can be (1987:701). In essence, they continue to define the functioning of the HTD in terms of confirmation values and probability theory, even though they also argue that such notions cannot account for logical validity or the hypothesis confirmation process.

In effect, S&W maintain the criterion of a computation process in the HTD that will assign metrics to indicate confirmation values, even though these values are not specific. It would seem that lack of specificity is sufficient for a non-logical account of deductive processes, even though this is inherently contradictory. Additionally, these vague confirmation values are thought to express degrees of probability, even though the parameter of probability exists in theory only. Therefore S&W have not by-passed the fundamental problem suggested by Fodor, that deductive systems cannot be defined in terms of probability or confirmation theory.

At this point it should be clear that S&W's definitions of the cognitive system are firmly logical-semantic. S&W have opted for minor transformations in terminology in their attempt to present a model that is meant to be more representative of global processes, without forfeiting the fruits of local processes; namely, guaranteed conclusions. That S&W have attempted such an approach is understandable given that they, like Fodor (1983:5), define both local and global processes as involving computations. This concept subsumes the semantic concepts of implication, confirmation and logical consequence. Such concepts immediately bring to mind analyticity and deductive logic. However, the major flaw of such a logical model of information processing is that deductive (or local) processing begins from specific input and will derive the necessary conclusions from that input; but global processing does not start from specific stimuli. If it were that specific stimuli could be independently identified for global processing, then the much desired guaranteed conclusions presumably would be forthcoming. This observation emphasizes the important role of context selection for any model of human communication and inferencing (see Luchjenbroers 1989).

4. Conclusions

Although it may be argued that S&W allow for inferencing processes other than strictly deductive ones to possibly be at work in comprehension tasks, this is not sustained by further discussion. Essentially S&W do not present any stage of the inferencing process as involving any other form of process other than deductive ones, nor do they mention any rules other than deductive, elimination rules. S&W maintain the position that the only logical rules spontaneously accessible to the human mind are deductive rules (1986:69); and that as inferences are a form of fixation of belief, the function of inference rules is to guarantee the logical validity of the inferences they govern (S&W 1986:83). This again stresses the definitional problems inherent in their approach, as they speak of logical validity and also of a HTD that operates according to deductive rules, but which does not compute confirmation values, although it can indicate an assumption's degree of confirmation.

It would appear that S&W spurn Fodor's distinction between those processes that establish levels of validity and levels of confirmation. The latter is not open to empirical investigation (Fodor 1983:119), precisely due to its non-modularity. Despite Fodor's (1983:119) claim that nothing is known about the neuropsychology of thought, S&W have presented a model that will offer the guarantees of a local deductive system, veiled in terms of a global system. I suspect that S&W have chosen to cling to the notions of 'validity', 'deductive reasoning' and 'probability values' generated by a deductive device, since a major aim of S&W's work is to devise a theory that can guarantee valid conclusions.

It may be pointed out that S&W have no problem with defining comprehension in 'truth-conditional' terms, as they hold that the proposition generated in the Central system is derived from the utterance plus the (relevant) context. This is then a local relation between a premise and its necessary conclusion. The only difficulty is then to extract the local premise from a global (possible) context. S&W argue that this is possible by virtue of the criterion of Relevance. However, this is by no means a straight-forward or totally reliable identification by the hearer. As premises are based on the speaker's ostensive behaviour, and additionally on the hearer's interpretation of that behaviour in the linguistic and non-linguistic context of an utterance, it is debatable to what extent a deductive reasoning process can be said to guarantee anything.

It is because the specific Input information, and information in memory chosen by the hearer, are variables and not given, that global processes cannot be defined in terms of guarantees.

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