Inferences in the Comprehension of Language

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Abstract
Previous research in experimental psychology and artificial intelligence (AI) states that listeners and readers make many inferences in their attempts to understand oral and written discourse. This paper tries to explore the types of inference listeners / readers make to understand language. It also investigates the role of each type in the course of understanding a text.
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Introduction

Inferences serve a variety of functions in language comprehension. The main function of inference is linking information from different parts of a text in order to establish its literal meaning. Among other things, they can be used to identify an unclearly pronounced word, to resolve a lexical ambiguity, to determine the referent of a pronoun, and to compute an intended message from a literal meaning.

To some extent, exploring the inferences listeners / readers make and their roles in the comprehension of language comes from common sense and from research in experimental psychology and artificial intelligence(AI). Garnham (1989) states that although there is some truth in answers from these sources, they are to a greater or lesser extent misleading. Common sense is never a very good source of psycholinguistic theories because we simply do not have conscious access to most of the processes of language understanding.

Since the discourse analyst, like the hearer / reader, has no direct access to a speaker's / writer's intended meaning in producing a text, he often has to rely on a process of inference to arrive at an interpretation for oral and written texts or for connections between utterances / sentences. Inferences that achieve the coherence of the representation by making backward links are deductive inferences made during reading, whereas inferences that do not create coherence, often called elaborative or forward inferences, are not made, are less likely to be made or are made under specific conditions (Garnham, 1989; Haviland and Clark, 1974; McKoon and Ratcliff, 1986, 1989; Potts, Keenan and Golding, 1988; Singer, 1988; Singer and Ferreirra, 1983). Therefore, such inferences appear to be of different types. Mainly they are deductive or backward inferences and elaborative or forward inferences.

Deductive or Backward Inferences

These inferences are necessary for comprehension. They link together the information in different parts of a text. They are necessary because that information can only be linked inferentially, and because, in some sense, the text has not been understood if the links have not been made. Miller and Johnson – laird (1976) state that these inferences depend, to a greater or lesser extent, on knowledge about the world. They establish the temporal, spatial, logical, causal, intentional and moral connections between the different parts of a text. Now, I am going to provide the reader with examples on this type of inference.

Clark (1977) describes the necessary inferences as bridging inferences, and he states the following example:

1 . I went shopping yesterday.
2 . The climb did me good.

To understand this passage, it is necessary to infer that *the climb* of the second sentence was part of *the shopping trip* of the first.

Charniak (1972) discusses the understanding of simple children's stories as follows:

1 . Jane was invited to Jack's birthday party.
2 . She wondered if he would like a kite.
3 . She went to her room and shook her piggy bank.
4 . It made no sound.

The inferences are necessary to link the information in these sentences, and to form a coherent representation of the text as a whole. This depends on a rich source of information about birthday parties, presents and saving money.

An example mentioned in Brown and Yule(1983: 256) is given below.

        1 . It is really cold in here with that window open.

        2 . Please close the window.

The general view of the interpretation of utterance (1) - used to convey an indirect request - is that the hearer works from the literal meaning to meaning (2) via inferences of what the speaker intended to convey. Such inferences are necessary to understand the intended meaning.

     Vonk and Noordman (1990) discuss the causal inference underlying *because* sentences. They mentioned the following example in a text on a sailing competition that is won by *Connors.*

       Connors used Kevlar Sails because he expected little wind.

What has to be inferred in this example is the connection between *Kevlar Sails* and *little wind*. The inference is the general rule that if there is *little wind* in a sailing competition, *Kevlar Sails* are advantageous (according to Connors). This relation closes the chain of reasoning expressed by the *because* sentences. Accordingly, this kind of inference is a bridging inference that is necessary to relate a concept in the subordinate clause to the concept of the main clause.

     To characterize the process of understanding a *because* sentence, the above sentence can be simplified as follows:

The sentence: Connors used Kevlar Sails because he expected little wind.

can be analyzed as "XRY" because "XRZ" in which X refers to the concept *Connors*, the first R to the predicate *using*, Y to the concept *Kevlar Sails* ,the second R to the predicate *expecting* and Z to the concept *little wind*. The word *because* in a sentence "XRY" because "XRZ" can be considered as a signal to close the chain of reasoning by checking the general connection between the concepts Y and Z with respect to one's knowledge .If the connection between Y and Z is part of the reader's knowledge , then the inference is made and so the relation between the concepts is activated, and applied to the specific situation or event described by the text. If the connection between Y and Z is not part of the reader's knowledge, the relation is not activated, and the inference is not made. Accordingly, one may predict that this kind of inference is necessary because it is a bridging inference and contributes to coherence.

     The inferences in the above examples are necessary for establishing coherence. They are bridging inferences and they are also backward inferences because one makes backward links during reading. In such inferences, the hearer / reader requires more interpretive work to understand how the text is linked coherently. Vonk and Noordman state that, to some extent, there is consensus in the literature that inferences which contribute to the coherence of the text representation are made during reading. They point out that one has to make a distinction between relations internal to the structure of the representation and relations that involve reference to the world. They also demonstrate that the reader's knowledge of the world is an important factor in controlling inferences.

Elaborative Inferences

An inference is elaborative if it plays no role in establishing the coherence of the text. We may or may not make elaborative inferences when reading a text - perhaps, we make some but not others. Such inferences are not necessary in the sense that the language understanding system is forced to make them (Garnham,1982). It has frequently been claimed that you do make such inferences. In this type of inference the hearer / reader has very little interpretive work to carry out in understanding a text. Given below are some examples on this type of inference.

Bransford and his colleagues (1973) have mentioned the following example:

    1.   He slipped on a wet spot and dropped the delicate glass pitcher on the floor.

    2.   He slipped on a wet spot and broke the delicate glass pitcher when it fell on the floor.

The subjects who heard sentence (1) in the first recognition test claimed that they had heard sentence (2) in a later recognition test. One interpretation of this result was that when subjects read the first sentence, they inferred that the pitcher had broken and encoded this fact into the memory representation of the sentences.

An example that may be an elaborative inference is the case – filling inference (Garnham, 1989). It goes as follows:

       A new hot-water tank had been installed.

The hearer / reader infers that it was probably a plumber who installed it. If the above example is followed by the following text,

       The plumber did a very good job.

then a very similar inference – that the plumber (definitely) installed the tank – would be necessary to establish the meaning of the text.

The following example is taken from Sanford and Garrod (1981:10).

John was on his way to school.

Most readers report that they infer from this example that John is a *schoolboy*.

When this example is followed later in the same text by the following sentence,

Last week he had been unable to control the class.

readers readily abandon their original inference and form another, for example that John is a *schoolteacher*.

Haviland and Clark (1974) mention the following example:

1 . Mary got some picnic supplies out of the car.

2 . The beer was warm.

The plausibility that picnic supplies contain *beer* is the basis for the inference that is signalled by the definite article in *the beer*. The implication from this type of research finding is that inferences take time.

Inference is made in the interpretation of pronouns. According to Garnham and his colleagues, when a pronoun cannot be resolved on the basis of its gender (and number), knowledge- based inference is almost always needed to determine its referent. For example, in:

Sue lent Jill her car because she had decided to take more exercise.

it can only be established that the *she* in the second clause refers to *Sue* on the basis of knowledge about *cars*, *exercise* and *lending*.

The understanding of so-called conceptual pronouns, studied by Oakhill and others (1992), is also an inference – driven process. For example, to understand a passage such as:

I need a plate. Where do you keep them?

it is necessary to infer a context in which the addressee most likely has more than one plate, and to construct a representation of it that contains a number of plates for *them* to refer to.

Garrod and Sanford (1981) studied the following passage.

1 . Keith was giving a lecture in London.

2 . He was driving there overnight.

3 .The car had recently been overhauled.

The noun phrase *the car* has no explicit antecedent. It must be inferred that the car is what *Keith* drove to London in. The explanation of this result is that the existence of *the car* is implied by the meaning of the verb *drive* in the second sentence. When the meaning of *drive* is retrieved from semantic memory and used to construct a representation of the meaning of the second sentence, that representation already contains a *vehicle* with which *the car* can quickly be identified. Garrod (1985:161) calls this elaborative inference a pseudo- inference.It arises from interpreting expressions against a mental model of the discourse domain. It occurs as an automatic byproduct of comprehension and is made in the forward direction. The fact that *Keith* used a *car* to get to *London* is an automatic consequence of interpreting *drive* appropriately in the context of a passage about a journey.

It was widely assumed in 1970s that many elaborative inferences are made during reading and the conclusions of these inferences are encoded into the memory representation of a text.

Conclusion

There is a consensus in the literature that inferences which contribute to the coherence of the text representation are made during reading. We make such inferences that are likely to help us to understand a text. Usually the need to make them only becomes apparent when the current sentence cannot be integrated satisfactorily with what has gone before. In this case, "a backward" inference is made and providing, that a successful connection can be found, that inference is necessary for understanding a text.

We make inferences by using knowledge about the world to help us construct mental models of what the world is probably like if the text is true. These inferences help us in understanding a text properly. Beaugrande (1980:229) suggests that there be a process, in our understanding of what you read and hear, of "spreading activation" which results naturally from concept activation in ideation and comprehension without specifically directed impulses. These specifically directed impulses are expressly aimed towards overcoming discontinuities or gaps in the reader's / hearer's understanding of what he reads / hears and are more properly treated as inferences.Such inferences are deductive and necessary for language understanding. They require more interpretive work on the reader's / hearer's part.

A large body of research in the late 1960th and early 1970th mainly by Bransford and his colleagues shows that many inferences other than those necessary for comprehension are made in the course of text comprehension. These inferences are elaborative inferences. Such inferences are elaborative if they play no role in establishing the coherence of the text; and they require little interpretive work on the reader's / hearer's part. In this type of

inferences, the connections are made automatically via pre – existing knowledge. People make them to predict upcoming consequences or information. For example, perhaps as soon as readers / hearers read / listen that " *the child fell from the 10th floor* " , they predict that the child died. If so, they would be generating what is called a predictive or forward inference. However, experimental research shows that this inference is only partially encoded into the mental representation of a text (McKoon and Ratcliff 1989).

Similarly, during anaphora processing , its interpretation can depend on a part of general knowledge which is not easily reachable. So, anaphora requires inferences, based on world knowledge or, on context which must be made very fast. Such inferences may be elaborative inferences which help to interpret a subsequent anaphora.

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